

Tender No.CGM/DFCCIL/NOIDA UNIT/INTERIOR & FURNISHING WORK/DFCCIL C. O. BUILDING /SEC-145 NOIDA/2020/01

For

Name of Work: Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

E-TENDER DOCUMENT TECHNICAL BID (PACKET-A)

Employer: DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) Under MINISTRY OF RAILWAYS

NOIDA OFFICE: -Chief General Manager/Noida/DFCCIL D-89, 1st Floor, Sector-2, Noida- 201301

INDEX

PART/CHAPTERS		PAGE NO.	
PART - I			4-145
Chapter I	Check list of documents to be uploaded in the E-Tender		4-6
Chapter II	Notice Inviting	g E-Tender	7-12
Chapter III	Preamble and	General Instructions to Tenderers	13-43
Chapter IV	General Condi	tions of Contract	44-86
Chapter V	Special Condit	ions of Contract	87-144
	Special Collar		07-144
		VOLUME-II	
PART - II	Technical Spec	cifications including list of Approved Makes	145-672
		VOLUME-III	
PART - III			673-1002
Chapter I	Milestones and	l Time Schedule	673-674
Chapter II	Tender Forms	S	675-1002
-	FORM No.	SUBJECT	
	Form No. 1A	Offer Letter	678-680
	Form No. 1B	Format for certificate to be submitted/uploaded	681-682
		by Tenderer alongwith the tender documents.	
	Form No. 2	Tenderer's Credentials	683
	Form No. 2A	Technical Eligibility Criteria Details	684
	Form No. 2B	Financial Eligibility Criteria Details	685
Form No. 2CBid CapaForm No. 3Summary		Bid Capacity Criteria Details	686-688
		Summary of Prices	689-690
Form No. 4 Schedule of Pric		Schedule of Prices and Total Prices	691-957
	Form No. 5	Sample Contract Agreement	958-959
	Form No. 6	Format of Bank Guarantee for Performance Security	960-962
	Form No. 7	Standing Indemnity Bond for On Account Payment	963
	Form No. 7A	Indemnity Bond	964
	Form No. 8	ECS / NEFT / RTGS Mandate Form	965
	Form No.9	Draft MOU for Joint Venture Participation	969
	Form No.10	Draft format of JV Agreement	970
	Form No.11	Pro-forma of Participation from each partner of JV	971-976
	Form No.12	Format for Power of Attorney for authorized signatory of JV Partners	973
	Form No.13	Format for Power of Attorney to lead partner of JV	979-975

	Form No.14	Proforma for Time Extension	976
	Form No. 15	Certificate of Fitness	977
	Form No. 16	Proforma of 7 days Notice for works as a	978
		Whole/In Parts	
	Form No. 17	Proforma of 48 Hours Notice for Whole Work	979
	Form No.	Proforma of 48 Hours Notice for Part of the	980
	17A	Work	
	Form No. 18	Proforma of Termination Notice	981
	Form No.	Proforma of Termination Notice for Part of	982
	18A	Work	
	Form No. 19	Pre-Contract Integrity Pact	983-990
	Form No. 20	Final Supplimentary Agreement	991-992
	Form No. 21	Format of Bank Guarantee for Security Deposit	993-995
	Form No. 22	Format for Power of Attorney for Authorized	996-997
		Representative	
	Form No. 23	No Deviation Certificate	998
	Form No. 24	GUARANTEE BOND for water proofing	999-1000
		works/Anti Termite Treatment works	
	Form No. 25	Agreement toward Wavier under section 12 (5)	1001
		and Section 31A (5) of Arbitration and	
		Conciliation (Amendment) Act	
	Form No. 26	Certification by Arbitrators appointed under	1002
		Clause 63 & 64 of Indian General Conditions of	
		Contract	
VOLUME-IV			
PART-IV	Tender Drawings		Complete Set

PART-I

CHAPTER-I

CHECK LIST OF DOCUMENTS TO BE UPLOADED IN E-TENDER

PART-I CHAPTER-I CHECK LIST

Check List of items/documents pertaining to Bid to be uploaded by the bidder in E-				
,	Tender portal on or before the last Date & Time of Bid Submission			
Item No.	Items			
Technical	Bid (Packet-A)			
	EMD of Rs. 1,15,28,106/- (Rupees One Crore Fifteen Lakh Twenty Eight Thousand One			
	<i>Hundred and Six Only)</i> to be paid online through payment gateway provided at <u>www.ireps.gov.in</u> in the account of Dedicated Freight Corridor Corporation of India Ltd., New Delhi on or before schedule date & time of submission of bid.			
1	 <u>Note:</u> (i) Any firm recognized by Department of Industrial Policy and Promotion (DIPP) as 'Startups' shall be exempted from payment of Earnest Money on submission of Registration Certificate issued by appropriate authority. 			
	(ii) 100% Govt. owned PSUs shall be exempt from payment of earnest money deposit.			
	(iii) Labor Corporate Societies shall deposit only 50% of above earnest money deposit.			
2	Cost of Bid Document of Rs.29,500/- (<i>Rupees Twenty-Nine Thousand & Five Hundred Only</i>) (Non-Refundable) to be paid online through payment gateway provided at www.ireps.gov.in in the account of Dedicated Freight Corridor Corporation of India Ltd., New Delhi on or before schedule date & time of submission of bid.			
	Note: "No exemption is admisibile for cost of bid document and shall not be claimed by bidder on the E-Tender portal".			
3	A declaration from the person having PoA (<i>Power of Attorney</i>) on the Letter Head of the Applicant/Bidder that they agree and abide by the bid documents and amendments thereof (<i>if any</i>) and would execute the work accordingly. (<i>Form No. 1A</i>)			
4	Format for Certificate to be Submitted / Uploaded by Tenderer Alongwith the Tender Documents (<i>Form No. 1B</i>)			
5	Power of Attorney of the person authorized for signing/submitting the Tender (<i>Form No. 22</i>).			
6	If applicable, the Power of Attorney for authorized signatory of JV partners and for Lead Member of JV (<i>Form No. 12 & 13 resp.</i>)			
7	Documentary Evidence in support of their formation as Properitory Firm/ Partneship Firm/ Company/ Joint Venture/ LLP /Registered Soceity/ Registered Trust/ HUF as per the requirement defined in Para 1.3.14 of Part-I, Chapter-III (Preamble and General Instructions to Tenderers) of Tender Document.			

	Integrity Pact duly signed by the bidder (Form No.19). The bidders are required	
8	to download the Integrity Pact as uploaded on the tender document & sign the	
	same put rubber stamp seal and upload the signed copy on E-Tendering website.	
	Submission of Tenderer's Credentials in accordance with Technical Eligibility	
9	Criteria defined in Para-1.3.11.1 (Preamble & General Instructions to	
	Tenderer) of Part-I, Chapter-III of Tender Document in prescribed forms.	
	(Form No.2A)	
	Submission of Tenderer's Credentials in accordance with Financial Eligibility	
10	Criteria defined in Para-1.3.11.2 (Preamble & General Instructions to	
10	Tenderer) of Part-I, Chapter-III of Tender Document in prescribed forms.	
	(Form No.2B)	
	Submission of Tenderer's Credentials in accordance with Bid Capacity	
11	Eligibility Criteria defined in Para-1.3.11.3 (Preamble & General Instructions	
11	to Tenderer) of Part-I, Chapter-III of Tender Document in prescribed forms.	
	(Form No.2C)	
12	Applicant's Party Information Form (Form No.2D)	
12	Memorandum of Understanding (in case of JV) as per bid document. (Form	
15	No.9)	
14	If applicable, Joint Venture agreement (Form No.10)	
15	Letter of participation from each partner of Joint Venture (JV)-(Form No. 11)	
16	Valid GST Registration, EPF Registration and PAN No. details	
17	No Deviation Certificate (Form No. 23).	
10	The entire Tender document should first be downloaded & then, upload the	
18	same through digital signature by the Authorized signatory of the bidder.	
	All pages of all the Corrigendum/Addendum/Clarification (<i>if any</i>) should first	
19	be downloaded then, upload the same through digital signature by the	
	Authorized signatory of the bidder.	
Financial Bid (Packet-B)		
20	Financial Bid to be filled and submitted on <i>www.ireps.gov.in</i> by following the	
20	steps available at E-Tender IREPS Portal.	

Note: All the uploaded documents should be in readable, printable & legible form.

IMPORTANT NOTES:

- i. **Document mentioned at S.No. 1 to 17** above of the Check list [Technical Bid (Packet-A)] should be scanned and uploaded as attachment at E-Tender portal (<u>www.ireps.gov.in</u>). The detailed instructions of E-tendering can be read through website <u>www.ireps.gov.in (Learning</u> Centre link provided on the home page).
- ii. Similarly, the *document mentioned at S.No. 18 & 19* of the Check list [Technical Bid (Packet-A)] should first be downloaded from E-Tender Portal (*in PDF Format*) and thereafter upload them to E-Tender Portal, through digital signature.

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

iii. For Document No. 20 of the Check list [Financial Bid (Packet-B)], Financial Bid to be filled and submitted on <u>www.ireps.gov.in</u> by following the steps available at E-Tender IREPS Portal.

PART-I

CHAPTER-II

NOTICE INVITING E-TENDER

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

<u>PART – I</u>

Chapter II

DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED (A GOVERNMENT OF INDIA ENTERPRISE)

Tender No: CGM/DFCCIL/NOIDA UNIT/INTERIOR & FURNISHING WORK/DFCCIL C. O. BUILDING / SEC-145 NOIDA/2020/01

NOTICE INVITING E-TENDER National Competitive Bidding

Name of Work: Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

1.2.1 Chief General Manager/Noida, Dedicated Freight Corridor Corporation of India Limited, D-89,1st Floor, Sector-2, Noida-201301, India, invites **E-Tenders** in **single stage two packet system** on prescribed forms from firms/Companies/Joint Ventures meeting requisite experience and financial capacity for execution of the following work:

Tender No.	CGM/DFCCIL/NOIDA UNIT/INTERIOR & FURNISHING	
	WORK/DFCCIL C. O. BUILDING /SEC-145 NOIDA/2020/01	
Name of Work	Complete Interior & Furnishing works such as Flooring, Wall &	
	ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing,	
	Electrical & other anciliary works for under construction DFCCIL	
	C. O. Building complex at Sec-145, Noida.	
Employer/Client/Owner	Dedicated Freight Corridor Corporation of India Ltd.	
	(DFCCIL), A Govt. of India (Ministry of Railways) Enterprises	
	through Chief General Manager/Noida, D-89, 1 st Floor, Sector-2, Noida-	
	201301.	
Type of Tender	Open E-Tender (Single stage two packet system)	
Type of Contract	Works Contract	
Total Estimated Cost	Rs. 115,28,10,621/- (Rs. 97,69,58,153/- + GST @ 18%)	
Period of Contract	18 Months	
Defect liability period	18 Months from the date of issue of completion certificate of the work by	
	the DFCCIL	

Earnest Money Deposit	Rs. 1,15,28,106/- (Rupees One Crore Fifteen Lakh Twenty Eight Thousand
	One Hundred and Six Only) to be paid online through payment gateway
	provided at www.ireps.gov.in in the account of Dedicated Freight
	Corridor Corporation of India Ltd., New Delhi.
	Note:
	(i) Any firm recognized by Department of Industrial Policy and
	Promotion (DIPP) as 'Startups' shall be exempted from payment of
	Earnest Money on submission of Registration Certificate issued by
	appropriate authority.
	(ii) 100% Govt. owned PSUs shall be exempt from payment of earnest
	money deposit.
	(iii) Labor Corporate Societies shall deposit only 50% of above earnest
	money deposit. D 20 $500/$ (D) 25 000/ (COT) (C) 100/ (D) T) (D) T
Cost of Tender Document	Ks. 29,500/- (Ks. 25,000/-+GS1 @ 18%) (Ks. 1 wenty-Nine Thousand
(Non-Refundable)	Five Hundred only) to be paid online through payment gateway provided
	at www.ireps.gov.in in the account of Dedicated Freight Corridor
	Corporation of India Ltd., New Deini.
	Note: "No exemption is admisibile for cost of bid document and shall not
Validita of Offer	be claimed by bidder on the E-1 ender portal".
Retention Money	5% of Contract value (as per Clause No. 16 (1) of GCC)
Performance Bank Guarantee	Performance Guarantee (PG) has to be submitted within 21(Twenty-One)
	days from the date of issue of Letter of Acceptance (LOA), amounting to
	3% of the contract value in terms of DFCCIL Letter No. HQ-
	ENWC/CON1(POLICY)/1/2020 dt. 28.12.2020, Railway Board
	Letter No. 2020/CE-I/CT/3E/GCC/Policy dt. 20.11.2020 and OM No. $E_0/4/2020$ DDD 14 12 11 2020 (
E tan davin a mahaita	F.9/4/2020-PPD dt. 12-11-2020 (rest is as per clause 16. (4) of GCC).
E-tendering website	<u>www.ireps.gov.in</u> For any help, please refer ""I earning centre under E Tender: Works, 1
	"Instructions to Contractors" containing the detailed guidelines for E-
	Tendering available on www.ireps.gov.in and on Helpdesk of IREPS:
	011-23761525.
Date & Time Schedule	
Date of uploading of NIT/	On 30.12.2020
Date of tender document	
download/Sale (Online)	From 11:00 Hrs of 31.12.2020
Pre-Bid meeting with the	12.01.2021 at 11:00 Hrs.
prospective bidders	
Issue of Corrigendum, if any	On or before three days from date of submission of Tender (on
Date & Time of Submission of	On or before $09.02.2021$ and time up to 15.00 hrs
Tender	On or before 07.02.2021 and time upto 13.00 ms
Last date & time of submission	On or before 09.02.2021 and time upto 15:00 hrs to be paid online
of EMD & tender document	through payment gateway provided at <u>www.ireps.gov.in</u>
cost	

Date & Time of Opening of Technical Bid (<i>Online</i>)	On date 09.02.2021 and time upto 15:30 hrs	
Date & Time of opening	To be communicated later to only those bidders who are found	
of Financial Bid (online)	technically qualified after closure of Technical Evaluation.	
Representative/Contact	Shri Madhup Kumar Upadhayay	
Personof DFCCIL/Noida Unit	Dy. Project Manager/Civil-I	
	Dedicated Freight Corridor Corporation of India Ltd. (Noida Unit)	
	D-89, 1 st Floor, Sector-2, Noida- 201301	
	Mobile No: 8826818484	
	Telephone: 0120-2542889	
	E-MAIL ID: <u>mkupadhayay@dfcc.co.in</u>	
Addressfor Pre-Bid meeting &	Chief General Manager Office	
opening of Tender	Dedicated Freight Corridor Corporation of India Ltd. (Noida Unit)	
	D-89, 1 st Floor, Sector-2, Noida- 201301	
	Mobile No: 8826818484	
	Telephone: 0120-2542889	

- 1.2.2 Eligibility shall be assessed on applicants, fulfilling the technical capability and competence as well as for financial and organizational resources as specified in **Clause no. 1.3.11** of Preamble and General Instruction to tenderers (*Part -I, Chapter-III of Tender Document*).
- 1.2.3 Tender document can be viewed & obtained/downloaded from <u>www.ireps.gov.in</u> w.e.f. 11:00 Hrs of 31.12.2020. The cost of the tender document is Rs. 29,500/- (incl. of GST) which is non-refundable payable towards the cost of one set of tender documents. The tender document shall have to be purchased in the name of Firms/Company/Joint Venture and can be downloaded from website <u>www.ireps.gov.in</u>. In case tenderer(s) do/does not deposit the cost of tender document (non-refundable) along with the submission of the tender, their tender shall bot be opened. Tenderer are advised not to make any correction/addition/alteration in the downloaded tender documents. If any such correction/addition/alteration in downloaded tender documents are made such tenders shall be not be considered.
- 1.2.4 DFCCIL may issue addendum(s) / corrigendum(s) to the tender documents. In such cases the addendum(s) / corrigendum(s) shall be issued and placed on <u>www.ireps.gov.in</u> only at least three days in advance of date of opening of tender. The tenderers who have purchased or downloaded the tender documents from the website before issue of addendum(s)/corrigendum(s) must visit the website and ensure that such addendum(s) / corrigendum (s) (if any) is also downloaded by them. Such addendum(s)/corrigendum (s) (if any) shall also be submitted/uploaded duly stamped and signed along with the submission of tender. Any tender submitted without addendum(s) / corrigendum(s) (*if any*) is *liable to be rejected*.
- 1.2.5 The tender documents shall be submitted in online mode only through website <u>www.ireps.gov.in</u> in two packets only viz Packet-A containing TECHNICAL BID and Packet B containing FINANACIAL BID.

Bidder shall submit the **EMD** & **Tender document cost** (as mentioned in clause 1.3.4.2 & 1.3.4.1 of preamble & general instructions to tenderer, Part I, Chapter III of Tender Document) on or before schedule date & time of submission of bid.

Financial Bid (as specified in "Financial Bid" in Tender Document) to be filled and submitted on E-Tender portal <u>www.ireps.gov.in</u> by following the steps available at E-Tender IREPS Portal.

It is mandatory for all Tenderers to have Class-III Digital Signature (or as specified in IREPS Portal) Certified from any of the Licensed Certifying Agencies ('CA') to participate in E-Tendering of DFCCIL, (Tenderer can see the list of Licensed CAs from the link <u>www.cca.gov.in</u> in the name of the person who will submit the Online tender and is authorized to do so.

1.2.6 To participate in the E-Tender, it is mandatory for the bidders to get themselves registered with the IREPS (<u>www.ireps.gov.in</u>) and to have user ID & password.

www.ireps.gov.in is the only website for submission of tender.

Tender shall be submitted through Online mode only at <u>www.ireps.gov.in</u>. Tender submitted by any other mode will not be accepted. All the required documents (legible) as mentioned in <u>Check</u> <u>List</u> have to be uploaded along with the offer on <u>www.ireps.gov.in</u> failing which, the bid shall not be considered for further evaluation.

1.2.7 Tenders shall be opened at the address given below on scheduled date & time in the presence of the tenderers or their authorized representatives intending to attend the opening.

Address of Office of the Chief General Manager/ Noida (*for opening of tenders*): - Chief General Manager/Noida, D-89, 1st Floor, Sector-2, Noida-201301, U.P.

All the Bids received shall be opened on the date and time mentioned above in the tender notice. Bid of the bidders shall be opened through process of e-tendering. The sequence of opening shall be:

- i) Earnest Money Deposit (*EMD*)
- ii) Technical offer.
- *iii)* Financial offer (at a later stage after scrutiny & finalization of acceptable Technical Bid)

Tender shall be submitted as per "General Instructions to Tenderers" forming as part of the complete tender documents.

1.2.8 Any tender received without Earnest money and cost of tender documents in the form as specified in the tender documents shall not be considered and shall be summarily rejected.

- 1.2.9 DFCCIL reserves right to cancel the tender before submission/opening of tender, postpone the tender submission / opening date and to accept / reject any or all tenders without assigning any reason thereof. DFCCIL's assessment of suitability as per eligibility criteria shall be final and binding.
- 1.2.10 Tenderers may note that they are liable to be disqualified at any time during tendering process in case, any of the information furnished by them is not found to be true. EMD of such tenderers shall be forfeited & the decision of DFCCIL in this regard shall be final and binding.

- 1.2.11 DFCCIL reserves the right to pre-qualify the bidder(s) provisionally based on the documents submitted by them in technical bid. Financial bids of only those bidders would be opened, whose technical offers are found acceptable. In the event of any document being found false (*at a later stage*), the provisional qualification shall stand withdrawn, and the next lower bidder shall automatically come to the position of such disqualified bidder. Also, action against such disqualified tenderer shall be taken as per the provisions of the Tender.
- 1.2.12 Information as required as per various Forms to tender document should be submitted by the tenderers without fail strictly as per formats.
- 1.2.13 The validity of offer shall be **120 days** from the date of opening of the tender.
- 1.2.14 Transfer of the tender document purchased by intending tenderer to another tenderer is not admissible. Tenderer can submit tenders only on the documents purchased /downloaded from website: <u>www.ireps.gov.in</u> by them.
- 1.2.15 Tenderers must read all instructions regarding E-Tendering process as mentioned in "Learnig centre under E-Tender: Works , 1. "Instructions to Contractors" available on <u>www.ireps.gov.in</u> and INSTRUCTION TO TENDERERS Part I, Chapter III of the Tender Document.
- 1.2.16 Tenderers are advised to regularly visit the E-Tender Portal (www.ireps.gov.in) for information regarding tender, corrigendum, addendum (if any) etc.

1.2.17 Joint Venture are allowed in terms of Para 1.3.17 of Part-I, Chapter-III of the Tender Document.

1.2.18 The rates quoted by the contract or are deemed to be inclusive of site clearance, setting outwork, profile, setting lay out on ground, establishment of reference benchmark(s), installing various signage, taking spotlevels, survey with total station, construction of all safety and protection devices, compulsory use of helmet and safety shoes, and other appropriate safety gadgets by workers, imparting continuous training for all the workers, barriers, preparatory works, construction of clean, hygienic and well ventilated workers housings in sufficient numbers working during monsoon or odd season, working beyond normal hours, working at all depths, height, lead, lift, levels and location etc. and any other unforeseen but essential incidental works required to complete this work. *Nothing extra shall be payable* on this account and *no extension of time* for completion of work shall be granted on the seaccounts.

The rates quoted by the tenderer shall be inclusive of all taxes and levies but excluding GST. The GST as legally leviable and payable by the Bidder under the provisions of applicable law/act shall be paid extra by DFCCIL.

Therefore, the Bidders should quote their rates after considering the Input Tax Credits on their input materials and services. Hence, Bidders should ensure that, full benefit of Input Tax Credit (ITC) likely to be availed by them is duly considered while quoting their rates.

- 1.2.19 Price Variation Clause (PVC) will not be applicable for this work.
- **1.2.20** Mobilization and Secured Advance will not be applicable for this work.

Chief General Manager/Noida For & on behalf of DFCCIL

PART-I

CHAPTER-III

PREAMBLE & GENERAL INSTRUCTIONS TO TENDERERS

PART-I

Chapter- III

PREAMBLE & GENERAL INSTRUCTIONSTOTENDERERS

1.3.1 Introduction

(i) General

Ministry of Railways (MoR) established the Dedicated Freight Corridor Corporation of India Limited (DFCCIL), a Schedule "A" Public Sector Undertaking wholly owned by Ministry of Railways, Govt. of India to undertake planning & development, mobilization of financial resources, construction, maintenance and operation of the Dedicated Freight Corridor project. DFCCIL was incorporated as a company under the Companies Act 1956 on 30th October 2006.

This company is now actively engaged in the implementation of Computerized Multi Modal High Axle Load Dedicated Freight Corridor Project between Delhi-Mumbai under the Western DFC Corridor and Ludhiana-Delhi-Kolkata under the Eastern DFC Corridor.

The DFC project will also restore the Indian Railway's competitive strength in the freight transportation market and emerge as the *major low carbon and energy efficient transport system in the country*. It will drive the establishment of industrial corridors and logistic parks along its alignment and play a crucial role in supporting India's growing economy.

(ii) Project Concept

"Construction of Corporate Office Building Complex and related allied facilities at Sec-145, Noida" is the part of Project "DFCCIL Integrated Office Cum Residential Complex with Pre-Certified GRIHA 5 Star Rating in the National Capital Region at Noida-Greater Noida Expressway in village Jhatta, Sector-145, Noida. Corporate Office Building Complex will be the Headquarters for all the present and future corridor of DFCC.

DFCCIL management desired to build in phases a very vibrant and dynamic complex which should be self-contained and self- sustaining, with state of art physical, social and economic infrastructure. This complex *would be developed on Green Building Concept* and will be eco-friendly, energy efficient, modern and integrated with its inspiring existing landscapes.

The contract for civil construction of DFCCIL Corporate Office Building (Framed Structure along with façade & glazing work) has already been awarded and construction of the same is under advance stage at site. Further, contract for civil construction of DFCCIL Heavy Haul & Research Institute (HHRI) (Framed Structure along with Façade & Interior works excluding furnishing/furniture and IT/HVAC/BMS work) has already been awarded and construction of the same is also under advance stage at site.

The scope of present composite tender includes Complete Interior/furnishing/furniture, Electrical, UPS, Lifts, IT, HVAC & BMS works, Part Fire fighting works for CO building and

furnishing/furniture, Electrical, Lifts, IT, HVAC & BMS works & Part Fire fighting works of HHRI Complex.

(iii) PROJECT MASTER LAYOUT:



(iv) PROJECT BACKGROUND & OVERVIEW:

- 1. DFCCIL is in possession of free hold land admeasuring 16.8491 hectares (approx. 40 Acres) at Noida-Greater Noida Expressway in village Jhatta, Noida. The schematic site plan is as shown above having exact location, adjacent features and boundaries of the land. DFCCIL is fully entitled to develop the said land. The land is almost flat and located in village Jhatta, G.B. Nagar (U.P).
- On the western & southern side, the site is bounded by Noida-Greater Noida Expressway & Noida-Gr. Noida Metro Line and on the eastern site it is bounded by Hindon river, its bund & forest area. The DFCCIL site lies between two functional Metro Stations Sec145 & Sec-146 Noida of Noida-Greater Noida metro line.
- 3. The plot enjoys excellent linkages with other parts of Noida & Greater Noida and is approachable by Noida-Greater Noida Expressway and is approx. 16 km from Mahamaya Flyover in Noida.

(v) General Instructions (for only E-Tendering system):

Submission of Online Bids is mandatory for this Notice Inviting Tender. E-Tendering is a new methodology for conducting Public Procurement in a transparent and secured manner. Suppliers/Vendors will be the biggest beneficiaries of this new system of procurement. An E-Tendering portal of Dedicated Freight Corridor Corporation of India (DFCCIL) introduced for the process of E-Tendering which can be accessed on http://www.ireps.gov.in. (*refer in the BID DOCUMENTS*)

Words in capital and not defined in this document shall have the same meaning as in "BID DOCUMENT".

A) <u>ACCESSING/OBTAINING/PURCHASING PROCESS OF TENDER DOCUMENT:</u>

- (i) It is mandatory for all the Tenderers to have class-III digital signature or as specified by IREPS (in the name of person who will sign the Bid and will submit the online tender and is authorized to do so) certified from any of the licensed certifying agency ("CA") to participate in E-Tendering of DFCCIL [Tenderers can see the list of licensed CAs from the link www.cca.gov.in].
- (ii) To participate in the E-Tender, it is mandatory for the Tenderers to get themselves registered with the IREPS (www.ireps.gov.in) and to have user ID & password.
- (iii) <u>www.ireps.gov.in</u> is the only website for submission of online tender. The detailed instructions of E-Tendering can be read through website <u>www.ireps.gov.in</u> on "Learnig centre under E-Tender: Works , 1. Instructions to Contractors" containing the detailed guidelines for E-Tendering.
- (iv) Tender shall be submitted through online mode only at <u>www.ireps.gov.in</u>. Tender submitted by any other mode will not be accepted.
- (v) All the required documents (legible) as mentioned in Check list S.No. 1 to 19 have to be uploaded along with the offer on <u>www.ireps.gov.in</u>, falling which, the bid shall be liable to be rejected and shall not be considered for further evaluation.
- (vi) The Addendum/Corrigendum, if any; shall be hosted on the website <u>www.ireps.gov.in</u> only.
- (vii) The supporting documents for Eligibility Criteria are essentially required to be uploaded on the website <u>www.ireps.gov.in</u> as bid shall be accepted through Online mode only.
- (viii) Tenderers are required to give Un-Conditional offers. A Conditional Offer is liable to be rejected. DFCCIL reserves the right to modify, expand, restrict, cancel, reject and re-float tender without assigning any reasons whatsoever.
- (ix) The Tenderers shall closely peruse all the clauses, instructions, terms and conditions, scope of work, specification etc. as indicated in the Tender Document before quoting

the rates. If the contractor have any doubt about the meaning of any portion of the Tender Document or find discrepancies/omissions in the tender document issued or required clarification, he shall at once contact the authority inviting the tender for clarification at least ten days before the due date of submission of the tender.

- (x) Bid document shall be accompanied by all the documents required to be submitted as specified in the Tender Document along with all Addendums and Corrigendum.
- (xi) All Bids shall be submitted in accordance with the instructions contained in the Tender Document (Bid Document). Non-Compliance of any of the instructions contained in the Tender Document is liable in Bid being rejected.
- (xii) After award of contract of the Successful Contractor, if it is observed that there is any discrepancy or ambiguity about any terms and conditions mentioned in the Tender Document, the interpretation of same given by DFCCIL shall be considered as final and binding.
- (xiii) Order of precedence of Documents: In tender/contract, in case of any difference, contracdiction, discrepancy, with regard to conditions of tender/contract, specifications, drawings, bill of quantities etc., forming part of the tender/contract, the following shall be the order of precedence:
 - a. Letter of Award
 - b. Schedule of items, Rates & Quantities.
 - c. Special Conditions of Contract.
 - d. Technical Specifications as given in tender documents.
 - e. Drawings, if any.
 - f. General Conditions of Contract.
 - g. Relevant BIS Codes.

For example, if any item is found common in Special Conditions of contract and General Conditions of Contract then the provision given in Special Conditions of Contract will prevail over General Conditions of Contract for the same item.

- (xiv) Contractor must fill up all the schedules and furnish all the required information on emode as per the instructions given in various sections of the Tender Document.
- (xv) Submission of a tender by a tenerer implies that he had read all the tender document including amendments/corrigendum if any, visited the site and made himself aware of the scope of the work to be done, local conditions and other factors having any bearing on the execution of the work.
- (xvi) DFCCIL reserves all rights to reject any tender including of those tenders who fail to comply with the instructions without assigning any reason whatsoever and does not bind itself to accept the lowest or any specific tender. The decision of DFCCIL in this regard shall be final and binding. Any failure on the part of the tenderer to observe the prescribed procedure and any attempt to canvass for the work will prejudice the tenderer's bid.

- (xvii) Tenderers may note that they are liable to be disqualified at any time during tendering process in case any of the information furnished by them is not found to be true. Earnest Money Depost (EMD) of such tenderer shall be forfeited. The decision of the DFCCIL in this regard shall be final and binding.
- (xviii) Evaluation of tenders will be made on the basis of fulfilment of Eligibility Criteria mentioned in the Bid Document. However, DFCCIL reserves the right ot seek any clarification from the contractor.

B) PREPARATION & SUBMISSION OF TENDER:

- a. **Document mentioned at S.No. 1 to 17** of the Check lists [Technical Bid (Packet-A)] should be scanned and uploaded as attachment at website (<u>www.ireps.gov.in</u>). The detailed instructions of E-tendering can be read through website www.ireps.gov.in.
- b. Similarly, the *document mentioned at S.No. 18 & 19* of the Check list [Technical Bid (Packet-A)] should first be downloaded from E-Tender Portal (*in PDF Format*) and thereafter upload them to E-Tender Portal, through digital signature.
- c. *For Document No. 20* of the Check list *[Financial Bid (Packet-B)]*, Financial Bid to be filled and submitted on *www.ireps.gov.in* by following the steps available at E-Tender IREPS Portal.

C) Modification/ Substitution/ Withdrawal of bids:

- (i) Once bid is submitted, the tenderer will not be allowed to withdraw the offer.
- (ii) The tenderer can however modify their bid till closing time of tender. In case of revising the bid, the revised bid will supersede earlier bids and the latest bid will be considered for evaluation.

D) PRE-BID MEETING:

Bidders may request for a clarification on any Clause(s) of the Bid Document on or before the date of Pre-Bid meeting. Any request for clarification must be sent in writing, or by standard electronic means to DFCCIL. DFCCIL will respond with explaination of quries on E-Tender Portal (*including an explanation of the query but without disclosing the source of query*) only. If DFCCIL deem it necessary to amend the Bid Document as a result of clarification or any other reason, it shall do so.

At any time before the submission of tender, DFCCIL may modify/amend the bid document and extend the last date of submission/opening of the tender by issuing a corrigendum/addendum.

Any Corrigendum/Addendum thus issued shall form part of tender document and shall be posted only on <u>www.ireps.gov.in</u> and the Bidders are thus advised to update their information by using said website <u>www.ireps.gov.in</u>. To give the Bidders reasonable time to take an

amendment into account in their bids and on account of any other reasonable circumstances, DFCCIL may at its discretion, extend the deadline for the submission/opening of the tender.

A Pre-Bid meeting with the prospective Bidders shall be conducted as per the scheduled date & time mentioned in the NIT. However, if any change occurs in date & time of the meeting then it would be communicated through <u>www.ireps.gov.in</u> only.

E) OPENING AND EVALUATION OF BIDS:

- (i) Opening of Bids will be done through online process at <u>www.ireps.gov.in</u>.
- (ii) E-Tender shall be opened Online at the address given below at the time and date as specified in Part-1 (Notice Inviting Tender) in the presence of Tenderers of their authorized representatives, if they choose to attend the Online Tender Opening.

Address: Online Opening of Tender

Dedicated Freight Corridor Corporation of India Ltd./Noida Unit, D-89, First Floor, Sector-2, Noida-201301.

- (iii) For participating in the tender, the authorized signatory holding Power of Attorney shall be the Digital Signatory. In case the authorized signatory, holding Power of Attorney and Digital Signatory are not the same, the *bid shall be considered nonresponsive*.
- (iv) The Authority shall Open Bid Documents received in electronic from online on the date and time as specified in the NIT.
- (v) The Authority will subsequently examine and evaluate the Technical Bids in accordance with the provisions set out in the BID DOCUMENTS.
- (vi) The Financial Bids will be opened only of the pre-qualified Bidders (*only after Technical evaluation*) & the date of opening of Financial Bids will be notified later on.

DISCLAIMER

The Bidder must read all the instructions in the BID DOCUMENTS and ensure to complete the tender submission process in time as <u>www.ireps.gov.in</u> will stop accepting any online tender after tender closing due date and time as specified in the NIT.

The agency may visit the site on any working day to assess the site conditions and scope of work before submitting their offer.

(vi) Scope of Work

Chief General Manager, Dedicated Freight Corridor Corporation of India Limited, D-89, 1st Floor, Sector-2, Noida-201301 India, hereinafter referred to as 'DFCCIL' is inviting E-Tenders from Firms/ Companies/Joint Ventures having requisite experience and financial capacity for execution of the following work:

Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

The details of the building for which scope of work (as mentioned below) would be executed is as under:-

S. No.	Name of Building	No. of Stories	Approx. Built-up area (sqmt)
1	Corporate Office Building	G+8	20,259
2	Admin Block of HHRI	G+3	3,541
3	Hostel Block of HHRI	G+5	5,108

The tender drawings for guidance have been enclosed in the tender document. The brief scope of work is given below:-

<u>1. Corporate Office Building</u>

- Interior works consist of partitions of Aluminum glass, lacquered glass paneling, acrylic paneling, acoustic paneling, painting, polishing etc.
- Ceiling work are of Metal Ceiling (Braided, Linear hingeable, Loop, Organic, etc), Gypsum ceiling, Acoustic Ceilings (Woodgrain, Stretch Ceiling, Wood Fiber Strand, etc), Acrylic Ceiling (Backlit, Hanging organic, etc), Fiber Ceilings, POP Ceiling etc.
- Carpentry works include doors, combination partitions, Plywood partitions, slim line aluminum Glass partitions, etc
- Wood work in partition, paneling, doors, celling and furniture of various specifications, etc.
- Laminate Paneling, Lacquered glass paneling, wooden paneling, fabric paneling, acoustic paneling etc.
- Wooden Fire rated doors, Glass doors, Automatic Sliding Doors, wooden door Frames etc.
- Toughened glass paneling in various colors, glass partition and sliding doors, etc.
- Flush Door for toilets etc.
- Fully glazed vitrified tile flooring, Italian Marble flooring, granite flooring, carpet tile flooring, vinyl flooring in Corporate building etc.
- Flooring works are of Tile, Italian Marble, Wooden Flooring, Carpet Flooring, Sports Flooring, vinyl flooring, raised flooring etc.
- Landscape work and green wall preserved wall works, etc.
- Civil and Masonry Works including brick work 115mm and 230mm thick, Plastering & painting, waterproofing etc. as per site requirement.
- BIFMA rated Furniture Consist of work station, Chairs, Sofas, Executive Tables, Storage/ compactors, Library Furniture, Bed, Mattress, blinds (automated and manual) and upholstery etc.
- Installation, testing and Commissioning of all CP fittings, Chinaware in Toilets and Pantry, Internal Drainage installations, Water supply Installations, Piping, External Drainage installation, Rain water, Water Tank etc.,
- Piping For water supply and drainage, Soap dispenser, Hand dryer, Tissue Dispenser, Dustbins, Urinal partitions, etc.
- Supply and placing of Kitchen equipment and fixing of signages.
- Electrical works including Internal Wiring for lights and power points, Conduiting, raceways, switches, junction boxes, internal lights, distribution boards, bus duct, rising mains, panels, UPS, etc.
- Lighting fixtures and lighting control

- Façade Lighting
- Distribution boards, Connection with Existing set up, Light Fixtures, Fans, Wiring, Earthling, Conduit, Control cables, LT cabling, Termination, Cable trays, race ways, Junction boxes, Safety Equipments, UPS, Switches/Sockets, MCBs, Busbars, Occupancy sensors etc.
- Lift work including supplying and installation as per design specifications including obtaining NOC from the lift inspector, etc.
- Firefighting, Internal & External plumbing including fixtures, Fire Hose cabinet, Wet riser, Sprinkler System. Pressure Gauge, Values, Hydrants, etc.
- HVAC Works consisting of VRV system, ducting, piping, insulation, ventilation fans, relevant electrical work etc.
- Building Management System consisting of BMS software, Sensors etc.
- Low Voltage works include Fire Alarm System, Public Announcement System, CCTV, IT Networks Access Control System, VESDA, Rodent Repellant system, Active & passive networking, IP PBX, Audio & Video Conferencing, etc.
- Maintaining GRIHA 5 Star Green building guidelines before procurement of material and during construction of above buildings & allied services.

2. Admin & Hostel Block of HHRI

- Furniture, upholstery, Wardrobes, Chairs, Beds, Mattress, Study Tables, Lecture Room Furniture etc and other ancillary works for Hostel and Administrative building of HHRI Complex at Sector-145, Noida.
- Supply and placing of Kitchen equipment and fixing of signages.
- Internal wiring, Lighting fixtures, MV Panels, DB installation, HT/LT Cabling & Earthing.
- Lift work including supplying and installation as per design specifications including obtaining NOC from the lift inspector, etc.
- Firefighting, Internal & External plumbing including fixtures, Fire Hose cabinet, Wet riser, Sprinkler System. Pressure Gauge, Values, Hydrants, etc.
- HVAC Works consisting of VRV system, ducting, piping, insulation, ventilation fans, relevant electrical work etc.
- Building Management System consisting of BMS software, Sensors etc.
- Low Voltage works such as Fire Alarm System, Public Announcement System, Access Control System, CCTV, IT Networks, IP PBX and Audio & Video Conferencing, etc.
- Maintaining GRIHA 5 Star Green building guidelines before procurement of material and during construction of above buildings & allied services.
- (vii) Cost of the work: The estimated cost of the tendered work is approximately Rs. 115,28,10,621/ (Rs. 97,69,58,153/- + GST @ 18%) (Rupees One Hundred & Fifteen Crore Twenty Eight Lakhs Ten Thousand Six Hundred and Twenty One Only)
- (viii) The tenderer(s) shall be governed by General Conditions of Contract (GCC), Preamble and General Instructions to Tenderers (ITT) and Special Conditions of Contract (SCC). Wherever, there is a conflict in any condition between GCC and Special Conditions of Contract mentioned in the tender documents, the condition mentioned in Special Conditions of Contract will prevail. However, Engineer's decision in this connection shall be final and binding.

Part-I, Chapter-IV and V of the tender document contains General Conditions of Contract and Special Conditions of Contract specific to this work and shall be applicable in the contract.

1.3.2 Form of Tender (Two Packet System of Tendering)

With the view to access the tenders technically without being influenced by the financial bids, "Two packet system of tendering" shall be adopted. The Tender bid shall have to be submitted in **Two Packet System (through IREPS i.e. www.ireps.gov.in)**

"Packet-A"

Eligibility/Qualifying Element of the tender bid along with other requisite documents as mentioned in Techinical bid (Packet-A) of Check List, Part-I Chapter-I of the Tender Document.

"Packet-B"

Price Element of tender bid with percentage above/below/at par on the Schedule of Prices duly filled in as mentioned in Financial bid (Packet-B) of Check List, Part-I Chapter-I of the Tender Document.

The technical bid (Packet-A) shall be opened on the date of tender opening and the detailed scrutiny of Technical bid shall be carried out. The "Financial Bid" (Packet-B) shall be opened only of those tenderers who qualify in "Technical Bid". The detailed procedure for tender opening and processing is defined in Para 1.3.9:

1.3.3 Provision of make in India policy 2017 issued by Govt. of India, as amended time to time, shall be followed for consideration of tenders.

1.3.4 Tender Document

This tender documentconsists of following four parts:

PART/CHAPTERS	DESCRIPTION
PART – I	
Chapter I	Check list of documents to be uploaded/submitted in the E-Tender
Chapter II	Notice Inviting E-Tender
Chapter III	Preamble and General Instructionps to Tenderers
Chapter IV	General Conditions of Contract
Chapter V	Special Conditions of Contract
PART – II	Technical Specifications
PART – III	
Chapter I	Milestones and Time Schedule
Chapter II	Tender Forms
PART – IV	Drawings

1.3.5 Sale & Submission of Tender Document:

1.3.5.1 Cost of Tender document: -

Tender document is available on <u>www.ireps.gov.in</u> and the same can be downloaded and used as tender documents for submitting the offer. The cost of tender document as prescribed in the NIT shall be deposited online through payment gateway of <u>www.ireps.gov.in</u> by the tenderer.

1.3.5.2 Earnest Money Deposit: -

- 1 (a) The tenderer shall be required to deposit earnest money with the tender for the due performance with the stipulation to keep the offer open till such date as specified in the tender, under the conditions of tender.
 - (i) Any firm recognized by Department of Industrial Policy and Promition (DIPP) as 'Startups' shall be exempted from payment of earnest money deposit detailed above.
 - (ii) 100% Govt. owned PSUs shall be exempt from payment of earnest money deposit detailed above.
 - (iii) Labour Cooperative Societies shall deposit only 50% of above earnest money deposit detailed above.
 - (b) It shall be understood that the tender documents have been sold/issued to the tenderer(s) and the tenderer(s) is/are permitted to tender in consideration of stipulation on his/their part, that after submitting his/their tender (subjected to the period being extended further), he will not resile from his offer or modify the terms and conditions, thereof in a manner not acceptable to DFCCIL. Should the tenderer fail to observe or comply with the foregoing stipulation, the amount deposited as earnest money for the due performance of the above stipulation, shall be forfeited by DFCCIL.
 - (c) If his tender is accepted this earnest money mentioned in sub clause (a) above will be retained as part security for the due and faithful fulfillment of the contract in terms of Clause 16 of the Standard General conditions of Contract. The Earnest Money of other Tenderers shall, save as herein before provided, be returned to them, but the DFCCIL shall not be responsible for any loss or depreciation that may happen thereto while in their possession, nor be liable to pay interest thereon.
 - (d) The tenderer must deposit the amount of Earnest Money for the amount prescribed, online through the payment gateway on www.ireps.gov.in as mentioned in the NIT.
 - (e) The tender must be accompanied by Earnest Money deposited through e-payment gateway or as mentioned as tender documents, failing which the tender shall not be considered. Any firm recognized by Department of Industrial Policy and Promotion (DIPP) as 'Startups' "shall be exempted from payment of Earnest Money on submission of Registration Certificate issued by appropriate authority. Tenderers received without Earnest Money in full in the manner prescribed above **shall be summarily rejected.**
 - (f) The Tenderer(s) shall keep the offer open for a minimum period of 120 days from the date of opening of the Tender. It is understood that the tender documents have been issued to the Tenderer(s) and the Tenderer(), is / are permitted to tender in consideration of the stipulation on his / their part that after submitting his / their tender subject to the period being extended further, if required by mutual agreement from time to time, he will not resile from his offer or modify the

terms and conditions thereof in a manner not acceptable to DFCCIL. Should the tenderer fail to observe or comply with the foregoing stipulation, the amount deposited as Earnest Money for the due performance of the above stipulation, shall be forfeited to the DFCCIL.

- (g) In case Contractor submits the Term Deposit Receipt/Bank Guarantee Bond towards full Security Deposit, the DFCCIL shall return the Earnest Money so retained to the Contractor.
- (h) DFCCIL reserves the rights of forfeiture of Earnest Money Deposit (EMD) in case of successful tenderers if:
 - a. Does not execute the Contract Agreement within stipulated time: or
 - **b.** Does not submit Performance Security in the form of Bank Guarantee of the requisite value within stipulated time: or
 - **c.** Does not commence the work after receipt of Letter of Acceptance or date as specified in the Letter Acceptance.
 - d. Withdraws the offer during the period of validity/extended validity.
 - e. When any of the information furnished by the tenderer not found true.
 - f. If the work is terminated at any stage as per terms and conditions of the contract.

1.3.5.3 Clause applicable for tender documents downloaded from Internet

Tenderer/s are free to download tender documents at their own cost, for the purpose of perusal as well as for using the same as tender document for submitting their offer. **Master copy of the tender document will be available in the office of Chief General Manager**, D-89, 1st Floor, Sector-2, Noida-201301, U.P., India.

After award of the work, an agreement will be drawn up. The agreement shall be prepared based on the master copy available in the office of Chief General Manager, Dedicated Freight Corridor Corporation of India Limited, D-89, 1st Floor, Sector-2, Noida- 201301, U.P., India and not based on the tender documents submitted by the Tenderer. In case of any discrepancy between the tender documents downloaded from the internet and the master copy, later shall prevail and will be binding on the Tenderers. No claim on this account shall been tertained.

- 1.3.5.4 Complete tender documents must be submitted online duly completed in all respect on <u>www.ireps.gov.in</u> upto 15.00 Hrs on 09.02.2021. The "Packet-A (*TECHNICAL BID*)" will be opened at 15:30 Hrs on 09.02.2021 and read out in the presence of such tenderer(s) as is/are present. In case the intended date for opening of tenders is declared a holiday, the tenders will be opened on the next working day at the same time. Any modified date and time for submission of tenders shall be uploaded on www.ireps.gov.in.The detail procedure of tender opening will beas per para-1.3.9.
- **1.3.5.5** The rates should be quoted in figures as well as in words. If there is variation between rates quoted in figures and in words, the rate quoted in 'words' shall be taken as correct. If more than one or improper rates are tendered for the same item, the tender is liable to be rejected.
- **1.3.5.6** Each page of the tender papers is to be signed by the tenderers or such person/s on his/their behalf who is/are legally authorized to sign for him/them.
- **1.3.5.7** Tenders containing erasures and/or alteration of the tender documents are liable to be rejected. Any correction made by Tenderer(s) in his/their entries must be attested by him/them.

1.3.5.8 Care in Submission of Tenders-

- (a) (i) Before submitting a tender, the tenderer will be deemed to have satisfied himself by actual inspection of the site and locality of the works, that all conditions liable to be encountered during the execution of the works are taken into account with that the rates he enters in the tender forms are adequate and all-inclusive to accord with the provisions in Clause 37 of the Standard General Conditions of Contract for the completion of works to the entire satisfaction of the Engineer/DFCCIL.
- (a) (ii) Tenderers will examine the various provisions of the Central Goods and Services Tax Act, 2017(CGST)/Integrated Goods and Services Tax Act, 2017(IGST)/Union Territory Goods and Services Tax Act, 2017(UTGST)/respective state's State Goods and Services Tax Act (SGST) also, as notified by Central/State Govt & as amended from time to time and applicable taxes before bidding. Tenders will ensure that full benefit of Input Tax (ITC) likely to be availed by them is duly considered while quoting rates.
- (a) (iii) The successful tenderer who is liable to be registered under CGST/IGST/UTGST/SGST Act shall submit GSTIN along with other details required under CGST/IGST/UTGST/SGST Act to Railway/DFCCIL immediately after the award of contract, without which no payment shall be released to the contractor. The contractor shall be responsible for deposition of applicable GST to the concerned authority.
- (a) (iv) In case, the successful tenderer is not liable to be registered under CGST/IGST/UTGST/SGST Act, the railway/DFCCIL shall deduct the applicable GST from his/their bills under reverse charge mechanism (RCM) and deposit the same to the concerned authority.
 - (b) When work is tendered for by a firm or company the tender shall be signed by the individual legally authorized to enter into commitments on their behalf.
 - (c) The Railway/DFCCIL will not be bound by any power of attorney granted by the tenderer or by changes in the composition of the firm made subsequent to the execution of the contract. It may however, recongnize such power of attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor.
- **1.3.6 Opening of Tender:** Two packet system of tendering shall be adopted in this tender
 - (a) Tender will be opened at 15:30 hrs on 09.02.2021, in the office of Chief General Manager/Noida, Dedicated Freight Corridor Corporation of India Limited, D-89, 1st Floor, Sector-2, Noida-201301, U.P, India in the presence of the tenderers or their representatives as may be present at the prescribed date and time.
 - (b) After the opening of "TECHNICAL BID" (Packet-A) of all the eligible tenderers, these bids shall be scrutinized and analysed. If, found necessary by the Employer, the tenderers shall be asked to furnish clarifications and the Employer may also hold discussions with the tenderers after giving due notice. The names of the tenderers whose bid are considered complete and meet eligibility criteria shall be shortlisted.
 - (c) The FINANCIAL BID(Packet-B) shall be opened on a subsequent date and time duly notified well in advance. The Financial bids of only those tenderers shall be opened who are shortlisted after scrutiny of theirTechnical bid. The Financial bid of the tenderers who do not qualify during scrutiny of Technical bid shall not be opened. The time of opening, date and venue shall be advised to qualified tenderers well in advance to enable them to depute their representative.

1.3.7 Validity of Tender: -

Tenderer shall keep his offer open for a minimum period of **120 days** from the date of opening of the tender or as mentioned in the Tender Notice.

1.3.8 Execution of Contract Agreement: -

The Tenderer whose tender is accepted shall be required to appear in person at the office of **Chief General Manager, Dedicated Freight Corridor Corporation of India Limited,** D-89, 1st Floor, Sector-2, Noida-201301, as the case may be, or if tenderer is a firm or corporation, a duly authorized representative shall appear and execute the contract agreement within 07 days of notice from DFCCIL that the contract agreement is ready. The Contract Agreement shall be entered into by DFCCIL only after submission of valid Performance Guarantee by the Contractor. Failure to do so shall constitute a breach of the agreement affected by the acceptance of the tender. In such cases, the DFCCIL may determine that such tenderer has abandoned the contract and there upon his tender and acceptance thereof shall be treated as cancelled and the DFCCIL shall be entitled to forefeit the full amount of the earnest money and other dues payable to the Contractor under this contract. The failed Contractor shall be debarred from participating in the re-tender for that work.

1.3.9 Security Deposit on Acceptance of Tender:

The security deposit/rate of recovery/mode of recovery on acceptance of tender shall be as per the Para 16. (1) to 16. (3) of General Conditions of Contract (GCC).

1.3.10 Right of DFCCIL to Deal with Tenders

- (a) The DFCCIL reserves the right of not to invite tenders for any of DFCCIL work or works or to invite open or limited tenders and when tenders are called to accept a tender in whole or in part or to reject any tender or all tenders without assigning reasons for any such action.
- (b) The authority for the acceptance of the tender will rest with the DFCCIL. It shall not be obligatory on the said authority to accept the lowest tenderor any other tender and no tenderer(s) shall demand any explanation for the cause of rejection of his/their tender nor the DFCCIL undertake to assign reasons for declining to consider or reject any particular tender or tenders.
- (c) If the tenderer(s) deliberately gives / give wrong information in his / their tender or creates / create circumstances for the acceptance of his / their tender, the Railway reserves the right to reject such tender at any stage.
- (d) If the tenderer(s) expire(s) after the submission of his / their tender or after the acceptance of his /their offer, the Railway shall deem such tender cancelled. If a partner of a firm expires after the submission of their tender or after the acceptance of their tender, the Railway shall deem such tender as cancelled, unless the firm retains its character.

1.3.11 Eligibility Criteria

1.3.11.1 <u>Technical Eligibility Criteria</u>

(a) The tenderer must have successfully completed any of the following during last 07 (seven) years, ending last day of month previous to the one in which tender is invited:

S. No.	Work	Advertised value of Tender [Incl.
		of GST]
1.	Complete Interior & Furnishing works such as	Rs. 115,28,10,621.00
	Flooring, Wall & ceiling finishes, Partitioning,	(Rs. 97,69,58,153/- + GST @ 18%)
	Wood work, False Ceiling, Plumbing, Electrical &	
	other anciliary works for under construction	
	DFCCIL C. O. Building complex at Sec-145,	
	Noida.	

Three similar works each costing not less than the amount equal to 30% of advertised value of tender, or

Two similar works each costing not less than the amount equal to 40% of advertised value of tender, or

One similar work each costing not less than the amount equal to 60% of advertised value of tender.

The definition of **"Similar Work"** for the above stated work is as below:

Similar work means Contracts having "Interior & Furnishing work such as Flooring, Wall & Ceiling finishes, Partitioning, Wood Work, False Ceiling, Plumbing, Electrical & other anciliary works inside the Office/Corporate building only".

The contracts primarily having Earth work, Structure work of RCC, Concrete, Masonry/Bricks/Block work, Steel Reinforcement and External Development works will not be considered in "Similar Works".

Note for Item 1.3.11.1:

1. Work experience certificate from private individual shall not be considered. However, in addition to work experience certificates issued by any Govt. Organisation, work experience certificate issued by Public listed company having average annual turnover of Rs 500 crore and above in last 3 financial years excluding the current financial year, listed on National Stock Exchange or Bombay Stock Exchange or any other stock exchange in India or Abroad or subsidiaries of such companies incorporated/registered at least 5 years prior to the date of opening of tender, shall also be considered provided the work experience certificate has been issued by a person authorized by the Public listed company to issue such certificates.

In case tenderer submits works, experience certificate issued by Public listed company, the tenderer shall also submit along with work experience certificate, the relevant copy of work order, bill of quantitites, bill wise details of payment received duly certified by Chartered Accountant, TDS certificates for all payments received and copy of final/last bill paid by company in support of above work experience certificate.

Note:

- 1. For "Similar Work", the credential certificate should not include the value of Earth work, Structure work of RCC, Concrete, Masonry/Bricks/Block work, Steel Reinforcement and External development.
- 2. It shall be the responsibility of the tenderer to submit proper credential certificate from the client indicating the value of "Similar Work" as defined in Para 1.3.11.1 (a) above. In case, such details are not submitted by the tenderer, the tender is liable to be rejected.

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

- 3. Value of complete work done by a member in an earlier JV Firm shall be reckoned only to the extent of the concerned member's share in that JV firm for the purpose of satisfying his or her compliance to the above-mentioned technical eligibility criteria in the tender under consideration.
- 4. In case the tenderer (s) is a partnership firm, the work experience shall be in the name of partnership firm only.
- 5. For judging the Technical eligibility works which had been executed for the government/ semigovernment organization/PSU/Public listed company (as mentioned in the Note of para 1.3.11.1 above) will only be considered.

1.3.11.2 Financial Eligibility Criteria

The tenderer must have received contractual payments in the three previous financial years and the current financial year upto the date of inviting of tender, at least 150% of the advertised value of the Tender. The tenderers shall submit **UDIN** Certificate from Chartered Accountant duly supported by **Audited Balance sheets, Form 16-A/Form-26 AS** issued by the Employer/generated through TRACES duly attested by Notary.

Note:

- 1. Contractual payments received by a Member in an earlier JV firm shall be reckoned only to extent to the concerned member's share in that JV Firm for the purpose of satisfying compliance of the above-mentioned financial eligibility criteria in tender under considerations.
- 2. In case the tenderer/s is a partnership firm, the turnover etc shall be in the name of partnership firm only.

1.3.11.3 Bid Capacity:

The tender/technical bid will be evaluated based on bid capacity formula detailed as below:

For Tenders costing more than \gtrless 20 Cr. wherein, eligibility criteria include bid capacity also, the tenderer will be qualified only if their available bid capacity is equal to or more than the total bid value of the present tender. The available bid capacity shall be calculated as under:

Available Bid Capacity = $[A \times N \times 2] - B$

Where,

A = Maximum value of construction works executed and payment received in any one of the previous three financial years or the during the current financial year (upto date of inviting tender) taking into account the completed as well as works in progress.

N= Number of years prescribed for completion of work for which bids has been invited.

B= Value of existing commitments and balance amount of ongoing works with the tenderer to be completed in next 'N' years.

Note:

(a) The Tenderer(s) shall furnish the details of existing commitments and balance amount of ongoing works with tenderer as per the prescribed proforma (**Form-2C**) for statement of all works in progress and also the works which are awarded to tenderer but yet not started upto the date of inviting of tender. In case of no works in hand, a 'NIL' statement should be furnished. This statement should be submitted duly verified by Chartered Accountant.

(b) In case of JV, the tenderer(s) must furnish the details of existing commitments and balance amount of ongoing works with each member of JV as per the prescribed proforma of Railway/DFCCIL for statement of all works in progress and also the works which are awarded to tenderer but yet not started upto the date of inviting of tender. In case of no works in hand, a 'NIL' statement should be furnished. This statement should be submitted duly verified by Chartered Accountant.

(c) Value of a completed work/work in progress/work awarded but yet not started for a Member in an earlier JV shall be reckoned only to the extent of the concerned member's share in that JV for the purpose of satisfying his/her compliance to the above-mentioned bid capacity in the tender under consideration.

(d) The arithmetic sum of individual "bid capacity" of all the members shall be taken as JV's "bid capacity".

(e) In case, the tenderer/s failed to submit the above statement along with offer, their/his offer shall be considered as incomplete and will **liable to be rejected.**

(f) The available bid capacity of tenderer shall be assessed based on the details submitted by the tenderer. In case, the available Bid Capacity is lesser than estimated cost of work put to tender, his offer shall not be considered even if he has been found eligible in other eligibility criteria/tender requirement.

1.3.11.4 Credentials if submitted in foreign currency shall be converted into Indian currency i.e., Indian Rupee as under:

The conversion rate of US Dollars into Rupees shall be the daily representative exchange rates published by the Reserve Bank of India for the relevant date. Where, relevant date shall be as on the last day of month previous to the one in which tender is invited. In case of any other currency, the same shall first be converted to US Dollars as on the last day of month previous to the one in which tender is invited, and the amount so derived in US Dollars shall be converted into Rupees at the aforesaid rate. The conversion rate of such currencies shall be the daily representative exchange rates published by the International Monetary Fund for the relevant date.

[Explanation for clause 1.3.11 including clause 1.3.11.1 to 1.3.11.4 - Eligibility Criteria:

- 1. In case a work is started prior to 07 (seven) years, ending last day of month previous to the one in which tender is invited, but completed in last 07 (seven) years, ending last day of month previous to the one in which tender is invited, the completed work shall be considered for fulfillment of credentials.
- 2. If a work is physically completed and completion certificate to this extent is issued by the concerned organization but final bill is pending, such work shall be considered for fulfillment of credentials.
- 3. If a part or a component of work is completed but the overall scope of contract is not completed, this work shall not be considered for fulfillment of technical credentials even if the cost of part completed work/component is more than required for fulfillment of credentials.

4. Deleted

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

- 5. The value of final bill including PVC amount-if paid, or otherwise in case final bill is pending the contract cost in last approved variation statement plus PVC amount paid or cumulative amount paid up to last on-account bill including PVC amount and statutory deductions whichever is less, shall be considered as the completion cost of work.
- 6. In case of newly formed partnership firm, the credentials of individual partners from previous propriety firm(s) or dissolved previous partnership firm(s) or split previous partnership firm(s), shall be considered only to the extent of their share in previous entity on the date of dissolution / split and their share in newly formed partnership firm. For example, a partner A had 30% share in previous entity and his share in present partnership firm is 20%. In the present tender under consideration, the credentials of partner A will be considered to the extent of 0.3*0.2*value of the work done in the previous entity. For this purpose, the tenderer shall submit along with his bid all the relevant documents which include copy of previous partnership deed(s), dissolution deed(s) and proof of surrender of PAN No.(s) in case of dissolution of partnership firm(s) etc.
- 7. In case of existing partnership firm, if any one or more partners quit the partnership firm, the credentials of remaining partnership firm shall be re-worked out i.e., the quitting partner(s) shall take away his credentials to the extent of his share on the date of quitting the partnership firm (e.g. in a partnership firm of partners A, B & C having share 30%, 30% & 40% respectively and credentials of Rs 10 crore; in case partner C quits the firm, the credentials of this partnership firm shall remain as Rs 6 crore). For this purpose, the tenderer shall submit along with his bid all the relevant documents which include copy of previous partnership deed(s), dissolution deed(s) and proof of surrender of PAN No.(s) in case of dissolution of partnership firm(s) etc.
- 8. In case of existing partnership firm if any other partner(s) joins the firm, the credentials of partnership firm shall get enhanced to the extent of credentials of newly added partner(s) on the same principles as mentioned in item 6 above. For this purpose, the tenderer shall submit along with his bid all the relevant documents which include copy of previous partnership deeds, dissolution/splitting deeds and proof of surrender of PAN No.(s) in case of dissolution of partnership firm etc.
- 9. Any partner in a partnership firm cannot use or claim his credentials in any other firm without leaving the partnership firm i.e., In a partnership firm of A&B partners, A or B partner cannot use credentials of partnership firm of A&B partners in any other partnership firm or propriety firm without leaving partnership firm of A&B partners.
- 10. In case a partner in a partnership firm is replaced due to succession as per succession law, the proportion of credentials of the previous partner will be passed on to the successor.
- 11. If the percentage share among partners of a partnership firm is changed, but the partners remain the same, the credentials of the firm before such modification in the share will continue to be considered for the firm as it is without any change in their value. Further, in case a partner of partnership firm retires without taking away any credentials from the firm, the credentials of partnership firm shall remain the same as it is without any change in their value.
- 12. In a partnership firm "AB" of A&B partners, in case A also works as propriety firm "P" or partner in some other partnership firm "AX", credentials of A in propriety firm "P" or in other partnership firm "AX" earned after the date of becoming a partner of the firm AB shall not be added in partnership firm AB.
- 13. In case a tenderer is LLP, the credentials of tenderer shall be worked out on above lines similar to a partnership firm.
- 14. In case company A is merged with company B, then company B would get the credentials of company A also.]

1.3.11.5 Credentials of Tenderer:

The tenderer shall submit documents testifying tenderer's previous experience and financial status in support of their technical and financial eligibility, which are acceptable to DFCCIL, alongwith the tender:

- (a) For **Technical eligibility criteria**, the details will be submitted in "**Form No.2A**" along with supporting documents.
- (b) For **Financial eligibility criteria**, the details will be submitted in "**Form No.2B**" alongwith supporting documents.
- (c) For **Bid capacity criteria**, the details will be submitted in "**Form No.2C**" alongwith supporting documents.
- (d) The tenderer shall submit the completion certificates/certified completion certificates from the client(s) or Photostat of original certificates of client. All documents either original or photocopy should be attested by Notary. These certificates should indicate the details of works carried out and successful commissioning of similar type of work executed by the tenderer. *Completion certificate from Govt. organisation/Semi Govt. organizations/PSUs/Public Listed Company (as mentioned in Note for Item 1.3.11.1) will only be accepted. The certificate from Private individual/Private Company for whom such works are executed shall not be accepted.* In case, the work is executed for Public Listed Company as mentioned above, copy of work order, bill of Quantity, Billwise details of payment received duly certified by Chareted Accountant, TDS certificates for all payments received and copy of final/last bill paid by Company in support of above work experience certificate shall be submitted.
- (e) Tenderer shall submit a statement of contractual payments received during last three financial years and current financial year on the prescribed Performa as per "Form No. 2B" duly certified by Chartered Accountant in the form of UDIN Certificate. The above certificate shall based on the form16-A issued by the employer i.e. the certificate of deduction of tax at source as per Income Tax Act, 1961 and Form-26AS issued by Income Tax Department. The photocopies of Form 16-A/Form-26AS shall be enclosed duly attested by Notary Public with seal and Notarial Stamp thereon or a certificate from auditor or audited balance sheet certified by Chartered Accountant clearly indicating the contractual amount received duly attested by Notary Public with seal and Notarial Stamp thereon. DFCCIL may invite the Tenderer for offline/online verification of Form-16A & Form-26AS.
- (f) The tenderers shall submit a copy of certificate stating that they are not liable to be disqualified and all their statements/documents submitted alongwith bid are true and factual. Standard format of the certificate to be submitted by the bidder is enclosed as "Form-1B". The bid is liable to be rejected upon Non submission of above certificate by the bidder. It shall be mandatorily incumbent upon the tenderer to identify, state and submit the supporting documents duly attested by Notary by which they/he are/is qualifying the Qualifying Criteria mentioned in the Tender Document.
- (g) The Railway/DFCCIL reserves the right to verify all statements, information and documents submitted by the bidder in his tender offer, and the bidder shall, when so required by the

Railway/DFCCIL, make available all such information, evidence and documents as may be necessary for such verification. Any such verification or lack of such verification, by the Railway/DFCCIL shall not relieve the bidder of its obligations or liabilities hereunder nor will it affect any rights of the Railway/DFCCIL thereunder.

- (h) (i) In case of any information submitted by tenderer is found to be false forged or incorrect at any time during process for evaluation of tenders, it shall lead to forfeiture of the tender Earnest Money Deposit besides banning of business for a period of upto five years.
 - (ii) In case of any information submitted by tenderer is found to be false forged or incorrect after the award of contract, the contract shall be terminated. Earnest Money Deposit (EMD), Performance Guarantee and Security Deposit available with the railway shall be forfeited. In addition, other dues of the contractor, if any, under this contract shall be forfeited and agency shall be banned for doing business for a period of upto five years.
- **1.3.12** Non-compliance with any of the conditions set forth therein above is liable to result in the tender being rejected.
 - (i) The tenderer shall be considered *disqualified/in-eligible if:*

(a) The Tenderer or any of its partners and/or subcontractors included in the tender has been banned for business with Ministry of Railways/DFCCIL along with any of its attached and subordinate offices through an order issued by Ministry of Railways as per list available on Web site (<u>http://www.indianrailways.gov.in/railwayboard</u>) of Railway Board pertaining to banning of Business, with the banning being valid as on the date of submission of the Tender.

(b) The Tenderer or any of its partners has suffered bankruptcy/insolvency or it is in the process of winding-up or there is a case of insolvency pending before any Court on the deadline of submission of application.

1.3.13 Execution of Contract Documents:

The successful Tenderer(s) shall be required to execute an agreement with the DFCCIL for carrying out the work according to Standard General Conditions of Contract, Special Conditions/Specifications annexed to the tender and Standard Specifications (Works and Materials) of CPWD/DFCCIL as amended/corrected upto latest correction slips, mentioned in tender form.

1.3.14 Documents to be submitted alongwith Tender:

(i) The tenderer shall clearly specify whether the tender is submitted on his own (Proprietary Firm) or on behalf of a Partnership Firm / Company / Joint Venture (JV) / Registered Society / Registered Trust/ HUF etc. The tenderer(s) shall enclose the attested copies of the constitution of their concern, and copy of PAN Card along with their tender. Tender Documents in such cases are to be signed by such persons as may be legally competent to sign them on behalf of the firm, company, association, trust or society, as the case may be.

(ii) Following documents shall be submitted by the tenderer:

(a) Sole Proprietorship Firm:

- (i) An undertaking that he is not blacklisted or debarred by Railways/DFCCIL or any other Ministry/ Department of Govt. of India from participation in tender on the date of opening of bids, either in individual capacity or as a member of the partnership firm or JV in which he was/ is a partner/member. Concealment / wrong information in regard to above shall make the contract liable for determination under Clause 62 of the General Conditions of Contract.
- (ii) All other documents in terms of explanatory notes in clause 1.3.11.1 to 1.3.11.5 above.

(b) HUF:

- (i) A copy of notarized affidavit on Stamp Paper declaring that he who is submitting the tender on behalf of HUF is in the position of 'Karta' of Hindu Undivided Family (HUF) and he has the authority, power and consent given by other members to act on behalf of HUF.
- (ii) An undertaking that the HUF is not blacklisted or debarred by Railways/DFCCIL or any other Ministry / Department of Govt. of India from participation in tender on the date of opening of bids, either in individual capacity or as a member of the partnership firm or JV in which HUF was/ is a partner/member. Concealment / wrong information in regard to above shall make the contract liable for determination under Clause 62 of the General Conditions of Contract.
- (iii) All other documents in terms of explanatory notes in clause 1.3.11.1 to 1.3.11.5 above.

(c) Partnership Firm:

- (i) The tenderer shall submit documents as mentioned in Clause 1.3.18 of the Part-I, Chapter-III of the Tender Document.
- (d) Joint Venture (JV): The tenderer shall submit documents as mentioned in Clause 1.3.17 of the Part-I, Chapter-III of the Tender Document.

(e) Company registered under Companies Act 2013:

- (i) The copies of MOA (Memorandum of Association) / AOA (Articles of Association) of the company
- (ii) A copy of Certificate of Incorporation
- (iii) A copy of Authorization/Power of Attorney issued by the Company (backed by the resolution of Board of Directors) in favour of the individual to sign the tender on behalf of the company and create liability against the company.
- (iv) An undertaking that the Company is not blacklisted or debarred by Railways/DFCCIL or any other Ministry / Department of Govt. of India from participation in tender on the date of opening of bids, either in individual capacity or as a member of the partnership firm or JV in which the Company was / is a partner/member. Concealment / wrong information in regard to above shall make the contract liable for determination under Clause 62 of the General Conditions of Contract.
- (v) All other documents in terms of explanatory notes in clause 1.3.11.1 to 1.3.11.5 above.
- (f) LLP (Limited Liability Partnership): If the tender is submitted on behalf of a LLP registered under LLP Act-2008, the tenderer shall submit along with the tender:
 - (i) A copy of LLP Agreement
 - (ii) A copy of Certificate of Incorporation
 - (iii) A copy of Power of Attorney/Authorization issued by the LLP in favour of the individual to sign the tender on behalf of the LLP and create liability against the LLP.

- (iv) An undertaking that the LLP is not blacklisted or debarred by Railways or any other Ministry / Department of Govt. of India from participation in tender on the date of opening of bids, either in individual capacity or as a member of JV in which the LLP was / is a member. Concealment / wrong information in regard to above shall make the contract liable for determination under Clause 62 of the General Conditions of Contract.
- (v) All other documents in terms of explanatory notes in clause 1.3.11.1 to 1.3.11.5 above.

(g) Registered Society & Registered Trust: The tenderer shall submit:

- (i) A copy of the Certificate of Registration
- (ii) A copy of Deed of Formation
- (iii) A copy of Power of Attorney in favour of the individual to sign the tender documents and create liability against the Society/Trust.
- (iv) All other documents in terms of explanatory notes in clause 1.3.11.1 to 1.3.11.5 above.
- (iii) If it is NOT mentioned in the submitted tender that tender is being submitted on behalf of a Sole Proprietorship firm/ Partnership firm/ Joint Venture/ Registered Company etc., then the tender shall be treated as having been submitted by the individual who has signed the tender.
- (iv) After opening of the tender, any document pertaining to the constitution of Sole Proprietorship Firm / Partnership Firm/ Registered Company/ Registered Trust / Registered Society / HUF etc. shall be neither asked nor considered, if submitted. Further, no suo moto cognizance of any document available in public domain (i.e., on internet etc.) or in Railway's/DFCCIL's record/office files etc. will be taken for consideration of the tender, if no such mention is available in tender offer submitted.
- (v) A tender from JV/ Partnership firm etc. shall be considered only where permissible as per the tender conditions.
- (vi) The Railway/DFCCIL will not be bound by any change in the composition of the firm made subsequent to the submission of tender. Railway/DFCCIL may, however, recognize such power of attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the Contractor.
- **1.3.15** The tenderer whether sole proprietor/ a company or a partnership firm /joint venture (JV)/registered society/ registered trust/HUF etc if they want to act through agent or individual partner(s), should submit along with the tender, a copy of power of attorney duly stamped and authenticated by a Notary Public or by Magistrate in favour of the specific person whether he/they be partner(s) of the firm or any other person specifically authorizing him/them to submit the tender, sign the agreement, receive money, co-ordinate measurements through contractor's authorized engineer, witness measurements, sign measurement books, compromise, settle, relinquish any claim(s) preferred by the firm and sign "No Claim Certificate" and refer all or any disputes to arbitration. The above power of attorney shall be submitted even if such specific person is authorized for above purposes through partnership deed/ Memorandum of Understanding/ Article of Association or such other document, failing which tender is liable to be rejected.

1.3.16 Employment/Partnership etc. of Retired Railway Employees:

(a) Should a tenderer

i) be a retired Engineer of the gazetted rank or any other gazetted officer working before his retirement, whether in the executive or administrative capacity or whether holding a pensionable post or not, in the

Engineering or any other department of any of the railways/DFCCIL owned and administered by the President of India for the time being, OR

ii) being partnership firm / joint venture (JV) / registered society / registered trust etc have as one of its partners a retired Engineer of the gazetted rank or any other gazetted officer working before his retirement, OR

iii) being an incorporated company have any such retired Engineer of the gazetted rank or any other gazetted officer working before his retirement as one of its directors

AND

in case where such Engineer or officer had not retired from government service at least 1 year prior to the date of submission of the tender

THEN

the tenderer will give full information as to the date of retirement of such Engineer or gazetted officer from the said service and as to whether permission for taking such contract, or if the Contractor be a partnership firm or an incorporated company, to become a partner or director as the case may be, has been obtained by the tenderer or the Engineer or officer, as the case may be from the President of India or any officer, duly authorized by him in this behalf, shall be clearly stated in writing at the time of submitting the tender.

- b) In case, upon successful award of contract, should a tenderer depute for execution of the works under or to deal matters related with this contract, any retired Engineer of gazette rank or retired gazetted officer working before his retirement in the Engineering or any other department of any of the railways/DFCCIL owned and administered by the President of India for the time being, and now in his employment, then the tenderer will ensure that retired Engineer or retired gazetted officer had retired from government service at least 1 year prior to the date of his employment with tenderer and in case he had retired from service within a year then he possesses the requisite permission from the President of India or any officer, duly authorized by him in this behalf, to get associated with the tenderer.
- c) Should a tenderer or Contractor being an individual, have member(s) of his family or in the case of partnership firm/ company / joint venture (JV) / registered society / registered trust etc. one or more of his partner(s)/shareholder(s) or member(s) of the family of partner(s)/shareholder(s) having share of more than 1% in the tendering entity employed in gazetted capacity in the Engineering or any other department of the railway/DFCCIL, then the tenderer at the time of submission of tender, will inform the authority inviting tenders the details of such persons.
- Note: If information as required as per 1.3.16 (a), (b), (c) above has not been furnished, contract is liable to be dealt in accordance with provision of clause 62 of Standard General Condition of contract.

1.3.17 JOINT VENTURE (JV) IN WORKS TENDERS

Participation of Joint Venture (JV) in Works Tender: This Clause shall be applicable for works tenders wherein tender documents provide for the same.

1.3.17.1 Separate identity/name shall be given to the Joint Venture.

1.3.17.2 Number of members in a JV shall not be more than three, if the work involves only one component and shall not be more than five, if the work involves more than one component. One of the members of the JV shall be its Lead Member who shall have a majority (at least 51%) share of interest in the JV. The other members shall have a share of not less than 20% each in case of JV with upto three members and not less than 10% each in case of JV with more than three members. In case of JV with foreign member(s), the Lead Member has to be an Indian firm/company with a minimum share of 51%.

1.3.17.3 A member of JV shall not be permitted to participate either in individual capacity or as a member of another JV in the same tender.

1.3.17.4 The tender form shall be purchased and submitted only in the name of the JV and not in the name of any constituent member. The tender form can however be submitted by JV or any of its constituent member or any person authorized by JV through Power of Attorney to submit tender.

1.3.17.5 Earnest Money Deposit (EMD) shall be deposited by JV or authorized person of JV through e-payment gateway or as mentioned in tender document.

1.3.17.6 A copy of Memorandum of Understanding (MoU) duly executed by the JV members on a stamp paper, shall be submitted by the JV along with the tender. The complete details of the members of the JV, their share and responsibility in the JV etc. particularly with reference to financial, technical and other obligations shall be furnished in the MoU. (The MoU format for this purpose is enclosed along with the tender).

1.3.17.7 Once the tender is submitted, the MoU shall not be modified / altered / terminated during the validity of the tender. In case the tenderer fails to observe/comply with this stipulation, the full Earnest Money Deposit (EMD) shall be liable to be forfeited.

1.3.17.8 Approval for change of constitution of JV shall be at the sole discretion of the Railway/DFCCIL. The constitution of the JV shall not be allowed to be modified after submission of the tender bid by the JV, except when modification becomes inevitable due to succession laws etc., provided further that there is no change in qualification of minimum eligibility criteria by JV after change of composition. However, the Lead Member shall continue to be the Lead Member of the JV. Failure to observe this requirement would render the offer invalid.

1.3.17.9 Similarly, after the contract is awarded, the constitution of JV shall not be allowed to be altered during the currency of contract except when modification become inevitable due to succession laws etc. and minimum eligibility criteria should not get vitiated. Failure to observe this stipulation shall be deemed to be breach of contract with all consequential penal action as per contract conditions.

1.3.17.10 On award of contract to a JV, a single Performance Guarantee shall be submitted by the JV as per tender conditions. All the Guarantees like Performance Guarantee, Bank Guarantee for Mobilization Advance, Machinery Advance etc. (if any) shall be accepted only in the name of the JV and no splitting of guarantees amongst the members of the JV shall be permitted.

1.3.17.11 On issue of LOA (Letter of Acceptance), the JV entity to whom the work has been awarded, with the same shareholding pattern as was declared in the MOU/JV Agreement submitted along with the tender, shall be got registered before the Registrar of the Companies under 'The Companies Act -2013' (in case of
Company) or before the Registrar/Sub-Registrar under the 'The Indian Partnership Act, 1932' (in case of Partnership Firm) or under 'The LLP Act 2008' (in case of LLP). A separate PAN shall be obtained for this entity. The documents pertaining to this entity including its PAN shall be furnished to the Railways/DFCCIL before signing the contract agreement for the work. In case the tenderer fails to observe/comply with this stipulation within 60 days of issue of LOA, contract is liable to be terminated. In case contract is terminated Railway/DFCCIL shall be entitled to forfeit the full amount of the Earnest Money Deposit and other dues payable to the Contractor under this contract. The entity so registered, in the registered documents, shall have, inter-alia, following Clauses:

1.3.17.11.1 Joint And Several Liability - Members of the entity to which the contract is awarded, shall be jointly and severally liable to the Railway/DFCCIL for execution of the project in accordance with General and Special Conditions of Contract. The members of the entity shall also be liable jointly and severally for the loss, damages caused to the Railways/DFCCIL during the course of execution of the contract or due to non-execution of the contract or part thereof.

1.3.17.11.2 Duration of the Registered Entity - It shall be valid during the entire currency of the contract including the period of extension, if any and the maintenance period after the work is completed.

1.3.17.11.3 Governing Laws - The Registered Entity shall in all respect be governed by and interpreted in accordance with Indian Laws.

1.3.17.12 Authorized Member - Joint Venture members in the JV MoU shall authorize one of the members on behalf of the Joint Venture to deal with the tender, sign the agreement or enter into contract in respect of the said tender, to receive payment, to witness joint measurement of work done, to sign measurement books and similar such action in respect of the said tender/contract. All notices/correspondences with respect to the contract would be sent only to this authorized member of the JV.

1.3.17.13 No member of the Joint Venture shall have the right to assign or transfer the interest right or liability in the contract without the written consent of the other members and that of the Railway/DFCCIL in respect of the said tender/contract.

1.3.17.14 Documents to be enclosed by the JV along with the tender:

1.3.17.14.1 In case one or more of the members of the JV is/are partnership firm(s), following documents shall be submitted:

- (i) A notarized copy of the Partnership Deed,
- (ii) A copy of consent of all the partners or individual authorized by partnership firm, to enter into the Joint Venture Agreement on a stamp paper,
- (iii) A notarized or registered copy of Power of Attorney in favour of the individual to sign the MOU/JV Agreement on behalf of the partnership firm and create liability against the firm.

1.3.17.14.2 In case one or more members is/are HUF, the following documents shall be enclosed:

(i) A copy of notarized affidavit on Stamp Paper declaring that he who is signing the affidavit on behalf of HUF is in the position of 'Karta' of Hindu Undivided Family (HUF) and he has the authority, power and consent given by other members to act on behalf of HUF.

1.3.17.14.3 In case one or more members of the JV is/are companies, the following documents shall be submitted:

- (i) A copy of resolutions of the Directors of the Company, permitting the company to enter into a JV agreement,
- (ii) The copies of MOA (Memorandum of Association) / AOA (Articles of Association) of the company
- (iii) A copy of Certificate of Incorporation
- (iv) A copy of Authorization/copy of Power of Attorney issued by the Company (backed by the resolution of Board of Directors) in favour of the individual to sign the tender, sign MOU/JV Agreement on behalf of the company and create liability against the company

1.3.17.14.4 All the Members of JV shall certify that they are not blacklisted or debarred by Railways/DFCCIL or any other Ministry/Department of the Govt. of India from participation in tenders/contract on the date of opening of bids either in their individual capacity or as a member of the JV in which they were/are members.

1.3.17.14.5 All other documents in terms of explanatory notes in clause 1.3.11.1 to 1.3.11.5 above.

1.3.17.15 Credentials & Qualifying Criteria: Technical, financial eligibility and Bid capacity of the JV shall be adjudged based on satisfactory fulfillment of the following criteria:

1.3.17.15.1 <u>Technical Eligibility Criteria</u> ('a' or 'b' mentioned hereunder):

(a) For Works without composite components

The technical eligibility for the work as per para 1.3.11 above, shall be satisfied by either the 'JV in its own name & style' or any member having min 26% share. Each other member of JV shall have technical capacity of minimum 10% of the cost of work i.e., each JV member must have satisfactorily completed during the last 07 (seven) years, ending last day of month previous to the one in which tender is invited, one similar single work for a minimum of 10% of advertised value of the tender.

Note for Clause 1.3.17.15.1:

(a) Value of a completed work done by a Member in an earlier JV shall be reckoned only to the extent of the concerned member's share in that JV for the purpose of satisfying his/her compliance to the above-mentioned technical eligibility criteria in the tender under consideration.

1.3.17.15.2 Financial Eligibility Criteria

The JV shall satisfy the requirement of "Financial Eligibility" mentioned at para 1.3.11.2 above. The "financial capacity" of the lead partner of JV shall not be less than 51% of the financial eligibility criteria mentioned at para 1.3.11.2 above.

The arithmetic sum of individual "financial capacity" of all the members shall be taken as JV's "financial capacity" to satisfy this requirement.

Note: Contractual payment received by a Member in an earlier JV shall be reckoned only to the extent of the concerned member's share in that JV for the purpose of satisfying compliance of the above-mentioned financial eligibility criteria in the tender under consideration.

1.3.17.15.3 <u>Bid Capacity</u>

The JV shall satisfy the requirement of "Bid Capacity" requirement mentioned at para 1.3.11.3 above. The arithmetic sum of individual "Bid capacity" of all the members shall be taken as JV's "Bid capacity" to satisfy this requirement.

1.3.18 Participation of Partnership Firms in works tenders:

1.3.18.1 The Partnership Firms participating in the tender should be legally valid under the provisions of the Indian Partnership Act.

1.3.18.2 The partnership firm should have been in existence or should have been formed prior to submission of tender. Partnership firm should have either been registered with the Registrar or the partnership deed should have been notarized prior to date of tender opening as per the Indian Partnership Act.

1.3.18.3 Separate identity / name should be given to the partnership firm. The partnership firm should have PAN / TAN number in its own name and PAN / TAN number in the name of any of the constituent partners shall not be considered. The valid constituents of the firm shall be called partners.

1.3.18.4 Once the tender has been submitted, the constitution of the firm shall not normally be allowed to be modified / altered / terminated during the validity of the tender as well as the currency of the contract except when modification becomes inevitable due to succession laws etc., in which case prior permission should be taken from Railway/DFCCIL and in any case the minimum eligibility criteria should not get vitiated. The reconstitution of firm in such cases should be followed by a notary certified Supplementary Deed. The approval for change of constitution of the firm, in any case, shall be at the sole discretion of the Railways/DFCCIL and the tenderer shall have no claims what-so-ever. Any change in the constitution of Partnership firm after opening of tender shall be with the consent of all partners and with the signatures of all partners as that in the Partnership Deed. Failure to observe this requirement shall render the offer invalid and full EMD shall be forfeited.

If any Partner/s withdraws from the firm after opening of the tender and before the award of the contract, the offer shall be rejected and EMD of the tenderer will be forfeited. If any new partner joins the firm after opening of tender but prior to award of contract, his / her credentials shall not qualify for consideration towards eligibility criteria either individually or in proportion to his share in the previous firm. In case the tenderer fails to inform Railway/DFCCIL beforehand about any such changes / modification in the constitution which is inevitable due to succession laws etc. and the contract is awarded to such firm, then it will be considered a breach of the contract conditions liable for determination of the contract under Clause 62 of General Conditions of Contract.

1.3.18.5 A partner of the firm shall not be permitted to participate either in his individual capacity or as a partner of any other firm in the same tender.

1.3.18.6 The tender form shall be submitted only in the name of partnership firm. The EMD shall be deposited by partnership firm through e-payment gateway or as mentioned in tender document. The EMD submitted in the name of any individual partner or in the name of authorized partner (s) shall not be considered.

1.3.18.7 One or more of the partners of the firm or any other person (s) shall be designated as the authorized person (s) on behalf of the firm, who will be authorized by all the partners to act on behalf of the firm through a "Power of Attorney", specially authorizing him / them to submit & sign the tender, sign the agreement, receive payment, witness measurements, sign measurement books, make correspondences, compromise / settle / relinquish any claim (s) preferred by the firm, sign "No Claim Certificate", refer all or any dispute to arbitration and to take similar such action in respect of the said tender / contract. Such "Power of Attorney" shall be notarized / registered and submitted along with the tender.

1.3.18.8 On issue of Letter of Acceptance (LOA) to the partnership firm, all the guarantees like Performance Guarantee, guarantee for various Advances to the Contractor shall be submitted only in the name of the partnership firm and no splitting of guarantees among the partners shall be acceptable.

1.3.18.9 On issue of Letter of Acceptance (LOA), contract agreement with partnership firm shall be executed in the name of the firm only and not in the name of any individual partner.

1.3.18.10 In case the Letter of Acceptance (LOA) is issued to a partnership firm, the following undertakings shall be furnished by all the partners through a notarized affidavit, before signing of contract agreement.

(a) Joint and several liabilities:

The partners of the firm to which the Letter of Acceptance (LOA) is issued, shall be jointly and severally liable to the Railway/DFCCIL for execution of the contract in accordance with General and Special Conditions of the Contract. The partners shall also be liable jointly and severally for the loss, damages caused to the Railway/DFCCIL during the course of execution of the contract or due to non-execution of the contract or part thereof.

(b) Duration of the partnership deed and partnership firm agreement:

The partnership deed/partnership firm agreement shall normally not be modified/altered/ terminated during the currency of contract and the maintenance period after the work is completed as contemplated in the conditions of the contract. Any change carried out by partners in the constitution of the firm without permission of Railway/DFCCIL, shall constitute a breach of the contract, liable for determination of the contract under Clause 62 of the General Conditions of Contract.

(c) **Governing laws:** The partnership firm agreement shall in all respect be governed by and interpreted in accordance with the Indian laws.

(d) No partner of the firm shall have the right to assign or transfer the interest right or liability in the contract without the written consent of the other partner/s and that of the Railway/DFCCIL.

1.3.18.11 The tenderer shall clearly specify that the tender is submitted on behalf of a partnership firm. The following documents shall be submitted by the partnership firm, with the tender:

- (i) A notarized copy of partnership deed.
- (ii) A notarized or registered copy of Power of Attorney in favour of the individual to tender for the work, sign the agreement etc. and create liability against the firm.
- (iii) An undertaking by all partners of the partnership firm that they are not blacklisted or debarred by Railways/DFCCIL or any other Ministry / Department of the Govt. of India from participation in tenders / contracts as on the date of opening of bids, either in their individual capacity or in any firm in which they were / are partners. Concealment / wrong information in regard to above shall make the contract liable for determination under Clause 62 of the General Conditions of Contract.

1.3.18.12 Evaluation of eligibility of a partnership firm:

Technical and financial eligibility of the firm shall be adjudged based on satisfactory fulfillment of the eligibility criteria laid down above.

1.3.19 Period of Completion

The entire work is required to be completed in all respects within **18 months** (*Eighteen Months*) from the date of issue of the acceptance letter. Time is the essence of contract. The contract or shall be required to maintain steady and regular progress to the satisfaction of the Engineer/DFCCIL to ensure that the work will be completed in all respects within the stipulated time.

1.3.20 If the Tenderer/s deliberately gives any wrong information about credentials / documents in his/their tenders and thereby create(s) circumstances for acceptance of his/their tender, DFCCIL reserves the right to reject such tender at any stage, besides, shall suspend business with such tenderer. **The EMD** of such tenderers shall *also be forfeited*.

1.3.21 Quantum of work and materials:

The indicative schedule of quantities of various items of works is included in Form Nos -3 & 4 of the tender document.

1.3.22 Employer not bound to accept any tender:

The Employer shall not be bound to accept the lowest or any tenderor to assign any reason for nonacceptance or rejection of a tender. The employer reserves the right to accept any tender in respect of the whole or any portion of the work specified in the tender papers or to reduce the work or to accept any tender for less than the tendered quantities without assigning any reason whatsoever.

1.3.23 Schedule of Prices

The Schedule as given in the Tender Document list out the Schedule of Prices of various items. Based on these, the total tender value has also been worked out.

1.3.24 Performance Guarantee: Refer clause no. 16(4) of GCC-2020 read in spirit of DFCCIL Letter No. HQ-ENWC/CON1(POLICY)/1/2020 dt. 28.12.2020, Railway Letter No. 2020/CE-I/CT/3E/GCC/Policy dt. 20.11.2020 and OM No. F/914/2020-PPD dt. 12.11.2020

1.3.25 The tenderer shall furnish information for making payment through ECS/NEFT/RTGS (*Tender Form No. 8 placed at Part III, Chapter-II of the tender document*).

1.3.26 Negotiation:

1.3.27 Site Inspection:

Tenderers are requested to inspect the site and carry out careful examination to satisfy them as to the nature of work involved and facilities available at the site. They should note carefully all the existing structures and those under construction through other agencies. They should also study the suitability of utilizing the different equipments and the machinery that they intend to use for the execution of the work. The tenderers should also select suitable sites for the purpose of locating their store yard, laboratory, staff quarters etc.

1.3.28 No form C & D shall be issued to the contractor for this work.

1.3.29 The rates quoted by the contractor are deemed to be inclusive of site clearance, setting outwork, profile, setting lay out on ground, establishment of reference benchmark(s), installing various signage, taking spot levels, survey with total station, construction of all safety and protection devices, compulsory use of helmet and safety shoes, and other appropriate safety gadgets by workers, imparting continuous training for all the workers, barriers, preparatory works, construction of clean, hygienic and well ventilated workers housings in sufficient numbers working during monsoon or odd season, working beyond normal hours, working at all depths, height, lead, lift, levels and location etc. and any other unforeseen but essential incidental works required to complete this work. *Nothing extra shall be payable* on this account and *no extension of time* for completion of work shall be granted on these accounts.

The rates quoted by the tenderer shall be inclusive of all taxes and levies but excluding GST. The GST as legally leviable and payable by the Bidder under the provisions of applicable law/act shall be paid extra by DFCCIL to the agency.

Therefore, the Bidders should quote their rates after considering the Input Tax Credits on their input materials and services. Hence, Bidders should ensure that, full benefit of Input Tax Credit (ITC) likely to be availed by them is duly considered while quoting their rates.

- **1.3.30** Price Variation Clause (PVC) will not be applicable for this work.
- 1.3.31 No Mobilization or Secured Advance would be paid by DFCCIL for this work.

1.3.32 Contract value:

The contract value shall be inclusive of all taxes and duties including ESIC, PF, Conditions of Contract contribution & all other statutory taxes and levies (*if any*) applicable to the Contractors/Workers etc (as

applicable). The GST as legally leviable and payable by the Bidder under the provisions of applicable law/act shall be paid extra by DFCCIL to the agency.

1.3.33 Taxes, Duties etc.:

- (i) GSTIN of DFCCIL will be provided to the contractor along with the letter of acceptance (LOA).
- (ii) Payment to the contractor will be subjected to TDS as per rules inforce from time to time. The tax deduction at source (*TDS*) shall be done as per the provisions of Income Tax Act & GST, as amended from time to time and a certificate to this effect shall be provided to the contractor by the DFCCIL.
- (i) Contractor shall submit GST compliant tax invoice containing (*GSTIN of DFCCIL*) and all the particulars as stipulated under invoice rules of GST law. Payment shall be made to the contractor only after submission of GST compliant Tax Invoice.
- (ii) No reimbursement on account of increase/decrease in the rate of taxes, levies, duties etc. on input goods/services/work shall be made. Bidder has to make his own assessment of the impact of future variation (*if any*) in rate of taxes/duties/levies etc. in his price bid.

PART- I

CHAPTER-IV

GENERAL CONDITIONS OF CONTRACT

PART - I

CHAPTER IV

GENERAL CONDITIONS OF CONTRACT

DEFINITIONS AND INTERPRETATION

- **1.** (1) **Definition:** In these General conditions of Contract, the following terms shall have the meaning assigned hereunder except where the context otherwise requires: -
 - (a) "Railway/DFCCIL" shall mean Dedicated Freight Corridor Corporation of India Ltd, a Govt. of India Enterprise (under Ministry of Railways) and a company incorporated under the provisions of the Companies Act, 1956 having it's registered office at 5th Floor, Supreme Court Metro Station Complex, New Delhi-110001 represented through its Managing Director or CGM/GM (hereinafter referred to as "DFCCIL") which expression shall, unless repugnant to the context, be deemed to include it's successors and assigns.
 - (b) **"General Manager of DFCCIL"** shall mean the officer in-charge of the General Superintendence and Control of the DFCCIL and shall mean and include their successors, of the successor of DFCCIL.
 - (c) **"Chief Engineer"** shall mean the officer in-charge of the Engineering Department of DFCCIL and shall also include CGM/GM of DFCCIL and shall mean and include their successor, of the successor DFCCIL.
 - (d) **"Engineer"** and Employer's Engineer shall mean the Chief General Manager/GM of DFCCIL and shall mean & include the Engineers of the DFCCIL or PMC appointed by DFCCIL. Employer/Owner shall mean DFCCIL.
 - (e) "Engineer's Representative" shall mean the Assistant Engineer, Assistant Signal and Telecommunication Engineer and Assistant Electrical Engineer, APM / Dy.PM / PM / Dy. CPM / Add. CPM of DFCCIL in direct charge of the work and shall include any Sr. Sec. / Sec / Jr. Engineer / Executive / Sr. Executive, APM/ Dy.PM / PM / Dy CPM of DFCCIL of Civil Engineering / Signal & Telecommunication Engineering/ Electrical Engineering Department appointed by the DFCCIL and shall mean and include the Engineer's Representative of the successor DFCCIL.
 - (f) "**Contractor**" shall mean the Person / Firm /Co-operative Society or Company whether incorporated or not who enters into the contract with the DFCCIL and shall include their executors, administrators, and successors and permitted assigns.
 - (g) "Contract" shall mean and include the Agreement of Work Order, the accepted Schedule of Rates or the Schedule or Rates of Railway/CPWD modified by the tender percentage for items of works quantified, or not quantified, the Standard General Conditions of Contract, the Special Conditions of Contracts, if any; the Drawing, the Specifications, the Special Specifications, if any and Tender Forms, if any and all other documents included as part of contract.
 - (h) "Works" shall mean the works to be executed in accordance with the contract.

- (i) **"Specifications"** shall mean the Standard Specifications for Materials & Works referred/mentioned in tender documents or CPWD/Railway or as specified by DFCCIL under the authority of the Chief Engineer/CGM or as amplified, added to or superseded by Special Specifications, if any.
- (j) **"Schedule of rates of DFCCIL"** shall mean rates specified in "Schedules" of the tender document or Delhi Schedule of Rates (DSR) of CPWD issued under the authority of the Chief Engineer from time to time.
- (k) **"Drawing"** shall mean the maps, drawings, plans and tracings or prints there of annexed to the contract and shall include any modifications of such drawings and further drawings as may be issued by the Engineer/DFCCIL from time to time.
- (1) **"Constructional Plant"** shall mean all appliances or things of whatsoever nature required for the execution, completion or maintenance of the works or temporary works (*as hereinafter defined*) but does not include materials or other things intended to form or forming part of the permanent work.
- (m) **"Temporary Works"** shall mean all temporary works of every kind required for the execution completion and/or maintenance of the works.
- (n) **"Site"** shall mean the lands and other places on, under, in or through which the works are to be carried out and any other lands or places provided by the DFCCIL for the purpose of the contract.
- (o) **"Period of Maintenance"** shall mean the specified period of maintenance from the date of completeion of the works, as certified by the Engineer/DFCCIL.
- (p) **'Contractor's authorized Engineer'** shall mean a graduate Engineer or equivalent, having more than 3 years experience in the relevant field of construction work involved in the contract, duly approved by Engineer/DFCCIL.
- (q) Date of inviting tender shall be the date of publishing tender notice on Tender Wizard/IREPS website if tender is published on website or the date of publication in newspaper in case tender is not published on website.
- **1. (2) Singular and Plural**: Words importing the singular number shall also include the plural and vice versa where the context requires.
- **1.(3) Headings & marginal headings:** -The headings and marginal headings in these Standard General Conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or be taken into consideration in the interpretation or construction thereof or the contract.

GENERAL OBLIGATION

2. (1) Execution Co-relation and intent of contract Documents: -The contract documents shall be signed in triplicate by the DFCCIL and the Contractor. The contract documents are complementary, and what is called for by any-one shall be as binding as if called for by all, the intention of the documents is to include all labour and materials, equipments and transportation necessary for the proper execution of work. Materials or work not covered by or properly inferable from any heading or

class of the specifications shall not be supplied by the Railway/ DFCCIL to the contractors unless distinctly specified in the contract documents. Materials or works described in words which so applied have a well-known technical or trade meaning shall be held to refer to such recognized standards.

- 2.(2) If a work is transferred from the jurisdiction of one Railway to another Railway or to a Project Authority/DFCCIL or vice versa while contract is in subsistence, the contract shall be binding on the Contractor and the Successor Railway/Project in the same manner & take effect all respects as if the Contractor and the Successor Railway/Project were parties there to from the inception and the corresponding officer or the Competent Authority in the Successor Railway/Project will exercise the same powers and enjoy the same authority as conferred to the Predecessor Railway/Project under the original contract/agreement entered into.
- 2.(3) If for administrative or other reasons, the contract is transferred to the Successor Railway/Successor Project Authority of Railway/DFCCIL, the contract shall notwithstanding any things contained herein contrary there to, be binding on the Contractor and the Successor Railway/Project Authority of Railway/DFCCIL in the same manner and take effect in all respects as if the Contractor and the Successor Railway/Successor Project Authority of Railway/DFCCIL had been parties thereto from the date of this contract.
- **3.(1)** Law governing the contract: -The contract shall be governed by the law for the time being in force in the Republic of India.
- **3.(2)** Compliance to regulations and bye-laws:-The contractor shall conform to the provision of any statute relating to the works and regulations and bye-laws of any local authority and of any water and lighting companies or undertakings, with whose system the work is proposed to be connected and shall before making any variation from the drawings or the specifications that may be necessitated by so confirming give to the Engineer/DFCCIL notice specifying the variation proposed to be made and the reasons for making the variation and shall not carry out such variation until he has received instructions from the Engineer/DFCCIL in respect thereof. The contractor shall be bound to give all notices required by statute, regulations or bye-laws as aforesaid and to pay all fees and taxes payable to any authority in respect thereof.
- 4. **Communications to be in writing:** All notices, communications, reference and complaints made by the Railway/DFCCIL or the Engineer/DFCCIL or the Engineer's/DFCCIL's representative or the contractor inter-se concerning the work shall be in writing or e-mail on registered e-mail ID's and no notice, communication, reference or complaint not in writing or through e-mail, shall be recognized.
- 5. Service of Notices on Contractors:-The contractor shall furnish to the Engineer the name designation and address of his authorized agent and all complaints, notices, communications and references shall be deemed to have been duly given to the contractor if delivered to the contractor or his authorized agent or left at or posted to the address so given and shall be deemed to have been so given in the case of posting on day on which they would have reached such address in the ordinary course of post or on the day on which they were so delivered or left. In the case of contract by partners, any change in the constitution of the firm shall be forthwith notified by the contractor to the Engineer/DFCCIL.

- 6. Occupation and use of land: No land belonging to or in the possession of the Railway/DFCCIL shall be occupied by the Contractor without the permission of the Railway/DFCCIL. The Contractor shall not use, or allow to be used; the site for any purposes other than that of executing the works. Whenever non-railway bodies/persons are permitted b use Railway/DFCCIL premises with competent authority's approval, conservancy charges as applicable from time to time may be levied.
- 7. Assignment or subletting of contract: The contractor shall not assign or sublet the contract or any part thereof or allow any person to become interested therein any manner whatsoever without the special permission in writing of the Chief Engineer/CGM, save as provided below. Any breach of this condition shall entitle the Railway/DFCCIL to rescind the contract under clause 62 of these conditions and also render the contractor liable for payment to the Railway/DFCCIL in respect of any loss or damage arising or ensuing from such cancellation; provided always that execution of the details of the work by petty contractor under the direct and personal supervision of the Contractor or his agent shall not be deemed to be sub-letting under this clause.

In case Contractor intends to subcontract part of work, he shall submit a proposal in writing seeking permission of Chief Engineer/CGM for the same. While submitting the proposal to Railway/DFCCIL, Contractor shall ensure the following:

- (a) (i) Total value of work to be assigned to sub-contractor(s) shall not be more than 50% of total contract value.
 - (ii) The subcontractor shall have successfully completed at least one work similar to work proposed for subcontract, costing not less than 35% value of work to be subletted, in last 5 years through a works contract directly given to him by a Govt. Department; or by a Public listed company having average annual turnover of Rs 500 crore and above in last 3 financial years excluding the current financial year, listed on National Stock Exchange or Bombay Stock Exchange, registered at least 5 years back from the date of submission of proposal by Contractor to Railway/DFCCIL and work experience certificate issued by a person authorised by the Public Listed Company to issue such certificates.

In case contractor submits subcontractor's work experience certificate issued by public listed company, the contractor shall also submit along with work experience certificate, the relevant copy of work order, bill of quantities, bill wise details of payment received duly certified by Chartered Accountant, TDS certificates for all payments received and copy of final/last bill paid by company in support of above work experience certificate.

(iii) There is no banning of business with the sub-contractor in force over IR/DFCCIL.

(b) The Contractor shall provide to the Engineer/DFCCIL a copy of the agreement to be entered into by Contractor with subcontractor. No subcontractor shall be permitted without a formal agreement between Contractor and subcontractor. This agreement shall clearly define the scope of work to be carried out by subcontractor and the terms of payment in clear & unambiguous manner.

(c) On receipt of approval from Chief Engineer/CGM, Contractor shall enter into a formal agreement legally enforceable in Court of Law with subcontractor and submit a copy of the same to the Engineer/DFCCIL.

(d) The Contractor shall intimate to the Engineer/DFCCIL not less than 7 days in advance, the intended date of commencement of subcontractor's work.

(e) Once having entered into above arrangement, Contractor shall discontinue such arrangement, if he intends to do so at his own or on the instructions of Railway/DFCCIL, with prior intimation to Chief Engineer/DFCCIL.

(f) The Contractor shall indemnify Railway/DFCCIL against any claim of subcontractor.

(g) The Contractor shall endeavour to resolve all matters and payments amicably and speedily with the subcontractor.

(h) In addition to issuance of work experience certificate to Contractor, the Engineer/DFCCIL, when, based on documents, is satisfied that subcontracted work has been carried out by subcontractor, shall issue work experience certificate to the subcontractor also for the portion of work subcontracted and successfully completed by the sub-contractor.

(i) The responsibility of successful completion of work by subcontractor shall lie with Contractor. Subcontracting will in no way relieve the Contractor to execute the work as per terms of the Contract.

(j) Further, in case Engineer/DFCCIL is of the view that subcontractor's performance is not satisfactory, he may instruct the Contractor to remove the subcontractor from the work and Contractor has to comply with the above instructions with due promptness. Contractor shall intimate the actual date of discontinuation of subcontract to Engineer/DFCCIL. No claim of Contractor whatsoever on this account shall be entertained by the Railway/DFCCIL and this shall be deemed as 'excepted matter' (matter not arbitrable).

(k) The permitted subcontracting of work by the Contractor shall not establish any contractual relationship between the sub-contractor and the Railway/DFCCIL and shall not relieve the Contractor of any responsibility under the Contract.

8. Assistance by the Railway/DFCCIL for the Stores to be obtained by the Contractor: - Owing to difficulty in obtaining certain materials (including Tools & Plant) in the market, the Railway/DFCCIL may have agreed without any liability therefore to endeavour to obtain or assist the contractor in obtaining the required quantities of such materials as may be specified in the tender. In the event of delay or failure in obtaining the required quantities of the aforesaid material the contractor shall not be deemed absolved of his own responsibility and shall keep in touch with day to day positions regarding their availability and accordingly adjust progress of works including employment of labour and the Railway/DFCCIL shall not in any way be liable for the supply of materials or for the non-supply thereof for any reasons whatsoever nor for any loss or damage arising in consequence of such delay or non-supply.

9. Deleted

10. **Carriage of materials:** - No forwarding orders shall be issued by the Railway/DFCCIL for the conveyance of contractor's materials, tools and plant by Train which may be required for use in the works and the contractor shall pay full freight charges at public tariff rates therefore.

11. Deleted

- 12. **Representation on Works:-** The contractor shall, when he is not personally present on the site of the works place and keep a responsible agent at the works during working hours who shall on receiving reasonable notice, present himself to the Engineer/DFCCIL and orders given by the Engineer/DFCCIL or the Engineer's/DFCCIL's representative to the agent shall be deemed to have the same force as if they had been given to the Contractor. Before absenting himself, the contractor shall furnish the name and address of his agent for the purpose of this clause and failure on the part of the Contractor to comply with this provision at any time will entitle the Railway/DFCCIL to **rescind the contract** under clause 62 of these conditions.
- **13. Relics and Treasures:-** All gold, silver, oil, other minerals of any description, all precious stones, coins, treasures relics antiquities and other similar things which shall be found in or upon the site shall be the property of the Railways/DFCCIL and the Contractor shall duly preserve the same to the satisfaction of the Railways/DFCCIL and shall from time to time deliver the same to such person or persons as the Railways/DFCCIL may appoint to receive the same.
- 14. Excavated material:-The contractor shall not sell or otherwise dispose of or remove except for the purpose of this contract, the sand, stones, clay, ballast, earth, trees, rock or other substances or materials which may be obtained from any excavation made for the purpose of the works or any building or produced upon the site at the time of delivery of the possession thereof but all the substances, materials, buildings and produce shall be the property of the Railways/DFCCIL provided that the contractor may, with the permission of the Engineer/DFCCIL, use the same for the purpose of the works either free of cost or pay the cost of the same at such rates as may be determined by the Engineer/DFCCIL.
- **15. Indemnity by Contractors:** The Contractor shall indemnify and save harmless the Railway/DFCCIL from and against all actions, suit, proceedings, losses, costs, damages, charges, claims and demands of every nature and description brought or recovered against the Railways/DFCCIL by reason of any act or omission of the contractor, his agents or employees, in the execution of the works or in his guarding of the same. All sums payable by way of compensation under any of these conditons shall be considered as reasonable compensation to be applied to the actual loss or damage sustained, and whether or not any damage shall have been sustained.
- **16.(1)** Security Deposit: The Earnest Money deposited by the Contractor with his tender will be retained by the Railways/DFCCIL as part of security for the due and faithful fulfillment of the contract by the Contractor. The Security Deposit shall be 5% of the contract value. Security Deposit may be deposited by the Contractor before release of first on account bill in cash or Term Deposit Receipt issued from Scheduled Bank, or may be recovered at the rate of 6% of the bill amount till the full Security Deposit is recovered. Provided also that in case of defaulting Contractor, the Railway/DFCCIL may retain any amount due for payment to the Contractor on the pending "on account bills" so that the amounts so retained (including amount guaranteed through Performance Guarantee) may not exceed 10% of the total value of the contract.

Further, in case of contracts having value equal to or more than ₹ 50 crore (Rs Fifty crore) the Security Deposit may be deposited as Bank Guarantee Bond also, issued by a scheduled bank after execution of contract documents, but before payment of 1st on account bill. Provided further that the validity of

Bank Guarantee Bond shall be extended from time to time, depending upon extension of contract granted in terms of Clause 17 of the Standard General Conditions of Contract.

Further, in case Security Deposit has been submitted as Term Deposit Receipt/Bank Guarantee Bond in full amount, the Earnest Money deposited by the Contractor with his tender will be returned by the Railways/DFCCIL.

Note: After the work is physically completed as certified by competent authority, Security Deposit recovered from the running bills of a Contractor can be returned to him, if he so desires, in lieu of Term Deposit Receipt/irrevocable Bank Guarantee for equivalent amount from Scheduled Bank, to be submitted by him.

- **16.(2)(i) Refund of Security Deposit:** Security Deposit mentioned in sub clause (1) above shall be returned to the Contractor along with or after, the following:
 - (a) Final Payment of the Contract as per clause 51. (1) and
 - (b) Execution of Final Supplementary Agreement or Certification by Engineer/DFCCIL that Railway/DFCCIL has No Claim on Contractor **and**
 - (c) Maintenance Certificate issued, on expiry of the maintenance period as per clause 50. (1), in case applicable.
- 16.(2)(ii) Forfeiture of Security Deposit: Whenever the contract is rescinded as a whole under clause 62 (1) of GCC, the Security Deposit already with Railways/DFCCIL under the contract shall be forfeited. However, in case the contract is rescinded in part or parts under clause 62 (1) of GCC, the Security Deposit shall not be forfeited.
- **16.(3)** No interest shall be payable upon the Earnest Money and Security Deposit or amounts payable to the Contractor under the Contract, but Government Securities deposited in terms of Sub-Clause 16. (4)(b) of this clause will be payable with interest accrued thereon.

16.(4) Performance Guarantee

The procedure for obtaining Performance Guarantee is outlined below:

(a) The successful bidder shall have to submit a Performance Guarantee (PG) within 21 (Twenty-one) days from the date of issue of Letter of Acceptance (LOA). Extension of time for submission of PG beyond 21 (Twenty-one) days and upto 60 days from the date of issue of LOA may be given by the Authority who is competent to sign the contract agreement. However, a penal interest of 12% per annum shall be charged for the delay beyond 21(Twenty-one) days, i.e. from 22nd day after the date of issue of LOA. Further, if the 60th day happens to be a declared holiday in the concerned office of the Railway/DFCCIL, submission of PG can be accepted on the next working day.

In all other cases, if the Contractor fails to submit the requisite PG even after 60 days from the date of issue of LOA, the contract is liable to be terminated. In case contract is terminated Railway/DFCCIL shall be entitled to forfeit Earnest Money Deposit and other dues payable against that contract.

The failed Contractor shall be debarred from participating in re-tender for that work.

- (b) The successful bidder shall submit the Performance Guarantee (PG) in any of the following forms, amounting to 3% of the contract value in terms of DFCCIL Letter No. HQ-ENWC/CON1(POLICY)/1/2020 dt. 28.12.2020, Railway Board Letter No. 2020/CE-I/CT/3E/GCC/Policy dt. 20.11.2020 and OM No. F.9/4/2020-PPD dt. 12-11-2020.
 - (i) Deleted
 - (ii) Irrevocable Bank Guarantee;
 - (iii) Deleted
 - (iv) Deleted
 - (v) Deleted
 - (vi) Deleted
 - (vii) Deleted
 - (viii) Deleted
 - (ix) Deleted
 - (x) Deleted
 - (xi) Deleted
- (c) The Performance Guarantee shall be submitted by the successful bidder after the Letter of Acceptance (LOA) has been issued, but before signing of the contract agreement. This P.G. shall be initially valid upto the stipulated date of completion plus 60 days beyond that. In case, the time for completion of work gets extended, the Contractor shall get the validity of P.G. extended to cover such extended time for completion of work plus 60 days.
- (d) The value of PG to be submitted by the Contractor will not change for variation upto 25% (either increase or decrease). In case during the course of execution, value of the contract increases by more than 25% of the original contract value, an additional Performance Guarantee amounting to 5% (five percent) for the excess value over the original contract value shall be deposited by the Contractor. On the other hand, if the value of contract decreases by more than 25% of the original contract value, Performance Guarantee amounting to 5% (five percent) of the decrease in the contract value shall be returned to the Contractor. The PG amount in excess of required PG for decreased contract value, available with Railways/DFCCIL, shall be returned to Contractor as per his request duly safeguarding the interest of Railways/DFCCIL.
- (e) The Performance Guarantee (PG) shall be released after physical completion of the work based on 'Completion Certificate' issued by the competent authority stating that the Contractor has completed the work in all respects satisfactorily.
- (f) Whenever the contract is rescinded, the Performance Guarantee already submitted for the contract shall be encashed in addition to forfeiture of Security Deposit available with Railway/DFCCIL.
- (g) The Engineer/DFCCIL shall not make a claim under the Performance Guarantee except for amounts to which the President of India is entitled under the contract (not withstanding and/or without prejudice

to any other provisions in the contract agreement) in the event of:

- (i) Failure by the Contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer/DFCCIL may claim the full amount of the Performance Guarantee.
- (ii) Failure by the Contractor to pay Railway/DFCCIL any amount due, either as agreed by the Contractor or determined under any of the Clauses/Conditions of the Agreement, within 30 days of the service of notice to this effect by Engineer/DFCCIL.
- (iii) The Contract being determined or rescinded under clause 62 of the GCC.

(h) Deleted in terms of Railway Board Letter No. 2020/CE-I/CT/3E/GCC/Policy dt. 20.11.2020 and OM No. F.9/4/2020-PPD dt. 12-11-2020.

- 17. Force Majeure Clause:- If at any time, during the continuance of this contract, the performance in whole or in part by either party of any obligation under this contract shall be prevented or delayed by reason of any war, hostility, acts of public enemy, civil commotion, sabotage, serious loss or damage by fire, explosions, epidemics/pandemics, strikes, lockouts or acts of God (hereinafter, referred to events) provided, notice of the happening of any such event is given by either party to the other within 30 days from the date of occurrence thereof, neither party shall by reason of such event, be entitled to terminate this contract nor shall either party have any claim for damages against the other in respect of such non-performance or delay in performance, and works under the contract shall be resumed as soon as practicable after such event has come to an end or ceased to exist, and the decision of the Engineer/DFCCIL as to whether the works have been so resumed or not shall be final and conclusive, PROVIDED FURTHER that if the performance in whole or in part of any obligation under this contract is prevented or delayed by reason of any such event for a period exceeding 120 days, either party may at its option terminate the contract by giving notice to the other party.
 - **17-A Extension of time in Contracts:-** Subject to any requirement in the contract as to completion of any portion or portions of the works before completion of the whole, the Contractor shall fully and finally complete the whole of the works comprised in the contract (with such modifications as may be directed under conditions of this contract) by the date entered in the contract or extended date in terms of the following clauses:
 - (i) **Extension due to modification:-** If any modifications have been ordered which in the opinion of the Engineer/DFCCIL have materially increased the magnitude of the work, then such extension of the contracted date of completion may be granted as shall appear to the Engineer/DFCCIL to be reasonable in the circumstances, provided moreover that the Contractor shall be responsible for requesting such extension of the date as may be considered necessary as soon as the cause thereof shall arise and in any case not less than one month before the expiry of the date fixed for completion of the works.
 - (ii) Extension for Delay not due to Railway/DFCCIL or Contractor: If in the opinion of the Engineer/DFCCIL, the progress of work has any time been delayed by any act or neglect of Railway's/DFCCIL's employees or by other Contractor employed by the Railway/DFCCIL under Sub-Clause (4) of Clause 20 of these Conditions or in executing the work not forming part of the contract but on which Contractor's performance necessarily depends or by reason of proceeding taken or threatened by or dispute with adjoining or to neighbouring owners or public authority arising otherwise through the Contractor's own default etc. or by the delay authorized by the Engineer/DFCCIL pending arbitration or in consequences of the Contractor not having received in

due time necessary instructions from the Railway/DFCCIL for which he shall have specially applied in writing to the Engineer/DFCCIL or his authorized representative then upon happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer/DFCCIL within 15 days of such happening, but shall nevertheless make constantly his best endeavours to bring down or make good the delay and shall do all that may be reasonably required of him to the satisfaction of the Engineer/DFCCIL to proceed with the works. The Contractor may also indicate the period for which the work is likely to be delayed and shall be bound to ask for necessary extension of time. The Engineer/DFCCIL on receipt of such request from the Contractor shall consider the same and shall grant such extension of time as in his opinion is reasonable having regard to the nature and period of delay and the type and quantum of work affected thereby. No other compensation shall be payable for works so carried forward to the extended period of time; the same rates, terms and conditions of contract being applicable as if such extended period of time was originally provided in the original contract itself.

- (iii) Extension for Delay due to Railways/DFCCIL: In the event of any failure or delay by the Railway/DFCCIL to hand over the Contractor possession of the lands necessary for the execution of the works or to give the necessary notice to commence the works or to provide the necessary drawings or instructions or any other delay caused by the Railway/DFCCIL due to any other cause whatsoever, then such failure or delay shall in no way affect or vitiate the contract or alter the character thereof or entitle the Contractor to damages or compensation therefor, but in any such case, the Railway/DFCCIL may grant such extension or extensions of the completion date as may be considered reasonable.
- **17-B** Extension of Time with Liquidated Damages (LD) for delay due to Contractor: The time for the execution of the work or part of the works specified in the contract documents shall be deemed to be the essence of the contract and the works must be completed not later than the date(s) as specified in the contract. If the Contractor fails to complete the works within the time as specified in the contract for the reasons other than the reasons specified in Clause 17 and 17-A, the Railway/DFCCIL may, if satisfied that the works can be completed by the Contractor within reasonable short time thereafter, allow the Contractor for further extension of time (**Proforma at Form-14**) as the Engineer/DFCCIL may decide. On such extension the Railway/DFCCIL will be entitled without prejudice to any other right and remedy available on that behalf, to recover from the Contractor as agreed damages and not by way of penalty for each week or part of the week, a sum calculated at the following rates of the contract value of the works.

For the purpose of this Clause, the contract value of the works shall be taken as value of work as per contract agreement including any supplementary work order/contract agreement issued. Provided also, that the total amount of liquidated damages under this condition shall not exceed 5% of the contract value or of the total value of the item or groups of items of work for which a separate distinct completion period is specified in the contract.

S.No.	Duration of extension of time under Clause 17-	Rate of Liquidated Damages
	В	
(i)	Up to Twenty percent of original period of	As decided by Engineer/DFCCIL,
	completion including period of extension of DOC	between 0.01% to 0.10% of contract
	granted under Section 17A(i)	value for each week or part of the week
(ii)	Above Twenty percent but upto Thirty percent of	0.20% of contract value for each week or
	original period of completion including period of	part of the week
	extension of DOC granted under Section 17A(i)	
(iii)	Above Thirty percent but upto Forty percent of	0.30% of contract value for each week or
	original period of completion including period of	part of the week

	extension of DOC granted under Section 17A(i)	
(iv)	Above Forty percent of original period of	0.50% of contract value for each week or
	completion including period of extension of DOC	part of the week
	granted under Section 17A(i)	

Provided further, that if the Railway/DFCCIL is not satisfied that the works can be completed by the Contractor and in the event of failure on the part of the contractor to complete the work within further extension of time allowed as aforesaid, the Railway/DFCCIL shall be entitled without prejudice to any other right or remedy available in that behalf, to appropriate the contractor's Security Deposit and rescind the contract under Clause 62 of these Conditions, whether or not actual damage is caused by such default.

- 17-C Bonus for Early Completion of Work: In case of open tenders having value more than Rs 20 crore and original period of completion 12 months or more, when there is no reduction in original scope of work by more than 10%, and no extension granted on either Railway/DFCCIL or Contractor's account, Contractor shall be entitled for a bonus of 1% for each 30 days early completion of work. The period of less than 30 days shall be ignored while working out bonus. The maximum bonus shall be limited to 3% of original contract value. The completion date shall be reckoned as the date of issuance of completion certificate by Engineer/DFCCIL.
- **18.(1) Illegal Gratification:-** Any bribe, commission, gift or advantage given, promised or offered by or on behalf to the contractor or his partner, agent or servant or, anyone on his behalf, to any officer or employee of the Railway/DFCCIL, or to any person on his behalf in relation to obtaining or execution of this or any other contract with the Railway/DFCCIL shall, in addition to any criminal liability which he may incur, subject contractor to the *rescission of the contract* and all other contracts with the Railway/DFCCIL and to the payment of any loss or damage resulting from such decision and the Railway/DFCCIL shall be entitled to deduct the amounts so payable from the Contractor(s)/bills/security deposite or any other dues of contractor with Government of India/Railways/DFCCIL.
- **18.(2)** The contractor shall not lend or borrow from or have or enter into any monitory dealings and transactions either directly or indirectly with any employee of the Railway/DFCCIL and if he shall do so, the Railway/DFCCIL shall be entitled forthwith to **rescind the contract** and all other contracts with the Railway/DFCCIL. Any question or dispute as to the commission or any such offence or compensation payable to the Railway/DFCCIL under this clause shall be settled by the Chief General Manager/Noida of the Railway/DFCCIL, in such a manner as he shall consider fit and sufficient and his decision shall be final and conclusive. In the event of rescission of the contract under this clause, the contractor will not be paid any compensation whatsoever except payments for the work done up to the date of rescission.

EXECUTION OF WORKS

19.(1) Contractor's understanding:- It is understood and agreed that the contractor has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the progress of the works, the general and local conditions, the labour conditions prevailing therein and all other matters which can in any way affect the works under the contract.

- **19.(2)** Commencement of works: -The contractor shall commence the works within 15 days after the receipt by him of an order in writing to this effect from the Engineer/DFCCIL and shall proceed with the same with due expedition and without delay.
- **19.(3)** Accepted Programme of work:- The contractor who has been awarded the work shall as soon as possible but not later than 30 days after the date of receipt of the acceptance letter in respect of contracts with initial completion period of two years or less or not later than 90 days for other contracts have to submit the detailed programme of work indicating the time schedule of various items of works in the form of Bar Chart/PERT/CPM. He shall also submit the details of organization (*in terms of labour and supervisors*) plant and machinery, that he intends to utilize (*from time to time*) for execution of the work within stipulated date of completion. The programme of work amended as necessary by discussions with the Engineer/DFCCIL, shall be treated as the agreed programme of work. The progress of work will be watched accordingly and the *liquidated damages will be with reference to the overall completion date*. Nothing stated herein shall preclude the contractor in achieving earlier completion of item or whole of the works than indicated in the programme.
- 19.(4) Setting out of works: The contractor shall be responsible for the correct setting out of all works in relation to original points, lines and levels of reference at his cost. The contractor shall execute the work true to alignment, grade, levels and dimensions as shown in the drawing and as directed by the Engineer's/DFCCIL's representative and shall check these at frequent intervals. The contractor shall provide all facilities like labour and instruments and shall co-operate with the Engineer's/DFCCIL's representative to check all alignment, grades, levels and dimensions. If, at any time, during the progress of the works any error shall appear or arise in any part of the work, the contractor, on being required so to do by the Engineer's/DFCCIL's representative shall, at his own cost rectify such errors, to the satisfaction of the Engineer's/DFCCIL's representative.

Such checking shall not absolve the contractor of his own responsibility of maintaining accuracy in the work. The contractor shall carefully protect and preserve all bench marks, sight rails, pegs and other things used in setting out the work.

- **20.(1)** Compliance to Engineer's/DFCCIL instructions:-The Engineer/DFCCIL shall direct the order in which the several parts of the works shall be executed and the contractor shall execute without delay all orders given by the Engineer/DFCCIL from time to time but the contractor shall not be relieved thereby from responsibility for the due performance of the works in all respects.
- **20.(2)** Alterations to be authorized: -No alterations in or additions to or omissions or abandonment of any part of the works shall be deemed authorized, except under instructions from the Engineer/DFCCIL. The contractor shall be responsible to obtain such instructions in each and every case in writing from the Engineer/DFCCIL.
- **20.(3)** Extra works: Should works over and above those included in the contract require to be executed at the site, the contractor shall have no right to be entrusted with the execution of such works which may be carried out by another contractor or contractors or by other means at the option of the Railway/DFCCIL.

- **20.(4)** Separate contracts in connection with works: The Railway/DFCCIL shall have the right to let other contracts in connection with the works. The contractor shall afford other contractors' reasonable opportunity for the storage of their materials and the execution of their works and shall properly connect and coordinate his work with theirs. If any part of the contractor's work depends for proper execution or result upon the work of another contractor(s), the contractor shall inspect and promptly report to the Engineer/DFCCIL any defects in such works that render it unsuitable for such proper execution and results. The contractor's failure so-to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of his work, except as to defects which may develop in the other contractor's work after the execution of his work.
- **21. Instruction of Engineer's/DFCCIL's Representative:** Any instructions or approval given by the Engineer's/DFCCIL's representative to contractor in connection with the works shall bind the contractor as though it had been given by the Engineer/DFCCIL provided always as follows.
 - (a) Failure of the Engineer's/DFCCIL's representative to disapprove any work or materials shall not prejudice, the power of the Engineer/DFCCIL thereafter to disapprove such work or material and to order the removal or breaking up thereof.
 - (b) If the Contractor shall be dissatisfied by reason of any decision of the Engineer's/DFCCIL's representative, he shall be entitled to refer the matter to the Engineer/DFCCIL who shall there upon confirm or vary such decision.
- **22.(1)** Adherence to specifications and drawings: The whole of the works shall be executed in perfect conformity with the specifications and drawings of the contract. If contractor performs any works in a manner contrary to the specifications or drawings or any of them and without such reference to the Engineer/DFCCIL, he shall bear all the costs arising or ensuing therefore and shall be responsible for all loss to the Railway/DFCCIL.
- **22.(2) Drawings and specifications of the works:** The contractor shall keep one copy of drawings and specifications at the site, in good order, and such contract documents as may be necessary available to the Engineer/DFCCIL or the Engineer's/DFCCIL's representative.
- **22.(3) Ownership of drawings and specifications:** All drawings and specifications and copies thereof furnished by the Railways/DFCCIL to the Contractor are deemed to be the property of the Railways/DFCCIL. They shall not be used on other works and with the exception of the signed contract set, shall be returned by the contractor to the Railways/DFCCIL on completion of the work or termination of the contract.
- **22.(4)** Compliance with Contractor's requests for details: The Engineer/DFCCIL shall furnish with reasonable promptness, after receipt by him of the contractor's request for the same, additional instructions by means of drawings or otherwise, necessary for the proper execution of the works or any part thereof. All such drawing and instructions shall be consistent with the contract Documents and reasonably inferable there from.
- 22.(5) Meaning and intent of specification and drawings:- If any ambiguity arises as to the meaning and intent of any portion of the specifications and drawings or as to execution or quality of any work or material, or as to the measurements of the works the decision of the

Engineer/DFCCIL thereon shall be final subject to the appeal (*within 7 days of such decision being intimated to the contractor*) to the Chief Engineer/CGM who shall have the power to correct any errors, omissions, or discrepancies in aforementioned items and whose decision in the matter in dispute or doubt shall be final and conclusive.

- 23 Working during night: The contractor shall not carry out any work between sun-set and sun-rise without the previous permission of the Engineer/DFCCIL. However, if the Engineer/DFCCIL is satisfied that the work is not likely to be completed in time except by resorting to night work, he may order the same without confirming any right on the Contractor for claiming any extra payment for the same.
- 24. Damage to Railway / DFCCIL property or private life and property:-The contractor shall be responsible for all risk to the work and for trespass and shall make good at his own expense all loss or damage whether to the works themselves or to any other property of the Railway/DFCCIL or the lives, persons or property of others from whatsoever cause in connection with the works until they are taken over by the Railway/ DFCCIL and this although all reasonable and proper precautions may have been taken by the contractor. In case the Railway / DFCCIL shall be called upon to make good any costs, loss or damages, or to pay an compensation, including that payable under the provisions of the Workmen's Compensation Act or any statutory amendments thereof to any person or persons sustaining damages as aforesaid by reason of any act, or any negligence or omissions on the part of the contractor the amount of any costs or charges including costs and charges in connection with legal proceedings, which the Railway / DFCCIL may incur in reference thereto, shall be charged to the contractor. The Railway / DFCCIL shall have the power and right to pay or to defend or compromise any claim of threatened legal proceedings or in anticipation of legal proceedings being instituted consequent on the action or default of the contractor, to take such steps as may be considered necessary or desirable to ward off or mitigate the effect of such proceedings, charging to contractor, as aforesaid any sum or sums of money which may be paid and any expenses whether for reinstatement or otherwise which may be incurred and the propriety of any such payment, defence or compromise, and the incurring of any such expenses shall not be called in question by the contractor.
- **25.** Sheds, Stores houses and Yards:-The contractor shall at his own expense provide himself with sheds, stores houses and yards in such situations and in such numbers as in the opinion of the Engineer/DFCCIL is requisite for carrying on the works and the contractor shall keep at each such sheds, stores houses and yard a sufficient quantity of materials and plant in stock as not to delay the carrying out of the works with due expedition and the Engineer/DFCCIL and the Engineer's/DFCCIL's representative shall have free access to the said sheds, store houses and yards at any time for the purpose of inspecting the stock of materials or plant so kept in hand, and any materials or plan which the Engineer/DFCCIL may object to shall not be brought upon or used in the works, but shall be forthwith removed from the sheds, store houses or yards by the contractor. The contractor shall at his own expenses provide and maintain suitable mortar mills, soaking vats or any other equipments necessary for the execution of the works.

26. Provision of efficient and competent Staff at work sites by the Contractor: -

- 26.1 The contractor shall place and keep on the works at all times efficient and competent staff to give the necessary directions to his workmen and to see that they execute their work in sound and proper manner and shall employ only such supervisors, workmen and labourers in or about the execution of any of these works as are careful and skilled in the various trades.
- 26.2 The contractor shall at once remove from the works any agents, permitted sub-contractor, supervisor, workman or labourer who shall be objected to by the Engineer/DFCCIL and if and whenever required by the Engineer/DFCCIL, he shall submit a correct return showing the names of all staff and workmen employed by him.
- **26.3** In the event of the Engineer/DFCCIL being of the opinion that the contractor is not employing on the works a sufficient number of staff and workmen as is necessary for the proper completion of the works within the time prescribed, the contractor shall forthwith on receiving intimation to this effect deploy the additional number of staff and labour specified by the Engineer/DFCCIL within seven days of being so required and failure on the part of the contractor to comply with such instructions will entitle the Railways/DFCCIL to *res-cind the contract* under clause 62 of these conditions.

26A. Deployment of Qualified Engineers at Work Sites by the Contractor: -

- **26A.1** The contractor shall also employ Qualified Graduate Engineer(s)or equivalent, or Qualified Diploma Engineer(s), as prescribed in the tender documents.
- **26A.2** In case, the contractor fails to employ the Engineer, as aforesaid in Para 26A.1, he shall be liable to pay liquidity damages at the rates, as prescribed in the tender documents.

26A.3 Deleted

- **27.(1)** Workmanship and testing:- The whole of the works and / or supply of materials specified and provided in the contract or that may be necessary to be done in order to form and complete any part thereof shall be executed in the best and most substantial workman like manner with materials of the best and most approved quality of their respective kinds, agreeable to the particulars contained in or implied by the specifications and as referred to in and represented by the drawings or in such other additional particulars, instructions and drawings given during the carrying on of the works and to the entire satisfaction of the Engineer/DFCCIL according to the instructions and directions which the contractors may from time to time receive from the Engineer/DFCCIL. The materials may be subjected to tests by means of such machines, instruments and appliances as the Engineer/DFCCIL may direct and wholly at the expense of the contractor.
- **27.(2)** Removal of improper work and materials: The Engineer/DFCCIL or the Engineer's/DFCCIL Representative shall be entitled to order from time to time:
 - (a) The removal from the site within the time specified in the order of any materials which in his opinion are not in accordance with the specifications or drawings.
 - (b) The substitution of proper and suitable materials, and

- (c) the removal and proper re-execution, notwithstanding any previous tests thereof or on account payments therefore, of any work which in respect of materials or workmanship; is not in his opinion in accordance with the specifications and in case of default on the part of the contractor in carrying out such order the Railway/DFCCIL shall be entitled to **rescind the contract** under clause 62 of these conditions.
- (d) The provision of Construction and Demolition Waste Management Rule 2016 issued by Ministry of Environment Forest and Climate Change dated 29.03.2016 and published in the Gazette of India, Part – II, Section -3, Sub-section (ii) are binding upon the Contractor. Contractor shall implement these provisions at worksites, for which no extra payment will be payable.
- **28.** Facilities for inspection:- The contractor shall afford the Engineer/DFCCIL and the Engineer's/DFCCIL's Representative every facility for entering in and upon every portion of the work at all hours for the purpose of inspection or otherwise and shall provide all labour, materials, planks, ladders, pumps, appliances and things of every kind required for the purpose and the Engineer/DFCCIL and the Engineer's/DFCCIL's Representative shall at all times have free access to every part of the works and to all places at which materials for the works are stored or being prepared.
- **29.** Examination of work before covering up:- The contractor shall give 7 days' notice to the Engineer/DFCCIL or the Engineer's/DFCCIL's representative whenever any work or materials are intended to be covered up in the earth, in bodies or walls or otherwise to be placed beyond the reach of measurements in order that the work may be inspected or that correct dimensions may be taken before being so covered, placed beyond the reach of measurement in default whereof, the same shall at the option of the Engineer/DFCCIL or the Engineer's/DFCCIL's representative be uncovered and measured at the contractor's expense or no allowance shall be made for such work or materials.
- **30. Temporary Works:** All temporary works necessary for the proper execution of the works shall be provided and maintained by the contractor and subject to the consent of the Engineer/DFCCIL shall be removed by him at his expenses when they are no longer required and in such manner as the Engineer/DFCCIL shall direct. In the event of failure on the part of the contractor to remove the temporary works, the Engineer/DFCCIL will cause them to be removed and cost as increased by supervision and other incidental charges *shall be recovered from the contractor*. If temporary huts are provided by the contractor on the Railway/DFCCIL land for labour engaged by him for the execution of works, the contractor shall arrange for handing over vacant possession of the said land after the work is completed; if the contractor's labour refuse to vacate, and have to be evicted by the Railway/DFCCIL necessary expenses incurred by the Railway/DFCCIL in connection therewith shall be borne by the contractor.
- **31.(1)** Contractor to supply water for works: Unless otherwise provided in the contract, the contractor shall be responsible for the arrangements to obtain supply of water necessary for the works.
- 31.(2) Deleted
- 31.(3) Deleted
- 31.(4)(a) Contractor to arrange supply of Electric power for works: Unless otherwise provided in the

contract, the contractor shall be responsible for arrangements to obtain supply of electric power for the works.

31.(4)(b) Deleted

- **32. Property in materials and plant:** The materials and plant brought by the Contractor upon the site or on the land occupied by the Contractor in connection with the works and intended to be used for the execution thereof shall immediately, they are brought upon the site of the said land, be deemed to be the property of the Railway / DFCCIL. Such of them as during the progress of the works are rejected by the Engineer/DFCCIL under Clause 25 of these conditions or are declared by him not to be needed for the execution of the works or such as on the grant of the certificate of completion remain unused shall immediately on such rejection, declaration or grant cease to be deemed the property of the Railway / DFCCIL and the Contractor may then (*but not before*) remove them from the site or the said land. This clause shall not in any way diminish the liability of the Contractor nor shall the Railway / DFCCIL be in any way answerable for any loss or damage which may happen to or in respect of any such materials or plant either by the same being lost, stolen, injured or destroyed by fire, tempest or otherwise.
- **33.** (1) **Deleted**
- 33.(2) Deleted
- **34.(1) Precaution during progress of works:-** During the execution of works, unless otherwise specified, the Contractor shall at his own cost provide the materials for and execute all shoring, timbering and strutting works as is necessary for the stability and safety of all structures, excavations and works and shall ensure that no damage, injury or loss is caused or likely to be caused to any person or property.
- **34.(2)** Roads and Water courses: Existing roads or water courses shall not be blocked, cut through, altered, diverted or obstructed in any way by the Contractor, except with the permission of the Engineer/DFCCIL. All compensations claimed for any unauthorized closure, cutting through, alterations, diversion or obstruction to such roads or water courses by the Contractor or his agent or his staff shall be recoverable from the Contractor's bill/security deposite or any other dues of contractor with the Government of India or Railway/DFCCIL.
- **34.(3) Provision of access to premises:-** During progress of work in any street or thoroughfare, the Contractor shall make adequate provision for the passage of traffic, for securing safe access to all premises approached from such street or thoroughfare and for any drainage, water supply or means of lighting which may be interrupted by reasons of the execution of the works and shall react and maintain at his own cost barriers, lights and other safeguards as prescribed by the Engineer/DFCCIL, for the regulation of the traffic, and provide watchmen necessary to prevent accidents. The works shall in such cases be executed night and day if, so ordered by the Engineer/DFCCIL and with such vigour so that the traffic way be impeded for as short a time as possible.
- **34.(4)** Safety of Public: The Contractor shall be responsible to take all precautions to ensure the safety of the public whether on public or DFCCIL/Railway property and shall post such look out men as may in the opinion of the Engineer/DFCCIL, be required to comply with regulations apertaining to the work. Contractor shall ensure placement of barricading/partitions at the place of work to ensure safety of habitants of adjacent area, failing which Engineer/DFCCIL may advise stoppage of work as

per his discretion.

- **34.(5) Display Board:** The contractor shall be responsible for displaying the details of works i.e. name of work, approximate cost, expected date of completion, name and address of the Contractor and address of Engineer on a proper steel Board of size not less than 1m x 1m.
- **35.** Use of Explosives: Explosives shall not be used on the works or on the site by the Contractor without the permission of the Engineer/DFCCIL and then also only in the manner and to the extent to which such permission is given. Where explosives are required for the works, they shall be stored in a special magazine to be provided by and at the cost of the Contractor in accordance with the Explosive Rules. The Contractor shall obtain the necessary license for the storage and the use of explosives. All operations in which or for which explosives are employed shall be at the sole risk and responsibility of the Contractor and the Contractor shall indemnify the Railway/DFCCIL in respect thereof.
- **36.(1)** Suspension of works:- The Contractor shall on the order of the Engineer/DFCCIL, suspend the progress of the works or any part thereof for such time or times and in such manner as the Engineer/DFCCIL may consider necessary and shall during such suspension properly protect and secure the work so far as is necessary in the opinion of the Engineer/DFCCIL. If such suspension is: -
 - (a) Provided for in the contract, or
 - (b) Necessary for the proper execution of the works or by the reason of weather conditions or by some default on the part of the Contractor, and/or
 - (c) Necessary for the safety of the works or any part thereof.
- **36.(2)** The Contractor shall not be entitled to the extra costs, if any, incurred by him during the period of suspension of the works, but in the event of any suspension ordered by the Engineer/DFCCIL for reasons other than aforementioned and when each such period of suspensions exceeds 14 days, the contractor shall be entitled to such extension of time for completion of the work as the Engineers/DFCCIL may consider proper having regard to the period or periods of such suspensions and to such compensations as the Engineer/DFCCIL may consider reasonable in respect of salaries or wages paid by the Contractor to his employees during the periods of such suspension.
- **36.(3)** Suspension lasting more than 3 months:- If the progress of the works or any part thereof is suspended on the order of the Engineer/DFCCIL for more than three months at a time, the Contractor may serve a written notice on the Engineer/DFCCIL requiring permission within 15 days from the receipt thereof to proceed with the works or that part thereof in regard to which progress is suspended and if such permission is not granted within that time the Contractor by further written notice so served may, but is not bound to, elect to treat the suspension where it affects part only of the works as an omission of such part or where it affects the whole of the works, as an abandonment of the contract by the Railway/DFCCIL.
- **37. Rates for items of works:-** The rates, entered in the accepted Schedule of Rates of the Contract are intended to provide for works duly and properly completed in accordance with the general and special (if any) conditions of the contract and the specifications and drawings together with such enlargements, extensions, diminutions, reductions, alterations or additions as may be ordered in terms of Clause 42 of these conditions and without prejudice to the generality thereof and shall be deemed to

include and cover superintendence and labour, supply, including full freight of materials, stores, patterns, profiles, moulds, fittings, centring, scaffolding, shoring props, timber, machinery, barracks, tackle, roads, pegs, posts, tools and all apparatus and plant required on the works, except such tools, plant or materials as may be specified in the contract to be supplied to the Contractor by the Railway/DFCCIL, the erection, maintenance and removal of all temporary works and, buildings, all watching, lighting, bailing, pumping and draining, all prevention of or compensation for trespass, all barriers and arrangements for the safety of the public or of employees during the execution of works, all sanitary and medical arrangements for labour camps as may be prescribed by the Railway/DFCCIL, the setting of all work and of the construction, repair and upkeep of all centre lines, bench marks and level pegs thereon, site clearance, all fees duties, royalties, rent and compensation to owners for surface damage or taxes and impositions payable to local authorities in respect of land, structures and all material supplied for the work or other duties of expenses for which the Contractor may become liable or may be put to under any provision of law for the purpose of or in connection with the execution of the contract, and all such other incidental charges or contingencies as may have been specially provided for in the specifications.

However, if rates of existing GST or cess on GST for Works Contract is increased or any new tax /cess on Works Contract is imposed by Statute after the date of opening of tender but within the original date of completion/date of completion extended under clause 17 & 17A and the Contractor thereupon properly pays such taxes/cess, the Contractor shall be reimbursed the amount so paid.

Further, if rates of existing GST or cess on GST for Works Contract is decreased or any tax/cess on Works Contract is decreased / removed by Statute after the date of opening of tender, the reduction in tax amount shall be recovered from Contractor's bills/Security Deposit or any other dues of Contractor with the Government of India or Railway/DFCCIL.

38. Deleted

39.(1) Rates for extra items of works:- Any item of work carried out by the Contractor on the instructions of the Engineer/DFCCIL which is not included in the accepted schedules of rates shall be executed at the rates set forth in the "Delhi Schedule of Rates of CPWD" modified by the tender percentage and such items are not contained in the latter, at the rate agreed upon between the Engineer/DFCCIL and the Contractor before the execution of such items of work and the Contractors shall be bound to notify the Engineer/DFCCIL at least seven days before the necessity arises for the execution of such items of works that the accepted schedule of rates does not include rate or rates for the extra work involved. The rates payable for such items shall be decided at the meeting to be held between the Engineer/DFCCIL and Contractor, in as short a period as possible after the need for the special item has come to the notice. In case the Contractor fails to attend the meeting after being notified to do so or in the event of no settlement being arrived at, the Railway/DFCCIL shall be entitled to execute the extra works by other means and the Contractor shall have no claim for loss or damage that may result from such procedure.

The assessment of rates for extra items shall be arrived at based on the prevailing rates and by taking guidance from the following documents in order of priority:

(i) Analysis of Delhi Schedule of Rates issued by CPWD

(ii) Analysis of Unified Schedule of Rates of Indian Railways

(iii) Market Analysis

- **39.(2)** Provided that if the Contractor commences work or incurs any expenditure in regard thereto before the rates as determined and agreed upon as lastly hereunto fore-mentioned, then and in such a case the Contractor shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of determination of rates as aforesaid according to the rates as shall be fixed by the Engineer/DFCCIL. However, if the Contractor is not satisfied with the decision of the Engineer/DFCCIL in this respect, he may appeal to the Chief Engineer/CGM within 30 days of getting the decision of the Engineer/DFCCIL, supported by analysis of the rates claimed. The Chief Engineer/CGM's decision after hearing both the parties in the matter would be final and binding on the Contractor and the Railway/DFCCIL.
- **40. (1) Handing over of works: -** The Contractor shall be bound to hand over the works executed under the contract to the Railway/DFCCIL complete in all respects to the satisfaction of the Engineer/DFCCIL. The Engineer/DFCCIL shall determine the date on which the work is considered to have been completed, in support of which his certificate shall be regarded as sufficient evidence for all purposes. The Engineer/DFCCIL shall determine from time to time, the date on which any particular section of the work shall have been completed, and the contractor shall be bound to observe any such determination of the Engineer/DFCCIL.
- **40.(2) Clearance of site on completion**: On completion of works, the Contractor shall clear away and remove from the site all constructional plant, surplus materials, rubbish and temporary works of every kind and leave the whole of the site and works clean and in a workman like condition to the satisfaction of the Engineer/DFCCIL. No final payment in settlement of the accounts for the works shall be paid, held to be due or shall be made to the, Contractor till, in addition to any other condition necessary for final payment, site clearance shall have been affected by him, and such clearance may be made by the Engineer/DFCCIL at the expense of the Contractor in the event of his failure to comply with this provision within 7 days after receiving notice to that effect. Should it become necessary for the Engineer/DFCCIL to have the site cleared at the expenses of the Contractor, the Railway/DFCCIL shall not be held liable for any loss or damage to such of the Contractor's property as may be on the site and due to such removal there from which removal may be effected by means of public sales of such materials and property or in such a way as deemed fit and convenient to the Engineer/DFCCIL.

Clause 40A: At the final stage of completion and commissioning of work, in case the contractor's failure is limited to only some of the works costing not more than 2% of the original contract value, and the Contractor request the Engineer/DFCCIL that such works may be offloaded from him and got executed through another agency and additional cost incurred, if any, should be recovered from his dues; the Engineer/DFCCIL on being convinced that the anticipated additional cost for such works will not be substantial and can be recovered from the dues of the contractor and that such offloading will help in completion and commissioning of work, may agree to such offloading without any adverse repercussion on the performance guarantee and security deposit of the Contractor. However, the Engineer/DFCCIL will not be under any compulsion to agree to such a request. Further, before issuing letter of acceptance to another agency for such work, the Contractor shall be informed of the rates at which the work will be got executed and the Contractor should give his consent to do so and certify that he would have no future

claim on this account and that the extra expenditure so incurred, if any, by the Engineer/DFCCIL in getting the offloaded work done, shall be recovered from subsequent Bills or any other dues of the Contractor. In case the Contractor fails to give such consent within three working days, the Engineer/DFCCIL may treat the same as not acceptable to Contractor and proceed accordingly. In any case, Railway/DFCCIL shall deduct 10% of cost of such work or Rs one lakh whichever is lower, from the Contractor's dues as administrative charges for the process of finalizing new agency for such work irrespective of whether or not such work is finally offloaded from Contractor or not.

VARIATIONS IN EXTENT OF CONTRACT

- **41. Modification to contract to be in writing:** In the event of any of the provisions of the contract required to be modified after the contract documents have been signed, the modifications shall be made in writing and signed by the Railway/DFCCIL and the Contractor and no work shall proceed under such modifications until this has been done. Any verbal or written arrangement abandoning, modifying, extending, reducing or supplementing the contract or any of the terms thereof shall be deemed conditional and shall not be binding on the Railway/DFCCIL unless and until the same is incorporated in a formal instrument and signed by the Railway/DFCCIL and the Contractor, and till then the Railway/DFCCIL shall have the right to repudiate such arrangements.
- **42.(1) Powers of modification to contract:-** The Engineer on behalf of the Railway/DFCCIL shall be entitled by order in writing to enlarge or extend, diminish or reduce the works or make any alterations in their design, character position, site, quantities, dimensions or in the method of their execution or in the combination and use of materials for the execution thereof or to order any additional work to be done or any works not to be done and the contractor will not be entitled, to any compensation for any increase/reduction in the quantities of work but will be paid only for the actual amount of work done and for approved materials supplied against a specific order.
- **42.(2)** (i) Unless otherwise specified in the contract, the accepted variation in quantity of each individual item of the contract would be up to 25% of the quantity originally contracted, except in case of foundation work.
 - (ii) The contractor shall be bound to carry out the work at the agreed rates and shall not be entitled to any claim or any compensation whatsoever up to the limit of 25% variation in quantity of individual item of works.
 - (iii) In case an increase in quantity of an individual item by more than 25% of the agreement quantity is considered unavoidable, then same shall be excuted at following rates:
 - (a) Quantities operated in excess of 125% but upto 140% of the agreement quantity of the concerned item, shall be paid at 98% of the rate awarded for that item in that particular tender;
 - (b) Quantities operated in exess of 140% but upto 150% of the agreement quantity of the concerned item shall be paid 96% of the rate awarded for that item in that particular tender;
 - (c) Variation in quantity of individual items beyond 150% will be avoided and would be permitted only in exceptional unavoidable circumstances and shall be paid at 96% of the rate awarded for that item in that particular tender.

(d) Variation to quantities for Minor value item:

The limit for varying quantities for minor value items shall be 100% (as against 25% prescribed for other items). A minor value item for this purpose is defined as an item whose original agreement value is less than 1% of the total original agreement value.

- (i) Quantities operated upto and including 100% of the agreement quantity of the concerned minor value item, shall be paid at the rate awarded for that item in that particular tender;
- (ii) Quantities operated in excess of 100% but upto 200% of the agreement quantity of the concerned minor value item, shall be paid at 98% of the rate awarded for that item in that particular tender;
- (iii) Variation in quantities of individual minor value item beyond 200% will be avoided and would be permitted only in exceptional unavoidable circumstances and shall be paid at 96% of the rate awarded for that item in that particular tender.
- (iv) In case of earthwork, the variation limit of 25% shall apply to the gross quantity of earth work and variation in the quantities of individual classifications of soil shall not be subject to this limit.
- (v) In case of foundation work, no variation limit shall apply and the work shall be carried out by the contractor on agreed rates irrespective of any variation.
- (vi) As far as SOR items are concerned, the limit of 25% would apply to the value of SOR schedule as a whole and not on individual SOR items. However, in case of NS items, the limit of 25% would apply on the individual items irrespective of the manner of quoting the rate (single percentage rate or individual item rate).
- **42.(3)** Valuation of variations:- The enlargements, extensions, diminution, reduction, alterations or additions referred to in sub-clause (2) of this clause shall in no degree affect the validity of the contract but shall be performed by the Contractor as provided therein and be subject to the same conditions, stipulations and obligations as if they had been originally and expressively included and provided for in the specifications and drawings and the amounts to be paid therefore shall be calculated in accordance with the accepted schedule of rates. Any extra items / quantities of work falling outside the purview of the provisions of sub-clause (2) above shall be paid for at the rates determined under clause-39 of these conditions.

CLAIMS

- **43.(1) Quarterly Statement of Claims:** The Contractor shall prepare and furnish to the Engineer/DFCCIL once in every quarter commencing from the month following the month of issue of Letter of Acceptance, an account giving full and detailed particulars of all claims for any additional expenses to which the Contractor may consider himself entitled to and of all extra or additional works ordered by the Engineer/DFCCIL which he has executed during the preceding month quarter and no claim for payment for such work will be considered which has not been included in such particulars.
- **43.(2)** Signing of "No Claim" Certificate:- The Contractor shall not be entitled to make any claim whatsoever against the Railway/DFCCIL under or by virtue of or arising out of this contract, nor shall

the Railway/DFCCIL entertain or consider any such claim, if made by the Contractor, after he shall have signed a "No Claim" Certificate in favour of the Railway/DFCCIL in such form as shall be required by the Railway/DFCCIL after the works are finally measured up. The contractor shall be debarred from disputing the correctness of the items covered by "No Claim" Certificate or demanding a clearance to arbitration in respect thereof.

MEASUREMENTS, CERTIFICATES AND PAYMENTS

- 44. Quantities in schedule annexed to Contract: The quantities set out in the accepted schedule of rates with items of works quantified are the estimated quantities of the works and they shall not be taken as the actual and correct quantities of the work to be executed by the Contractor in fulfilment of his obligations under the contract.
- 45.(i) Measurement of works by Railway/DFCCIL:- The Contractor shall be paid for the works at the rates in the accepted schedule of rates and for extra works at rates determined under Clause 39 of these conditions on the measurements taken by the Engineer/DFCCIL or the Engineer's/DFCCIL's representative in accordance with the rules prescribed for the purpose by the Railway/DFCCIL. The quantities for items the unit of which in the accepted schedule of rates is 100 or 1000 shall be calculated to the nearest whole number, any; fraction below half being dropped and half and above being taken as one; for items the unit of which in the accepted schedule of rates is single, the quantities shall be calculated to two places of decimals. Such measurements will be taken of the work in progress from time to time and at such intervals as in the opinion of the Engineer/DFCCIL shall be proper having regard to the progress of works. The date and time on which "on account" or final measurements are to be made shall be communicated to the Contractor who shall be present at the site and shall sign the results of the measurements (which shall also be signed by the Engineer/DFCCIL or the Engineer's/ DFCCIL's representative) recorded in the official measurements book as an acknowledgement of his acceptance of the accuracy of the measures. Failing the Contractor's attendance, the work may be measured up in his absence and such measurements shall, notwithstanding such absence, be binding upon the Contractor whether or not he shall have signed the measurement books provided always that any objection made by him to measurement shall be duly investigated and considered in the manner set out below: -
 - (a) It shall be open to the Contractor to take specific objection to any recorded measurements or Classification on any ground within seven days of the date of such measurements. Any re-measurement taken by the Engineer/DFCCIL or the Engineer's/DFCCIL's representative in the presence of the Contractor or in his absence after due notice has been given to him in consequence of objection made by the Contractor shall be final and binding on the Contractor and no claim whatsoever shall thereafter be entertained regarding the accuracy and classification of the measurements.
 - (b) If an objection raised by the Contractor is found by the Engineer/DFCCIL to be incorrect the Contractor shall be liable to pay the actual expenses incurred in measurements.

45. (ii) Measurement of works by Contractor's Authorized Representative (In case the Contract provides for the same)

(a) The Contractor shall be paid for the works at the rates in the accepted Schedule of Rates and for extra works at rates determined under Clause 39 of these Conditions on the measurements taken by the contractor's authorized engineer in accordance with the rules prescribed for the purpose by Railways/DFCCIL. The quantities for items the unit of which in the accepted Schedule of Rates is 100 or 1000 shall be calculated to the nearest whole number, any fraction below half being dropped and half above being taken as one; for items the unit of which in the accepted Schedule of Rates is single, the quantity shall be calculated to two places of decimals. Such measurements will be taken of the works in progress from time to time. The date and time on which 'on account or final' measurements are to be made shall be communicated to the Engineer/DFCCIL.

Date and time of test checks shall be communicated to the Contractor, who shall be present at the site and shall witness the test checks, failing Contractor's adherence, the test check may be conducted in his absence and such test checks shall not, withstanding such absence be binding upon Contractor provided always that any objections made by Contractor to test check shall be duly investigated and considered in the manner set out below:

- (i) It shall be open to Contractor to take specific objections to test check of any recorded measurements within 7 days of date of such test checks. Any re-test check done by the concerned Railway's/DFCCIL's Authority in the presence of the Contractor or in his absence after due notice, given to him in consequent of objections made by the Contractor shall be final and binding on the Contractor and no claim whatsoever shall thereafter be entertained regarding the accuracy and classification of the measurements.
- (ii) If an objection raised by the Contractor is found by the Engineer/DFCCIL to be incorrect, the Contractor shall be liable to pay the actual expenses incurred in measurements.
- (b) Incorrect measurement/action to be taken: If in case during test check or otherwise, it is detected by the Engineer/DFCCIL that Agency has claimed any exaggerated measurement or as claimed any false measurement for the work which have not been executed; amounting to variation of 5% or more of claimed gross bill amount, action shall be taken as following:
 - (i) On first occasion of noticing, exaggerated/false measurement, Engineer/DFCCIL shall impose a penalty of 10% of claimed gross bill value.
 - (ii) On any next occasion of noticing any exaggerated/false measurement, Railway/DFCCIL shall impose penalty of 15% of claimed gross bill value. In addition, the facility of recording of measurement by Contractor as well as release of provisional payment shall be withdrawn. Once withdrawn, measurement shall be done by Railway/DFCCIL as per Clause-45(i) above.
- **46. (1)" On-Account" Payments:** The Contractor shall be entitled to be paid from time to time by way of "One-Account" payment only for such works as in the opinion of the Engineer/DFCCIL he has executed in terms of the contract. All payments due on the Engineer's / DFCCIL's representative's certificates of measurements or Engineer's/ DFCCIL's Certified "Contractor's Authorized Engineer's

measurements" shall be subject to any deductions which may be made under these presents and shall further be subject to, unless otherwise required by Clause 16 of these conditions, a retention of ten percent by way of security deposits, until the amount of security deposit by way of retained earnest money and such retentions shall amount to 5% of the total value of the contract provided always that the Engineer/DFCCIL may by any certificate make any correction or modification in any previous certificate which shall have been issued by him and that the Engineer/DFCCIL may withhold any certificate if the works or any part thereof are not being carried out to his satisfaction.

- **46.(2)** Rounding off amounts: The total amount due on each certificate shall be rounded off to the nearest rupee i.e. sum less than 50 paise shall be omitted and sums of 50 paise and more upto Re. 1/- will be reckoned as Re. 1/-.
- **46.(3)** On Account Payments not prejudicial to final settlement:- "On-Account" payments made to the 'Contractor shall be without prejudice to the final making up of the accounts (except where measurements are specifically noted in the Measurement Book as "Final Measurements" and as such have been signed by the Contractor Engineer's/Engineer's/DFCCIL Representative) and shall in no respect be considered or used as evidence of any facts stated in or to be inferred from such accounts nor of any particular quantity of work having been executed nor of the manner of its execution being satisfactory.
- **46.(4)** Manner of payment: Unless otherwise specified payments to the Contractor will be transferred electronically to his bank account.

46A PRICE VARIATION CLAUSE:(*Not applicable*)

- 46A.1 Deleted
- 46A.2 Deleted
- 46A.3 Deleted
- 46A.4 Deleted
- 46A.5 Deleted
- 46A.6 Deleted
- 46A.7 Deleted
- 46A.8 Deleted
- 46A.9 Deleted
- 46A.10 Deleted
- **47.0 Maintenance of works:-** The Contractor shall at all times during the progress and continuance of the works and also for the period of maintenance specified in the Tender Form after the date of issue of the certificate of completion by the Engineer/DFCCIL or any other earlier date subsequent to the

completion of the works that may be fixed by the Engineer/DFCCIL be responsible for and effectively maintain and uphold in good substantial, sound and perfect condition all and every part of the works and shall make good from time to time and at all times as often as the Engineer/DFCCIL shall require, any damage or defect that may during the above period arise in or be discovered or be in any way connected with the works, provided that such damage or defect is not directly caused by errors in the contract documents, act of providence or insurrection or civil riot, and the contractor shall be liable for and shall pay and make good to the Railway/DFCCIL or other persons legally entitled thereto whenever required by the Engineer/DFCCIL so to do, all losses, damages, costs and expenses they or any of them may incur or be put or be liable to by reasons or in consequence of the operations of the Contractor or of his failure in any respect.

48.(1) Certificate of completion of works:- As soon as in the opinion of the Engineer/DFCCIL, the works has been completed and has satisfactorily passed any final test or tests that may be prescribed, the Engineer/DFCCIL shall issue a certificate of completion duly indicating the date of completion in respect of the work and the period of maintenance of the work shall commence from the date of completion mentioned in such certificate. The certificate, inter alia, should mention that the work has been completed in all respects and that all the contractual obligations have been fulfilled by the Contractor and that there is no due from the Contractor to Railways/DFCCIL against the contract concerned.

The Engineer/DFCCIL may also issue such a certificate indicating date of completion with respect to any part of the work (*before the completion of the whole of work*), which has been both completed to the satisfaction of the Engineer/DFCCIL and occupied or used by the Railway/DFCCIL. When any such certificate is given in respect of part of a work, such part shall be considered as completed and the period of maintenance of such part shall commence from the date of completion mentioned in the completion certificate issued for that part of the work.

- **48.(2)** Contractor not absolved by completion Certificate:- The Certificate of completion in respect of the works referred to in sub-clause (1) of this clause shall not absolve the Contractor from his liability to make good any defects imperfections, shrinkages or faults which may appear during the period of maintenance specified in the tender arising in the opinion of the Engineer/DFCCIL from materials or workmanship not in accordance with the drawings or specifications or instruction of the Engineer/DFCCIL, which defects, imperfections, shrinkages or faults shall upon the direction in writing of the Engineer/DFCCIL be amended and made good by the Contractor at his own cost: and in case of default on the part of Contractor the Engineer/DFCCIL may employ labour and materials or appoint another Contractor to amend and make good such defects, imperfections, shrinkages and faults and all expenses consequent thereon and incidental thereto shall be borne by the Contractor and shall be recoverable from any moneys due to him under the contract.
- 48.(3) Final Supplementary Agreement: After the work is completed or otherwise concluded by the parties with mutual consent, and taken over by the Railway/DFCCIL as per terms and conditions of the contract agreement, and there is unequivocal no claim on either side under the Contract other than as mentioned in item 4 of Form no. 20, the parties shall execute the Final Supplementary Agreement as per Form No. 20.
- 49. Approval only by maintenance Certificate: No certificate other than maintenance certificate

referred to in Clause 50 of the conditions shall be deemed to constitute approval of any work or other matter in respect of which it is issued or shall be taken as an admission of the due performance of the contract or any part thereof.

50.(1) Maintenance Certificate: - The Contract shall not be considered as completed until a Maintenance Certificate shall have been signed by the Engineer/DFCCIL stating that the works have been completed and maintained to his satisfaction. The Maintenance Certificate shall be given by the Engineer upon the expiration of the period of maintenance or as soon thereafter as any works ordered during such period pursuant to sub clause (2) Clause 48 of these conditions shall have been completed to the satisfaction of the Engineer/DFCCIL and full effect shall be given to this Clause notwithstanding the taking possession of or using the works or any part thereof by the Railway/DFCCIL.

The Competent Authority to issue above Maintenance Certificate shall normally be the authority who is competent to sign the contract. If this Competent Authority is of the rank lower than JA Grade, then a JA Grade Officer (concerned with the work) should issue the Certificate. The Certificate, inter alia, should mention that the work has been completed in all respects and that all the contractual obligations have been fulfilled by the Contractor and that there is no due from the Contractor to Railways/DFCCIL against the contract concerned.

- **50.(2)** Cessation of Railway's/DFCCIL Liability: The Railway/DFCCIL shall not be liable to the Contractor for any matter arising out of or in connection with the contract of the execution of the works unless the contractor has made a claim in writing in respect thereof before the issue of the Maintenance Certificate under this clause.
- **50.(3)** Unfulfilled Obligations:- Notwithstanding the issue of the Maintenance certificate the Contractor and (*subject to sub-clause 2 of this clause*) the Railway/DFCCIL shall remain liable for the fulfilment of any obligation incurred under the provision of the contract prior to the issue of the Maintenance Certificate which remains unperformed at the time such certificate is issued and for the purposes of determining the nature and extent of any such obligations the contract shall be deemed to remain in force between the parties thereto.
- **51.(1) Final Payment:-** On the Engineer's/DFCCIL certificate of completion in respect of the works, adjustment shall be made and the balance of account based on the Engineer/DFCCIL or the Engineer's/DFCCIL representative's certified measurements or Engineer's/DFCCIL certified "Contractor's Authorized Engineer's measurements" of the total quantity of work executed by the contractor upto the date of completion and on the accepted schedule or rates and for extra works on rates determined under Clause 39 of these conditions shall be paid to the Contractor subject always to any deduction which may be made under these presents and further subject to the Contactor having signed delivered to the Engineer/DFCCIL either a full account in detail of all claims he may have on the Railway/DFCCIL in respect of the works or having delivered "No Claim Certificate" and the Engineer/DFCCIL having after the receipt of such account given a certificate in writing that such claims are not covered under excepted matter i.e. Clauses 7 (j), 8, 18, 22(5), 39, 43(2), 45(a), 55, 55-A(5), 57, 57A, 61(1), 61(2) and 62(1)(i) to (xv) of Standard General Conditions of Contract or in any Clause (stated as excepted matter) of the Special Conditions of the Contract, that the whole of the

works to be done under the provisions of the Contracts have been completed, that they have been inspected by him since their completion and found to be in good and substantial order, that all properties, works and things, removed, disturbed or injured in consequence of the works have been properly replaced and made good and all expenses and demands incurred by or made upon the Railway/DFCCIL for or in the respect of damage or loss by from or in consequence of the works, have been satisfied agreeably and in conformity with the contract.

51.(2) Post Payment Audit:- It is an agreed term of contract that the Railway/DFCCIL reserves to itself the right to carry out a post-payment audit and or technical examination of the works and the final bill including all supporting vouchers, abstracts etc. and to make a claim on the contractor for the refund any excess amount paid to him till the release of Security Deposite of settlement of claims, which ever is later, if as a result of such examination any over-payment to him is discovered to have made in respect of any works done or alleged to have been done by him under the contract.

51A. Production of vouchers etc. by the Contractor: -

- (i) For a contract of more than one crore of rupees, the contractor shall, whenever required, produce or cause to be produced for examination by the Engineer/DFCCIL any quotation, invoice, cost or other account, book of accounts, voucher, receipt, letter, memorandum, paper of writing or any copy of or extract from any such document and also furnish information and returns verified in such manner as may be required in any way relating to the execution of this contract or relevant for verifying or ascertaining cost of execution of this contract (the decision of the engineer on the question of relevancy of any documents, information or return being final and binding in the parties). The contractor shall similarly produce vouchers; etc., if required to prove to the Engineer/DFCCIL, that materials supplied by him, are in accordance with the specifications laid down in the contract.
- (ii) If any portion of the work in a contract of value more than one crore of rupees be carried out by a sub-contractor or any subsidiary or allied firm or company (as per Clause 7 of the General Conditions of Contract), the Engineer/DFCCIL shall have power to secure the books of such sub-contract or any subsidiary or allied firm or company, through the contractor, and such books shall be open to his inspection.
- (iii) The obligations imposed by sub clause (i) & (ii) above is without prejudice to the obligations of the contractor under any statute rules or orders binding on the contractor.
- **52.0** Withholding and lien in respect of sums claimed:- Whenever any claim or claims for payment of a sum of money arises out of or under the contract against the contractor, the Railway/DFCCIL shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the security, if any, deposited by the contractor and for the purpose aforesaid, the Railway/DFCCIL shall be entitled to withhold the said cash security deposit or the security if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Railway/DFCCIL shall be entitled to withhold and nave a lien to the extent of the such claimed amount or amounts referred to supra, from any sum or sums found payable or which at any time thereafter may become payable to the contractor under the same contract or any other contract with this or any other Railway/DFCCIL or any Department of the Central Government pending finalization or adjudication of any such claim.
It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above, by the Railway/DFCCIL will be kept withheld or retained as such by the Railway/DFCCIL till the claim arising out of or under the contract is determined by the arbitrator (if the contract governed by the arbitration clause) or by the competent court as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to supra and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Railway/DFCCIL shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company, as the case may be whether in his individual capacity or otherwise.

52A. Lien in respect of claims in Other Contracts: -

- (i) Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Railway/DFCCIL, against any claim of this or any other Railway/DFCCIL or any other Department of the Central Government in respect of a payment of a sum of money arising out of or under any other contract made by the contractor with this or any other Department of the Central Government.
- (ii) However, recovery of claims of Railway/DFCCIL in regard to terminated contracts may be made from the Final Bills, Security Deposits and Performance Guarantees of other contract or contracts, executed by the contractor. The Performance Guarantees submitted by the Contractor against other contracts, if required, may be withheld and encashed. In addition, 10% of each subsequent 'onaccount bill' may be withheld, if required, for recovery of DFCCIL/Railways' dues against the terminated contract.
- (iii) It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Railway/DFCCIL will be kept withheld or retained as such by the Railway/DFCCIL till the claim arising out of or under any other contract is either mutually settled or determined by arbitration, if the other contract is governed by arbitration clause or by the competent court as the case may be and contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.
- **53.0 Signature on Receipts for Amounts:-** Every receipt for money which may become payable or for any security which may become transferable to the Contractors under these presents, shall, if signed in the partnership name by anyone of the partners of a Contractor's firm be a good and sufficient discharge to the Railway/DFCCIL in respect of the moneys or security purported to be acknowledged thereby and in the event of death of any of the Contractor, partners during the pendency of the contract it is hereby expressly agreed that every receipt by anyone of the surviving Contractor partners shall if so signed as aforesaid be good a sufficient discharge as aforesaid provided that nothing in this clause contained shall be deemed to prejudice or effect any claim which the Railway/DFCCIL may hereafter have against the legal representative of any contractor partner so dying for or in respect to any breach of any of the conditions of the contract, provided also that nothing in this clause contained shall be deemed to prejudice or effect the respective rights or obligations of the Contractor partners and of the legal representatives of any deceased Contractor partners interse.

LABOUR

54.0 Wages to Labour: - The Contractor shall be responsible to ensure compliance with the provision of the Minimum Wages Act, 1948 (hereinafter referred to as the "said Act") and the Rules made there under in respect of any employees directly or through petty contractors or subcontractors employed by him for the purpose of carrying out this contract.

If, in compliance with the terms of the contract, the Contractor supplied any labour to be used wholly or partly under the direct orders and control of the Railway/DFCCIL whether in connection with any work being executed by the Contractor or otherwise for the purpose of the Railway/DFCCIL such labour shall, for the purpose of this clause, still be deemed to be persons employed by the Contractor.

If any moneys shall, as a result of any claim or application made under the said Act be directed to be paid by the Railway/DFCCIL, such money shall be deemed to be moneys payable to the Railway/DFCCIL by the Contractor and on failure by the Contractor to repay the Railway/DFCCIL any moneys paid by it as aforesaid within seven days after the same shall have been demanded, the Railways/DFCCIL shall be entitled to recover the same from Contractor's bills/Security Deposit or any other dues of Contractor with the Government of India or Railway/DFCCIL.

54A. Apprentices Act: - The Contractor shall be responsible to ensure compliance with the provisions of the Apprentices Act, 1961 and the Rules and Orders issued there under from time to time in respect of apprentices directly or through petty contractors or sub-contractors employed by him for the purpose of carrying out the Contract.

If the contractor directly or through petty contractors or sub-contractors fails to do so, his failure will be a breach of the contract and the Railway/DFCCIL may, in its discretion, rescind the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation of the provisions of the Act.

55. Provisions of payments of Wages Act: - The Contractor shall comply with the provisions of the Payment of Wages Act, 1936 and the rules made there under in respect of all employees employed by him either directly or through petty Contractors or sub-contractors in the works. If in compliance with the terms of the contract, the Contractor directly or through petty Contractors or sub-contractors or sub-contractors shall supply any labour to be used wholly or partly under the direct orders and control of the Engineer/DFCCIL whether in connection with the works to be executed hereunder or otherwise for the purpose of the Engineer/DFCCIL, such labour shall nevertheless be deemed to comprise persons employed by the Contractor and any moneys which may be ordered to be paid by the Engineer/DFCCIL shall be deemed to be moneys payable by the Engineer/DFCCIL on behalf of the Contractor and the Engineer/DFCCIL may on failure of the Contractor in terms of the contract. The Railway/DFCCIL shall be entitled to recover the same from Contractor's bills/Security Deposit or any other dues of Contractor with the Government of India or Railway/DFCCIL all moneys paid or payable by the Railway/DFCCIL by way of compensation of aforesaid or for costs of expenses in connection with any

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

claim thereto and the decision of the Engineer/DFCCIL upon any question arising out of the effect or force of this Clause shall be final and binding upon the Contractor.

55A. Provisions of Contract labour (Regulation and Abolition) Act, 1970:

- **55A.** (1) The contractor shall comply with the provision of the contract labour (Regulation and Abolition) Act, 1970 and the Contract labour (Regulation and Abolition) Central Rules 1971 as modified from time to time, wherever applicable and shall also indemnify the Railway/DFCCIL from and against any claims under the aforesaid Act and the Rules.
- **55A.** (2) The Contractor shall obtain a valid licence under the aforesaid Act as modified from time to time before the commencement of the work and continue to have a valid licence until the completion of the work. Any failure to fulfil the requirement shall attract the penal provision of the Act.
- **55A.** (3) The Contractor shall pay to the labour employed by him directly or through subcontractors the wages as per provision of the aforesaid Act and the Rules wherever applicable. The Contractor shall notwithstanding the provisions of the contract to the contrary, cause to be paid the wages to labour indirectly engaged on the works including any engaged by subcontractors in connection with the said work, as if the labour had been immediately employed by him.
- **55A.** (4) In respect of all labour directly or indirectly employed in the work for performance of the contractor's part of the contract, the Contractor shall comply with or cause to be complied with the provisions of the aforesaid Act and Rules wherever applicable.
- In every case in which, by virtue of the provisions of the aforesaid Act or the rules, the 55A.(5) Railway/DFCCIL is obliged to pay any amount of wages to a workman employed by the Contractor or his sub-contractor in execution of the work or to incur any expenditure on account of the contingent, liability of the Railway/DFCCIL due to the Contractor's failure to fulfill his statutory obligations under the aforesaid Act or the rules, the Railway/DFCCIL will recover from the Contractor, the amount of wages so paid or the amount of expenditure so incurred and without prejudice to the rights of the Railway/DFCCIL under the Section 20, Sub-Section (2) and Section 2, Sub-Section (4) of the aforesaid Act, the Railway/DFCCIL shall be at liberty to recover such amount or part thereof from Contractor's bills/Security Deposit or any other dues of Contractor with the Railway/DFCCIL. The Railway/DFCCIL shall not be bound to contest any claim made against it under Sub-Section (1) of Section 20 and Sub-Section (4) of Section 21 of the aforesaid Act except on the written request of the Contractor and upon his giving to the Railway/DFCCIL full security for all costs for which the Railway/DFCCIL might become liable in contesting such claim. The decision of the Chief Engineer/Chief General Manager regarding the amount actually recoverable from the Contractor as stated above shall be final and binding on the Contractor.

55B. Provisions of Employees Provident Fund and Miscellaneous Provisions Act, 1952:

The Contractor shall comply with the provisions of Para 30 & 36-B of the Employees Provident Fund Scheme, 1952; Para 3 & 4 of Employees' Pension Scheme, 1995; and Para 7 & 8 of Employees Deposit Linked Insurance Scheme, 1976; as modified from time to time through enactment of "Employees Provident Fund & Miscellaneous Provisions Act, 1952", wherever applicable and shall

also indemnify the Railway/DFCCIL from and against any claims under the aforesaid Act and the Rules.

- 55C. Contractor is to abide by the provisions of Payment of Wages act & Minimum Wages act in terms of clause 54, 55, 55A and 55B of Indian Railways General Condition of Contract. In order to ensure the developed hosted same, an application has been and on website 'www.shramikkalyan.indianrailways.gov.in'. Contractor shall register his firm/company etc. and upload requisite details of labour and their payment in this portal. These details shall be available in public domain. The Registration/ updation of Portal shall be done as under:
 - (a) Contractor shall apply for one-time registration of his company/firm etc. in the Shramikkalyan portal with requisite details subsequent to issue of Letter of Acceptance. Engineer/DFCCIL shall approve the contractor's registration in the portal within 7 days of receipt of such request.
 - (b) Contractor once approved by any Engineer/DFCCIL, can create password with login ID (PAN No.) for subsequent use of portal for all Letter of Acceptances (LoAs) issued in his favour.
 - (c) The contractor once registered on the portal, shall provide details of his Letter of Acceptances (LoA) / Contract Agreements on shramikkalyan portal within 15 days of issue of any LoA for approval of concerned Engineer/DFCCIL. Engineer/DFCCIL shall update (if required) and approve the details of LoA filled by contractor within 7 days of receipt of such request.
 - (d) After approval of LoA by Engineer/DFCCIL, contractor shall fill the salient details of contract labours engaged in the contract and ensure updating of each wage payment to them on shramikkalyan portal on monthly basis.
 - (e) It shall be mandatory upon the contractor to ensure correct and prompt uploading of all salient details of engaged contractual labour & payments made thereof after each wage period.
 - (f) While processing payment of any 'On Account bill' or 'Final Bill' or release of 'Advances' or 'Performance Guarantee / Security deposit', contractor shall submit a certificate to the Engineer/DFCCIL or Engineer's/DFCCIL representatives that "I have uploaded the correct details of contract labours engaged in connection with this contract and payments made to them during the wage period in Railway's Shramikkalyan portal at 'www.shramikkalyan.indianrailways.gov.in' till _____Month, ____Year."

55-D Provisions of "The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996" and "The Building and Other Construction Workers' Welfare Cess Act, 1996":

The tenderers, for carrying out any construction work, shall get themselves registered with the Registering Officer under Section-7 of the Building and Other Construction Workers Act, 1996 and rules made thereto by the concerned State Govt., and submit certificate of Registration issued from the Registering Officer of the concerned State Govt. (Labour Dept.). The Cess shall be deducted from contractor's bills as per provisions of the Act.

56.0 Reporting of Accidents: - The Contractor shall be responsible for the safety of all employees directly or through petty contractors or sub- contractor employed by him on the works and shall report serious accidents to any of them however and wherever occurring on the works to the Engineer/DFCCIL or the

Engineers/DFCCIL Representative and shall make every arrangement to render all possible assistance.

- **57.0 Provision of Workmen's Compensation Act:-** In every case in which by virtue of the provisions of section 12 sub-section (1) of the Workmen's Compensation Act 1923, Railway/DFCCIL is obliged to pay compensation to a workman directly or through petty contractor or subcontractor employed by the Contractor in executing the work, Railway/DFCCIL will recover from the Contractor the amount of the compensation so paid, and, without prejudice to the rights of Railway/DFCCIL under Section 12 Sub-section (2) of the said Act, DFCCIL shall be at liberty to recover such amount or any part thereof from contractor's bills/Security Deposit or any other dues of Contractor with the Government of India. Railway/DFCCIL shall not be bound to contest any claim made against it under Section 12 Sub-section (1) of the said Act except on the written request of the Contractor and upon his giving to Railway/DFCCIL full security for all costs for which Railway/DFCCIL might become liable in consequence of contesting such claim.
- **57A. Provision of Mines Act:-** The contractor shall observe and perform all the provisions of the Mines Act, 1952 or any statutory modifications or re-enactment thereof for the time being in force and any rules and regulations made there under in respect of all the persons directly or through the petty contractors or sub-contractors employed by him under this contract and shall indemnify the Railway/ DFCCIL from and against any claims under the Mines Act, or the rules and regulations framed there under, by or on behalf of any persons employed by him or otherwise.
- **58.0** Railway/DFCCIL not to provide quarters for Contractors: No quarters shall normally be provided by the Railway/DFCCIL for the accommodation of the contractor or any of his staff employed on the work. In exceptional cases where accommodation is provided to the Contractor at the Railway/DFCCIL discretion, recoveries shall be made at such rates as may be fixed by the Railway/DFCCIL for the full rent of the buildings and equipments therein as well as charges for electric current, water supply and conservancy.
- **59.(1)** Labour Camps: The contractor shall at his own expense make adequate arrangements for the housing, supply of drinking water and provision of latrines and urinals for his staff and workmen, directly or through the petty contractors or sub-contractors and for temporary crèche (*Bal-mandir*) where 50 or more women are employed at a time. Suitable sites on Railway/DFCCIL land, if available, may be allotted to the contractor for the erection of labour camps, either free of charge or on such terms and conditions that may be prescribed by the Railway/DFCCIL. All camp sites shall be maintained in clean and sanitary conditions by the contractor at his own cost.
- **59.(2)** Compliance to rules for employment of labour:- The contractor(s) shall conform to all laws, by-laws rules and regulations for the time being in force pertaining to the employment of local or imported labour and shall take all necessary precautions to ensure and preserve the health and safety of all staff employed directly or through petty contractors or sub-contractors on the works.
- **59.(3) Preservation of peace: -** The contractor shall take requisite precautions and use his best endeavours to

(i) Prevent any riotous or unlawful behaviour by or amongst his workmen and other employed directly or through the petty contractors or sub-contractors on the works and for the preservation of peace and protection of the inhabitants and CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

(ii) Security of property in the neighbourhood of the works. In the event of the Railway/DFCCIL requiring the maintenance of a special Police Force at or in the vicinity of the site during the tenure of works, the expenses thereof shall be borne by the contractor and if paid by the Railway/DFCCIL shall be recoverable from the contractor.

- **59.(4)** Sanitary Arrangements: The contractor shall obey all sanitary rules and carry out all sanitary measures that may from time to time be prescribed by the Railway Medical Authority and permit inspection of all sanitary arrangements at all times by the Engineer/DFCCIL, the Engineer's/DFCCIL Representative or the Medical staff of the Railway/DFCCIL. Should the contractor fail to make the adequate sanitary arrangements, these will be provided by the Railway/DFCCIL and the cost therefore recovered from the contractor.
- **59.(5) Outbreak of infectious disease:** The contractor shall remove from his camp such labour and their families as refuse protective inoculation and vaccination when called upon to do so by the Engineer/DFCCIL or the Engineer's/DFCCIL representative on the advice of the Railway/DFCCIL Medical Authority. Should cholera, plague or other infectious disease break out, the contractor shall burn the huts, beddings, clothes and other belongings of or used by the infected parties and promptly erect new huts on health sites as required by the Engineer/DFCCIL, failing which within the time specified in the Engineer's/DFCCIL requisition, the work may be done by the Railway/DFCCIL and the cost therefore recovered from the contractor.

59.(6) Deleted

- **59.(7)** Medical facilities at site: The Contractor shall provide medical facilities at the site as may be prescribed by the Engineer/DFCCIL on the advice of the Railway/DFCCIL Medical Authority in relation to the strength of the Contractor's resident staff and workmen.
- **59.(8)** Use of intoxicants: The sale of ardent spirits or other intoxicating beverages upon the work or in any of the buildings, encampments or tenements owned, occupied by or within the control of the contractor or any of his employees shall be forbidden and the Contractor shall exercise his influence and authority to the utmost extent to secure strict compliance with this condition.
- **59.(9)** Restrictions On The Employment Of Retired Engineers Of Railway/DFCCIL Services Within one Year Of Their Retirement: The Contractor shall not, if he is a retired Government Engineer of Gazetted rank, himself engage in or employ or associate a retired Government Engineer of Gazetted rank, who has not completed one year from the date of retirement, in connection with this contract in any manner whatsoever without obtaining prior permission of the President and if the Contractor is found to have contravened this provision it will constitute a breach of contract and administration will be entitled to terminate the contract and forfeit his Performance Guarantee as well as Security Deposit.
- **60.(1)** Non-employment of labours below the age of 15: The Contractor shall not employ children below the age of 15 as labourers directly or through petty contractors or subcontractors for the execution of work.
- **60.(2)** Medical Certificate of fitness for labour: It is agreed that the contractor shall not employ a person above 15 and below 19 years of age for the purpose of execution of work under the contract unless a

medical certificate of fitness in the prescribed form (**Proforma at Form No. 15**) granted to him by a certifying surgeon certifying that he is fit to work as an adult, is obtained and kept in the custody of the contractor or a person nominated by him in this behalf and the person carries with him, while at work; a token giving a reference to such certificate. It is further agreed that the responsibility for having the adolescent examined medically at the time of appointment or periodically till he attains the age of 19 years shall devolve entirely on the contractor and all the expenses to be incurred on this account shall be borne by him and no fee shall be charged from the adolescent or his parent for such medical examination.

- **60.(3) Period of validity of medical fitness certificate:** A certificate of fitness granted or renewed for the above said purposes shall be valid only for a period of one year at a time. The certifying surgeon shall revoke a certificate granted or renewed if in his opinion the holder of it is, no longer fit for work in the capacity stated therein. Where a certifying surgeon refuses to grant or renew a certificate or revoke a certificate, he shall, if so, required by the person concerned, state his reasons in writing for doing so.
- **60.(4) Medical re-examination of labourer:-** Where any official appointed in this behalf by the Ministry of labour is of the opinion that any person employed in connection with the execution of any work under this contract in the age group 15 to 19 years is without a certificate of fitness or is having a certificate of fitness but no longer fit to work in the capacity stated in the certificate, he may serve on the Contractor, or on the person nominated by him in the regard, a notice requiring that such persons shall be examined by a certifying surgeon and such person shall not if the concerned official so directs, be employed or permitted to do any work under this contract unless he has been medically examined and certified that he is fit to work in the capacity stated in the certificate.

EXPLANATIONS: -

- (1) Only qualified medical practitioners can be appointed as "Certifying Surgeons" and the term "Qualified Medical Practitioners" means a person holding a qualification granted by an authority specified in the Schedule to the Indian Medical Degrees Act, 1916 (*VII to 1916*) or in the Schedule to the Indian Medical Council Act, 1933 (*XXVII*) of 1933.
- (2) The Certifying surgeon may be a medical officer in the service of State or Municipal Corporation.

DETERMINATION OF CONTRACT

- **61.(1) Right of Railway/DFCCIL of determine the contract:-** The Railway/DFCCIL shall be entitled to determine and terminate the contract at any time should, in the Railway's/DFCCIL's opinion, the cessation of work becomes necessary owing to paucity of funds or from any other cause whatever, in which case the value of approved materials at site and of work done to date by the Contractor will be paid for in full at the rate specified in the contract. Notice in writing from the Railway/DFCCIL of such determination and the reasons therefore shall be conclusive evidence thereof.
- **61. (2) Payment on determination of contract:** Should the contract be determined under sub clause (1) of this clause and the Contractor claims payment for expenditure incurred by him in the expectation of completing the whole of the work, the Railways /DFCCIL shall admit and consider such claims as are

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

deemed reasonable and are supported by vouchers to the satisfaction of the Engineer/DFCCIL. The Railway's/ DFCCIL's decision on the necessity and propriety of such expenditure shall be final and conclusive.

61.(3) The contractor shall have no claim to any payment of compensation or otherwise, howsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not derive in consequence of determination of contract.

62.(1) Determination of contract owing to default of contractor: - If the Contractor should: -

- (i) Becomes bankrupt or insolvent, or
- (ii) Make an arrangement with of assignment in favour of his creditors, or agree to carry out the contract under a Committee of Inspection of his creditors, or
- (iii) Being a Company or Corporation, go into liquidation (*other than a voluntary liquidation for the purposes of amalgamation or reconstruction*), or
- (iv) Have an execution levied on his goods or property on the works, or
- (v) Assign the contract or any part thereof otherwise than as provided in Clause 7 of these conditions, or
- (vi) Abandon the contract, or
- (vii) Persistently disregard the instructions of the Engineer/DFCCIL, or contravene any provision of the contract, or
- (viii) Fail to adhere to the agreed programme of work by a margin of 10% of the stipulated period, or
- (ix) Fail to execute the contract documents in terms of Clause 1.3.7 of the Preamble and Instructions to Bidder in Part-I, Chapter-III of Tender Document.
- (x) Fails to submit the documents pertaining to identity of JV and PAN in terms of Clause 1.3.17.11 of Tender Form available in the Regulations for Tenders and Contracts.
- (xi) Fail to remove materials from the site or to pull down and replace work after receiving from the Engineer notice to the effect that the said materials or works have been condemned or rejected under Clause 25 and 27 of these Conditions, or
- (xii) Fail to take steps to employ competent or additional staff and labour as required under Clause 26 of the Conditions, or
- (xiii) Fail to afford the Engineer/DFCCIL or Engineer's/DFCCIL representative proper facilities for inspecting the work or any part thereof as required under clause 28 of the conditions, or
- (xiv) Promise, offer or give any bribe, commission, gift or advantage either himself or through his partner, agent or servant to any officer or employee of the Railway/DFCCIL or to any person on his or on their behalf in relation to the execution of this or any other contract with this Railway/DFCCIL.
- (xv) Fail to adhere to the provisions specified in **"Preamble & Instructions to Tenderers"**, Part-I, Chapter-III of Tender Document or Provision of above Clause 59(9).

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

(xvi) Submits copy of fake documents/certifications in support of credentials, submitted by the tenderer

Then and in any of the said Clause, the Engineer on behalf of the Railway/DFCCIL may serve the Contractor with a notice (**Proforma at Form no. 16**) in writing to that effect and if the Contractor does not within seven days after the delivery to him of such notice proceed to make good his default in so far as the same is capable of being made good and carry on the work or comply with such directions as aforesaid of the entire satisfaction of the Engineer/DFCCIL, the Railway/DFCCIL shall be entitled after giving 48 hours' notice (**Proforma at Form no. 17 or 17A, as the case may be**) in writing under the hand of the Engineer/DFCCIL to rescind the contract as a whole or in part or parts (as may be specified in such notice) and after expiry of 48 hours' notice, a final termination notice (**Proforma at Form no. 16 or 18A, as the case may be**) should be issued.

Note: Engineer/DFCCIL at his discretion may resort to the part termination of contract with notices (**Proforma at Form no. 16, 17A and 18A**), only in cases where progress of work is more than or equal to 80% of the original scope of work.

62.(2) Right of Railway/DFCCIL after, rescission of contract owing to default of contractor:

In the event of any or several of the courses, referred to in sub-clause (1) of the clause, being adopted.

- (a) The Contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any commitments or made any advances on account of or with a view to the execution of the works or the performance of the contract and Contractor shall not be entitled to recover or be paid any sum for any work thereto for actually performed under the contract unless and until the Engineer/DFCCIL shall have certified the performance of such work and the value payable in respect thereof and the Contractor shall only be entitled to be paid the value so certified.
- (b) In the contract which has been rescinded as a whole, the Security Deposit already with Railways/DFCCIL under the contract shall be encashed/ forfeited and the Performance Guarantee already submitted for the contract shall be encashed. The balance work shall be got done independently without risk & cost of the failed Contractor. The failed Contractor shall be debarred from participating in the tender for executing the balance work. If the failed Contractor is a JV or a Partnership firm, then every member/partner of such a firm shall be debarred from participating in the tender for the balance work in his/her individual capacity or as a partner of any other JV /partnership firm.

Further the authorized representative of failed Contractor cannot be accepted as authorized representative in new contract.

- (c) In the contract rescinded in part or parts,
- (i) The full Performance Guarantee for the contract shall be recovered. No additional Performance Guarantee shall be required for balance of work being executed through the part terminated contract. The contract value of part terminated contract stands reduced to the balance value of work under the contract.

- (ii) The Security Deposit of part terminated contract shall be dealt as per clause 16(2) of GCC.
- (iii) The defaulting Contractor shall not be issued any completion certificate for the contract.
- (iv) The balance work shall be got done independently without risk & cost of the failed Contractor. The failed Contractor shall be debarred from participating in the tender for executing the balance work. If the failed Contractor is a JV or a Partnership firm, then every member/partner of such a firm shall be debarred from participating in the tender for the balance work in his/her individual capacity or as a partner of any other JV /partnership firm.
- (v) Further the authorized representative of failed Contractor will not be accepted as authorized representative in new contract.
- (d) The Engineer/DFCCIL or the Engineer's/DFCCIL Representative shall be entitled to take possession of any materials, tools, implements, machinery and buildings on the works or on the property on which these are being or ought to have been executed, and to retain and employ the same in the further execution of the works or any part thereof until the completion of the works without the Contractor being entitled to any compensation for the use and employment thereof or for wear and tear or destruction thereof.
- (e) The Engineer/DFCCIL shall as soon as may be practicable after removal of the Contractor fix and determine ex-parte or by or after reference to the parties or after such investigation or enquiries as he may consider fit to make or institute and shall certify what amount (if any) had at the time of rescission of the contract been reasonably earned by or would reasonably accrue to the Contractor in respect of the work then actually done by him under the contract and what was the value of any unused, or partially used materials, any constructional plant and any temporary works upon the site. The legitimate amount due to the Contractor after making necessary deductions and certified by the Engineer/DFCCIL should be released expeditiously.

SETTLEMENT OF DISPUTES

63.0 Conciliation of disputes: All disputes and differences of any kind whatsoever arising out of or in connection with the contract, whether during the progress of the work or after its completion and whether before or after the determination of the contract, shall be referred by the Contractor to the Chief Engineer/Chief General Manager(CGM)" through "Notice of Dispute" provided that no such notice shall be served later than 30 days after the date of issue of Completion Certificate by the Engineer/DFCCIL. Chief Engineer/Chief General Manager (CGM) shall, within 30 days after receipt of the Contractor's "Notice of Dispute", notify the name of conciliator(s) to the Contractor, "who shall be chosen from the list of empanelled Conciliators maintained by DFCCIL".

The Conciliator(s) shall assist the parties to reach an amicable settlement in an independent and impartial manner within the terms of contract.

If the parties reach agreement on a settlement of the dispute, they shall draw up and sign a written settlement agreement duly signed by Engineer/DFCCIL, Contractor and conciliator(s). When the parties sign the settlement agreement, it shall be final and binding on the parties.

The parties shall not initiate, during the conciliation proceedings, any arbitral or judicial proceedings in respect of a dispute that is the subject matter of the conciliation proceedings.

The conciliation proceedings shall be terminated as per Section 76 of 'The Arbitration and Conciliation Act, 1996.

63.1 Matters Finally Determined by the Railways/DFCCIL: All disputes and differences of any kind whatsoever arising out of or in connection with the contract, whether during the progress of the work or after its completion and whether before or after the determination of the contract, shall be referred by the Contractor to the CGM and the CGM shall, within 120 days after receipt of the Contractor's representation, make and notify decisions on all matters referred to by the Contractor in writing provided that matters for which provision has been made in Clauses 7(j), 8, 18, 22(5), 39, 43(2), 45(i)(a), 55, 55-A(5), 57, 57A, 61(1), 61(2) and 62(1) of Standard General Conditions of Contract or in any Clause (stated as excepted matter) of the Special Conditions of the Contract, shall be deemed as 'excepted matters' (matters not arbitrable) and decisions of the Railway/DFCCIL Authority, thereon shall be final and binding on the Contractor; provided further that 'excepted matters' shall stand specifically excluded from the purview of the Arbitration Clause.

64. (1) Demand for Arbitration: -

- **64.** (1)(i) In the event of any dispute or difference between the parties hereto as to the construction or operation of this contract, or the respective rights and liabilities of the parties on any matter in question, dispute or difference on any account or as to the withholding by the Railway/DFCCIL of any certificate to which the Contractor may claim to be entitled to, or if the Railway/DFCCIL fails to make a decision within 120 days, then and in any such case, but except in any of the "excepted matters" referred to in Clause 63.1 of these Conditions, the Contractor, after 120 days but within 180 days of his presenting his final claim on disputed matters shall demand in writing that the dispute or difference be referred to arbitration.
- **64.(1) (ii)(a)** The demand for arbitration shall specify the matters which are in question, or subject of the dispute or difference as also the amount of claim item-wise. Only such dispute or difference, in respect of which the demand has been made, together with counter claims or set off, given by the Railway/DFCCIL, shall be referred to arbitration and other matters shall not be included in the reference.
- **64.(1)(ii)(b)** The parties may waive off the applicability of Sub-Section 12(5) of Arbitration and Conciliation (Amendment) Act 2015, if they agree for such waiver in writing, after dispute having arisen between them, in the format given under (Form No. 25) of these conditions.
- 64.(1)(iii)(a) The Arbitration proceedings shall be assumed to have commenced from the day, a written and valid demand for arbitration is received by the Railway/DFCCIL.
- **64.(1)(iii)(b)** The claimant shall submit his claim stating the facts supporting the claims alongwith all the relevant documents and the relief or remedy sought against each claim within a period of 30 days from the date of appointment of the Arbitral Tribunal.

- **64.(1)(iii)(c)** The Railway/DFCCIL shall submit its defence statement and counter claim(s), if any, within a period of 60 days of receipt of copy of claims from Tribunal, unless otherwise extension has been granted by Tribunal.
- **64.(1)(iii)(d) Place of Arbitration:** The place of arbitration would be within the geographical limits of the CGM Unit/DFCCIL where the cause of action arose or the Headquarters of the concerned CGM Unit/DFCCIL or any other place with the written consent of both the parties.
- **64.(1)(iv)** No new claim shall be added during proceedings by either party. However, a party may amend or supplement the original claim or defence thereof during the course of arbitration proceedings subject to acceptance by Tribunal having due regard to the delay in making it.
- **64.(1)(v)** If the Contractor(s) does/do not prefer his/their specific and final claims in writing, within a period of 90 days of receiving the intimation from the Railways/DFCCIL that the final bill is ready for payment, he/they will be deemed to have waived his/their claim(s) and the Railway/DFCCIL shall be discharged and released of all liabilities under the contract in respect of these claims.
 - **64.(2) Obligation During Pendency of Arbitration:** Work under the contract shall, unless otherwise directed by the Engineer/DFCCIL, continue during the arbitration proceedings, and no payment due or payable by the Railway/DFCCIL shall be withheld on account of such proceedings, provided, however, it shall be open for Arbitral Tribunal to consider and decide whether or not such work should continue during arbitration proceedings.

64.(3) Appointment of Arbitrator

- 64.(3)(a)(i) In cases where the total value of all claims in question added together does not exceed ₹ 1,50,00,000/- (Rupees One Crore Fifty Lakh), the Arbitral Tribunal shall consist of a Sole Arbitrator who shall be "Out of approved panel of Arbitrators in DFCCIL". The sole arbitrator shall be appointed within 60 days from the day when a written and valid demand for arbitration is received by M.D/DFCCIL.
- **64.(3)(a)(ii)(a)** In cases not covered by the Clause 64(3)(a)(i), the Arbitral Tribunal shall consist of a panel of three Officials, as the Arbitrators. For this purpose, the DFCCIL will send a panel of more than Three (3) names of DFCCIL empanelled Arbitrators Officers which may include the name(s) of Officers empanelled to work as Arbitrator to the contractor within 60 days from the day when a written and valid demand for Arbitration is received by the MD/DFCCIL. Contractor will be asked to suggest to M.D/DFCCIL at least 2 names out of the panel for appointment as Contractor's nominee within 30 days from the date of dispatch of the request by DFCCIL. The M.D/DFCCIL shall appoint at least one out of them as the Contractor's nominee and will, also simultaneously appoint the second Arbitrator.
 - (b) Third member, who will also act as the presiding member, will be appointed by mutual consent of the first two members from the list of empanelled Arbitrators. If these two members fail to reach an agreement on the third member then, on request by either or both parties, appointment will be made by the Managing Director/DFCCIL.

- (c) The tribunal shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the concialiator/s relevant to the dispute.
- (d) Neither party shall be limited in the proceedings before the tribunal to the evidence or arguments previously put before the conciliator/s to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction.
- (e) Arbitration may be commenced prior to or after completion of the works. The obligations of the Parties, the Engineer and the conciliator/s shall not be altered by reason of any arbitration being conducted during the progress of the Works.
- **64.(3)(a)(iii)** If one or more of the arbitrators appointed as above refuses to act as arbitrator, withdraws form his office as arbitrator, or vacates his/their officer/offices or is/are unable or unwilling to perform his functions as arbitrator for any reason whatsoever or dies or in the opinion of the MD/DFCCII fails to act without undue delay, the MD/DFCCIL shall appoint new arbitrator/arbitrators to act in his/their place in the same manner in which the earlier arbitrator/arbitrators had been appointed. Such reconstituted Tribunal may, at its discretion, proceed with the reference from the stage at which it was left by the previous arbitrator(s).
- 64.(3)(b)(i):(a) The Arbitral Tribunal shall have power to call for such evidence by way of affidavits or otherwise as the Arbitral Tribunal shall think proper, and it shall be the duty of the parties hereto to do or cause to be done all such things as may be necessary to enable the Arbitral Tribunal to make the award without any delay. The proceedings shall normally be conducted on the basis of documents and written statements.
 - (b) Before proceedings into the merits of any dispute, the Arbitral Tribunal shall first decide and pass its orders over any plea submitted/objections raised by any party, if any, regarding appointment of Arbitral Tribunal, validity of arbitration agreement, jurisdiction and scope of the Tribunal to deal with the dispute(s) submitted to arbitration, applicability of time 'limitation' to any dispute, any violation of agreed procedure regarding conduct of the arbitral proceedings or plea for interim measures of protection and record its orders in day to day proceedings. A copy of the proceedings duly signed by all the members of tribunal should be provided to both the parties.
 - **64.3(c)(i):** The abitral award shall state item wise, the sum and reasons upon which it is based. The analysis and reasons shall be detailed enough so that the award could be inferred therefrom.
 - **64.3(c)(ii):** A party may apply for corrections of any computational errors, any typographical or clerical errors or any other error of similar nature occurring in the award of a Tribunal and interpretation of a specific point of award to Tribunal within 60 days of receipt of the award.
 - **64.3(c)(iii):** A party may apply to Tribunal within 60 days of receipt of award to make an additional award as to claims presented in the arbitral proceedings but omitted from the arbitral award.
 - **64.(4):** In case of the Tribunal, comprising of three members, any ruling on award shall be made by a majority of members of Tribunal. In the absence of such a majority, the views of the Presiding Arbitrator shall prevail.

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

- **64.(5):** Where the arbitral award is for the payment of money, no interest shall be payable on whole or any part of the money for any period till the date on which the award is made.
- 64.(6): The cost of arbitration shall be borne by the respective parties. The cost shall inter-alia include fee of the arbitrator(s), as per the rates fixed by Railway/DFCCIL from time to time and the fee shall be borne equally by both the parties, provided parties sign an agreement in the format given at "Form No. 25" to these conditions after/ while referring these disputes to Arbitration. Further, the fee payable to the arbitrator(s) would be governed by the instructions issued on the subject by Railway Board/DFCCIL from time to time irrespective of the fact whether the arbitrator(s) is/are appointed by the Railway Administration/DFCCIL or by the court of law unless specifically directed by Hon'ble court otherwise on the matter.
- 64.(7) Subject to the provisions of the aforesaid Arbitration and Conciliation Act 1996 and the rules thereunder and relevant para of General Conditions of Contract (GCC) and any statutory modifications thereof shall apply to the appointment of arbitrators and arbitration proceedings under this Clause.

<u>Part- I</u>

Chapter-V

Special Conditions of Contract

PART-I

CHAPTER-V

SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS (SECTION-1)

Note: The Special Conditions of contract (SCC) should be read in conjunction with the General Conditions of Contract (GCC). However, if there is any provision in the GCC, which is at variance with the provisions in SCC, the provisions in the Special Conditions of Contract (SCC) shall take precedence.

1.1 The amended provisions for public procurement circulated by Ministry of Finance (MoF) – Dept of Expenditure – Public procurement Division OM No. F No. 6/18/2019 – PPD dated 23-07-2020 would be applicable in this tender also. The copy of the same is enclosed herewith for ready reference.

1.2 <u>Electrical Contractor License</u>

- 1.2.1 The Tenderer should have a valid Electrical Contractor License.
- 1.2.2 The Tenderer should have a valid Electrical Supervisor License.

1.3 <u>Warranty/Guarantee period for Specialized Items :</u>

- 1.3.1 The contractor has to provide OEM Warranty certificates in the name of DFCCIL for specialized items. In case of specialized items become obsolete in the market, OEM support for such items (spare parts/ technical support) is to be provided for a minimum of 3/<u>5/7 years</u> after completion of Warranty period or as specified in the bill of quantities or technical specifications. Warranties shall be in the form of Certificates issued by the Manufacturer/OEM in the name of DFCCIL clearly specifying the period of warranty, quantity & description of items.
- 1.3.2 The procurement of specialized items/ equipments (such as IT, Audio Video System & Networking etc.) shall be planned by the contractor such that, the specialized items/ equipments shall not be purchased more than **03 months** from the date of commissioning of building or as instructed by Engineer/DFCCIL.
- 1.3.3 The procurement of specialized items/ equipments (such as IT, Audio Video System & Networking etc.) should be as per specification given in Bill of Quantities/ Technical Specification. If in case, the specialised item/ equipment is out of market/ upgradation of technology/discontinued by the Company or OEM, the specialised item/ equipment with latest/upgraded version may be installed with the prior approval of Engineer/DFCCIL.
- 1.3.4 5% of the value of the executed specialised item/equipments (such as IT, Audio Video System & Networking etc.) will be withheld from the payments issued to the contractor till completion of the warranty period and will be released after successful completion of the warranty period. It will be the sole responsibility of the contractor to repair, replacement and maintainence the specialized items till the completion of the warranty period at its own cost. However, in case, contractor does not respond to such issues of repair, replacement and maintainence during or after Defect Liability Period (DLP) till the completion of full warranty period, the cost of such repairs, replacement & maintainence of items would be borne by DFCCIL and the same would be deducted by DFCCIL from the 5% withheld value of such item.

- 1.3.5 All LED Luminaries (including Façade Lighting) and LMS (hardware and software) shall have a replacement guarantee of 5 years from date of completion of work from OEM. The Contractor has to submit the guarantee certificate from OEM in the name of DFCCIL for the same.
- 1.3.6 All furniture items for Corporate Office Building should be BIFMA Gold rated SCS Global certified for in-house air quality with 10 years replacement warranty in the name of DFCCIL or as specified in the bill of quantities or technical specifications etc.
- 1.3.7 All furniture items for Admin Building should be BIFMA Gold rated SCS Global certified for inhouse air quality and with 10 years replacement warranty in the name of DFCCIL or as specified in the bill of quantities or technical specifications etc.
- 1.3.8 All furniture items for Hostel Building should be BIFMA certified for in-house air quality and with 5 years warranty in the name of DFCCIL as specified in the bill of quantities or technical specifications etc.

1.3.9 Special Conditions for HVAC Works

- (ii) The Contractor shall have the option to get the CAMC OF VRV/VRF HVAC system executed by the OEM/Authorized channel partner of OEM of VRV/VRF. In this case it shall be the responsibility of the contractor to get the CAMC agreement executed between DFCCIL and the OEM/Authorized channel partner of OEM at the quoted rates of the Contractor and as per Terms & Conditions related to CAMC mentioned in the Tender Document at least one month before completion of DLP period. In case of CAMC agreement with Authorized channel partner of OEM, MOU with OEM as per clause 1 above has to be submitted by Authorized channel partner of OEM.
- (iii) Security Deposit @ 5% and Performance Guarantee @ 3% of the contract value of CAMC of 7 years shall be retinaed by DFCCIL till successful completion of CAMC of 7 years.

1.4 Handing Over Schedule:

1.4.1 On completion of all items of work as per contract, the Agency shall hand over the works to DFCCIL. The handing over of the completed works in all respect to DFCCIL (officially in writing) shall be the responsibility of the Agency. The defect liability period will commence from the date of handing/taking over to the DFCCIL. The process of handing over shall be as under:

One month in advance of the stipulated date of completion, joint inspection shall be carried out with Agency and Engineer's/DFCCIL representatives and all the defects, deficiencies shall be noted and a time bound programme to be made for rectifying/making good all the defects and deficiencies. After removing all defects, deficiencies at its own cost upto the satisifaction of Engineer/DFCCIL, the agency shall handover the building premises to DFCCIL.

The Agency shall remove at his own cost all surplus materials, debris, material waste, labour hutments before handing over to Engineer/DFCCIL. If it is felt that the Agency is not responding to rectify the defects urgently and the Engineer/DFCCIL is suffering in using the assets created due to

default of the contract, Engineer/DFCCIL shall be entitled to get the defects rectified at the risk and cost of the Agency at any time after expiry of 24 hours notice issued to the Agency.

- 1.4.2 The tentative handing over schedule for the buildings is as under:
- 1.4.3 The agency has to first provide the handover of Admin & Hostel Building of HHRI Complex within 3 months of issuing of LOA after completing all items of works as defined in scope of work/BOQ or as per the priority decided by the DFCCIL.
- 1.4.4 The agency has to provide the handing over of C.O. Building Complex (floor wise) in multiple stages as per the schedule given below after completing all items of works as defined in scope of work/BOQ or as per the priority decided by the Engineer/DFCCIL.

S. No.	C.O. Building Floor	Completion Period from the Start Date
1	1 st Floor & 2 nd Floor	4 Months
2	6 th Floor, 3rd Floor & 4 th Floor	8 Months (by Nov, 2021)
3	5 th Floor	10 Months
4	7 th , 8 th & Ground Floor	18 Months

1.5 <u>Approved Makes/Brands:</u>

- 1.5.1 The brands/makes of the items would be executed as per the "List of Approved Makes" provided in the Tender Document. However, colour coding, shade or design shall be the discretion of the Architect/DFCCIL.
- 1.5.2 In case of non-availability of the brand/make specified in the approved list, the agency shall be allowed to use alternate equivalent brands of the material subject to approval of the same from DFCCIL.
- 1.5.3 The agency has to submit requisite catalogues and samples of the material to DFCCIL before approval and ensure that the supply would only be taken by agency after the materials are duly approved by DFCCIL.
- 1.5.4 The agency has to produce Manufacturer Test Certificates (MTC), Warranty Certificates/Invoices for material/equipment supplied for certification and approval.
- 1.5.5 Submittals and samples must be approved from PMC/Architect/DFCCIL before supply.

1.6 <u>Co-ordination with other Contractors/Agencies/Sub-Contractors/Consultants during the</u> <u>execution of the works:</u>

The contract for civil construction of DFCCIL Corporate Office Building (Framed Structure along with façade & glazing work) has already been awarded and construction of the same is under advance stage at site. Further, contract for civil construction of DFCCIL Heavy Haul & Research Institute (HHRI) (Framed Structure along with Façade & Interior works excluding furnishing/furniture & IT/HVAC/BMS work) has already been awarded and construction of the same is also under advance stage at site. Other agencies will also join in future for other work contract packages.

The Contractor for "Interior and Furnishing work" would be working parallerly with the agencies already working at site for contract awarded and agencies which will join in future for other work packages. Hence, proper co-ordination would be required with other agencies at site during

execution of the works. Conflicting situations should be minimized and if any should be resolved amicably with the participation of PMC/DFCCIL. In any of such situations, the decision of Engineer /DFCCIL would be final and binding.

CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

F.No.6/18/2019-PPD Ministry of Finance Department of Expenditure Public Procurement Division

> 161, North Block, New Delhi 23rd July, 2020

Office Memorandum

Subject: Insertion of Rule 144 (xi) in the General Financial Rules (GFRs), 2017

Rule 144 of the General Financial Rules 2017 entitled 'Fundamental principles of public buying', has been amended by inserting sub-rule (xi) as under:

Notwithstanding anything contained in these Rules, Department of Expenditure may, by order in writing, impose restrictions, including prior registration and/or screening, on procurement from bidders from a country or countries, or a class of countries, on grounds of defence of India, or matters directly or indirectly related thereto including national security; no procurement shall be made in violation of such restrictions.

(San)ay Prasad) Joint Secretary (PPD) Email ID: j<u>s.pfc2.doe@gov,in</u> Telephone: 011-23093882

To,

(1) Secretaries of All Ministries/ Departments of Government of India

(2)

Chief Secretaries/ Administrators of Union Territories/ National Capital Territory of Delhi

1/13

F.No.6/18/2019-PPD Ministry of Finance Department of Expenditure Public Procurement Division

> 161, North Block, New Delhi 23rd July, 2020

Order (Public Procurement No. 1)

Subject: Restrictions under Rule 144 (xi) of the General Financial Rules (GFRs), 2017

Attention is invited to this office OM no. 6/18/2019-PPD dated 23rd July 2020 inserting Rule 144 (xi) in GFRs 2017. In this regard, the following is hereby ordered under Rule 144 (xi) on the grounds stated therein:

Requirement of registration

- Any bidder from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non-consultancy services) or works (including turnkey projects) only if the bidder is registered with the Competent Authority, specified in Annex I.
- This Order shall not apply to (i) cases where orders have been placed or contract has been concluded or letter/notice of award/ acceptance (LoA) has been issued on or before the date of this order; and (ii) cases falling under Annex II.

Transitional cases

- 3. Tenders where no contract has been concluded or no LoA has been issued so far shall be handled in the following manner:
 - a) In tenders which are yet to be opened, or where evaluation of technical bid or the first exclusionary qualificatory stage (i.e. the first stage at which the qualifications of tenderers are evaluated and unqualified bidders are excluded) has not been completed: No contracts shall be placed on bidders from such countries. Tenders received from bidders from such countries shall be dealt with as if they are non-compliant with the tender conditions and the tender shall be processed accordingly.
 - b) If the tendering process has crossed the first exclusionary qualificatory stage: If the qualified bidders include bidders from such countries, the

1/12

entire process shall be scrapped and initiated *de novo*. The *de novo* process shall adhere to the conditions prescribed in this Order.

c) As far as practicable, and in cases of doubt about whether a bidder falls under paragraph 1, a certificate shall be obtained from the bidder whose bid is proposed to be considered or accepted, in terms of paras 8, 9 and 10 read with para 1 of this Order.

Incorporation in tender conditions

 In tenders to be issued after the date of this order, the provisions of paragraph 1 and of other relevant provisions of this Order shall be incorporated in the tender conditions.

Applicability

- Apart from Ministries / Departments, attached and subordinate bodies, notwithstanding anything contained in Rule 1 of the GFRs 2017, this Order shall also be applicable
 - a. to all Autonomous Bodies;
 - b. to public sector banks and public sector financial institutions; and
 - c. subject to any orders of the Department of Public Enterprises, to all Central Public Sector Enterprises; and
 - d. to procurement in Public Private Partnership projects receiving financial support from the Government or public sector enterprises/ undertakings.
 - e. Union Territories, National Capital Territory of Delhi and all agencies/ undertakings thereof

Definitions

- 6. "Bidder" for the purpose of this Order (including the term 'tenderer', 'consultant' 'vendor' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency, branch or office controlled by such person, participating in a procurement process.
- 7. "Tender" for the purpose of this Order will include other forms of procurement, except where the context requires otherwise.
- 8. "Bidder from a country which shares a land border with India" for the purpose of this Order means



- a) An entity incorporated, established or registered in such a country; or
- b) A subsidiary of an entity incorporated, established or registered in such a country; or
- c) An entity substantially controlled through entities incorporated, established or registered in such a country; or
- d) An entity whose beneficial owner is situated in such a country; or
- e) An Indian (or other) agent of such an entity; or
- f) A natural person who is a citizen of such a country; or
- g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above
- 9. "Beneficial owner" for the purpose of paragraph 8 above will be as under:
 - (i) In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person(s), has a controlling ownership interest or who exercises control through other means. Explanation—
 - a. "Controlling ownership interest" means ownership of, or entitlement to, more than twenty-five per cent of shares or capital or profits of the company;
 - "Control" shall include the right to appoint the majority of the directors or to control the management or policy decisions, including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

(iii) In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

(iv) Where no natural person is identified under (i) or (ii) or (iii) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

/12

(v) In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

10. "Agent" for the purpose of this Order is a person employed to do any act for another, or to represent another in dealings with third persons.

Sub-contracting in works contracts

11. In works contracts, including turnkey contracts, contractors shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority. The definition of "contractor from a country which shares a land border with India" shall be as in paragraph 8 above. This shall not apply to sub-contracts already awarded on or before the date of this Order.

Certificate regarding compliance

12.A certificate shall be taken from bidders in the tender documents regarding their compliance with this Order. If such certificate given by a bidder whose bid is accepted is found to be false, this would be a ground for immediate termination and further legal action in accordance with law.

Validity of registration

13. In respect of tenders, registration should be valid at the time of submission of bids and at the time of acceptance of bids. In respect of supply otherwise than by tender, registration should be valid at the time of placement of order. If the bidder was validly registered at the time of acceptance / placement of order, registration shall not be a relevant consideration during contract execution.

Government E-Marketplace

14. The Government E-Marketplace shall, as soon as possible, require all vendors/ bidders registered with GeM to give a certificate regarding compliance with this Order, and after the date fixed by it, shall remove non-compliant entities from GeM unless/ until they are registered in accordance with this Order.



Model Clauses/ Certificates

15. Model Clauses and Model Certificates which may be inserted in tenders / obtained from Bidders are enclosed as **Annex III**. While adhering to the substance of the Order, procuring entities are free to appropriately modify the wording of these clauses based on their past experience, local needs etc. without making any reference to this Department.

(Sanjay Prasad) Joint Secretary (PPD) Email ID: js.pfc2.doe@gov,in Telephone: 011-23093882

- То
- Secretaries of All Ministries/ Departments of Government of India for information and necessary action. They are also requested to inform these provisions to all procuring entities.
- (2) Secretary, Department of Public Enterprises with a request to immediately reiterate these orders in respect of Public Enterprises.
- (3) Secretary DPIIT with a request to initiate action as provided under Annex I
- (4) Chief Secretaries/ Administrators of Union Territories/ National Capital Territory of Delhi

/12

Annex I: Competent Authority and Procedure for Registration

- A. The Competent Authority for the purpose of registration under this Order shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT)*.
- B. The Registration Committee shall have the following members*:
 - i. An officer, not below the rank of Joint Secretary, designated for this purpose by DPIIT, who shall be the Chairman;
 - Officers (ordinarily not below the rank of Joint Secretary) representing the Ministry of Home Affairs, Ministry of External Affairs, and of those Departments whose sectors are covered by applications under consideration;
 - iii. Any other officer whose presence is deemed necessary by the Chairman of the Committee.
- C. DPIIT shall lay down the method of application, format etc. for such bidders as stated in para 1 of this Order.
- D. On receipt of an application seeking registration from a bidder from a country covered by para 1 of this Order, the Competent Authority shall first seek political and security clearances from the Ministry of External Affairs and Ministry of Home Affairs, as per guidelines issued from time to time. Registration shall not be given unless political and security clearance have both been received.
- E. The Ministry of External Affairs and Ministry of Home Affairs may issue guidelines for internal use regarding the procedure for scrutiny of such applications by them.
- F. The decision of the Competent Authority, to register such bidder may be for all kinds of tenders or for a specified type(s) of goods or services, and may be for a specified or unspecified duration of time, as deemed fit. The decision of the Competent Authority shall be final.
- G. Registration shall not be granted unless the representatives of the Ministries of Home Affairs and External Affairs on the Committee concur*.
- H. Registration granted by the Competent Authority of the Government of India shall be valid not only for procurement by Central Government and its agencies/ public enterprises etc. but also for procurement by State Governments and their agencies/ public enterprises etc. No fresh registration at the State level shall be required.

t/12

- I. The Competent Authority is empowered to cancel the registration already granted if it determines that there is sufficient cause. Such cancellation by itself, however, will not affect the execution of contracts already awarded. Pending cancellation, it may also suspend the registration of a bidder, and the bidder shall not be eligible to bid in any further tenders during the period of suspension.
- J. For national security reasons, the Competent Authority shall not be required to give reasons for rejection / cancellation of registration of a bidder.
- K. In transitional cases falling under para 3 of this Order, where it is felt that it will not be practicable to exclude bidders from a country which shares a land border with India, a reference seeking permission to consider such bidders shall be made by the procuring entity to the Competent Authority, giving full information and detailed reasons. The Competent Authority shall decide whether such bidders may be considered, and if so shall follow the procedure laid down in the above paras.
- L. Periodic reports on the acceptance/ refusal of registration during the preceding period may be required to be sent to the Cabinet Secretariat. Details will be issued separately in due course by DPIIT.

[*Note: i. I

- In respect of application of this Order to procurement by/ under State Governments, all functions assigned to DPIIT shall be carried out by the State Government concerned through a specific department or authority designated by it. The composition of the Registration Committee shall be as decided by the State Government and paragraph G above shall not apply. However, the requirement of political and security clearance as per para D shall remain and no registration shall be granted without such clearance.
- ii. Registration granted by State Governments shall be valid only for procurement by the State Government and its agencies/ public enterprises etc. and shall not be valid for procurement in other states or by the Government of India and their agencies/ public enterprises etc.]

0/10

Annex II: Special Cases

- A. Till 31st December 2020, procurement of medical supplies directly related to containment of the Covid-19 pandemic shall be exempt from the provisions of this Order.
- B. Bona fide procurements made through GeM without knowing the country of the bidder till the date fixed by GeM for this purpose, shall not be invalidated by this Order.
- C. Bona fide small procurements, made without knowing the country of the bidder, shall not be invalidated by this Order.
- D. In projects which receive international funding with the approval of the Department of Economic Affairs (DEA), Ministry of Finance, the procurement guidelines applicable to the project shall normally be followed, notwithstanding anything contained in this Order and without reference to the Competent Authority. Exceptions to this shall be decided in consultation with DEA.
- E. This Order shall not apply to procurement by Indian missions and by offices of government agencies/ undertakings located outside India.

9/12

Annex III Model Clause /Certificate to be inserted in tenders etc.

(While adhering to the substance of the Order, procuring entities and GeM are free to appropriately modify the wording of the clause/ certificate based on their past experience, local needs etc.)

Model Clauses for Tenders

- I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority.
- II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.
- III. "Bidder from a country which shares a land border with India" for the purpose of this Order means:
 - a. An entity incorporated, established or registered in such a country; or
 - b. A subsidiary of an entity incorporated, established or registered in such a country; or
 - c. An entity substantially controlled through entities incorporated, established or registered in such a country; or
 - d. An entity whose beneficial owner is situated in such a country; or
 - e. An Indian (or other) agent of such an entity; or
 - f. A natural person who is a citizen of such a country; or
 - g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above
- IV. The beneficial owner for the purpose of (iii) above will be as under:
 - In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means. Explanation—

a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent. of shares or capital or profits of the company;



b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

- In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;
- 3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;
- Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;
- 5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.
- V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.
- VI.

[To be inserted in tenders for Works contracts, including Turnkey contracts] The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority.

Model Certificate for Tenders (for transitional cases as stated in para 3 of this Order)

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I hereby certify that this bidder is not from such a country and is eligible to be considered."

Model Certificate for Tenders

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfills all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Model Certificate for Tenders for Works involving possibility of sub-contracting

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfills all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Model Certificate for GeM:

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this vendor/ bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this vendor/ bidder fulfills all requirements in this regard and is eligible to be considered for procurement on GeM. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

12/12

PART-I

CHAPTER-V

SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS (SECTION-2)

Note: The Special Conditions of contract (SCC) should be read in conjunction with the General Conditions of Contract (GCC). However, if there is any provision in the GCC, which is at variance with the provisions in SCC, the provisions in the Special Conditions of Contract (SCC) shall take precedence.

2.1 TEMPORARY WORKERS' HOUSING:

- **2.1.1** The bidder himself shall construct clean hygienic and well-ventilated labour housing with adequate water supply, electrical, sanitation facilities, etc as per "Model Rules for the Protection of Health and Sanitary Arrangement for the Workers Employed by the Contractors" of General Conditions of Contract, or applicable Labour Regulations.
- 2.1.2 The contractor has to arrange for the labour passes for entry and exit of labourers at the work site.
- 2.1.3 Adequate number of temporary housing units shall be constructed within two months of the date of start of work to the satisfaction of Engineer/DFCCIL.
- 2.1.4 Toilet blocks having WC, wash basin and bathing area @ one set for approximately 15 labours with arrangement for sewage disposal through ready to install adequate capacity septic tank units shall be made available along with the labour huts.
- 2.1.5 These housing units can be inspected by Engineer/DFCCIL and contractor will be allowed to take up main work only after satisfactory completion of these units.

2.1.6 No extra payment shall be made by DFCCIL for construction of such temporary labour housing.

2.2 Tool and Plants

The required T&P shall be brought to site well in advance so as to ensure the progress of the work as per the Contract Schedule.

2.3 **Technical Staff:**

The contractor shall submit the list of engineers / technical staff with charter of duties / responsibilities of each one related to execution of the work after issue of Letter of Acceptance (as given below) and deploy the same at work site according to the requirement and progress of work as decided by Engineer/DFCCIL. However, the exact composition of the team shall consist of any or all the above-mentioned functionaries depending on the requirement of the project. It could also consist of more/less than the number of one type of functionaries, as decided by Engineer/DFCCIL depending on the requirement of the project. The decision of DFCCIL in this regard would be final and binding.

Requirement of technical representative(s)						
S.N.	Minimum Qualification of Technical Representative	Designation of Technical Staff	Minimum experience	Number		
1.	Graduate Engineer	Project Manager/Civil/Interior	15 years (and having experience of similar nature of work)	1 No.		
2.	Graduate Engineer	Dy. Project Manager/Interior	10 years (and having experience of similar nature of work)	1 No.		
3.	Graduate Engineer/Electrical	Dy. Project Manager/Electrical	10 years (and having experience of similar nature of work)	1 No.		
4.	Graduate Engineer or Diploma Engineer	Project/Site Engineer (Interior/Electrical/Mechan ical/IT)	5 Years or 10 Years respectively	6 Nos.		
5.	Graduate Engineer	Project Planning/Billing Engineer	10 Years	1 No.		

2.4 **Compliance with GRIHA Guidelines**

Agency is advised to note that entire work shall be carried out in such a manner so as to satisfy Green building parameters / GRIHA guidelines. Conditions of Contract specific to Green Building Practices have been narrated in Special Conditions for Green Building Practices (*Part-I, Chapter-V, Section-4 & 5*).

2.5 Defects Liability Period (DLP)

2.5.1 Defects liability period shall be taken as **18** (**Eighteen**) **months** from the date of completion of the work for building as a whole, wherein all the defects shall be rectified by the contractor at his own cost.

For specialized works such as water proofing etc, the defect liability period shall be for a minimum period of 10 years, in which:

- a. The contractor shall be fully responsible for and shall guarantee proper performance of the entire waterproofing system for a period of 10 (Ten) years from the final completion of works. For this, a specific 10 years written guarantee (*to be furnished in a non-judicial stamp paper of value not less than Rs.100/-*) in the prescribed proforma (*Form No.24*) shall be submitted for the performance of the system before final payment and shall not in any way limit any other rights the Employer may have under the contract. All water-proofing work shall be carried out through specialized agency as per method of working approved by the Engineer. However, the contractors shall be solely responsible for waterproofing treatment until the expiry of the above guarantee period.
- b. In addition, 10% (ten percent) of the cost of these items of water proofing under this sub head shall be retained as guarantee to watch the performance of the work executed. However, if the performance of the waterproofing works is found satisfactory, then, half of this amount (withheld) would be released after five years from the date of completion of the

work & the remaining withheld amount, shall be released after completion of ten years from the date of completion of work (*if the performance of the waterproofing work is found satisfactory*).

However, if any defect is noticed during the guarantee period, it would need to be rectified by the contractor within seven days of issuing of notice by the Engineer / DFCCIL and, if not attended to, the same shall be got done through other agency at the risk and cost of the contractor and recovery shall be effected from the amount retained towards guarantee. In any case, the contractor and the specialized agency, during the guarantee period, shall inspect and examine the treatment once in every year and make good any defect observed and confirm the same in writing to DFCCIL.

- 2.5.2 Defects of serious nature causing inconvenience such as leakage, reverse floor slopes affecting the drainage (*ponding of water*), warping and opening of joints in doors and window shutters, etc, shall be undertaken by the contractor immediately on receipt of the complaint but not exceeding one week time, failing which, the defects will be got removed at his risk and cost plus 25% + GST extra as supervision and establishment charges.
- 2.6.1 All other defects notified to the contractor during the DLP shall be rectified to the entire satisfaction of Engineer/DFCCIL or item replaced as soon as possible but not beyond one month failing which, Engineer/DFCCIL shall get it done at his cost plus 25% + GST extra as supervision and establishment charges. The decision of Engineer/DFCCIL regarding a defect being of serious nature or otherwise shall be final and binding.
- 2.6.1 Contractor shall undertake the comprehensive maintenance for **18** (**Eighteen**) **months** after the certified date of completion of the buildings constructed or services provided in the building and shall include all labour material, T&P etc., required to attend any complaint lodged by the Engineer/DFCCIL. The contractor shall make all the arrangement for receiving and recording the complaints through a maintenance cell & land for construction of site office and storage of material shall be provided by DFCCIL in the campus.

S. No	Description	Defect Liability
(i) Concrete/Brickwork/		(a) Rectification of structural /superficial/non-structural cracks.
	waterproofing	(b) Rectification of dampness/leakages/seepage in roof slab /
		junctions & sunken portion, depressed portion, through RCC slab,
		vertical ties, bands, walls, base slab, junction of RCC walls with
		base slab and construction joints of RCC water tanks.
		(c) Rectification of cracks in confined masonry panel wall / partition
		wall in full length or in part portion.
		(d) Cracks / settlement of main wall, partition wall or dwarf walls.
		(e) Rectification of efflorescence, dampness.

The scope of the defect liability will be as under (as applicable):

	1	
(ii)	Painting work/polishing	(a) Rectification of cracks Ceiling/ wall / partition wall in full length
	work/ POP work/ POP	or in part portion.
	punning work	(b)Rectification of occurrence of Undulations in any surfaces of. ceiling / walls/partitions wall or wherever these items have been
		executed.
		(d) Polishing work shall be rectified if any hubbles or creeks appear
		on the polished surface.
(iii)	Woodwork & Joinery/	(a) Replacement of warped / bent / weather affected joinery, termite
	Veneer paneling work/	& borer affected joinery of wooden door / window shutters and
	Glass paneling work/	frames.
	Acrylic paneling and ceiling	(b)Cracks in panels, bars / rails / styles of wooden door / window shutters etc.
	6	(c)Rectification of bulges/ swelling of veneer.
		(d) Rectification of all veneer surfaces where the grains of veneer have split.
		(e) Rectification of glass paneling for all areas where the adhesive of sticking tapes has given way and the glass has moved fro its original position.
		(f) Rectification of glass paneling wherever the glass color has lost its shade.
		(g) rectification of all acrylic surface wherever the gaps have occurred.
		(h) rectification of all acrylic surfaces which have visible bulge
		(i) rectification of all acrylic surfaces which have lost color
(iv)	Hardware/ digital lock/	(a) Repairs / Replacement of loosened / premature failure of fittings
	automatic sliding door/	including lever mechanics in door locks, hydraulic door closers,
	floor spring/ cam action	handles, tower blots, cupboard locks etc.
	door closer	(b) Rectification of all digital locks which have malfunctioned.(c) Rectification and regular maintenance of automatic sliding door(d) Adjustment of floor springs and cam action door closer to have smooth and perfect functioning
(v)	Aluminum partitions/	(a) Rectification of all aluminum parts and joints of aluminum
	Steel framing work for	partition to ensure no gaps or surface warping is observed.
	paneling and partition/	(b)Redoing of defective portion in fabrication / welding including
	Kanngs	painting thereon.
		(c) steel work and MS/ SS railings should be properly fastened to their positions and shall be painted /polished if any rust is observed
(vi)	Furniture loose and fixed	(a) Rectification of all furniture items towards malfunctioning o
		hardware in loose furniture.
		(b) all fixed furniture should be stead fast to its position. All nuts
		bolts and screws shall be fastened to ensure the fixed furniture
		does not lose its shape and surfaces remain perfect.

(vii)	Finishing	(a) Rectification of structural / superficial cracks.
		(b) Rectification of protruding / peeling off plaster.
		(c) Rectification of efflorescence, dampness appeared.
		(d) Undulation / unevenness in plaster.
		(e) Paint & polishing.
(viii)	Flooring	(a) Rectification of sunken / deflected / depressed portion of plinth
		protection, flooring in rooms, toilets, entrance fover, staircase and
		other locations.
		(b) Rectification / Replacement of settled floors.
		(c) Settlement of foundation & floors and resultant undulation of
		door finishes
		(d) Rectification / Replacement of floor tiles which are sunken /
		upeyen / undulating at joints / different in colour texture atc
		uneven / undulating at joints / unrefent in colour, texture, etc.
(ix)	Aluminium / u- PVC	(a) Rectification / Replacement of defective part of Aluminium frame
	WORK	/shutters.
(X)	Electrial works	(a) Repair and rectification of damaged wiring, points, switches.
		(c) Repair and rectification of damage MCB's MCCB's RCB's in
		distribution board, panels etc.
(xi)	Lifts	(a) Repairs, if any, of motors, LOP, Cable, Car etc.
()		(,,,,
(xii)	Fire Fighting Works	(a) Repairs to leakage in sprinklers, hydrants, valves etc.
		(b) Repairs and refilling of fire fighting equipment such as fire
		extinguishers.
(xiii)	Fire Alarm/PA system	(a) Repairs and replacement of faulty or damaged detectors,
		indicators, sounders etc.
(X1V)	Access Control System	(a) Repairs to bollards and Boom barriers etc.
		(b) Repairs and replacement of smart card readers, electronic
$(\mathbf{x}\mathbf{y})$	CCTV System	(a) Repair and replacement of Cameras NVR and other CCTV
$(\mathbf{X}\mathbf{V})$	CCI v System	equipment
(xvi)	Networking components	(a) Repair and replacement of IP phones
		(b) Repair to IP Network
		(c) Repair and replacement of damaged OFC.
(xvii)	Audio Visual System	(a) Repairs and replacement of video conferenceing cameras.
		(b) Repair to digital lecturn, projectors, motorized screen, displays
		etc.
(xviii)	HVAC	(a) Repair & Replacement of HVAC equipment
()	DMC	(b) Repairs to grills, ducting, insulation etc.
(X1X)	BMS	(a) Kepair and Keplacement of sensors & field equipment.
1	1	(U) maintenance of Divis software.

Note: The above list is illustrative for works, however the same is not exhaustive and the decision of Engineer/DFCCIL would be final and binding in this regard.
2.6.1 Other Conditions

- (a) The execution of items shall be carried out in accordance to relevant CPWD specifications (amended upto date of receipt of tenders). For the items which are not covered under CPWD specifications, the Technical Specifications provided in the Tender document / B.I.S. Specifications shall have to be followed. The decision of Engineer/DFCCIL shall be final in this regard.
- (b) Wherever any reference is made to any Indian Standard, it shall be taken as reference to the latest edition with all amendments / revision issued thereto upto the date of receipt of tenders.
- (c) Unless otherwise specified, the agreement rates for all items of work of the Schedule of Quantities are for all heights, depths, leads and lifts involved in the execution of work.
- (d) The contractor shall make his own arrangement of water required for the work.
- (e) The contractor shall make his own arrangements for obtaining electric connection for carrying out any activity and make necessary payment to the department concerned. In the absence of electric connection or failure of power supply, the contractor shall make his own arrangements of generators etc..
- (f) Other agencies working at site will also simultaneously execute the work. The contractor shall offer necessary cooperation to other agencies wherever required.
- (g) On account of security consideration, there could be some restrictions on the working hours, movement of vehicles for transportation of materials, etc. The contractor shall be bound to follow all such restrictions and adjust the programmes for execution of works accordingly.
- (h) The work shall be carried out in a manner complying in all respects with the requirements of any prevalent statutory laws enacted either by Central Govt. as well as State Govt./Authority.
- (i) Any malba / building rubbish generated is to be removed from the site within 24 hours and to be stacked at a pre-designated place. The malba / building rubbish so stacked shall be disposed off as soon as one truck load is accumulated (*approx 5 cum*) from such designated place.
- (j) This malba / building rubbish has to be disposed off to the dumping ground as approved by the Engineer in consultation with DFCCIL. *The rates quoted by the contractor are inclusive of all operations, labour, leads and lifts from site of work to the dumping ground.*
- (k) Maintenance Engineer/Supervisor shall carry mobile telephone (s) to enable the Engineer- in-Charge to have easy and quick communication. *Nothing extra shall be paid to the contractor* on this account and his *quoted rates* for various items under this contract will be *inclusive of this obligation*.
- (1) The replaced materials used shall have same or richer specifications to the original materials and compatible to the work.
- (m) The staff employed by the contractor should be well behaved and any complaint of misbehaviour shall be taken very seriously and such staff will have to be removed by the contractor immediately from the site.

- (n) The dismantled materials shall be taken away and disposed off by the contractor at his cost. *Nothing extra shall be paid* / recovered on account of this.
- (o) The contractor shall make all safety arrangements required for the labour engaged by him at his cost. All consequences due to negligence on behalf of security / safety or otherwise shall be on the contractor. The department shall not be responsible for any mishap, injury, accident or death of the contractor's staff. No claim in this regard shall be entertained / accepted by the department.
- (p) Contractor shall be fully responsible for any damages caused to government property or allottee's property by him or his labour in carrying out the work and shall be rectified by the contractor at his own cost.
- (q) Chases, holes, etc. shall be done using power operated tools.

2.6 Safety measures

- 2.6.1 The issue of construction safety & standards has gained utmost importance in recent times. This subject is to be dealt with, in an overall manner with an approach to developing and establishment a safety culture at work sites. Broadly, its components are:
 - a Creating an awareness
 - b Education
 - c Training
 - d Implementation
 - e Enforcement measures

All workers of contractor and associate agencies, invariably and at all the times, must follow all safety norms, adopt safe construction practices and use all required safety gadgets in their working, throughout the project duration.

- 2.6.2 The *contractor* shall be primarily responsible for developing safety programs, training, implementation and propagating safety culture.
- 2.6.3 The contractor shall issue *Photo Identity Cards* with unique numbers containing salient information of workers. Further the contractor shall establish a *Time Office* at the entry to demarcate area of site.

2.7 Insurance:

Before commencing of works, it shall be obligatory for the Contractor to obtain, *at his own cost*, *insurance cover* in the *joint name of the Contractor and Employer* (DFCCIL) from reputed companies for the following requirements:

- a) Contractor's All Risk (CAR) Policy.
- b) Liability for death of or injury to any person or loss of or damage to any property (*other than the work*) arising out the performance of the contract.
- c) Construction Plant, Machinery and Equipment brought to site by the Contractor.
- d) Workmen Compensation Policy
- e) Any other insurance cover as may be required by the law of the land.
- f) The Contractor, if required, will engage a suitable Engineer to liaise with Insurer Company in the interest of realization of insurance claims at no cost to Employer.
- g) Contractor/Insurance Company shall have to indemnify DFCCIL for all losses. Claims if any given by insurance company to be given directly to DFCCIL. Decision of DFCCIL will be binding on Contractor to distribute claim in part or full.

All insurance covers referred to in the Contract shall be affected with an Indian Insurance Company incorporated and registered in India.

2.8 SECURITY

- 2.8.1 Contractor shall take all measures and precautions relating to security of the construction site. He shall *barricade the construction site* / designated area of construction through the barriers and as approved by the Engineer/DFCCIL. No material shall be stored / dumped outside the designated area.
- 2.8.2 The movement of the construction vehicles and the labours shall be restricted to the designated routes which will be decided by the Engineer/DFCCIL.
- 2.8.3 All the vehicles carrying the material to the work site shall be subject to check and entries to be made at the gates. No material shall be taken out without proper gate pass.
- 2.8.4 Any labour engaged by the contractor shall be in possession of photo ID card failing which they are liable to be disengaged from the work and shall not be allowed to enter into the construction site.
- 2.8.5 In case of any nuisance caused by activates attributed to contractors' staff, workmen and movement of vehicle, and reported to Engineer/DFCCIL, a suitable action will be taken by the Engineer/DFCCIL.
- 2.8.6 The movement of the labour shall be restricted to the barricaded work site area only.

2.9 PROJECT MANAGEMENT CONSULTANCY SERVICES

2.9.1 In order to achieve high standards of materials, workmanship and overall quality of the execution, an agency engaged by DFCCIL (called Engineer/PMC) will carry out supervision of the work with Inspections and 3rd party testing of materials at site. This agency will carry out the checks of the quality assurance procedures followed at site, take samples of the materials for independent testing and check the workmanship of the works carried out. The contractor shall extend full co-operation to the Engineer/PMC in facilitating the inspections and collection of samples and regulate the execution stages with regards to the hold and witness points which shall be strictly adhered to by the contractor. The next stage work shall not be undertaken at the hold point stage and

work shall be done in presence of the Engineer/PMC representative at the witness stage. The contractor shall be required to co-operate with agency in carrying out various activities including documentation at no extra time and cost to the owner. In case of any adverse findings by the PMC, the contractor shall do the needful rectifications to the entire satisfaction of the PMC agency and DFCCIL. If contractor fails to rectify the defects of the serious nature within a reasonable time frame, *no further payment shall be made to Agency*.

If work is stopped due to non- rectification of defects and delay occurs on this account, no relief in completion of mile stone by way of grant of EOT or any other relaxation be given.

2.10 CONSTRUCTION VEHICLES TYRE WASHING FACILITIES

All the vehicles leaving the site shall be loaded in such a manner that the excavated materials, mud or debris will not be deposited on roads. All such loads shall be covered or protected to prevent dust being emitted. The wheels of all vehicles shall be washed properly before leaving the site to avoid the deposition of mud and debris on the roads. Also, the contractor shall make necessary arrangements for sweeping and removal of mud from roads if it is deposited even after washing of wheels of vehicles leaving site. *Nothing extra shall be paid* for providing and maintaining this facility.

2.11 **BARRICADING OF SITE**

The contractor shall make adequate arrangement for new barricading as directed by the Engineer/DFCCIL to cover the entire construction site including all T&P and materials. The requirement of providing and fixing new barricading at site shall be decided as per the direction and approval of Engineer/DFCCIL. The barricading shall be provided continuously during the execution of the entire work till completion and shall not be removed at any stage without prior approval of the Engineer/DFCCIL. The barricading shall be provided and shall be the property of the contractor after completion of the work.

2.12 WATER SUPPLY

Contractor shall be responsible for the arrangement to obtain supply of water necessary for the works at his own cost.

2.13 ELECTRIC SUPPLY

Contractor shall be responsible for the arrangement to obtain supply of electric power necessary for the works at his own cost.

2.14 COMPLIANCE TO ENVIRONMENTAL LAWS

The contractor shall comply the directives of Hon'ble National Green Tribunal dated 04.12.2014 & 10.04.2015 and EIA Guidance Manual issued in February 2010 and Construction & Demolition Waste Management Rules, 2016. The compliance of the contractor shall not be limited to the following:

- 1. The contractor shall not store/dump construction material or debris on metalled road.
- 2. The contractor shall get prior approval from Engineer/DFCCIL for the area where the construction material or debris can be stored beyond the metalled road. This area shall not cause any obstruction to the free flow of traffic/inconvenience to the pedestrians. It should be ensured by the contractor that no accidents occur on account of such permissible storage.

- 3. The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot/area using CGI sheets or plastic and/or other similar material to ensure that no construction material dust fly outside the plot area.
- 4. The contractor shall ensure that all the trucks or vehicles of any kind which are used for construction purposes/or are carrying construction material like cement, sand and other allied material are fully covered. The contractor shall take every necessary precaution that the vehicle is properly cleaned and dust free to ensure that enroute their destination, the dust, sand or any other particles are not released in air/contaminate air.
- 5. The contractor shall provide mask to every worker working on the construction site and involved in loading, unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.
- 6. The contractor shall provide all medical help, investigation and treatment to the workers involved in the construction of building and carry of construction material and debris relatable to dust emission.
- 7. The contractor shall ensure that C&D waste is transported to the approved C&D waste site of local authority only as per Construction & Demolition Waste Management Rules, 2016 and due record shall be maintained by the contractor.
- 8. The contractor shall compulsorily use jet in grinding and stone cutting.
- 9. The contractor shall comply all the preventive and protective environmental steps as stated in the MoEF Guidelines, 2010.
- 10. The contractor shall carry out On-Road-Inspection for black smoke generating machinery. The contractor shall use cleaner fuel.
- 11. The contractor shall ensure that the DG sets comply emission norms notified by MoEF.
- 12. The contractor shall use vehicles having pollution under control certificate. The emissions can be reduced by a large extent by reducing the speed of a vehicle to 20 kmph. Speed bumps shall be used to ensure speed reduction. In cases where speed reduction cannot effectively reduce fugitive dust, the contractor shall divert traffic to nearby paved areas.
- 13. The contractor shall ensure that the construction material is covered by tarpaulin. The contractor shall take all other precaution to ensure that no dust particles are permitted to pollute air quality as a result of such storage.

2.15 *Nothing extra shall be paid* on the account of above Special Conditions as stated above in *Section-2 of Part-I, Chapter-V*.

2.16 Tenderer is advised to visit the site before submitting their bid. *Nothing extra shall be payable on this account.*

PART-I

CHAPTER-V

SPECIAL CONDITIONS OF CONTRACT

ADDITIONAL SPECIAL CONDITIONS (SECTION-3)

3. GENERAL

a. Where there is any conflict between the various documents in the contract, the following order of priority shall be followed i.e. a document appearing earlier shall override the document appearing subsequently. However, the *decision of Engineer/DFCCIL would be final & binding* in this regard.

Order of Priority of Documents:

- 1. Agreement
- 2. Letter of Acceptance of Tender
- 3. Preamble and General Instructions to the Tenderers
- 4. Special Conditions of the Contract
- 5. General Conditions of Contract
- 6. Description of items as given in "Schedule of Prices".
- 7. Technical Specifications

Note: Unless otherwise specified, CPWD Specifications with corrections slips till the last date of tender submission shall be followed in general.

- b. The work shall be carried out in accordance with the Architectural drawings and Interior drawings, to be issued from time to time, by the Architect/Engineer. Before commencement of any item of work, the contractor shall correlate all the relevant Architectural and Interior drawings issued for the work and satisfy himself that the information available from there is complete and unambiguous. The discrepancy, if any, shall be brought to the notice of the Engineer /DFCCIL before execution of the work. The contractor alone shall be responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and or incomplete information.
- c. The contractor shall be responsible for the watch and ward / guard of the buildings, till the building is physically handed over to the DFCCIL. *No extra payment* shall be made on this account.
- d. For works below ground level, the contractor shall keep that area free from water. If, dewatering or bailing out of water is required, the contractor shall *do it at his cost* and *nothing extra shall be paid* except otherwise provided in the items of schedule of quantities.
- e. The Contractor shall make all necessary arrangements for protecting from rains, fog or likewise extreme weather conditions, the work already executed and for carrying out the further work, during monsoon including providing and fixing temporary shelters, protections

etc. *Nothing extra shall be payable* on this account. Also, no claims for hindrance shall be entertained on this account.

- f. In case of flooding of site on account of rain or any other cause and any consequent damage, whatsoever, *no claim financially or otherwise* shall be entertained not withstanding any other provisions elsewhere in the contract agreement. Also, the Contractor shall make good, at his own cost, the damages caused, if any. Further, no claims for hindrance shall be entertained on this account.
- g. The contractor will take reasonable precautions to prevent his workmen and employees from removing and damaging any flora (*plant/vegetation*) from the project area.

h. Emergency Work:

In the event of any action or failure occurring in on or about the work or arising out of or in connection with the construction, completion or maintenance of the work which in the Engineer/DFCCIL opinion requires immediate attention, Engineer/DFCCIL may by its own workmen or other agency execute or partly execute the necessary work or carry out repairs if the Engineer/DFCCIL considers that the contractor is not in a position to do in time and to charge the cost thereof to the contractor as determined by the Engineer/DFCCIL.

i. Protection & Care of Works:

a. The works are to be protected as asked by the Engineer/DFCCIL. Protection is required for all hazardous works and during installation, testing & commissioning of work. The cost of safety measures & other gadgets etc. shall be deemed to be included in the quoted rates and *nothing extra* shall be paid for the same.

b. *Care of the building:*

- (i) Care shall be taken by the contractor during execution of the work to avoid damage to the building and adjacent buildings.
- (ii) They shall also be responsible for repairing all such damages and restoring the same to the original finish at their cost.
- (iii) They shall also remove all unwanted and waste materials arising out of the execution of work from the site from time to time.

j. TOOLS AND PLANTS

- (i) The bidder should arrange construction equipments required for the proper and timely execution of the work. *Nothing extra shall be paid* on this account.
- (ii) No tools and plants including any special T&P etc. shall be supplied by the Department and the contractor shall have to make his *own arrangements at his own cost*. No claim of hindrance (*or any other claim*) shall be entertained on this account.

(iii) The contractor shall do proper sequencing of the various activities by suitably staggering the activities within various floors of the buildings, so as to achieve the early completion. The agency may deploy adequate equipment, machinery and labour as required for the completion of the entire work within the stipulated period specified. Also, ancillary facilities shall be provided by contractor commensurate with requirement to complete the entire work within the stipulated period. *Nothing extra shall be payable* on this account. Adequate number/sets of equipment in working condition, along with adequate stand-by arrangements, shall be deployed during entire construction period. It shall be ensured by the Contractor that all the equipment, Tools & Plants, machineries etc. provided by him are maintained in proper working conditions at all times during the progress of the work and till the completion of the work. Further, all the constructional tools, plants, equipment and machineries provided by the contractor, on site of work or his work shop for this work, shall be exclusively intended for use in the construction of the Engineer/DFCCIL.

k. ROYALTY

(i) Royalty at the prevalent rates shall be paid by the contractor for any such item or the RMC supplier as per the terms of supply between them, on all materials such as boulders, metals, all sizes stone aggregates, brick aggregates, coarse and fine sand, moorum, river sand, gravels and bajri etc. collected by him for the execution of the work, directly to the revenue authority of the state government concerned. Further, contractor needs to submit proof of submission of full royalty to the state government or local authority. *Nothing extra shall be payable* on this account.

1. PRESERVATION AND CONSERVATION MEASURES

- (i) Existing drains, pipes, cables, over-head wires, sewer lines, water lines and similar services encountered in the course of the execution of work shall be protected against the damage by the contractor, *at his own expense*, for which *nothing is payable*. The contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.
- All fossils, coins, articles of value of antiquity, structures and other remains or things of (ii) geological or archaeological interest discovered on project location during excavation/construction shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer/DFCCIL of such discovery and carry out the official instructions of Engineer/DFCCIL for dealing with the same, till then, all work shall be carried out in a way so as not to disturb/ damage such article or thing.

m. **RESPONSIBILITY**

- (i) The Contractor shall keep himself fully informed of all relevant acts and laws of the Central & State Governments, orders, decrees of statutory bodies, tribunals having any jurisdiction or authority, which in any manner may affect those engaged or employed and anything related to carrying out the work. All the rules & regulations and bye-laws laid down by District Collector /Noida Authority and any other statutory bodies shall be adhered to, by the contractor, during the execution of work. The Contractor shall also adhere to all traffic restrictions notified by the local authorities. The water charges (for municipal water connection as well as tanker water) shall be borne by the contractor. Also, if the contractor obtains water connection for the drinking purposes from the municipal authorities or any other statutory body, the consequent sewerage charges shall be borne by the contractor. All statutory taxes, levies, charges (including water and sewerage charges, charges for temporary service connections and / or any other charges) payable to such authorities for carrying out the work, shall be borne by the Contractor. The Contractor shall arrange to give all notices as required by any statutory / regulatory authority and shall pay to such authority all the fees that is required to be paid for the execution of work. He shall protect and indemnify the DFCCIL and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts.
- (ii) The fee payable to statutory authorities for obtaining the various permanent service connections and Building Use Certificate for the building shall be borne by the DFCCIL. The contractor shall assume all liability, financial or otherwise in connection with this contract and shall protect and indemnify DFCCIL from any and all damages and claims that may arise on any account.

The Contractor shall indemnify against all claims in respect of patent rights, royalties, design, trademarks of name or other protected rights, damages to adjacent buildings, roads or members of public, in course of execution of work or any other reasons whatsoever, and shall himself defend all actions arising from such claims and shall indemnify the DFCCIL in all respect from such actions, costs and expenses. *Nothing extra shall be payable* on this account.

(iii) The contractor shall keep himself fully informed of all acts and laws of the Central Government and Government of U.P., all local bye laws, ordinances, rules and regulations and all orders and decree of bodies or, tribunals having any jurisdiction or authority which in any manner affect those engaged or employed on the work or which in any way affect the conduct of the works. Contractor shall at all times, observe and comply with all such laws, ordinances, rules, regulations, orders and decrees, and shall give all notices and *pay out of his own money any fees or charges to which he may be liable*. He shall protect and indemnify the DFCCIL and its officers and employees against any claim or liability arising out of violations of any such law, ordinances, legislations, order or decree, whether by himself or by his employees & authorized representatives.

n. CO-OPERATION WITH OTHER CONTRACTORS/SPECIALIZED AGENCIES/SUB-CONTRACTORS

- The contractor shall take all necessary precautions to prevent any nuisance or (i) inconvenience to the owners, tenants or occupants of the adjacent properties and to the public in general. The Contractor shall take all care, as not to damage any other adjacent property or other services running adjacent to the plot. If any damage is done, the same shall be made good by the contractor at his own cost and to the entire satisfaction of the Engineer. The contractor shall use such methodology and equipment for execution of the work, so as to cause *minimum environmental pollution* of any kind during construction, to have minimum construction time and minimum inconvenience to road users and to the occupants of the buildings on the adjacent plot and public in general, etc. He shall make good at his own cost and to the entire satisfaction of the Engineer any damage to roads, paths, cross drainage works or public or private property whatsoever caused, due to the execution of the work or by traffic brought thereon, by the Contractor. Further, the contractor shall take all precautions to abide by the environmental related restrictions imposed by U.P. state Pollution control board, Govt. of U.P. as well as prevent any pollution of streams, ravines, river bed and waterways. All waste or superfluous materials shall be transported by the Contractor, entirely to the satisfaction of the Engineer. Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the occupants / users of adjoining buildings. No claim what so ever on account of site constraints mentioned above or any other site constraints, such as distance from Noida city as approximately 20 km, lack of public transport, inadequate availability of skilled, semi-skilled or unskilled workers in the near vicinity, non-availability of construction machinery spare parts and any other constraints not specifically stated here, shall be entertained from the contractor. Therefore, the Tenderers are advised to visit site and get first-hand information of site constraints. Accordingly, they should quote their tenders. Nothing extra shall be payable on this account.
- (ii) The contractor shall cooperate with and provide the facilities to the sub-contractors and other agencies working at site for smooth execution of the work. The contractor shall indemnify the DFCCIL against any claim(s) arising out of such disputes. The contractor shall:
 - 1. Allow use of scaffolding, toilets, sheds etc.
 - 2. Properly co-ordinate their work with the work of other Contractors.
 - 3. Provide control lines and benchmarks to his Sub-Contractors and the other Contractors.
 - 4. Provide electricity and water at mutually agreed rates.
 - 5. Provide hoist and crane facilities for lifting material at mutually agreed rates.
 - 6. Co-ordinate with other contractors for leaving inserts, making chases, alignment of services etc. at site.
 - 7. Adjust work schedule and site activities in consultation with the Engineer and other contractors to suit the overall schedule completion.
 - 8. Resolve the disputes with other contractors / sub-contractors amicably and the

Engineer shall not be made intermediary or arbitrator.

- (iii) The work should be planned in a systematic manner so as to ensure proper co-ordination of various disciplines.
- (iv) The contractor shall leave recesses, holes, openings trenches etc. as may be required for the related works and *nothing extra shall be payable* on this account.
- (v) The contractor shall conduct his work, so as not to interfere with or hinder the progress or completion of the work being performed by other contractor(s) or by the Engineer and shall as far as possible arrange his work and shall place and dispose of the materials being used or removed so as not to interfere with the operations of other contractor or he shall arrange his work with that of the others in an acceptable and in a proper co-ordination manner and shall perform it in proper sequence to the complete satisfaction of others.

(vi) Specialized Agencies

- 1. The tenderer must associate with himself, agencies of the appropriate eligibility to tender for each of specialized nature of items / work. Such works shall be got executed only through associated agencies specialized in these fields.
- 2. It shall be the responsibility of main contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the DFCCIL. The main contractor shall be solely responsible for settling any dispute / litigation arising out of his agreement with the Specialized Agencies. The contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the specialized agencies / sub- contractor(s). No claim of hindrance in the work shall be entertained from the Contractor on this account. *No extension of time* shall be granted and *no claim* what so ever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agencies.

vii. RATES

The rates quoted by the contractor are deemed to be inclusive of site clearance, setting out work, profile, setting lay out on ground, establishment of reference bench mark(s), installing various signage, taking spot levels, survey with total station, construction of all safety and protection devices, compulsory use of helmet and safety shoes, and other appropriate safety gadgets by workers, imparting continuous training for all the workers, barriers, preparatory works, construction of clean, hygienic and well ventilated workers housings in sufficient numbers working during monsoon or odd season, working beyond normal hours, working at all depths, height, lead, lift, levels and location etc. and any other unforeseen but essential incidental works required to complete this work. *Nothing extra shall be payable* on this account and *no extension of time* for completion of work shall be granted on these accounts.

The rates quoted by the tenderer shall be inclusive of all taxes and levies but excluding GST. The GST as legally leviable and payable by the Bidder under the provisions of applicable law/act shall be paid extra by DFCCIL.

Therefore, the Bidders should quote their rates after considering the Input Tax Credits on their input materials and services. Hence, Bidders should ensure that, full benefit of

Input Tax Credit (ITC) likely to be availed by them is duly considered while quoting their rates.

Price variation will not be applicable for this work. No mobilization or secured advance against material is applicable for this work.

- (viii) No foreign exchange shall be made available by the DFCCIL for importing (*purchase*) of equipment, plants, machinery, materials of any kind or any other items required to be carried out during execution of the work. *No delay and no claim* of any kind shall be entertained from the Contractor, on account of *variation in the foreign exchange rate*.
- All ancillary and incidental facilities required for execution of work like labour camp, (ix) stores, fabrication vard, offices for Contractor, watch and ward, temporary ramp required to be made for working at the basement level, temporary structure for plants and machineries, water storage tanks, installation and consumption charges of temporary electricity, telephone, water etc. required for execution of the work, liaison and pursuing for obtaining various No Objection Certificates, completion certificates from local bodies etc., protection works, testing facilities / laboratory at site of work, facilities for all field tests and for taking samples etc. during execution or any other activity which is necessary (for execution of work and as directed by Engineer), shall be deemed to be included in rates quoted by the Contractor, for various items in the schedule of quantities. Nothing extra shall be payable on these accounts. Before start of the work, the Contractor shall submit to the Engineer, a site / construction yard layout, specifying areas for construction, site office, positioning of machinery, material yard, cement and other storage, steel fabrication yard, site laboratory, water tank, etc. DFCCIL shall provide rent free piece of land for construction of these facilities at construction site for the duration of this work.
- (x) For completing the work in time, the contractor might be required to work in two or more shifts (*including night shifts*). No claim whatsoever shall be entertained on this account, not with-standing the fact that the contractor may have to pay extra amounts for any reason, to the labourers and other staff engaged directly or indirectly on the work according to the provisions of the labour and other statutory bodies regulations and the agreement entered upon by the contractor with them.
- (xi) All material shall only be brought at site as per program finalized with the Engineer/DFCCIL. Any pre-delivery of the material not required for immediate consumption shall not be accepted and thus not paid for.

o. SAFETY PRACTICES

WARNING / CAUTION BOARDS: All temporary warning / caution boards / glow signage display such as "Construction Work in Progress, "Keep Away", "No Parking", Diversions & protective Barricades etc. shall be provided and displayed during day time by the Contractor, wherever required and as directed by the Engineer. These glow

signages and red lights shall be suitably illuminated during night also. The Contractor shall be solely responsible for damage and accident caused, if any, due to negligence on his part. Also, he shall ensure that no hindrance, as far as possible, is caused to general traffic during execution of the work. This signage shall be dismantled & taken away by the Contractor after the completion of work, only after approval of the Engineer. *Nothing extra shall be payable* on this account.

- (ii) **SIGN BOARDS**: The contractor shall provide and erect a display board of size and shape as required and paint over it, in a legible and workman like manner, the details about the salient features of the project, as required by the Engineer. The Contractor shall fabricate and put up a sign board in an approved location and to an approved design indicating name of the project, client / owner, architects, structural consultants etc. besides providing space for names of other Contractors, Sub-Contractors and specialized agencies. *Nothing extra shall be payable* on this account.
- (iii) Necessary protective and safety equipment shall be provided to the Site Engineer, Supervisory staff, labour and technical staff of the contractor by the contractor *at his own cost* and to be used at site.
- (iv) No inflammable materials including P.O.L shall be allowed to be stored in huge quantity at site. Only limited quantity of P.O.L may be allowed to be stored at site subject to the compliance of all rules/instructions issued by the relevant authorities and as per the direction of Engineer in this regard. Also, all precautions and safety measures shall be taken by the contractor for safe handling of the P.O.L products stored at site. All consequences on account of unsafe handling of P.O.L shall be borne by the Contractor.

p. QUALITY ASSURANCE

- (i) The proposed building is a prestigious project of DFCCIL and quality of work is of paramount importance. Contractor shall have to engage well-experienced skilled labour and deploy modern T&P and other equipment to execute the work. Many items like exposed finish form work, specialized flooring work, Polysulphide/P.U. sealant and backer rod fixing in expansion joints, factory made door- window shutters, proper slope maintaining in toilet units, sanitary- water supply installation, textured finishing, grit plastering with aluminium channel insertions, water proofing treatment, Extruded Polystyrene insulation boards, façade works and chemical treatment in toilet drops will specially require engagement of skilled workers having experience particularly in execution of such items.
- (*ii*) The contractor shall ensure quality construction in a planned and time bound manner. Any sub-standard material/work beyond set out tolerance limit *shall be summarily rejected* by the Engineer & contractor shall be bound to replace / remove such sub-standard/defective work immediately. If any material, even though approved by Engineer/DFCCIL is found defective or not conforming to specifications shall be replaced/removed by the contractor *at his own risk & cost.*
- (iii) The contractor shall submit, a detailed and complete method statement for the execution, testing and Quality Assurance, of such items of works, as directed by the Engineer /DFCCIL. All the materials to be used in the work, to give the finished work complete in all respects, shall comply with the requirements of the specifications and shall pass all

the tests required as per specifications as applicable or such specifications / standards as directed by the Engineer/ DFCCIL. However, keeping the Quality Assurance in mind, the Contractor shall submit, on request from the Engineer/ DFCCIL, his own Quality Assurance procedures for basic materials and such items, to be followed during the execution of the work, for approval of the Engineer/ DFCCIL.

- (iv) All materials and fittings brought by the contractor to the site for use shall conform to the samples approved by the Engineer which shall be preserved till the completion of the work. If a particular brand of material is specified in the item of work in Schedule of Quantity, the same shall be used after getting the same approved from Engineer/DFCCIL. Wherever brand/quality of material is not specified in the item of work, the contractor shall submit the samples as per suggested list of brand names given in the tender document/SCC for approval of Engineer/DFCCIL- For all other items, materials and fittings of ISI Marked shall be used with the approval of Engineer.
- (v) Wherever ISI Marked material / fittings are not available, the contractor shall submit samples of materials / fittings manufactured by firms of repute conforming to relevant specifications or IS codes and use the same only after getting the approval of Engineer.
- (vi) The contractor shall procure and provide all the materials from the manufacturers / suppliers as per the list attached with the tender documents/SCC, as per the item description of the work. The equivalent brand for any item shall be permitted to be used in the work, only after approval of Engineer/Employer. *No claim*, whatsoever, of any kind *shall be entertained* from the contractor on this account and *Nothing extra shall be payable* on this account.
- (vii) All materials whether obtained from Govt. stores or otherwise shall be got checked by the Engineer or his authorized supervisory staff on receipt of the same at site before use.
- (viii) The tests, as necessary, shall be conducted in the laboratory approved by the Engineer/DFCCIL. The samples shall be taken for carrying out all or any of the tests stipulated in the specifications and as directed by the Engineer/DFCCIL or his authorized representative.
- (ix) All the registers of tests carried out at Construction Site or in outside laboratories and all material at site (*MAS*) registers including cement register shall be maintained by the contractor. All the entries in the registers will be made by the designated Engineering Staff of the contractor and same should be regularly reviewed by Engineer/Employer. Contractor shall be responsible for safe custody of all the test registers.
- (x) The contractor shall at his own risk and cost make all arrangements and shall provide all such facilities including material and labour, the Engineer/DFCCIL may require for collecting, preparing, forwarding the required number of samples for testing as per the frequency of test stipulated in the contract specifications or as considered necessary by the Engineer/DFCCIL, at such time and to such places, as directed by the Engineer/DFCCIL. *Nothing extra shall be payable* for the above.
- (xi) The contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case he or his authorized representative is not present or does not associate him, the result of such tests and consequences thereon shall

be binding on the contractor. The contractor or his authorized representative shall remain in contact with the Engineer or his authorized representative associated for all such operations. No claim of payment or claim of any other kind, whatsoever, shall be entertained from the contractor.

(xii) All the testing charges shall be borne by the contractor.

- (xiii) All the hidden items such as water supply lines, drainage pipes, conduits, sewers etc. are to be properly tested as per the design conditions before covering and their measurements in computerized measurement book duly test checked shall be deposited with Engineer or his authorized representative, prior to hiding these items.
- (xiv) Water tanks, taps, sanitary, water supply and drainage pipes, fittings and accessories should conform to byelaws and municipal body / Corporation/Authority where CPWD Specifications are not available.
- (xv) The contractor shall give performance test of the entire installation(s) as per the standing specifications before the work is finally accepted and *nothing extra* whatsoever *shall be payable* to the contractor for the test.

(xvi) The contractor shall have to execute guarantee bonds in respect of water proofing / anti termite treatment works as per Proforma enclosed.

- (xvii) The contractor shall depute Site Engineer & skilled workers as required for the work. He shall submit organization chart along with details of Engineers and supervisory staff. It shall be ensured that all decision-making powers shall be available to the representatives of the contractor at site itself to avoid any likely delays on this account. The contractor shall also furnish list of persons for specialized works to be executed for various items of work. The contractor shall identify and deploy key persons having qualifications and experience in the similar and other major works, as per the field of their expertise. If during the course of execution of work, the Engineer is of the opinion that the deployed staff is not sufficient or not well experienced; the Contractor shall deploy more staff or better- experienced staff at site to complete the work with quality and in stipulated time limit.
- (xviii) The contractor shall maintain all the work in good condition till the completion of entire work. The contractor shall be responsible for and shall make good, all damages and repairs, rendered necessary due to fire, rain, traffic, floods or any other causes. The Engineer shall not be responsible for any claims for injuries to person/workmen or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the contractor or of any other of his representatives, in his employment during the execution of the work. The compensation, if any, shall be paid directly to the Department / authority / persons concerned, by the Contractor *at his own cost.*
- (xix) The contractor shall *arrange electricity at his own cost* for testing of the various electrical installations as directed by Engineer and for the consumption by the contractor for executing the work. Also, all the *water required* for testing various electrical installations, fire pumps, wet riser / fire-fighting equipment, fire sprinklers etc. and also testing water supply, sanitary and drainage lines, water proofing of underground sump, overhead tanks, water proofing treatment etc. shall be arranged by the contractor at his own cost. Nothing extra shall be payable on this account.

q. SUBMISSION AND DOCUMENTATION

- (i) The contractor shall display all permissions, licenses, registration certificates, bar charts, other statements etc. under various labour laws and other regulations applicable to the works, at his site office.
- (ii) The contractor shall make available four (04) sets of computerized Standard Measurement Books (SMBs) having measurement of all the permanent standing in a building.
- (iii) The contractor will submit computerized measurement sheet for the work carried out by him for making payment. For casting of RCC members and other hidden items the corrected and duly test checked measurement sheets of reinforcement or that of other hidden items shall be deposited with Engineer or his authorized representative, before casting of RCC or other hidden items. The delay in submission of corrected and duly checked measurement sheet may, therefore, delay casting of RCC or execution of hidden item for which no hindrance shall be recorded.
- (iv) To avoid delay, contractor should submit all samples well in advance so as to give timely orders for procurement.

(v) **Program Chart:**

The contractor shall prepare an integrated program chart including civil activities for the execution of work, showing clearly all activities from the start of work to completion of civil work, with details of manpower, equipment and machinery required for the fulfillment of the program within the stipulated period and submit the same for approval of the Engineer. These shall be submitted by the contractor through electronic media besides forwarding hard copies of the same. The integrated program chart so submitted should not have any discrepancy with the physical milestones attached in the contract agreement. The program chart should include the following: -

- 1. Descriptive note explaining sequence of various activities.
- 2. Network (*PERT/CGM/BAR CHART*) prepared on MS project which will indicate resources in financial terms, manpower and specialized equipment for every important stage.
- 3. Program for procurement of materials by the contractor.
- 4. Program for arranging and deployment of manpower both skilled and unskilled so as to achieve targeted progress.
- 5. Program of procurement of machinery / equipment having adequate capacity, commensurate with the quantum of work to be done within the stipulated period, by the contractor.
- 6. Program for achieving fortnightly micro milestones and periodic milestones.
- (vi) If at any time, it appears to the Engineer/DFCCIL that the actual progress of work does not conform to the approved program referred above, the contractor shall produce a revised program showing the modifications to the approved program by additional inputs to ensure completion of the work within the stipulated time.
- (vii) The submission for approval by the Engineer/DFCCIL of such program or the furnishing of such particulars shall not relieve the contractor of any of his duties or responsibilities under the contract. This is without prejudice to the right of Engineer to take action against

the contractor as per terms and conditions of the agreement.

- (viii) Apart from the above integrated program chart, the contractor shall be required to submit fortnightly progress report of the work in a computerized form on 1st and 16th of every month. The progress report shall contain the following, apart from whatever else may be required as specified:
 - 1. Construction schedule of the various components of the work through a bar chart for the next two fortnights (or as may be specified), showing the micro-milestone/milestones, targeted tasks (*including material and labour requirement*) and up to date progress.
 - 2. Progress chart of the various components of the work that are planned and achieved, for the fortnight as well as cumulative up to the fortnight under reckoning, with reason for deviations, if any in a tabular format.
 - 3. Plant and machinery statement, indicating those deployed in the work.
 - 4. Man-power statement indicating:
 - a. Individually the names of all the staff deployed on the work, along with their designations.
 - b. No. of skilled workers (*trade wise*) and total no. of unskilled workers deployed on the work and their location of deployment i.e. blocks.
 - 5. Financial statement, indicating the broad details of all the running account payment received up to date, such as gross value of work done, advances taken, recoveries effected, amount withheld, net payments details of cheque payment received, extra/substituted/deviation items if any, etc.

TEMPORARY WATER/ ELECTRICITY/ TELEPHONE CONNECTION

- (i) Arrangement of temporary telephone connection, water and electricity required by contractor, shall be made by him *at his own cost* and also necessary permissions shall be obtained by him directly from concerned authorities, under intimation to the Department. Also, all initial cost and running charges, and security deposit, if any, in this regard shall be borne by him. The contractor shall abide by all the rules/ bye laws applicable in this regard and he shall be solely responsible for any penalty on account of violation of any of the rules / byelaws in this regard. *Nothing extra shall be payable* on this account.
- (ii) The contractor shall be responsible for maintenance and watch and ward of the complete installation and water / electricity meter and shall also be responsible for any pilferage, theft, damage, penalty etc. in this regard. The contractor shall indemnify the DFCCIL against any claim arising out of pilferage, theft, damage, penalty etc. whatsoever on this account. *Security deposit* for the work shall be released only after No Dues Certificates are obtained from the local Authorities from whom temporary electric/ water/telephone connection have been obtained by the contractor. Nothing extra shall be payable on this account.
- (iii) The DFCCIL shall in no way be responsible for either any delay in getting electric and/or water and/or telephone connections for carrying out the work or not getting connections at all. No claim of delay or any other kind, whatsoever, on this account shall be entertained from the contractor. Also, contingency arrangement of stand-by water & electric supply shall be made by the contractor for commencement and smooth progress of the work so that

work does not suffer on account of power failure or disconnection or not getting connection at all. No claim of any kind whatsoever shall be entertained on this account from the contractor. *Nothing extra shall be payable* on this account.

s. CLEANLINESS OF SITE

(i) The contractor shall not stack building material / malba / muck on the land or road of the local development authority or on the land owned by the others, as the case may be. So, the muck, rubbish etc. shall be removed periodically as directed by the Engineer, from the site of work to the approved dumping grounds as per the local byelaws and regulations of the concerned authorities and all necessary permissions in this regard from the local bodies shall be obtained by the contractor. *Nothing extra shall be payable* on this account.

In case, the contractor is found stacking the building material / malba as stated above, the *contractor shall be liable to pay* the stacking charges / *penalty* as may be levied by the local body or any other authority and also to face penal action as per the rules, regulations and bye-laws of such body or authority. *The Engineer shall be at liberty to recover*, such sums due but not paid to the concerned authorities on the above counts, from any sums due to the contractor including amount of the Security Deposit and performance guarantee in respect of this contract agreement.

- (ii) The contractor shall take instructions from the Engineer regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services and compound walls are to be constructed.
- (iii) The site of work shall be always kept clean due to constraints of space and to avoid any nuisance to the users of buildings in the adjacent plots. The contractor shall take all care to prevent any water- logging at site. The waste water, slush etc. shall not be allowed to be collected at site. It may be directly pumped into the creek with prior approval of the concerned authorities. For discharge into public drainage system, necessary permission shall be obtained from relevant authorities after paying the necessary charges, if any, directly to the authorities. The work shall be carried out in such a way that the area is kept clean and tidy. *All the fees/charges in this regard shall be borne by the Contractor. Nothing extra shall be payable* on this account.

t. **INSPECTION OF WORK**

(i) In addition to the provisions of relevant clauses of the contract, the work shall also be open to inspection by the Chief General Manager, and other senior officers of DFCCIL in addition of the Architect, Engineer and his authorized representative. The contractor shall at times during the usual working hours and at all times at which reasonable notices of the intention of the Architect/Engineer/DFCCIL or other officers as stated above to visit the works shall have been given to the contractor, either himself be present to receive the orders and instructions or have a responsible representative duly accredited in writing, to be present for that purpose.

(ii) **Inspection of the work by Architects appointed by the DFCCIL**

1. The consulting architect appointed by DFCCIL shall be inspecting the works including workshops and fabrication factory to ensure that the works are in general being executed

according to the design, drawings and specifications laid down in the contract. His observations shall be communicated by Engineer/DFCCIL engineering staff and compliance is to be reported to Engineer/DFCCIL.

- 2. The consulting architect appointed by DFCCIL shall certify on completion of particular building that it has been constructed according to the approved drawings design and specifications.
- (iii) Senior Officers of DFCCIL/Railway, Dignitaries from Central Ministry / Department, State Government shall be inspecting the on-going work at site at any time with or without prior intimation. The contractor shall, therefore, keep updated the following requirements and detailing.
 - 1. Display Board showing detail of work, weekly progress achieved with respect to targets, reason of shortfall, status of manpower, wages being paid for different categories of workers.
 - 2. Entrance and area surrounding to be kept cleaned.
 - 3. Display layout plan key plan, building drawings including plans, elevations and sections.
 - 4. Upto date displays of Bar chart, CGM and PERT etc.
 - 5. Keep details of quantities executed, balance quantities, deviations, possible Extra item, substituted Item etc.
 - 6. Keep plastic / cloth mounted one sets of building drawings.
 - 7. Set of Helmets and safety shoes for safety.

u. SETTING OUT

- (i) The contractor shall carry out *survey* of the work area, *at his own cost, setting out* the layout of building in consultation with the Engineer & proceed further. Any discrepancy between the architectural drawings and actual layout at site shall be brought to the notice of the Engineer. It shall be responsibility of the contractor to ensure correct setting out of alignment. Total station survey instruments only shall be used for layout, fixing boundaries, and center lines, etc., along with theodolites. *Nothing extra shall be payable* on this account.
- (ii) The contractor shall establish, maintain and assume responsibility for grades, lines, levels and benchmarks. He shall report any errors or inconsistencies regarding grades, lines, levels, dimensions etc. to the Engineer before commencing work. Commencement of work shall be regarded as the Contractor's acceptance of such grades, lines, levels, and dimensions and no claim shall be entertained at a later date for any errors found.
- (iii) If at any time, any error appears due to grades, lines, levels and benchmarks during the progress of the work, the contractor shall, at his own expense rectify such error, if so required, to the satisfaction of the Engineer. *Nothing extra shall be payable* on this account.

- (iv) Though the site levels are indicated in the drawings the contractor shall ascertain and confirm the site levels with respect to benchmark from the concerned authorities. The contractor shall protect and maintain temporary/permanent benchmarks at the site of work throughout the execution of work. These benchmarks shall be got checked by the Engineer or his authorized representatives. The work at different stages shall be checked with reference to bench marks maintained for the said purpose. Nothing extra shall be payable on this account.
- (v) The approval by the Engineer/DFCCIL, of the setting out by the contractor, shall not relieve the contractor of any of his responsibilities and obligation to rectify the errors/ defects, if any, which may be found at any stage during the progress of the work or after the completion of the work.
- (vi) The contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignments, the level and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the contractor *at his own cost* to the entire satisfaction of the Engineer.
- (vii) The *rates quoted by the Contractor* are deemed to be *inclusive* of site clearance, setting out work (*including marking of reference points, center lines of buildings*), construction and maintenance of reference bench mark(s), taking spot levels, construction of all safety and protection devices, barriers, barricading, signage, labour safety, labour welfare and labour training measures, preparatory works, working during monsoon, working at all depths, height and location etc. and any other incidental works required to complete this work. *Nothing extra shall be payable* on this account.

v. RECESS, HOLES, OPENINGS, ETC

The contractor shall leave such recesses, holes, openings, etc. as may be required for the electric, air-conditioning and other related works for which inserts, sleeves, brackets, conduits, base plates, clamps etc. and the contractor shall fix the same at the time of casting of concrete, stone work & brick work or at any similar location if required, and *nothing extra shall be payable* on this account.

w. JURISDICTION OF COURT

Courts at Delhi/Noida alone shall have the jurisdiction to decide any dispute arising out of or in respect of this contract.

x. ALL HEIGHTS, LIFTS, LEADS AND DEPTHS

Unless otherwise provided in the Schedule of quantities or in CPWD Specifications or in tender document, the rates tendered by the contractor shall be *all inclusive (except GST)* and shall apply to all heights, lifts, leads and depths of the building and nothing extra shall be payable to him on this account.

y. PREVENTION OF NUISANCE AND POLUTION CONTROL

The contractor shall take all necessary precautions to prevent any nuisance or inconvenience to the owners, tenants or occupiers of adjacent properties and to the public in general and to prevent any damage to such properties from pollutants like smoke, dust, noise. The contractor shall use such methodology and equipment so as to cause minimum environmental pollution of any kind during and minimum hindrance to road users and to occupants of the adjacent properties or other services running adjacent/near vicinity. The contractor shall make good at his cost and to the satisfaction of the Engineer, any damage to roads, paths, cross drainage works or public or private property whatsoever caused due to the execution of the work or by traffic brought thereon by the contractor. All waste or superfluous materials shall be carried away by the contractor, without any reservation, entirely to the satisfaction of the Engineer.

z. SCAFFOLDING

Wherever required for the execution of work, all the scaffolding shall be provided and suitably fixed by the contractor. It shall be provided strictly with steel double scaffolding system, suitably braced for stability, with all the accessories, gangways, etc. with adjustable suitable working platforms to access the areas with ease for working and inspection. It shall be designed to take all incidental loads. It should cater to the safety features for workmen. *Nothing extra shall be payable* on this account. It shall be ensured that no damage is caused to any structure due to the scaffolding.

aa. PRODUCT DELIVERY, STORAGE AND HANDLING OF CHEMICALS

- (i) The contractor shall construct storage space for Chemicals materials to ensure that the storage conditions are as recommended by the manufactures.
- (ii) All the materials shall be procured and delivered in sealed containers with labels legible and intact.
- (iii) All the chemicals {polymers, epoxy, water proofing compound, plasticizer, Polysulphide, SBR based elastomeric, APP (Atactic Polypropylene Polymer), all exterior and interior paints, polish etc.} shall be procured in convenient packs say 20 litres/Kgs. capacity packing only or as approved by the Engineer, and not in bigger capacity containers, say 200 litre (Kgs.) drums unless otherwise specifically permitted by the Engineer. One sample from each lot of the chemical procured by the contractor shall be tested in a laboratory as approved by the Engineer.
- (iv) All material required for the execution of the work shall be got approved, procured and deposited with the Contractor's supervisory staff. The watch and ward of such material shall, however, remain to be the responsibility of the contractor and no claim, whatsoever, on this account shall be entertained. Different containers of each chemical shall be serially numbered on packing and also consumed in that order. Day- to-Day account of receipt, issue and balance shall be regulated by the Contractor and proper account shall be maintained at site of work in the prescribed form as per the standard practice.
- (v) All the chemicals shall be procured by the contractor directly from the manufacturer. In exceptional circumstances, the contractor may be allowed to procure the materials from the authorized dealers of the manufacturers.
- (vi) The original copies of challan/cash memos towards the quantity of various chemicals procured shall be made available by the contractor at the request from the Engineer-and a copy of the same shall be kept in record.
- (vii) The Name of manufacturers, manufacturer's product identification, manufacturer's mixing instructions, warning for handling and toxicity and date of manufacturing and shelf life

shall be clearly and legibly mentioned on the labels of each container.

- (viii) The contractor shall submit for the chemicals procured, manufacturer's and / or authorized dealer's certificate regarding supplying and verifying conformance to the material specifications, as specified.
- (ix) All filled containers shall be handled in safe manner and in a way to avoid breaking container seals.
- (x) All arrangements for measuring, dosing and mixing of material / chemicals at site have to be made by the contractor.
- (xi) Contractor shall suitably advise his site Engineer and all the workers as regards safe handling of chemicals. Necessary protective and safety equipment in form of hand gloves, goggles etc. shall be provided by the contractor and be also used at site.
- (xii) All incidental charges of any kind including cartage, storage and wastage and safe custody of material etc. shall be borne by the contractor and no claim, whatsoever, shall be entertained on this account.
- (xiii) The chemicals shall be tested in an independent laboratory as approved by the Engineer at the frequency as specified. If required, more samples may have to be tested as per the directions of the Engineer. *Nothing extra shall be payable* on this account.

bb. De-watering:

- (i) De-watering required, if any, shall be done conforming to BIS Code IS: 9759 (*guide lines for de-watering during construction*) and/or as per the specifications approved by the Engineer. Design of an appropriate and suitable dewatering system shall be the Contractor's responsibility.
- (ii) Such scheme shall be modified/augmented as the work proceeds based on fresh information discovered during the progress of work, *at no extra cost*. At all times during the construction work, efficient drainage of the site shall be carried out by the Contractor and especially during the laying of plain cement concrete, taking levels etc. The Contractor shall also ensure that there is no danger to the nearby properties and installations on account of such lowering of water table. If needed, suitable precautionary measures shall be taken by the Contractor. Also, the scheme of dewatering adopted shall have adequate built in arrangement to serve as stand-by to attend to repair of pumps etc. and disruption of power / fuel supply. *Nothing extra shall be payable* on this account.
- (iii) In trenches where surface water is likely to get into cut / trench during monsoons, a ring bund of puddle clay or by any other means shall be formed outside, to the required height, and maintained by the Contractor. Also, suitable steps shall be taken by the Contractor to prevent back flow of pumped water into the trench. *Nothing extra shall be payable* on this account.
- (iv) For works below ground level the contractor shall keep that area free from water. If dewatering or bailing out of the water is required, the contractor shall do the same at *his own cost and nothing extra shall be paid*. It is intimated that the foundation depth and water table below the ground level may be approximately at the same level. So most likely, the water table may be struck in the excavation of foundation. *Nothing extra shall be paid* for execution of work in or under water and / or liquid mud including pumping out of water as required.

PART-I CHAPTER-V

SPECIAL CONDITIONS OF CONTRACT

METHODOLOGIES FOR GREEN BUILDINGS (SECTION-4)

- 4.1 To secure at least **5-Star GRIHA** ratings, a high degree of responsibility and cooperation is necessary from the contractor employed.
- 4.2 The following guideline provides the general concept of green, green building rating and the expectations from each one of those involved in this project:

4.3 GENERAL NOTE ON GREEN BUILDING PRACTICES

All materials and systems used in the project are intended to maximize energy efficiency for operation of Project throughout service life (*substantial completion to ultimate disposition – reuse, recycling, or demolition*) with an emphasis on top quality. Materials and systems are to maximize environmentally-benign construction techniques, including construction waste recycle, reusable delivery packaging, and reusability of selected materials. All vendors / contractors must adhere to best practices related to Green Buildings. Other than the particular specifications / methodologies for green buildings outlined here, all vendors / contractors will be furnished with a supplementary set of guidelines more specific to their nature of service/product.

4.4 **GREEN BUILDING PRACTICES:**

- 4.4.1 Ensure healthy indoor air quality in final Project.
- 4.4.2 Maximize use of products with low embodied energy (*harvesting, mining, manufacturing, transport, installation, use, operations, recycling and disposal*). Exceptions might include materials that result in net energy conservation during their useful life in building and building's life cycle.
 - 4.4.2.1 Where possible, select materials harvested and manufactured regionally, within a 800-km radius of the project site.
 - 4.4.2.2 Maximize use of durable products.
 - 4.4.2.3 Maximize use of products easy to maintain, repair, and that can be cleaned using non-toxic substances.
 - 4.4.2.4 Maximize recycled content in materials, products, and systems.
 - 4.4.2.5 Maximize use of reusable and recyclable packaging.
 - 4.4.2.6 Where possible and feasible, provide for non-destructive removal and re-use of materials after their service life in this building.
- 4.4.3 Re-use existing building materials to extent feasible within design concept expressed in Contract Documents. Provide materials that utilize recycled content to maximum degree possible without being detrimental to product performance or indoor air quality.

- 4.4.4 Use construction practices such as material waste reduction and dimensional planning that maximize efficient use of resources and materials.
- 4.4.5 Provide or contribute to O&M Manuals wherever applicable.
- 4.4.6 Be conversant with the Site Waste Management Program Manual and actively contribute to its compilation. Assist the Engineer by estimating the nature and volume of waste generated by the process/installation in question.
- 4.4.7 Minimize pollution: Select materials that generate least amount of pollution during mining, manufacturing, transport, installation, use, and disposal.
 - 4.4.7.1 Avoid materials that emit greenhouse gases
 - 4.4.7.2 Avoid materials that require energy intensive extraction, manufacturing, processing, transport, installation, maintenance, or removal.
 - 4.4.7.3 Avoid materials that contain ozone-depleting chemicals (e.g. CFCs or HCFCs).
 - 4.4.7.4 Avoid materials that emit potentially harmful volatile organic chemicals (VOCs).
 - 4.4.7.5 Employ construction practices that minimize dust production and combustible byproducts.
 - 4.4.7.6 Avoid materials that can leach harmful chemicals into ground water; do not allow potentially harmful chemicals to enter sewers or storm drains.
 - 4.4.7.7 Protect soil against erosion by wind or storm-water and topsoil depletion.
 - 4.4.7.8 Minimize noise generation during construction; screen mechanical equipment to block noise.
 - 4.4.7.9 Select materials that can be reused or recycled and materials with significant percentage of recycled content; conform with or exceed specified Project recycled content percentages for individual materials; avoid materials difficult to recycle. Protect natural habitats; restore natural habitats where feasible within scope of Project.

PART-I CHAPTER-V

SPECIAL CONDITIONS OF CONTRACT

CONDITIONS OF CONTRACT SPECIFIC TO GREEN BUILDING PRACTICES (SECTION-5)

5.0 The contractor shall strictly adhere to the following conditions as part of his contractual obligations as the project is targeted to get **5-Star GRIHA** ratings certification:

5.1 **SITE**

- 5.1.1 The contractor shall ensure that adequate measures are taken for the prevention of erosion of the top soil during the construction phase. The contractor shall implement the Erosion and Sedimentation Control Plan (ESCP) provided to him by the GRIHA Consultant / Architect / Engineer/DFCCIL as part of the larger Construction Management Plan (CMP). The contractor shall obtain the Erosion and Sedimentation Control Plan (ESCP) Guidelines from the Landscape Architect and then prepare "working plan" for the following month's activities as a CAD drawing showing the construction management, staging & ESCP. At no time, soil should be allowed to erode away from the site and sediments should be trapped where necessary.
- 5.1.2 The contractor shall ensure that all the top soil excavated during construction works is neatly stacked and is not mixed with other excavated earth. The contractors shall take the clearance architects landscape consultant building of the / green Consultant/Engineer/DFCCIL before any excavation. Top soil should be stripped to a depth of approximately 20 cm (centimetres) from the areas to be disturbed, for example proposed area for buildings, roads, paved areas, external services and area required for construction activities etc. It shall be stockpiled within the plot area only to a maximum height of 40 cm in designated areas, covered or stabilized with temporary seeding for erosion prevention. This stockpiled soil in the end shall be reapplied to site during plantation of the proposed vegetation. Top soil shall be separated from subsoil, debris and stones larger than 50 mm (millimetre) diameter.
- 5.1.3 The contractor shall carry out the recommendations of the soil test report for improving the soil under the guidance of the landscape consultant who would also advise on the timing of application of fertilizers and warn about excessive nutrient levels.
- 5.1.4 The contactor shall carry out post-construction placement of topsoil or other suitable plant material over disturbed lands to provide suitable soil medium for vegetative growth. Prior to spreading the topsoil, the sub-grade shall be loosened to a depth of 50mm to permit bonding. Topsoil shall be spread uniformly at a minimum compacted depth of 50mm on grade 1:3 or steeper slopes, a minimum depth of 100mm on shallower slopes. A depth of 300mm is preferred on relatively flatter land.
- 5.1.5 The Contractor should follow the construction plan as proposed by the architect / landscape Consultant/Engineer/DFCCIL to minimize the site disturbance such as soil pollution due to spilling. Use staging and spill prevention and control plan to restrict the spilling of the contaminating material on site. Protect top soil from erosion by collection storage and reapplication of top soil, constructing sediment basin, contour trenching, mulching etc.
- 5.1.6 The barricading by sheets of the construction area shall be done as per direction of Engineer/DFCCIL.

- 5.1.7 The contractor shall not change the natural gradient of the ground unless specifically instructed by the architects / landscape consultant. This shall cover all natural features like water bodies, drainage gullies, slopes, mounds, depressions, rocky outcrops, etc. Existing drainage patterns through or into any preservation area shall not be modified unless specifically directed by the Landscape Architect / Architect/ Engineer.
- 5.1.8 The contractor shall not carry out any work which results in the blockage of natural drainage.
- 5.1.9 The contractor shall ensure that existing grades of soil shall be maintained around existing vegetation and lowering or raising the levels around the vegetation is not allowed unless specifically directed by the landscape architect/architect/Engineer.
- 5.1.10 Contractor shall reduce pollution and land development impacts from automobiles use during construction.
- 5.1.11 Overloading of trucks is unlawful and creates and erosion and sedimentation problems, especially when loose materials like stone dust, excavated earth, sand etc. are moved. Proper covering must take place. No overloading shall be permitted.

5.2 CONSTRUCTION PHASE AND WORKER FACILITIES

- 5.2.1 The contractor shall specify and limit construction activity in pre-planned/designated areas and shall start construction work after securing the approval for the same from the Engineer/DFCCIL. This shall include areas of construction, storage of materials, and material and personnel movement.
- 5.2.2 Preserve and Protect Landscape during Construction
- 5.2.3 The contractor shall ensure that no trees, existing or otherwise, shall be harmed and damage to roots should be prevented during trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the tree, or, from a safe distance from the tree/plant by means of barricading. Trees will not be used for support; their trunks shall not be damaged by cutting and carving or by nailing posters, advertisements or other material. Lighting of fires or carrying out heat or gas emitting construction activity within the ground, covered by canopy of the tree is not to be permitted.
- 5.2.4 The contractor shall take steps to protect trees or saplings identified for preservation within the construction site have to be protected using tree guards as per Engineer/DFCCIL. *Nothing extra shall be payable* on this account.
- 5.2.5 The contractor shall conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity. Contractor should limit all construction activity within the specified area as per the Construction Management Plan (CMP) proposed by the architect / Landscape consultant/Engineer. All the existing trees should be preserved, if not possible than compensate the loss by re-planting trees in the proportion of 1:3.
- 5.2.6 The contractor shall avoid cut and fill in the root zones, through delineating and fencing the drip line (*the spread limit of a canopy projected on the ground*) of all the trees or group of trees. Separate the zones of movement of heavy equipment, parking, or excessive foot

traffic from the fenced plant protection zones.

- 5.2.7 Maintenance activities shall be performed as needed to ensure that the vegetation remains healthy. The preserved vegetated area shall be inspected by the Landscape Architect / Architect / Engineer/DFCCIL at regular intervals so that they remain undisturbed.
- 5.2.8 Contractor shall be required to develop and implement a waste management plan, quantifying material diversion goals. He shall establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals. A project-vide policy of "Nothing leaves the Site" should be followed. In such a case when strictly followed, care would automatically be taken in ordering and timing of materials such that excess doesn't become "waste". The Contractor's ingenuity is especially called towards meeting GRIHA 5 Star Rating requirement.
- 5.2.9 Consider recycling cardboard, metal, brick, acoustical tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Designate a specific area(s) on the construction site for segregated or collection of recyclable material, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.
- 5.2.10 Contractor shall collect all construction waste generated on site. Segregate these wastes based on their utility and examine means of sending such waste to manufacturing units which use them as raw material or other site which require it for specific purpose. Typical construction debris could be broken bricks, steel bars, broken tiles, spilled concrete and mortar etc.
- 5.2.11 The contractor shall comply with the safety procedures, norms and guidelines (*as applicable*) as outlined in the document Part 7, Constructional Management Practices and Safety, National Building Code of India (NBC) 2016 issued by Bureau of Indian Standards which has safety measures for different construction activities.
- 5.2.12 The contractor shall provide clean drinking water for all workers
- 5.2.13 The contractor shall provide the minimum level of sanitation and safety facilities for the workers at site. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and effluent; provide clean drinking water and latrines and urinals as per applicable standard. Adequate toilet facilities shall be provided for the workman within easy access of their place of work. The total no. to be provided shall not be less than 1 per 30 employs in any one shift. Toilet facilities shall be provided from the start of building operations, connection to a sewer shall be made as soon as practicable. Every toilet shall be so constructed that the occupant is sheltered from view and protected from the weather and falling objects. Toilet facilities shall be maintained in a sanitary condition. A sufficient quantity of disinfectant shall be provided. Natural or artificial illumination shall be provided.
- 5.2.14 The contractor shall ensure that air pollution due to dust/generators is kept to a minimum, preventing any adverse effects on the workers and other people in and around the site. The contractor shall ensure proper screening, covering stockpiles, covering brick and loads of dusty materials, wheel-washing facility, gravel pit, and water spraying. Contractor shall ensure the following activities to prevent air pollution during construction:

- 5.2.14.1 Clear vegetation only from areas where work will start right away
- 5.2.14.2 Vegetate / mulch areas where vehicles do not ply.
- 5.2.14.3 Apply gravel / landscaping rock to the areas where mulching / paving is impractical
- 5.2.14.4 Identify roads on-site that would be used for vehicular traffic. Upgrade vehicular roads *(if these are unpaved)* by increasing the surface strength by improving particle size, shape and mineral types that make up the surface & base. Add surface gravel to reduce source of dust emission. Limit amount of fine particles *(smaller than 0.075mm)* to 10 20%
- 5.2.14.5 Water spray, through a simple hose for small projects, to keep dust under control. Fine mists should be used to control fine particulate. However, this should be done with care so as not to waste water. Heavy watering can also create mud, which when tracked onto paved public roadways, must be promptly removed. Also, there must be an adequate supply of clean water nearby to ensure that spray nozzles don't get plugged. Water spraying can be done on:
- 5.2.14.6 Any dusty materials before transferring, loading and unloading
- 5.2.14.7 Area where demolition work is being carried out
- 5.2.14.8 Any un-paved main haul road
- 5.2.14.9 Areas where excavation or earth moving activities are to be carried out
 - a) The contractor shall ensure that the speed of vehicles within the site is limited to 10 km/hr.
 - b) All material storages should be adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust / particulate emissions.
 - c) Spills of dirt or dusty materials will be cleaned up promptly so the spilled material does not become a source of fugitive dust and also to prevent of seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean-up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained / cleaned up immediately before they can infiltrate into the soil / ground or runoff in nearby areas
 - d) Provide hoardings of not less than 3m high along the site boundary, next to a road or other public area
 - e) Provide dust screens, sheeting or netting to scaffold along the perimeter of the building
 - f) Cover stockpiles of dusty material with impervious sheeting
 - g) Cover dusty load on vehicles by impervious sheeting before they leave the site
- 5.2.15 Contractor shall be required to provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling

including (*at a minimum*) paper, corrugated cardboard, glass, plastics, and metals. He shall coordinate the size and functionality of the recycling areas with the anticipated collections services for glass, plastic, office paper, newspaper, cardboard, and organic wastes to maximize the effectiveness of the dedicated areas. Consider employing cardboard balers, aluminum can crushers, recycling chutes, and collection bins at individual workstations to further enhance the recycling program.

- 5.2.16 The contractor shall ensure that no construction leach ate (*Ex: cement slurry*), is allowed to percolate into the ground. Adequate precautions are to be taken to safeguard against this including, reduction of wasteful curing processes, collection, basic filtering and reuse. The contractor shall follow requisite measures for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant-laden water directly to the treatment device or facility (*municipal sewer line*).
- 5.2.17 Staging (dividing a construction area into two or more areas to minimize the area of soil that will be exposed at any given time) should be done to separate undisturbed land from land disturbed by construction activity and material storage.
- 5.2.18 Comply with the safety procedures, norms and guidelines (*as applicable*) as outlined in the document Part 7 Constructional Management Practices and Safety, NBC 2016 issued by Bureau of Indian Standards. A copy of all pertinent regulations and notices concerning accidents, injury and first-aid shall be prominently exhibited at the work site. Depending upon the scope & nature of work, a person qualified in first-aid shall be available at work site to render and direct first-aid to causalities. A telephone may be provided to first-aid assistant with telephone numbers of the hospitals displayed. Complete reports of all accidents and action taken thereon shall be forwarded to the competent authorities.
- 5.2.19 Adopt additional best practices, prescribed norms as in Doc No. CED 46(6086), July 2003: NBC 2016: Part 7 Constructional Management Practices and Safety issued by Bureau of Indian Standards
- 5.2.20 The storage of material shall be as per standard good practices as specified in Part 7, Section 2 Storage, Stacking and Handling practices, NBC 2016 and shall be to the satisfaction of the Engineer to ensure minimum wastage and to prevent any misuse, damage, inconvenience or accident. Watch and ward of the Contractor's materials shall be his own responsibility. There should be a proper planning of the layout for stacking and storage of different materials, components and equipment with proper access and proper maneuverability of the vehicles carrying the materials. While planning the layout, the requirements of various materials, components and equipment at different stages of construction shall be considered. The Employer/Engineer/DFCCIL shall not take any responsibility on any account.
- 5.2.21 The contractor shall ensure the following activities for construction workers safety, among other measures:
 - 5.2.21.1 Guarding all parts of dangerous machinery.
 - 5.2.21.2 Precautionary signs for working on machinery
 - 5.2.21.3 Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in

good condition.

- 5.2.21.4 Durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained.
- 5.2.21.5 Ensuring that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.
- 5.2.21.6 Provide protective equipment; helmets etc.
- 5.2.21.7 Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire-prone area and elsewhere.
- 5.2.21.8 Provide sufficient and suitable light for working during night time.
- 5.2.22 The contractor shall provide for adequate number of garbage bins around the construction site and the workers facilities and will be responsible for the proper utilization of these bins for any solid waste generated during the construction. The contractor shall ensure that the site and the workers facilities are kept litter free. Separate bins should be provided for plastic, glass, metal, biological and paper waste and labelled in both Hindi and English.
 - 5.2.23 The contractor shall prepare and submit 'Spill prevention and control plans' before the start of construction, clearly stating measures to stop the source of the spill, to contain the spill, to dispose the contaminated material and hazardous wastes, and stating designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.
 - 5.2.24 Contractor shall collect the relevant material certificates for materials with high recycled *(both post-industrial and post-consumer)* content.
 - 5.2.25 Contractor shall collect the relevant material certificates for rapidly renewable materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheat board, strawboard and cork.
 - 5.2.26 The contractor shall ensure that a flush out of all internal spaces is conducted prior to handover. This shall comprise an opening of all doors and windows for 14 days to vent out any toxic fumes due to paints, varnishes, polishes, etc.
 - 5.2.27 Contractor shall make efforts to reduce the quantity of indoor air contaminants that are odorous or potentially irritating harmful to the comfort and well-being of installer and building occupants. Contractor shall ensure that the VOC (*Volatile Organic Compounds*) content of paints, coatings and primers used must not exceed the VOC content limits mentioned below:

Paints

Anti-corrosive/ anti rust - 250 g/L Coatings / Clear wood finishes Varnish - 350 g/L Lacquer - 550 g/L Floor coatings - 100 g/L Stains - 250 g/L Sealers Waterproofing sealer - 250 g/L Sanding sealer - 275 g/L Other sealants - 200 g/L

The VOC (*Volatile Organic Compounds*) content of adhesives and sealants used must be less than VOC content limits mentioned:

Architectural Applications VOC Limit (g/l less water) Indoor Carpet adhesives - 50 Pad Adhesives - 50 Wood Flooring Adhesives - 100 Floor Adhesives - 60 Sub Floor Adhesives - 50 Ceramic Tile Adhesives - 65 VCT and Asphalt Tile adhesive - 50 Dry Wall and Panel Adhesives - 50

Structural Glazing Adhesives - 100 Multipurpose Construction Adhesives - 70 Substrate Specific Application VOC Limit (g/l less water) Metal to Metal - 30 Plastic Foams - 50 Porous material (except wood) - 50 Wood - 30 Fiber Glass - 80

- 5.2.28 Wherever required, Contractor shall meet and carry out documentation of all activities on site, supplementation of information, and submittals in accordance with GRIHA LD program standards and guidelines. Towards meeting the aforementioned building environmental rating standard(s) expert assistance shall be provided to him up on request.
- 5.2.29 Contractor shall provide quantities, manufacturer's data, O&M manuals, and Certificates required from manufacturer in accordance with GRIHA LD program requirement for all equipment and materials.

5.2.30 Water Use during Construction

Contractor should spray curing water on concrete structure and shall not allow free flow of water. After liberal curing on the first day, all the concrete structures should be painted with curing chemical to save water. Areas on which the curing compound is to be used shall be decided by Engineer (*as on some areas water may also be used for curing*) for water curing nothing shall be paid extra. Concrete structures should be kept covered with thick cloth/gunny bags and water should be sprayed on them. Contractor shall do water ponding on all sunken slabs using cement and sand mortar.

5.2.31 The Contractor shall remove from site all rubbish and debris generated by the Works and keep Works clean and tidy throughout the Contract Period. All the serviceable and non-serviceable (*malba*) material shall be segregated and stored separately. The malba obtained during construction shall be collected in well-formed heaps at properly selected places, keeping in a view safe condition for workmen in the area.

Materials which are likely to cause dust nuisance or undue environmental pollution in any other way, shall be removed from the site at the earliest in the plot elsewhere and **nothing extra shall be paid** for cartage within the campus and till then they shall be suitable covered. Glass & steel should be dumped or buried separately to prevent injury. The work of removal of debris should be carried out during day. In case of poor visibility artificial light may be provided. Debris shall be disposed in the campus within a lead of 2 kms by digging a

well and properly covering the same with soil. *Nothing extra shall be paid* for this.

5.3 MATERIALS & FIXTURES FOR THE PROJECT

- 5.3.2 All materials sourced specifically for construction at this project, shall be strictly sourced from a distance (*as specified in GRIHA guidelines*) from the project site. Contractor shall collect the relevant material certificates to prove the same
 - 5.3.2.1 Any material that is to be sourced from outside the prescribed radius shall be done after securing the necessary approval from the Engineer/DFCCIL.
 - 5.3.2.2 All cement used at site for mortar, plaster, building blocks, etc. shall be PPC (*Portland Pozzolana Cement*) unless otherwise specifically mentioned in the tender documents. The PPC must meet the requirements of IS 1489: 1991.
 - 5.3.2.3 As a measure to reduce wastage and water consumption during construction, the contractor shall source or set up the infrastructure for a batch mix concrete.
 - 5.3.2.4 The contractor has to comply as per MoEF issued notification 8.0.763(E) dated 14th Sept.1999 containing directive for greater fly ash utilization, where it stipulates.
 - 5.3.2.5 The contractor shall ensure that all paints, polishes, adhesives and sealants used both internally and externally, on any surface, shall be Low VOC products. The contractor shall get prior approval from the Architects and the Engineer/DFCCIL before the application of any such material.
 - 5.3.2.6 All plumbing and sanitary fixtures installed shall be as per the prescription of the Engineer/DFCCIL and shall adhere to the minimum LPM and LPF mentioned.
 - 5.3.2.7 The contractor shall employ 100% zero ODP (*ozone depletion potential*) insulation; HCFC (*hydro-chlorofluorocarbon*)/ and CFC (*chlorofluorocarbon*) free HVAC and refrigeration equipment and/halogen-free fire suppression and fire extinguishing systems.
 - 5.3.2.8 The contractor shall ensure that all composite wood products/agro-fibre products used for cabinet work, etc. do not contain any added urea formaldehyde resin.

5.4 **RESOURCES CONSUMED DURING CONSTRUCTION**

- a) The contractor shall ensure that the least amount of water and electricity is wasted during construction. The Engineer/DFCCIL can bring to the attention any such wastage and the contractor will have to ensure that such bad practices are corrected.
- b) The contractor shall install necessary meters and measuring devices to record the consumption of water, electricity and diesel on a monthly basis for the entire tenure of the project.
- c) The contractor shall ensure that all run-off water from the site, during construction is collected and reused to the maximum.
- d) The contractor shall use treated recycled water of appropriate quality standards for construction, if available.
- e) No lights shall be turned on during the period between 6:00 AM to 6:00 PM, without the permission of the Engineer/DFCCIL.

f) The contractor is encouraged to use bio-diesel in place of petroleum diesel for the running of generators during construction.

5.5 **CONSTRUCTION WASTE**

- a) Contractor shall ensure that wastage of construction material is kept to a maximum of 3%.
- b) All construction debris generated during construction shall be carefully segregated and stored in a demarcated waste yard. Clear, identifiable areas shall be provided for each waste type. Employ measures to segregate the waste on site into inert, chemical, or hazardous wastes.
- c) All construction debris shall be used for road preparation, back filling, etc., as per the instructions of the Architects and the Engineer/DFCCIL, with necessary activities of sorting, crushing, etc. and surplus shall be disposed of in a well after digging a well for this purpose and suitably covered with soil within the 2 kms lead in the plot. *Nothing extra shall be paid* for this.
- d) No construction debris shall be taken away from the site, without the prior approval of the Engineer.
- e) The contractor shall recycle the unused chemical/hazardous wastes such as oil, paint, batteries, and asbestos.
- f) If and when construction debris is taken out of the site, after prior permissions from the Engineer then, the contractor shall ensure the safe disposal of all wastes and will only dispose of any such construction waste in approved dumping sites.
- g) Inert waste to be disposed of by Municipal Corporation/ local bodies at landfill sites.
- h) The facility for cleaning the tyres of trucks/ dumpers carting the material shall be provided at the entry points and sedimentation trap shall be made. *Nothing shall be extra payable* on this account.

5.6 **Documentation**

- a) The contractor shall, during the entire tenure of the construction phase, submit the following records to the Engineer/DFCCIL on a monthly basis:
 - i) Water consumption in litres
 - ii) Electricity consumption in 'kwh' units
 - iii) Diesel consumption in litres
 - iv) Quantum of waste generated at site and the segregated waste types divided into inert, chemical and hazardous wastes.
 - v) Digital photo documentation to demonstrate compliance of safety guidelines.
- b) The contractor shall, during the entire tenure of the construction phase, submit the following records to the Engineer/DFCCIL on a weekly basis:

- i) Quantities of material brought into the site
- ii) Quantities of construction debris (if at all) taken out of the site
- iii) Digital photographs of the works at site, the workers facilities, the waste and other material storage yards, pre-fabrication and block making works, etc. as guided by the Engineer/DFCCIL.
- c) The contractor shall submit one document after construction of the buildings, a brief description along with photographic records to show that other areas have not been disrupted during construction. The document should also include brief explanation and photographic records to show erosion and sedimentation control measures adopted. Document CAD drawing showing site plan details of existing vegetation, existing buildings, existing slopes and site drainage pattern, staging and spill prevention measures, erosion and sedimentation control measures and measures adopted for top soil preservation during construction
- d) The contractor shall submit to the Engineer after construction of the buildings, a detailed as built quantification of the following:
 - i) Total materials used,
 - ii) Total top soil stacked and total reused
 - iii) Total earth excavated,
 - iv) Total waste generated,
 - v) Total waste reused,
 - vi) Total water used,
 - vii) Total electricity, and
 - viii) Total diesel consumed.
- e) The contractor shall submit to the Engineer, as built drawings after construction of the buildings as detailed.
- f) The contractor shall submit to the Engineer/DFCCIL, before the start of construction, a site plan along with a narrative to demarcate areas on site from which top soil has to be gathered, designate area where it will be stored, measures adopted for top soil preservation and indicate areas where it will be reapplied after construction is complete.
- g) The contractor shall submit to the Engineer/DFCCIL, a detailed narrative (*not more than* 250 words) on provision for safe drinking water and sanitation facility for construction workers and site personnel.
- h) Provide supporting document from the manufacturer of the cement specifying the fly- ash content in PPC used in reinforced concrete/ in other works.
- i) Provide supporting document from the manufacturer of the pre-cast building blocks specifying the fly ash content of the blocks used in an infill wall system.

- j) The contractor shall, at the end of construction of the buildings, submit to the Engineer, submit following information, for all material brought to site for construction purposes, including manufacturer's certifications, verifying information, and test data, where Specifications sections require data relating to environmental issues including but not limited to:
 - i) Source of products: Supplier details and location of the supplier.
 - ii) Project Recyclability: Submit information to assist Employer/Engineer and Contractor in recycling materials involved in shipping, handling, and delivery, and for temporary materials necessary for installation of products.
 - iii) Recycled Content: Submit information regarding product post industrial recycled and post consumer recycled content. Use the "Recycled Content Certification Form", to be provided by the Commissioning Authority appointed for the Project.
 - iv) Product Recyclability: Submit information regarding product and product's component's recyclability including potential sources accepting recyclable materials.
 - v) Provide certification for all wood products provided by a Forest Stewardship Council (*FSC or equivalent organization*) accredited certifier.
 - vi) Provide final certification of well-managed forest of origin to provide final documentation of certified sustainably harvested status: Acceptable wood "certified sustainably harvested" certifications shall include:
 - a) Wood suppliers' certificate issued by one of the Forest Stewardship Councilaccredited certifying agencies;
 - b) Suppliers' invoice detailing the quantities of certified wood products for project;
 - c) Letter from one of a certifying agency corroborating that the products on the wood supplier's invoice originate from certified well-managed forests.
- k) Clean tech: Provide pollution clearance certificates from all manufacturers of materials
- 1) Indoor Air quality and Environmental Issues: Submit emission test data, sourced from the manufacturers, produced by acceptable testing laboratory listed in Quality Assurance Article for materials as required in each specific Specification section.
 - a. Certifications from manufacturers of Low VOC paints, adhesives, sealant and polishes used at this particular project site.
 - b. Certification from manufacturers of composite wood products/agro fibre products on the absence of added urea formaldehyde resin in the products supplied to them to this particular site.
 - c. Submit environmental and pollution clearance certificates for all diesel generators installed as part of this project.
- m) Provide total support to the Architects / Engineer / Green Building Consultants appointed by the DFCCIL in completing all Green Building Rating related formalities, including signing of forms, providing signed letters in the contractor's letterhead.

5.7 EQUIPMENT

- a) To ensure energy efficiency during and post construction all pumps, motors and engines used during construction or installed, shall be subject to approval and as per the specifications of the architects.
- b) All lighting installed by the contractor around the site and at the labour quarters during construction shall be CFL bulbs of the appropriate illumination levels. This condition is a must, unless specifically prescribed.

The contractor is expected to go through all other conditions of the GRIHA ratingS stipulations, which can be provided to him by the Architects/Engineer/DFCCIL. Failure to adhere to any of the above mentioned items, without necessary clearances from the Engineer/DFCCIL shall be deemed as a violation of contract and the contractor shall be held liable for *penalty as determined by the Engineer/DFCCIL*.
CGM/DFCCIL/NOIDA UNIT/Interior & Furnishing work for DFCCIL C. O. Building/Sec-145 Noida/2020/01

<u>PART – II</u>

TECHNICAL SPECIFICATIONS

145 | Page

GENERAL TECHNICAL SPECIFICATION

All works shall be executed as per latest CPWD's specification as amended up to date, BIS Codes amended up to date and other relevant codes as per directions of Engineer/DFCCIL.

In terms of work for which CPWD specifications are not available, execution of work shall be carried out in accordance with Technical specifications as given below. Further, if any specification(s) is not available in technical specification as provided in the tender document, standard practices and/or Manufacturer's catalogue are to be referred.

TECHNICAL SPECIFICATIONS FOR INTERIOR & FURNISHING WORKS (SCHEDULED DSR ITEM)

(SECTION-I)

TECHNICAL SPECIFICATIONS FOR INTERIOR WORKS-GENERAL

1. General: -

The scope of work covers execution of the Interior, Finishes, Services and Allied works for Corporate office Building, Administrative Block and Hostel Block of DFCCIL Project **"Integrated Office Cum Residential Complex"** at Sector-145, Noida, in accordance with the BOQ, Technical Specifications & drawings provided in the Tender Documents and to the satisfaction of the Architect/Engineer/DFCCIL.

Unless provided otherwise the work shall be executed as per CPWD specifications 2009 Volume I & II with up to date amendments, and correction. All relevant Indian Standard (IS) codes related to items of work shall be completely followed for execution.

2. Drawings:

Two sets of all drawings shall be furnished to the contractor for his own use to be kept at site office for reference & execution of works till the completion of the project in all respect. It shall be accessible at all reasonable times to the Architect/Engineer/DFCCIL and their representatives. All-important drawings are to be mounted on boards and placed in racks and indexed.

3. Dimensions:

Figured dimensions are in all cases to be followed & accepted in preference to scaled sizes. Largescale details take precedence over small-scale drawings. In case of discrepancy the Contractor is to ask for clarification before proceeding with the work. The decision of Architect/Engineer/DFCCIL shall be final and binding.

4. Contractor to inspect site:

The contractor shall visit and examine the construction site and satisfy himself as to the nature of the existing roads or other means of communications, the extent and magnitude of the work and facilities for obtaining materials and shall obtain generally his own information of all matters affecting the execution of the project. Misunderstanding or incorrect information on any of these points or on expenses incurred by the contractor in connection with obtaining site data/information or efforts in compiling the tender shall be borne by the Tenderer/Contractor and no claims for reimbursement thereof shall be entertained.

4.1 Access to Site:

The Contractor is to include in his rates for making access to the site, with all-temporary gangways, access platforms etc. as required for execution and completion of the works.

4.2 Setting Out:

The Contractor shall set out the works in accordance with the plans. All grid/centre lines shall be pegged out to the satisfaction of the Architect/Engineer/DFCCIL. The Contractor shall be responsible for the correctness of lay out and any inaccuracies to be rectified at his own expense.

The Contractor shall construct and maintain proper benches at the intersection of all main walls, columns etc; in order that the lines and levels may be accurately checked at all times.

4.3 Treasure Trove:

Should any treasure, fossils, minerals, or works of art of antiquarian interest be found during excavation or while carrying out the works, the Contractor shall give immediate notice to the DFCCIL of any such discovery and shall hand over such finds to the DFCCIL immediately.

4.4 Access for Inspections:

The contractor is to provide at all times during the progress of the works and the maintenance period proper means of access, with ladders, gangways etc. and the necessary attendance to move and adapt as directed for the inspection or measurement of the works by the Architect/ Engineer/DFCCIL or their representatives.

4.5. Attendance upon all Trades:

It will be the responsibility of the main Contractor to attend on all Tradesman or Subcontractors for other services not included in scope of contract i.e. for water supply, security Equipment, hardware, Telephone, Water bore well and other specialist Sub-Contractors. The rates quoted shall be inclusive of all attendance and also allow the other Contractors appointed by the DFCCIL for other contract packages.

4.6 Gate Keeper and Watchmen:-

- 4.6.1 The Contractor from the time of being placed in possession of the site must make arrangements for watching, lighting and protecting the work, all materials, workmen and the public during day and night on all days including Sundays and holidays at his own cost.
- 4.6.2 Before starting the work the contractor shall intimate to the Engineer/DFCCIL the number and names of works and other personnel together with a copy of each identity card with photograph along with a list of tools, tackles and construction materials for obtaining respective inward gate pass, in triplicate. The contractor shall be permitted similar outward pass on completion of work and on submission of contractor's copy of same inward pass.
- 4.6.3 The contractor shall apply for gate passes for taking out any materials, tools, tackles etc. brought by him inside the DFCCIL premises based on contractor's copy of inward pass and also for his personnel going out of the DFCCIL premises.
- 4.6.4 The contractor shall be responsible for any unauthorized removal of materials, tools, tackles etc. from the DFCCIL premises.
- 4.6.5 DFCCIL gate office norms to be followed.

5. Storage for Materials:-

The Contractor shall provide for all necessary sheds of adequate dimension for storage and protection of materials like cement, lime, timber and such other materials including tools and equipment which are likely to deteriorate by the action of sun wind, rain or other natural causes due to exposure in the open. For cement the contractor shall arrange for leak proof godown of sufficient size to store not less than 3 months requirement of cement.

All such sheds shall be cleared away and the whole area left in good order on completion of the contract to the satisfaction of the Engineer/DFCCIL.

All materials, which are stored on the site such as bricks, aggregates etc., shall be stacked in such a manner as to facilitate rapid and easy checking of quantities of such materials.

6 Cost of Transporting:-

The Contractor shall allow at his cost for all transporting, unloading, stacking and storing of supplier of goods and materials for this work on the site and in the places approved from time to time by the Architect/Engineer/DFCCIL. The Contractor shall consider in his price for transport of all materials controlled or otherwise to the site.

7. W.C. and Sanitary Accommodation and Office Accessories and Accommodations:-

The Contractor shall provide at his own cost and expense adequate water closet and sanitary accommodation complying in every respect to the rules and regulations in force of the DFCCIL, Architect, Engineer, for his workmen, for the workmen of sub-contractors, and other Contractor's agents connected with this building project and maintain the same in good working order.

He shall arrange to provide a Dumpy level/Theodolite and at all times maintain in good working order at site, to enable the Architect/Engineer/DFCCIL to check the lines and levels of the work.

8. Materials, Workmanship and Samples:-

Samples of materials to be used with original/coloured catalogue with specification shall be brought by Contractor well in advance and shall be displayed and kept in separate sample room on site. Samples of all kind of material to be used shall be getting approved from Architect/ Engineer/DFCCIL.

Materials shall be of approved quality and the best of their kind available and shall generally conform to I.S. Specifications. The Contractor shall order all the materials required for the execution of work as early as necessary and ensure that such materials are on site well ahead of requirement for use in the work. The work involved calls for high standard of workmanship with accelerated progress to the entire satisfaction of the Architect/Engineer/DFCCIL.

8.1 Rate to Include:-

The Rates quoted shall be for all lead, heights and depths and for finished work complete in all respect and to the satisfaction of Architect/Engineer/DFCCIL.

8.2 To ascertain from Contractors for the other trades:-

The Contractor shall ascertain from other Contractors as directed by the Architect/Engineer/DFCCIL all particulars relating to their work with regard to the order of its execution and the position in which chases, pockets, holes and similar items will be required, before the work is taken in hand as no claims for extras will be allowed for cutting away work already executed in consequence of any neglect by the Contractors to ascertain these particulars beforehand.

9. Foreman and Tradesman:-

All Tradesmen shall be experienced men properly equipped with suitable tools for carrying out all the work of carpentry and joinery and other specialist trades in a first class manner and where the Architect/Engineer/DFCCIL deem necessary, the Contractor shall provide any such tools, special or ordinary, which are considered necessary for carrying out of the work in a proper manner.

All such tradesman shall work under an experienced and properly trained Foreman, who shall be capable of reading and understanding all drawing, pertaining to this work and the Contractor shall also comply with other conditions set out in the General Conditions of the Contract.

10. Work Programme/Weekly Progress Report:-

The Contractor shall prepare and submit to Engineer/DFCCIL for approval, a PERT/CPM chart showing the programme of construction of various items, fitted within the period stipulated for completion, within 30 days of the communication of the acceptance of Tender. The Contractor shall also furnish necessary particulars monthly progress reports in the form furnished by the Engineer/DFCCIL. Approved programme shall be the basis for monitoring the progress of work.

The Contractors also should up date and re-analyze the PERT/CPM chart as often as required as per direction of Engineer/DFCCIL to assess and reassess the progress of work done and take corrective measures for making out any deficiency.

11. Clearing of site:-

The contractor shall immediately after completion of the work clear the site of all debris and left over materials at his own expense to the entire satisfaction of the Engineer/DFCCIL and Municipal or other public authorities. Before taking out any surplus material, reconciliation of materials shall be submitted by the contractor for approval. For taking out the materials, the contractor shall strictly follow the provisions laid down in General Specifications and/or any subsequent circulars that may be issued by DFCCIL.

12. Photographs:-

The Contractor shall at his own expense supply to the Architect/Engineer/DFCCIL with triplicate copies (including the soft copy) of photographs of the works taken from two approved portions of each building, in every month during the progress of the work, or at every important stages of construction.

13. Preparation of Building for occupation and use on Completion:-

The whole of the work shall be thoroughly inspected by the Contractor and all deficiencies and defects put right. On completion of such inspection, the Contractor shall inform the Engineer/DFCCIL in writing that he has finished the work and it is ready for the inspection.

On completion, the Contractor shall clean all windows and doors and all glass panes, including cleaning of all floors, skirting, dados, staircases and every part of the building including oiling all hardware. He will leave the entire building neat and clean and ready for immediate occupation and to the satisfaction of the Architect/Engineer/DFCCIL.

14. Contractor to Provide Sign Board:-

The Contractor shall provide notice on proper supports 3 m x 2 m (10' x 6') in a position approved by the Architect/Engineer/DFCCIL. He shall allow for painting and lettering stating name of work, name of Architect, Structural Consultants; General Contractor and Sub-Contractors, all letters except that of the name of the work shall be in letters to the approval of the Architect/Engineer/DFCCIL. He will also display safety notices as per requirement and direction of Architect/Engineer/DFCCIL.

15. Vouchers:-

The Contractor shall furnish the Architect/Engineer/DFCCIL with vouchers on request to prove that the materials are as specified in contract and for non tender items to indicate the rate at which the materials are purchased in order to work out the rate analysis of the non-tender items which he may be called upon to carry out. He will also have to provide the gate entry challan.

16. Protection:-

The Contractor shall properly cover up and protect all work throughout the duration of work until completion, particularly masonry/finish, moulding, steps, terrazzo or special floor finishes, staircase and balustrades, doors and window frames, plaster angles, lighting and sanitary fittings, glass, paint work and all finishing works.

17. Workmanship: -

- 17.1 The workmanship is to be the best possible and of a high standard. The contractor shall take all steps immediately to make up deficiency if any noticed by the Architect/Engineer/DFCCIL. Use must be made of special tradesmen in all aspects of the work and allowance must be made in the rates for the same.
- 17.2 Contractor shall maintain uniform quality and consistency in workmanship throughout the execution of the work.
- 17.3 The contractor shall be responsible for providing and maintaining temporary coverage required for the protection of finished work. He is also to clean out all wood shavings; cut ends and other waste from all parts of the works before covering of infillings are constructed.
- 18. The Architect/Engineer/DFCCIL shall have full powers and authority to issue such instructions as to the order of proceeding with or carrying out the work as he may deem necessary for the guidance of the Contractor and contractor shall be bound by such instructions of the Architect/Engineer/DFCCIL.
- 19. The levels and measurements of the existing site, as shown in the drawings, are believed to be correct, but the Contractor should verify them for himself. No claim or allowance whatsoever will be entertained hereafter on account of any errors or omission in the description of the site turning out different from what was expected or shown in the drawings.
- 20. All floors, paving, staircase, etc. are to be scrubbed, all glasses to be cleaned on both sides of windows/curtain wall including its members, screens, doors, sky-lights, roof lights, etc., all gulley, gutters, pipe heads, etc. to be cleaned out and the premises left clean, perfect and water tight upon completion. However, a proper care needs to be taken during such cleaning works that the original finishing such as polishing, painting, anodizing, powder coating etc. are not scratched/damaged. In case of any such damage, the contractor shall have to reinstate the same as original as per the instructions of Architect/Engineer/DFCCIL, without any cost to Employer.
- 21. Any loss or damage caused due to fault or negligence on the part of Contractors labours, staff etc. during working in the premises will be made good by contractor at no extra cost or the damage and repair cost will be reimbursed in full to the Employer.

22. Completion Schedule: -

- 22.1 The works shall be executed strictly as per time schedule mentioned in NIT. Contractor shall have to plan his construction programme and activities so as to complete the work in the stipulated period. The period of completion given includes the time required for mobilization as well as testing, rectifications, if any, re-testing and completion in all respects to the entire satisfaction of Architect/Engineer/DFCCIL.
- 22.2 The contractor shall furnish within 30 days of letter of award CPM network chart showing the mile stone and critical path for completion of work within the stipulated time and as per conditions of the contract. The programme should clearly include Manpower, Material and Machinery resources proposed to be deployed for achieving the targeted progress, justification for same based on machinery output, the date from which each machinery shall

be available at site in working condition etc. complete. The programme shall be subject to the approval of Architect/Engineer/DFCCIL who may order changes in the programme. The decision of Architect/Engineer/DFCCIL shall be final and binding in this regard.

- 22.3 Contractor is expected to mobilize and employ sufficient resources to achieve the progress within the broad frame work of accepted methods of working and safety. No additional payment shall be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedule even though the time schedule is approved by the Architect/Engineer/DFCCIL.
- 22.4 During the currency of the work the contractor is expected to adhere to the time schedule on mile stone and total completion and this adherence will be a part of Contractor's performance under contract.
- 22.5 The Engineer/DFCCIL can hold the payment till such time; the contractor does not submit CPM/Milestone Chart/Construction Equipment Programme etc. The Contractor will be fully responsible to submit at the time of start Milestone Chart in consultation with Engineer/DFCCIL.

23. For Monitoring of Project: -

- 23.1 The contractor shall submit the programme Network based on Critical Path Method using precedence Diagram method to complete the work within stipulated time schedule.
- 23.2 The agency shall submit month wise details of manpower and machinery to be deployed in project along with material procurement schedule for completion of work with in stipulated period based on programme Networking. The progress will be reviewed monthly with respect' to the programme/Net Work chart submitted by agency. The revised CPM chart with additional manpower/machinery/ labour deployment scheduled should also be submitted in case regular backlog is observed and revised programme is essential to complete the work within stipulated period.
- 23.3 The approval to the revised schedule resulting in a completion date beyond the stipulated date of completion shall not automatically amount to grant of extension of time to the Contractor.
- 23.4 Contractor shall submit monthly progress reports (3 copies) highlighting status of various activities and physical completion of work.
- 23.5 Contractor shall give every day report on category wise labour and equipment deployed in the proforma prescribed by the Engineer/DFCCIL.

SECTION – 2

TECHNICAL SPECIFICATIONS FOR INTERIOR AND FURNISHING WORKS

- 1.1 The Contractor shall furnish for approval, with reasonable promptness, samples of all materials and workmanship. The Engineer/DFCCIL shall check and confirm in consultation with Architect / Consultants, approval of such samples with reasonable promptness only to conform with the design concept of the Works and for compliance with the information given in the contract documents. The work shall be in accordance with approved samples. The procedure for submission and approval of samples shall be as follows;
 - a) All material samples in duplicate shall be delivered to the Engineer-in-charge/ DFCCIL's office at the Contractor's cost. Samples shall be properly labeled with.
 - Name of Project
 - Name of Contractor
 - Name Product
 - Name of Manufacturer
 - Reference No of Schedule of Quantities (BOQ)
 - Date of Submission
 - Date of fabrication / casting if applicable
 - b) Samples shall be accompanied with technical specification / manufacturer's catalogue
 - c) In case the Contractor intends to keep an approved sample in his possession he shall submit one additional samples for the Architect/Engineer/DFCCIL's approval.
 - d) Samples shall be furnished well in advance to give the Architect/Engineer/DFCCIL reasonable time for their consideration.

2.0 **DISMANTLING**

TERMINOLOGY

- (i) **Dismantling**: The term 'Dismantling' implies carefully separating the parts without damage and removing. This may consist of dismantling one or more parts of the building as specified or shown on the drawings.
- (ii) **Demolition**: The term 'Demolition' implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the drawings.

2.1 GENERAL

This chapter relates to buildings only.

- 2.1.1 Precautions
 - 2.1.1.1 All materials obtained from dismantling or demolition shall be the property of the DFCCIL unless otherwise specified and shall be kept in safe custody until they are handed over to the Engineer/DFCCIL.

- 2.1.1.2 The demolition shall always be well planned before hand and shall generally be done in reverse order of the one in which the structure was constructed. The operations shall be got approved from the Engineer/DFCCIL before starting the work. Due care shall be taken to maintain the safety measures prescribed in IS 4130.
- 2.1.1.3 Necessary propping, shoring and or under pinning shall be provided to ensure the safety of the adjoining work or property before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property. Wherever specified, temporary enclosures or partitions and necessary scaffolding with suitable double scaffolding and proper cloth covering shall also be provided, as directed by the Engineer/DFCCIL.
- 2.1.1.4 Necessary precautions shall be taken to keep noise and dust nuisance to the minimum. All work needs to be done under the direction of Engineer/DFCCIL. Helmets, goggle, safety belts etc. should be used whenever required and as directed by the Engineer/DFCCIL. The demolition work shall be proceeded with in such a way that it causes the least damage and nuisance to the adjoining building and the public.
- 2.1.1.5 Dismantling shall be done in a systematic manner. All materials which are likely to be damaged by dropping from a height or by demolishing roofs, masonry etc. shall be carefully removed first. Chisels and cuters may be used carefully as directed. The dismantled articles shall be removed manually or otherwise, lowered to the ground (and not thrown) and then properly stacked as directed by the Engineer/DFCCIL.
- 2.1.1.6 Where existing fixing is done by nails, screws, bolts, rivets, etc., dismantling shall be done by taking out the fixing with proper tools and not by tearing or ripping off.
- 2.1.1.7 Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer/DFCCIL within a lead of 50 metres. All unserviceable materials, rubbish etc. shall be disposed off as directed by the Engineer/DFCCIL.
- 2.1.1.8 The contractor shall maintain/disconnect existing services, whether temporary or permanent, where required by the Engineer/DFCCIL.
- 2.1.1.9 No demolition work should be carried out at night especially when the building or structure to be demolished is in an inhabited area.
- 2.1.1.10 Screens shall be placed where necessary to prevent injuries due to falling pieces.
- 2.1.1.11 Water may be used to reduce dust while tearing down plaster from brick work.
- 2.1.1.12 Safety belts shall be used by labourers while working at higher level to prevent falling from the structure.
- 2.1.1.13 First-aid equipment shall be got available at all demolition works of any magnitude.

3.0 BRICK AND BLOCK WORK

3.1 **SCOPE**

This specification describes the general requirements for brickwork and blockwork on projects.

3.2 APPLICABLE CODES

The latest revision of the following Indian Standards and Codes, unless otherwise specified, shall be applicable to all brickwork and blockwork.

- IS 383 Coarse and fine aggregate from natural source for concrete
- IS 432 Specifications for Mild Steel and Medium Tensile Bars.
- IS 1077 Specification for Common Burnt Clay Building Bricks.
- IS 2116 Specification for Sand for Masonry Mortar.
- IS 2185 Specification for Cement Concrete Block.
- IS 2212 Code of Practice for Brickwork
- IS 2250 Code of Practice for Preparation and Use of Masonry Mortar
- IS 2572 Code of practice for Construction of Concrete Walls
- IS 3495 Method of testing for burnt clay building bricks
- IS 9103 Specification for Admixture of Concrete
- IS 1200 (Part 3) Method of Measurement for Building Works Brick works.
- IS 5454 Method of Sampling of clay building bricks.

3.3 BRICKWORK

Bricks shall conform to the relevant Indian Standards and shall be table moulded, sound, hard, homogeneous in texture, well burnt without being vitrified, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square edges and parallel faces.

Bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing unground particles and/or which absorb more than 20% of their weight in water when soaked for 24 (twenty-four) hours shall be rejected. Over- burnt or under-burnt bricks shall be rejected.

Bricks shall give a clear ring sound when struck and shall have a minimum crushing strength of 75 Kg/sq. cm. Unless otherwise specified. The classes and quality requirements of bricks shall be as laid down in IS 1077.

Bricks shall be 23 x 11.5 x 7.5 cm, unless otherwise specified. Tolerances up to+/- 3mm in each direction will be permitted. However the contractor may be permitted to use 200mm long modular bricks of specified quality on getting written approval from Consultant /Engineer/DFCCIL. No extra claim shall be entertained in this regard.

Bricks shall be provided with frogs. Only full size bricks shall be used for masonry work. Cut bricks may be used with the permission of the Engineer/DFCCIL only to make up required wall

lengths or for bonding. Sample bricks shall be submitted to the Engineer/DFCCIL for approval and bricks supplied shall strictly conform to the approved samples.

The brick samples shall be tested by the Contractor at his own cost in accordance with IS 3495 as and when required by Consultant / PMC. Bricks rejected by the Engineer/DFCCIL for whatever reason shall be removed from the Site within 24 (twenty four) hours.

3.4 FACING BRICKWORK

Facing bricks of the type, size and colour specified shall be laid in the positions indicated on the drawings. Samples brick shall be submitted to the Engineer/DFCCIL for approval and bricks supplied shall strictly conform to the approved samples.

Fair faced brickwork shall be well bonded to the backing brickwork and no fair faced brickwork shall be at any time more than 600mm above the backing brickwork or raised more than one metre per day.

Fair faced brickwork shall be pointed as the work proceeds and internal faces of the brickwork shall be pointed with neat flush joints to give a fair face. Bricks shall be kept constantly moist on all faces for a minimum period of 10 (ten) days.

Newly laid fair-faced brickwork shall be protected from rain by suitable covering until the mortar has sufficiently set.

Fair-faced brickwork shall be kept clean and free from damage, defacing, dis- colouration and the like at all times. The Contractor shall carefully fill all holes with bricks similar to the surrounding brickwork and point as required to the satisfaction of the Engineer/DFCCIL.

Double scaffolding shall be used against fair-faced brickwork and no holes in fair- faced brickwork shall be allowed for the erection of scaffolding.

The rates quoted by the Contractor are inclusive of transoms and mullions. The Contractor shall provide the same as shown or indicated on the drawings. They shall be generally provided only in half and one brick walls. Dimensions of the transoms and mullions shall conform to wall thickness. Concrete work for transoms and mullions shall conform to the Specifications for concrete and shall be of concrete Grade M20.

3.5 **CONCRETE BLOCKWORK**

Hollow or solid concrete blocks shall conform to IS 2185 and shall be regular in size and shape and of the specified strength.

Blocks shall be properly cured before being bought to Site and shall have a texture such that plaster and/or render will readily adhere to it.

The Contractor shall supply samples for the approval of the Engineer/DFCCIL and all blocks supplied shall conform strictly to the approved samples.

Half or three quarter size blocks may be used wherever required to make up lengths of walls but broken blocks shall not be used.

Pre-cast concrete screen or special blocks or 'jali' work for decorative purposes shall be as specified on the drawings or as directed by the Engineer/DFCCIL. Sample blocks shall be submitted to the Engineer/DFCCIL for approval and blocks supplied shall strictly conform to the approved samples.

3.6 MORTAR FOR BRICKWORK AND BLOCKWORK

Mortar shall be prepared in accordance with IS 2250. Mixes for cement mortar shall be as specified for the respective items of work.

Cement shall be 43 grade ordinary Portland cement as described in Specification for concrete works Chapter 2.0.

Sand shall be natural sand in accordance with IS 383, passing a 4.75mm size IS sieve, and shall be free from clay, shale, loam, alkali, organic and other deleterious matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by the Engineer/DFCCIL and, if so directed, shall be thoroughly washed until it is free of any contamination.

Gauge boxes for sand shall be of such dimensions that one complete 50 Kg bag of cement forms one unit.

For the preparation of cement mortar the ingredients shall first be thoroughly mixed dry in the mixer machine. Water shall then be added and the mixing continued until a uniform mix of the required consistency is achieved. Only machine mixed mortar is permitted.

However hand mixing in troughs may be allowed with the approval of the Engineer/DFCCIL for the quantity of brick work less than 1 cum in whole days work. Mortar so mixed shall be used within 25 (twenty five)minutes of mixing. Mortar left unused within the specified period shall be rejected and disposed of by the Contractor to the satisfaction of the Engineer/DFCCIL. Retempering of mortar shall not be permitted.

The Contractor shall arrange at his own cost for tests on mortar samples, if so directed by the Engineer/DFCCIL.

3.7 WORKMANSHIP FOR BRICKWORK

Workmanship shall conform strictly to IS 2212. Bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. Cement mortar for brickwork shall be as specified in the respective item or work.

Brickwork of thickness 230 mm and above shall be laid in English Bond unless otherwise specified. Brickwork 115 mm thick shall be laid in Stretcher Bond. Brickwork 200 mm thick shall be laid as per the drawings issued by the Engineer/DFCCIL. If Brick of length 200 mm is used after approval of Engineer/DFCCIL, the brick work shall be laid similar to English Bond.

A layer of mortar shall be spread over the full width of a suitable length of the lower course and bricks pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

Bricks shall be laid so that all joints are well filled with mortar. The thickness of joints shall not be less than 6mm and not more than 10mm. Face joints shall be raked to a minimum depth of 12mm by raking tools during the progress of work when the mortar is still green so as to provide a proper key for pointing, plastering or rendering. When pointing, plastering or rendering is not required joints shall be uniform in thickness, struck flush and finished at the time of laying.

Brickwork shall be plumb, square and true to lines and the dimensions shown on drawings. Vertical joints in alternate courses shall laid directly one over the other and be in line. Horizontal courses shall be leveled.

The thickness of brick courses shall be kept uniform. For walls greater than 230 m thick both faces shall be kept in vertical planes. All interconnected brickwork shall be carried out at one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work. Where this is not possible the work shall be raked back according to bond (and not saw toothed) at an angle not exceeding $45\Box$ but in no case shall the difference in levels between adjoining walls be allowed to exceed 1.25 metres.

Faces of brickwork shall be cleaned daily and all mortar droppings cleaned off and removed. Top surfaces of each course shall be thoroughly cleaned before other courses are laid. If mortar in lower courses has begun to set joints shall be raked out to a depth of 12mm before laying is continued.

Brickwork shall be built tightly against columns, floor slabs or other structural members.

Where drawings indicate that structural steel columns are to be fireproofed with brickwork, brickwork shall be built closely against all flanges and webs with all spaces between the steel and brick work filled solid with mortar. Steel members partly embedded in brick and not described as fireproofed with concrete shall be covered with coat of mortar not less than 12mm thick unless otherwise directed by the Engineer/DFCCIL.

Openings, arches, chases, pockets and the like shall be provided as shown on the drawings to receive windows, louvers, before frames and the like.

Wall ties and flashing shall be built into brickwork in accordance with the drawings and Specifications. It shall be clearly understood that the rates quoted by the Contractor shall be deemed to include for leaving openings, forming arches, cutting chases, pockets and the like in brickwork for various trades.

3.8 WORKMANSHIP FOR BLOCKWORK

Blockwork shall be plumb, square and properly bonded with broken joints. The thickness of the courses shall be uniform with courses horizontal. All connected work shall be carried out at one level and no portion of the work shall be left more than one course lower than the adjacent work.

Blocks shall be laid so that all joints are well filled with mortar. Joined shall not be less than 6mm and not more than 8mm thick. Face joints shall be raked to a minimum depth of 10mm by raking tools during the progress of work when the mortar is still green so as to provide a proper key for

pointing, plastering or rendering. When pointing, plastering or rendering is not required joints shall be struck flush.

For pointed blockwork or blockwork without plaster or render approved, smooth textured concrete blocks shall be used.

Faces of blockwork shall be cleaned daily and all mortar droppings cleaned off and removed. Top surface of each course shall be thoroughly cleaned before other courses are laid. If mortar in lower courses has begun to set joints shall be raked out to a depth of 12mm before laying is continued.

Where blocks are to be used for load bearing walls the uppermost course of blocks supporting slabs or other structural members shall be solid or treated as directed by the Engineer/DFCCIL.

Openings, arches, chases, pockets and the like shall be provided as shown on the drawings to receive windows, louvers, doors frames and the like.

Wall ties and flashing shall be built into blockwork in accordance with the drawings and Specifications. It shall be clearly understood that the rates quoted by the Contractor shall be deemed to include for leaving openings,

4.0 GYPSUM BOARD WORKS

4.1 **SCOPE**

This Specification describes the general requirements pertaining to materials and methods to be used for gypsum board works.

4.2 **APPLICABLE CODES**

The latest revision of the following Indian Standards and Codes, unless otherwise specified shall be applicable to all gypsum board works.

IS 2095 – 1982	Gypsum Plaster boards.	

IS 2542 – 1981 (Part 1/Sec 1 to 12 & Part 2/Sec 1 to 8)Methods of test for gypsum plaster, concrete and products.

4.3 GYPSUM BOARD – PLAIN

The gypsum board shall consist of an aerated gypsum core treated with special additives covered on each face with a specially prepared durable paper liner binding the longitudinal sides of the board.

Physical Properties and Performance

- i. Thickness: 12.5 mm
- ii. Width 610 mm and 1220 mm
- iv. Weight: 10.20 Kg/m2
- iv. Density (dry state): 807.10

- v. Fire Resistance: as per BS 476 Part 7 1971
- vi. Sound Insulation: The average rate of noise reduction between frequencies of 100-3150 Hz:
 - * 35.6 dB for a partition of 75mm or 97 mm thickness with a 12.5mm board on each face.
 - * 38.5 dB for a partition as above but including 25mm of mineral wool in the cavity.
 - * 42.5 dB for a 100mm partition comprising of two layers of 12.5mm board on each side.
- vii. Resistance to knocking and scuffing: Greater than that of cement plaster work.
- viii. Thermal Conductivity: 0.16 W/mK
- ix. Thermal Resistance: 0.08 m2 K/W.

The Gypsum boards shall be of tapered edged boards which gives an invisible joint, gap between each board being filled and finished in such a way that the linings or partitions present a continuous, smooth and seamless surface.

Accessories

- i. Floor and ceiling channel: The floor and ceiling channel used for metal framed partition shall be 0.55 mm thick, in width 72 mm or 148 mm as specified in Bill of Quantities with equal flange of 32 mm each.
- ii. Stud Section: The stud section used for partition shall be 0.55 mm thick with width 70mm or 146mm as specified in Bill of Quantities and one flange of 36mm and other flange of 34mm. The studs shall be cut along its length for services.
- iii. Drywall screws: The drywall screw used for fixing the gypsum board shall be zinc plated, self drilling and self tapping screws with counter sunk Phillips heads of the length as required as per the thickness and number of layers of the gypsum boards:

Gypsum boards of thickness	Screw length
12.5 mm	25 mm
25 mm	35 mm

- iv. Angle bead: The angle bead shall be galvanized steel angle strip, used to reinforce external angles that need maximum protection. It shall be a 25mm x 25 mm x 2 mm, suitable for 12.5 mm gypsum board.
- v. Edge bead: The edge bead shall be perforated, galvanized steel angle strip of 2mm thickness, used to form a positive perimeter detail where cover strips are not used. It shall be a 25mm and a 10mm short return leg, suitable for 12.5 mm and 25 mm gypsum board.
- vi. Control Joints: Control joints shall be used where the ceiling covers a large area or where long partitions are used. The control joints shall be formed by a GI cold rolled metal strip

of thick 0.38 mm and 47 mm wide with the edges perforated to ensure adhesion of applied finishes.

4.4 METAL STUD GYPSUM PARTITION (SINGLE / DOUBLE LAYER)

The System should consist of single/double layer of tapered edge Gypsum board of thickness 12.5 mm each screw fixed to lightweight cold rolled metal sections to be suitable for any type of direct decoration. The partition shall be extremely versatile should provide high levels of fire resistance, sound insulation and stability.

Metal stud partitions include single / double layer of tapered edge 12.5 mm thick Gypsum board (conforming to IS: 2095 - 1982) screw fixed with drywall screw of 25 mm for first layer and 35 mm for second layer at 300 mm centre to either side of studs as per manufacturers specifications & as mentioned in the relevant item (0.55 mm thick having one flange of 34 mm and another flange of 36 mm made of G.I. steel) placed at 610 mm centre to centre in 72 mm floor and ceiling channel (0.55 mm thick having equal flanges of 32 mm made of G.I. steel) with joints staggered on each layer to avoid through joints. 25 mm thick rockwool to be provided in the cavity after fixing one side board. Finally square and tapered edges of the board are to be jointed and finished so as to have a flush look which includes filling and finishing with jointing compound, joint paper tape and twocoats of Drywall topcoat suitable for Gypboard (as per the recommended practice of Indian Gypsum of Equivalent).

Double layer of Gypboard is fixed to either side of each stud and channel section with Gypboard drywall screws at 300 mm centers. At external angle, screw centers are reduced to 200 mm centers.

Finally the boards are to be jointed and finished to have a flush look which includes filling and finishing the tapered or Square edges of boards with jointing compound and point paper tapes. Two coats of Drywall Top coat are applied as primer.

4.5 GYPSUM BOARD FALSE CEILING

The false ceiling of gypsum board shall be laid on the supporting system Comprising of :

- a) GI perimeter channels shall be of size 27 mm x 0.55 mm thick having one flange of 20 mm another flange of 30 mm. These shall be along the perimeter of the ceiling, fixed to brick wall / partition with the help of rawl plugs and screws.
- b) GI intermediate channels shall be of size 45 mm x 0.9 mm thick with two flanges of 15 mm each and shall be suspended from the soffit at 1200 mm centre to centre.
- c) Ceiling angle 25 mm x 10 mm x 3 mm.
- d) They shall be fixed to soffit with GI cleat and steel expansion fasteners.
- e) Ceiling section of 0.55 mm thickness having knurled web of 51.5 mm and two flanges of 26 mm each with lips of 10.5 mm are to be fixed to the intermediate channel with the help of connecting clips and in direction perpendicular to the intermediate channel at 450 mm centre to centre.
- f) Painting MS members with red oxide paint.

The gypsum board shall be 12.5 mm thick tapered edge gypsum plaster board (conforming to IS: 2095 - 1092) should be screw fixed to the ceiling section with 25 mm drywall screws at 230 mm centre to centre, keeping board length perpendicular to ceiling section, using screw driver or drilling machine with suitable attachment.

The tapered edges of the boards should be jointed and finished to a flush finish with requisite filler, paper tapes, finisher and primer suitable for gypsum plasterboards. (As per recommendation of manufacturer, Indian Gypsum or equivalent). The job shall be completed including necessary hardware and provisions for light fitting and grills, diffusers, (cut-outs have to be made with the frame of perimeter channels of size $20 \times 27 \times 30$ mm x 0.5 mm thick supported suitably) and painting with two or more coats of plastic emulsion paint etc.

4.6 **METHOD OF MEASUREMENT**

The work shall be measured net in square metres. Deductions shall be made for predefined openings exceeding 0.5 square metres in area. Rates shall be inclusive of all supporting systems, extras for fittings and access panels, consumables, etc. complete.

Rates for Celotex grid ceiling system shall exclude the cost of ceiling tile.

5.0 FLOORING, SKIRTING, DADOING

5.1 **SCOPE**

This Specification describes the general requirements for flooring, tiling & cladding & chemical rendering workis.

5.2 **APPLICABLE CODES**

IS 8112	Specification for 43 grade ordinary Portland Cement.
IS 383	Specification for Coarse and fine Aggregates from natural sources.
IS 457	Specification for Ceramic unglazed Vitreous Acid-Resisting tiles.
IS 777	Specification for Glazed Earthenware Tiles.
IS 1237	Specification for Cement Concrete Flooring Tiles.
IS 1443	Code of Practice for Laying and Finishing of Cement concrete Flooring Tiles.
IS 2114	Specification for laying in-situ terrazzo floor finish.
IS 2571	Code of Practice for Laying In-situ Cement Concrete Flooring.
IS 1200 (Part 11)	Method of measurement of building works.

5.3 IN-SITU TERRAZO

5.3.1 Material:

The cement used shall conform to IS 8112.

The aggregate & sand shall conform to IS 383 & shall be approved by the Engineer/DFCCIL.

Coloured cement may be either ready mix material or may be obtained by mixing pigments and the cement at site. The colour pigment shall conform to IS 2114 - 1962.

The marble chips shall be white, green, black, chocolate, grey, yellow and green of Udaipur / Baroda variety of size specified in the BOQ items.

5.3.2 Methodology:

The surface to receive the flooring shall be thoroughly cleaned with water using wire brush and made free from all dust and oily substances before the work is started.

The terrazzo cast - in - situ floor shall be laid on the cement concrete screed base of 1:2:4 cement concrete mix using 12mm down aggregate.

The thickness of the base shall be as specified in the BOQ. The mixing, laying and other related activities shall be as specified in chapter 2.0 (Concrete). The top surface of the screed shall be roughened / broomed for proper bonding with terrazzo layer on top.

The PVC / metal / glass strip of the specified size shall be secured properly in the concrete bed maintaining proper line & level to form panels of area not greater than 1.5 mm2 each. The top of these strips shall be flush with the laid terrazzo level to ensure full & clear exposure after polishing.

When the cement concrete base has sufficiently hardened, terrazzo mixture of chips & cement of appropriate thickness as specified in the BOQ shall be laid. The terrazzo mix shall be prepared by dry mixing of marble chips, cement, pigments in the specified proportions. Water shall then be added to obtained a plastic mix of suitable consistency as directed.

This terrazzo layer shall be then rolled length wise as well as cross wise. Additional chips shall be sprinkled on the surface and rammed until the surplus cement oozes out and chips forced together to ensure that the finished floors have less than 70% visible aggregate. Final surface shall be lightly trowelled. Templates shall be used for leveling. Leveling shall be true and checked with 3 m straight edge.

In case of skirting &dadoing, terrazzo layer of approved mix & colour shall be laid over a base coat of cement mortar 1:3 (1 Cement : 3 Coarse Sand) to true line & level.

Laid terrazzo shall be kept wet for a period not less than 6 (Six) days and then minimum 3 (Three) coats of machine polishing shall be done using Carborundum stone of appropriate grade. Sufficient quantity of water shall be used while polishing to prevent scratching. Voids, if any, shall be filled with neat grout of same mix & colour as the base and allowed to cure for minimum 72 (Seventy two) hours before subsequent coat of polishing is taken up. The surface shall then be cleaned thoroughly, dried and finally be polished using approved made of polish to a finish to the entire satisfaction of the Engineer/DFCCIL.

Samples of terrazzo and mosaic work shall be prepared first for the approval of the Engineer/DFCCIL. Work shall conform strictly to the approved samples and only approved materials shall be brought to the Site.

5.3.3 Measurements

In-situ terrazzo flooring &dadoing shall be measured in Square metres after making deductions for openings and the likes. Skirting shall be measured in running meters of specified height except for staircase where the same shall be measured in square metres. The rates shall include providing base, forming angles, rounding, curing, rubbing and polishing etc. complete.

5.4 **INDIAN PATENT STONE**

5.4.1 Cement concrete floor in a ratio of 1:2:4 (1 cement: 2 Sand: 4 Aggregate) of average 50 mm thickness shall be laid in panels.

The concrete surface finish may be monolithically laid with structural slab or laid over hardened structural slab. For convenience and to protect final finish during the period of construction, laying of concrete over- hardened structural slab shall be preferred.

- 5.4.2 Indian Patent Stone Laid over hardened slab shall be carried out as under:
 - a) Hardened structural slab shall be thoroughly wire-brushed, hacked with mechanical scabler to remove all scum, laitance of cement mortar and allowed to expose coarse aggregate. Surface shall be wetted and cleaned thoroughly.
 - b) Concrete shall be laid in panels. Panels shall be such as to minimize shrinkage and curing. Their length to breadth ratio shall be 1.5:1. It is advisable to keep the maximum length of each panel as 3.0m.

Panels shall be formed by providing shuttering of timber or steel angles to dead accurate level. They shall be rigid and watertight.

- c) In case dividing strips are to be provided, the same shall be fixed to dead accurate level and concrete poured into them.
- 5.4.3 a) The concrete mix used shall be as stiff as possible. When mix is held in hand it shall form a ball but when released will crumble by itself.
 - b) All excess water from the surface shall be mopped up keeping surface just wet.
 - c) Thick cement paste/slurry shall be brushed into the surface just prior to laying of the concrete. It must be noted that slurry shall not be brushed over area where concrete laying is likely to be delayed.
 - d) Concrete laid shall be rammed & compacted as required. It shall be leveled with 3m straight edge.
 - e) Surface shall be well trowelled and rubbed smooth to the satisfaction of the Engineer/DFCCIL.

- f) No additional dry cement or cement mortar shall be sprinkled on the stiffened concrete surface to achieve smoothness.
- g) Concrete shall be kept moist for 14 days.
- h) Edges of panels shall be well compacted to minimize liftings and curlings.
- 5.4.4 IPS-laid monolithic with structural concrete shall be carried out as under:
 - a) Floor concrete slab shall be allowed to stiffen enough but still be in a plastic stage.
 - b) Mix shall be laid in position and well compacted with wooden float and leveled with 3 m straight edge.
 - c) After the surface has become slightly hard, steel trowelling shall be carried out to achieve a smooth, leveled surface.
 - d) No additional dry cement or cement mortar shall be sprinkled on the stiffened concrete surface at any stage.
 - e) The concrete shall be wet cured for 14 days.
- 5.4.5 The hardener in the concrete floor of quality as approved shall be applied at the rate as specified by the manufacture in the top coat of flooring, if specified in BOQ.
- 5.4.6 In case of skirting &dadoing, it shall be laid with a cement sand rendering 1:3 to true line & level and finished with a floating coat of neat cement.

5.5 MARBLE FLOORING / GRANITE FLOORING

5.5.1. Materials

Marble / granite Slab – The marble / granite shall be of approved shade/texture and sources as mentioned in the schedule of quantities and their size and the thickness shall be as shown on the drawings and as approved by the Architect/Engineer/DFCCIL. They shall be of selected quality, hard, dense, uniform and homogeneous in texture and free from flaws, cracks or other structural defects. It shall have even and crystalline grains. The surfaces & edges shall be machine cut, surfaces to an even and perfectly plain surface and edges true and square. The rear face shall be keyed to provide bond for the mortar. No slab shall be thinner than the specified thickness at its thinnest part. The dimension of the slab shall be sizes as required. In case of bigger slabs, smaller sizes in required shapes may be drawn out as shown on drawings. The granite slabs shall be pre-worked to mirror/flame/chisel dressed finish. A few approved samples of finished slabs shall be deposited by the contractor in the office of the Engineer/DFCCIL.

Concrete Base and Mortar Bedding – Cement mortar for bedding shall be mixed by a mechanical mixer or as directed. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Care shall be taken in preparing the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the stones. Before spreading the mortar, base shall be cleaned of all dirt, scum, or loose materials and then well wetted without formed any pool of water on the surface. In case

of RCC floors, the top shall be left a little dry. All point of level for the finished paving surface shall be marked out. The mortar shall then be evenly and smoothly spread over the base by the use of screed battens to line, Level/slope asified, only over so much area as will be covered with slabs within half an hour. The thickness of the mortar bedding shall be as specified in the BOQ and shall not be less than 12 mm. Unless otherwise specified, the proportion of mortar bedding shall be 1:4 cement mortar (1 cement : 4 coarse sand).

5.5.2 Workmanship

Laying Marble / granite slabs – Before laying, the marble / granite shall be thoroughly wetted with clean water. Neat cement grout of honey like consistency shall be spread on the mortar bed over as much area as cold be covered with the slabs within half an hour. Specified type of marble / granite slabs shall be laid to pattern as directed on the neat cement float evenly and firmly and shall be laid to a pattern as directed on the bed to the required level and slope in the mortar bed. Each slab shall begently tapped with a wooden mallet, till it is firmly and properly bedded. There shall be no hollows left. If there is a hollow sound heard while gently tapping on the slabs, such slabs shall be removed and refixed properly. The edges of the slabs shall be buttered with slurry of white cement mixed with pigment matching the colour of stone slab and joint shall be hair fine in width and straight, grouted with neat coloured cement slurry to match the colour of the marble / granite. The joints shall be stuck smooth but there shall be no smearing of mortar over the slabs. The edges of the adjoining slabs shall be in one plain. All surplus cement slurry shall be removed and the surface wiped out clean with wet soft cloth.

The flooring shall be kept undisturbed for at least 7 days, and wet for fourteen days. Marble flooring shall be machine polished to anti-skid/wax/tin-oxide polish finish as specified.

5.5.3 **Rates to include**

The rates for item of marble / granite flooring shall include for the following:

- Preparing/treating the sub-floor or base.
- All labour, materials and equipment and consumables, sub-base, laying mortar bed, grouting, fixing marble / granite slabs, as specified and making up the joints including grinding, finishing, polishing and all bye works to the satisfaction of Consultant/ Engineer/DFCCIL.
- Any cutting and wastage, if required, to achieve required size/shape and configuration as specified in the drawing.
- Curing and removal of muck.
- Cleaning the floor from all stains, etc.
- Rounding or nosing at the edge and making holes, finishing around opening wherever required and finishing with the adjoining surface and machine polishing wherever required.
- Work at all locations & heights with all lead and lift.

5.6. CERAMIC TILE FLOORING

5.6.1 Materials

Ceramic tiles shall be coated or fully vitrified and shall conform to IS:770/ BS 6431/E.N.777 of the latest edition. Sizes maybe 450 x 450. 300 x 300, 200 x 200mm or as specified. The thickness of the tiles shall vary from 7.3mm to 10mm. The colour, design and brand shall be as approved by Architect/Engineer/DFCCIL.

5.6.2 Workmanship

Sub-floor preparation – The floor should be structurally sound and rigid and cleared off waxy/oily/films and curing compounds. Surface must be free from rising dampness and hydrostatic pressure. If required, the floor should be leveled with cement screed as per directions of the Engineer/DFCCIL.

Floor layout – The room should be squared off, measured and chalk lines are marked. Once marking is in place, lay loose tiles across the slope in both directions to balance the room so that the cut tiles are of the same size on either side.

Fixing – Tiles shall be laid over a cement mortar 1:4 (1 Cement : 4 Coarse Sand) and a floating coat of neat cement of required thickness as per the drawings. Joints shall be finished and pointed with white cement and pigment of matching shade.

5.7 GLAZED/CERAMIC TILES DADO AND SKIRTING, ETC.

5.7.1 Materials

Tiles – Glazed, coloured, plain or with design, glossy or mat finished of size as specified, including specials, shall be of approved make and quality and shall have a gloss or mat unfading stable finish of uniform shade, free from flaws and defects and shall conform to IS 777 1961 in all respects. Samples of tiles shall be got approved by the Architect/Engineer/DFCCIL who will keep them in his office for verification as to whether the materials brought and used conform to the approved samples.

Mortar backing – All joints in the face work shall be raked out to a depth equal to but not less than the width of the joints or as directed bys the Engineer/DFCCIL. Concrete surfaces shall be properly hacked to the lines and levels. All dirt, soot, spill, or any other materials that might interfere with satisfactory bond shall be removed. The surface shall be cleaned and scrubbed with fresh water and kept wet for 6 hours prior to applying backing mortar. The dado work shall not be commenced unless the preparatory work is passed by the Consultant / PMC. The proportion of mortar for backing shall be 1:3 cement mortar. Sand in mortar bedding shall be form approved source, and shall conform to quality of sand for plastering. The thickness of mortar backing shall be as specified in the BOQ but shall not be less than 12 mm.

5.7.2 Workmanship

Fixing Dado Tiles – The fixing of tiles to the walls shall be done only after flooring is laid. The white or coloured glazed tiles shall be soaked in water for at least 12 hours before use. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff. The back of tiles shall be covered with a layer of neat cement paste and the tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet until it achieves the desired level and plumb and configuration, as specified in the drawing. The fixing shall be done from bottom of wall upwards without any hollows in the bed or joints. Each tile shall be fixed as close as possible to the adjoining tiles so that all tiles faces are in one vertical plane. The joints between the tiles shall be filled with non-staining white cement/white cement mixed with pigment for coloured tiles and shall not exceed 1.5 mm in width and they shall be kept continuously wet for 14 days. If doors, windows or other openings are located with in the dado area, the sills, jambs, angles, etc. shall be provided with appropriate specials according to the specification and such areas shall be measured along with the dado. Drains shall be provided with specials.

Cleaning – After the tiles have been fixed the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado or skirting work shall be washed and thoroughly cleaned.

5.7.3 **Rates to include**

The rates for the items of dado or skirting shall include the following:

- i) Preparing/treating the base surface to the required line, level or slope to the specified configuration with all bye-works.
- ii) Backing mortar.
- Providing and fixing tiles including all specials, like round edges, angles, gappings, etc. in neat cement float over backing mortar, including cutting of tiles and wastage of tiles etc.
- iv) Joining of the tiles with white cement or white cement mixed with pigment slurry.
- v) Curing.
- vi) Cleaning the wall/dado/skirting surface and flooring from all stains and removal of all debris.
- vii) All labour, materials, use of tools and equipments and consumables for carrying out the items as specified above including all by works for achieving the required surface finish.
- viii) Chamfering the edges including cutting or making holes in tiles for providing, opening in walls wherever required.
- ix) Work at all locations & heights with all lead and lift.

5.8 KOTA STONE FLOORING

5.8.1 Materials

The slabs shall be of selected quality and sizes as required or bigger from which smaller sizes are drawn out as shown on drawings, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering and flaws. It shall be free from strains, cracks, decay and weathering, flaws, defects or damages. These shall be machine cut to the requisite sizes, they should be of the colour indicated in the drawings or as instructed by the Architect/Engineer/DFCCIL. The slabs shall have the top (exposed) face polished before laying.

Before starting the work, the contractor shall get the samples of slabs approved by the Architect/Engineer/DFCCIL.

5.8.2 Workmanship:

Dressing of slabs – Each slab shall be cut to the required size and shape and fine dressed/cut at all the edges to the full depth. The sides thus dressed shall have a full contact if a straight edge is laid along. The sides shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be in true square and free from chippings giving a plane surface.

Preparation – The surface shall be clean and wetted thoroughly before commencing the laying work.

Laying – Sub-grade shall be cleaned, wetted and mopped and mortar bedding spread to line, level/slope as specified. The slab shall be washed clean before laying. It shall be laid on top of bedding, pressed, tapped gently to bring it in level with the other slabs. It shall then be lifted and laid aside. Top surface of the mortar shall then be corrected by adding fresh mortar at hollows or depressions. The mortar is then allowed to harden a bit. Over this surface a cement slurry of honey like consistency at 4.4 kg of cement per square metre shall be spread. The edges of the slabs already paved shall be buttered with grey or white cement with or without pigment to match the shade of the kota slabs as given in the description of item. The slab shall then be gently placed in position and taped with wooden mallet till it is properly bedded, in level with and close to the adjoining slab. The joint shall be as fine as possible and surplus cement on the surface of the slab shall be removed. The slabs fixed in the floor adjoining the walls shall enter not less than 10 mm under the plaster, skirting or dado. The junction between the wall and floor shall be finished neatly. The finished surface shall be true to lines, levels and slopes as specified in the drawing and or instructed by Architect/Engineer/DFCCIL.

Curing – The floor shall be cured for a minimum period of seven days.

Polishing and Finishing – Unevenness at the meeting edges of slabs shall be removed by fine chiseling. First grinding shall be done with Carborundum stones of 48 to 60 grade grit fitted in the machine. Water shall be properly uses during grinding. The second grinding shall be started with carborundum of 120 grit. Final grinding shall be done when other works are finished. The machine shall be fitted with Carborundum of grit 220 to 350 and the floor

ground using water in abundance. The floor shall then be washed clean with water. The floor shall then be finally finished/polished as specified.

5.9. GRANITE SLAB CLADDING

5.9.2 Materials

Slab shall be of selected quality, hard, sound, dense and homogeneous textures, free from cracks, decay, weathering of flaws. Stone slabs shall be of uniform colours and as approved by the Architect/Engineer/DFCCIL. They shall be machine cut and mirror polished or finished as specified and shall conform to the required sizes. Thickness shall be as specified in the respective items.

5.9.3 Workmanship

Stone or stone slab shall be of size as shown on drawings or as directed by Architect/Engineer/DFCCIL. Exposed faces, full beds and joints shall be dressed/finished as directed. Joints shall be cut square to the face and shall be at right angles to each other or as directed. The facing shall be fixed in cement mortar truly in plumb and in perfect place straight or curved as shown on drawing, the base being fully flushed with mortar. The joints shall be exactly true to details. The joints shall be machine polished/fine tooled work. The stones shall break joints for about half height of the coarse. Courses shall be shown on the drawing as directed. Gap between the facing stone and the wall shall be filled with 1:3 cement mortar. Lugs of approved design shall be used to support the stone at every 600mm height and 450mm apart or as necessary to secure the facing stone slab. The surface shall be protected from sun and rain and cured for ten days. Face shall be finished as specified or directed after filling the joints with matching shade cement/cement mortar 1:1 proportion mixed with approved water proofing materials.

5.9.4 **Rates to include**

The rates for the items of cladding / dado shall include the following:

- i. Preparing/treating the surface of the base to the required line, level or slope to the specified configuration with all bye-works.
- ii. Backing mortar.
- iii. Providing and fixing slabs including wastage etc.
- iv. Joining of the slabs with white cement or white cement mixed with pigment slurry (white cement and pigment to be provided by the contractor).
- v. Curing.
- vi. Cleaning the wall/dado surface and flooring from all stains and removal of all debris.
- vii. All labour, materials, use of tools and equipments and consumables including lugs etc. for carrying out the items as specified above including all by works for achieving the required surface finish.

- viii. Chamfering/rounding at the edges including cutting or making holes in slabs for providing, opening in walls wherever required and finishing with the adjoining.
- ix. Work at all locations & heights with all lead and lift including scaffolding, platform etc., complete.

5.10 SELF LEVELLING EPOXY FLOORING FOR DUST PROOF, LIGHT DUTY FLOORING

5.10.1 Scope

This specification defines the material and other performance requirements for self leveling epoxy flooring in pharmaceutical, food, hospital and other industries. The thickness shall be as specified.

5.10.2 Recommended Epoxy system

The system should be resin rich (resin and hardener component in comparison to the filler content), solvent free, attractive in nature having a smooth finish, excellent adhesion to concrete, excellent chemical and abrasion resistance, easy to clean and tested by National Chemical Laboratory for anti fungal and anti bacterial properties.

The self leveling floor compound is epoxy based consisting of four component viz., resin, hardener, color paste and filler which when mixed provides approx. 1mm or 2mm thick flooring as required. A two component epoxy primer is suggested to thoroughly cleaned substrate prior to application of self leveling compound. The self level flooring system should have the following mechanical properties:

Compressive strength	-	780 kg/cm2
Flexural strength	-	62 kg/mr
Tensile strength	-	200 kg/cm2
Impact strength	-	68 kg/cm2
Bond strength	-	36 kg/cm2
Pot life	-	50 – 60 minutes
Full curing	-	7 days for heavy loads. 2 days for light Loads

5.10.3 Application

Surface Preparation

Oil grease, algae or any other substances likely to impair good bonding, should be removed from the surface. All new concrete should be sound and be given a maturation time of 28 days and dried thoroughly. Moisture testing should be done to ensure moisture limit not exceeding 7%. Ground floor slabs should be water proofed to prevent seepage from the negative side. Shot blasting should be carried out on all surfaces prior to application of primer coat.

Mixing Proportion

Primer coat

As per approved manufacturer's specification

Self level topping (Beck Bond SLF 18 or equivalent) As per approved manufacture's specification Method of Application

Primer Application

Mix the two components viz. resin and hardener in proportion as directed. Once mixed the system should be applied in a thin, continuous film using stiff brush or roller. Porous floors may require two coats of primer. The system should be allowed to be tack free (approx. 4h at room temperature) prior to application of the self leveling compound.

Self leveling topping

Beck bond SLF 18 or equivalent is supplied in pre-weighed four components ready to use on site. Preferably use slows speed electric stirrer for mixing the components. First mix Beck Bond SLF 18 A with Beck Bond SLF 18 CP in a mixing vessel until uniform colour is obtained. Then add Beck Bond SLF 18 B and stir well. Finally add Beck Bond SLF 18 F and stir until a homogeneous mixture is obtained. Spread Beck Bond SLF 18 mixture on the prepared surface by using toothed trowel or comb as per desired size for the required thickness. After approx. 10 minutes, use spiked roller to remove entrapped air. Allow floor topping to cure for 2 for 7 days at room temperature before use.

The area should be covered properly to ensure no deposition of dust and other particles to ensure that the finish does not get affected.

5.10.4 Coverage

Coverage depends on the nature of the substrate. Approximate consumption:

0.25 kg/sq.m. for primer

6.0 sq.m. kit for floor topping of a thickness of 1mm.

5.10.5 Handling precaution

Only skilled and experienced workers should be entrusted with the application of the self leveling epoxy system. Rubber or polyethylene gloves must be worn by the workers handling resin products. Tools and mixing equipment should be cleaned immediately after use by using scrappers and solvents like xylene.

6. TIMBER, ALUMINIUM DOORS & WINDOWS

6.1 **SCOPE**

This Specification describes the general requirements of woodwork & joinery & Aluminium works to be used on projects.

6.2 **APPLICABLE CODES**

The latest revision of the following Indian Standards and Codes, unless otherwise specified shall be applicable.

6.2.1 Woodwork & Joinery

- IS 287 Recommendations for Maximum Permissible Moisture Content for Timber Wood for Different Purposes in different Zones.
- IS 851 Specification for synthetic Resin Adhesive for Construction (Non- Structural) in Wood.
- IS 1141 Code of practice for Seasoning Timber.
- IS 852 Specification for Animal Glue for General Woodworking Purpose.
- IS 2202 Specification for Wooden Flush Door Shutters (solid core type)
- Part I Plywood Face Panels.
- Part II Particle Board Panels and Hardboard Face Panels
- IS 3087 Specification for Wood Particle Board (medium density) for General Purposes.
- IS 1200 Recommended for method of measurement.

6.2.2 Aluminium Works

- IS: 504 Methods of Chemical Analysis of Aluminium and its alloys
- IS: 733 Wrought Alumini8um Alloys Bars, Rods and Sections (for General Engineering Purposes)
- IS: 1081 Code of Practice for Fixing and Glazing of Metal (Steel and Aluminium) door, Windows and ventilators.
- IS: 1285 Specifications for Wrought Aluminium and Aluminium Alloy, Extruded Round Tube and Hollow Sections (for General Engineering Purposes)
- IS: 1382 Glossary of Terms Relating to Glass and Glassware
- IS: 1868 Specification for Anodic Coatings on Aluminium and its Alloys.
- IS: 1948 Specification for Aluminium Doors Windows and Ventilators (incorp amend 1)
- IS: 1949 Specification for Aluminium Doors Windows for Industrial Buildings
- IS: 2553 Safety glass-specification (Part-1) General Purpose(third Revision).
- IS: 2673 Dimensions for Wrought Aluminium and Aluminium Alloys, Extruded Round Table.
- IS: 2835 Specification for Flat Transparent Sheet Glass.
- IS: 6477 Methods of Testing Anodic Coatings on Aluminium.

Note:

1. Wherever a reference to any Indian Standard appears in this specification and as above it shall be taken as a reference to the latest version of the Standard.

The lists are included for guidance only and the omission of any CP, IS code from the list does not relieve the contractor from compliance therewith:

Aluminium Glazing shall be designed and fabricated as per Indian Standard Codes of practice relevant to Aluminium doors, windows, glazing, testings, measurements etc. in absence, guidance is also to be taken from British and American Standards. All such reference to be taken for guidance and adopted to suit local conditions.

6.3 WOOD WORK AND JOINERY

6.3.1 **Timber**

Timber used for joinery shall be the best of its respective class, seasoned for a minimum of six months by air-drying, of natural growth and free from defects such as cracks, splits, shakes, dead knots, soft spongy spots and waves of injurious open stakes. When one kind of timber is used it shall be of uniform colour to the satisfaction of the Architect/Engineer/DFCCIL.

Grains shall be reasonably larger than 6 square centimeters and the aggregate of all knots shall not exceed 0.5% area of any one piece.

Timber shall be kiln dried to IS: 1141 and conform to IS: 287 in regard to moisture content. The maximum permissible limit shall be +3% for the average moisture content of all samples from a given lot and +5% from individual samples from a given lot. This shall apply when the thickness of timber is more than 50mm. Small size timber tolerances shall be +/-2% and +/-3% respectively.

The Contractor shall provide samples of all timber and other materials to be used in the work for the approval of the Architect/Engineer/DFCCIL. All timber and other materials brought on to the Site shall strictly comply with the approved samples.

Timber shall be seasoned, chemically treated and treated with a 10 (ten) year guaranteed and approved anti-termite treatment to render it free from decay and insect attack.

6.3.2 **Doors**

Doors shall be paneled or solid flush doors as described, external flush doors being made with weatherproof plywood. Flush doors shall conform to IS:2202 (Part I) and commercial veneers shall conform to IS: 303.

Decorative veneers shall be Grade 1 and conform to the requirements for decorative veneers specified for Grade 1 decorative plywood interior grade with a thickness not exceeding 1 mm.

Lippings shall be of best quality hardwood. Teak lippings, where described, shall conform to the specification for best quality teakwood. Lippings around doors shall be of one piece not less than 25mm wide with a depth equal to the door thickness. Double leaf doors shall have lippings on the meeting stiles not less than 35/40 mm deep.

Approved plastic or laminated veneers shall be provided where specified and fixed with "Revicol" or other equal and approved adhesive. Finished surfaces shall be thoroughly cleaned with wax polish.

6.3.3 Windows

Windows shall be as specified and, unless otherwise described, shutters shall have one pair of hinges, two tower bolts (one 225mm long and the other 150mm long), one handle and one hook with eye and a pegstay. Ventilators shall have two mild steel holdfasts and hinges, one handle and one hook and eye at each end with one tower bolt in the centre.

6.3.4 Cupboards and Cabinets

Cupboards, wooden cabinets shall be provided as shown on the drawings. Doors may be either hinged type or sliding type as detailed. Dimensions shown on the drawings shall be strictly followed.

6.3.5 Railings and Architraves

Railings and architraves shall conform to the shape shown ons the drawings or as approved by the Architect/Engineer/DFCCIL and fixed by means of screws, counter-sunk or otherwise, or bolts.

6.3.6 Glazing in Windows, Doors

Glazed windows, louvers, ventilators and doors shall be provided with either clear, float or pinheaded glass 5.5mm thick or as otherwise described, shall be free from all blemishes and conform to IS 1761.

6.3.7 **Ironmongery and Fittings**

Fittings and fixtures and other ironmongery shall be as detailed drawing and shall comply with the relevant IS Standards and Codes of Practice.

All nails, screws, fixings, and the like shall be of hot dip galvanized or brass or non-ferrous material as described.

6.4 WORKMANSHIP

6.4.1 General

Workmanship shall be of the best quality and the Contractor shall check all dimensions on Site prior to putting joinery work in hand.

All joinery work shall be accurately set out in strict accordance with the drawings and shall be framed together in the best possible manner and with the best possible method of jointing.

No timber shall be painted, tarred, oiled or the like before it has been inspected by the Architect/Engineer/DFCCIL. Any effort to hide defects by plugging, painting and the like shall lead to the timber being rejected by the Architect/Engineer/DFCCIL. All rejected timber shall be immediately removed from the Site.

Thickness specified for wrought timber are, unless otherwise specified, prior to planning and an allowance of 3mm shall be made for wrought faces.

Sawing and planning of timber shall be done in straight lines and planes to produce uniform thickness. Joinery work shall be wrought on all faces and finished off by hand with sandpaper with slightly rounded arises.

Before joining wood frame members shall be planed smooth and accurate to the final size. Rebates, roundings, mouldings and the like shall be made before the members are jointed.

Mortice and tenon and dovetailed joints as required shall be strong, neat and shall fit without wedging and/or filling. Joints of frames shall be pinned with 10 to 15mm diameter hardwood pins and white lead after the members have been glued and pressed together.

Joinery work which splits, fractures, shrinks or shows flaws or other defects due to unsoundness, inadequate seasoning or bad workmanship shall be immediately removed and replaced with sound material at the Contractor's own cost.

6.4.2 **Door and Window Frames**

Door, window and ventilator frames, transoms and mullions shall be rebated. Top frame members of doors and top and bottom frame members of windows and ventilators shall project about 150mm in brickwork. Vertical members of door-frames shall project about 50mm below finished floor levels.

Door and window frames shall be provided on each side with 3 nos. 225 x 25 x 6mm mild steel flat split hold-fasts which shall be built into masonry or cast into concrete work in accordance with IS: 4021.

Frames shall be finished smooth to receive paint, polish or any other specified finish. Surfaces of timber fixed to masonry or concrete shall be painted with hot bitumen coal tar or any other approved wood preservative or primer before being placed in position.

6.4.3 **Door and Window Shutters**

Door and window shutters shall conform to the requirements of IS: 1003 (Part I and II) and IS: 2202 (Part I)> If required, flush door panels shall be tested in accordance with the requirements of IS: 4020.

All faces of door and window shutters shall be at right angles, free from twist and warp in the plane. Faces shall be sanded to obtain a smooth, even texture.

Shutters shall be painted on the commercial side with two coats of synthetic enamel paint over an approved coat of primer. Decorative veneer sides shall be wax or French or Melamine polished with two or more coats as specified.

Double leaf shutters shall have meeting stiles rebated 20mm deep and shall be either splayed or square type with teak wood lipping not less than 35/40 mm deep.

Care shall be taken to prevent damage of any kind or loss of shape during transport, handling, stacking and hanging.

6.5 MEASUREMENT AND PAYMENT

Timber frame for Doors, windows, ventilators and louvers will be measured in cubic metres. Shutter for Doors Windows shall be measured in square metre. Hardware and ironmongery shall be measured separately, unless otherwise described in the Bill of Quantities. Quoted rates shall be deemed to the exclusive of polishing and/or painting.

6.6 SPECIFICATION FOR ALUMINIUM WORK

Standards, Specifications, associations, and regulatory bodies are generally referred to throughout the specifications by their abbreviated designations. The materials and workmanship shall be in accordance with the requirement of the appropriate CP, IS code wherever applicable together with any building regulations or bye-laws governing the works.

6.7. **SCOPE**

This specification applies to the aluminium windows and glazing works to be executed by the Contractor. It is to be read in conjunction with and subject to the general and special conditions of contract and in conjunction with the drawings, the schedule of rates and such other documents as may from time to time be agreed upon as comprising part of this contract.

DESCRIPTION

The work as shown or specified includes the designing, fabricating, furnishing and installing of Exterior Windows and fixed glazing and related glazing materials.

The work shall include all labour, materials, equipments, accessories, tools, plants and services necessary to complete the aluminium windows as shown on the drawings and specified herein, but not limited to the following:-

Aluminium casement windows with one side / both side openable shutters. Fixed aluminium windows with large size glasses.

6.8 SETTING OUT THE WORKS

The Contractor shall arrange necessary instruments, equipments and personnel and shall establish lines and elevations at the site as required for completion of the Works as per architectural drawings. The proposed layout showing all grid lines and exterior wall locations and setting-out points, lines etc. shall be got checked from the Engineer/DFCCIL.

All setting-out points / levels shall be protected during construction by the Contractor and he shall also be responsible for any intermediate setting-out points / levels required for the work.

6.9 SUBMITTALS

6.10.1 SAMPLES

The Contractor shall submit to the Architect/Engineer/DFCCIL samples of all materials for approval and no work shall commence before such samples are duly approved. Samples of aluminium finishes, 300 mm square samples of each type of glass required, range olf tinted /

reflective glasses, glazing sealants, locking arrangements, hinges, hardwares and other accessories and every other work requiring samples in the opinion of the Architect/Engineer/DFCCIL shall be supplied to him by the Contractor and these samples will be retained as standards of materials and workmanship. The cost of the samples shall be borne by the Contractor. The Contractor shall also install sample between two strips of materials similar to or representative of channel surface here sealant or gasket will be used, held part to represent typical joint details.

6.10.2 SHOP DRAWINGS

Contractor's and / or Manufacturer's and Supplier's full scale fabrication, installation and assembly drawings for fullscale each type of windows and for all parts of the work in sufficient detail to enable the Project Manager / Architect to verify conformity with the intent of Contract. Drawing shall identify materials and show the details and dimensions of all component parts including plan and elevation, cross section and details.

Documents showing conformance with specified sound rating.

Design analysis and calculation include design calculations for review of design loads and member profile.

Design parameter adopted and their sources.

6.11 SPECIFICATION FOR FIRE DOORS

6.11.1 Materials

Door frames and leaves are made from Galvanized Steel and in Stainless Steel 304 Grade on request.

6.11.2 Door Leaves

Constructed from 1.25 MM thick galvanized sheet press formed to provide a 46 MM thick fully flush, double skin door shell with lock seam joints and stile edges. Internal reinforcements are provided at top, bottom and stile edges for fire rating. The internal construction of the door is a specially designed honey comb structure with reinforcement at top, bottom and stile surrounds. The internal construction of the door varies with the degree of fire rating as tested. For doors having overall height in the excess of 2300 mm the shutters shall essentially have double latching.

6.11.3 Panels Removeable

Constructed from 1.25 MM thick galvanized steel sheet press formed to provide a 46 MM thick fully flush, double skin panel shell with lock seam joints at stile edges. Internal reinforcements are provided at top, bottom and stile edges for the rating. The internal construction of the panel is a specially designed honey comb structure with reinforcement at top, bottom and stile surrounds. The internal construction of the panel varies with the degree of Fire Rating as tested.

6.11.4 Door Frames

Produced from 1.6 MM thick galvanized steel sheet press formed to double rebate profile of size 143 X 57 MM (+/- 0.3 MM) with a maximum bending radius of 1.4 MM.

The door frames may be built into the brick or block walls using corrugated "TEE" anchors not welded to the frame (first fix). Frames may also be fixed on plastered openings with the help of Metallic Expansion Shield with counter sunk screw (second fix). Door Frames are supplied to knock down form with butt joints for bolted assembly at site.

6.11.5 Vision Glass

Fire rated vision glass with 6 MM thick clear glass can be provided for a maximum of 2 hours fire rating. The vision glass can be provided in 380 MM dia or square / rectangle in various dimensions such as 200 MM X 300 MM, 300 MM X 300 MM etc.

6.11.6 Finish

The doorframes and door shutters are primed with Zinc-Phosphate Stoving Primer. Various finishes in Synthetic Stoving Enamel, Acrylic Stoving Paint or Polyurethane can be provided on request.

6.12 **IRONMONGERY**

6.12.1 Hinges

M.S. Powder Coated Hinges 3 MM thick, fixed to the frame and shutter or stainless steel ball bearing butt hinges 3 MM thick available on request.

6.12.2 Lock

Mortise Sash Lock with Internal Thumb Turn & External Key Operation with Lever Handles, Mortise Dead Bolt, Mortise Baby Latch etc.

6.12.3 FLUSH BOLTS (DOUBLE DOOR)

300 MM concealed extended lever action flush bolt satin finish fixed to top and bottom of the inactive blade.

6.13 SPECIAL FITTINGS

Automatic Door Closer, Panic Hardware, Electro Magnetic Hold Open Device, Door Coordinator, Smoke Seals etc., shall be provided if/as specified.

7. **STEEL WORK**

7.1 **SCOPE**

This Specification describes the general requirements for metalwork on projects.
7.2 STEEL DOORS, WINDOWS AND FITTINGS

Steel doors, windows, ventilators and louvers shall conform to IS 4351 and 1038. Workmanship shall conform to IS 1081.

Steel doors, windows, ventilators, louvers and the ties shall be of the sizes specified and conform to the description in the respective items of work. Whether or not specifically mentioned, all fixtures and fittings necessary for the operation of doors, windows, ventilators and louvers shall be provided.

Doors, windows, ventilators and louvers shall be obtained from an approved manufacturers. Specific approval of the Consultant /PMC for such purchases shall be obtained. Sample shall also be provided for approval before the start of manufacture.

Steel doors shall be of gauge as specified in Bill of Quantities pressed steel flush type with or without removable transoms. Doors shall be provided with a three way bolting device and locking arrangement with duplicate keys and handles on both sides and openable as specified.

Steel windows shall be provided with friction hinges in place of windows with pegstays if so directed by the Architect/Engineer/DFCCIL. For centre hung and top hung ventilators suitable spring catch/pulley and chord arrangements shall be provided to facilitate opening. Whenever fly mesh over windows is specified it shall be fixed to windows and suitable lever type roto-type arrangements provided for the opening or closing of the glazed panels from inside.

Where specified steel doors, windows, ventilators and louvers shall be airtight. For this purpose the Contractor shall provide necessary padding material such as rubber felt or other equal and approved material.

Doors, windows, ventilators and louvers shall be measured in square metres. Quoted rates, unless otherwise described shall be inclusive of glazing and shall be free from all blemishes.

Quoted rates shall also be inclusive of fixing doors, windows, ventilators and louvers to brickwork, concrete work or steel framing by making holes/drilling holes in steelwork where required complete.

Quoted rates, unless otherwise described in the Bill quantities, shall include for one coat of approved zinc rich primer.

7.3 **ROLLING SHUTTERS**

Rolling shutters shall conform to the size indicated on the drawings and shall be of best quality to the approval of the Architect/Engineer/DFCCIL. Rolling shutters shall be in one piece and be made of minimum 18-gauge heave steel sheets.

Cylindrical hoods shall be provided at the top to enclose the shutter when open and rolling shutters shall be provided with suitable locking arrangements and deep channel guides.

Galvanized rolling shutters shall be made of hot dipped galvanized slats; hood, and deep channel guides all preferably in one piece.

Hand operated pull and push type rolling shutters of sizes larger than 10 square metres in area and of very large gear operated and/or as directed by the Architect/Engineer/DFCCIL shall be provided with ball bearings for smooth and efficient operation. In case of large rolling shutters and depending upon local wind conditions rolling shutter should be provided with special locking type of wider channel guides or shall be provided with central movable channel supports to take up the design wind pressures in the area.

Quoted rates shall be deemed to be inclusive of providing one coat of approved primer coat. Quoted rates shall also include the cost of lever locks and erection. Fixing lugs are to be provided to guide channel to suit actual site conditions or as directed by the Architect/Engineer/DFCCIL.

7.4 **PRESSED STEEL DOOR FRAME**

7.4.1 Material

Guardian Door frames and leaves are form galvanized steel.

7.4.2 **Door Leaves**

Constructed from 1.25 MM thick galvanized sheet press formed to provide a 46 MM thick fully flush, double skin door shell with lock seam joints at stile edges. Internal reinforcements are provided at top, bottom and stile edges for fire rating. The internal construction of the door is a specially designed honey comb structure with reinforcement at top, bottom and stile surrounds. The internal construction of the door varies with the degree of fore rating as tested.

7.4.3 **Door Frames**

Produced from 1.6 MM thick galvanized steel sheet press formed to double rebate profile of size 143 X 57 MM (+/- 0.3 MM) with a maximum bending radius of 1.4 MM.

The door frames may be built into the brick or block walls using corrugated "TEE" anchors not welded to the frame (first fix). Frames may also be fixed on plastered openings with the help of Metallic Expansion Shield with counter sunk

screw (second fix). Door Frames are supplied to knock down form with butt joints for bolted assembly at site.

7.4.4. Vision Glass

Fire rated vision glass with 6 MM thick clear glass, if specified shall be provided for a maximum of 2 hours fire rating. The size of the vision glass may be 380 MM dia or square / rectangle in various dimensions such as 200 MM X 300 MM, 300 MM X 300 MM, 130 MM X 270 MM etc.

7.4.5 **Finish**

The door frames and door shutters shall be primed with Zinc-Phosphate Stoving Primer.

7.5 **IRONMONGERY**

7.5.1 Hinges

Stainless steel ball bearing butt hinges, 3 MM thick, flushed to the frame and shutter.

7.5.2 **Lock**

Mortise Sash Lock with Internal Thumb Turn & External Key Operation with Lever Handles.

7.5.3 Flush Bolts (Double Door)

300 MM concealed extended lever action flush bolt satin finish fixed to top and bottom of the inactive blade.

7.5.4 **Options**

Automatic Door Closer, Panic Hardware, Electro Magnetic Hold Open Device, Door Coordinator, Smoke Seals etc., can be provided if required.

7.6 MILD STEEL GRILLS

Mild steel grills for window's, ventilators and the like shall be made of square, flat or round steel sections and of the sizes specified and conform to the descriptions of the respective items of work.

Grills shall be fixed to the structure of any material by the use of build-in fixings, screws and/or welding and the making good of the surround.

Quoted rates, unless otherwise specified in the Bill of Quantities shall include for painting with two coats of approved enamel paint over one coat of approved zinc rich primer.

7.7 MILD STEEL RAILINGS

Mild steel railings shall be made of square, flat or round steel sections and of the sizes specified and conform to the description of the respective items of work.

Quoted rates shall include for all fabrication and fixing in place as shown on drawings using the described methods.

Quoted rates, unless otherwise specified in the Bill of Quantities, shall also include for painting with two coats of approved enamel paint over one coat of approved zinc rich primer.

Quoted rates shall not include for woodwork items, such as hand rail, sills, side posts, newels and the like, which shall be paid separately against corresponding items in the Bill of Quantities.

7.7.1 MILD STEEL LADDERS / CATWALK

Mild steel ladders of the width and length specified shall be made of 40mm x 6mm or approved size flat steel stringers and 18mm or approved diameter steel rungs and fixed to the structure as described.

Quoted rates shall include for all fabrication and fixing in place as shown on drawings using the methods described.

Quoted rates, unless otherwise specified in the Bill of Quantities, shall also include for painting with two coats of approved enamel paint over one coat of approved zinc rich primer.

8. WATER PROOFING

8.1 **SCOPE**

This specification describes the general requirements of water proofing for basements, water tanks, toilets and roofs on projects.

8.2 APPLICABLE CODES

The latest revision of the following India Standard and Codes, unless otherwise specified shall be applicable to roof treatment:

1202-1978	Determination of Specific Gravity (Reaffirmed 1990)
1203-1978	Determination of Penetration (Reaffirmed 1990)
1205-1978	Determination of Softening Point (Reaffirmed 1988)
1208-1978	Determination of Ductility (Reaffirmed 1988)
1209-1978	Determination of Flash Point and Free Point
	(Reaffirmed 1988)
1211-1978	Determination of Water Content (Dean and Stark Method)
	(Reaffirmed 1988)
1212-1978	Determination of Loss On Heating (Reaffirmed 1988)
2645-1975	Specifications For Integral Cement Water Proofing
	Compounds (Reaffirmed 1992) (1st Revision)
3346-1980	Method of The Determination of Thermal Conductivity
	Of Thermal Insulation Materials (two slabs guarded not
	Plat method (Reaffirmed 1990)
3348-1965	Specifications For Fibre Insulation Boards (Reaffirmed 1990)
4671-1984	Expanded Polystyrene For Thermal Insulation
	Purposes (Reaffirmed 1990) (1st Revision)
5688-1982	Method of Test of Preformed Block Type and Pipe
	Covering Type Thermal Insulations (Reaffirmed 1990) (1 st Revision)
7193-1994	Cellular Concrete For Thermal Insulation (Reaffirmed

8183-1976 (1990) Bonded Mineral Wool (1st Revision)

8183-1993 IS 1200 Recommended mode of measurement.

8.3 WATERPROOFING AND INSULATION:

Waterproofing and Insulation for roof slab: waterproofing treatment and insulation on concrete slabs with polymetric standard waterporoofing membrane of 3 kg/sq.m. of 4mm thick (Multiplas standard) including coating with compatible Multiplas primer / Cold sticker / Multiplas blown bitumen 85/25 or 90/15 and torch application of membrane with 10 cms overlap where required and ensuring all joints are staggered and overlapped including flashing on parapet or any wall up to a height of 300 mm.

Laying 50mm thick Extruded Polystyrene – Formular Metric 150 slab roof insulation boards to be laid on the above surface with CPRX compound.

Spreading a layer of polyethylene sheet of 200 gauge and struck with bitumen compound at the overlap joints only.

Over the polyethylene sheet fix wire mesh with screed cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded aggregate 12 mm downgrade) with small amount.

Laying screed cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded aggregate 12 mm downgrade) of average thickness 75 mm with slopes to match the drainage including the wattas, gola, etc. including all labour material, plant and machinery etc., complete as directed.

8.4 **INSULATION**

Insulation over terrace at all levels 50mm thick Extruded Polystyrene – Formular Metric 150 slab roof insulation boards to be laid on the above surface with CPRX compound through the approved specialist agency, Spreading a layer of polyethylene sheet of 200 gauge and struck with bitumen compound at the overlap joints only the method of application shall confirm to manufacturer's specification.

8.5 **CEMENT SCREED**

Laying at all levels & locations the cement screed to required slope with average thickness of 75mm in 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 12.5mm) with the weld mesh of size 150mm x 150mm x 3.25mm as per drawing

& details with slopes to match the drainage with all labour, material, plant and machinery etc. including the wattas, Khuras etc. all complete, as directed.

8.6 WATERPROOFING FOR TOILET

Acrylic Polymer modified cementitious compound water-proofing Treatment to toilet floors and vertical sides up to 150mm high as under including all labour, material plant and machinery etc. all complete with guarantee of 10 years.

1st coat of Tapecrete or equivalent Acrylic Polymer modified cementitious compound mixed with white cement and silica in proportion of 1:2:1-1/2 (1 Tapecrete: 2 white cement: 1-1/2 silica).

2nd coat of Tapecrete or equivalent Acrylic Polymer modified cementitious compound mixed with white cement in proportion 1:2.

3rd coat of Tapecrete or equivalent Acrylic Polymer modified cementitious compound mixed with white cement in proportion 1:2 (allow for necessary curing and drying time of each coat, providing proper bonding keys in the coats where required) and vata of 75 mm on all vertical and horizontal junctions.

Protective layer: A layer of cement sand screed plaster of thickness 12mm in proportion 1:3 (1 Cement: 3 Sand) mixed with the water proofing Compound as per manufacturer's specification including providing the guarantee for 10 years and all labour material, plant and machinery etc., complete as directed.

8.7 WATERPROOFING KHURRAS

Khurras of size approx. 45x45 cm with average minimum thickness of 50 mm cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20mm nominal size) over PVC sheet 1m x 1m x 400 micron, finished with 12mm cement plaster 1:3 (1 cement: 3 coarse sand) and a coat of neat cement rounding the edges and making it flash with the water proofing treatment and finishing the outlet complete as per the details including all labour, material, plant and machinery.

8.8 BRICKBAT COBA

Providing and laying 100 mm thick average brick bat coba water proofing treatment on RCC slab / screed surface with acrylic chemicals of approved make by 1% by weight i.e. minimum 1 kg. Of chemical shall be mixed with 100 Kg. Of ordinary Portland cement of approved make including finishing the surface complete as per specifications for terrace. Cleaning of RCC slabs/screed surface laying a coazt of slurry and plaster in cement mortar 1:4 (minimum 20mm thick) consisting of admixture of cement chemical to have even surface and to have

grip existing surface/brick bats. Laying a layer of broken bricks in cement mortar 1:4 or as specified admixed with chemical to necessary gradient. After proper curing, once again chemical slurry is provided to fill the joints. The top surface is then finished smoothly with cement mortar 1:4 (minimum 20mm thick) mixed with chemicals. The whole area shall be flooded with water for a period of 2 weeks for curing and testing.

8.9 MEASUREMENT AND PAYMENT FOR WATERPROOF TREATMENT

For terraces and flat and sloping roofs work shall be measured and paid for on the basis of the quoted rates per square metre of surface treated including finished wattas, which will not be measured separately.

Vertical surface treatment shall be measured along the inside perimeter of the parapet and he height of treatment. Treatment continued over horizon tops of parapets shall be added to the

vertical areas calculated as above. Payment will made on the basis of the quoted rates per square metre.

Brickbat coba treated with waterproofing compound will be measured and paid on the basis of quoted rates per Square metre.

8.10 MODE OF MEASUREMENT

For terraces, underground and overhead water tanks, basements, lift pits, AHU Rooms, kitchens and pantries and the like the area covered between the insides of walls (finished) shall be measured in square meters.

Vertical surface treatment shall be calculated in square meters by taking the inside perimeter of the parapet and the height of the treatment over parapet walls measured from the finished horizontal treatment. Where the treatment is continued over horizontal portions of parapets the same shall be added of the areas calculated as above.

Construction Joint treatment shall be measured in Running Metres.

For bathrooms and WC areas treatment carried out in the areas of the sunken floors shall be measured separately in square meters.

Treatment to walls in bathrooms and WC areas shall be measured in square meters taking the height of the waterproof treatment above the finished level of the treatment to the sunken floors.

Brickbat coba treated with waterproofing compound will be measured in square metres.

No deductions shall be made in the floor and wall treatment for sanitary and other fittings and fixtures.

9. PLASTERING

9.1 **Scope**

This Specification describes the general requirements for plaster finishes and rendering on projects.

IS 383	Specification for Coarse and Fine Aggregates.
IS 412	Specification for Expanded Metal Sheet for general Purposes.
IS 8112	43 Grade Ordinary Portland cement.
IS 1542	Specification for Sand for Plaster.
IS 2402	Code of Practice for External Rendered Finishes.
IS 2645	Specification for Integral Cement Waterproofing Compound
IS 1200	Method of Measurement of building and civil Engineering works : Part 12 Plastering and pointing (third revision).

9.2 Materials

Cement shall be ordinary Portland cement confirming to IS 8112 for all purposes.

Sand shall confirm to IS 1542 for white and for colour render only quartz or silica sand shall be used.

For textured finishes and final or finishing coats sand used shall be screened through 3.35mm and 22.36mm IS sieves respectively. For torn texture a slightly larger proportion of sand screened through a 4.75mm IS sieve shall be used.

Water used for mixing and curing shall be clean, clear and free from silt, oil alkalis, acids, salts and the like.

Coloured cement shall be either ready mixed material or may be obtained by mixing pigments and cement on Site. Pigments mixed with cement shall conform to IS 2114.

Integral waterproofing compound shall conform to IS 2645.

Expanded metal backgrounds for plastering and/or rendering shall conform to IS 412.

Neeru shall be obtained by mixing lime putty and sand in equal proportions with chopped jute at the rate of 4 kg per cubic metre and ground to a fine paste in a chemical grinder. Ready mixed neeru shall only be used with prior approval of the Architect/Engineer/DFCCIL

9.3 Workmanship

Mortar mix shall be measured in volume using gauge boxes or by weight. Mixing shall be done mechanically and each mortar batch shall be used within 30 (thirty) minutes. Hand mixing shall only be allowed with the prior approval of the Engineer/DFCCIL and in accordance with his directions.

Proportions for mortar shall be as specified under the respective items of work. Cement and sand shall be mixed dry in the required proportion to obtain uniform colour and water added to produce the required consistency of plaster or render.

Joints in masonry shall be raked to a depth of 12mm with a hooked tool made for the purpose when the mortar is still green and in any case within 48 (forty eight) hours of laying. Concrete surfaces shall be hacked or chipped. Excess bulges and uneven surfaces must be removed and chipped properly to line and level and no additional payment shall be made for this work.

Surfaces to be plastered or rendered shall be washed with fresh clean water to remove all dirt, lose material, grease and the like and thoroughly wetted for 6 (six) hours before plaster work or render is commenced. Concrete surfaces to be plastered or rendered shall however, be kept perfectly dry.

Walls shall not be too wet but only damp at the time of plastering. Damping shall be uniform to obtain a uniform bond between the plaster and walls.

Curing of plaster or render shall be started as soon as the applied coats have hardened enough so as not to be damaged. Curing shall be done by the continuous application of water in a fine spray and shall be carried out for at least 10 (seven) days. Where the specification or the item of work calls for water proofing, the Contractor shall add the recommended percentage of waterproofing compound to the mortar mix. Plaster or render to ceilings shall be carried out before plaster or render to walls and plaster or render to walls shall commence at the top and proceed downwards.

9.4 Internal Plaster or Render

12mm thick single coat cement sand mortar shall be dashed on to prepared wall and ceiling surfaces and finished smooth by trowelling on the surface with neeru (lime cream).

Internal plaster shall also be applied to door and window jambs and the undersides of lintels and the like.

9.5 External Plaster or Render

18mm two coat cement and sand mortar shall be applied to external surfaces as specified. The first coat shall be 12mm thick and the second coat 6mm thick. The first layer shall be dashed against prepared surfaces with a trowel to obtain an even surface. The second layer shall then be applied and finished moving a trowel finished even and uniform surface.

9.6 External Sand Faced Plaster or Render

18mm two coat cement and sand mortar shall be applied to external surfaces. The first or the scratch coat shall be approximately 12mm thick and shall be carried out continuously without break to the full lengths of walls or natural breaking points, such as doors, windows and the like. The scratch coat shall be applied to prepared surfaces with heavy pressure to produce a true and even surface and then lightly roughened by cross scratch lines to provide a bond for the finishing coat. The scratch coat shall be cured for at least 7 (seven) days and then allowed to dry.

The second coat shall be 6mm thick and shall not be applied until at least 10 (ten) days after the application of the scratch coat. Before the application of the second coat the scratch coat shall be uniformly dampened. This coat shall be applied from top to bottom in one operation and without joints and the finish shall be straight, true and even. Only approved white sand shall be used for the second coat and for finishing work Sand for finish shall be of even coarse size and shall be dashed on the surface and sponged.

Where 32mm thick plaster or render is specified for the purpose of providing breading, bands and the like work shall be carried out in either two or three coats as directed by the Architect/Engineer/DFCCIL.

For pebble face finished plaster or render pebbles of approved size and quality shall be dashed against the final surface to obtain a uniform pattern to the satisfaction of the Architect/Engineer/DFCCIL.

9.7 Plaster of Paris

Surface of walls / Ceilings where specified shall be treated with Plaster of Paris. The particular brand of this special plaster and its composition must be previously approved by the Architect/Engineer/DFCCIL. The basic materials for the plaster shall be either Calcium Sulphate for Gypsum. The entire surface must be very smooth and unevenness must be removed. Special

trained and skilled artisans with previous experience of this work will have to be employed for the purpose of achieving high grade finish.

Before application of Plaster of Paris the surface to be treated shall be thoroughly cleaned, brushed and patching must be scraped properly, and then all holes, cracks and patches shall be made good with approved materials.

9.8 Waterproof Finishes

Where specified or directed by the Architect/Engineer/DFCCIL the Contractor shall mix approved waterproofing admixtures obtained from reputed manufacturers to the mortar for plasterwork and render.

Quantities to be used and the method of mixing shall be strictly in accordance with the manufacturer's instructions subject to the satisfaction of the Architect/Engineer/DFCCIL`. Admixtures shall not contain calcium chloride unless specifically approved by the Architect/Engineer/DFCCIL and shall conform to IS 2645.

9.9 Measurement

Work under this item shall be measured by taking the surface of the area plastered or rendered, less deductions for openings, doors, windows, fan opening and the like. Plasterwork or render carried on door and window jambs, around openings and the like shall be measured and added to the general areas. Wherever wattas are required they will not be measured separately but included in the surface areas as measured here above.

10. PAINTING

10.1 **SCOPE**

This Specification describes the general requirements of painting and decorating on internal and external surfaces, woodwork and metal work and varnishing and polishing to be executed on projects.

10.2 APPLICABLE CODES

- IS 75 Specification for raw and refined linseed oil.
- IS 345 Specification for transparent liquid wood filler IS 348 Specification for French polish
- IS 427 Specification for distemper dry colour
- IS 428 Specification for distemper oil emulsion colour
- IS 533 Specification for gum spirit of turpentine
- IS 1477 Code of Practice for painting of ferrous metals in buildings Parts I and II (Pretreatment and Painting)
- IS 2338 Code of Practice for finishing of wood and wood-based materials

- Parts I and II (Operation and workmanship and Schedule).

- IS 2395 Code of Practice for painting concrete, masonry and plaster surfaces.
- IS 2932 Specification for enamel synthetic exterior undercoating and finishing.
- IS 2933 Specification for enamel exterior undercoating and finishing.
- IS 3140 Code of Practice for painting asbestos cement building products.
- IS 3537 Specification for ready-mixed paint, finishing, interior, for general purposes to IS colours.
- IS 4597 Code of Practice for finishing of wood and wood-based products with nitrocellulose and cold-catalysed materials.
- IS 5410 Specification for coloured cement paints.
- IS 6005 Code of Practice for phosphating iron and steel
- IS 6278 Code of Practice for whitewashing and colour washing
- IS 1200 Recommended for mode of measurement.

10.3 PAINTING, LIME WASING AND COLOUR WASHING

10.3.1 **General**

Paint, lime wash and colour wash shall except for white wash, be factory made, delivered to Site in manufacturers' sealed drums in colours approved by the Architect/Engineer/DFCCIL and conform to the relevant Standards.

Paints shall be such as to be capable of withstanding the effects of weather and the atmosphere and the results of wood decay and metal corrosion and shall have good spreading coverage, be easy to apply, form a thin uniform film upon application, not crack when dry and have hard and durable surfaces.

10.3.2 Lime Wash

Materials for lime wash shall be freshly burnt fat lime of good quality free from unburnt stone and other foreign matter dissolved in sufficient quantities of water (4 to 5 litres per kg. Of lime), stirred thoroughly and strained through aclean coarse cloth. Clean gum or Fevicol dissolved in hot water shall then be added in the proportion of 2 gm of gum Arabic per litre of lime to prevent lime wash being removed when rubbed.

Surfaces shall be prepared by removing all mortar droppings and other deleterious foreign matter and thoroughly cleaned with wire or fibre brushes to the approval of the Engineer/DFCCIL. Holes and/or depressions shall be finished with mortar and cured prior to lime washing.

Lime wash shall be applied by brush, the first stroke being from the top downwards, the second from the bottom upwards over the first stroke and similarly with strokes from right and left over the first strokes before they dry. This application forms one coat and each coat shall

be allowed to dry and shall be subject to inspection by the Architect/Engineer/DFCCIL before the next coat is applied. When dry surfaces shall not show signs of cracking and present a smooth and uniform finish free from brush marks, not easily removed when rubbed. Patchy or streaky work will be rejected and shall be re-executed at the Contractor's own expense.

Doors, windows, floors, fittings, fixtures and the like shall be protected from splashes, splashing and droppings, if any being removed and surfaces thoroughly cleaned to the satisfaction of the Architect/Engineer/DFCCIL.

10.3.3 Colour Wash

Colour wash shall consist of lime was composed as described above to which a solution of water and lime fast pigment, boiled if directed, shall be gradually added and stirred until the required tinge is obtained to the satisfaction of the Engineer/DFCCIL.

Surfaces shall be prepared by removing all mortar droppings and other deleterious foreign matter and thoroughly cleaned with wire or fibre brushes to the approval of the Engineer/DFCCIL. Holes and/or depressions shall be finished with mortar and cured prior to colour washing.

Colour wash shall be applied by brush, the first stroke being from the top downwards, the second from the bottom upwards over the first stroke and similarly with strokes from right and left over the first strokes before the dry. This application forms one coat and each coat shall be allowed to dry and shall be subject to inspection by the Architect/Engineer/DFCCIL before the next coat is applied. When dry surfaces shall not show signs of cracking and present a smooth and uniform finish free from brush marks, not easily removed when rubbed. Patchy or streav work will be rejected and shall be re-executed at the contractor's own expense.

Doors, windows, floors, fittings, fixtures and the like shall be protected from splashes, splashing and droppings, if any, being removed and surfaces thoroughly cleaned to the satisfaction of the Architect/Engineer/DFCCIL.

10.3.4 Dry Distemper

Dry distemper shall be of approved make and shade and shall be applied only in dry weather with a broad stiff brush in long parallel strokes.

Priming coats shall be applied to completely dry surfaces as recommended by the manufacturers of patent distempers and approved by the Architect/Engineer/DFCCIL and allowed to dry thoroughly before the next coat is applied.

Surfaces shall be cleaned and all cracks, holes and surface defects repaired with gypsum and allowed to set hard. All irregularities shall be removed by sand papering smooth and wiped clean and surfaces so prepared shall be completely dry and free from dust before distempering is commenced. In the case of newly plastered surfaces special care shall be taken to ensure that they are completely dry before any application is attempted.

Existing, previously distempered surfaces shall be cleaned of grease, dirt, dust and other deleterious matter and cracks, holes and surface defects repaired with plaster of Paris, allowed

to set hard, sand papered smooth and wiped clan. Flaking from previous coatings, if any shall be thoroughly removed.

10.3.5 Acrylic Emulsion Paint

Acrylic emulsion paint shall be of approved make, color and shade to the satisfaction of the Architect/Engineer/DFCCIL.

Acrylic emulsion paint shall be diluted by the addition of a quantity of water equivalent to half the volume of the paint to be applied. The paint and water shall be thoroughly mixed and then strained through cloth.

Priming coats shall be applied to surfaces by brush and allowed to dry properly, holes and depressions being filled with putty prepared with whitening and Acrylic emulsion paint and rubbed smooth and dry and touched up with Acrylic emulsion paint.

Subsequent coats, diluted by the addition of a quantity of water equivalent to about 15% to 20% of the volume of paint to be applied shall be applied to surfaces by brush and allowed to dry thoroughly so that no brush marks shall be seen.

Surfaces shall be cleaned and all cracks, holes and surface defects repaired with gypsum and allowed to set hard. All irregularities shall be removed by sand papering smooth and wiped clean and surfaces so prepared shall be completely dry and free from dust before painting is commenced. In the case of newly plastered surfaces special care shall be taken to ensure that they are completely dry before any application is attempted.

Existing, previously distempered or painted surfaces shall be cleaned of grease, dirt, dust and other deleterious matter and cracks, holes and surface defects repaired with plaster of Paris, allowed to set hard, sand papered smooth and wiped clean. Flaking from previous coatings, if any shall be thoroughly removed.

10.3.6 Synthetic Enamel Paint

Synthetic Enamel Paints and primers, in general, shall be of approved quality, colour and of approved manufacturer. These materials shall be in sealed tins and shall be opened in the presence of the Engineer/DFCCIL.

Preparation of Surface

Iron and Steel Works:

Surface to be painted shall be thoroughly cleaned, sand papered and / or rubbed with emery cloth, if necessary, to remove grease, mortor or any other foreign materials incase of rusted surface, it shall be first cleaned with wire brush till the corroded rust is removed. The prepared surface shall be shiny and free from brush marks, patches, blisters and other irregularities. The surface thus finished shall be got approved for painting.

Wood Work:

All surface to be painted shall be thoroughly cleaned sand papered and removed of all foreign materials. In case of surface having knots and nails holes, this shall be filled knotting and stopping materials. The materials shall be consist of pure shellac dissolved in methylated spirit. Stopping materials shall consist of putty. The surface thus treated shall be allowed to dry and then sand paper smooth (for veneered surface film or French chalk shall be provided to give a smooth surface prior to application of primer).

Application

After preparing the surface, a primer coat shall be applied. The primer coat shall be ready mixed of approved make and manufacturer. After the primer coat is applied and perfectly dried all holes, cracks etc., still remaining shall be filled in with putty and the surface sand papered smooth. Then a second coat of paint of approved shade and manufacturer shall be evenly applied and allowed to dry.

The third coat shall be carefully applied to achieve smooth and even surface after the previous coat has dried up. Minimum 3 coats of paint

Shall be applied inclusive of a primer coat. If a proper and even surface is not obtained to be the satisfaction of the Architect/Engineer/DFCCIL in 3 coats. Contractor shall be taken to be see that dust or other foreign materials do not settle or otherwise disfigure the various coats.

10.3.7 Enamel Painting

Enamel paint shall conform to the relevant Standards and be of the specified make, colour and shades as approved by the Architect/Engineer/DFCCIL. Materials shall be obtained directly from approved manufacturers and brought to Site in manufacturers' sealed drums and tins for inspection by the Architect/Engineer/DFCCIL.

Paint for undercoats and finishing coats shall be ready mixed. Mixing by the Contractor shall not be allowed except with the prior written permission of the Engineer/DFCCIL, in which case preparation of the ingredients and the control of quality shall be in strict conformity with the manufacturers' recommendations and the relevant Standards and Codes of Practice.

Materials shall be properly stored and protected when not in use with the lids of containers kept tightly closed. Paint in open containers during painting operations shall be covered with a thin layer of turpentine to prevent the formation of skin on the surface.

If required by the Architect/Engineer/DFCCIL paint supplied by the Contractor shall be quality tested in an approved laboratory as described in IS 101. Rejected paint shall be removed immediately from Site.

Application

Unless otherwise specified, paint shall be applied by brush. Brushes of appropriate size shall either round or oval shaped and shall be maintained carefully throughout the work so as to be pliable and free from loose bristles. All brushes, rollers, implements and the like used for painting shall be cleaned of all foreign matter prior to beginning different operations.

Contents of drums and tins shall be well stirred before use and constantly during operations with a small, clean and smooth stick to prevent sedimentation at the bottom of containers.

Painting shall be carried out, as far as possible, in dry, warm weather.

Primer coats shall be applied as soon as surfaces have been cleaned and before the deterioration of surfaces by rust and/or contamination by dust, dirt or any other deleterious material. Sufficient time shall be allowed for one coat of paint to dry before the next is applied.

Painted surfaces shall be protected from sun, rain condensation, contamination or other surface damage until they are completely dry, "wet Paint" boards being placed where necessary.

Surface preparation, the application of priming coats, undercoats and finishing coats shall be carried out as specified below or as recommended by the manufacturer.

New plaster shall be carefully rubbed smooth and thoroughly cleaned with fresh water to leave dry and smooth surfaces free from dirt.

Surfaces shall not be primed or painted until they are completely dry and hard and have been approved by the Architect/Engineer/DFCCIL.

Steel surfaces shall be degreased using proprietary brand solvent cleaners approved by the Architect/Engineer/DFCCIL or mineral turpentine or petroleum and other petroleum solvents, such as trichloroethylene or other equal and approved alkali solutions or detergents.

De-rusting of steel surfaces shall be done by manual scraping using wire brushes, fine steelwool, sand paper and the like, mechanically by sand blasting, shot blasting or by flame cleaning or chemical cleaning by methods approved by the Architect/Engineer/DFCCIL.

Enamel paint shall not be applied to woodwork that is not well seasoned. Surfaces of woodwork to be painted shall be thoroughly dry clean and smooth and prepared by using coarse and medium grade sandpaper with finished surfaces free from scratches.

Before applying primers to surfaces of woodwork knotting shall be done with two coats of varnish made by dissolving Shellac in methylated spirits wine or as directed by the Architect/Engineer/DFCCIL.

Recommended Primer shall be

- a) Wood Work Pink conforming to IS 3534
- b) Steel Work Red oxide, zine chromate contorming to IS 2074.
- c) Cement Primer Conforming to IS 109.

Plastered Surfaces: Priming coats shall consist of equal parts of white and red lead mixed in boiled linseed oil to the required consistency applied uniformly over surfaces to be painted. When dry, all cracks, holes and other such defects shall be filled with a mixture of one part of white lead and 3 parts of ordinary putty. Surfaces shall then be rubbed with sandpaper and dusted clean and an undercoat thinly applied so that plastered surfaces are saturated.

Steel surfaces: Priming coats shall consist of red lead conforming to IS 102 applied uniformly over surfaces to be painted. On old or previously painted surfaces and new surfaces already primed with red lead, surfaces shall be thoroughly cleaned and primed with red lead on exposed surfaces as necessary or over whole surfaces as directed by the Architect/Engineer/DFCCIL.

Woodworker surfaces: Priming coats shall consist of red lead, white lead, raw and boiled linseed oil and patent dryers applied uniformly over surfaces to bepainted. When dry, small holes, cracks, open joints and other minor defects shall be stopped with putty made from whitening mixed to proper consistency with raw linseed oil and white lead to facilitate hardening of putty. Surfaces shall then be lightly rubbed down smooth with sandpaper and dusted clean.

Finishing coats: Unless otherwise specified, finishing of all surfaces shall consist of minimum two coats of synthetic enamel paint of approved make, colour and shade. The second coat of paint shall give a flat, semi-glossy or glossy finish as specified or as directed by the Architect/Engineer/DFCCIL and shall present on even appearance and show no brush marks. Stipple finishes, if directed by the Architect/Engineer/DFCCIL, shall be provided at no extra cost.

10.3.8 French Polishing

French sprit polish shall conform to IS 2338 and shall be made by dissolving 0.15 Kg of best quality shellac, free from resin or dirt, in 1 litre of methylated spirit. Suitable pigment shall be added to obtain the required shade or colour.

Workmanship

Surfaces to be polished shall be cleaned and all unevenness rubbed smooth with sandpaper, knots, if visible, being covered with a preparation of red lead and glue. Holes and indentations in surfaces shall be filled with putty made of whiting and linseed oil. Surfaces shall then be given a coat of filler comprising 2.25 Kg of whiting dissolved in 1.5 litres of methylated spirit. When dry surfaces shall again be rubber down perfectly smooth with sandpaper and wiped clean.

Polish shall be applied by using pieces of clean fine cotton cloth wrapped around cotton wool made into pads. Pads shall be moistened with polish sparingly, but uniformly, and completely over the entire surface. When dry a further coat shall be applied in the same way. Finishing shall be carried out with pads covered with a fresh pieces of clean, fine cotton cloth, slightly dampened with methylated spirit, rubbing lightly and quickly with a circular motion, to give a uniform, high class texture.

10.4 RATES FOR PAINTING AND POLISHING

The Contractor's rates for painting, polishing and varnishing work shall include:

1. Provision of all materials, labour and equipment required to execute the work as specified.

- 2. Provision of scaffolding (single/double) including erection and removal.
- 3. Preparation of surfaces.
- 4. Application of the specified number of coats of approved paint, polish or varnish, including priming coat and where proper, even surfaces or shades are not obtained the application of extra coat (s) as directed and to the final approval of the Architect/Engineer/DFCCIL.
- 5. Application of additional priming or other preparatory coat (s) to obtain thoroughly saturated surfaces and filling with putty as required and/or directed.
- 6. Extra cost of painting smooth and/or rough surfaces, such as precast concrete pardis, rough cast plaster, sand faced plaster and the like.
- 7. Curing cement paint as directed for a minimum of 7 days.
- 8. Protection of doors, windows, floors, furniture and fittings, including ironmongery and metalwork from splashing and droppings, including cleaning surfaces as directed.
- 9. Repair of cracks, developing in plaster prior to or after final painting, by filling with suitable putty and painting surfaces again as directed to give even surfaces to the satisfaction of the Architect/Engineer/DFCCIL. Neeru surfaces damaged due to any reason before painting shall be redone by using plaster of Paris as directed.
- 10. Cleaning of all surfaces after painting, polishing and varnishing.

10.5 MEASUREMENT COEFFICIENTS

10.5.1 **Timber Doors and Windows**

- 1. Panelled doors/windowsMeasured flat 1.3 (for each side) including frame
- 2. Flush Doors -do- 1.20(for each side)
- 3. Partly paneled and partly -do- 1.0 (for each side) glazed
- 4. Fully glazed doors windows -do- 0.80(for each side)
- 5. Fully venetioned or louvered
- 6. Door / Windows -do- 0.80(for each side)

10.5.2 Steel Doors and Windows

- 1. Fully glazed doors/windows Measured flat 0.50 (for each side) including frame
- 2. Plain sheeted steel doors / -do- 1.10 (for each side) windows
- 3. Collapsible gates Measured flat 1.50 (for paintingall over)
- 4. Rolling shutters of interlocked -do- jump guide1.10. (for each side) lathsbottom rails, lockingarrangement included (Top cover measured separately)

10.5.3 General Work

1. Expanded metal, MS grill work, Measured flat 1 (Painting all over) grating in guard bars, supporting of balustrades, railing and members shall not be measured separately.

TECHNICAL SPECIFICATIONS FOR INTERIOR & FURNISHING

(NON SCHEDULED ITEMS)

(SECTION-3)

TECHNICAL SPECIFICATIONS FOR NON DSR ITEMS

1. ITALIAN MARBLE STONE FLOORING:

Italian marbles Quarried in Italy and these marble raw stones are imported from Italy to India. Italian marble is famous for rendering a high sheen and visual appeal to the ambiance in which it is installed. It is available all over world.

Italian Marble gives the rich appearance to the house floor, walls, Kitchen, rooms and bathroom with its beautiful colour and special luster. Because of its elegant visual it is commonly used for the decorative purpose in buildings.

1.1.1. Italian Marble Stone

The Italian marble details shall be as specified. Other details such as dressing of slabs laying, polishing, finishing, measurements, and rates shall be as specified in clause.

- 1.1.2. Border. if any, shall be made with Italian marble stone.
- 1.1.3. Approval of Sample Before starting the work, the contractor shall get samples of marble approved by the Architect. Approved samples shall be kept in the custody of the Architect and the marble supplied and used on the work shall conform to samples with regard to soundness, colour, veining and general texture.
- 1.1.4. Curing the work shall be kept constantly moist on all faces for a period of at least seven days.
- 1.1.5 Finishing after the marble work is cured, it shall be rubbed with carborandum stone of different grades no. 60, 120 and 320 in succession or with electrical rubbing machines rubbed with carborandum items 0 to 6 nos. in succession, so as to give a plane true and highly smooth surface. It shall then be cleaned with a solution of oxalic acid, washed and finished clean.
- 1.1.6 Measurements for plain work: Measurements shall be taken correct to a cm in length and breadth and correct to 0.5 cm in thickness.
- 1.1.7 In the case of radially dressed or circular stone used in the work, the dimensions of the circumscribing rectangle of the dressed stone, shall be measured correct to a centimeter and thickness, correct to 0.5 cm.

The cubical contents shall be calculated in cubic decimeter nearest to two places of decimal.

- 1.1.8 The marble work in arches, circular and domes shall be measured as for plain work, but extra shall be allowed for such work over the rate for plain work.
- 1.1.9 Sunk or moulded work in marble shall be measured by volume as per plain marble work or work in arches or domes as the case may be on the basis of circumscribed rectangular block of the finished work but extra shall be paid for such work over the rate for plain work for work in arches, circular and domes. For the purpose of extra payment, volume of every stone sunk or moulded shall be considered.

1.2 WALL LINING/VENEER WORK

- 1.2.1 Stone to be laid shall be wetted before laying. They shall then be fixed with mortar in position without the use of chips or under pinning of any sort. Attemp shall be made to match the grains of veneer work as directed by the Architect/Engineer/DFCCIL. For purpose of matching the grains, the marble slabs shall be selected judiciously. Preferably the slabs shall be those got out of the same block from the quarry. The design shall be reproduced on the ground and the marble slabs should be laid in position and arranged in the manner to give the desired matching of grains. Any adjustment needed for achieving the best results shall be then carried out by interchanging the particular slabs. Special care shall be taken to achieve the continuity of grains between the two slabs one above the other along the horizontal joints. Each marble slabs numbered properly and the same number shall be marked on a separate drawing as well as on the surface to be actually veneered, so as to ensure the fixing of the particular slabs in the correct location.
- 1.2.2 Where cramps are used to hold the unit in position only, the facings shall be provided with a continuous support on which the stones rest at the ground level and other storey levels, the support being in the form of projection from or recess into the concrete floor slab, or a beam between the columns or a metal angle attached to the floor slab or beams. These supports shall preferably be at vertical intervals not more than 3.5 m apart and also over the heads of all openings. Such supports shall also be provided where there is transition from thin facing below to thick facings above.
- 1.2.3 Measurements the length and breadth shall be measured correct to a cm. In case of radially dressed or circular slabs used in the work, the dimensions of the circumscribing rectangles of the dressed stone used in the work, shall be measured & paid for. The area shall be calculated in sqm nearest to two places of decimal.

Marble work in lining upto 4 cm thickness shall be paid by area under veneer work and lining of greater thickness paid by volume under plain marble work.

- 1.2.4 Pointing all exposed joints shall be pointed with mortar as specified. The pointing when finished shall be sunk from stone face by 5 mm or as specified. The depth of mortar in pointing work shall not be less than 15mm.
- 1.2.5 Measurements the length and breadth of the finished work shall be measured in metre correct to cm. The area should be calculated in sq. metre correct to two places of decimal.

The veneering work curved on plan shall be measured as plain work, but extra payment shall be allowed for radii for individual stone not exceeding six metres on external face. For radius beyond six metres the work shall be measured as plain work only.

2. WOODEN FLOORING:

2.1 Material Properties: -

The material shall have a wear resistance surface abrasion resistance, impact resistance, indentation resistance, resistance to rolling castors, resistance to furniture legs, stain resistance, resistance to burning cigarettes, slip resistance and resistance to color fading. Apart from the above properties, the material shall have following additional properties: -

Dimensional Stability:	Less than 0.9 mm
Surface Soundness:	More than 0.8 N per sq mm
Impact Resistance:	IC 2 as per EN 13329
Thickness Swelling:	Less than 12%.

2.2 Material Storage & Pre-requisites: -

The material shall be stored in unopened packages at normal room temperature at least 0.5m away from the walls, for at-least 48 hours prior to the installation. The contractor shall ensure that the boards are undamaged and free from any faults before installation. The contractor shall use felt pads and castor cups on furniture legs and provide external doormats inside all the external doorways to protect the floor at the time of handover. A maintenance guide of the approved company shall be made available any time and handed over to the client at the time of handover.

2.3 Material Installation: -

The normal method of installation of laminated wooden flooring is in a random installation pattern taking into consideration the type of installation pattern desired for the purpose of aesthetics or any technical reasons. The joinery is tongue & grooved in an interlocking pattern including beading at the end. A teak moulding shall be provided and installed at the joinery junction of the wall and the floor as per the approved manufacturer's specifications. The quoted rate shall be inclusive of leveling and laying. Underlay shall be provided as per manufacturer specification.

It is important to ensure the sub floor on which the laminate is being laid is smooth, flat & hard & free from moisture, grease, etc. In case of uneven sub floor the same should be leveled if required by self leveling compound to be paid seperately. There should be no moisture or the moisture level present in the subfloor should be less than 10% before installation of the floor. The laminate shall have Unilin/click locking system. It is recommended to use underlay having water barrier of 250 microns and 2mm polyethylene foam under the planks. The installation shall be undertaken as per the manufacturer's installation instructions.

2.4 Measurements: -

Length and breadth of superficial area of the finished work shall be measured correct to a cm. The area shall be calculated in square metre correct to two places of decimal. No deduction shall be made nor extra paid for voids not exceeding 0.20 square metre. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square metres. The rate shall include the cost of the labour, T&P and materials involved in all the operations described above.

3. Carpet flooring using Carpet Tile of approved make, shade and pattern and of the following specification: High Cut – Low Loop Carpet tile, Premium Solution Dyed Nylon with Anti Stain Treatment, 1/10 gauge, minimum Pile height should be 8.0mm Cut and 3.5mm Loop or with acceptable tolerance, total minimum thickness 9.0mm, Tile size should be minimum 500mm x 500mm, Secondary Back Commercial 100% Re-cyclable. Wear Warranty– product should be warranted for10 Year Warranty with minimum weight loss of pile and colour. All yarns used are Solution dyed to minimize use of water and exclude any effluent production. The tolerance in thickness shall not be more than +/-0.5mm. measurement shall be for the visible area. The carpet shall be laid on levelled surface and no undulations shall be allowed.

3.1 ENTRY MAT

Entry Mat System Providing & Fixing entrance matting (Heavy Duty) with enhanced apsorption. Construction - Looped pile carpet design with solid vinyl backing. Material - Polypropylene & Nylon with vinyl backing. Size - Standard/ as per site.

4. **PVC VINYL FLOORING:**

6mm thick PVC Vinyl flooring with foam backing, vinyl floor covering of size 1200 mm width x 6 metres length of weight 4400 g/m2 with wear layer thickness of 1 mm. Wear layer should be treated with Protocol (UV cured Polyurethane surface treatment) which facilitates ease of maintenance and eliminates the use of acrylic emulsions. Residual indentation should be less than 0.25mm & should conform to EN ISO 24343-1(EN 433). The product should have antibacterial properties. The product should also fulfill dimensional stability (EN ISO 23999(EN 434) & effect of furniture (EN 424). It should also be suitable for under floor heating. The product should have excellent sound absorption of 24 db and excellent shock absorbent behavior. The laid flooring shall confirm the fire rating Cfl-S1 class as per EN 13501-1.

5. TOILET CUBICLES

Toilet cubicles of width and depth as per specifications/ site drawings. Cubicle height to be 2105 mm. Made from solid grade compact high pressure laminate as per IS:2046 manufactured under high specific pressure > 5 MPa with bunch of kraft papers impregnated with thermosetting phenolic resin and decorative papers impregnated with thermosetting melamine resin which provide superior scratch, abrasion, heat, chemical, impact, graffiti & moisture resistance along with anti-bacterial properties. Top Head frame fixed to the wall on both sides using MS- wall brackets. The pilaster is

slotted & affixed to the top head frame and secured from the top leaving all clear gap of 150mm and without any support from the bottom. The intermediate panel shall be anchored to the wall and pilasters. Panel thickness 12 mm. Design no. as specified by Arch. in suede finish. Size of panels to be as per drawing. One door and shared/ stand alone partition shall mean one quantity. The cost of protecting Tile work with polythene and a layer of POP or by any other mean as required to be included in the quoted price of this item.

6. HARDWARE & ACCESSORIES FOR CUBICLE

• H shaped (Top) head frame structure made of extruded Aluminium grade 6063 T5-50-micron epoxy powder coated for surface protection. Size to be 125x70x5T. Corner joinery section, Size to be 40x16.5x1.8T. U-Channel Wall joinery section, Size to be 22x16x1.6T. Door stopper section, Size to be 21x12.5x1.6T.

• Spring loaded Butt Hinges made from Stainless steel grade 304. Surface finish to be matt type. Covers to be lacor coated.

• Conical shape Coat hook with rubber stopper made from Stainless steel grade 304. Surface finish to be matt type.

• Round Door knob diameter 30 mm with grooves for better hand grip made from Stainless steel grade 304. Surface finish to be matt type.-

• Rotating Thumb-turn locking system with privacy indicator made from Stainless steel grade 304. Surface finish to be matt type.

• Stainless steel grade 304 screws.

• Anti-rotation Nylon polyamide grade-6 expandable wall plugs.

• The Work shall complete as per drawing, under supervision of Architect and company experts

SS Series Cubicles- Std Sizes (W x D x H)- 900 mm x 1550 mm x 2105 mm, (Height is including 150 mm gap from bottom) Door Size- 600 mm

6.1 Double Glazed Fixed Partition

Slim Line Modular Aluminium Fixed partitioning frame of 100-105 mm x 25-30 mm which can accommodate 2 panels of glass of 10 mm thicknes separated by 40-50 mm distance for better sound insulation and acoustic properties. The rate to include Design, Fabrication, Supply, Installation & Handover of slimline fixed partition system. the fixed partion system should accomodate openable door on Hinges.Door to be paid seperately. The system of fixed partion with openable door to be custom designed to with stand the design confirming to IS -875 part III. The system shall have two barrier gasket system to hold glasses.

Microwave cured EPDM gaskets to accomodate glass thickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranteed for minimum 10 yr against design & workmanship defects.

The extruded aluminium sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability (Akzonobel) / Super durable (Jotun) Powder coating of 60 - 80 micron confirming to ASTM E 283, ASTM E 331, ASTM E 330AAMA 2604 or anodising shade as approved by architect with minimum 25 micron The non visible aluminium surfaces shall have minimum chromatizing treatment.

Material shall be as per make list in tender document..

All shade approval shall be as per Architect's Approval.

The system shall demonstrate performance for air seal / water seal / structural requirement . The system performance test shall be mandatory to verThe performance test shall be carried out at an accredited laboratory having fully automised data acquisition system with provision to capture all values in the test results sheet . The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330 , AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification.

The quote rate shall include all design, engineering & shop drawing approval from architect.

Glass : 2 NO.10 mm clear Heat strengthened/ TOUGHENED Glass

Tolerence of 5 mm allowed in both dimension of the cross section of the slim line partition as per manufacturers specification.

6.2 SLIM LINE MODULAR SINGLE GLAZED PARTITION

Slim Line ModularAluminums single glazed partition frame of 100-105 mm x 25-30 mm with in bottom and top channel with acoustic gasket as per specification.

The rate to include Design, Fabrication, Supply, Installation & Handover of Fixed partition frame. The fixed partition should accommodate 10mm HS glass. Door to be paid separately. The fixed partition to be custom designed to with stand the design confirming to IS -875 part III. The system shall have barrier gasket system to hold the glass.

Microwave cured EPDM gaskets to accommodate glass thickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranteed for minimum 10 yr against design & workmanship defects.

The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability (Akzonobel) / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 oranodizing shade as approved by architect with minimum 25 micron The non-visiblealuminum surfaces shall have minimum chromatizing treatment.

Material shall be as per make list in tender document.

All shade approval shall be as per Architect/Engineer/DFCCIL Approval.

The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully automised data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification.

The quote rate shall include all design, engineering as per drawing /approval from architect.

Glass: 10 mm clear Heat strengthened/ Toughened.

Tolerence of 5 mm allowed in both dimension of the cross section of the slim line partition as per manufacturers specification.

6.3 HINGED DOOR

Door shutter for above Modular Aluminium partitioning frame should be of 44mm x 70mm using outer frame of 100-105 mm x 25-30 mm veritcal 2 top frame and 50mm x 25mm as outer frame. Glasss beads at horizontal top and bottom should accommodate Glass 11.52 mm thick acoustic glass of combination (5mm + two layers of 0.76 mm thick acoustic PVB + 5mm) HS glass for optimum sound insulation wherever required. Microwave cured EPDM gaskets to the glass as per reqirement. Door to function on hinges.

Tolerence of 5 mm allowed in both dimension of the cross section of the slim line partition as per manufacturers specification.

6.4 SLIDING DOOR AND PARTITION SYSTEM

Slim Line Modular Aluminum single glazed SLDING Door partition SYSTEM unit of total width size of slider door shall be 2.0 mt to 2.4mt as per site requirement with top outer frame of 46x76mm, shutter with top and bottom channel of 30mmx38mm and vertical channels of 18mmX38MM with acoustic gasket as per specification.

The rate to include Design, Fabrication, Supply, Installation & Handover of slim Sliding door system and Fixed partition frame system unit Sliding Openable Door should be on Sliding Mechanism

Partition to be paid separately. The system of Sliding door and fixed partition to be custom designed to withstand the design confirming to IS -875 part III. The system shall have barrier gasket system to hold the glass.

Microwave cured EPDM gaskets to accommodate glass thickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warrantee for minimum 10 yr. against design & workmanship defects.

The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability (Akzonobel) / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 confirming to AAMA 2604 or anodizing shade micron as approved by Architect/Engineer/DFCCIL with minimum 25 micron the non-visible aluminum surfaces shall have minimum achromatizing treatment.

Material shall be as per make list in tender document.

All shade approval shall be as per Architect/Engineer/DFCCIL Approval.

The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify the performance test shall be carried out at an accredited laboratory having fully automised data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification.

The quote rate shall include all design, engineering & shop drawing approval from Architect/Engineer/DFCCIL.

Specifications for ACCOUSTIC Glass: 11.52 mm thick acoustic glass of combination (5mm + two layers of 0.76 mm thick acoustic PVB + 5mm) HS glass for optimum sound insulation wherever required.

Tolerence of 5 mm allowed in both dimension of the cross section of the slim line partition as per manufacturers specification.

7. LACQUERED GLASS:

6 mm and 10mm: 6 mm and 10 mm shall be Extra Clear Glass used for lacquered glass should be of Saint Gobain/ Asahi/ Pilkington and should be toughened in horizontal tempering line.

Lacquered glass to be made industrially (via air brushing process); opaque (if viewed against a support wall), coated with WATER BASED lacquer colour of brand Colour Spray AQUA by Regalead – United Kingdom Or Equivalent Brand ;Which is binded by nano particle pure acrylic); Gloss Level – 40 ; where VOC < 1% ; highly durable ; humidity resistant (conforms to BS EN 1036

1999); environmentally friendly (no lead, no arsenic, no copper, no formaldehyde; compressive strength (1000 MPa) & tensile strength (40 MPa),same as float glass as per the detailed drawings and as approved by Architect. Colour to be checked and tested via INDEX Colour shade card used worldwide as a colour choosing parameter.

INSTALLATION:

Before fitting the glass as a wall covering/paneling requires checking the state of the walls to avoid any deterioration in the paint on the back of the glass • should be fixed on a plain, dry, and clean surface free of aggressive agents • the entire surface should be in a uniform colour or ply colour to ensure a uniform appearance after installation • Glass should not be fixed on the support directly; there should be some space between the and the support to ensure air circulation • Air circulation space should be gap of 1-2 mm between the edges of two glass panels • In case a frame is being used for fixing of the AIS Décor, ensure that the frame is dry and clean • Layout for installation should be prepared prior to installation of the glass • A neutral base Clear silicone (like Dow Corning or McCoy Soudol/ Pentagon mounting tape, and ensure that the tape is pasted in a vertical direction Acid-based silicone should not be used to fix • In case glass is being fixed on plywood, ensure that the surface of the plywood is free from any chemical, lubricant, or moisture • it is recommended tht installation on perfectly levelled 12 mm-thick water- proof marine plywood / MDF / Mineral fibreboard which is mounted on RCC wall / any other structure • If double-sided adhesive tape is used, mounting tape, and ensure that the tape is pasted in a vertical direction. If the glass is to be fixed in partion then the glass should be fixed in microwave cure EPDM gasket perectly fittin in appropriate profile to ensue proper insulation.

In case to be fixed on a wooden frame with beading, ensure good air circulation by making slots or holes at the side of the frame • In case to be fixed on studs, ensure no metallic surface is in touch with the glass. Plastic spacers and sleeves can be used • In kitchens, do not allow the glass to come into direct contact with flames or strong heat source, e.g., ovens, cooker hobs, very hot utensils, or pans. If used near a heater, for example, the temperature of the wall must not exceed 65° C • Vertical gap between two adjacent sheets should be a minimum of 1 mm • Ensure that moisture is not allowed to collect behind the glass, either by allowing sufficient drainage and ventilation, or by suitable material • If the fitting is done by using a frame or clip, we sealing the area with recommend the insertion of nonmetal spacer between the frame or clip and the glass • When fitting lighter colours using adhesive strips, it is important to ensure that light cannot penetrate through the sides of the glass as this could cause shadows from the adhesive strips to show up on the front • Always use Silicone / tape brands recommended by AIS and exactly follow the instructions given by the adhesive manufacturer (particularly regarding the quantities of adhesive to be used per square metre).

HANDLING AND CUTTING

Always use clean gloves when handling decorative glass products • Lift the sheets one by one • When handling sheets with suction cups, apply cups to the flat, untreated surface. If this is not possible, extra care should be taken to ensure that proper vacuum is achieved. Be sure to keep the cups clean and free of dust • Regularly sweep the cutting tables with a stiff brush to control dust and

to minimize any glass grit and particles which could scratch the glass • Individual sheets should be washed after cutting to reduce the chance of staining from cutting oil • Glass sheets are cut most easily by scoring the flat, untreated side. If not possible, increased cutting pressure may be required, and testing is recommended prior to cutting stock sheets • Never allow coolant or cerium oxide to dry on the glass, as it may become a permanent stain on a porous surface • Painted side of the lacquered glass should be placed on the table while cutting • Care must be taken to insert paper or cardboard spacers in order to avoid scratches.

8. ACRYLIC SOLID SURFACE SHEET PANELLING

Wall cladding panels with 6mm solid, non-porous and homogeneous seamless, stain resistant, repairable, durable, hygienic environment friendly surfacing material acrylic solid surface sheet of or approved make with a minimum thickness 06 mm in color, design, fixing in customize design arrangement as per direction of architect. acrylic solid surface sheet to be fixed on wall on top of 12 mm marine ply. adhesive of the same color to provide inconspicuous joints. grooves to be given at every 1mtr to give expansion & contraction movement to material. Thermoformable Acrylic solid surfaces should be used wherever required and shaped using heat. Acrylic solid surfaces should be as per requirement in relevant colour and should be developed as per design. The material / product used should be selected as per requirement and wherever it requires thermoforming, laying, etching, carving and shaping capabilities then thermoformable material /product should be used. The product should be selected according to its use. The final finished product should be seam less, joint less and shall maintain lustre and when etched it should have a smooth finish. The rate is inclusive of all operation, material and required pattern. cost of base like framework and 12mm thick ply will be paid under respective item.

Durability performance & Design flexibility / Non-porous & Hygienic(Anti-bactrial)

<u>Acrylic</u> solid surfaces should be tough and repairable. <u>Acrylic</u> solid surfaces should be solid all the way through, minor cuts, scratches or nicks can be quickly sanded out, restoring the surface to its initial appearance. solid surfaces should be long lasting.

<u>Acrylic</u> solid surfaces should be easy to clean and maintain. <u>Acrylic</u> solid surfaces should be stain and resistant and shall be non-porous.

<u>Acrylic</u> solid surfaces to be non-porous it should not support the growth of microbial growth. <u>Acrylic</u> solid surfaces should be workable and as per requirement it should be carve able, sandblasted, polished and cut-out to create a one-of-a-kind look in a variety of shapes and finishes. <u>Acrylic</u> solid surfaces wherever required should also be thermoform able or shaped using heat. <u>Acrylic</u> solid surfaces should be as per requirement in relevant colour and should be developed as per design and the material / product used should be selected as per requirement and it may require thermoforming, laying, etching, carving and shaping capabilities. The material / product used should be selected as per requirement and wherever it requires thermoforming, laying, etching, carving and shaping capabilities then thermoformable material /product should be used. The product should be selected according to its use. The final finished product should be seam less, joint less and shall maintain lustre and when etched it should have a smooth finish. The product should be in the colour seleted by the Architect/Engineer/DFCCIL. The final finished product should be seam less, joint less and shall maintain lustre and when etched it should have a smooth finish. Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.

Product Specifications

	FUNCTION		
Property	INDEX SIGN	UNII	TEST METHOD
Density	1.5 - 1.8	kg/dm3	DIN 52 102
Mass	16	kg/m2	
Barcol Hardness	55-70		DIN 68 861
Tensile Strength	25-60	N/mm2	DIN EN ISO 527
Flextural	30-60	N/mm2	EN 310
Modulus elasticity	5000 - 9000	N/mm2	EN 310
Ball Drop	170 - 280	N/mm2	DIN ISO 2039
Impact Strength	1.5 - 6.5	kj/m2	Din EN ISO 179
Long/thermal Expansion	3.5 x 10	m/m'k	DIN 53 752
Water Absorption	<0.04	%(mass)	DIN 53 495/ASTMD 570
Light Fastness	Blue Scale 5-7,		DIN EN ISO 4892
	Grey Scale 4-5		
Fungi & Bacteria	No Infestation		ISO 846 A/C
Calotitic Value	Ca. 10	Mj/kg	DIN 51 900
Fire Behaviour	B2		DIN EN 13501-1
Chemical Resistant	1B		DIN 68 861-1
Specific Weight	1.55-1.74g/cm at 2	20 degree C	DIN ISO 1183
Young's modulus	10900 N/mm2		DIN 53457

Bending Strength (12 mm		
Panel)	60 + - 5 N/mm2	DIN 53452
Impact Strength (12 mm		
Panel)	6.5 kj/m2	DIN EN ISO 179
Impact Resistance (12 mm		
Panel)	No Break	ISO 19 712-2
Stability Of Glued Joint	60%-80% Of Material Stability	ISO 527
Barcol Hardness	65 + - 5	DIN EN 59
Scratch Resistance	0.6 N	DIN EN 438-2
Thermal Expansion (length)	5.05 x 10-5 K-1	ASTM D 696
Stability - Boiling Water	No Visible changes	DIN 53799
Stability - Dry Heat	No Visible changes	DIN 68861 T7
Cigarette Burn	No Visible changes	DIN 53799
Stain Resistance Requirement	Meets Requirements	ANSI Z 124.3 (5.2)
water Resistance requirements	Meets Requirements	ANSI Z 124.3 (6.0)

9. **PARTICLE BOARD:**

Pre -laminated medium density fibre board exterior grade (Grade-I) IS: 14587:1998 marked, to frame, backing or studding with screws etc. complete (Frames, backing or studding to be paid separately).

Pre-laminated with decorative lamination on both side exterior Grade - I MDF Board 12 mm thick conforming to IS: 14587

10. WOODEN FIRE RATED DOOR:

Wooden fire rated doors as per BS: 476 Part- 20 & 22 & IS 3614 part-2 for stability, integrity and thermal insulation. 03 Criteria Wooden door confirming to IS 277 with the following specification. Recommended fire door shall have doors tested at CBRI for maximum rating of 2hrs tested either with or without vision panel. Individual Test certificates should be available for glass used in vision lites confirming the required fire ratings. Any deviation in specification other than what is mentioned in the test certificates are not allowed. Proper label confirming the type of door and the hourly rating is mandatory. Approved manufacturer should be ISO Certified Company. Door leaf shall be minimum 52mm thick fully flush door with or without vision lite. 52mm thick shutter, comprising of

75mm x 44mm hardwood internal timber frame work, with infill of 48 kg/m3, ceramic fiber blankets, coated with FR intumuscent coating on both sides for insulation. The coated insulation shall be sandwiched between maximum 12mm thick Calcium Silicate Boards on both sides (edge to edge on internal Hardwood frame) having a maximum density of 900 Kgs/ Cum, cladded with 3mm ply commercial ply on both faces. (The same can be pasted with 1mm thick laminate (as per approved shade) or replaced with 4mm thick teak ply as per client's requirement at an extra cost) on both sides of the shutter, with 50mm x 10mm hard wood lipping all round the shutter. The door frame will be made out of Hardwood of maximum section 120 x 70mm and coated with Fire Retardant Primer. The rebate shall be of 20mm x 54mm in the Door Frame to accommodate the shutter. Fire seal of size 20x4mm on all the three sides of the except bottom.

The pasting of the ply/veneer/laminate should be done using automatic machine and should be free from any nails or perforations.

11.0 Ecoresin Panel

Ecoresin translucent panel 10mm thickness finish as approved make Complete as per specification & approval of Architect/Engineer/DFCCIL as per tender drawing. These panels will be fixed to wall with SS studs and maintain gap off 200mm from the wall. LED lights at the back as required.

12.1 FULLY AUTOMATIC GLAZED SLIDING DOOR: -

12.1.1 General:-

Automatic sliding door operator Automatic sliding door Set 1 operator as per approved dwg. Compliant with European standards. Product should be TÜV test certified for 1 Million cycles, tested according to the low voltage guidelines & operator unit power consumption not exceeding 100 W/Hr, fulfils DIN 18650 standards. The track profile should be flexible for both surface mounted & ceiling hung application with additional profile for vibration & sound dampening feature. It should includes micro processor controlled drive unit, with self learning mechanism, program selector with knob, motion detection sensor -2 nos, 1 on each side , including passage safety combi-sensor on one side , mechanical components, toothed belt, cover profile not exceeding 110mm visible H, floor guide for frameless glass (02 nos), glass clamping rail (02 nos), Body finish : standard silver anodised operator profile electromechanical lock with 12 mm plain toughened frameless glass for complete elevation - 2 moving panels. UPS of 750 VA shall be provided by others, which will give power backup of 20 min. Only & if the duration of power cut to the operator is more than 30 min., then separate arrangement needs to be done for the same as automatic operator requires uninterrupted stabilized power supply. it should include wall corner Protection. (WCP)

All complete as per direction of Architect/Engineer/DFCCIL.

12.1.2 Installation:-

The track profile should be separate from the main profile for enabling reduction in vibration insulation. Microprocessor control, self-learning, reverses when obstruction is encountered. Microprocessor-controlled control unit. It should be Self-learning, with adjustable parameters for opening and closing speed, hold-open time and opening and closing force. Class of protection IP 20. The electric operating Mechanism shall be mounted and concealed within the Stainless Steel header and the Controller Unit shall be Micro Processor Based.

12.1.3 Technical Parameters: -

Parameter		
Drive Unit	Top mounted actuator	
Travel Control	Encoder	
system		
Capacity	90 kg each leaf maximum	
Power Supply	< 100 W	
Duty Class	5-very heavy duty	
Intermittent	\$3=100%	
operation		
Opening speed	150-600 mm/s (Adjustable)	
Closing Speed	100-550 mm/s (Adjustable)	
Opening Time	0-9 Seconds (Adjustable)	
Accessories	24V=/0.5A	
Power supply		
Manually	Drive force. Dwell time during opening 0-30 seconds. Partial opening.	
adjustable		
functions		
Self-adjusting	Maximum opening closing limits Rotary programmer.	
functions		
Safety devices	Combi Sensor(Microwave+ Infrared)/Built-in photocells	
Control Switch	Pair of microwave radar for open & close operations	

Std. Cable Length	5 Mtr - Motor to Radar & 5 Mtr - Motor to Sensor
Safety devices	Combi Sensors for passage safety/Built-in photocells
Test Certificate	1 million Cycle

Features:-

- 1. CE marked according to the European Machinery Directive 2006/42/CE and type tested according to standard European Norm 13241-1.
- 2. Extruded anodized aluminum profile sliding guide and casing, sliding on reinforce nylon wheels.
- 3. Electronic control board with microprocessor.
- 4. Built in electronic antic rush devise with encoder.
- 5. Manual and automatic settings with trimmer and dipswitch.
- 6. Automatic closing, reversal safety, obstacle detection, adjustment, automatic closer time.
- 7. Test certification for the number of cycle tested.

12.2 HARDWARE:

12.2.1 Digital Lock:-

Glass glass mirror finish digital lock without cut-out with fingerprint + password + IC card with necessary accessories. Has a capacity of 10 administrators and more than 490 ordinary users? Should have minimum 2 cards.

12.2.2 Hydraulic Door Closer: -

Overhead cam action door closer with adjustable closing force EN2-4.

12.2.3 Floor Spring: -

Double action floor spring for door including cost of cutting floor required, embedding in floor and cover plates with pivot and single piece sheet cover box with side plates etc. as per direction of Architect/Engineer/DFCCIL.

Floor spring certified with std. spindle and cover plate. The floor spring with back check and adjustable closing speed. Non-hold open options As per EN 1154 and CE marked. Finish: satin stainless steel.

12.2.4 Pull Handle: -

SS Pull handle of 300 x 25mm size, CTC 212 mm with necessary fixing accessories, washers & screws etc. complete as per direction of Architect/Engineer/DFCCIL. A.150 Back to back with adjustable fixing for glass, wood and metal doors in satin stainless steel. The pull handles should have supporting washer with raised beveling on the outer surface. Length=171mm, 19mm dia, ctc 152mm- SS304. 300 back to back with adjustable fixing for glass, wood and metal door in satin stainless steel. The pull handles should have. Supporting washer with raised beveling on the outer surface should have. Supporting washer with raised beveling on the outer surface. Length=300MM, 25MMDIA-SS304 supporting washer with raised beveling on the outer surface. Length=300MM, 25MMDIA-SS304

12.2.5 Lever Handle with Lock: -

Tubular lever handle with sash lock with back set, Foreend, Euro profile cylinder with one side key and other side knob operation with strike plate and fitting with necessary screws etc. complete

- a. External trim lever type finish: silver. Complete set including spindle, screws & all fixing accessories.
- b. pin euro profile half cylinder with one side key operation standard length 42mm in satin nickel plated finish with 3 keys. Optional master keying and grand master keying can be done on request.
- c. Lever handle package consist of tubular lever handle sash lock with 55mm back set, CTC-72mm and 20 mm for end, euro profile cylinder with one side key and other side knob operation with 20 SS strike plate.

13. ABOVE FALSE CEILING GYPSUM PARTITION - FORMED OF GI FRAME WORK

Partition from false ceiling level till true ceiling level

Framework - (2 layers of GI Ultra studs)

To be formed 2 layers of GI Ultra studs of size 48mm (0.5mm thk having one flange of 34mm and another flange of 36mm made of GI Steel), placed at 600mm centre to centre fixed on to the floor channels. The GI channels of size 50mm x 0.55mm (section thick) to be fixed on the floor to hold GI studs as per details. To have 5mm air gap between the 50mm frame work as per details. Infill -2 Layers of Fibre glass wool insulation - 1000gms/m2. As an acoustic requirement, contractor to affix 50mm thick 2 layers of Fibre glass wool insulation of density 1000gms/m2, of approved make wrapped in GI chicken mesh on both sides as per manufacturer's specifications, Cladding - First layer on both sides - Fibre cement board Density 1400kg/M3. The framework to be cladded on both sides with single layer of 12 mm thick (High Pressure Steam Cured) Fibre Cement Wall Board confirming to IS 14862: 2000 Category Type B are screw fixed on either side of the framework with 25mm fully threaded self drilling self tapping countersunk fibre cement screws at 300mm c/c. The joints of board are to be staggered to avoid through joints. Finally, the beveled edges of the board are to be jointed and finished so as to achieve flush finish, which includes Interior Jointing Compound &

Paper tape as per the recommended practices. To have 3mm thick sound deadening membrane (Density 1800Kg/M3) as per details. Cladding - Second layer on both sides - Gypsum board Density 1000kg/M3. The Second layer to be cladded on both sides with single layer of Acoustic Rated Gypsum board which includes tapered edge 12.5mm thick Acoustic Rated Gyp board (conforming to IS 2095-1982 & 2542-1981) screw fixed with 35mm dry wall screw at 300mm c/c to Existing first skin of Partition. Care should be taken that the joint should be staggered to avoid sound leakage. Finally square and tapered edges of the boards are to be jointed and finished so as to have a flush look which includes filling and finishing with a jointing compound, joint paper tape and two coats of drywall top coat suitable for Gyp board (as per recommended practice of India Gypsum or equivalent). Rate shall be inclusive approved make Gypsum edge guard on edges of the partition and finished as per manufacturer's specifications. To have 3mm thick sound deadening membrane (Density 1800 Kg / M3) as per details.

14.0 MODULAR PANTRY

14.1 General: -

Kitchen Base Unit Box with BWP 18mm Water Proof Plywood's with Inside Quality 0.8mm laminate finish with Merino Lam or Green Lam Post form Sutter's Finish with Box Backside BWR 6mm Water Proof Plywood's with Box Backside applying 1Coat the Primer. With Quality Handles, Auto Hinges and all Doors Single Colors Finish.

Technical Specification and Materials Used in This Pantry

a. b.	Finishing Materials Structural Materials	: Laminated Kitchen : 18mm Boiling Water Proof Plywood
c.	Handle	: G Profile Handle
d.	Accessories	: Plain Basket
e.	Hardware	: 0°Degree Hinges & 20" Channels, Glass Profile
f.	Size of the Pantry	: Approx. 2688mm / as per site

14.2 Material use Detail: -

- a. BWP Plywood / Block board
- b. Hardware
- c. Trolly
- d. Edge Bidding / Burma teak lipping
- e. Frosted/Clear glass

15. PATCH DOOR

12 mm thick frameless toughened glass door shutter of approved brand and manufacture, including providing and fixing top & bottom pivot & spring type fixing arrangement and making necessary
holes etc. for fixing required door fittings, all complete as per direction of Architect/Engineer/DFCCIL.

Hydraulic Floor Spring

The hydraulic floor spring shall be heavy duty double action floor spring of make approved by the Architect/Engineer/DFCCIL suitable for door leaf of weight minimum 100 kg. The top cover plate shall be of stainless steel, flushing with floor finish level. The contractor shall cut the floor properly with stone cutting machine to exact size & shape. The spindle of suitable length to accommodate the floor finish shall be used.

Measurements

All the door sections including snap beadings fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimetre. The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts.

16. STRUCTURAL STEEL

16.1 ROLLING SHUTTER

Steel rolling shutter with 18 swg. of approved type M.S sheet to the 75mm wide fitted with coil wire spring to necessitate the fitting of required number of CI pulley on heavy type solid drawn seamless steel tube complete with locking arrangement both inside and outside specially built up side guide channels including providing a hood for the steel rolling shutter in the room painting two coats of approved paint over a coat of red lead primer complete.

16.2 G.I LOUVERS

1 mm thick GI louvers shutters of desired profile and shape to MS framework. The job shall be completed in all respects as per Architectural Drawings including fixing, necessary locks, hardware and within the spacing required, one or more coat of approved quality steel primer and two or more coats of synthetic enamel paint.

16.3 STAINLESS STEEL (GRADE 304)

Stainless Steel (Grade 304) cladding with sheet of thickness 1.5mm on MS built up sections.

17. SCREED

Finishing Unformed Surface

The Contractor shall provide normal finishes in unformed surfaces which can be achieved by plain cement concrete screeding, floating, troweling etc., A few typical and common cases of treatment of concrete surface are cited below:

a) Floor

Whenever a non-integral floor finish is indicated, the surface of reinforced concrete slab shall be struck off at the specified levels and slopes and shall be finished with a wooden float fairly smooth removing all laitance. No over-troweling, to obtain a very smooth surface, shall be done as it will prevent adequate bond with the subsequent finish. If desired by the Architect/Engineer/DFCCIL, the surface shall be scored and marked to provide better bond.

Where monolithic finish is specified or required, concrete shall be compacted and struck off at the specified levels and slopes with a screed, preferably a vibrating type and then floated with a wooden float. Steel troweling is then started after the moisture film and shine have disappeared from the surface and after the concrete has hardened enough to prevent excess of fines and water to rise to the surface but not hard enough to prevent proper finishing of aberrations. Steel troweling properly done will flatter and smoothen sandy surface left by wooden floats and produce a dense surface free from blemishes, ripples and trowel marks.

A fine textured surface that is not stick and can be used where there is likelihood of spillage of oil or water can be obtained by troweling the surface lightly with a circular motion after initial troweling keeping the steel trowel flat on the surface.

To provide a better grip the Engineer may instruct marking the floor in a regular geometric pattern after initial troweling.

b) Beams, Columns & Walls

If on such or any other concrete structure it is intended to apply plaster or such concrete surfaces against which brickwork or other allied works are to be built, the Contractor shall hack the surface adequately as soon as the form is stripped off so that proper bond can develop. Pattern, adequacy and details of such hacking shall meet with the approval of the Architect/Engineer/DFCCIL, who shall be informed to inspect such surfaces before they are covered up.

18. FALSE CEILING

18.1 Pinewood Perforated Panels:

Pinewood E1 grade fiberboard, with big circle perforations of 50mm dia, melamine/veneer laminated finish, size 600x1200x16mm, Square edge, volume density of base board 800Kg/m3, weight 8.8Kgs/m2 installed by using Strut framework system and Strut Z bar. Strut framework system includes Strut having thickness 0.55mm, length 3600mm, knurled web 35, depth 20mm and equal flanges 15mm is fastened to wall positioned vertically in a regular manner at 600mm c/c. Strut Z bar having 40mm height, thickness 1mm is first fixed behind the panels by using suitable fasteners. Another length of Strut Z bar are then installed over Strut horizontally at spacing so as to match with Strut Z bar at rear of panels. Panels of size 600x1200x12/16mm are then slided into the Strut Z bar fixed on Strut CC25. Long edges of panels should be

perpendicular to Strut Z bar and Short edges of the panel are staggered. Panels are backlined with Synth PF 10x25 held in position with dab spots of Stick S7.

Technical Parameters

- Fire (Class) 1 & P (For FR grade)
- Acoustics NRC upto 0.85
- Thermal conductivity (W/mk)- na
- Climate (°C, RH) 40, 70
- Light reflectance (%) Colour Dependant
- Green (VOC, RC %) Low, 25

18.2 Printed Stretch Fabric Ceiling:

Stretch Graphic Fabric FR Grade Solserene fabric system with high-performance integrated core with a white matte face covering, acoustically-transparent textile of size 1.7mx75m. Wooden base 10mm is first installed to the true slabs/grids on the marked lines with metal fasteners at 300mm centers embedded in plastic sleeves. Fix Strut SE 25 half wrap / full wrap, Midseam and Outer corner, rigid FR-PVC high strength tracks square / bevel edge on the wooden surface by using heavy-duty fasteners at 150mm centers on one/both sides of Strut Tracks. Strand magnesite bonded pinewood fibre panels of size 600x1200x15mm, density 400kg/m3, weight 6kg/m2 is installed/fastened to slab or grid in between tracks by using suitable fasteners, Synth PF 10x10mm is then adhered on Strand using Stick 7 adhesive. Ensure 5mm air gap between Synth PF and SLS fabric. The Stretch SLS acoustical membrane of width 1.7m is stretched and tucked into the Strut Tracks and secured to the locking jaws with purpose-specific tucking tools to obtain smooth, taut, wrinkle-free finish. Ensure the weft and weave of the fabric along with the surface are all oriented in one direction to achieve uniform shade.

Note: minimum 200mm additional fabric is required for tucking hence maximum module wall fabric width would be 1.5 mtr. Installed on MS framework.

Technical Parameters of fabric

- Fire (Class) A
- Acoustics na
- Thermal conductivity (W/mk)- 0.1
- Climate (°C, RH) 49, 90
- Light reflectance (%) Color Dependant
- Green (VoC, RC %) Low, 25

18.3 Loop Ceiling:

LOOP® Type 2 system forms as an open metal ceiling with an open area of more than 50% and to the flare [5mm] of the perforation pattern the ceiling has a three-dimensional visual effect and hides the insight into the plenum. Bypassing the perforation, the S-shaped sides of the LOOP® interlock both the long and front side joint with a nonmagnetic suspension, the elements are installed with a circumferential 1 mm joint, thus compensating tolerances in x and y direction. The non-magnetic suspension system effectuates a self-alignment of the elements [puzzle effect]. The module size 966x1115x1.0mm GMS is perforated with 60mm deep drawn holes .The substructure consists of a form perforated L profile [U1040] as a lateral grid which is suspended from the ceiling with nonius adjustable upper and lower parts or with threaded rods using official approved dowel plugs. The grid profiles are to be connected together at the ends by means of longitudinal connectors [U 1041] [screw fasteners]. The spacing of the grid profile is according to the requirements of DIN EN 13964 as well as the loads of the system and to be determined and checked by the contractor. The profiles are attached to the walls with U 1042 wall brackets. On profiles angles, C-band raster as secondary profiles are bolted on by means of C channel hanger bracket with M6 bolts. The longitudinal connections of the C-profiles are made by C profile connectors. The attachment to the walls is made with wall brackets. The ceiling elements are provided with magnets at the back and are force-fitted to the C-profiles. Thus, they are removable without using tools. They are secured with ropes against swinging down in an uncontrolled way. Only construction parts approved by the manufacturer may be used. Provide necessary supports, provisions as per the Architect/Engineer/DFCCIL Instructions.

Finish of ceiling is in powder coated RAL 9016 white colour or RAL 9006 Silver Grey or Black colour.

18.4 Braided Ceiling:

"Braided" metal open ceiling is a decorative single blade open cell ceiling system manufactured from 1mm thick perforated aluminium blades pressed together, available in white, Black, Metallic silver. The unique process in which the aluminium blades are punched creates a interwoven structure finish resulting in daylight reflecting off the exposed edges producing a radiant effect which can be enhanced with illumination to create a reflected spacious modern ceiling. The ratio between cell dimension and cell height allows the technical elements of to effectively disappear in the ceiling void which guarantees maximum transparency. The panel having cell size of 33.33 x 33.33 mm. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 EN 13501-01 "non-combustible", according to as per the Direction of Architect/Engineer/DFCCIL. The system will meet fire retardant standards.

18.5 Acrylic Solid Surface Hanging Ceiling:

Hanging false ceiling made of 12mm thick Acrylic solid surface. The cost includes the framing, hanging arrangement and boxing required as per the instructions of Architect/Engineer/DFCCIL.

Thermoform able Acrylicsolid surfaces should be used wherever required and shaped using heat. Acrylic solid surfaces should be as per requirement in relevant colour and should be developed as per design. The material / product used should be selected as per requirement and it may require thermoforming, laying, etching, carving and shaping capabilities. Entire surface area to be measured including border for payment.

The joints are to be treated to give a seamless and jointless finish as per the manufacturer's specifications. the cost includes making perforation for services and lights in the ceiling.

Durability performance & Design flexibility / Non-porous & Hygienic(Anti-bactrial)

<u>Acrylic</u> solid surfaces should be tough and repairable. <u>Acrylic</u> solid surfaces should be solid all the way through, minor cuts, scratches or nicks can be quickly sanded out, restoring the surface to its initial appearance. <u>Acrylic</u> solid surfaces should be long lasting.

<u>Acrylic</u> solid surfaces should be easy to clean and maintain. <u>Acrylic</u> solid surfaces should be stain and resistant and shall be non-porous.

<u>Acrylic</u> solid surfaces to be non-porous it should not support the growth of microbial growth. <u>Acrylic</u> solid surfaces should be workable and as per requirement it should carve able, sandblasted, polished and cut-out to create a one-of-a-kind look in a variety of shapes and finishes. Thermoform able <u>Acrylic</u> solid surfaces should be used wherever required and shaped using heat if required. <u>Acrylic</u> solid surfaces should be as per requirement in relevant colour and should be developed as per design. The material / product used should be selected as per requirement and wherever it requires thermoforming, laying, etching, carving and shaping capabilities then thermoformable material /product should be used. The product should be selected according to its use. The final finished product should be seam less, joint less and shall maintain lustre and when etched it should have a smooth finish. Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.

Property	FUNCTION	UNIT	TEST METHOD
	INDEX SIGN		
Density	1.5 - 1.8	kg/dm3	DIN 52 102
Mass	16	kg/m2	
Barcol Hardness	55-70		DIN 68 861
Tensile Strength	25-60	N/mm2	DIN EN ISO 527
Flextural	30-60	N/mm2	EN 310
Modulus elasticity	5000 - 9000	N/mm2	EN 310
Ball Drop	170 - 280	N/mm2	DIN ISO 2039
Impact Strength	1.5 - 6.5	kj/m2	Din EN ISO 179
Long/thermal Expansion	3.5 x 10	m/m'k	DIN 53 752

Product Specifications

Water Absorption	< 0.04	%(mass)	DIN 53 495/ASTMD 570
Light Fastness	Blue Scale 5-7,		DIN EN ISO 4892
	Grey Scale 4-5		
Fungi & Bacteria	No Infestation		ISO 846 A/C
Calotitic Value	Ca. 10	Mj/kg	DIN 51 900
Fire Behaviour	B2		DIN EN 13501-1
Chemical Resistant	1B		DIN 68 861-1
Specific Weight	1.55-1.74g/cm at 20	degree C	DIN ISO 1183
Young's modulus	10900 N/mm2		DIN 53457
Bending Strength (12 mm			
Panel)	60 + - 5 N/mm2		DIN 53452
Impact Strength (12 mm			
Panel)	6.5 kj/m2		DIN EN ISO 179
Impact Resistance (12 mm			
Panel)	No Break		ISO 19 712-2
Stability Of Glued Joint	60%-80% Of Material Stability		ISO 527
Barcol Hardness	65 + - 5		DIN EN 59
Scratch Resistance	0.6 N		DIN EN 438-2
Thermal Expansion (length)	5.05 x 10-5 K-1		ASTM D 696
Stability - Boiling Water	No Visible changes		DIN 53799
Stability - Dry Heat	No Visible changes		DIN 68861 T7
Cigarette Burn	No Visible changes		DIN 53799
Stain Resistance Requirement	Meets Requirements		ANSI Z 124.3 (5.2)
water Resistance requirements	Meets Requirements		ANSI Z 124.3 (6.0)

18.6 Digitally Printed Hook-On Ceiling

Linear hook-on ceiling System have panels that are 2100(L)x300(W) manufactured out of minimum 0.7 mm thick. Finish of the panels to be powder coated dur graphics 3D effect digitally printed UV cured finish with minimum 60 microns' base coating. All panels are hooked onto a secondary grid known installed at shorter side of the panel to ensure individual demounting of panels for easy accessibility of services. A primary grid of L- Angle in 30x30x1.2mm thick galvanized steel known is installed perpendicularly to hook on profiles at maximum centers at 1200mm. The entire ceiling shall be suspended with M6 threaded rod using Hilti M6 fastener with minimum load of at least 0.5kn per anchor. The suspension system shall be as per manufacturer specification. The panels shall include the site cutting / making openings for services e.g. lights for information boards, smoke detectors, speakers, diffusers, grills etc. Measurement to be done on edge to edge basis without any deductions for AC grills or any other services integrated within the false ceilings. A primary grid of L- Angle in 30x30x1.2mm thick

galvanized steel known is installed perpendicularly to hook on profiles at maximum centers at 1200mm. The entire ceiling shall be suspended with M6 threaded rod using Hilti M6 fastener with minimum load of at least 0.5kn per anchor. The suspension system shall be as per manufacturer specification. The panels shall include the site cutting / making openings for services e.g. lights for information boards, smoke detectors, speakers, diffusers, grills etc. Measurement to be done on edge to edge basis without any deductions for AC grills or any other services integrated within the false ceilings.

18.7 Glassfiber Cloud Ceiling:

Square edge, FR grade NRC fabric (colour choice) wrapped Glassfiber core panel of size 600x1200x25mm having volume density 120Kgs/m3 and weight 3kg/m2. Each cloud is provided with 4 sets of accessories containing spring hooks, levelling clip and hanger wires. Springs to be rotated and anchored at back of each panel at four points to hold the panel stable. Supplied hanger wires to be first dropped from the beam/slab/truss to desired height with suitable cleats/anchor bolts. Subtex Clouds NRC panels are then suspended using spring hooks and hanger wires and levelled into position with supplied levelling clips.

Technical Parameters

- Fire (Class) 1 & P
- Acoustics NRC 0.9
- Thermal conductivity (W/mk)-0.07
- Climate (°C, RH) 49, 90
- Light reflectance (%) Colour dependant
- Green (VoC, RC %) Low, 25

18.8 Polyfiber Cloud Ceiling:

Acoustic Polyfiber Ceiling in shapes and design to be fixed by suspending through the ceiling with necessary angles, cleats, etc. as per the instructions of the architect/ Architect to form cloud ceiling as per the approved design. the frameless ceiling is to be anchored from the ceiling for which the framework and support system is to be of patented technology and after necessary approvals by the Architect/Engineer/DFCCIL.

18.9 Metal Mesh Ceiling:

Hook on expanded Metal Mesh Ceiling in 1.2mm GMS manufactured as per TIAM quality standards. The ceiling panels shall be in size of 600x600-1200mmx1.2mm(thick) galvanized mild steel and Mesh size shall be 20(Length)x10(Width)x2.5mm(Web Width) x 1.2mm(Thickness) having open area more than 55%. All panels are hooked onto a secondary grid known as U1005 installed at 600mm. A primary grid of perforated L- Angle in 30x30x1.2mm thick galvanized steel known as U1040 is installed perpendicularly to hook on profiles at maximum centers at

1200mm. The entire ceiling shall be suspended with M6 threaded rod using Hilti M6 fastener with minimum load of at least 0.5kn per anchor. The system should be in accordance with Material class A2-s1, do according to EN 13501-01 "non-combustible", as per the Direction of Architect/Engineer/DFCCIL

18.10 Organic Metal Ceiling:

The organic metal ceiling creates elegant circles. This Ceiling counterpoints the strict lines of conventional ceilings with a flowing, harmonious room 'look'. The ceiling integrates the round lighting areas elements; which diameter determines the basic size of the different ceiling elements. Additionally, spot lights or LED lines can be integrated into the joints. The innovative system allows creating individual ceiling configurations with only a few different parts. The dynamics of the ceiling can be influenced by the choice of the circles as well as by the possibility to choose the colour. FLUID®-C can be used as a closed ceiling or as a circular raft ceiling. This variety gives completely new design perspectives. The form elements made of sheet steel are available in any RAL colours. Module size is 1204mm×1204mm Joint width, 10mm Also available on request in the 600 or 900mm modules. S7 Linear ceiling system Module size is 1204mm×1806mm and Joint width is 10 mm. This Ceiling can be acoustically effective using perforated rectangular metal panels with acoustic fleece on the rear side. The ceiling elements are fitted on the rear side with bolts and magnets and screwed on a rectangular ceiling system suspended in rail channels in the [KS] system. The elements at the butt of plates are force-fitted. Security ropes prevent uncontrolled swinging down of the ceiling elements. The rail channels are tightened by means of screws to L-shaped primary carriers. The L-shaped primary carriers are used to enable lateral stiffening and are suspended to the structural slab using Nonius suspension elements or threaded rods. The area lightings are an integral part of the creative metal ceiling. The Lights should be available in the sizes 600, 900, 1200mm and determines the basic size of the ceiling. The translucent covering made out of high-quality that gives the lamps a vivid character.

18.11 Hingeable Linear Ceiling:

Hingeable cell ceilings are made out of Aluminium and are assembled in cell ceiling panels of size 600x1200 in mm. The assembled cell ceiling panels shall made out of main blades in 3mm (W) x 20mm (H) in 1200mm (L), installed at 30mm c.c. and cross connected to secondary blades in 9mm(W) x 22mm (H) in 600mm (L) with 375mm pitch. The assembled cell ceiling panels are then clipped into carriers in GMS, coated in black enameled finished at 1200mm c.c. Wire clips shall hold the cell ceiling panels into the carriers. Once the carriers are installed then primary angles made out of GMS, are cross connected to the carriers at 1200mm c.c. for lateral bracing The whole ceiling shall be suspended by M6 threaded rods installed 100mm c.c. All panel modules must be Hingeable through wire clips.

18.12 Backlit Acrylic Ceiling:

Backlit Ceiling in acrylic solid surface sheet should be of approved make. Ceiling Installation to be done in translucent glacier ice color, thickness (12 mm), design backlit provision as approved by architect or Engineer-in- charge. The material should be CNC cut to achieve the desired design

as per architect. The CNC cut Acrylic solid surface sheet to be fixed on ceiling. The cost shall include the framing, the frame should be of stainlss steel or wood as per requirent of stability and weigt carrying capacity and its requirement for support. The hanging/fixing arrangement and boxing shal be done as per the requirement of light translucency and reflection of lights required as per the design and instructions of Architect/Engineer/DFCCIL. The backlic ceiling shall have the light passing and shall have translucency.the cost of framing and boxing included in cost of item.

Durability performance & Design flexibility / Non-porous & Hygienic (Anti-bactrial)

<u>Acrylic</u> solid surfaces should be tough and repairable. <u>Acrylic</u> solid surfaces should be solid all the way through, minor cuts, scratches or nicks can be quickly sanded out, restoring the surface to its initial appearance. <u>Acrylic</u> solid surfaces should be long lasting.

<u>Acrylic</u> solid surfaces should be easy to clean and maintain. <u>Acrylic</u> solid surfaces should be stain and resistant and shall be non-porous.

<u>Acrylic</u> solid surfaces to be non-porous it should not support the growth of microbial growth. <u>Acrylic</u> solid surfaces should be workable and as per requirement it should carve able, sandblasted, polished and cut-out to create a one-of-a-kind look in a variety of shapes and finishes. <u>Acrylic</u> solid surfaces wherever required should also be thermoform able or shaped using heat. <u>Acrylic</u> solid surfaces should be as per requirement in relevant colour and should be developed as per design and the material / product used should be selected as per requirement and it may require thermoforming, laying, etching, carving and shaping capabilities. The product should be selected according to its use. The final finished product should be seam less, joint less and shall maintain lustre and when etched it should have a smooth finish and shall be translucent so that the back light maintains translucency..Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.

Property	FUNCTION INDEX SIGN	UNIT	TEST METHOD
Density	1.5 - 1.8	kg/dm3	DIN 52 102
Mass	16	kg/m2	
Barcol Hardness	55-70		DIN 68 861
Tensile Strength	25-60	N/mm2	DIN EN ISO 527
Flextural	30-60	N/mm2	EN 310
Modulus elasticity	5000 - 9000	N/mm2	EN 310
Ball Drop	170 - 280	N/mm2	DIN ISO 2039
Impact Strength	1.5 - 6.5	kj/m2	Din EN ISO 179
Long/thermal Expansion	3.5 x 10	m/m'k	DIN 53 752
			DIN 53 495/ASTMD
Water Absorption	< 0.04	%(mass)	570
Light Fastness	Blue Scale 5-7,		DIN EN ISO 4892

Product Specifications

	Grey Scale 4-5		
Fungi & Bacteria	No Infestation		ISO 846 A/C
Calotitic Value	Ca. 10	Mj/kg	DIN 51 900
Fire Behaviour	B2		DIN EN 13501-1
Chemical Resistant	1B		DIN 68 861-1

18.13 Measurements:

Length and breadth shall be measured correct to cm. Installed Grid Ceiling area shall be measured in square meter nearest to two places of decimal. Openings for light fixtures shall not be deducted while measuring area. The rate shall include the cost of materials and labour required for all the operations described above.

19. WALL PANELLING:

Frame work for partitions/ wall lining etc. made of 50x25x1.6 mm hollow MS tube, placed along the walls, ceiling and floor in a grid pattern with spacing @ 60 cm centre to centre both ways (vertically & horizontally) or at required spacing near opening, with necessary welding at junctions and fixing the frame to wall/ ceiling/ floors with steel dash fasteners of 8 mm dia, 75 mm long bolt, including making provision for opening for doors, windows, electrical conduits, switch boards etc., including providing with two coats of approved steel primer etc. complete.

19.1 ZINC PERFORATED CLADDING

Supply and fixing of Zinc Titanium Cladding System made with 1 mm or thickness Zinc Titanium Alloy comprising of the following layers.

Top Layer: Zinc titanium Interlocking panels wall cladding system (thickness: :1.0 mm) of 300 mm width as per manufacturer recommendation X up to 2000 mm length interlocking wall cladding panels in Pre weathered Quartz Aspect of approved makes. Interlocking panels are rain screen system with available pan width of panels of 300 mm Centre to Centre Panels are attached to supports/substrates using stainless screws located under edges of the panels.

Panels Shall have perforations with CNC punched perforation of 8/10/12 mm as per approved Pattern. Perforated Panels shall be manufactured by the Zinc Manufacturer & not by the dealer to ensure proper quality and perforation pattern. The zinc manufacturer shall have the design assistance in India & should have completed projects in India as per Technical Specs.

Framework (1.6 mm thick): 25 mm X 50 mm Aluminum Box section installed over the Main Structure / Masonry plastered surface. Zinc interlocking panels shall be fixed over the aluminum box section substructure using stainless screws as approved.

All screws shall be of authentic stainless steel 304 series or higher in order to prevent corrosion / galvanic action with the components fastened. All installation is to be carried out by approved trained facade installer. The installation team shall be fully trained and approved by the manufacturer. The zinc titanium sheeting manufacturer must have a registered office in India &

must have completed government projects in India. The zinc titanium sheeting manufacturer shall have ISO 9001 / 14001 quality certifications for their manufacturing units.

Item includes Designing, Supplying, installation and fixing of profiled zinc panels including stainless steel screws as required for the project.

Physical characteristics of pre-weathered Zinc Cladding sheets:

- (I) Density: 7.2kg/dm3
- (II) Thermal expansion coefficient: 0.022 mm/m x °C
- (III) Melting point: 420 °C
- (IV) Re-crystallization point: 300 °C
- (V) Heat conductivity: 110 W/ (m.K)
- (VI) Electrical conductivity: 17Ms/m

As an indication, the average characteristics of this conversion coating are as follows:

Nature: quadric-hydrated zinc phosphate (hopeite)

Weight: 35 mg/dm2

Thickness: approx. 1 micrometer

Solubility: insoluble in water

Colour: Y luminance = approx. 25 (bright grey)

02-Scope of the works

The Contractor shall be responsible for the supply, fabrication, transportation, assembly and installation of the façade cladding system as described in the Drawing and Specification.

The Contractor shall provide the necessary materials, drawings, documents related to Zinc Cladding System.

The work will be inclusive of cost of all labour, equipments, materials, submission of shop drawing, fasteners, washers, and screws etc. The work is to be carried out directly as per specifications, drawings and direction of Architect/Engineer/DFCCIL and the manufacturer.

TECHNICAL SPECIFICATIONS FOR ZINC WALL CLADDING SYSTEM

MATERIAL: The Zinc Titanium roofing wall cladding system shall be made of Zinc Titanium alloy as per below specifications

Controlled characteristics	EN 988 Standard	
Chemical composition		
Zinc	Zl	
Copper	0.08 - 1.0%	
Titanium	0.06 - 0.2%	
Aluminium	0.015%	
Mechanical properties (in the direction of rolling):		
0.2% proof strength	>= 100 N/mm	
Tensile strength	>=150 N/mm	
Elongation at fracture	>= 35%	
Bend test	No cracks on fold	
Creep resistance	0.1%	

SPECIFICATIONS FOR ZINC TITANIUM ALLOY

The zinc façade cladding system shall consist of the following elements to form a rigid & ventilated support base for installation of the ZINC Pigmento Green Finish cladding facade systems

The facade system shall comprise of the following described from top to bottom:

- (I) 1 mm thick ZINC Pre weathered Quartz Finish
- (II) Aluminum Box Section 50 X 25 mm 1.6 mm thick.

Panel Sizes shall be of 300 mm width X 2000 mm length or as site conditions and direction of Architect/Engineer/DFCCIL.

The system can be installed vertically or horizontally on a metal framework that is fixed to the existing Main Structure / plastered wall using appropriate Aluminum Framework The panels have an elegant appearance with a reveal joint. The system belongs to the rain screen family -wall cladding installed with a ventilated air space.

Interlocking metal wall panels:

- Interlocking Metal wall panel with reveal joint, with finished panel depth of 24mm.
- Available pan width of panels of custom width around 300 mm Centre to Centre Panels are formed with interlocking lap at panel edges and smooth, flat pan; designed to be field assembled in sequential installation by engaging edges of each panel to edge of adjacent panel. Panels are attached to supports/substrates using concealed clips located under edges of panels.
- Reveal width joint: 5mm 20 mm Adjustable.
 Panel lengths: as indicated and required per jobsite conditions, with a maximum of 2500 mm vertical,.
- Panels are installed Vertically with screws . Interlock the upper edge or succeeding edge of the panel into the clipped edge of the previously installed panel.
- Fasteners for Metal Wall Panels to steel substrate: 300 series stainless steel thread design and length appropriate for substrate.

Oval head, self-drilling screws, 304 series stainless steel. All fasteners are designed to seat in prepunched holes of the clips to eliminate potential contact and abrasion between fastener head and panel. Fasteners shall be selected to resist all negative design load requirements.

Execution:

Zinc Titanium Wall Cladding to be done by specialized agencies as approved by the manufacturer & Architect/Engineer/DFCCIL. The execution installer shall have experience in installation of Zinc Wall Cladding system and should have completed Zinc Titanium wall cladding works in India of similar Magnitude. Agencies without any prior experience of zinc wall cladding shall not be approved for execution of the zinc façade item.

Measurement:

The area for wall cladding shall be calculated by measuring actual length X breadth of roof wall cladding on site up to two decimal places.

In case of tapered panels / diagonal cutting standard width of the coil shall be taken in to account for arriving at measurement.

Rate:

The rate shall include the cost of all the materials, machinery and manpower involved in all the operations described above. Any other item required for completion of wall cladding system shall also be treated as included in the item and nothing extra will be paid for such extra work.

19.2 Green Wall:

Green Wall planting media of organic fertilizer like crop residue, verme compost, wood ash, poultry manure, cow urine etc., lighter than the soil, with good moisture capacity and used to ensure that load on vertical wall is minimized in Kg/Sqft.

UV Stabilized polypropelene planters of nominal size 19.6 Inches(Length)X6.2 inches(Height)X9 inches (Wide) of each module or equivalent make, specially designed to keep the centre of gravity of growing plants with in the planters with suitable Geo-Textile separator to separate the planting media with water reservoir and keep the perforation holes unclogged. The installation of planter will be such that to make it theft proof.

Plants of minimum height 152mm(5 plants for each planter) such as Inermi, Lal sag, Alternanthera Chlorophytum vareigated, Jade, Schafflera, etc. selected on the basis of temperature, incidence of sun light and humidity on site ;in pattern finalised in consultation with client/ department and as per direction of Architect. Drip Irrigation - with BIS approved 50 mm CPVC pipes, inlet supply of water, outlet pipe for distribution of water with 25mm Dia pipe and grid of dripper with 15mm Dia pipe with dripper. Nozzles can unscrewed and cleaned in case of clogging. The installation shall be without pumpset. The watering should be as per Gravitational Force i/c fixing. The suitable pressure compensating device, valve, elbow, end cap and all other accessories required to complete the irrigation system.

Mild Steel pipe frame grouting in RCC of mix 1:2:4, @ 51cm center to center embedded with vertical MS square pipe size 2.5cmX2.5cm with MS rectangular Pipe of 5cmX 2.5cm of border frame with MS Flats 25mm(W)X 2.3mm thick weight not less than 2.5 kg per mtr. 15cm center to center horizontally and with MS flats to hang the planter, with or without connecting plate on supporting wall or standalone including cutting, hoisting, fixing in position, welding etc & frame painted with 2 coats of Black ati-corrosive bitumastic paint in all complete as per site requirement. Complete maintenance of vertical garden with supply of water for irrigation through pump set/water tanker including watering through drip irrigation, cleaning/replancement of dripper, replacement of dripper, change of pot pattern after 15 days interval or as per requirement of site complete. T&P shall be provided by the Contractor. The cost of casualty of plants 25% as natural casualty for the first three years and also refilling of cup inside covered by Geotextile cloth of 250 GSM in bottom and further fill up 1:2 ratio with coco peat and soil rite mixture all complete.

Supply installation testing and commissioning of pump set for Green Wall

Single phase submersible motor pumpset - suitable HP, in underground tank with starter panel completer in all respect (KSB, Kirloskar, Techno, Texmo, Taro, Calama, Pluga, Crompton Greaves etc.) Note : motor pump shall be able to cover upto area of 1000 sqft comprising of 10 normal/standard panel of size 10ft x10ft =100ft each.

19.3 Polyfiber Shapes:

Polyfiber panels customized to desired shapes, core-pigmented, high-density, Polyfiber rigid panels of size 600/1200x600/1200x9/12mm, volume density 220/180kg/m3, weight 2kg/m2 and Strand, square edge Magnesite bonded pinewood fibre core tiles of size 600x1200x10mm, volume density 400kgs/m3, weight 4kg/m2 installed by using Strut framework system.

Prior to installation, ensure surface behind are flat dry and free from dust or other contaminants and leveled. then adhered to Panels behind with stick adhesive. Edges of the Strand to be finished accordingly so as to match.

19.4 MDF

Pre-laminated medium density fiber boards are available in two grades namely Grade I and II as per IS 14587:1998. Each grade is further classified in four types; namely Type –I, II, III, IV.

Material

A medium density fiber board laminated on both surfaces by synthetic resin impregnated base papers conforming to IS 14587:1998 Grade-I, type II or I shall be used. Impregnated Base Paper : Printed or plain coloured absorbent base paper having a weight of 60-140 g/m2 impregnated in a suitable synthetic resin and dried to a volatile content of 4-8 per cent shall be used for prelamination on both surfaces of medium density fiber board.

Impregnated Overlay :

An absorbent tissue paper having a weight of 18-40 g/m2 impregnated in a suitable synthetic resin and dried to volatile content of 4-8 per cent.

Dimension and Tolerances

Dimensions of pre-laminated medium density fiber boards shall be as follows:

Thickness : The thickness of pre-laminated medium density fibre boards shall be 6, 9, 12, 15, 18, 22, 25, 30, 35 and 40 mm.

Tolerances :

Tolerances on the nominal sizes of finished boards shall be as given below :

Dimension Tolerance

Length \pm 3 mm/metre

Width \pm 3 mm/metre

Thickness $\pm 0.3 \text{ mm}$

Edge straightness 2 mm/metre

Squareness 2 mm/metre

Marking:

Each pre-laminated medium density fibre board shall be legibly and indelibly

marked on any of its edges with following:

- (a) Name of the manufacturer or trade mark.
- (b) Grade and type of pre-laminated medium density fiber board.
- (c) Thickness and
- (d) Batch number and year of manufacture.

19.5 Wooden Acoustic Ceiling made of pinewood E1/good grade fiberboard, with big circle perforations of 50mm diameter, melamine/veneer laminated finish

Wooden Acoustic Ceiling made of pinewood E1/good grade fiberboard, with big circular perforations of 50mm dia, melamine/veneer laminated finish, size 600x1200x16mm, Square edge, volume density of base board 800Kg/m3, weight 8.8Kgs/m2 installed by using Strut framework system and Strut Z bar.

Strut framework system includes Strut having thickness 0.55mm, length 3600mm, knurled web 35, depth 20mm and equal flanges 15mm is fastened to wall positioned vertically in a regular manner at 600mm c/c. Strut Z bar having 40mm height, thickness 1mm is first fixed behind the panels by using suitable fasteners. Another length of Strut Z bar is then installed over Strut horizontally at spacing so as to match with Strut Z bar at rear of panels. Panels of size 600x1200x12/16mm are then slided into the Strut Z bar fixed on Strut. Long edges of panels should be perpendicular to Strut Z bar and Short edges of the panel are staggered.

Panels are backlined with Synthetic Polyfiber(SPF) 10x25 held in position with dab spots

Technical Parameters

- Fire (Class) 1 & P (For FR grade)
- Acoustics NRC upto 0.85
- Thermal conductivity (W/mk)- na
- Climate (°C, RH) 40, 70
- Light reflectance (%) Colour dependent
- Green (VOC, RC %) Low, 25

19.6 Pinewood Fibre Core Tiles:

Square edge with embossed patterns, magnesite bonded pinewood fibre core tiles of size 600x600x20mm, volume density 600kgs/m3, weight 12kg/m2 installed by using Strut framework system and Z bars. The framework system includes thickness 0.55mm, length 3600mm, knurled web 40mm, depth 10mm and equal flanges 15mm is fastened to wall positioned vertically in a regular manner at 600mm centers. Z-Bar 40mm height, thickness 1mm is first fixed behind the panels by using suitable fasteners on cement spots, at 500mm centres. If cement spots are not provided on panel rear then consult to provide methodology for insitu provision of cement spots.

Another length of Z-Bar to be fastened perpendicular to framing at spacing so as to match with that of Z-Bars rear to panels, square edge panels with their Z-Bar on rear are then slided on to Z-Bar fixed on framing. The system is backlined with the acoustical infill.

Technical Parameters:

- Fire (Class) 1 & P
- Acoustics NRC Upto 0.5
- Thermal (W/mk)- 0.07
- Climate (°C, RH) 50, 95
- Light (%) Colour dependant
- Green (VOC, RC %) Low, 30

19.7 Customized Printed Poly Fibre Panels:

Customized printed, poly fibre panels, high-density, rigid panels of size 1200x2400x9/12mm thk, volume density 220/180kg/m3, weight 2kg/m2.

Prior to installation, ensure wall or surface behind are flat, dry and free from dust or other contaminants and leveled.

Panels are then adhered to wall or surface behind with suitable adhesive.

Technical Parameters of system:

- Fire (Class) A
- Acoustics NRC 0.4 (For A mounting)
- Thermal conductivity (W/mk)- 0.039
- Climate (°C, RH) 50, 99
- Light reflectance (%) Print dependant

• Green (VoC, RC %) – Nil, 60

19.8 Core Pigmented Polyfibre Panels:

Polyfibre panels, core-pigmented, high-density, Synth PF rigid panels of size 1200x2400x9mm thk, volume density 210 - 230kg/m3, weight 1.9 - 2.1kg/m2 and ,square edge, magnesite-bonded pinewood fibre ceiling tile of size 600x1200x10mm, volume density 400Kgs/m3, weight 4kg/m2 installed by using ceiling framework. The ceiling framework system shall include Strut WC25 Wall channel, fully knurled, sectional thickness 0.55mm, length 3600mm, unequal flanges of 20&30mm and web of 25mm, fixed along the perimeters of the wall with nylon sleeves and suitable fasteners at every 300mm centers. Then suspend Strut MC45 Main channels, fully knurled, sectional thickness 0.8mm,length 3600mm, equal flanges of 15mm and web 45mm from the soffit at 1200mm centers with Strut SA25, fully knurled, Suspender angle with sectional thickness 0.55mm, length 3600mm, depth of 20mm and equal flanges 9.5mm is fastened to the Strut MC45 perpendicularly at 600mm centers. Strand is installed on the Strut CC25 with suitable fasteners in staggered manner. Longer edges of the strand should be perpendicular to length of CC25.

Prior to installation of panels, ensure Strand surface behind is flat, dry and free from dust or other contaminants and leveled. Slim panels are then adhered to Strand surface behind with stick S7 adhesive.

Technical Parameters of system

- Fire (Class) 1 & PB
- Acoustics NRC, 0.6
- Thermal conductivity (W/mk)- na
- Climate (°C, RH) 50, 99
- Light reflectance (%) Colour Dependant
- Green (VoC, RC %) Nil, 30

19.9 Veneer Laminated Unperforated Panels:

Fiberboard core plain, unperforated panels, veneer laminated finish, tongue-groove edge 1200x600x12mm thk - Wall Paneling- Supply and Installation of Fiberboard core plain, unperforated panels, veneer laminated finish, square edge, FR Grade of size 1200x600x12mm having density 750Kgs/ m3, weight 12 kg/m2 installed by using GI framework and Z-bars. The GI strut work includes Cross channel having thickness 0.45mm, length 3600mm, knurled web 40, depth 10mm and equal flanges 15mm is fastened to wall positioned vertically at 600mm centers. GI Z bars having 40mm height, thickness 1.2mm is first fixed behind the panels by using suitable fasteners @ 500mm c/c. Another length of GI Z-Bars are then installed over Strut cross

channel horizontally so as to match spacing with Z-bars installed behind panels. Panels are then slided into the Z bars fixed on cross channel. Long edged of panels should be perpendicular to Z-bars.

Technical Parameters

- Core Fibreboard
- Fire Class 1 & P
- Acoustics NRC 0.25
- Climate (OC RH) 50, 70
- Termite resistance Yes
- Light reflectance Colour dependent
- Green (RC %) 25
- Hygiene (VoC, Clean room) Low, Class 3
- Strength, Load capacity (Kg) Antisag

19.10 Measurements:-

Length and breadth shall be measured correct to cm. Wall panelling area shall be measured in square meter nearest to two places of decimal. The moulded work shall not be measured separately. The rate shall include the cost of materials and labour required for all the operations described above.

20. BWP PLYWOOD

BWP plywood shall be generally conforming to IS 710. Selection of timber species for manufacture of plywood shall be as prescribed in IS 710 and as far as possible a single species of timber shall be used.

Adhesive : The adhesive used for bonding the veneer shall be of the hot press synthetic resin, phenol formaldehyde type (BWP) and shall conform to IS 848. Extender shall not be added to the adhesive by the plywood manufactures. Fillers, if used, shall not exceed 10 percent by mass of solid content of the glue.

Dimensions

The thickness of any board shall not exceed the number of pieces multiplied by 2.5 mm. The two face veneers in finished board shall be of the same nominal thickness.

21. HEAT REFLECTIVE COOL PAINT

Finishing Terrace with a premium specially formulated roof and exterior coating which reflects the damaging UV rays and reduces the internal temp of the buildings. Reflects damaging ultra violet rays from the structures.

- Reduces internal energy demand.
- Dirt pick-up resistant technology.
- Excellent elongation and adhesion.
- Carbonation resistant.
- Breathable and waterproof.

SURFACE PREPARATION

- Thoroughly abrade the surface to remove loose particles, dust and lattaince incrustations and existing paint using coarse wire brushes and water jetting.
- Fill up all the cracks and crevices with Putty. No. of Coats: 1 Primer + 2 top coats

22. ROLLER BLINDS

22.1 The item shall include supplying & fixing roller blinds of following specifications:

The drive unit shall be made of moulded plastic with steel spring support & inserted into the tube and it shall be driven by a ball chain pulley with ball chain and can be positioned at right side or left side of the shade. The shade when lowering or raising, shall be automatically locked in position upon release of the ball chain by means of a built-in friction lock. The end plug shall be moulded of plastic with a steel location pin. The plug shall be inserted into the tube end.(opposite to the drive unit).

The support brackets shall be of coated steel & provided with covers & used in right hand positions differentiated by the acceptance of the rectangular drive unit support or the round idler plug pin. The roller tube shall be of extruded aluminum with 38mm internal diameter & skin thickness of 1mm & shall incorporate a keyway integral with the tube to accommodate the spline. The outside diameter of the roller tube shall be 40mm. The bottom rail shall be a stiffening inserted into bottom rod pocket.

The bottom rail shall be a stiffening inserted into bottom rod pocket. The material may be timber, PVC covered steel tube or VB bottom rail. The ball chain shall be 2mm diameter cord with 4.5mm diameter acetal balls moulded co-axially to it on 6mm pitch to form an endless ball chain which is used for raising or lowering action of the shades.

Fabric shall be attached to the tube with an adhesive strip. A minimum of one turn of fabric must be placed on the roller before the working section of fabric starts.

The fabric shall be as per selection from specified Manufacturer's range & shall be sized according to site requirements, manufactured by Approved make as described below:

- a. Blackout roller blinds with 100% polyester blackout fabric with reverse & front side pigment colour coated complete with installation.
- b. Roller blinds with fabric made of 35% fiberglass, 65% vinyl on fiberglass and has to have Gold Green guard Certification.

22.2 Measurements:

Length and breadth shall be measured correct to cm. fully opened Roller Blind area from Drive unit to Bottom rail shall be measured in square meter nearest to two places of decimal. The rate shall include the cost of materials and labour required for all the operations described above.

23. GLASS FILM

23.1 Frosted Film:

Crystal Glass film FROSTED effect with approved artwork, cut using digital plotter. Selfadhesive, bubble-free installation to be done on clean glass, by Authorised Installers only.3M or equivalent Architectural Markets Warranty for a period of 180 months for interior application, 36 months for exterior application to be submitted along with invoice.

23.2 Digitally Printed Film

Digitally reproduced Film could be fixed on Lift lobbys & Corridor partitions of 3M or equivalent Clear Graphics 114 make or approve equivalent. The film shall be Durable inkjet printed graphics on self adhesive vinyl, special CLEAR film to produce coloured imagery on glass. Customized imagery with approved graphics including providing company warranty at all leads & lifts etc.

24. TOUGHENED CERAMIC DIGITALLY PRINTED GLASS

12mm thick toughened ceramic digitally printed glass. 12 mm annealed Glass used for digital printing should be of Saint Gobain/ Asahi/ Pilkington and should be toughened in vertical tempering line. Digitally printed glass must be and only be of ceramic ink and printed on DIPTECH/TECGLAS Plant; ink should be of ceramic and carrier should be terepthalene oil, Which is then tempered post printing so that the ceramic ink embeds inside the glass making it permanent and homogeneous;; highly durable ; water resistance , UV resistance; environmentally friendly (no lead, no arsenic, no copper, no formaldehyde; compressive strength (1000 MPa) & tensile strength (40 MPa),same as float glass as per the detailed drawings and as approved by Architect/Engineer/DFCCIL.



25. SPIDER GLAZING WORKS

25.1 Design, manufacture, supply and installation of Spider Glazing/ skylight / canopy with finishing / shading as per Architect/Engineer/DFCCIL approval incorporating toughened / laminated clear float glass on MS / SS structure used at each vertical joint to provide lateral stiffness against wind loading, deflections and other specified loads expected including frame work structural supports wherever necessary. Hardware of spiders shall be sleek better strength and Aesthetic features. The Spiders Shall be Manufactured my Investment casting process of grade SS316. The BHFB / BHAB bolts shall be of SS316 grade with all necessary accessories. The Contact between glass surface and metal shall be protected by using EPDM washers. The glass hole shall be protected from direct contact with the Metal by Derlin bush. A spring washer confirming to SS316 acts as a locking mechanism to secure nut in place ensuring full tightness for long period of time. All fasteners, sealants and weather elements such as flashing, coping etc. Shall be approved by the Architect/consultant to make the system completely water proof. Design calculations for the façade shall be furnished for approval to Architect/Engineer/DFCCIL.



25.2 Measasurements:

Plan area from out to out shall be measured in square meter nearest to two places of decimal. The rate shall include the cost of materials and labour required for all the operations described above.

Modesty Panel of 12mm Thick Compact Laminate should be provided and fixed and Size of UMP: 900 mm (W) x 450 mm (H), 1850 mm Height of Cubicle (Including bottom Gap of 650 mm).

Complete in all respect as per instruction of Architect.

Accessories:

Standard - Stainless Steel – 304 Grade accessories)

Right Angel Brackets.

S.S. Screws 304 G & P.V.C. Wall plugs.

25.3 Aluminium Trims:

The top trims and end trims for 50-60 mm shall be made from aluminum extrusion. All kinds of extrusions for 50-60mm shall have average wall thickness of 1.2 mm & having finish of powder coating. Top trim in 50-60mm thick panel shall be press fitted on the horizontal extrusion, it shall be slide fitted with the help of top trim connector made from PP copolymer 3530 grade. End trim for 50-60mm thick panel shall be slide fitted with the help of end trim connector made from 2.0mm thick M.S. CRCA Grade D as per IS: 513

26. STAINLESS STEEL RAILING WORKS

26.1 Dia 50mm Round Baluster System:-

Supply and installation of Arch make 304 Grade Stainless Steel Knock Down railing system comprising \emptyset 50mm Handrail fixed on \emptyset 50mm S.S. Round baluster (Design Code ABT222-1-163) placed at maximum 1200mm c/c along with 3 Nos. \emptyset 16 mm mid rails connected at the side of baluster with fixtures. The balustrade would be fixed onto floor with casted base plate of minimum 6mm thickness. Base plate shall be concealed with suitable S.S. 304 grade cover Cap so that the mounting anchor fasteners are not visible after installation. Wall thickness of Handrail & Baluster Pipes shall be taken as 1.5mm & Mid Rail Shall be 1.2 mm along with all visible components developed in High Grade S.S. and whenever required, joints to be filled with bushings for extra strength. Railing height to be taken @ 1000mm from floor level.

26.2 Wall Mounted Railing systems:-

Supply and installation of Arch make 304 Grade Stainless Steel Knock Down Wall mounted Railing system comprising \emptyset 50mm Handrail mounted on the wall through Wall Brackets & anchor fasteners which will be placed at maximum 1200mm c/c distance and as per site requirement. Wall thickness of all Pipes shall be taken as 1.5mm along with all visible components developed in High Grade S.S. and whenever required, joints to be filled with bushings for extra strength.

26.3 Installation:-

Installation shall be by done a qualified, authorized representative of the manufacturer. Installation must be in accordance with standard or non-standard, yet applicable details (instructions) included on installation/shop drawings provided by the manufacturer. Install components plumb and in-line, accurately fitted, free from distortion or defects and securely anchored to structure.

26.4 Protection after installation:-

Contractor is to provide protective covering on handrails and guardrails if construction is not yet finished in the area where the railings are installed.

26.5 Measurements:-

Length of the finished Railing shall be measured correct to a cm. The rate shall include the cost of the labour, T&P and materials involved in all the operations described above.

27. Acrylic Solid surface LATTICE JALLI

Lattice Jalli partitions in 12mm thick acrylic solid surface sheet of approved make. The acrylic solid surface should be conforming to TUV (Austria)standards. Installation to be done in basic series with spickles, thickness (12 mm), as approved by Architect/Engineer/DFCCIL. The material should be CNC cut to achieve the desired design as per Architect. The 6mm deep CNC cut Acrylic solid surface/ cnc cut lattice jail sheets to be fixed with the help of 25x25 mm Aluminum/25x25mm teak wood/75x75mm class teak wooden frame from all the 4 sides of the lattice jalli. Lattice jaali frame to be supported with the help of Hilti/ or approved fasteners as per requirement. Adhesive of the same color. The rate is inclusive of framework, material and required pattern approved.

Durability performance & Design flexibility / Non-porous & Hygienic(Anti-bactrial)

<u>Acrylic</u> solid surfaces should be tough and repairable. <u>Acrylic</u> solid surfaces should be solid all the way through, minor cuts, scratches or nicks can be quickly sanded out, restoring the surface to its initial appearance. <u>Acrylic</u> solid surfaces should be long lasting.

<u>Acrylic</u> solid surfaces should be easy to clean and maintain. <u>Acrylic</u> solid surfaces should be stain and resistant and shall be non-porous.

<u>Acrylic</u> solid surfaces to be non-porous it should not support the growth of microbial growth. <u>Acrylic</u> solid surfaces should be workable and as per requirement it should carve able, sandblasted, polished and cut-out to create a one-of-a-kind look in a variety of shapes and finishes. <u>Acrylic</u> solid surfaces wherever required should also be thermoform able or shaped using heat. <u>Acrylic</u> solid surfaces should be as per requirement in relevant colour and should be developed as per design. The material / product used should be selected as per requirement and wherever it requires thermoforming, laying, etching, carving and shaping capabilities then thermoformable material /product should be used. The product should be selected according to its use. The final finished product should be seam less, joint less and shall maintain lustre and when etched it should have a smooth finish.Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.,

Property	FUNCTION INDEX SIGN	UNIT	TEST METHOD
Density	1.5 - 1.8	kg/dm3	DIN 52 102
Mass	16	kg/m2	

Product Specifications

Barcol Hardnoss	55 70		DIN 68 861
Darcoi Hardiless	55-70		
Tensile Strength	25-60	N/mm2	DIN EN ISO 527
Flextural	30-60	N/mm2	EN 310
Modulus elasticity	5000 - 9000	N/mm2	EN 310
Ball Drop	170 - 280	N/mm2	DIN ISO 2039
Impact Strength	1.5 - 6.5	kj/m2	Din EN ISO 179
Long/thermal Expansion	3.5 x 10	m/m'k	DIN 53 752
Water Absorption	-0.04	0/ (maga)	DIN 53 495/ASTMD
water Absorption	<0.04	%(mass)	570
Light Fastness	Blue Scale 5-7,		DIN EN ISO 4892
	Grey Scale 4-5		
Fungi & Bacteria	No Infestation		ISO 846 A/C
Calotitic Value	Ca. 10	Mj/kg	DIN 51 900
Fire Behaviour	B2		DIN EN 13501-1
Chemical Resistant	1B		DIN 68 861-1

28. 3D COPPER MURAL:

3D copper mural to be in panels in various sizes varies from 1.2 to 4.5 sqmtr. Hammered copper shall be fixed on 12mm BWP ply. Cot of ply to be included. Concept of copper mural will be specially be designed keeping in mind that the art mural will enhance the ambience and would improve its look aestheticallyFraming Cost includes frame of 25 mm X 50 mm Aluminum Box/ teak wood section installed on the plastered wall with suitable brackets /fasteners.

29. GI TRAP DOORS

GI Trap Doors are to be made to big sizes – upto 8' long. For instance, even 8' x 4'. Big frames & shutter are reinforced with stiffeners to prevent warping

Only a uniform 2.5mm groove all around to be provided with sliding hinges, making it blend seamlessly with the ceiling

Trap Door to consist of an Inner Frame and an Outer Frame. Both the frames are to be completely flexible for any size requirement. Material for the frame is Galvanised Iron and the finish can be anodized or powder coated as per the recommendation of Architect/Engineer/DFCCIL.

30. 3D ENGRAVED ACRYLIC PANEL:

Designer Wall Paneling with 3D engraving in 18mm thick in solid surface sheet of approved make manufactured as per TUV (AUSTRIA). The colour shall be as as approved by Architect/Engineer/DFCCIL basic white color. Design &, fixing arrangement as per direction of Architect/Engineer/DFCCIL. The material should be CNC 3D cut to achieve the desired design. The CNC cut Acrylic solid surface sheet to be fixed in a cove developed as per design and the cost of cove wood or stainless steel shall be paid separately in separate items. The 3D acrylic shall be carved in the desin and theme suiting the environment. The material used shall bevery trancelucent and the light shall pass through the acrylic solid surface enhancing the design. The material used shall have translucency to enhance 3D effect.

Durability performance & Design flexibility / Non-porous & Hygienic (Anti-bactrial)

<u>Acrylic</u> solid surfaces should be tough and repairable. <u>Acrylic</u> solid surfaces should be solid all the way through, minor cuts, scratches or nicks can be quickly sanded out, restoring the surface to its initial appearance. <u>Acrylic</u> solid surfaces should be long lasting. Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.,

<u>Acrylic</u> solid surfaces should be easy to clean and maintain. <u>Acrylic</u> solid surfaces should be stain and resistant and shall be non-porous.

<u>Acrylic</u> solid surfaces to be non-porous it should not support the growth of microbial growth. <u>Acrylic</u> solid surfaces should be workable and as per requirement it should carve able, sandblasted, polished and cut-out to create a one-of-a-kind look in a variety of shapes and finishes. <u>Acrylic</u> solid surfaces wherever required should also be thermoform able or shaped using heat. <u>Acrylic</u> solid surfaces should be as per requirement in relevant colour and should be developed as per design and the material / product used should be selected as per requirement and it may require thermoforming, laying, etching, carving and shaping capabilities. The product should be selected according to its use. The final finished product should be seam less, joint less and shall maintain lustre and when etched it should have a smooth finish. The backlic ceiling shall have the light passing and shall have translucency.

Property	FUNCTION INDEX SIGN	UNIT	TEST METHOD
Density	1.5 - 1.8	kg/dm3	DIN 52 102
Mass	16	kg/m2	

Product Specifications

Barcol Hardness	55-70		DIN 68 861
Tensile Strength	25-60	N/mm2	DIN EN ISO 527
Flextural	30-60	N/mm2	EN 310
Modulus elasticity	5000 - 9000	N/mm2	EN 310
Ball Drop	170 - 280	N/mm2	DIN ISO 2039
Impact Strength	1.5 - 6.5	kj/m2	Din EN ISO 179
Long/thermal Expansion	3.5 x 10	m/m'k	DIN 53 752
Water Absorption	<0.04	%(mass)	DIN 53 495/ASTMD 570
Light Fastness	Blue Scale 5-7,		DIN EN ISO 4892
	Grey Scale 4-5		
Fungi & Bacteria	No Infestation		ISO 846 A/C
Calotitic Value	Ca. 10	Mj/kg	DIN 51 900
Fire Behaviour	B2		DIN EN 13501-1
Chemical Resistant	1B		DIN 68 861-1

31. STAIN GLASS MURAL:

Stain glass mural sandwich panel in 5mm stain toughened glass panel+5 mm thick toughened clear glass facing outside. Concept of stain glass will be specially be designed keeping the company's profile in mind the art mural will enhance the ambience and would improve its look aesthetically.

The material used in making the stain glass will be lead, 5 stain toughened glass panel+5 mm thick clear toughened glass, Imported resins and staining chemicals, imported color dyes overall thickness of glass in 10mm,thw two panes will be sealed with silicon as/approved from all sides.

Cost includes frame of aluminum powder coating which runs around the glass panel fixed to wall/RCC column.

32. ARTIFICIAL TURF:

Artificial Turf 40 mm thickness –Drain cells & application of Solvent below the Drain Cells. Drain cells functions as a highly efficient lightweight drainage system that rapidly captures and transports even high water volumes associated with torrential rain.

Terms that goes under artificial turf other than Drain Cells:

- 1. Large Stones. Rocks ranging from three-eighths to three-fourths of an inch are perfect for artificial grass sub-base.
- 2. Fine Materials. It is imperative to have a filler material, called fines, to surround the larger crushed rocks for overall turf stability.
- 3. Ideal Mixture.
- 4. Weed Fabric.

33. PLANTERS:

Planters for display of plants at Reception and diff area of Building indoor/Outdoor, highly resistant to breakage, harsh weathers and ultra violet rays. These Plants include air purifying plants, that would absorb all the toxins from the air released from the computers thus benefitting the long term health of the employees spending 8-10 hrs Indoors.

- Areca palm (3'-4' ht., bushy) & planter size -13"X13"X18" with fillers
- Spathypyullum wallici (1'-2' ht. bushy) & FRP planter size -7.5"X7" with fillers
- Bosten fern (1'-2' ht. bushy) with & FRP planter size -7.5"X7" with fillers
- Drasaena marginata (2' ht. multibranch) & FRP planter size 10"X10"X10" with Fillers
- Ficus lyrata (4' ht. branched) & planter size -13"X18" with Fillers
- Snake Plant (2.5' Ht.) & planter size -10"X 10"X10" with Fillers
- Alocasia with 6" pvc (white) pot of 1' ht
- Raphis Palm 3-4' ht. multi tiller (4-5 tiller)
- Chamadora of 5-6' ht. bushy of 5-6' ht. bushy
- Japanese bamboo/ Black bamboo of 4'-5' ht. multi tiller (7-8 tiller)
- Ficus elastica of 2' ht. bushy

Technical Specification of furniture Sub-head to be derived from the Nomanclature of the BOQ ITEM

34. MODULAR WORKSTATIONS (TILE BASED SYSTEM)

34.1 Components:-

Panels Construction - Each panel consists of Vertical extrusions 2Nos and Horizontal extrusions made of 1.2mm thick aluminum with duly powder coated at every division of tile/block. Each panel have Bottom frame fabricated for 50-60mm panel comprises of L-channels made of 2mm thick CRCA steel (IS: 513), formed plates of 3mm thick HR steel (IS: 2062) & ERW steel tube of size 35x15x1.6mm thick in oval cross section (IS: 7138) welded together. The complete bottom

frame shall be powder coated with an average of 50-60 microns thickness of epoxy powder coating. The Bottom Frame is bolted with the Upright verticals. Each Panel is provided with 2Nos Legs of height 120mm are fixed at the bottom frame of the panel. Legs are fabricated by CO2 welded MS Tube of section 38mm x 25mm (IS: 7138 ERW Tube, 38mm x 25mm x 16bg) with the base plate of the MS plate of 35x22x5mm (IS: 2062, 5mm HR) over which an M8 Leveler is fitted which allows for adjustment of the height by 50mm. It will be coated with 45-50micron thickness of epoxy powder coating. Each Panel consists of 2Nos Intermediate blocks. In a 50-60mm Thick panel intermediate block shall comprise of 38mm thick paper honeycomb with 3mm MDF/ Hollow MDF on each sides and 0.6mm decorative laminate on both sides. Particle board framing shall be used on outer boundary of these blocks as well as intermediately at certain locations forming conduit for passing cables. These blocks will be located in the middle bands of the panels made out of a composite construction of MDF and paper honeycomb/ hollow MDF. Each Panel consists of TOP TILES/SPLIT TILES. These tiles shall be slide in to the panels from top before fixing the top horizontal. These tiles shall be supported from top & bottom side with clips made from PP co polymer fitted in horizontal extrusion. In case of split tiles it shall be offered in Fabric magnetic tiles, Whiteboard tiles. Each Panel consists a BOTTOM TILE. These bottom tiles shall be press fitted on to the assembly frame of the panel with the help of snap on clips made of nylon-66 and support clips made from Polypropylene (PP). All partitions and side panels have levelling screws for adjustment in case of uneven floor to take care of +/- 40 mm of uneven flooring.

Tile Finishes :

- FABRIC MAGNETIC TILES: Fabric magnetic tiles shall be fabric upholstered metal tiles in 0.6 mm thick G.I. Grade O as per IS: 277. The fabrics shall be upholstered with adhesives.
- FABRIC TACK TILES: Fabric tackable tiles shall be upholstered metal tiles in 0.6mm thick G.I. grade O as per IS: 277, with Polyurethane foam in the tile for tackablity. The fabric shall be upholstered with adhesives.
- WHITE BOARD TILES : White board tiles shall be made of 8.0 mm thick particle board conforming to IS: 12823 laminated with 0.6mm thick white glossy high pressure laminate on outer side & 0.6mm backing laminate on inner surface and will be having all its edges with minimum 0.5 mm thick PVC edging.

Aluminum Trims: The top trims and end trims for 50-60 mm shall be made from aluminum extrusion. All kinds of extrusions for 50-60mm shall have average wall thickness of 1.2 mm & having finish of powder coating. Top trim in 50-60mm thick panel shall be press fitted on the horizontal extrusion, it shall be slide fitted with the help of top trim connector made from PP copolymer 3530 grade. End trim for 50-60mm thick panel shall be slide fitted with the help of end trim connector made from 2.0mm thick M.S. CRCA Grade D as per IS: 513.

Legs - System shall also have 120 mm high powder coated welded metal legs to give the system an elevated look. Single side legs are fabricated by CO2 welded MS Tube of section 38 mm x 25

mm (IS: 7138 ERW Tube, 38 mm x 25 mm x 16bg) with the base plate of the MS plate of 35mm x 22mm x 5mm (IS: 2062, 5 mm HR) over which an M8 Leveler is fitted

End/Intermediate separator: partitions of 22.8mm thick including powder coated aluminum trims and supported on Legs for better air circulation and helps in keeping floor clean. The 22.8 mm panels are only to be used as Separator/End panels to provide additional privacy. These panels have various finishes and no cable management ability.

Panel Construction: The 22.8mm End/Separator panels shall be made of horizontal and vertical uprights. These uprights and horizontals shall be made of aluminum extrusion having material AL96063-T6 & have average wall thickness of 1.2mm & powder coated with epoxy-polyester powder. The Blocks for the End/Separator panels shall be of 16mm to 18mm thickness in the selected finish. The top most block in the panel shall be the top block of the panel. It shall be available in fabric, laminate, whiteboard, fabric metal, tackable and clear glass finishes. The 2Nos blocks in the intermediate bands shall be available in fabric or laminate finish and the lowermost block in the panel shall be the bottom block which shall be in fabric, metal or laminate finish.

Tiles: Tile Finishes in End/Separator Partitions to be provided as per the site and layout approval. Finishes in these panels shall be

- LAMINATE FINISH BLOCKS: Laminate finish blocks shall be made from 18mm thick particle board, cladded with 1mm thick laminate of approved shade.
- FABRIC FINISH BLOCKS: These shall be made from 18mm thick Pre-Laminated Particle Board upholstered with 1mm thick approved shade of fabric using adhesives.
- WHITEBOARD BLOCKS: These shall be made of 16mm thick particle board laminated with 0.6mm thick white glossy high pressure laminate on both sides and having all its edges with minimum 0.5 mm thick PVC edging.
- GLASS BLOCKS: These shall be made of 4mm thick toughened plain glass having diamond polish edge finish.
- FABRIC TACKABLE BLOCKS: These shall be made from 18mm thick Pre-Laminated Board battens which hold 3mm MDF in between. 6mm thick Polyurethane foam shall be pasted on 3mm thick MDF and this assembly shall be upholstered with approved shade of fabric on both sides using adhesive.
- METAL FINISH BLOCKS: Metal finish blocks shall be made from two components of 0.8mm thick M.S. CRCA Grade D as per IS: 513 powder coated with epoxy polyester finish.

Aluminum Trims: The top trims and end trims for 22.8mm partition shall be made from aluminum extrusion having material AL96063-T6. Top trim in 22.8mm thick panel shall be slide fitted with the help of top trim connector made from PP copolymer 3530 grade. End trim for 50-60mm thick panel shall be slide fitted with the help of end trim connector made from 2.0mm thick M.S. CRCA Grade D as per IS: 513. End trim for 22.8 mm thick panel shall slide with the help of end trim connector made from nylon-66.

Legs: Legs shall be 120 mm high powder coated welded metal legs. Legs shall be fabricated by CO2 welding MS Tube of section 38mm x 20mm (IS: 7138 ERW Tube) with the base plate of the MS plate of 35mm x 22mm x 5mm (IS: 2062, 5 mm HR) over which an M8 Leveler shall be

fitted, The height of the panel leg will be 126mm. This shall be coated with minimum 45 micron thickness of epoxy powder coating.

Workstation Worktop as per the approved shape and site requirement made out of 25mm thick prelam particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick PVC lipping glued with hot melt EVA glue. The work surface shall be provided with circular cut out of Dia.65mm as per the requirement, for passing of wires. These cut outs shall be provided with ABS covers. Work surfaces are fitted to the panels by work surface brackets. Brackets are made of 2.0mm thick CRCA grade D steel as per IS : 513-19. Brackets are slide in between end trim and vertical extrusions. The product should be complete and as per approved sample and as per the direction of Architect/Engineer/DFCCIL.

Computer Key Board Tray of 480mm (L) X 280mm (D) X 40mm(H) made out of CRCA steel as per IS : 513I made of 0.9mm thick powder coated with sliding channels and other fixtures/fittings. It should also have a sliding system for accommodating mouse. The product should be complete and as per approved sample and as per the direction of Architect/Engineer/DFCCIL.

CPU Trolley of Size - 345mm(W) x 226(D) x 180mm(H) is made of 1.0 mm thick MS CRCA Sheet and Side support is made of 0.8 mm thick MS CRCA Sheet. It consists of 4Nos Nonlockable twin wheel castors are injection moulded in Black Nylon. The product should be complete and as per approved sample and as per the direction of Architect/Engineer/DFCCIL.

Mobile Pedestal having 3 Drawers Unit having flat metal front and top with Central locking. The Drawer Unit consists of 2Box and 1File Drawers. The Overall size of the Drawer Units is 450mm(W) X 435mm(D) X 646mm(H). Construction & Material of Drawer Unit : Welded Assembled of 0.8 thick CRCA for Body Shell, Drawer Front & tray, Front Side Stiffener, Rear Side Stiffener & Bottom, 1.2mm thick CRCA Top Stiffener & Bottom stiffener. Drawer Fronts & Metal Front Straight Edge. All Drawers with Double extension precision ball slide shall be provided. For Drawer pulling, side wise tapered recess provided in shell behind Drawer Fronts. Locking:10 lever Cam Lock & Central RH locking with actuator & lock channel mechanism. Top Panel : 0.8mm thick Metal Straight Edge Top. Castors : Swiveling non-lockable 4Nos Castors mounted below the body shell. The Total drawer unit is finished with Epoxy Polyester Powder coated to the thickness of 50 microns (+/-10). The product should be complete and as per approved sample and as per the direction of Architect/Engineer/DFCCIL.

34.2 Electrical Fittings and Wire management:-

Wires shall be taken into the system through cable ducts from the junction boxes and it is carried upto the panels through concealed conduits inside the blocks. Wires runs through the system from Bottom tile and extended to the top at various locations by the help of 2 nos. vertical Cable Ducts in each panels. Cable duct shall be made from 0.8 mm thick M.S. CRCA Grade D as per IS: 513 - 1994. It is constructed with two parts, one is body & another is cover. It holds the cables & gives aesthetic appearance by covering all cables entry, which are moving upward to the panels. Size of Cable duct is 107mm W X 154 mm H X 21 mm D.

34.3 Measurement: Measurement for payment shall be for each unit for single person seating capacity

35 TILE BASE FULL HEIGHT MODULAR PARTITION

35.1 Frames: -

Partition thickness is 50- 80mm for added stability and main structure shall be a combination of different Aluminum Sections made from Aluminum alloy 63400-WP and shall be powder coated with Epoxy Polyester or Anodized, varying in heights and widths to make a full height cabin up to 3000 mm below the false ceiling level. The frame structure shall be made by joining Aluminum Extrusions by means of brackets made of 3 mm thick HR (IS-2062) and screws. Overall thickness of panel assembly shall be 66 mm. In elevations, the width of tiles shall vary from 300mm to 2400mm in pitch of 150mm and heights shall vary from 600 mm to 2400 mm (actual 534 mm to 2136 mm) in pitch of 600 mm. The system shall provide to make junctions straight partition panels as per approved layout. The super structure above false ceiling level shall consist of True ceiling mounting bracket which shall hold wooden batten frame work made from Rubber wood (50x50xlength of partition). The partition panel extrusions shall be grouted to this superstructure. The system shall have provision for leveling adjustment to compensate for floor unevenness (up to 40 mm) as well as false ceiling height difference (up to 15 mm). Provision shall be provided Horizontal adjustment at wall side with adjustment up to 20 mm.

35.2 Raceways:-

Provision of wire management through the panels vertically shall be possible. Wiring intake into the panel from flooring as well as ceiling shall be provided. Provision in panel width up to 1200 mm width for 2 slots of 100 x 25 at a distance of 100 mm from the edge of the panel shall be provided. Beyond 1200 mm to 2400 mm, the slots shall increase from 2 to 4 nos. the intermediate slots shall be equidistance from the end slots. The end slots shall be same as the ones in the 1200 mm w panels. Provision to provide wire management in full glazed panel in separate power post should be possible.

35.3 Tiles:-

Fabric Tile:

Fabric Non-tack tiles shall be made of 9.0 mm thick PLB / PLT boards(IS: 12823:1990) edge banded with 0.5 mm thick PVC lipping, and upholstered with approved fabric on front side. The overall thickness of tile shall be 10mm.

Glass Tile:

The glass used is 5 mm thick clear Toughened glass or 5mm thick BPG Toughened glass (IS-2835)

PVC Rubber extrusion fixed on to the extrusion profile, supports the glass edges from back side

Tackable tile:

Fabric Tackable tiles shall be made of 0.7mm thick GI Sheet (IS-277), with 8mm thick P.E. foam glued to it on front side which are fabric upholstered on front side. The overall thickness of tile shall be 9 mm. Stiffeners made of GI Sheet (IS-277) shall be provided at the back of the tile.

Whiteboard marker tiles:

Back painted glass of 5 mm Shall be provided for glass finished writing board in the panel itself.

Laminate Tile:

Wooden DL tile of 9 mm thick PLB edge banded with 0.5 mm thick PVC lipping with approved design of laminate shade shall be provided as per approved panel elevations.

35.4 Wire Management: -

Provision of wire management through the panels vertically shall be possible. Wiring intake into the panel from flooring as well as ceiling shall be provided. Provision in panel width up to 1200 mm width for 2 slots of 100 x 25 at a distance of 100 mm from the edge of the panel shall be provided. Beyond 1200 mm to 2400 mm, the slots shall increase from 2 to 4 nos. the intermediate slots shall be equidistance from the end slots. The end slots shall be same as the ones in the 1200 mm w panels. Provision to provide wire management in full glazed panel in separate power post should be possible.

36.0 TILE BASE LOW HEIGHT MODULAR PARTITION

36.1 Frame:-

Each panel consists of Vertical extrusions 2Nos and Horizontal extrusions made of 1.2mm thick aluminium with duly powder coated at every division of tile/block. Each panel have Bottom frame fabricated for 50-60mm panel comprises of L-channels made of 2mm thick CRCA steel (IS: 513), formed plates of 3mm thick HR steel (IS: 2062) & ERW steel tube of size 35x15x1.6mm thick in oval cross section (IS: 7138) welded together. The complete bottom frame shall be powder coated with an average of 50-60 microns thickness of epoxy powder coating. The Bottom Frame is bolted with the Upright verticals. Each Panel is provided with 2Nos Legs of height 120mm are fixed at the bottom frame of the panel. Legs are fabricated by CO2 welded MS Tube of section 38mm x 25mm (IS: 7138 ERW Tube, 38mm x 25mm x 16bg) with the base plate of the MS plate of 35x22x5mm (IS: 2062, 5mm HR) over which an M8 Leveler is fitted which allows for adjustment of the height by 50mm. It will be coated with 45-50micron thickness of epoxy powder coating. Each Panel consists of 2Nos Intermediate blocks. In a 50-60mm Thick panel intermediate block shall comprise of 38mm thick paper honeycomb with 3mm MDF/ Hollow MDF on each sides and 0.6mm decorative laminate on both sides. Particle board framing shall be used on outer boundary of these blocks as well as intermediately at certain locations forming conduit for passing cables. These blocks will be located in the middle bands of the panels made out of a composite construction of MDF and paper honeycomb / Hollow MDF. Each Panel consist of TOP TILES/SPLIT TILES. These tiles shall be slide in to the panels from top before fixing the top horizontal. These tiles shall be supported from top & bottom side with clips made from PP co polymer fitted in horizontal extrusion. In case of split tiles it shall be offered in Fabric magnetic tiles, Whiteboard tiles. Top Tiles can be offered in Fabric Magnetic, Fabric Tack tiles, White Board tiles as per approval of Architect/ Architect. Each Panel consists a BOTTOM TILE. These bottom tiles shall be press fitted on to the assembly frame of the panel with the help of snap on clips made of nylon-66 and support clips made from Polypropylene(PP). All partitions and side panels have levelling screws for adjustment in case of Uneven floor to take care of +/- 40 mm of uneven flooring.

36.2 Wire Management: -

Wires shall be taken into the system through cable ducts from the junction boxes and it is carried up to the panels through concealed conduits inside the blocks. Wires runs through the system from Bottom tile and extended to the top at various locations by the help of 2 nos. vertical Cable Ducts in each panels. Cable duct shall be made from 0.8 mm thick M.S. CRCA Grade D as per IS: 513 - 1994. It is constructed with two parts, one is body & another is cover. It holds the cables & gives aesthetic appearance by covering all cables entry, which are moving upward to the panels.

Size of Cable duct is 107mm W X 154 mm H X 21 mm D. Legs - System shall also have 120 mm high powder coated welded metal legs to give the system an elevated look. Single side legs are fabricated by CO2 welded MS Tube of section 38 mm x 25 mm (IS: 7138 ERW Tube, 38 mm x 25 mm x 16bg) with the base plate of the MS plate of 35mm x 22mm x 5mm (IS: 2062, 5 mm HR) over which an M8 Leveler is fitted.

36.3 Tiles:-

Tile Finishes in End/Separator Partitions to be provided as per the site and layout approval. Finishes in these panels shall be

- LAMINATE FINISH BLOCKS: Laminate finish blocks shall be made from 18mm thick particle board, cladded with 1mm thick laminate of approved shade.
- FABRIC FINISH BLOCKS: These shall be made from 18mm thick Pre-Laminated Particle Board upholstered with 1mm thick approved shade of fabric using adhesives.
- WHITEBOARD BLOCKS: These shall be made of 16mm thick particle board laminated with 0.6mm thick white glossy high pressure laminate on both sides and having all its edges with minimum 0.5 mm thick PVC edging.
- GLASS BLOCKS: These shall be made of 4mm thick toughened plain glass having diamond polish edge finish.
- FABRIC TACKABLE BLOCKS: These shall be made from 18mm thick Pre-Laminated Board battens which hold 3mm MDF in between. 6mm thick Polyurethane foam shall be pasted on 3mm thick MDF and this assembly shall be upholstered with approved shade of fabric on both sides using adhesive.

- METAL FINISH BLOCKS: Metal finish blocks shall be made from two components of 0.8mm thick M.S. CRCA Grade D as per IS: 513 powder coated with epoxy polyester finish.
- 37. MD Cabin Table ,Main Table is Size : 3300mm(L) x 1200mm(D) x 750mm(H), return storage of size 1500mm(L) x 480mm(D) x 550mm(H) and Back storage of size: 3600mm (W) x 480mm (D) x 2050mm(H). Main Table: Table is made up of E1/good grade MDF /BB with 0.45 mm natural veneer, 5mm solid wood edge banding for protection. Desktop thickness is 75-80 mm with leather pad and leather flip wire box. E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Wiring management system is introduced from floor and side table to wire box. Including 3 cabinets with pulling doors and 1 CPU cabinet. L shape design, Main desk on right or left hand return cabinet. Including multi-functional wire box. (2 power, 1 HDMI, 1 Internet, 1 Phone, 1 VGA). Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. With 3 drawer mobile pedestal with matching to table finish.

Back Storage: E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Doors constructed 0.45mm natural veneered MDF /BB with solid wood handles and Italy FGV soft damping hinge, the door is soft close. Including sliding cloth hook to keep cloth. Solid wood handles. Italy FGV soft damping hinge, the door is soft close. Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space.

All hardware shall be of reputed as per sample finally approved by the Architect/Engineer/DFCCIL.

Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

- **38.** Meeting table in Natural Veneer in MD Cabin Size 2100mm (W) x 1050mm (D) x 750mm (H) (With Veneer Finish),Providing and placing Rectangular shape 8 Seater meeting table of Size 2100mm(L) x 1050mm(W) x 750mm(H).Table top and legs are made of 60-70 mm thick Particle Board (E-1/good Grade), veneer finish with matched 2 mm ABS edge-banding.E1/good grade in veneer finish with zero urea formaldehyde emissions (<or = 8mg/100 g oven dry board-perforated method) for better in-house quality. This should comply with (EN 120-1992).It has Net box axial comfort 4 gang (UNIVERSAL Version).The Modesty is Particle board wood Grade E-1/good (Environmental Friendly) thickness 25 mm in veneer finish Edge-Banding(ABS) 2 mm. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.
- **39.** Chairman Cabin Table, The Main Table is Size: 2700mm(L) x 1150mm(D) x 750mm(H), Return Storage of size 1500mm(L) x 480mm(D) x 550mm(H) and Back storage of size:5000mm (W) x 480mm(D) x 2050 mm(H) & Free-standing swing door storage of size: 2100W 450D 750hmm. Main Table: Table is made up of E1/good grade MDF/BB with 0.45 mm natural veneer, 5mm solid wood edge banding for protection. Desktop thickness is 75-80 mm with leather pad and leather flip wire

box. E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Wiring management system is introduced from floor and side table to wire box. Including 3 cabinets with pulling doors and 1 CPU cabinet. L shape design, Main desk on right or left hand return cabinet. Including multi-functional wire box. (2 power, 1 HDMI, 1 Internet, 1 Phone, 1 VGA). Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. With 3 drawer mobile pedestal with matching to table finish.

Back Storage: E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Doors constructed 0.6mm natural veneered MDF/BB with solid wood handles and Italy FGV soft damping hinge, the door is soft close.

Including sliding cloth hook can keep cloth. Solid wood handles. Italy FGV soft damping hinge, the door is soft close. Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL.

Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

40. CEO Cabin, The Main Table: 2700mm(L) x 1150mm(D) x 750mm(H), Side Storage 1350mm(L) x 480mm(D) x 550mm(H) and Back storage of size: 3600mm (W) x 480mm(D) x 750mm(H) & Free Standing swing door storage of size 2500mm(L) x 450mm(D) x 750mm(H). Table is made up of E1/good grade MDF/BB with 0.45 mm natural veneer, 5mm solid wood edge banding for protection. Desktop thickness is 65-70mm with leather pad and leather flip wire box. E1/good grade MDF/BB with 0.45 mm solid wood edge banding for protection. Wiring management system is introduced from floor and side table to wire box. Including 3 cabinets with pulling doors and 1 CPU cabinet. L shape design, Main desk on right- or left-hand return cabinet. Including multifunctional wire box. (2 power, 1 HDMI, 1 Internet, 1 Phone, 1 VGA). Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. With 3 drawer mobile pedestal with matching to table finish.

Back Storage: E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Doors constructed 0.6mm natural veneered MDF with solid wood handles and Italy FGV soft damping hinge, the door is soft close. Including sliding cloth hook can keep cloth. Solid wood handles. Italy FGV soft damping hinge, the door is soft close. Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space.

All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.
41. Director Cabin Table Set consisting of Main table, Mobile Drawer Unit and Side Unit. The Main Table is Size : 2400mm(L) x 1050mm(D) x 750mm(H), Side Unit of size 1350mm(L) x 480mm(D) x 550mm(H) and Back storage of size: 2400mm (W) x 450mm(D) x 750mm(H) . Table is made up of E1/good grade MDF/BB with 0.45 mm natural veneer, 5mm solid wood edge banding for protection. Desktop thickness is 65-70mm with leather pad and leather flip wire box. E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Wiring management system is introduced from floor and side table to wire box. Including 3 cabinets with pulling doors and 1 CPU cabinet. L shape design, Main desk on right or left hand return cabinet. Including multi-functional wire box. (2 power, 1 HDMI, 1 Internet, 1 Phone, 1 VGA). Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. With 3 drawer mobile pedestal with matching to table finish.

Back Storage: E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Doors constructed 0.6mm natural veneered MDF/BB with solid wood handles and Italy FGV soft damping hinge, the door is soft close. Including sliding cloth hook can keep cloth. Solid wood handles. Italy FGV soft damping hinge, the door is soft close. Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space.

All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

42. ED CABIN of Size: 2400W x 1050D x 750mmH, Side table Size: 1200W x 450D X 750mmH and Back storage: 4300W x 450D X 750mmH. Side free standing storage - 2400W X 400D X 750mmH. Table is made up of E1/good grade MDF/BB with 0.45 mm natural veneer, 5mm solid wood edge banding for protection. Desktop thickness is 45-55mm with leather pad and leather flip wire box. E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Wiring management system is introduced from floor and side table to wire box. Including 3 cabinets with pulling doors and 1 CPU cabinet. L shape design, Main desk on right- or left-hand return cabinet. Including multi-functional wire box. (2 power, 1 HDMI, 1 Internet, 1 Phone, 1 VGA). Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. With 3 drawer mobile pedestal with matching to table finish.

Back Storage: E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Doors constructed 0.6mm natural veneered MDF/BB with solid wood handles and Italy FGV soft damping hinge, the door is soft close. Including sliding cloth hook can keep cloth. Solid wood handles. Italy FGV soft damping hinge, the door is soft close. Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space.

All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

43. GM CABIN, Main table of Size: 2100(W) x 1050(D) x 750(H) Return table of Size: 1000W x 450D X 750mmH and Back storage of Size: 3600W x 450D X 750H and Side storage of size: 1650W X 400D X 750MmmH. Table is made up of E1/good grade MDF/BB with min 0.45 mm natural veneer, 5mm solid wood edge banding for protection. Desktop thickness is 45-55mm with leather pad and leather flip wire box. E1/good grade MDF with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Use the state of from floor and side table to wire box. Including 3 cabinets with pulling doors and 1 CPU cabinet. L shape design, Main desk on right- or left-hand return cabinet. Including multi-functional wire box. (2 power, 1 HDMI, 1 Internet, 1 Phone, 1 VGA). Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. With 3 drawer mobile pedestal with matching to table finish.

Back Storage: E1/good grade MDF/BB with 0.45mm natural veneer, 5mm solid wood edge banding for protection. Doors constructed 0.6mm natural veneered MDF/BB with solid wood handles and Italy FGV soft damping hinge, the door is soft close. Including sliding cloth hook can keep cloth. Solid wood handles. Italy FGV soft damping hinge, the door is soft close. Waterborne Paint Technology decrease 95% of VOC to create more friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space.

All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

44. Conference room table in Veneer finishes, where table top and legs are made of 60-70 mm thick MDF/B board (E-1/good Grade), veneer finishes(Minimum thickness of 0.45) with matched 2 mm thick ABS edge-banding. The E1/good grade laminate board should be used with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house quality. This should comply with (EN 120-1992).The height of worktop shall be 740mm from ground level. Veneer Flipper with wiring tray made of 1.5-2 mm thick CRCA duly powder cited of 60-70 micron with housing supported Veneer legs made of minimum 36-45mm thick with approved shade of natural Veneer (minimum thickness of 0.5-0.6 mm).An intelligence wiring system shall be hidden underneath the work surface, to deliver all wires and cables from wiring tray to floor, which make the working atmosphere looks more neat, harmony and aesthetic.

The wiring tray shall be made of steel sheet thickness 1.2mm Epoxy powder coated spray color, baked at temperature 200 C° coated of 80-90-micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The Modesty shall be Particle board wood Grade E-1/good (Environmental Friendly) thickness 25 mm. cover with Veneer Edge-Banding (ABS) 2

mm. Complete as per the direction of Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

45. Meeting/ Conference tables: Worktop: Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The height of Worktop shall be 750 mm from ground level. Understructure: MS understructure with 50mm x 50mm C type square Straight leg, well supported with MS beams under table top to supported top & connected to leg to leg.

Wire management: Access Flap and Switch Mounting Tray is provided in the table. It is made from Matt silver Anodized Aluminium extrusion and plastic moulded components to facilitate access of Electrical/Data/Voice sockets access from Top. Powder coated switch mounting tray made from 0.8mm and 1.2mm MS sheet (IS: 513) which is powder coated 80-90micron. Switches to be mounted on tray as per requirement. Provision for mounting 8Module Switch plate on switch mounting tray shall be provided. Electrical/Data/Voice wire and IO to be paid separately. The product should be complete and as per approved sample and as per the direction of Architect. Completely consoled wire management with vertical wire uptake from floor via middle leg having removable cover one side and wire separator for data and wire separation, segregates to horizontal cable tray below Access Flap. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

46. DGM CUBICLE SIZE - 2400MM X 3500MM X 1200-1250MM H. Workstations- Size of Main table - 1500MM X 600MM X 750MM H. size of return table with extended top- 1450W1 x 2400(W2) x450(D1) x450(D2), Swing door storage made of Prelaminated finish - 1200W x450D x 725Hmm Below the back worktable. Worktop shall be made out of 25mm thick E-1/good Grade Pre-Laminated particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick ABS lipping glued with hot melt EVA glue. The work surface shall be provided with circular cut out of Dia.65mm as per the requirement, for passing of wires. These cut outs shall be provided with ABS covers. Work surfaces are fitted to the panels by work surface brackets, wooden legs & wooden modesty. Brackets are made of 2.0mm thick CRCA grade D steel as per IS: 513. Brackets are slide in between end trim and vertical extrusions.

Panel: Frame work shall consist of main spine and return spine of aluminium extruded section of minimum thickness of 1.2 mm. The thinness of main & return Panel is 60-70 mm. The panel will be hollow inside to accommodate wiring for electrical/data and outer frame of panel should be made of extruded aluminium, cladding with 3mm thick MDF both sides of the panel to create the hollow for the wire management. Panels could be shared or isolated as per layout. MDF 0.5-0.6 mm covered by fabric / Steel CR 0.5.06 mm EPC/ EPF Foam 3-4 mm for pin up/ magnetic as an option based on the requirement and as per approved by Architect. For the glass panel different aluminium profile (Top

and bottom of the frame) with 60-70 mm thick which should accommodate the glass of thickness 4-6 mm.

Finishes of panel: Above the top fabric pinup & Glass writable board with raceway in main spine (return table) & fabric pinup (Main table) & balance fabric finish for aisle side & return panel, below the top should be metal with MDF tile with one raceway at skirting level and etc. whichever required.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm (H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

Key Board Pullout Tray: Supplying and fixing of sliding computer key board tray of 550-570mm (L) X 280mm (D) X 40mm (H) made out of CRCA steel of thickness 1-1.2 mm, duly Powder Coated of 60-70 Micron.

CPU Trolley : Supplying and Fixing of CPU Trolley of Size - 345mm(W) x 226(D) x 180mm(H) is made of 1.0 mm thick MS CRCA Sheet and Side support is made of 0.8 mm thick MS CRCA Sheet. It consists of 4Nos Non- lockable twin wheel castors made of injection moulded in Black Nylon.

47. Manager Cubical, Overall size: 2100 W1x 3000(W2) x1200-1250Hmm L shape Workstations of Size: 2100 (W1) x1800(W2) x600 (D1) x 500 (D2) x 1200-1250 (H). L Shape Workstations of size: 1800W 1050W & rectangular worktop 1050W x 600D x750H mm, Side Swing door storage made of Prelaminated finish - 1200W X 500 X 750Hmm. Worktop shall be made out of 25mm thick E-1/good Grade Pre-Laminated particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick ABS lipping glued with hot melt EVA glue. The work surface shall be provided with circular cut out of Dia.65mm as per the requirement, for passing of wires. These cut outs shall be provided with ABS covers. Work surfaces are fitted to the panels by work surface brackets, wooden legs & wooden modesty. Brackets are made of 2.0mm thick CRCA grade D steel as per IS: 513. Brackets are slide in between end trim and vertical extrusions. Panel: Frame work shall consist of main spine and return spine of aluminium extruded section of minimum thickness of 1.2 mm.

The thickness of main & return Panel is 60-70 mm. The panel will be hollow inside to accommodate wiring for electrical/data and outer frame of panel should be made of extruded aluminium, cladding with 3mm thick MDF both sides of the panel to create the hollow for the wire management. Panels could be shared or isolated as per layout. MDF 0.5-0.6 mm fabric / Steel CR 0.5.06 mm EPC/ EPF

Foam 3-4 mm for pin up/ magnetic as an option based on the requirement and as per approved by Architect/Engineer/DFCCIL. For the glass panel different aluminium profile (Top and bottom of the frame) with 60-70 mm thick which should accommodate the glass of thickness 4-6 mm. Finishes of panel: Above the top fabric pinup & Glass writable board with raceway in main spine & fabric pinup (Return Spine) & balance fabric finish for aisle side & return panel, below the top should be metal with MDF tile with one raceway at skirting level and etc. whichever required.

Finishes of panel: Above the top fabric pinup & Glass writable board with raceway in main spine (return table) & fabric pinup (Main table) & balance fabric finish for aisle side & return panel, below the top should be metal with MDF tile with one raceway at skirting level and etc. whichever required.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm (H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

Key Board Pullout Tray: Supplying and Fixing of sliding computer key board tray of 550-570mm (L) X 280mm (D) X 40mm (H) made out of CRCA steel of thickness 1-1.2 mm, duly Powder Coated of 60-70 Micron.

CPU Trolley : Supplying and Fixing of CPU Trolley of Size - 345mm(W) x 226(D) x 180mm(H) is made of 1.0 mm thick MS CRCA Sheet and Side support is made of 0.8 mm thick MS CRCA Sheet. It consists of 4Nos Non- lockable twin wheel castors made of injection moulded in Black Nylon.

48. SR. REG. CUBICLE SIZE - 2400MM X 3150MM X 1200-1250MM H. Workstations- Size of Main table - 1650MM X 600MM X 750MM H. size of return table- 1050W1 x x450(D) x 750Hmm, Swing door storage made of Prelaminated finish - 2400W x450D x 750Hmm. Worktop shall be made out of 25mm thick E-1/good Grade Pre-Laminated particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick ABS lipping glued with hot melt EVA glue. The work surface shall be provided with circular cut out of Dia.65mm as per the requirement, for passing of wires. These cut outs shall be provided with ABS covers. Work surfaces are fitted to the panels by work surface brackets, wooden legs & wooden modesty. Brackets are made of 2.0mm thick CRCA grade D steel as per IS: 513. Brackets are slide in between end trim and vertical extrusions. Panel: Frame work shall consist of main spine and return spine of aluminium extruded section of minimum thickness of 1.2 mm.

The panel will be hollow inside to accommodate wiring for electrical/data and outer frame of panel should be made of extruded aluminium, cladding with 3mm thick MDF both sides of the panel to create the hollow for the wire management. MDF 0.5-0.6 mm fabric / Steel CR 0.5.06 mm EPC/ EPF Foam 3-4 mm for pin up as an option based on the requirement and as per approved by Architect. For the glass panel different aluminium profile (Top and bottom of the frame) with 60-70 mm thick which should accommodate the glass of thickness 4-6 mm. Finishes of panel: Panels could be shared or isolated as per layout. Above the top fabric pinup & Glass writable board with raceway in main spine (return table) & fabric pinup (Main table) & balance fabric finish for aisle side & return panel, below the top should be metal with MDF tile with one raceway at skirting level and etc. whichever required with 3 drawer metal mobile pedestal with side recess handle(400W 450D 600Hmm). Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Brackets are made of 2.0mm thick CRCA grade D steel as per IS: 513. Brackets are slide in between end trim and vertical extrusions. Panel: Frame work shall consist of main spine and return spine of aluminium extruded section of minimum thickness of 1.2 mm. The thickness of main & return Panel is 60-70 mm.

The panel will be hollow inside to accommodate wiring for electrical/data and outer frame of panel should be made of extruded aluminium, cladding with 3mm thick MDF both sides of the panel to create the hollow for the wire management. On the MDF 0.5-0.6 mm fabric / Steel CR 0.5.06 mm EPC/ EPF Foam 3-4 mm for pin up as an option based on the requirement and as per approved by Architect/Engineer/DFCCIL. For the glass panel different aluminium profile (Top and bottom of the frame) with 60-70 mm thick which should accommodate the glass of thickness 4-6 mm.

Finishes of panel: Above the top fabric pinup & Glass writable board with raceway in main spine (return table) & fabric pinup (Main table) & balance fabric finish for aisle side & return panel, below the top should be metal with MDF tile with one raceway at skirting level and etc. whichever required.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm (H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

Key Board Pullout Tray: Supplying and Fixing of sliding computer key board tray of 550-570mm (L) X 280mm (D) X 40mm (H) made out of CRCA steel of thickness 1-1.2 mm, duly Powder Coated of 60-70 Micron.

CPU Trolley : Supplying and Fixing of CPU Trolley of Size - 345mm(W) x 226(D) x 180mm(H) is made of 1.0 mm thick MS CRCA Sheet and Side support is made of 0.8 mm thick MS CRCA Sheet. It consists of 4Nos Non- lockable twin wheel castors made of injection moulded in Black Nylon.

49. L Shape Workstations

Frame Work, Partition and Cable management: Frame work shall consist of main spine and return spine of aluminium extruded section of minimum thickness of 1.2 mm. The overall thickness of Panel base System should be 60-70 mm. The panel will be hollow inside to accommodate wiring for electrical/data and outer frame of panel should be made of extruded aluminium. The panel shall be made up of 3 mm thick MDF both sides of the wooden frame to create the hollow for the wire management. Panels could be shared or isolated as per layout. Finishes of panel above the worktop: Above the top fabric pinup with raceway on main spine between workstation. The hollow panel made of MDF and 3mm thick foam which is upholstered with 0.5mm thick fabric with half fabric pinup + half glass marker board. The thickness of partition panel should be 60-70 mm for main & return spine.

Finishes of panel below the worktop: Below the top the hollow panel should be made of MDF tile and 0.5mm thick steel sheet pasted on MDF which is powder coated with EPC finish 80-90 microns for durability on the inside as well on the outside. The thickness of partition panel should be 60-70 mm for main spine & 25mm thick return spine.

The panel outer aluminium frame is designed such a way that it can be easily slide in to the columns/ Connectors by means of stacking one over the other. Horizontal race way should be 150-170 mm height aluminium profile. There shall be complete cable management arrangement with open able raceway below worktop with provision for fitting electrical/data switches and holes for passing cable.

Connectors/ Post Description: End Post: Aluminium 60-70 mm width – 1200-1250 mm height. One way post: Aluminium 60-70 mm width – 1200-1250 mm height. Two way post: Aluminium 60-70 mm width – 1200-1250 mm height. Three way post: Aluminium 80-120 mm width – 1200-1250 mm height. Four way post: Aluminium 80-120 mm width – 1200-1250 mm height. Brackets:

Table top support: 50-60mm width steel bracket.

Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992), the work surface shall be

provided with circular cut out of Dia.65mm as per the requirement. With 3 drawer metal mobile pedestal with side recess handle (400W 450D 600Hmm)

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm (H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Key Board Pullout Tray: Supplying and Fixing of sliding computer key board tray of 550-570mm (L) X 280mm (D) X 40mm (H) made out of CRCA steel of thickness 1-1.2 mm, duly Powder Coated of 60-70 Micron.

CPU Trolley : Supplying and Fixing of CPU Trolley of Size - 345mm(W) x 226(D) x 180mm(H) is made of 1.0 mm thick MS CRCA Sheet and Side support is made of 0.8 mm thick MS CRCA Sheet. It consists of 4Nos Non- lockable twin wheel castors made of injection moulded in Black Nylon. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

50. Tables for PA to ED, Main Table: 1800(W) x 750(D) x 750(H) & Side Table: 1000W x 450D X750H, Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.

The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding.

The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of

thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm (H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

51. Tables for P.A. Table of GM Cabin of size 1800(W) x 600(D) x 750(H) & Side Table: 1000W x 450D X750H & Back Storage: 1800W x 450D x 750Hmm, Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or=8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.

The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method).The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage: The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardware and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm (H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

52. Tables for AGM Cabin, Main Table: 1650(W) x 600(D) x 750(H) & Side Table:1000W x 450D X750H & Back Storage: 1650W x 450D x 750Hmm,Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5 -2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.

The understructure is made of 2mm thick Steel square pipe dimension 50X50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage: The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

53. Providing and placing tables for JGM Cabin, Main Table 1800(W) x 600(D) x 750(H) & Side Table:1000W x 450D X750H &Swing shutter Back Storage : 1800W x 450D x 750Hmm, Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.</p>

The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

54. Theme Cabin Table-This should comply with (EN 120-1992). The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap

(400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage: The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

55. Tables for Waiting Cabin of size 1800(W) x 750(D) x 750(H) & Side Table:1400W x 450D X750H & free standing Swing shutter with laminated finish of size: 1800W 450D 750Hmm Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method).The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding.</p>

The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns. Back Storage: The storages should be made out of

particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

56. Security/Dispatch /Travel Cabin With Running desk

Tables for Security Room of size 1800(W) x 750(D) x 750(H) & Side Table: 1000W x 450D X750H, With Running desk of size: 3000W x 600D x 750Hmm.Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.

The understructure is made of 2mm thick Steel square pipe dimension 50X50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method).The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

57. Tables for Control Room, Main Table: 1800(W) x 750(D) x 750(H) & Side Table:1000W x 450D X750H & Back Storage : 4050W x 450D x 750Hmm, Worktop: Worktop shall be made out of

25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue.

E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).

The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method).The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage: The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

58. Tables for Waiting/P.A./ Doctor Room of size 1800(W) x 600(D) x 750(H) & Side Table:1000W x 450D X750H &Swing shutter Back Storage with laminated finish of size: 1800W x 450D x 750Hmm,Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade

laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).

The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage: The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

59. Tables for Helping Desk of size 1500(W) x 600(D) x 750(H), Worktop :Worktop shall be made out of 25mm thick E-1/good Grade Pre-Laminated particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick ABS lipping glued with hot melt EVA glue. This should comply with (EN 120-1992). The understructure is made of Steel square pipe dimension 38 X 38mm. Thickness 2mm. Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method).

The modesty panel(wherever required) is made of 16 mm thick Particle Board (E-1/good grade), Coated of Laminated ABS edge-banding with 2mm and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns. Complete as per the direction of Architect/Engineer/DFCCIL.

Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

60. Sofa For MD/Chairman/Director Cabin/CEO

Sofa for Other Cabin. wooden structure of sofa to be fabricated using good quality hardwood duly seasoned and applying anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kg cum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm. All SS work should be in grade 304. Base of sofa should be in filled with suitable wood sections so as to give proper support to the seat. Height of the base of sofa shall be 200-250mm (approx.). Finished width of arm shall be 100mm after upholstery work. Sofa to be fully upholstered using approved fabric (stitch) of A grade of desired shade duly embossed including providing & fixing of all other related materials including hardwares etc. complete as directed by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Tables of size - 600mm x 600mm 400mm h for whose top is made of Particle board wood Grade E-1/good(Environmental Friendly), thickness 25mm cover with Melamine, Edge banding (PVC) 2mm.E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house quality. This should comply with (EN 120-1992).The understructure is made of SS.

Tables of size - 1200mm x 600mm x 400mmh for whose top is made of Particle board /BB E-1/good(Environmental Friendly), thickness 25mm cover with Veneer finish, Edge banding (ABS) 2mm.E1/good grade Veneer with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house quality. This should comply with (EN 120-1992).The understructure is made of SS.

61. Sofa For Other Cabins

Sofa for Other Cabin. wooden structure of sofa to be fabricated using good quality hardwood duly seasoned and applying anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kg cum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm.

All SS work should be in grade 304. Base of sofa should be in filled with suitable wood sections so as to give proper support to the seat. Height of the base of sofa shall be 200-250mm (approx.). Finished width of arm shall be 100mm after upholstery work. Sofa to be fully upholstered using approved fabric (stitch) of A grade of desired shade duly embossed including providing & fixing of all other related materials including hardwares etc. complete as directed by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Tables of size - 600mm x 600mm 400mm h for whose top is made of Particle board wood Grade E-1/good(Environmental Friendly), thickness 25mm cover with Melamine, Edge banding (PVC) 2mm.E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house quality. This should comply with (EN 120-1992).The understructure is made of SS.

62. Sofa For Open Area & Lounge

Sofa for Lounge & open area. wooden structure of sofa to be fabricated using good quality hardwood duly seasoned and applying anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kg cum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm. All SS work should be in grade 304. Base of sofa should be in filled with suitable wood sections so as to give proper support to the seat. Height of the base of sofa shall be 200-250mm (approx.).

Finished width of arm shall be 100mm after upholstery work. Sofa to be fully upholstered using approved fabric (stitch) of A grade of desired shade duly embossed including providing & fixing of all other related materials including hardwares etc. complete as directed by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Tables of size - 600mm x 600mm 400mm h for whose top is made of Particle board wood Grade E-1/good(Environmental Friendly), thickness 25mm cover with Melamine, Edge banding (PVC) 2mm.E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house quality. This should comply with (EN 120-1992).The understructure is made of SS.

Tables of size - 1200mm x 600mm x 400mmh for whose top is made of Particle board/BB, thickness 25mm cover with Veneer finish, Edge banding (ABS) 2mm.E1/good grade Veneer with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better inhouse quality. This should comply with (EN 120-1992).The understructure is made of SS.

63. Medium laminated Height Storage

Providing and fixing Medium height storages H. Body of storages made out 25 mm thick Particle/B Board (E-1/good Grade), melamine finishes with 2 mm PVC edge-banding. E1/good grade laminate to be used which provide no urea formaldehyde emission and formaldehyde should be phenol base with emission of not more than (<or= 8mg/100 g oven dry board-perforated method) for better inhouse quality. This should comply with (EN 120-1992).front of low height Storages should be made out of metal or 16 mm. thick Particle Board (E-1/good Grade),melamine finishes with 2 mm. PVC edge-banding fitted with extruded aluminum handle, as per requirement. Storages should be provided with adjustable levelers. Door Lock should be of three-way lock mechanism, the hinged doors can be locked at once. Door should be provided with Hinge-damping mechanism to enable soft closing of doors. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

64. Compactor Single Static Bay Push Pull Type of following specifications: Overall Dimensions of SS1 - Single Static 1 Bay Push Pull Type (U/C + Fittings) shall be 915mm(W) x 460mm(D) x 2080mm (H) (Height with undercarriage and rails in mm: 1980+65+35=2080). The Construction shall be Welded Construction sheet thickness is 0.8 mm for back & shelves and 0.9 mm for sides & top . Finish shall be Epoxy polyester powder coated thickness of 40 microns. Shelf construction shall be made from CRCA steel 0.8 mm thick IS: 513. Uniformly distributed load capacity of 80 Kg . Undercarriage shall have construction in welded frame made of HR sheet 3.15 mm thick conforming to IS : 10748 . Finish shall be epoxy polyester powder coat of approved color & shade with a dry film thickness of minimum 40 microns . The movements of the system shall be Push pull configuration (TYPE-P1/TYPE-P2): Movement of units achieved by pushing or pulling chrome plated 'C' Handle fitted onto 1.6 mm thick plate (mounted on each double & single movable units) & rigidly fixed at suitable height on body side.

Each movable undercarriage has 4 nos. of antifriction ball bearings for rolling onto channels & 4 no. of antifriction ball bearings for guiding between channels & 'J' section . Fittings shall be centralized locking arrangement through locking stiffener mounted onto back of single last unit so that it gets locked on channels when all the units are brought together .

The Recess handle lock is of make & placed at suitable height . This arrangement occupies a space of 90.0 mm . When the last unit is twin movable , hinged doors are provided for the end bodies, so in this case locking stiffener is mounted onto drive unit cover ; and with tile fascia option , it will be mounted in the recess of vertical trim . Each Drive Type units shall have Locking Knob near the drive wheel for manual locking of individual units when a person is using those units . Knob shall be rotated to unlock position when units are to be moved . End stoppers shall be provided to prevent derailment. Door locking shall be having hinged doors of recessed die cast handle cum lock giving 3 way locking through a lever & shooting bolts . Guide channels shall have 'J' section 2 mm thick HR & 25 mm square bright bar. Easterners shall be galvanized/blackodized/Zn plated .The label holder shall be made from 2 mm thick clear transparent acrylic sheet. Also total no. of loading levels per understructure shall be 5 for SS1.

65. Café Tables

Providing and fixing tables for whose top is made of Particle board wood Grade E-1/good(Environmental Friendly), thickness 25mm cover with laminate, Edge banding (PVC) 2mm.E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house quality. This should comply with (EN 120-1992).The understructure is made of Steel square pipe dimension 38 X 38mm. Thickness 2.5mm. Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness.

Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

66. Cafe Chair

The seat and back are made up injection molded high impact strength polypropylene polymer (PP) compound with indoor grade UV Resistance. The Powder coated weled tubular frame is made from M.S.E.R.W tub. Leveler are made of high impact strength polypropylene polymer compound with indoor grad UV Resistance and pressed fitted with tubular frame. Overall size: 420W x 500D x 830Hmm. Powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years

Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

67. Library Chair

Chair Seat made up of insert moulded polyurethane foam upholstered with foam laminated mesh fabric, insert moulded foam assembled over a load bearing plastic seat cover, back made up of two piece injection moulded frame, inner frame upholstered with mesh fabric and mounted on the main assembly, back adjustable lumbar support for achieving comfortable seating posture, seat size 52.5 cm width (approx.), 54.0 cm depth (approx.), sub assembly back size 48.5 cm max. width, 62.0 cm height.(approx.), effective back height from Seat 57.0 cm. (approx.), polyurethane foam for seat moulded with density 65±4 kg/m3, sled base leg frame welded assembly made of MS ERW round tube having outer dia 24mm (approx.) and thickness 2mm. including powder coating, based shoes on frame etc. all complete as per manufacturers specification.

Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

68. Library Book Storage(Double Sided)

Library book storage Back to Back Cantilever shelving Module

Back to Back Cantilever shelving Module

Welded Frame Upright with base shelf and adjustable shelves. Canopy brackets fixed to welded frame upright. Module having one base shelf and 5 adjustable shelves with clear height between each shelf to be 330 mm.

Welded Frame Upright (900x2190) to be made of 2 mm thick fully welded superior quality MS powder coated rolled form section or standard closed section with slots at pitch of 25 mm. Frame having intermediate tie member for extra strength.

Base shelf Tray to be made of 1 mm thick superior quality MS CRCA powder coated sheet with bottom stiffener made of 1 mm thick MS CRCA powder coated sheet skirting to be made of 1 mm

thick superior quality MS CRCA power coated sheet end bracket to be made out of 1.6 mm thick MS CRCA powder coated sheet. Base support is made out of 1.6 mm thick MS CRCA powder coated sheet.

Adjustable Shelf Tray to be made of 1 mm thick superior quality MS CRCA powder coated sheet with bottom stiffener made of 1 mm thick MS CRCA power coated sheet end bracket is made out of 1.6 mm thick MS CRCA powder coated sheet. Each shelf to have an index plate in polycarbonate. Canopy bracket made up of 1.6 mm thick MS CRCA powder coated sheet, fixed to welded frame upright.

Metal finish: All metal components are colour with powder coating not more than 60 micron. Wooden cladding of 25 mm thick Pre-laminated MDF. (Foil same as classroom table top) Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

69. Library Book Storage Non Sharing (Single Sided)

Library book Single Sided storage Back to Back Cantilever shelving Module

Back to Back Cantilever shelving Module

Welded Frame Upright with base shelf and adjustable shelves. Canopy brackets fixed to welded frame upright. Module having one base shelf and 5 adjustable shelves with clear height between each shelf to be 330 mm.

Welded Frame Upright (900x2190) to be made of 2 mm thick fully welded superior quality MS powder coated rolled form section or standard closed section with slots at pitch of 25 mm. Frame having intermediate tie member for extra strength.

Base shelf Tray to be made of 1 mm thick superior quality MS CRCA powder coated sheet with bottom stiffener made of 1 mm thick MS CRCA powder coated sheet skirting to be made of 1 mm thick superior quality MS CRCA power coated sheet end bracket to be made out of 1.6 mm thick MS CRCA powder coated sheet. Base support is made out of 1.6 mm thick MS CRCA powder coated sheet.

Adjustable Shelf Tray to be made of 1 mm thick superior quality MS CRCA powder coated sheet with bottom stiffener made of 1 mm thick MS CRCA power coated sheet end bracket is made out of 1.6 mm thick MS CRCA powder coated sheet. Each shelf to have an index plate in polycarbonate.

Canopy bracket made up of 1.6 mm thick MS CRCA powder coated sheet, fixed to welded frame upright.

Metal finish: All metal components are colour with powder coating not more than 60 micron. Wooden cladding of 25 mm thick Pre-laminated MDF. (Foil same as classroom table top) Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

70. Digital Librarian Workstations of Size: 1500W x 600D x 1200-1250 (H). Cubical Workstations with rectangular worktop- Size of Main table - 1500MM X 600MM X 750MM H. Worktop shall be made out of 25mm thick E-1/good Grade Pre-Laminated particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick ABS lipping glued with hot melt EVA

glue. The work surface shall be provided with circular cut out of Dia.65mm as per the requirement, for passing of wires. These cut outs shall be provided with ABS covers. Work surfaces are fitted to the panels by work surface brackets, wooden legs & wooden modesty. Brackets are made of 2.0mm thick CRCA grade D steel as per IS: 513. Brackets are slide in between end trim and vertical extrusions. Panel: Frame work shall consist of main spine and return spine of aluminium extruded section of minimum thickness of 1.2 mm.

The thickness of main & return Panel is 60-70 mm. The panel will be hollow inside to accommodate wiring for electrical/data and outer frame of panel should be made of extruded aluminium, cladding with 3mm thick MDF both sides of the panel to create the hollow for the wire management. On the MDF 0.5-0.6 mm fabric / Steel CR 0.5.06 mm EPC/ EPF Foam 3-4 mm for pin up as an option based on the requirement and as per approved by Architect. For the glass panel different aluminium profile (Top and bottom of the frame) with 60-70 mm thick which should accommodate the glass of thickness 4-6 mm. Finishes of panel: Above the top fabric pinup & Glass writable board with raceway in main spine (return table) & fabric pinup (Main table) & balance fabric finish for aisle side & return panel, below the top should be metal with MDF tile with one raceway at skirting level and etc. whichever required.

Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm (H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

71. The horizontal cable channel that fitted with a modesty panel tidily and effectively.

The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage: The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares

and anti-shock hinges. All hardware shall be of reputed make/brands per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

72. Librarian Cabin table of size 1650(W) x 750(D) x 750(H) & Side Table: 1000W x 450D X750H & Free standing Swing shutter with laminated finish of size: 1650W 450D 750Hmm, Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.</p>

The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and antis hock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in house air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

73. Single Bed - Ante Room For MD/ Chairman & Director Cabin

Single Bed of Size 950(W)X2050 (L)X750(H) with Head board and foot board. Head Board & Foot Board made up of 18 mm thick MDF/BB with 0.4 mm membrane foil. Head board size: 900x600 mm and foot board of size: 990x300 mm Support structure of Bed made up of M.S. Pipe 75x25x1mm thick and 40x40x1.2mm thick duly powder coated through seven tank process of Powder Coating. Side Panel: - The side panels are made up of 18mm thick MDF /Board with both side decorative laminate. All exposed edges are sealed with 2mm thick MDF/B Board with both side wood. Bed Base: - The Bed Base shall be made up of 12mm thick MDF/B Board with both side White laminate.

All Exposed edges of MDF/BB to be sealed with 2mm thick PVC edge band and 0.8mm thick PVC edge-band to be applied on Non-exposed edges with the help of hot-melt glue through fit edge-banding machines. The Edge-banding of exposed area to be done in the way that there should not be any sharp edge or corner left after processing. All the exposed edges should have buffing radius of 1.5 to 2mm without affecting aesthetic value of the panel. Mattress- Providing quilted mattress 4" with coir, Thickness of 100mm, density 80 GM/dcm3, pilled foam quilting (one side) 14 mm thickness, pilled foam density 18 GM/d cm3, PU foam thickness 5 mm, Fabric 85 GSM poly cotton material. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

74. Lounge Chair, Providing & placing Lounge chair. Chair seat & back made up of insert moulded Polyurethane Foam upholstered with foam laminated mesh fabric, insert moulded foam assembled over a load bearing ply seat cover, fixed and seats.Base: wooden structure of chair with PVC glides, on the wooden leg of the chair to be provided with M.S. brackets, Product should be BIFMA gold rated SCS global certified for in-house air quality and

75. Custom made Reception Table.

with 10 years warranty.

Reception Table and reception counter cladded with 122mm thick solid surface. This include reception counter. The shape desired to be achieved through 19mm Marine Mdf BB carcess, cladded with Italian marble, stainless steel and 12mm thick Acrylic Sold Surfaces sheets thermoformed by using dyes and molds and pasted and seamlessly finished over. MS pipe framework to be used for strengthening the structure. The item includes cost of 12mm Acrylic Solid Surfaces. 19mm Marine Mdf/BB & MS square pipe, hardware, drawer units, shutter doors with laminated mica or veneers,

locking mechanism, foot rest etc. as per architect's drawing and finished as per guidelines of site in charge.

76. Staff table of Size: 1500(W) x 750(D) x 750(H) & back storage of size 1500W x450D x750H Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.

The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.

Back Storage: The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm-2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect/Engineer/DFCCIL. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

Drawer Unit: 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W).

Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCS global certified for inhouse air quality and with 10 years warranty.

77. Auditorium Chairs with Writable tablet of overall dimensions of 515mm (W) x 720mm (D) x 980mm (H). Seat Height from floor should be of 440mm as per Ergonomic standards. The chairs should have following description: The dimensions after push back shall be 515 mm wide and seat and Backrest should be made with cutting and moulded foam covered by acrylic fabric. The shell

should made up of plywood cover of termite, fire resistant plywood and should be capable of bearing minimum height of 120 kgs. Seat should be with buffering mechanism to enable soft closing of seat when it is folded and all hole on seat shelf should be noise absorbing.

Armrest of chairs should be of fixed type made out of wood and should be provided with option of folding table to be used as writing pad. Legs of chairs should be made with cold rolled cold annealed steel duly powder coated with 80-100 micron thickness to provide smooth and clean surface. Seat should be foldable to enable comfortable seating, maintenance and to provide space utilization to walk around. Seat and Back should be wrapped with Titch make O-Fabric of desire colour as per Architect/Engineer/DFCCIL with zero formaldehyde glue. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

78. Podium of overall size 600mm x600mm x1200mm H made of 18mm pre-laminated MDF board. The top is made up of 25mm thick Pre=laminated MDF Board. The Podium also has a shelf below the top made up of 18mm Pre Laminated MD Board to keep papers etc. All exposed edges are sealed with 2mm thick PVC edge banding and unexposed edges sealed and unexposed edges sealed with 0.6mm PVC edge banding tape pressed at 2000 C with hot melt glue on special machines. Product should be BIFMA gold rated SCS global certified for in-house air quality and with 10 years warranty.

79. Custom made Reception Table.

Reception Table and – Providing and fixing reception counter cladded with 122mm thick solid surface. This include reception counter. The shape desired to be achieved through 19mm Marine Mdf carcess, cladded with Italian marble, stainless steel and 12mm thick Acrylic Sold Surfaces sheets thermoformed by using dyes and molds and pasted and seamlessly finished over. MS pipe framework to be used for strengthening the structure. The item includes cost of 12mm Acrylic Solid Surfaces. 19mm Marine Mdf & MS square pipe, hardware, drawer units, shutter doors with laminated mica or veneers, locking mechanism, foot rest etc. as per architect's drawing and finished as per guidelines of site in charge.

- 80. Study Table :-18mm MDF for table with 0.18mm PVC vacuum laminating for surface of table top & shelf thickness is 15mm, Top & shelf fixed on MS powder coated SQ pipe. Load bearing capacity (table top):35 Kg. Construction: Knock down fitting Color: Granite black Dimensions (L) 1350 x 550 x (H) 1050/ 750 mm. Product should be BIFMA certified for in-house air quality and with 5 years warranty.
- 81. Providing and placing of Study Chair:-The seat and back shall be made up of 1.2 ±0.1cm. Thick hot-pressed plywood and upholstered with fabric upholstery covers and moulded Polyurethane foam. The back foam shall be designed with contoured lumbar support for extra comfort. The seat shall be extra thick foam on front edge to give comfort to popliteal area. The dimensions of back shall be 47.5 cm(W) x 58.0 cm(H) and of seat shall be 47.0 cm (W) x 48.0 cm (D). The HR polyurethane foam shall be moulded with density= 45±2 kg/m3 and hardness load 16 ± 2 kgs as per IS:7888 for 25% compression. The one-piece armrests shall be injection moulded from black Co. polymer

Polypropylene. The mechanism shall be designed with 360° revolving type, Upright-position locking, Tilt tension adjustment, Seat/back tilting ratio of 1:3. The pneumatic height adjustment shall have an adjustment stroke of 12.0 ± 0.3 cm.

The bellow shall be 3 piece telescopic type and injection moulded in black Polypropylene. The pedestal shall be injection moulded in black 33% glass-filled Nylon-66 and fitted with 5 nos. twin wheel castors. The pedestal shall be 66.3 ± 0.5 cm. Pitch-center dia. (76.3 ± 1.0 cm with castors). The twin wheel castors shall be injection moulded in Black Nylon. Overall Dimensions of Chair shall be Seat Height - min 42.5 to max 54.5 cm, Height - min 85.5 to max 97.5 cm, Width & Depth of Chair as measured from pedestal - Width-76.3 cm and Depth-76.3 cm. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

82. Wooden Wardrobe

Build-in Almira on site 450 -600mm deep with 18 mm thick moisture resistant ply board on all four sides with swing shutters, finished with 2mm thick edge binding tape. Back ply to be 6mm thk . Almira to be finished with 1mm thk selected gloss/matt finish laminate on the outside and white laminate on the inside(as approved from the Architect), with shelves and drawers fixed with telescopic channel, lock and embedded handle, hanging rod and looking mirror 5mm thick as per drawing and other necessary hardware (preferred make : haffle, ozone, kich or door set) Details to be taken as per drawing attached. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

83. Single Bed of Size 950(W) X 2050 (L) X 750 (H) with Head Board and foot board. Head Board & Foot Board made up of 18 mm thick MDF with 0.4 mm membrane foil. Head board size: 900x600 mm and foot board of size: 990x300 mm Support structure of Bed made up of M.S. Pipe 75x25x1mm thick and 40x40x1.2mm thick duly powder coated through seven tank process of Powder Coating. Side Panel: - The side panels are made up of 18mm thick MDF Board with both side decorative laminate. All exposed edges are sealed with 2mm thick PVC edge Banding. Bed Base: - The Bed Base shall be made up of 12mm thick MDF Board with both side White laminate. All Exposed edges of MDF to be sealed with 2mm thick PVC edge band and 0.8mm thick PVC edge-band to be applied on Non-exposed edges with the help of hot-melt glue through fit edge-banding machines.

The Edge-banding of exposed area to be done in the way that there should not be any sharp edge or corner left after processing. All the exposed edges should have buffing radius of 1.5 to 2mm without affecting aesthetic value of the panel. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

84. Providing and fixing of Bed Side table with Overall Size : Depth - 450.0 mm, Width -440.0 mm, Height - 510.0 mm Material : Body and drawer panels of Bed side table are made of 18 mm thick Prelaminated MDF Board. All the exposed edges are edge banded with 0.8 mm thick PVC edge banding. Side panels are made of 18 mm thick Prelaminated MDF board with imported H.D.F. foil wrapped decorative trim fixed on to it. Hardware: The high quality hardware used like Roller slides,

Hinges, minifix, dowels is of make Hettich. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

- **85.** Mattress- Providing quilted mattress 4" with coir, Thickness of 100mm, density 80 GM/dcm3, pilled foam quilting (one side) 14 mm thickness, pilled foam density 18 GM/d cm3, PU foam thickness 5 mm, Fabric 85 GSM poly cotton material.
- 86. Customized TV unit as per the site requirement. Maximum size 1200x350 x900Hmm, TV unit made of with 18 mm thick moisture resistant ply board on all four sides. Product should be BIFMA certified for in-house air quality and with 5 years warranty.
- **87.** Cafe table. Top made of 40 to 50 mm thick Block Board with Laminated covering on all sides. Edge Banding/Matching solid wood lipping. The understructure for tables up to one meter length /dia shall be made out of stainless steel tubes in 304 grades. The size of the stainless steel 304 grade shall be 38x38 square tubes having minimum thickness of 3 mm. The understructure shall be star shaped base with four legs and four arm supports for top with a central pole support of 38x38 mm stainless steel tubes having minimum thickness of 2 mm. There should be extra four vertical supports for four legs of base joining the legs and the arms by this vertical support. Table having any side more than 1 mtr shall have end to end support structure with 38x38 mm stainless steel tube minimum 3mm thick. The structure so designed shall be made to ensure proper stability. The tables shall be in house custom made at site.
- **88.** Cafe Chair. The seat and back are made up injection molded high impact strength polypropylene polymer compound with indoor grade UV Resistance. The Powder coatedweled tubular frame is made from 22mm x 0.12 mm x15mm x 0.12mm M.S.E.R.W tub The Shoes are made of high impact strength polypropylene polymer compound with indoor grad UV Resistance and pressed fitted with tubular frame. SIZE : (W)x525mm (D)x 558mm(H)845 (seat H) 450mm Seat Size 525mm(W)x432 mm(D) Back Size 516 mm(W)x405mm (H). Product should be BIFMA certified for in-house air quality and with 5 years warranty.

89. Office Table

MAIN TABLE of size 2100W x 750D x 750H MM with top made of with top made of 25mm thick Pre-laminated MDF board and balancing laminate on unexposed face. The Gable end is made up of 25mm thick. Pre-laminated MDF board. The understructure is made of 18mm thick prelaminated MDF board with all exposed edges sealed with 2mm PVC edge banding tape and all unexposed edges sealed with 0.6mm edge banding tape pressed at 2000 C with hot melt glue on special machines. Table has a provision for wire manager caps at top. Side Unit Of size 1000L X 450D X 750H MM: The Side top is made up of 25mm thick. Pre-laminated MDF board all exposed edges sealed with 0.6mm edge banding tape and all unexposed edges sealed with 0.6mm thick. Pre-laminated MDF board all exposed edges sealed with 0.6mm thick. Pre-laminated MDF board at 2000 C with hot melt glue on special machine the up of 18mm thick. Pre-laminated MDF board all exposed edges sealed with 2mm PVC edge banding tape and all unexposed edges sealed with 0.6mm edge banding tape pressed at 2000 C with hot melt glue on special.

The side unit is combination of 2 drawers + 1 filling & one open able shutter with proper locking arrangement. Back Unit Of size 2100L X 450D X 750H MM: The Side top is made up of 25mm thick. Prelaminated MDF Board & under structure is made up of 18mm thick. Pre-laminated MDF board. all exposed edges sealed with 2mm PVC edge banding tape and all unexposed edges sealed with 0.6mm edge banding tape pressed at 2000 C with hot melt glue on special. The side unit is combination of 2 drawer + 1 filling & one open able shutter with proper locking arrangement All Hardware (Handles, Slides, Hinges) Hettich Make. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

90. High chair For Office

Chair for Office Table- seat made up of insert moulded Polyurethane Foam upholstered with foam laminated mesh fabric (Stitch Make), insert moulded foam assembled over a load bearing plastic seat cover, back is made up of two piece injection moulded frame, inner frame upholstered with mesh fabric and mounted on the main assembly, back adjustable lumbar support for achieving comfortable seating posture. Armrests should be adjustable with 120-160 mm adjustability with PU padded. Base: Black nylon base with nylon castors.

Chair should be of 360 degree swivel Posture Control with multi pointer locking and synchro tilt mechanism and hydraulic gas lift gas lift to allows 90-100 mm. of height adjustment. Seat size 440 - 550 mm depth, Seat width of 530-550 mm Seat Height of 430-530mm with hydraulic height adjustability of 90-100mm.

Sub assembly back size 550 - 620 mm height. Chair Back should be connected to four directional adjustable lumbar support for achieving comfortable seating posture. Effective back height form Seat - 570mm, polyurethane foam for seat having density 65-70 kg/m3. Pedestal made of nylon base fitted with 5 nos. twin wheel castors (castor wheel dia. 60-70 cm), base pedestal dia 60-70 mm and pitch center dia. 700-720mm with castors, twin wheel castors injection moulded in Nylon etc. all per manufacturers specification, approved sample complete as and direction of Architect/Engineer/DFCCIL. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

91. Low back revolving chairs for Office. Chair seat made up of insert moulded Polyurethane Foam upholstered with foam laminated mesh fabric, insert moulded foam assembled over a load bearing plastic seat cover, back is made up of two piece injection moulded frame, inner frame upholstered with mesh fabric and mounted on the main assembly, back adjustable lumbar support for achieving comfortable seating posture.

Armrests should be adjustable with 120-160 mm adjustability with PU padded. Base: Black nylon base with 5 nos. nylon castors.

Chair should be of 360 degree swivel Posture Control with multi pointer locking and synchro tilt mechanism and hydraulic gas lift gas lift to allows 90-100 mm. of height adjustment. Seat size 440 -

550 mm depth, Seat width of 530-550 mm Seat Height of 420-510mm with hydraulic height adjustability of 90-100mm. Sub assembly back size 550 - 620 mm height. Effective back height from Seat - 570mm, polyurethane foam for seat having density 65-70 kg/m3. Pedestal made of nylon base fitted with 5 nos. twin wheel castors (castor wheel dia. 60-70 cm), base pedestal dia 60-70 mm and pitch center dia. 700-720mm with castors, twin wheel castors injection moulded in Nylon etc. all complete as per manufacturers specification, approved sample and direction of Architect/Engineer/DFCCIL. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

- **92.** Three Seater Sofa : The seat should be made of PU foam with Density 32 ± 2 kg/cu.mtr having an additional top layer of J PU foam with Density 28 ± 2 kg/cu. Seat should be upholstered with fabric or leatherette. 2) BACK FOAM: The back should be made of PU foam with Density 28 ± 2 kg/cu. mtr with two additional top layer of super soft foam of density 23 ± 2 kg/cu. mtr, upholstered with fabric or leatherette. Understructure should be made up of 1.2 ± 0.1 cm. thick hot pressed plywood. Spring assembly should be mounted in understructure for support and additional cushioning purpose should be a welded assembly made in Stainless steel (grade SS 202) tube & plate. Product should be BIFMA certified for in-house air quality and with 5 years warranty.
- **93.** Single Seater Sofa :The seat should be made of PU foam with Density 32 ± 2 kg/cu.mtr having an additional top layer of J PU foam with Density 28 ± 2 kg/cu. Seat should be upholstered with fabric or leatherette. 2) BACK FOAM: The back should be made of PU foam with Density 28 ± 2 kg/cu. mtr with two additional top layer of super soft foam of density 23 ± 2 kg/cu. mtr, upholstered with fabric or leatherette. Understructure should be made up of 1.2 ± 0.1 cm. thick hot pressed plywood. Spring assembly should be mounted in understructure for support and additional cushioning purpose should be a welded assembly made in Stainless steel (grade SS 202) tube & plate. Product should be BIFMA certified for in-house air quality and with 5 years warranty.
- **94.** Center table (1200W x600D 450H) with top made 25mm thk. Pre-Laminated MDF Board and understructure with a shelf is made of 18mm thick prelaminated MDF board with all exposed edges sealed with 2mm PVC edge banding tape and unexposed edges sealed with 0.6mm PVC edge banding tape pressed at 2000 C with hot melt glue on special machines. Product should be BIFMA certified for in-house air quality and with 5 years warranty.
- **95.** Side table (450mmW x 450mmD x 450mmH) with top made 25mm thk. Pre-Laminated MDF Board and understructure with a shelf is made of 18mm thick prelaminated MDF board with all exposed edges sealed with 2mm PVC edge banding tape and unexposed edges sealed with 0.6mm PVC edge banding tape pressed at 2000 C with hot melt glue on special machines. Product should be BIFMA certified for in-house air quality and with 5 years warranty.

96. Chairs for VVIP Seating

Executive Task Chair with Seat Ht range 17"-22" with adjustable seat depth ranging 15"-18" inches with overall back height 45". The tilt mechanism should be 2 fiberglass leaf springs, a gear-driven tension adjustment, and stamped-steel housing. A 2-piece ABS cover shall enclose the tilt

mechanism. Chairs shall have a nominal 18° of body weight-controlled recline. The tilt limiter, located at left rear corner below the seat, lets users limit the amount of recline in 3 incremental adjustments: upright, 42%, 77%, and full recline. The back & seat should have a pixilated engineering with textile cover should consist of a 3D knit fabric top layer of breathable, 100% virgin polyester bonded to an underlying 100% polyester clear monofilament spacer construction that allows for a visual transfer of color through the chair back. Chairs should have 10.4"-by-4.5" arm pads of self-skinning urethane foam molded in place to a glass-filled nylon insert. Arm pads should be flexible with a lightly textured surface. Base should be 5-star base with casters, should be die-cast aluminum, with a textured or smooth-coat powder-coat epoxy finish. The chair should swivel 360°. Chairs should be furnished with interchangeable casters. Chair should be Greenguard certified. Should have a weight bearing capacity of 300 pounds or under.

Warranty: The chair should carry a 12year 3 shift warranty. Chair should meet or exceed (ANSI/ BIFMA) performance requirements per ANSI X5.1-2002.

97. Senior Officer's Chair

Executive Task Chair The approximate seat height range shall be 15 3/4" to 20 7/8". The tilt mechanism should contain 2 fiberglass leaf springs, a nylon gear-driven tension adjustment and a die-cast aluminum front and rear housing with either a polished, smooth or wrinkle-coat powder-coat epoxy finish. A 3-piece ABS cover shall snap together to enclose the mechanism. The chair base should be 5 star with high quality casters should house a unitized pneumatic seat height adjustment mechanism contained in 2 steel tubes; an inner tube shall slide and rotate in an acetal bushing within an outer tube. The 5-star base should be either die-cast aluminum, with either a polished, smooth, or wrinkle coat powder-coat epoxy finish or a glass-filled nylon material. The chair should swivel 360°. The height-adjustable arms shall have a lever to enable the user to adjust arm height. The arm height adjustment range shall be approximately 4", and adjustments can be made to any height within the range. The arm support should have detents to allow the arm support to pivot to 9 different positions. The arm shall be adjustable to 16° outward and 16° inward by applying pressure to the side of the arm. Arm should have a yoke of die-cast aluminum with either a polished, smooth or wrinkle-coat powder-coat epoxy finish. The lumbar pad shall be a nylon bow with integral attachment clip features on each side. A flexible Hytrel strap should be stretched across the width of the lumbar bow, connecting with a hook and loop. A 5 1/2" high by 4 1/4" wide support pad made of nylon snaps to the center of the strap with 4 snaps. The separate seat and back should be a durable, breathable Pellicle material stretched within a carrier ring and fitted into an outer frame. The mesh material should be a woven blend of colored polyester yarn with Hytrel elastomeric polyester of various stiffness, which should be high- performance polymer. It should support and distribute the user's weight through zonal stretching including more support in the front zone and reduced support around the it. Should have a weight bearing capacity of 350 pounds or under.

Warranty: the chair should carry a 12 year 3 shift warranty. The chair should meet ANSI/BIFMA X5.1-2017.

98. Visitor Chair

Task Chair with sizes Height: 15.7"-20.4", Depth: 15.0", Width: 18.9". Seat and Back: The seat and back surfaces should be constructed from a single sheet of mesh material, Lyris, the should be constructed from Hytrel® monofilaments in the horizontal direction and polyester fibers in the vertical direction. Arms : Chairs shall have 9"-by-2.5" arm pads with a lightly textured surface. The arm pad should be made from thermoplastic elastomer material and should be attached to the loop arm through an over molding process. Tilt the tilt mechanism should be Silver Alloy aluminum yoke, front link, and a glass filled nylon rear link. The tilt should contain Kinematic Spine that should flex as body weight applied. Base: 5-star bases with casters should be a corrosion resistant Silver Alloy aluminum, with a bead blasted textured surface. The chair should swivel 360° and should be furnished with interchangeable casters. Chair should be certified ANSI/ BIFMA as per ANSI X5.1-2002. Chair should support weight of 300 pounds or under.

99. Conference Room Chair and Junior Visitor Chair

Task Chair that should have sizes of: Overall Height: 37 ³/4", Seat Depth: 16-18" (adjustable) Overall Width: 26.75". Seat: The contoured seat should be constructed of molded polypropylene insert with molded polyurethane foam. The foam should have a nominal ½'- 1 ½" thickness and have waterfall edges. Back : the suspension back should be constructed of thermoplastic urethane (TPU), stretched and fastened onto a structural frame (Arc Span) on the bottom and fastened at the top by a Y-Tower made of an injection molded glass-filled nylon. Lumbar Pad: the lumbar pad should be constructed of unfilled nylon and should attach to and slides up and down on an acetal lumbar bow. Arms: Each arm should have an arm support stem of glass-filled nylon with self-skinning polyurethane arm pads. Arms should be height adjustable. Tilt: the tilt mechanism should be made of 2 fiberglass leaf springs, a lead-screw-driven tension adjustment, and a stamped steel housing. The tilt mechanism should also be in a 4-piece, snap-together polypropylene cover. The tilt tension adjustment should have 18 full revolution turns. Base: the chair base should house a unitized pneumatic cylinder seat height adjustation turns. Base: the chair base should house a unitized pneumatic cylinder seat height adjustment mechanism contained in 2 steel tubes, the inner tube should slide and rotate in a bushing within an outer tube.

Warranty:12 years 3 shift warranty. Chair should be certified with BIFMA/CMD-1-2002. The should have a weight bearing capacity of 350 pounds or under.

100. Staff Chair

Task chair ht size seat height 16–20.5" seat depth 16.25" and seat width 19.25". The tilt mechanism should be 2 fiberglass leaf springs, a gear-driven tension adjustment, and cast aluminum housing. A 3-piece, polycarbonate ABS blend cover shall snap together to enclose the tilt mechanism. The back-to seat tilt ratio shall be 2° to 1° when the chair is reclined from a neutral angle. The molded back should be a durable polypropylene attached to a loop-shaped support spine made from glass-filled Nylon 6. It should support and distribute the user's weight evenly over the entire back of the chair and shall retain its original shape when the chair is unoccupied. The seat should be a durable, breathable Airwave material stretched within a carrier ring and fitted into an outer frame. The Airwave material should be a woven blend and a solution-dyed polyester yarn. It should support and

distribute the user's weight evenly over the seat of the chair and shall retain its original shape when the chair is unoccupied. Adjustable Lumbar pad should be a molded polypropylene thermoplastic secured to a bow-shaped attachment. The bow-shaped attachment (a.k.a. lumbar bow) shall be molded-in nylon. The pad should be approximately .130" thick. The handles of the lumbar support should be made from glass filled nylon (GFPA). The chair base should be 5 star with casters should house a unitized single-stage pneumatic seat height adjustment mechanism contained in 2 steel tubes; an inner tube shall slide and rotate in a bushing within an outer tube. The outer tube shall be coated black and shall have a tapered end that shall be pressed into the base, and an upper end that shall be pressed into the tilt mechanism. Chair should be tested and warranted for use by persons 350 pounds and under. Warranty: the chair should carry a 12 year 3 shift warranty. The chair should meet the California Technical Bulletin 117-2013 fire safety standard and ANSI/BIFMA X5.1-2017.

101. UPVC PIPES

- 101.1 UNPLASTICISED POLYVINYL CHLORIDE PIPES AND FITTINGS 12.26.1 UPVC Pipes Pipes shall conform to Type A pipes of IS 13592. The internal and external surfaces of the pipes shall be smooth and clean and free from grooving and other defects. The end shall be clearly cut and shall be square with the axis of the pipe. The end may be chamfered on the plain sides. Slight shallow longitudinal grooves or irregularities in the wall thickness shall be permissible provided the wall thickness remains within the permissible limit.
- 101.2 Colour of Pipe Surface colour of the pipes shall be dark shade of grey or as specified.
- 101.3 Marking Each pipe shall be clearly and indelibly marked with the following information's at intervals not more than 3 meter.
 - (a) Manufacturer's name or trade mark.
 - (b) Nominal outside dia of pipe.
 - (c) Type 'A'
 - (d) Batch number.
 - 101.4 Dimensions 12.26.4.1 Diameter and Wall Thickness: Mean outside diameter, outside diameter at any point and wall thickness for type –A manufactured plain or with socket shall be as given in Table-1 of IS 13592.

UPVC rain water pipes shall be of the dia, specified in the description of the item and shall be in nominal lengths of 2,3,4 or 6 metres either plain or with sliding/grooved socket unless shorter lengths are required at junctions with fittings. Tolerances on specified length shall be + 10 mm and -0 mm.

101.5 Fixing and Jointing Pipes shall be either fixed on face of wall or embedded in masonry as required in the description of the item. Plain pipes shall be secured to the walls at all joints with PVC Pipes clips by means of 50 x 50 x 50 mm hard wood plugs, screwed with M.S. screws of required length i/c cutting brick work and fixing in cement mortar 1:4 (1 cement: 4 coarse sand). The clips shall be kept about 25 mm clear off finished face of wall, so as to facilitate cleaning of

pipes. Pipes shall be fixed perfectly vertical or to the lines as directed. The pipes shall be fitted to fittings with seal ring conforming to IS 5382 allowing 10 mm gap for thermal expansion.

- 101.6 Installation in Wall/Concrete The walls/concrete slots should allow for a stress free installation. Pipes and fittings to be inserted into the slots without a cement base have to be applied first with a thin coat of PVC solvent cement followed by sprinkling of dry sand (medium size). Allow it to dry. The process gives a sound base for cement fixation. This process is repeated while joining PVC material to CI/AC materials.
- 101.7 Fittings used shall be of the same make as that of the PVC pipes Injection moulded or fabricated by the manufacturer and shall have a minimum wall thickness of 3.2 mm. The fittings shall be supplied with grooved socketed ends with square grooves and provided with Rubber Gasket conforming to IS 5382. The plain ends of the fittings should be chamfered. The fittings shall be joined with the help of Rubber lubricant. The details of fittings refer IS 13592.
- 101.8 Measurements The fittings shall be measured by numbers. The pipes shall be measured net when fixed correct to a cm. excluding all fittings along its length.
- 101.9 Rate The rate shall include the cost of all materials and labour involved in all the operations described above including jointing but excluding the supply and fixing of wall plugs and PVC clips which shall be paid for separately.
- **Note:** These pipes shall be used only in shaft or unexposed location to avoid damage to these pipes due to willful act.

102. SANITARY

102.1 Wash Basins

Wash basins shall be of white vitreous china conforming to IS 2556 (Part -I) and IS 2556 (Part-4). Wash basins either of flat back or angle back as specified shall be of one-piece construction, including a combined overflow. All internal angles shall be designed so as to facilitate cleaning. Each basin shall have a rim on all sides, except sides in contact with the walls and shall have a skirting at the back. Basins shall be provided with single or double tap holes as specified. The tap holes shall be 28 mm square or 30 mm round or 25 mm round for pop up hole. A suitable tap hole button shall be supplied if one tap hole is not required in installation. Each basin shall have circular waste hole to which the interior of basin shall drain. The waste hole shall be either rebated or beveled internally with dia meter of 65 mm at top. Each basin shall be provided with a non-ferrous 32 mm waste fitting. Stud slots to receive the brackets on the underside of the wash basin shall be suitable for a bracket with stud not exceeding 13 mm diameter, 5 mm high and 305 mm from the back of basin to the centre of the stud. The stud slots shall be of depth sufficient to take 5 mm stud. Every basin shall have an integral soap holder recess or recesses, which shall fully drain into the bowl. A slot type of overflow having an area of not less than 5 sq. cm, shall be provided and shall be so designed as to facilitate cleaning of the overflow.

Where oval shape or round shape wash basins are required to be fixed these shall be fixed preferably in RCC platform with local available stone topping either fully sunk in stone top or top flush with the stone topping as directed by Architect.

The wash basins shall be one of the following patterns and sizes as specified.

- (a) Flat back: 660 x 460 mm (Surgeon's Basin) 630 \times 450 mm 550 \times 400 mm 450 \times 300 mm
- (b) Angle back: $600 \times 480 \text{ mm } 400 \times 400 \text{ mm}$

White glazed pedestals for wash basins, where specified shall be provided. The quality of the glazing of the pedestal shall be exactly the same as that of the basin along with which it is to be installed. It shall be completely recessed at the back to accommodate supply and waste pipes and fittings. It shall be capable of supporting the basin rigidly and adequately and shall be so designed as to make the height from the floor to top of the rim of basin 75 to 80 cm. All the waste fittings shall be brass chromium plated, or as specified.

102.2 Waste Fittings for Wash Basins and Sinks

The waste fittings shall be of nickel chromium plated brass, with thickness of plating not less than service grade 2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall be sound, free from laps, blow holes and fittings and other manufacturing defects. External and internal surfaces shall be clean and smooth. They shall be neatly dressed and be truly machined so that the nut smoothly moves on the body.

Waste fitting for wash basins shall be of nominal size of 32 mm. Waste fittings for sinks shall be of nominal size 50 mm.

102.3 Water Closet

Wash Down Type (European Type W.C.): Water closets shall be of white vitreous china conforming to IS 2556 (Part-1) and 2556 (Part-2), as specified and shall be of "Wash down type". The closets shall be either of the two patterns (Pattern I & Pattern II) and sizes as specified. The closets shall be of one-piece construction. Each water closet shall have not less than two holes having a minimum diameter of 6.5 mm for fixing to floor and shall have an integral flushing rim of suitable type. It shall also have an inlet or supply horn for connecting the flushing. The flushing rim may be boxed or open type. In the case of box rims adequate number of holes, on each side together with a slot opposite the inlet shall be provided. The flushing rim and inlet shall be of the self draining type. The water closet shall have a weep hole at the flushing inlet. Each water closet shall have an integral trap with either 'S' or 'P' outlet with at least 50 mm water seal. For P trap, the slope of the outlet shall be 14 deg. below the horizontal. Where required the water closet shall have an antisiphonage 50 mm dia vent horn on the outlet side of the trap and on either right or left hand or centre as specified set at an angle of 45 deg. and invert of vent hole not below the central line of the outlet. The inside surface of water closets and traps shall be uniform and

smooth in order to enable an efficient flush. The serrated part of the outlet shall not be glazed externally. The water closet, when sealed at the bottom of the trap in line with the back plate, shall be capable of holding not less than 15 litres of water between the normal water level and the highest possible water level of the water closet as installed.

103. GENERAL REQUIREMENTS FOR INSTALLATION OF W.C. PAN

- 103.1 The work shall be carried cut, complying in all respects with the requirements of relevant byelaws of the local body in whose jurisdiction the work is situated.
- 103.2 Any damage caused to the building, or to electric, sanitary, water supply or other, installations etc. therein, either due to negligence on the part of the contractor, or due to actual requirements of the work, shall be made good and the building or the installation shall be restored to its original condition by the contractor. Nothing extra shall be paid for such restoration works except where otherwise specified.
- 103.3 For making good the damage to the under mentioned items of work, the specifications as given in the following paras shall apply, unless directed otherwise.
 - (a) Masonry Work: The masonry work shall be made good by using the same class of bricks, tiles or stones as was damaged during the execution of the work. The mortar used shall be cement mortar 1:5 (1 cement: 5 fine sand) or as directed by the Architect.
 - (b) Plain Concrete Work : Concrete work for sub-grade of the flooring, foundations and other plain concrete works shall be cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size). A coat of neat cement slurry shall be applied at the junction with old work, before laying fresh concrete.
 - (c) Cement Concrete Flooring and R.C.C. Work : Cement concrete 1:2:4 (1 Cement : 2 Coarse sand : 4 graded stone aggregate 20 mm nominal size) shall be used after applying a coat of neat cement slurry at the junction with old work, and the surface finished to match with the surrounding surface.
 - (d) Plastering: Cement plaster 1:4 (1 cement: 4 sand) shall be used. The sand shall be fine or coarse, as used in the original work. The surface shall be finished with two or more coats of white wash, colour wash, distemper or painting as required, but where the surface is not to be white washed, colour washed, distempered or painted, it shall be finished as required to match with the surrounding surface.
 - (e) Other Items: Damage to any other item shall be made good as directed by the Architect.
- **Note:** In all the above operations the damaged portion shall be cut in regular geometric shape and cleaned before making good the same.
- 103.4 All exposed G.I., C.I. or lead pipes and fittings shall be painted with approved quality of paint and shade as specified. The painting work shall conform to specification.
- 103.5 All sanitary and plumbing work shall be carried out through licensed plumbers.

- 103.6 On completion of the work the site shall be cleaned and all rubbish disposed off as directed by the Architect/Engineer/DFCCIL.
- 103.7 Various sanitary fittings described in the specifications including fixing shall be enumerated individually or in combination under relevant items of works as described below. When used in combination, specifications as described under relevant paras shall apply but nothing extra shall be paid for making connections required for successful functioning of the combination.

104 INSTALLATION OF DRAINING BOARD

- 104.1 Fixing One end of the board shall rest on sink and the other end shall be supported on C.I. bracket embedded in cement concrete (1:2:4) block $100 \times 75 \times 150$ mm. The brackets used shall be of cantilever type or wall fixed type as for the sink.
- 104.2 Painting

The brackets shall be painted with two or more coats of approved paint.

104.3 Measurements

Draining board shall be measured in numbers.

104.4 Rate

The rate shall include the cost of all materials and labour involved in all operations.

105. INSTALLATIONS OF FLUSHING CISTERN

- 105.1 Fixing
- 105.2 Low Level Cistern: The cistern shall be fixed on C.I. cantilever brackets which shall be firmly embedded in the wall in cement concrete (1:2:4) block 100 x 75 x 150 mm. Connection between cistern and closet shall be made by means of 40 mm dia flush bend with rubber or G.I. inlet connection as specified.
- 105.3 Automatic Cistern:

Clause 17.4.1.1 shall apply except that CP Brass stop cock shall be provided for cistern having a capacity of more than 5 liter. The main & distribution flush pipe shall be fixed to the wall by means of standard pattern holder bat.

105.4 Painting

The brackets shall be painted, if specified, with two or more coats of paint of approved shade and quality.

105.5 Measurements

Cistern, including all fittings, shall be measured in numbers.
105.6 Rate

The rate shall include the cost of all materials and labour involved in all the operations described above

106.0 INSTALLATION OF MIRROR

106.1 Fixing

The mirror shall be mounted on backing with environmentally friendly material other than asbestos cement sheet shall be fixed in position by means of 4 C.P. brass screws and C.P. brass washers, over rubber washers and wooden plugs firmly embedded in walls. C.P. brass clamps with C.P. brass screws may be an alternative method of fixing, where so directed. Unless specified otherwise the longer side shall be fixed horizontally.

106.2 Measurements

Mirror shall be measured in numbers.

106.3 Rate

Rate shall include the cost of all the materials and labour involved in all the operations described above.

107. FIXING AND JOINTING OF PIPES AND FITTINGS

107.1 The specifications described in sub-head 12.0 shall apply, as far as applicable, except that the joint shall be lead caulked. All soil pipes shall be carried up above the roof and shall have sand cast iron terminal guard.

107.2 Height of Ventilating Pipes

The ventilating pipe or shaft shall be carried to a height of at least 60 cms above the outer covering of the roof of the building or in the case of a window in a gable wall or a dormer window it shall be carried up to the ridge of the roof or at least 2 metres above the top of the window. In the case of a flat roof to which access for use is provided it shall be carried up to a height of 2 metres above the roof and shall not terminate within 2 metres, measured vertically from the top of any window opening which may exist up to a horizontal distance of 3 meters from the vent pipe into such building and in no case shall be carried to a height less than 3 metres above plinth level. In case the adjoining building is taller, the ventilating pipe shall be carried higher than the roof of the adjoining building, wherever it is possible.

The pipes above the parapet shall be secured to the wall by means of M.S. stay and clamps as specified in the Technical Specifications.

The connections between the main pipe and branch pipes shall be made by using branches and bends with access doors for cleaning. The waste from lavatories, kitchen, basins, sinks, baths and other floor traps shall be separately connected to respective waste stack of upper floors. The

waste stack of lavatories shall be connected directly to manhole while the waste stack of others shall separately discharge over gully trap. Where single stack system is provided, the connection shall be made direct to the manhole.

107.3 Jointing

The interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of treated spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment.

The leading of pipes shall be made by means of ropes covered with clay or by using special leading rings. The lead shall be melted so as to be thoroughly fluid and each joint shall be filled in one pouring.

The following precautions shall be taken for melting lead:

- (a) The pot and the ladle in which lead shall be put shall be clean and dry.
- (b) Sufficient quantity of lead shall be melted.
- (c) Any scum or dross which may appear on the surface of the lead during melting shall be skimmed off.
- (d) Lead shall not be overheated.

After the lead has been run into the joint the lead shall be thoroughly caulked. Caulking of joints shall be done after a convenient length of the pipes has been laid and leaded.

The leading ring shall first be removed and any lead outside the socket shall be removed with a flat chisel and then the joint caulked round three times with caulking tools of increasing thickness and hammer 2 to 3 kg. weight. The joints shall not be covered till the pipe line has been tested under pressure.

Use of collars for jointing is not permitted in any concealed or embedded location. However, in exposed locations where full length pipes cannot be fixed due to site constraints, collars (and not loose sockets) may be used subject to the following:

- (a) No two consecutive joint shall be with the use of collars.
- (b) The joint of collar with the cut/spigot end of the pipe shall be made on the ground in advance and tested against leakage before fixing.
- (c) Cut/spigot end of the pipes shall be inserted in the collars up to the projection inside the collar and jointing shall be done as in the case of socket and spigot joint. The jointed pipe line shall be at required level/slope and alignment.

Note: The dimensions of loose sockets shall correspond to those of appropriate nominal size of pipe.

107.4 Testing

In order to ensure that adequate lead is poured properly into the joints and to control waste in use of lead, at the beginning of work three or four sample joints shall be made and the quantum of lead per joint approved by the Architect. All sand cast iron/cast iron (Spun) pipes and fittings including joint shall be tested by smoke test to the satisfaction of the Architect and left in working order after completion. The smoke test shall be carried out as under:

Smoke shall be pumped into the pipes at the lowest end from a smoke machine which consists of a bellow and burner. The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detectable by sight as well as by smell, if there is leak at any point of the drain.

107.5 Painting

All sand cast iron/cast iron (Spun) pipes and fittings shall be painted with shade to match the colour of the background as directed by the Architect.

107.6 Measurements

- 107.7 The pipes shall be measured net when fixed in position excluding all fittings along its length, correct to a cm.
- 107.8 When collars are used for jointing SCI pipes these shall be measured as fittings and shall be paid for separately
- 107.9 No allowance shall be made for the portions of the pipe lengths entering the sockets of the adjacent pipes or fittings. The above shall apply to both cases i.e. whether the pipes are fixed on wall face or embedded in masonry.
- 107.10 No deduction shall be made in the former case from the masonry measurement for the volume of concrete blocks embedded therein. Similarly no deduction shall be made for the volume occupied by the pipes from the masonry when the former are embedded in the later.

107.11 Rates

The rate shall include the cost of all labour and materials involved in all the operations described above, excluding fittings, lead caulk jointing, the supply and fixing M.S. holder bat clamps and M.S. stays and clamps, floor trap and painting, which shall be paid for separately.

108. INSTALLATION OF SEAT AND COVER TO WATER CLOSET

Fixing

The seat shall be fixed to the pan by means of two corrosion resistant hinge bolts with a minimum length of shank of 65 mm and threaded to within 25 mm of the flange supplied by the manufacturer along with the seat. Each bolt shall be provided with two suitably shaped washers of rubber or other similar materials for adjusting the level of the seat while fixing it to the pans. In addition, one

nonferrous or stainless steel washer shall be provided with each bolt. The maximum external diameter of the washer fixed on the underside of the pan shall not be greater than 25 mm. Alternative hinging devices as supplied by the manufacturer of the seat can also be used for fixing with the approval of Architect.

Measurements

Seat with cover shall be measured in numbers.

Rate

Rate shall include the cost of all the materials and labour involved in all the operations described above.

109. INSTALLATION OF SINK

The installation shall consist of assembly of sink C.I. brackets, union and G.I. or P.V.C. waste pipe.

Fixing

The sink shall be supported on C.I. cantilever brackets, embedded in cement concrete (1:2:4) block of size 100 x 75 x 150 mm. Brackets shall be fixed in position before the dado work is done. The C.P. brass or P.V.C. union shall be connected to 40 mm nominal bore G.I. or PVC waste pipe which shall be suitably bent towards the wall and shall discharge into a floor trap. C.P. brass trap and union and waste shall be paid separately. The height of front edge of sink from the floor level shall be 80 cm.

Measurements

The sinks shall be measured in numbers.

Rate

Rate shall include the cost of all materials and labour involved in all the operations described above but shall not included the cost of waste fitting and brackets which shall be paid for separately.

110. INSTALLATION OF URINAL LIPPED, HALF STALL (SINGLE OR RANGE)

Urinal installation shall consist of a lipped urinal (Single or range), an automatic flushing cistern, G.I. flush and waste pipe. The capacity of flushing cistern and relevant size of flush pipe for urinals.

Waste pipe shall be of 32 mm nominal bore G.I. pipe and shall be paid separately.

Fixing

Urinals shall be fixed in position by using wooden plugs and screws. It shall be at a height of 65 cm from the standing level to the top of the lip of the urinal, unless otherwise directed by the Engineer - in-Charge. The size of wooden plugs shall be 50 mm \times 50 mm at base tapering to 38 mm \times 38 mm at

top and of length 5.0 cms. These shall be fixed in the wall in cement mortar 1:3 (1 cement: 3 fine sand). After the plug fixed in the wall, the mortar shall be cured till it is set.

Each urinal shall be connected to 32 mm dia waste pipe which shall discharge into the channel or a floor trap. The connection between the urinal and flush or waste pipe shall be made by means of putty or white lead mixed with chopped hemp.

Measurements

Urinals shall be measured in numbers.

Rate

Rate shall include the cost of all the materials and labour involved in all the operations described above.

111. INSTALLATION OF STALL URINAL (SINGLE OR RANGE)

The installation shall consist of stall urinal (single or range), automatic flushing cistern, C.P. brass standard flush pipes, C.P. brass spreader and C.I. trap with tail piece and outlet grating of C.P. brass. Capacity of flushing cistern and relevant size of flush pipe, C.I. trap shall be as prescribed in the Technical Specifications.

Fixing

The floor slab shall be suitably sunk to receive the stall urinal. Where the floor slab is not sunk, the stall urinal shall be provided over a platform. The lip of the stall urinal shall be flush with the finished floor level adjacent to it. The stall urinal shall be laid over a fine sand cushion of average 25 mm thickness.

A space of not less than 3 mm shall be provided all -round, in front, sides and filled with water proofing plastic compound. Care shall be taken that after the sub-grade for the floor is cast, one week should lapse before urinals are installed. The trap and fittings shall be fixed as directed by the Architect. Payment for the floor and its sub-grade shall be made separately.

Measurements

Stall urinals shall be measured in numbers.

Rate

The rate shall include the cost of all the materials and labour involved in all the operations described above.

112. INSTALLATION OF WASH BASIN

The installation shall consist of an assembly of wash basin, pillar taps, C.I. brackets, C.P. brass or P.V.C. union, as specified. The wash basin shall be provided with one or two 15 mm C.P. brass

pillar taps, as specified. The height of top of the rim of wash basin from the floor level shall be within 750 mm to 800 mm.

Fixing

The basin shall be supported on a pair of C.I. cantilever brackets conforming to IS 775 and be embedded in cement concrete (1:2:4) block 100 x 75 x 150 mm. Use of M.S. angle or Tee section as bracket is not permitted. Brackets shall be fixed in position before dado work is done. The wall plaster on the rear shall be cut to rest over the top edge of the basin so as not to leave any gap for water to seep through between wall plaster & skirting of basin. After fixing the basin, plaster shall be made good and surface finished matching with the existing one. S.C.I. floor traps conforming to IS 1729 having 50 mm water seal (minimum 35 mm in two pipe systems with gully trap) should be used. Waste pipes laid horizontally should have gradient not flatter than 1 in 50 and not steeper than 1 in 10.

The waste water from wash basin shall be discharged directly to vitreous semi-circular open drain, discharging to a floor trap and finally to the vertical stack on upper floors and in case of ground floor, the waste water shall be discharged either directly to the gully trap or through the floor trap. C.P. brass trap and union are not to be used in such situations.

If waste pipe is concealed or crosses the wall, waste water shall be discharged through non ferrous trap like PVC Engineering plastic or C.P. brass and union to vertical stack. The C.P. brass trap and union shall be paid for separately.

Where so specified a 20 mm G.I. puff pipe terminating with a perforated brass cap screwed on it on the outside of the wall or connected to the antisyphon stack shall be provided.

Measurements

Wash basins shall be measured in numbers.

Rate

The rate shall include the cost of all the materials and labour involved in all the operations described above.

113. INSTALLATION OF STAINLESS STEEL SINK: -

Stainless steel A ISI 304 (18/8) kitchen sink. The installation shall consist of assembly of sink C.I. brackets, union and G.I. or P.V.C. waste pipe.

Fixing

The stainless steel sink shall be fixing as per IS:13983 and shall be supported on C.I. cantilever brackets, embedded in cement concrete (1:2:4) block of size 100 x 75 x 150 mm. Brackets shall be fixed in position before the dado work is done. The C.P. brass or P.V.C. union shall be connected to 40 mm nominal bore G.I. or PVC waste pipe which shall be suitably bent towards the wall and shall

discharge into a floor trap. C.P. brass trap and union and waste shall be paid separately. The height of front edge of sink from the floor level shall be 80 cm.

DIMENSIONS AND TOLERANCES

Thickness of Sheet/Strip

Nominal thickness of stainless steel sheet/ strip used in the construction of sink shall be not less than 1.00 mm before forming.

Thickness at any point of sink, after forming, shall not be less than 0.75 mm.

Depth of Bowls The depth of the sink bowl shall be 150 mm minimum, when measured from the top edge of the bowl to the base of the sink.

Internal Dimensions of Bowls

The minimum internal dimensions, when measured on the bowl centre lines across the top of the bowl. shall be 380 mm x 340 mm for rectangular bowls and 360 mm for round bowls.

114. Bowl Locating Limits

The distance between the edge of the sink bowl and the end of the sink shall be 15 mm minimum for sit-on type sinks and 30 mm minimum for inset type sinks. Depth of the collar provided for inset sinks shall be 10 ± 2 mm,

For sinks designed for use with a 600 mm wide work top, the distance between the edge of the sink bowl and the front of the sink shall be 50 mm minimum and in the case of sinks designed for use with 500 mm wide worktop, the distance shall be 45 mm minimum.

Both single and double bowl sink shall be set a minimum of 10 mm from gridline.

Measurements

The sinks shall be measured in numbers.

Rate

Rate shall include the cost of all materials and labour involved in all the operations described above but shall not included the cost of waste fitting and brackets which shall be paid for separately.

115. CUTTING CHASE IN MASONRY WALL

Cutting chasing in brick masonry wall shall be has specified in the TS.

Filling chases After sand cast iron/ centrifugally cast/spun iron pipe etc. are fixed in chases, the chases shall be filled with cement concrete 1:3:6 (1 cement: 3 coarse sand: 6 graded stone aggregate 12.50 mm nominal size) or cement mortar 1:4 (1 cement: 4 coarse sand) as may be specified or

otherwise directed by the Architect/Engineer/DFCCIL and made flush with the masonry surface. The concrete surface shall be roughened with wire brushes to provide a key for plastering.

Measurements

Chases shall be measured in running meter correct to a cm.

Rates

The rate shall include the cost of labour the materials involved in all the operations described above excluding the cost of providing pipes etc. which shall be paid separately.

116. INSTALLATION OF WALL MOUNTING WATER CLOSET (WC)

Installation It shall consist of white vitreous china extended wall mounting WC of size 780x370x690 mm of approved shape, brand and manufacture with duel flush fitting of flushing capacity 3 Ltr / 6 Ltr (adjustable to 4 Ltr/8 Ltr) including seat cover and cistern fittings, nuts, bolts and gasket etc. complete in all respect as per direction of Architect. Wall mounting water closet shall be of white vitreous China confirming to IS 2556 (Part 16) : 2002. For general requirement relating to terminology, materials, manufacture, glazing, defects, minimum thickness, tolerances, performance and methods of tests shall confirm to IS 2556 (Part 1). Wall mounted water closet shall be of one piece construction. Each wall mounted water closet shall be provided with fixing arrangement and shall have an integral flushing rim of suitable type. It shall have an inlet for connecting the flushing pipe of dimension confirming to IS. The flushing rim may be box or open rim type or a combination of both. In case of box rim, adequate number of holes and slot be provided at the flushing rim and the inlet shall be of the self draining type and weep hole shall be provided at the flushing inlet of the wall mounted water closet.

The WC shall be provided with not less than two fixing holes to enable the WC to be securely installed to the wall using metallic corrosion resistant bolts and nuts and an independent concealed support frame. The support frame (metal hanger or carrier), depending on the design shall be securely attached to the building structural members so that no strain is transmitted to WC connector or any part of the plumbing system.

Each wall mounted water closet shall have an integral trap and P type outlet confirming to IS 2556 (Part 16): 2002. Inside surface of water closet and trap shall be uniform and smooth in order to ensure an efficient flushing. The outlet if without serration, shall be glazed and if same is with serration, may not be glazed.

Marking

Each piece of wall mounted water closet shall be Cleary and indelibly marked at a suitable place with the following:(a) Name of trade mark of the manufacturer and (b) Batch/lot numbers.

BIS certification marking Wall mounted water closet shall be marked with the standard mark. The use of Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made .

General requirement for installation of WC The specification described in 17.2 shall be hold good so far as it is applicable.

All sanitary and plumbing work shall be carried out through licensed plumbers.

On completion of the work the site shall be cleaned and all rubbish disposed off as directed by the Architect/Engineer/DFCCIL.

Measurement

Wall mounted water closet shall be measured in numbers.

117. INSTALLATION OF FLOOR MOUNTED SINGLE PIECE WATER CLOSET (WC)

Installation It shall consist of white vitreous China single piece, double traps syphonic water closet of approved shape, brand, size, pattern and manufacturer with integrated white vitreous china cistern of capacity 10 ltr. with dual flushing system, including all fitting and fixtures with seat cover, cistern fittings, nuts, bolts and gasket etc. including making connection with the existing P/S trap, complete in all respect as per direction of the Architect/Engineer/DFCCIL.

The general requirement relating to terminology, materials, manufacture, glazing, defects, minimum thickness, tolerances, performance and methods of tests shall confirm to IS 2556 (Part-1). Single piece floor mounted WC generally smaller than a two piece floor mounted WC. The flushing tank is connected and sits lower on the bowl than on a two piece. Due to the smaller size, single piece WC are able to be installed in toilet/bathroom with less square footage.

Fixing

The water closet shall be fixed to the floor by means of 75mm long and 6.5mm dia counter sunk bolts and nuts embedded in the floor concrete.

Marking

Each piece of wall mounted water closet shall be Cleary and indelibly marked at a suitable place with the following:

- (a) Name of trade mark of the manufacturer and
- (b) Batch/lot numbers.

General requirement for installation of WC

The specification described in 17.2 shall be hold good so far as they are applicable.

All sanitary and plumbing work shall be carried out through licensed plumbers.

On completion of the work the site shall be cleaned and all rubbish disposed off as directed by the Architect.

Measurement Single piece floor mounted water closet shall be measured in numbers.

TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS

(SECTION – 4)

INTERNAL WIRING

1. GENERAL

This section covers specification for Internal wiring of the office area and building.

2. STANDARDS AND CODES

The wiring work shall be carried out as per standards and specifications of the CPWD. In addition the relevant clauses of the Indian Electricity Act 2003 and Indian Electricity Rules 1956 as amended upto date shall also apply.

IS:732 - 1989	Code of practice for electrical wiring installations
IS: 8828 - 1978	Miniature air break circuit breakers for voltages not exceeding 1000 volt
IS:13032 - 1991	Miniature circuit breaker boards for voltages upto and including 1000 volts AC
IS:12640 - 1988	Residua current operated circuit breakers
IS:694 - 1990	PVC Insulated cables for working voltages upto and including 1100 V
IS:694 - 1990	PVC Insulated cables for working voltages upto and including 1100 V
IS:9537(Part-1)-1980	Conduits for electrical installations : General requirements
IS:3480 - 1966	Flexible steel conduits for electrical wiring
IS:2667 - 1988	Fittings for rigid steel conduits for electrical wiring
IS: 371 - 1979	Ceiling roses
IS: 3854 - 1988	Switches for domestic and similar purposes
IS: 4615 - 1968	Switch socket outlets (non-interlockingtype)

3.1 Introduction

The electric power shall be received and distributed in a building, through following means:-

(i) Cabling and switchgear to receive power.

The building shall be divided into convenient number of parts, each part served by a rising main system to distribute power vertically/horizontally.

(ii) Power flows from rising main through tap-off box to floor main board to final DBs and then to wiring.

(iii) Dedicated circuit for different loads such as lighting, HVAC, power plug loads shall be provided, wherever possible.

3.2 System of Distribution and Wiring

- (i) The wiring shall be done from a distribution system through main and/or branch distribution boards.
- (ii) Each main distribution board and branch distribution board shall be controlled by an incoming circuit breaker. Each outgoing circuit shall be controlled by a circuit breaker.
- (iii) Only MCCB/MCB DBs shall be used.
- (iv) 'Power' wiring shall be kept separate and distinct from light wiring, from the level of circuits, i.e., beyond the branch distribution boards. Conduits for light/power wiring shall be separate.
- (v) Essential/non-essential/UPS distribution each will have a completely independent and separate distribution system starting from the main, switchboard upto final wiring for each system. No mixing of wiring is allowed.
- (vi) Each MDB/DB/Switch Board will have reasonable spare outgoing ways for future expansion.
- (vii) Balancing of 3-phase circuit shall be done.

3.3 Wiring

- 3.3.1 Submain & Circuit Wiring
 - (a) Submain Wiring

Submain wiring shall mean the wiring from one main/distribution switchboard to another.

(b) Circuit Wiring

Circuit wiring shall mean the wiring from the distribution board to the 1st tapping point inside the switch box, from where point wiring starts.

3.4 Point Wiring

3.4.1 Definition

A point (other than socket outlet point) shall include all work necessary in complete wiring to the following outlets from the controlling switch or MCB.

- (a) Ceiling rose or connector (in the case of points for ceiling/exhaust fan points, prewired light fittings, and call bells).
- (b) Ceiling rose (in case of pendants except stiff pendants).

3.4.2 Scope

Following shall be deemed to be included in point wiring:

(a) Wiring cables between the switch box and the point outlet, loop protective earthing of each

fan/light fixture.

- (b) All fixing accessories such as clips, screws, Phil plug, rawl plug etc. as required.
- (c) Control switch or MCB, as specified.
- (d) 3 pin or 6 pin socket, ceiling rose or connector as required. (2 pin and 5 pin socket outlet shall not be permitted.)
- (e) Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc. Bushed conduit or porcelain tubing where wiring cables pass through wall etc.
- (f) Interconnecting wiring between switches within the switch box on the same circuit.
- 3.4.3 Point Wiring for Socket Outlet Points
 - (i) The light plug (6 A) point and power (16 A) point wiring shall be measured on linear basis, from the respective tapping point of live cable, namely, switch box, another socket outlet point, or the sub-distribution board as the case may be, up to the socket outlet.
 - (ii) The metal/PVC box with cover, switch/MCB, socket outlet and other accessories shall be measured and paid as a separate item.
 - (iii) The power point outlet may be 16 A/6 A six pin socket outlet, where so specified in the tender documents.

3.4.4 Group Control Point Wiring

- (i) In the case of points with more than one point controlled by the same switch, such points shall be measured in parts i.e. (a) from the switch to the first point outlet as one point and classified accordingly and (b) for the subsequent points, the distance from that outlet to the next one and so on, shall be treated as separate point(s) and classified accordingly.
- (ii) No recovery shall be made for non-provision of more than one switch in such cases.

3.4.5 Twin Control Light Point Wiring

- (i) A light point controlled by two numbers of two way switches shall be measured as two points from the fitting to the switches on either side and classified according to 3.4.4.
- (ii) No recovery shall be made for non-provision of more than one ceiling rose or connector in such cases.

3.5 Wiring System

- (i) Wiring shall be done only by the looping system. Phase/live conductors shall be looped at the switch box. For point wiring, neutral wire/earth wire looping for the 1st point shall be done in the switch box; and neutral/earth looping of subsequent points will be made from point outlets.
- (ii) In wiring, no joints in wiring will be permitted any where, except in switch box or point outlets, where jointing of wires will be allowed with use of suitable connector.
- (iii) The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switchgear.
- (iv) Light, fans and call bells shall be wired in the 'lighting' circuits. 15A/16A socket outlets and

other power outlets shall be wired in the 'power' circuits. 5A/6A socket outlets shall also be wired in the 'power' circuit both in residential as well as non-residential buildings.

(v) Colour Coding

Following colour coding shall be followed in wiring:

Phase	:	Red/Yellow/Blue.(Three phase
wiring) Live	:	Red (Single phase wiring)
Neutral	:	Black
Earth	:	Yellow/Green.

(vi) Termination of Circuit into Switchboard

Circuit will consist of phase/neutral/earth wire. Circuit will terminate in a switch board (first tapping point, where from point wiring starts) in following manner:

Phase wire terminated in phase connector. Neutral

wire terminated in neutral connector. Earth wire

terminated in earth connector.

The switchboard will have phase, neutral and earth terminal connector blocks to receive phase/ neutral/ earth wire.

3.6 Passing through Walls or Floors

- (i) When wiring cables are to pass through a wall, these shall be taken through a protection (steel/ PVC) pipe or porcelain tube of suitable size such that they pass through in a straight line without twist or cross in them on either porcelain, PVC or other approved material.
- (ii) All floor openings for carrying any wiring shall be suitably sealed after installation.

3.7 Joints in Wiring

- (i) No bare conductor in phase and/or neutral or twisted joints in phase, neutral, and/ or protective conductors in wiring shall be permitted.
- (ii) There shall be no joints in the through-runs of cables. If the length of final circuit or submain is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.
- (iii) Termination of multistrand
- (iv) ded conductors shall be done using suitable crimping type thimbles.

3.8 Capacity of Circuits

- (i) Lighting circuit shall feed light/fan/ call bell points. Each circuit shall not have more than 800 Watt connected load or more than 10 points whichever is less. However, in case of LED points where load per point may be less, number of points may be suitably increased.
- (ii) Power circuit in non-residential building will have only one outlet per circuit.

- Load more than 1 KW shall be controlled by suitably rated MCB and cable size shall be decided (iii) as per calculations.
- (iv) Power Wiring with Bus Trunking

3.9 **Socket Outlets**

(i) Socket outlets modular type shall be 6A 3 pin, 16 Amp 3 pin or 16/6 Amp 6 pin. 5 pin socket outlets will not be permitted.

The third pin shall be connected to earth through protective (loop earthing) conductor. 2 pin or 5 pin sockets shall not be permitted to be used.

- Conductors connecting electrical appliances with socket outlets shall be of flexible type with an (ii) earthing conductor for connection to the earth terminal of plug and the metallic body of the electrical appliance.
- (iii) Sockets for the power outlets of rating above 1KW shall be of industrial type with associated plug top and controlling MCB.
- (iv) Shutter type (interlocking type) of sockets shall be used.
- (v) Every socket outlet shall be controlled by a switch or MCB, as specified. The control switch/MCB shall be connected on the 'live' side of the line.
- (vi) Unless and otherwise specified, the control switches for the 6A and 16A socket outlets shall be kept along with the socket outlets.

3.10 Cables

Copper conductor cable only will be used for submain/ circuit/ point wiring. (i)

(ii)	Minimum size of wiring:		
	Light Wiring	:	1.5 sq.mm.
	Power Wiring	:	4.0 sq.mm.
	Power circuit rated	:	More than 1 KW, Size as per calculation.
(iii)	Insulation	:	Copper conductor cable shall be FRLS, PVC insulated Conforming to BIS Specification.
(iv)	Multi stranded	:	Cables are permitted to be used.

3.11 Wiring Accessories

Switch Box (a)

- (i) Switch box shall be hot dip galvanized, factory fabricated, suitable in size for surface/ recess mounting and suitable in size for accommodating the required number of switches and accessories (where required to be used for applications other then modular switches/ sockets).
- (ii) Switch box also can be of non-metallic material. The Engineer will approve specified makes of reputed quality and specifications.

- (b) Ceiling Rose
 - (i) A ceiling rose shall not be used on a circuit, the voltage of which normally exceeds 250V.
 - (ii) Only one flexible cord shall be connected to a ceiling rose. Specially designed ceiling roses shall be used for multiple pendants.
- (c) Fittings

Types : The type of fittings shall be as specified in tender documents.

3.12 Attachment of Fittings and Accessories

- (*a*) Conduit Wiring System
 - (i) All accessories like switches, socket outlets, call bell pushes and regulators shall be fixed in flush pattern inside the switch/regulator boxes. Accessories like ceiling roses, brackets, batten holders etc. shall be fixed on outlet boxes. The fan regulators may also be fixed on outlet boxes, if so directed by the Engineer-in-charge.
 - (ii) Aluminium alloy or cadmium plated iron screws shall be used to fix the accessories to their bases.
 - (iii) The switch box/regulator box shall normally be mounted with their bottom 1.25 m from floor level, unless otherwise directed by the Engineer-in-charge.
- (*b*) Fixing to Walls and Ceiling
 - (i) Wooden plugs for fixing to wall/ceiling will not be allowed. Fixing will be done with the help of PVC sleeves/Rowel plugs/ dash fasteners as required.
 - (ii) Drilling of holes shall be done by drilling machines only. No manual drilling of hole will be allowed.

3.13 Fans, Regulators and Clamps

- (a) Ceiling Fans
 - (i) Ceiling fans including their suspension shall conform to relevant Indian Standards.
 - (ii) The capacity of a ceiling fan to meet the requirement of a room with the longer dimension D meters should be about 55 D m³/min.
 - (iii) The height of fan blades above the floor should be (3H + W)/4, where H is the height of the room, and W is the height of the work plane.
 - (iv) The minimum distance between fan blades and the ceiling should be about 0.3 meters.
 - (v) When actual ventilated zone does not cover the entire room area, then optimum size of ceiling fan should be chosen based on the actual usable area of the room, rather than the total floor area of the room.
 - (vi) Energy Efficient fans with BEE 3-5 star rating or complying with IS 374: 1979, shall be used. The minimum service value of fans shall be 3.5 m³/min/W and air delivery 200 m³/min.

- (vii) Standard power with air delivery of Fans shall be as per IS 374.
- (viii) Step Type Electronic regulators shall be used instead of resistance type regulators for controlling speed of fans.
- (ix) All ceiling fans shall be wired to ceiling roses or to special connector boxes, and suspended from hooks or shackles, with insulators between hooks and suspension rods. There shall be no joint in the suspension rod.
- (x) The leading in wire shall be of nominal cross sectional area not less than 1.5 sq. mm. and shall be protected from abrasion.
- (xi) Unless otherwise specified, all ceiling fans shall be hung 2.75 m above the floor.
- (xii) In the case of measurement of extra down rod for ceiling fan including wiring, the same shall be measured in units of 10 cm. Any length less than 5 cm shall be ignored.
- (b) Exhaust Fans
 - (i) Exhaust fans shall conform to relevant Indian Standards.
 - (ii) Exhaust fans shall be erected at the places indicated drawings. For fixing an exhaust fan, a circular opening shall be provided in the wall to suit the size of the frame, which shall be fixed by means of rag bolts embedded in the wall. The hole shall be neatly plastered to the original finish of the wall. The exhaust fan shall be connected to the exhaust fan point, which shall be wired as near to the opening as possible, by means of a flexible cord, care being taken to see that the blades rotate in the proper direction.
 - (iii) Exhaust fans for installation in corrosive atmosphere, shall be painted with special PVC paint or chlorinated rubber paint.
 - (iv) Installa
 - (v) tion of exhaust fans in kitchens, dark rooms and such other special locations need careful consideration; any special provisions needed shall be specified.

3.14 Marking of Switch Boards

(*i*) Schematic Diagram

First a comprehensive schematic diagram for each building is to be prepared, starting from Main LT Panel, rising main, submain boards, DBs, etc. and the manner in which they are connected. This will include essential, non-essential and UPS systems. Sizes of interconnecting main/submain cables shall be indicated.

(ii) Marking of each Main Board

Each main board/submain board shall be marked indicating rating of each incoming/ outgoing switch and the details of load/area it feeds. Detail/size of incoming and outgoing cable also shall be marked indicating from where the incoming cable has originated.

(iii) Marking of Distribution Board

Each Distribution Board shall be marked indicating detail of incoming switch (Size of cable and from where it is fed) and marking of each outgoing MCB indicating the area it feeds. Suitable marking sticker will be suitably fixed to indicate such details.

(iv) Marking of Power/Light DBs

Power/light DBs shall be marked 'P' and 'L' respectively.

(v) Marking for Non-essential/Essential/UPS/Switch Boards

Each switchboard shall be marked essential/non-essential/UPS to indicate the nature of such switchboards.

(vi) Marking of Main Earthing Terminal

Main earthing terminals in main/submain switchboard shall be permanently marked, as "Safety Earth – Don't Remove".

3.15 LT Distribution Switchgear

Only following type switchboards will be used:

- (a) Main/Submain switchboard of cubicle type.
- (b) DBs Conventional DBs of reputed makes can also be used with the approval of Engineer-in-Charge in addition to prewired DB.
- (c) Specially designed switchboards.

Also specially designed switchboards can be used with detailed specification and fabrication drawings approved by the Engineer-in-Charge.

3.16 Location of Switchboards

- (i) Switchboards are to be located in common areas like corridors, lobby etc. and not to be located in locked room.
- (ii) Switchboard shall be located only in dry situation and in well-ventilated space. They shall not be placed in the vicinity of storage battery or exposed to chemical fume.
- (iii) Switchboards shall not be erected above gas stove, or sinks or within 2.5 meter of any washing unit in washing rooms of launderings or in the bath rooms, toilets, or kitchen.
- (iv) As far as possible main boards shall not be located in basement. Such main boards can be located in ground floor.
- (v) It is preferable to locate floor main boards in rising main shafts of adequate size, with steel doors (having ventilation) or in suitable room.
- (vi) Similarly DBs can be in suitable nitches in corridor walls having doors.
- (vii) Locating main boards under staircase or standing open in corridor is not a desirable practice, besides being highly unaesthetic.
- (viii) The main switchboard, which receives power to the building, should be invariably located in a switch room, having round the clock access, for emergency attendance to the switchboard.

4. LIGHTING SYSTEM

4.1 SCOPE

- a. The Contractor shall design, supply, install, test and commission a high efficiency lighting system for all areas of the buildings. Light fittings for all areas shall be complete with lamps, supports and accessories. The light fittings and all associated accessories shall be subject to the acceptance of the Engineer.
- b. The Lighting System shall also incorporate Lighting Management System (LMS) to manage and control lights from single location. LMS shall use wireless technology (Zigbee/Bluetooth/Wi-fi) to control the lights with minimal wiring.
- c. The LMS shall be able to communicate to Building Management System (BMS) seamlessly over BACnet or other open protocol. LMS shall provide all available data to BMS.
- d. Lux level study shall be conducted to assess the lux levels in various areas as per NBC and then luminaire type and quantity drawing to be submitted accordingly for approval of the Engineer-in-Charge.
- e. The quantity of the luminaires is only indicative as per attached drawings which may change according to the lux level report submitted.
- f. Lighting levels shall be uniformly distributed throughout the area, and shall be designed such that glare, dark recesses and areas of poor lighting levels are avoided.
- g. The type of luminaries and normal average maintained illumination levels for various areas and services shall be as per prevalent specification of NBC or other applicable codes.
- h. Various types of luminaires are being employed as per BOQ. The details of application of such variety of lights shall be made available at the time of finalisation of lighting drawing.

4.2 ACCEPTABLE CODES AND STANDARDS

The luminaries and associated equipment shall comply with the following codes and standard:

IS: 1913	General Safety Requirements for Luminaires
IS: 1777	Industrial Luminaires with Metal Reflectors
IS: 3553	Specification for Watertight Electric Lighting Fitting
IS: 3528-	Water Proof Electric Light Fitting
1966	
IS: 1646:	Code of Practice for Fire Safety of Building
1997	
IEC 60598-	Fixed General Purpose Luminaires
2-1	
IEC 60598-	General Requirements and Tests
1	
IS: 3646	Code of Practice for Interior Illumination
(All 3	
Parts)	
NFPA	National Fire Protection Association
IEC 62031	LED modules for general lighting-Safety requirements
EN 61547	Equipment for general lighting purposes EMC immunity
	requirement.
IEC 60598-	Fixed general purpose luminaries
2-1	

IEC 60598-	Luminaires- General requirement and tests
1	
IEC 61000-	Electro Magnetic compatibility (EMC) -Limits for
3-2	Harmonic current emission
IEC 61347-	Lamp control gear : particular requirements for DC or
2-13	AC supplied electronic control gear for LED modules
IS 10322	Specification for the luminaries
IEC 62384	DC or AC supplied electronic control gear for LED modules performance requirements
EN 13032-	Measurement and presentation of photometric data of
1	lamps and luminaires: Measurement and file format
EN 13032-	Measurement and presentation of photometric data of
2	lamps and luminaires: Presentation of data for indoor and outdoor work places
LM 79	Internationally recognized method for the electrical and photometric measurement of solid state lighting products
LM 80	Internationally recognized method for measuring lumen maintenance of LED light sources
IEC 60529	Classification of degree of protections provided by enclosures
IS	Photo biological safety of Lamps & Lamp Systems
16108.2012	

4.3 SYSTEM DESCRIPTION

The lighting system shall comprise of the following:

I. Normal Lighting

The normal lighting shall be fed from normal supply Distribution Boards.

II. Emergency Lighting

10% of lighting fixtures in all areas and minimum one light in each chamber shall be emergency light fixtures powered by UPS.

III. General

- a. Motion sensors (PIR) occupancy sensing and lighting sensors for day light harvesting shall be used.
- b. All luminaires with drivers shall have power factor of 0.90 or above.

4.4 LUMINAIRE

4.4.1 Lighting Features

Following features are required in the lighting fixtures:

- a. Energy efficient
- b. Long Life
- c. Rugged and durable
- d. Smaller lighting fixture

- e. Environmental friendly no Mercury
- f. Dimmable for automation
- g. Available in different colours
- h. Better heat management
- i. Use of good quality diffuser

4.4.2 Design Parameters

Following parameters shall be met in the Luminaire:

- a. CRI of the source, must be >80
- b. Usable lumen per watt of fitting, must be >100 lm/W
- c. Glaring Index of fixture, UGR<19
- d. Life of lamp, must be 50k+

4.4.3 Construction

The luminaire shall be made of extruded or die cast aluminium, otherwise as specified in the BOQ.

4.4.4 LED Chip

Suitable number of LED lamps shall be used in the luminaires. LED lamps of NICHIA/CREE/OSRAM/ SEOUL/BRIDGELUX/ make shall be used for the purpose.

High power and high lumen efficient LEDs shall be used: The efficiency of the LED lamps at 85 Deg C junction temperature shall be more than 100%.

The working life of the lamp at junction temperature of 85 Deg C at rated current shall be more than 50,000 working hours @ L70 of accumulative operation.

These features shall be supported with data-sheet. Colour temperature of the proposed white colour LED shall be as mention in BOQ and the color variation should be within McAdam Step specified in the fixture description in BOQ. The output of LED shall be more than 100 lumen per watt at minimal operating current and shall ensure guaranteed Lumen maintenance report as per guidelines shall be produced for the power LEDs used. Power factor of complete fitting shall be more than 0.9 at full load

All manufacturers must confirm that all supplied LEDs fall within a 3-step MacAdam

4.4.5 Secondary Optic:

Suitable diffuser (made of PC/PMMA) or lenses shall be provided to increase the illumination uniformity and distribution.

4.4.6 Parameters

Each luminaire shall meet the following parameters, or as specified in the BOQ:

- Fixture should have minimum efficacy at System level (Not Chip Level) >=110 lumens/watt, unless otherwise specified in BOQ
- ➤ CRI >80,
- ➤ THD<10%,</p>
- ▶ PF >0.90,
- ► R9>20,
- ➢ IP20,
- ▶ UGR<19,
- ► IK>=04,

- ➤ CCT of 5700/6500K (SDCM<3)</p>
- > Operating working temp range $0^{\circ}C < Ta < 45^{\circ}C$
- Operating Voltage Range of 140 270V.
- Internal Surge Protection 2.5KV
- \blacktriangleright Flicker free operations ripple <5%,
- > The internal wiring to be done with LSZH wires.
- \succ The fixture should comply with the parameters as per IS10322.
- The LED driver should comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI.
- Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm.
- LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters.
- Both the fixture and Driver should have BIS approval.

4.5 LIGHTING MANAGEMENT SYSTEM

LMS shall need to be connected wirelessly to the luminaires installed in whole area of the building in order to meet the requirement of control and management of light fixtures. It must be able to sense the data and transmit to the central system.

Note: LMS and its associated components/devices shall be supplied and installed by the supplier of Luminaire.

4.5.1 SYSTEM REQUIREMENTS

Grouping

The system shall be able to group together number of lights and a lighting behaviour template shall be assigned to each group. The lighting behaviour and grouping of lighting fixtures shall be able to be changed remotely.

> Switching

The system shall be able to switch off/on the lights with predefined schedule and manually as well from remote location. Switching shall be for a group of lights or individual, as well.

> Daylight Harvesting

The system shall be capable to communicate the lighting sensors of individual/group of lights to measure the light level and shall reduce the light output of the fixture (reduced energy consumption) when enough light is already available, for example through sun light

Dimming

The system shall be able to adopt the preconfigured office light behaviour templates that enable targeted dimming.

Human Centric Lighting

The system shall be able to adopt the human centric lighting behaviour of the light fixtures depending on the period of the time during a day. The CCT of lighting shall adopt different CCT from beginning of day to evening to provide the comfort.

Connectivity and Network Topology:

Each light/sensor shall communicate wirelessly using the ZigBee/Bluetooth protocol with a Wireless Gateway. Every light fixture shall be connected in the network and can ensure that the control data is transmitted reliably to network node/device.

4.5.2 SYSTEM DESCRIPTION

a. User Dashboard:

The standalone/cloud software shall allow the lighting system to be controlled, monitored and managed. The dashboard shall have functionality that includes energy reports, occupancy reports and heatmaps, ability to set up and run schedules, and to manage generated alerts. The software shall allow for users to control the light levels for areas across the building at area or floor level. The lighting control software shall incorporate of user login access security. The system shall be capable of displaying alternate applications in accordance with the user rights profile defined for each user. The system shall automatically log out users after a defined period has elapsed since the last application activity.

b. System Health Monitoring:

It shall be possible to monitor and control the entire system in near real-time. The system shall be capable of monitoring and displaying a comprehensive range of diagnostic and fault information in a graphical dashboard.

c. Energy Monitoring:

The management software shall display historical measured energy consumption data in a dashboard format. Notional calculations will not be accepted. The purpose of this facility shall be to provide clear visibility of lighting system energy performance to occupants, to encourage utilization behaviour that reduces energy demand

d. Occupancy Graphs & Heatmaps:

The management software shall display historical occupancy metrics based on the PIR sensors. The system shall support occupancy metrics without the inclusion of the hold time of the sensor.

The dashboard shall be able to display occupancy reports with a percentage of occupancy.

The purpose of this feature is to provide clear visibility of occupancy usage of the spaces to encourage decisions or strategies to improve the facility overall usage and reduce real state costs. The dashboard shall also include heatmaps visualization for an easy display of information.

The system shall support the visualization of range heatmap, were the user can select the hours of the day, days of the week, months and years to get an average for every single sensor. It shall be displayed in both a graph and a heatmap picture.

4.5.3 System Components

The Lighting Control System, in general must comprise of the following components:

a. Wireless Dimmable Controller

Wireless Dimmable Controller with PIR and Ambient Light Sensing shall be used. Temperature & Humidity capability in these sensors may be additional feature, but optional only. Sensors shall be factory fitted along with the driver. Drivers and sensors shall be CE, UL and BIS compliant.

The sensor shall be field configured through LMS or IR and operator can override operation of the sensor. The sensor shall hold up to five configurations to operate the light based on the time of the day. The sensor shall cover an area of 200 - 300 sq. feet depending on the height of ceiling. Operator shall have the ability to override the sensor mode to Auto or manual based on the time of the day for special occasions.

b. Wireless Controller for Tunable Lights

Wireless Controller with one PIR Sensor capable of controlling tunable colour fixtures with inbuilt Ambient Light Sensor for dimming shall be used. It shall have capability to add additional sensors to extend the overall coverage area. The controller shall be configurable from LMS to override PIR / ALS / Colour. The controller shall have field configurable various modes of operation. Drivers and sensors shall be CE, UL and BIS compliant.

The sensor shall be field configured through LMS or IR and operator can override operation of the sensor. The sensor shall hold up to five configurations to operate the light based on the time of the day. The sensor shall cover an area of 300 - 500 sq. feet depending on the height of ceiling. Operator shall have the ability to override the sensor mode to Auto or manual based on the time of the day for special occasions.

The additional sensor shall have the same specification as primary sensor.

c. Wireless Relay Controller for ON/Off controls

Wireless Relay Controller with one PIR only sensor shall be used for Controlling nondimmable fixtures. It shall be CE, UL and BIS compliant.

d. Wireless Switch for area control

Wireless Switches shall be used for Room and Scene Control. It shall have LCD display to display light status, Temperature & humidity status. It shall allow control of lights of ON/Off, Dim or CCT. It shall allow to set pre-determined scenes.

e. Battery Operated Wireless Switch for area or Zone Control

Wireless Battery-Operated Wall mounting switch/remote capable of controlling ON/Off and Dim up/down shall be used. Battery operated remote operation with a life of at least 5 year of battery life

f. Wireless Receiver/Transmitter

Wireless Receiver will be a tunnelling device for all control, status and configuration messages from LMS to individual controllers and vice-versa. The device shall have a range of at least 25 meters indoor and shall have the capability to handle at least 100 controllers.

g. Main Gateway Processor

Processor panel containing one processor. The processor shall allow third party BMS application to discover all lighting points and Group points over BACnet IP and allow control of lights for ON/Off/DIM and change colour. The product shall be CE and FCC certified.

4.6 TESTS

The electronics covered for this equipment shall pass all the tests called for in the specification. The tenderer shall indicate the deviation or compliance otherwise the offer may be rejected.

- Tests are classified as:
- Type test,
- \succ Routine and

Type Test:

Type tests shall be carried out to prove confirmation with the requirement of specification and general quality/design features of the unit. In case of any change in design of unit, complete type test shall be repeated.

Routine Tests:

These tests shall be performed by the manufacturer on sample(s) taken from a lot as per sampling plan specified by BIS at NABL accredited labs in the presence of Client Representative. The charges for the above tests to be borne by the manufacturer/supplier. The test results shall be submitted to the Engineer. The firm shall maintain the records with traceability.

4.6.1 Test Scheme:

Routine Test

- 1. Visual and Dimensional check
- 2. Checking of documents of purchase of LED
- 3. Resistance to humidity
- 4. Insulation resistance test
- 5. HV test
- 6. Over voltage protection
- 7. Surge protection
- 8. Reverse polarities
- 9. Temperature rise Test
- 10. Ra % (Color Rendering Index) as per BOQ specifications
- 11. Lux measurements
- 12. Tests for IP as per BOQ specifications

4.7 WARRANTY

All Luminaires and its gears along with LMS software & hardware shall carry replacement warranty for a period of 05 (Five) years from the date of commissioning.

5.0 MEDIUM VOLTAGE CABLES

GENERAL

Technical specifications in this section covers supplying and laying of :

• Medium voltage cables.

STANDARDS AND CODES

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

PVC insulated heavy duty cables	IS 1554 - 1988
Cross link polyethylene insulated PVC	IS 7098 - 1985
(sheathed XLPE cables)	
Code of practice for installation and maintenance	IS 1255 - 1983
of power cables	
Conductors for insulated electrical cables	IS 8130 - 1984
Drums for electrical cable	IS 10418 - 1982
Methods of test for cables	IS 10810 - 1988
Recommended current rating	IS 3961 - 1987
Recommended short circuit rating of high voltage	IS 5891 - 1970

CABLES

Medium Voltage Cables

Medium voltage cables shall be aluminium conductor XLPE insulated, PVC sheathed armoured conforming to IS 7098. Cables shall be rated for a 1100 Volts. The conductor of cables from 16 Sq. mm. to 50 Sq. mm. shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq. mm and above. Conductors shall be made of electrical purity aluminium 3/4 H or H temper. Conductors shall be insulated with high quality PVC base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of unvulcanised compound. Armouring shall be applied over outer sheath of PVC sheathing. The outer sheath shall bear the manufacturer's name and trade mark at every metre length. Cores shall be provided with following colour scheme of PVC insulation.

1 Core	:	Red/Black/Yellow/Blue
2 Core	:	Red and Black
3 Core	:	Red, Yellow and Blue
3 1/2 /4 Core	:	Red, Yellow, Blue and Black

Current ratings shall be based on the following conditions.

a)	Maximum conductor temperature	70° C
b)	Ambient air temperature	45° C
c)	Ground temperature	30° C
d)	Depth of laying	1000 mm

Short circuit rating of cables shall be as specified in IS 7098.

Cables have been selected considering conditions of maximum connected loads, ambient temperature, grouping of cables and allowable voltage drop. However, the contractor shall recheck the sizes before cables are fixed and connected to service.

Delivery, Storage and Handling

Cable drum shall be stored on a well drained, hard surface, preferably of concrete, so that the drums do not sink in ground causing rot and damage to the cable drum. The cable drum shall conform to IS 10418. During storage, periodical rolling of drums, in the direction of arrow marked on the drum, shall be done once in 3 month through 90°C Both ends of cables shall be properly sealed to prevent moisture ingress Drums shall be stored in well ventilated area protected from sun and rain. Drums shall always be rested on the flanges and not on flat sides. Damaged battens of drums etc. shall be replaced. Movement of drums shall always be in direction of the arrow marked on the drum. For transportation over long distance, the drums

shall either be mounted on drum wheels and pulled by ropes or they shall be mounted on trailers etc. drums shall be unloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps. While transferring cable form 1 drum to another, the barrel of the new drum shall have diameter not less than the original drum. Cables with kinks or similar visible defects like defective armouring etc shall be rejected. Cables shall be supplied at site in cut pieces as per actual requirements.

LAYING OF CABLES

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for medium voltage cables. Cables shall be laid in masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts as elaborated below. Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement cannot be met, medium voltage cables shall be laid above HT cables.

In Masonry Trenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches to be provided by Owners. Cables shall be laid on MS supports fabricated from minimum 38mm x 38mm x 6mm painted / galvanized angle iron supports grouted in trench walls at intervals not exceeding 600 mm. If required, cables shall be arranged in tier formation inside the trench. Suitable clamps, hooks and saddles shall be used for securing the cables in position and dressing properly so that the clear spacing between the cables shall not be less then the diameter of the cable. Trenches shall be provided with chequered plate/RCC covers. Wherever so specified, trenches shall be filled with fine sand.

On Trays/Walls

Wherever

so specified, cables shall be laid along walls/ceiling or on cable trays. Cable shall be secured in position and dressed properly by means of suitable clamps, hooks, saddles etc. such that the minimum clear spacing between cables is diameter of the cable. Clamping of cables shall be at minimum intervals as below.

Type of cables	Size	Clamping by	Fixing intervals
MV	Upto and including 25 sq mm	Saddles 1 mm thick	45 cm
MV & HV	35 sq mm to 120 sq mm	Clamps 3 mm thick 25 mm wide	60 cm
MV & HV	150 sq mm and above	Clamps 3 mm thick 40 mm wide	60 cm

Note : The fixing intervals specified apply to straight runs. In the case of bends, additional clamping shall be provided at 30 cm from the centre of the bend on both sides.

Cable trays, of sizes as per schedule of quantities and drawings shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Cable trays shall comply with the following:

Trays shall have suitable strength and rigidity to provide proper support for all contained cables. Trays shall not have sharp edges, burrs or projections injurious to cable insulation. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalent structural members.

Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out ensuring the following :

Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the electrical contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Architect/Engineer/DFCCIL. Wherever embedded plates & structural beams are not available for welding the tray mounting structure electrical contractor to supply the MS plates & fix them to floor slab by four anchor fasteners of minimum 16 mm dia having minimum holding power of 5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be 120 Kg. metre of cable run. Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs to be 300 mm. Cable trays will be welded to their mounting supports. Minimum clearance between the top most tray tier and structural member to be 300 mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angels. Clamps to be fabricated from 3 mm thick aluminium strip at site by the electrical contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS: 226 & 808. Welding shall be as per latest revisions of IS: 816. All structural steel to be painted with one shop coat of red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected properly to present a neat and clean appearance. Trays shall be installed as a complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid. Each run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

Buried Directly In Ground

General

Cables shall be so laid that they will not interfere with under ground structures. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded as directed by Architects/Owners. Surface of the ground shall be made good so as to conform in all respects to the surrounding ground to the satisfaction of Architect/Engineer/DFCCIL.

Routing of cables

Before cable laying work is undertaken, the route of the cables shall be decided with the Architects/Owners. While shortest practicable route shall be preferred, cable runs shall follow fixed development such as roads, footpaths etc with proper off-sets so that future maintenance and identification are rendered easy. Whenever cables are laid along well demarcated or established roads, the LV/MV cables shall be laid further from the kerb line than HV cables. Cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted, LV/MV cables shall be laid at a lower level than the cables of lower voltage. Power and communication cables shall as far as possible cross at right angles. Where power cables are laid in proximity to communications cables the horizontal and vertical clearances shall not normally be less than 60 cm.

Width of Trench

The width of trench shall be determined on the following basis. The minimum width of trench for laying single cables shall be 350 mm. Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables except where otherwise specified shall be at least 200 mm. There shall be a clearance of at least 150 mm between axis of the end cables and the sides of the trench.

Depth of Trench

The depth of trench shall be determined on the following basis:

- Where cables are laid in single tier formation, the total depth of the trench shall not be less than 750 mm for cables upto 1.1 kV and 1250 mm for cables above 1.1 kV.
- When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of trench shall be increased by 300 mm for each additional tier to be formed.

Excavation Of Trenches

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature of 12 times the overall diameter of the largest cable shall be

provided. Where gradients and changes in depths are unavoidable these shall be gradual. Excavation should be done by any suitable manual or mechanical means. Excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. Adequate precautions shall be taken not to damage any existing cables, pipes or other such installations during excavation. Wherever bricks, tiles or protected covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Architect/Engineer/DFCCIL. Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Architect/Engineer/DFCCIL. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled as required. If there is any danger of a trench collapsing or endangering adjacent structures the sides shall be well shored up with timbering and/or sheathing as the excavation proceeds. Where necessary these may even be left in place when back filling the trench. Excavation through lawns shall be done in consultation with the Architect/Engineer/DFCCIL. Bottom of the trench shall be level and free from stone, brick, etc. The trench shall then be provided with a layer of clean dry sand cushion of not less than 80 mm in depth.

Laying Of Cable In Trench

The cable drum shall be properly mounted on jacks or on a cable wheel at a suitable location. It should be ensured that the spindle, jack etc are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks or strains. The entire cable length shall, as far as possible, be laid in one stretch. However when this is not possible the remainder of the cable shall be removed by flaking i.e. making one long loop in the reverse direction. After the cable is uncoiled and laid over the rollers, the cable shall be lifted slightly over the rollers beginning from one end by helpers standing about 10 metres apart and drawn straight. The cable should then be taken off the rollers by additional helpers lifting the cables and then laid in the trench in a reasonably straight line. For short runs and cable sizes upto 50 sq mm 1.1 kV grade the alternative method of direct handling can be adopted with the prior approval of the Architect/Engineer/DFCCIL. If two or more cables are laid in the same trench care should be taken to preserve relative position. All the cables following the same routes shall be laid in the same trench. Cables shall not cross each other as far as possible. When the cable has been properly straightened the cores shall be tested for continuity and insulation resistance. The cable shall be measured thereafter. Suitable moisture sealing compound/tape shall be used for sealing of the ends. Cable laid in trenches in a single tier formation shall have a covering of clean dry sand of not less than 170 mm above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid. If additional tiers are formed each of the subsequent tiers also shall have a sand cushion of 300 mm. The top most cable shall have a final sand covering not less than 170 mm before the protective cover is laid. A final protection to cables shall be laid to provide warning to future excavators of the presence of the cable and also to protect the cables against accidental mechanical damage. Such protection shall be with

second class bricks of not less than 200 mm x 100 mm x 100 mm (normal size) laid breadth wise for the full length of the cable to the satisfaction of the Architect/Engineer/DFCCIL. Where more than one cable is to be laid in the same trench this protective covering shall cover all the cables and project at least 50 mm over the sides of the end cables. In addition bricks on edge shall be placed along the entire run on either side of the cable run. The trenches shall then be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered in successive layers not exceeding 300 mm. Unless otherwise specified a crown of earth not less than 50 mm in the centre and tapering towards the side of the trench shall be left to allow for subsidence. The crown of earth should however not exceed 100 mm so as not to be a hazard to vehicular traffic. Where road berms or lawns have been cut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Architect/Engineer/DFCCIL and all surplus earth and rocks removed to places as specified.

Laying In Pipes/Closed Ducts

In locations such as road crossings, entry to buildings/poles in paved areas etc., cables shall be laid in pipes or closed ducts. Spun reinforced concrete pipes shall be used for such purposes and the pipe shall not be less than 100 mm in diameter for a single cable and not less than 150 mm for more than one cable. These pipes shall be laid directly in ground without any special bed. Sand cushioning and/or brick tiles need not be used in such installations. Unless otherwise specified the top surface of pipes shall be at a minimum depth of 1000 mm from the ground level when laid under roads, pavements etc. The pipes for road crossings shall preferably be on the skew to reduce the angle of bend as the cable enters and leaves the crossing. Pipes shall be smoothened to prevent injury to cable insulation or sheathing. No deduction shall be made for sand and bricks not used for cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles.

Laying Of Cables In Floors

Laying of cables directly in floors shall be avoided and GI pipes of adequate size shall be used wherever necessary. However if the cables have to be laid direct in the floor specific written approval of Architect/Engineer/DFCCIL shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

<u>Cable Entry Into Buildings</u>

Cable entry into buildings shall be made through RCC pipes recessed in the floor. RCC Hume pipes shall be provided well in advance for service cable entries. The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water. Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

TERMINATION/JOINTING OF CABLES

Soldered jointing/termination shall be totally avoided. Solderless terminations by using Dowel crimping tools and suitable legs shall be adopted for all cable terminations. Any terminations may without use of proper crimping tool is shall be liable to be rejected. In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper and then a thin coat of tin is applied before pinching into any equipment. Heat shrinkable Raychem type or approved equivalent terminations shall be provided for High Voltage cables and Siemens make or approved equivalent make brass double compression glands shall be provided for Medium Voltage cable terminations. Straight through jointing of Medium Voltage or High Voltage cable shall normally be totally avoided. If absolutely unavoidable, such jointing shall be carried out as per procedure to be got specifically approved from Architect/Engineer/DFCCIL.

MEASUREMENT OF CABLE RUNS

The cable runs shall be measured upto the outer end of the boxes without any allowances for over lap in joints. The actual run of the cables shall be measured and the rate shall include all the above mentioned material, labour etc for laying as required.

CABLE LOOPS

At the time of the installation approximately 3 metres of surplus cable shall be left

- at each end of the cable
- on each side of underground straight through/tee/termination joints.
- at entries to buildings
- and such other places as may be decided by the architects/owners.

This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the Architect/Engineer/DFCCIL.

BONDING OF CABLES.

Where a cable enters any piece of apparatus it shall be connected to the casting by means of an approved type of armoured clamp or gland. The clamps must grip the armouring firmly to the gland or casting, so that in the event of ground movement no undue stress is placed on to the cable conductors.

TESTING

Tests At Manufacturer's Work

The cables shall be subjected to shop test in accordance with relevant standards to prove the design and general qualities to the cables as below (as per IS 10810) :

- Routine test on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot.
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

Site Testing

- All cables before laying shall be tested with a 500 V megger for 1.1 kV grade or with a 2500/5000 V megger for cables of higher voltages. The cables cores shall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors.
- All cables shall be subject to above mentioned test during laying, before covering the cables by protective covers and back filling and also before the jointing operations.
- After laying and jointing, the cable shall be subjected to a 1.5 minutes AC/DC pressure test.
- In the absence of facilities for pressure testing in accordance with clause___ above it is sufficient to test for one minute with 1000 V megger for cables of 1.1 kV grade and with 2500/5000 V megger for cables of higher voltages.

Test Witness

Tests shall be performed in presence of representative of Architect/Engineer/DFCCIL. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

LT PANELS AND DB

MEDIUM VOLTAGE SWITCHGEAR

GENERAL

This section covers specification of Medium Voltage Switchboards incorporating items of switchgear like Circuit Breakers, SFUs, metering and protection.

STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Low Voltage switchgear & controlgear			IS 13947 : 1993	
Part I	:	General rules		
Part II	:	Circuit Breakers		
Part III	:	Switches, disconnectors, switch disconnectors		
Part IV	:	Contactors and Motor starters		
Part V	:	Control circuit devices and switching elements		
Marking of Switchgear busbars IS 11353 : 1985				
Degree of Protection of Enclosures for low voltage IS 214			IS 2147 : 1962	
switchgear.				
Electrical relays for power system protection			IS 3231 : 1986	
Code of Practice for selection, installation and IS 10118 : 1982				
Maintenance of switchgear & controlgear				
Low voltage switchgear & controlgear assemblies IS 8623 : 199			IS 8623 : 1993	

SWITCHGEAR

Moulded Case Circuit Breakers

Moulded case circuit breakers (MCCB) incorporated in switchboards wherever required, shall conform to IS 13947 : 1993 in all respects. MCCBs shall be suitable either for single phase 240 Volts or 3 Phase 415 Volts AC 50 Hz supply.

MCCB cover and case shall be made of high strength heat resisting and flame retardant thermosetting insulating material. Operating handle shall be quick make/break, trip - free type. Operating handle shall have suitable ON, OFF and TRIPPED indicators. Three phase MCCBs shall have a common handle for simultaneous operation and tripping of all the three phases. Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be of

thermal/magnetic type provided on each pole and connected by a common tripe bar such that tripping of any one pole causes three poles to open simultaneously. Thermal/magnetic tripping device shall have IDMT characteristics for sustained over loads and short circuits.

Contact trips shall be made of suitable arc resistant sintered alloy. Terminals shall be of liberal design with adequate clearances.

MCCBs shall be provided with following accessories, if specified in drawings/ schedule of quantities :

- Under voltage trip
- Shunt trip
- Alarm switch
- Auxiliary switch

MCCBs shall be provided with following interlocking devices for interlocking the door a switch board.

- Handle interlock to prevent unnecessary manipulations of the breaker.
- Door interlock to prevent door being opened when the breaker is in ON position
- Deinterlocking device to open the door even if the breaker is in ON position.

MCCBs shall have rupturing capacity as specified in drawings/schedule of quantities.

All MCCB shall be provided with adapter terminal for facilitates higher sizes of cable/ links

Metering, Instrumentation And Protection.

Ratings, type and quantity of meters, instruments and protective devices shall be as per drawings and schedule of quantities.

Current Transformers

C/Ts shall confirm to IS 2705 (part -I, II and III) in all respects. All C/Ts used for medium voltage application shall be rated for 1 kV. C/Ts shall have rated primary current, rated burden and class of accuracy as specified in schedule of quantities/drawings. Rated secondary current shall be 5A unless otherwise stated. Minimum acceptable class for measurement shall be class 0.5 to 1 and for protection class 10. C/Ts shall be capable of withstanding magnetic and thermal stresses due to short circuit faults of 31 MVA on medium voltage. Terminals of C/Ts shall be paired permanently for easy identification of poles. C/Ts shall be provided with earthing terminals for earthing chassis, frame work and fixed part of metal casing (if any). Each C/T shall be provided with rating plate indicating :

- Name and make
- Serial number
- Transformation ratio
- Rated burden
- Rated voltage
- Accuracy class

CTs shall be mounded such that they are easily accessible for inspection, maintenance and replacement. Wiring for CT shall be with copper conductor PVC insulated wires with proper termination works and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

Potential Transformer

PTs shall confirm to IS 3156 (Part-I,II and III) in all respects.

Measuring Instruments

Direct reading electrical instruments shall conform to IS 1248 or in all respects. Accuracy of direct reading shall be 1.0 of voltmeter and 1.5 for ammeters. Other instruments shall have accuracy of 1.5. Meters shall be suitable for continuous operation between -10° C to $+50^{\circ}$ C. Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel or phenolic mould. Design and manufacture of meters shall ensure prevention of fogging of instrument glass. Pointer shall be black in colour and shall have Zero position adjustment device operable from out side. Direction of deflection shall be from left to right. Selector switches shall be provided for ammeters and volt meters used in three phase system.

Multi Function meters

MFM shall be employed on the Panels and DBs as specified in the BOQ. MFM shall have seamless integration with BMS and shall supply all data with suitable means. All parameters shall be made available to BMS. Meters shall be suitable for operation with current and potential transformers available in the panel.

<u>Relays</u>

Protection relays shall be provided with flag type indicators to indicate cause of tripping. Flag indicators shall remain in position till they are reset by hand reset. Relays shall be designed to make or break the normal circuit current with which they are associated. Relay contacts shall be of silver or platinum alloy and shall be designed to withstand repeated operation without damage. Relays shall be of draw out type to facilitate testing and maintenance. Draw out case shall be dust tight. Relays shall be capable of disconnecting faulty section of network without causing interruption to remaining sections. Analysis of setting shall be made considering relay errors, pickup and overshoot errors and shall be submitted to Architect/Engineer/DFCCIL for approval.

Over current relays

Over current relays shall be induction type with inverse definite minimum time lag characteristics. Relays shall be provided with adjustable current and time settings. Setting for

current shall be 50 to 200 % insteps of 25%. The IDMT relay shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5 Amps.

Earth fault relay

Same as over current relay excepting the current setting shall be 10% to 40% in steps of 10%.

Under voltage relay

Under voltage relays shall be of induction type and shall have inverse limit operation characteristics with pickup voltage range of 50 to 90% of the rated voltage.

MEDIUM VOLTAGE DISTRIBUTION BOARDS

6 <u>GENERAL</u>

This section covers specification of DBs.

STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Miniature Air Circuit Breakers for AC circuits	IS 8828 : 1978
Degrees of Protection provided by enclosures	IS 2147 : 1962
for low voltage switchgear	
Code of Practice for installation and maintenance	IS 10118 : 1982
of switchgear not exceeding 1000 volts	
General requirements for switchgear and controlgear	IS 4237 : 1982
for voltages not exceeding 1000 volts	

MINIATURE CIRCUIT BREAKERS

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.
- The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.f.
- The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with H.R.C. fuse/PVC cable characteristic.
- Type test certificates from independent authorities shall be submitted with the tender.

FINAL DISTRIBUTION BOARDS

- Final distribution boards shall be flush mounting, totally enclosed, dust and vermin proof and shall comprise of miniature circuit breakers, earth leakage circuit breakers, neutral link etc as detailed in the schedule of quantities.
- The distribution equipment forming a part of the Distribution Boards shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and as per detailed specifications included in this tender document.
- The board shall be fabricated from 14 gauge CRCA sheet steel and shall have a hinged lockable spring loaded cover. All cutouts and covers shall be provided with synthetic rubber gaskets. The entire construction shall give a IP 42 degree of protection.
- The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulated throughout the length.
- All the internal connections shall be with either solid copper PVC insulated or copper conductor PVC insulated wires of adequate rating.
- All the internal connections shall be concealed by providing a hinged protective panel to avoid accidental contact with live points.
- All outgoing equipment shall be connected direct to the bus bar on the live side. The equipment shall be mounted on a frame work for easy removal and maintenance.
- The sheet steel work shall undergo a rigorous rust proofing process, two coats of filler oxide primer and final powder coated paint finish.
- All the circuits shall have an independent neutral insulated wire, one per circuit, and shall be numbered and marked as required by the Architect/Engineer/DFCCIL.
- A sample of the completed board is to be got approved by the architects/owners before commencement of supply and erection.

SHEET STEEL TREATMENT AND PAINTING

• Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute

sulphuric acid and a recognised phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.

• All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

NAME PLATES AND LABELS

• Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

ROUTINE AND COMPLETION TESTS

INSTALLATION COMPLETION TESTS

At the completion of the work, the entire installation shall be subject to the following tests:

- (a) Wiring continuity test
- (b) Insulation resistance test
- (c) Earth continuity test
- (d) Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

Wiring Continuity Test

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energised.

Insulation Resistance Test

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 megohms divided by the number of points

provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 11.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

Testing Of Earth Continuity Path

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

Testing Of Polarity Of Non-Linked Single Pole Switches

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Architect/Engineer/DFCCIL as well as the local authorities.

Earth Resistivity Test

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

Performance

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

Tests and Test Reports

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Architect/owners for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

7 Conduit, Cable Tray and Raceway

7.1 Scope

The Contractor shall supply and install the conduits, cable trays and raceways as indicated in BOQ and specified herein.

7.2 Applicable Codes and Standards

The conduits, cable trays and raceways shall comply with the following codes and standards:

IS: 9537 P-I:1980	: Conduits for Electrical Wiring Part I General Requirements
IS: 9537 P-II: 1981	: Conduits for electrical wiring Part II Rigid Steel Conduits
IS: 3837	: Accessories for Rigid Steel Conduits for Electrical Wiring
IS: 3480	: Flexible Steel Conduits for Electrical Wiring
IS: 732	: Code of Practice for Electrical Wiring Installations
IS: 2667	: Fittings for Rigid Steel Conduits for Electrical Wiring
IS 9537 : Part 1	: 1980/IEC 60614-1 (1978) : Conduits for electrical installations: Part 1 General requirements
IS 9537 : Part 2	: 1981(superseding IS:1653) : Conduits for electrical installations: Part 2 Rigid steel conduits
IS: 3837:1976	: Accessories for rigid steel conduits for electrical wiring
IS: 3480:1966	: Flexible steel conduits for electrical wiring
IS: 732: 1989	: Code of practice for electrical wiring installations
IS: 2667-1988	: Fittings for rigid steel conduits for electrical wiring
IS: 2412-1975	: Link clips for electrical wiring
IS:371-1999	: Ceiling roses

In addition to above, Indian Electricity Act 2003 and IE Rules 1956 as amended from time to time, General Specifications for electrical works Part-1 internal-2005 issued by CPWD shall be followed.

7.3 Material Description

The conduit, cable tray and raceway shall be designed and manufactured in accordance to the Indian Standards or International Standards and accepted by the authority and shall be installed to comply with relevant provision in Indian Standards Specifications, Indian Electricity Rules and IE wiring regulation.

7.4 Components

(1) GI Conduits and Accessories

- a. The steel conduits shall be made of hot-dip galvanized, produced in electrical resistance welding process with the weld bead on both inside and outside removed in accordance with Indian standard IS:9537 part 3 or equivalent.
- b. Flexible conduit and fittings for life safety equipment shall be galvanized, watertight pattern, flame retardant, Low smoke and fume, over-sheathed and separate earth wire enclosed within the conduit (if applicable).
- c. The standard manufactured elbows shall be used for all sizes of conduits diameter larger than 1 inch (25mm), and the field bends to be handled with great care not to damage the conduits, shall be permitted to be used for conduit of 1 inch and smaller.
- d. The conduits shall be defined in SI units.

(2) Cable Tray

- a. Cable trays used in indoors shall be made of hot dip galvanized perforated steel after fabrication to provide good corrosion resistance during storage, installation and service. The ventilated type cable tray, punching with cover shall be provided with the dimensions as indicated on the drawings.
- b. The number of cables laid in the cable tray shall be provided in compliance in compliance with the requirements of the Indian Standard Specifications, Indian Electricity Rules and IE wiring regulations. 40% spare capacity shall be provided for cable laying inside the cable tray.
- c. Cable tray shall not be installed across building or structural expansion joints. On horizontal runs, the tray shall be installed with a 20 mm gap at the expansion joint. Support shall be installed within 150 mm on either side of the joint.
- d. Wherever cables are laid in cable trays these shall be concealed above false ceiling. Trays shall conform to NEMA with minimum 2.0 mm thickness, perforated and galvanized steel.

(3) Raceway

a. Raceways shall be made of hot dip galvanized perforated steel after fabrication to afford good corrosion resistance during storage, installation and service life and shall be provided to form the continuous steel sheet troughs with removable covers attached to the race way by screws for housing the cables. The minimum thickness required for raceway shall be as per the following table:

Size of the Raceway (WXH) (mm)	Thickness (mm)
50X50 up to100X50	1.6
100X100 up to 150X100	1.6
200X100 up to 300X100	1.6
150X150 up to 300X150	1.6
Larger that above	2.0

- b. Raceways shall be installed so that all networking/telecom cables are separate from power cables.
- c. Each section of the raceway shall be electrically bonded with a minimum 6 mm2 cross section area earth bonding strap or wire, to the next section to form an electrically continuous system and bonding to main grounding system shall be with copper green/yellow, LSZH material sheathed single core cable.
- d. The number of cables laid in the cable tray shall be provided in compliance in compliance with the requirements of the Indian Standard Specifications, Indian Electricity Rules and IE wiring regulations.
 40% spare capacity shall be provided for cable laying inside the raceway.

(4) Boxes and Accessories

- a. All boxes provided in the conduit work shall be made of metal. A box provided for cable connections and concealed in ceiling shall be a standard galvanized steel square or circular box or a metal box, made of steel sheet with not less than 1.6 mm thickness, with one primer anti-rust coated and two coating finishes.
- b. All wall/ceiling boxes on exposed work shall be of die cast aluminium or cadmium-plated cast-iron.
- c. Conduit outlet boxes, for socket outlets, lighting switches, etc., shall be of hot dip galvanized steel complete with adjustable lug, ample knockouts, and brass earth terminals fitted in the base.

7.5 Testing and Commissioning

Field inspection and testing for conduit, cable tray and raceways installed shall be carried out prior to energization of any equipment / system.

8. TECHNICAL SPECIFICATIONS FOR MACHINE-ROOM LESS LIFTS

GENERAL

8.1 SCOPE

+

This specification covers the requirements of Design, Fabrication, Supply, Installation, Commissioning, packing, forwarding, transportation to site, unloading, furnishing of final drawings and manuals, handling at site, performance demonstration and performance acceptance etc. of various capacity passenger and goods lifts as per BOQ. To make the system complete in all respects and required Civil/Electrical work as per technical Specification & as per the tender document. The lift shall be capable for seamless integration with BMS.

8.2 SITE CONDITIONS

:	Maximum 45 Deg. C	
	Minimum 4 Deg. C	
:	Not more than 90% at maximum temperature.	
:	1000 - 1500mm Per Annum	
	:	

8.3 ELECTRICAL SUPPLY SPECIFICATION

System Voltage	415V
Voltage variation limits	+/- 10%
No. of phases	3
Frequency	50 c/s
Frequency variation limits	+3% or -5%
Fault level	Not exceeding 50 KA at 415 V
Neutral earthing on LV side	Solidly earthed

9 STANDARDS

The following Indian Standard Specifications and Codes of Practice, currently applicable and updated as of date irrespective of dates given below, shall apply to the equipments and the work covered by this contract. In addition the relevant clauses of the Indian Electricity Act 2003 and Indian Electricity Rules 1956 with latest amendments up to date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable

- 1. Code of Practice for installation, operation and maintenance of electric passenger & goods lifts.IS-14665 (Part 2) Sec-1 :2000
- 2. Code of practice for installation, operation and maintenance of electric service lift.IS-14665 (Part 2) Sec-2 : 2000
- 3. Safety Rules Section-1 Passenger and Good lifts IS-14665 (Part 3) Sec-1
- 4. Safety Rules Section-2 Service Lifts IS-14665 (Part 3) Sec-2 : 2000
- 5. Outline dimension for electric lifts. IS-14665 (Part-1): 2000
- 6. Inspection Manual for Electric Lifts IS-14665 (Part 5): 1999
- 7. Electric Traction Lifts Components
- Installation And Maintenance of Lifts For Handicapped Persons (Code of Practice) IS-14665 (Part 4) Sec-1 to 9 :2001IS 15330 :2003
- 9. Specification for lifts cables. IS-4289 (Par-1) : 1984 Reaffirmed 1991
- 10. Specification for hot rolled and slit steel tee bars IS-1173-1978 Reaffirmed 1987
- 11. Method of loading rating of worm gear. IS-7443-1974 Reaffirmed 1991
- Code of practice for selection of standard worn and helical gear box.IS-7403-1974 Reaffirmed 1991
- 13. Isometrics screw threads. IS-4218-(Part-II)1976 Reaffirmed 1996
- 14. Degree of protection provided by enclosure for low voltage switchgear and control gear. IS-2147-1962
- 15. Classification of insulating materials for electrical machinery and apparatus in relation to their thermal stability in service. IS-1271-1985 Reaffirmed 1990
- 16. Code of practice for earthing. IS-3043-1987

:2000

- 17. Electrical installation Fire Safety of Building. IS-1646-1997
- 18. PVC insulated electric cable for working voltage up to and including 1100 volts.IS-694-1990
- 19. Code of practice for electrical wiring and installation IS-732-1989
- 20. PVC insulated (Heavy Duty) electric cables for working voltage up to and including 1100 volts. IS-1554-1988 (Part-1)
- 21. Flexible steel conduits IS-3480-1966
- 22. Accessories for rigid steel conduit for electrical wiring IS-3837-1976
- 23. Boxes for the enclosure of electrical accessories IS-5133-1969 (Part 1)
- 24. Guide for safety procedures and practices in electrical work. IS-5216- 1982 (Part-1)
- 25. Conductors for insulated electric cables and flexible cordes IS-8130-1984
- 26. Miniature Circuit Breakers IS-8828-1996
- 27. Rigid steel conduits for electrical wiring (Second revisions) IS-9537-1981
- 28. Methods of test for cables IS-10810-1998
- 29. Earth Leakage Circuit Breakers. IS-12640-1988
- 30. Moulded Case Circuit Breakers IS-13947-1993
- 31. General requirement for switchgear and control gear for voltage not exceeding 1000 volts.IS-13947-1993
- 32. 1100 volt grade XLPE insulated armoured cables IS 7098
- 33. Specifications for hoistway door-locks IS 7754-1975
- 34. Rules for design, installation, testing and operation of lifts, escalators and moving parts.IS 1735-1975

In addition the relevant clauses of the following, as amended upto date shall ALSO apply:

Fire safety regulations pertaining to lifts

The tenderers shall also take into account local and State regulations as in vogue for the design and installation of lifts.

10 TECHNICAL SPECIFICATIONS - GENERAL

10.1 GENERAL REQUIREMENTS

Machine room-less electric traction passenger elevators work includes:

- 1. Gearless electric traction passenger elevators.
- 2. Elevator car enclosures, hoistway entrances and signal equipment.
- 3. Operation and control systems.
- 4. Accessibility provisions for physically disabled persons.
- 5. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
- 6. Materials and accessories as required to complete the elevator installation.

The Elevators shall include all elements confirming to specifications or as amended herein. Elevators covered by these specifications shall be provided, installed, tested, commissioned, certified and approved as per statutory requirements of Lift Inspectorate. Elevator shall have its own driving machine.

The method of drive shall be Electric Traction with Gear less motor having VVVF Control.

The design of the Elevators shall take into consideration fire prevention, elimination of dust and dirt traps, and easy accessibility for cleaning and routine maintenance.

10.2 ELECTRIC TRACTION DRIVE SYSTEM

10.2.1 TRACTION MACHINE

The construction of all Elevator machines shall conform with IS-14665

10.2.2 BRAKE

- a. The Electro-magnetic brake with non-asbestos lining shall be spring applied and electrically released type having noiseless operation.
- b. The brake shall be capable of stopping and holding the Elevator car in its downward travel to rest with 125% of its rated load from the maximum governor tripping speed. In this condition the retardation of the Car shall not exceed that resulting from the operation of the Safety gear or stopping on the buffer.
- c. Springs used to apply the brake shoes (two nos.) shall be in compression and adequately supported.
- d. Brake linings shall be of renewable incombustible materials and shall be secured to the brake shoes such that normal wear shall not weaken their fixings. Band brakes shall not be used.
- e. No earth fault, short circuit or residual magnetism shall prevent the brake from being applied in the event of loss of power supply to the Elevator motor and control circuit.
- f. A means of adjusting the brake plunger stroke and releasing the brake in emergency shall be provided.
- g. The Elevator machine shall be fitted with a manual emergency device capable of having the brake released by hand and requiring a constant effort to keep the brake open.
- h. The fail safe break shall incorporate an approved design of brake switch i.e. pick up, hold, discharge. Brake coil shall be wired in series & their respective switches in parallel. The operation of brake shall be thyrestor controlled from solid state drive in order to effect minimum pick up time and synchronized start.

10.2.3 Driving Mechanism

Lift Machine

The lift machine shall be suitable for 415 volt 3 phase 50 Hz AC supply with a voltage variation of $\pm 10\%$. The lift machine shall have high efficiency and low power consumption and shall be designed to withstand peak currents in lift duties.

10.2.4 Driving Sheaves

- a. The sheaves shall be manufactured in steel or SG iron and fitted with sealed for life lubricated bearings.
- b. The sheaves shall have machined rope grooves that can be reworked for future wear.
- c. Adequate provision shall be made to prevent any suspension ropes leaving groove due to rope slack or introduction of foreign objects.

10.2.5 Alignment

- a. The brake plunger, collar, sleeve, motor, sheaves and all bearings shall be mounted and assembled so that proper alignment of these parts is maintained.
- b. The assembly shall be reviewed and rectified when excessive noise is emitted during operation.

10.2.6 Gearless Machines

The gearless machine shall consist of a motor traction sheave and brake drum or brake disc completely aligned on a single shaft. Gearless machine shall be AC gearless with VVVF drive.

10.2.7 Anti-Vibration Supports

The whole traction machine shall be mounted on appropriate anti-vibration supports to minimize noise and vibration.

10.3 CONTROL SYSTEMS

10.4 DESCRIPTION

The Lifts shall have state of art microprocessor based AC variable voltage variable frequency (ACVVVF) drive. Some of the technical parameters required are innumerate below.

- a. Starting current 1.2 1.5 times full load running current
- b. Power saving 50 55%
- c. Leveling accuracy $\pm 3 \text{ mm}$
- d. Acceptable voltage fluctuation +10%

The controller shall be suitable mounted totally enclosed cubicle type with hinged doors on the front provide easy access to all components in the controller. Cubicle shall be well ventilated such that the temperature inside never exceeds the safe limits of the components at ambient room conditions. The controller shall operate within the supply voltage variation of plus 10% to minus 10% of the nominal voltage.

The Controller shall include protection against the following abnormalities and shall cut off the power supply, apply the brake and bring the car to a rest in the event of any of the abnormalities occurring.

- a. Over current
- b. Under voltage
- c. Overvoltage
- d. Single phasing
- e. Phase reversal
- f. Earth leakage

10.5 Features

Control system features are detailed as below.

Attendant Operation

Lift shall be provided with attendant control facilities. A key switch for change of operation mode shall be provided in a lockable recess panel on the car operation panel. After gaining control on the lift, the attendant can direct the car to stop at any storey. The attendant can also by pass the landing calls (but not cancel them) or reverse the direction of travelling.

• Automatic By-pass

Load weighing devices located either on car top or under the car cage shall be provided for all lifts. Whenever the load exceed 60-70% of the capacity load of the lifts, the lifts shall ignore all landing calls and only respond to car calls.

• Over load device

A load weighing devices shall operate when the load in the car exceeds the rated capacity. The operation of the device shall activate buzzer sound and flashing 'overload' signals. At the same time the car doors shall be prevented from closing. When the excess load has been removed from the car, the buzzer alarm shall be muted automatically and the car shall function normally. The sensitivity shall be 30 kg for Passenger lift.

• Automatic self-levelling

All lifts shall be provided with automatic self-levelling feature that shall bring the lift car level to within ± 3 mm for passenger elevators of the landing floor regardless of load or direction of travel. The automatic self levelling feature shall correct for over travel and rope stretch.

10.6 TECHNICAL SPECIFICATIONS: LIFTS, LIFT CAR, DOORS AND SAFETY DEVICES

10.6.1 CAR ENCLOSURES

• Frame

Every lift car body shall be in a steel car frame assembly which shall have sufficient mechanical strength to resist the forces applied by the safety gear or impact of the car on the buffers. The deflection of the steel members carrying the platform shall not exceed 1/1000 of their span under static conditions when the rated load is evenly distributed on the platform.

At least four renewable guide shoes or shoes with renewable linings or sets of guides rollers shall be provided two at the top and two at the top and two at the bottom of the car frame assembly.

• Enclosure finishes

The car enclosure, doors etc. shall be as per detailed in BOQ. The following are to be provided.

- Alarm System: An emergency alarm buzzer, including wiring shall be provided and connected to a plainly marked push button in the car operating panel. The alarm bell shall be located in central security room. The alarm unit shall be solid state siren type, to give a waxing and waning siren when the alarm button in the car is pressed momentarily
- Sealed Maintenance Free Nickel Cadmium Batteries capable of maintaining the following in each lift for 2 hrs after mains failure.
 - > Emergency light of adequate illumination in car
 - Car Ventilation
 - > ARD
 - Intercommunication System
 - Alarm bell
- One no. 16 amp switch socket outlet to IP 54 and a permanent weatherproof type luminaries to IP54 (with lighting switch) adequately protected shall be provided on the top of the lift car for maintenance
- One no. 16 amp switch socket outlet to IP 54 at bottom of lift car for maintenance

10.6.2 **OPERATION PANEL**

A full length car operating panel incorporating following control/indications shall be provided on the return panel

- CD Illuminated touch push buttons of micro pressure type corresponding to the floors served at Ground floor and Inside Car. For Other floors LED Illuminated touch push buttons of micro pressure type to be provided.
- Door open and door close button
- Emergency stop button with Alarm
- Two position key operated switch for 'with attendant' and 'without attendant' operation.
- Ventilation fan ON/OFF switch with auto OFF when there is no call after 120 seconds (Two Speed & concealed vents).
- Built in intercom of the hands free type as well as space for providing EPABX telephone instrument and 5 pair telephone trailing cable to communicate from car to Two Locations i.e. Operator's Room (at remote location) & Security Guard Room and vice-versa.
- Dynamic car direction display
- Car position indicator (digital)
- Audio/Visual overload warning indicator
- Digital voice synthesizer (Optional) for announcing special messages with background music.

10.6.3 LANDING FIXTURE

The landing fixtures shall be recess mounted on a base junction box in the wall by the side or on top of landing doors as required. Each landing fixtures shall consist of

micro touch type landing call buttons with illuminated call acknowledge signal and illuminated digital type car position indicators on separate stainless steel face panels with hairline finish.

10.6.4 CAR AND LANDING DOORS

All car doors shall extend to the full height and width of landing opening unless otherwise specified and shall be operated with variable frequency door operator. A similar imperforate door shall be provided for every landing opening in the lift hoistway enclosure. The top track of the landing and car doors shall not obstruct the entrance to the lift cars. All car and landing doors shall have a fire resistance of not less than 1 hours. In addition, all the car and landing doors shall meet the following general requirements.

• Car door locking devices

Every car door shall be provided with an electrical switch to prevent the lift car from being started or kept in motion unless the car door is closed. A mechanical locking device shall also be provided to prevent door opening from inside the car whilst the car is in motion.

• Landing door locking devices

Every landing door shall be provided with a mechanical locking device to prevent opening of the door from the landing side in normal cases unless the lift car is in that particular landing zone.

• **Projections and recesses**

Sliding car and landing doors shall be guided on door tracks and sills for the full travel of the doors.

• Door locking devices

All doors locking devices, door switches and associated actuating rods, levers or contracts, shall be inaccessible from the landing or the car.

• Protective devices

Protective devices shall be fitted to the leading edges of both car door panels. It shall automatically initiate reopening of the door in the event of a passenger being struck (or about to be struck) by the door in crossing the entrance during the closing movement. The obstruction of either leading edge when closing shall actuate the protective device to function.

• **"Door open" alarm**

"Door open" alarm shall be provided in the car to initiate alarm and a continuous buzzer if a car or landing door has been mechanically kept open for a present period. The period shall be adjustable from 0-10 minute.

o Emergency landing door unlocking devices and key

- Every landing door shall be provided with an emergency landing door unlocking device. When operated by an authorized person with the aid of a key to fit the unlocking triangle, the landing door shall be unlocked irrespective of the position of the lift car for rescue purpose. When there is no "unlocking" action, the key shall only be able to stay in the locked position.
- In the case of coupled car and landing doors, the landing doors shall be automatically closed by means of weight or springs when the car is outside the unlocking zone.

10.6.5 Door Hangers and Tracks

The car and the landing doors shall be provided with two point suspension sheave type hangers complete with tracks. Sheaves and rollers shall be steel with moulded nylon collar and shall include shielded ball bearings. Tracks shall be of suitable steel section with smooth surface. The landing doors shall be complete with headers, sills, frames etc. as required.

10.6.6 Lift Door Protection

Multiple-Infra red door protection and mechanical shoes shall be provided for lift to control door movement which shall cover the entire door opening effectively.

10.6.7 Protective Hand Rail in the Car

10.6.8 CABIN FAN

A noiseless pressure fan shall be provided in the lift cabin.

10.7 HOIST ROPES

Hoist way material shall be non-flammable (02 hrs fire rated) except travelling cables which shall be flame resistant.

Lift Ropes – IS 14665 (Part 4 / Sec 8)-2001

Round strand steel wires ropes made from steel wire ropes having a tensile strength not less than 12.5 tonnes/cm2 and of good flexibility shall be used for lift. Lubrications between the strands shall be achieved by providing impregnated hemp core. The lift ropes shall conform to IS 14665-(Part-4-Sec. 8):2001 and the required factor of safety shall be adhered to. The minimum diameter of rope for cars and counter weight of passenger and goods lift shall be 8mm.

Rope fastenings

The ends of lift ropes shall be properly secured to the car and counter weight hitch plates as the case may be with adjustable rope shackles having individual tapers babbit sockets, or any other suitable arrangement. Each lift rope shackle shall be fitted with a suitable shackle spring, seat washer, shackle nut & lock & shackle nut split pin.

Guards for Lift Ropes

Where lift ropes run round a sheave or sheaves on the car and/ or counterweight of geared/ gearless machine suitable guards shall be provided to prevent injury to maintenance personnel.

Number & Size of Ropes

The contractor must indicate the number and size of lift ropes and governor ropes proposed to be used, their origin, type, ultimate strength and factor of safety. The contractor should furnish certificate or ropes from the rope manufacturers issued by competent authority.

10.8 COUNTER WEIGHT

The counter weight for lift cars shall be in accordance with clause 6 of IS 14665 (Part 4-Sec-3) : 2001 and shall be designed to balance the weight of empty lift car plus approximately 50 percent of the rated load. It shall consist of cast sections firmly secured in relative movement by at least two numbers steel tie rods having lock nuts/split pins at each end and passing through each section and Housed in a rigid steel frame work. Cracked and broken sub weights shall not be accepted. Counter weight for passenger lifts should be able to accommodate suitable weight Interior finishes. In case interior finishes material exceeds this provision, then the elevator contractor shall adjust the Counter Weight accordingly, however this will be decided and intimated much before the delivery of the elevators.

• Counter Weight Guards

Guards of wire metal / mesh shall be provided in the lift pit to a suitable height above the pit floor to eliminate the possibility of injuries to the maintenance personnel.

10.9 GUIDES / Guide Rails

Car and counterweight guide shall be machined T section as per relevant Indian Standards IS-14665 of 2000 revised up to date. The guides shall be capable of withstanding forces resulting from the application of the car or counter weight safety devices The guide rails shall be minimum 16mm Tongued & Grooved type.

10.10 TRAILING CABLES

A single trailing cable for lighting control and signal circuit is permitted, if all the conductors of this trailing cables are insulated for maximum voltage running through

any one conductor of this cable. The lengths of the cables shall be adequate to prevent any strain due to movement of the car. All cables shall be properly tagged by metallic / plastic tags for identification. Cable jacket should be suitable for immersion in water, salt water & oil etc.

10.11 SAFETY DEVICES

Safety devices shall be capable of operating only in the downward direction and stopping fully loaded car, at the tripping speed of the over speed governor, even if the suspension devices break, by gripping the guides, and holding the car there. Governer sheeve in elevator pit shall be enclosed in a wire cage to a height of 2.40 mtr. All safety devises statutorily required by Lift Inspector, including but not restricted to the following shall be provided.

• Terminal slow down switches

These shall be provided and installed to slow down the lift car when approaching the top and bottom landings. The slow down switches shall act independently from the normal car operating device.

• Over travel limit switches

These shall be provided and installed to stop the car within the top and bottom clearance, independent of the normal car operating device. The bottom over travel limit switch shall become operative when the bottom of the car touches the buffer.

When the over travel limit switches are operative, it shall be impossible to operate the car until the car has been hand would to a position within the normal travel limits.

• Pit Switch

An emergency stop switch shall be located in the pit which when operated shall stop the car regardless of the position of hoist way.

• Terminal Buffers

Suitable spring buffers mounted on RCC foundation blocks shall be provided in the pit in compliance with ANSI/ASME/CENEN-81 /JIS codes for stopping the car in case of mal-operation. Dowels for the purpose shall be left while casting the pit floor alternatively floor reinforcement could be exposed by chipping for welding additional reinforcement for Dowels. However clearance from underside of the car resting on a fully compressed buffer shall not be less than 1.20 mtr. Buffers shall be designed for a design speed + 15%. Oil buffers shall be provided for the passenger elevators for speed of more than 1.75 mps and spring buffers for lower speed.

• Interlocking

Adequate interlocking is to be provided so that the car shall not move if the landing doors are even partially open and also the lift is overloaded.

Over speed governor

Over speed governor shall be of centrifugal type and shall operate the safety gear at a speed at least equal to 115% of the rate speed and less than the over speed governors shall be driven by flexible wire ropes with the following requirements:

- The breaking load of ropes shall be related to the force required to operate the safety gear by the safety factor of at least 8
- > The nominal rope diameter shall be at least 7 mm
- The radio between the pitch diameter of the over speed governor pulley and the nominal rope diameter shall be at least 30 The over speed governors shall be sealed after setting the tripping speed. The breaking or slackening of the governor rope shall cause the motor to stop by an electric safety device.

• Alarm bells

A Concealed 200 mm diameter alarm bell shall be installed in the main security area. The alarm bell shall sound when the alarm bell button in the car operating panel is pressed. The bell shall mute when the pressure on the alarm bell button is released.

• Emergency Stop Switches

An emergency stop for use by maintenance personal shall be provided in each lift car.

10.12 FIREMAN SWITCH

Lift shall have a Fireman switch with glass front for access by the Firemen. The operation of this switch shall cancel all calls to this lift and shall stop at the next nearest landing if traveling upwards. The doors shall not open at this landing and the lift shall return to the ground floor. In case the lift is traveling downwards when the fireman's switch is operated it shall go straight to the ground floor bypassing all calls enroute. The emergency stop button inside the car shall be rendered in-operative. The fireman's switch shall be located adjacent to the lift opening at the terminal floor and shall be at a height of approximately 2 m above the floor level. For easy identification of firemens lift which confirm to the local authorities requirements, a red and white diagonal striped backing shall be provided behind the glass of the firemen's switch.

A permanent notice of prominent size indicating the floors served shall be provided and displayed adjacent to the firemen's lift at the terminal floor. The notice shall be made of laminated plastic sheet or other approved materials with red letters on white background. Details of the notice shall be submitted to the Architect/Engineer/DFCCIL for approval prior to fabrication.

10.13 CONTROL OF NOISE AND VIBRATION

10.13.1 General

The whole of the lift assembly, including the opening and closing of the car and landing doors shall be quiet in operation and shall be free of rattling or squeaking noises. Lift doors operation shall be smooth to avoid the transmission of impact noise to the surrounding structure. Noise level resulting from the operation of the lifts, including direct sound transmission, breakout noise and re-radiation of structure borne noise, shall not exceed the specified noise criteria of the adjacent spaces. Vibration resulting from operation of lifts of escalators shall not be perceptible in any occupied areas.

10.13.2 Car construction

All elements of the lift car construction shall be sufficiently rigid to avoid generation of noise by panel excitation as a result of movement. The total noise level in a moving lift car shall not exceed 45 dBA with the ventilation system operating.

10.13.3 Machinery

The gearless traction machine and compact PM motor are installed within the hoist way and the slim control panel is located on the shaft side wall. Provision shall be made for the control vibration isolation measures employed to ensure that structure borne noise resulting from the operation of the lift machinery is not audible in any occupied area. Lift machinery noise levels under normal operating conditions shall not exceed 70 dBA at 1 m from the equipment in free field.

10.13.4 Arrival chimes

Noise from arrival chimes shall not exceed 60 dBA.

The above levels shall be measured at 3 m from the arrival chimes using a noise meter set to 'fast' response. Chimes with adjustable loudness shall be provided.

11. FIRE SAFETY REQUIREMENTS

General requirements of lifts shall be as follows:

- Landing doors in lift enclosures shall have a fire resistance of not less than one hour.
- Lift car door shall have a fire resistance rating of one hour.
- Grounding switch (es), at ground floor level, shall be provided on all the lifts to enable the fire services to ground the lifts.

12. TECHNICAL SPECIFICATIONS - LIFTS-ASSOCIATED WORKS

12.1 ASSOCIATED ELECTRICAL WORKS

12.2 Scope

Based on power requirements of lifts furnished by the lift contractor, power supply for the lifts machines, terminating in a Switchboard located at a desired location, shall be provided by IIA. The earth bar provided on this Switchboards shall be connected to the building earthing system. All cabling /wiring/loop earthing beyond this Switchboard for interconnection with the lift controllers / motors/ indicators / push buttons / safety devices etc. shall be provided by the lift contractor and its cost shall be deemed to be included in the quoted rates.

12.3 Cabling

Cabling between switchboard and the controller /lift motor shall be with XLPE insulated FR PVC sheathed 1100 volt grade aluminium conductor armoured cables conforming to IS 7098 or PVC insulated, PVC sheathed, 1100 volt grade al conductor armoured cables conforming to IS 1554. Cables shall be terminated in glands fitted with armour clamps the gland body shall be provide with an internal conical sating to receive the armour clamping cone and clamping nuts which shall secure the armour wires. A PVC shroud shall be fitted to cover the gland body and exposed armour wires Trailing cables for the lifts shall be EPR insulated stranded copper conductor flexible cables conforming to IS 9968 Control cabling shall be with multi core stranded copper conductor PVC insulated and sheathed 1100 volt grade cables conforming to IS 8130. Minimum size of the cable shall be 2.5 sq mm. Where cables pass through walls or floor slabs, pieces of GI sleeves shall be provided for cast into the wall / floor and cable shall be drawn therein.

12.4 Wiring

All wiring shall be carried out with FRLS PVC insulated 1100 volt grade stranded copper conductor wires conforming to IS 694 drawn in MS rigid / flexible conduiting system and / or MS raceways. Minimum 2.5 sq mm size wires shall be used. Wires shall be cut only at terminations. Intermediate jointing shall not be permitted. Drawing, cutting and terminating of the wires shall comply with the relevant Indian standard specifications and shall be carried out in the most workman like manner as per standard practice. All normal care like cutting the insulation with a pencil edge, taking care not to cut the strands and proper tightening of terminal connector screws to avoid loose connection or breaking of conductors etc. shall be taken. Heavy gauge black enameled screw type ISI embossed MS conduits with superior quality accessories approved by Architect/Engineer/DFCCIL shall be used in the work. Conduits could either be recessed in floors / walls or fixed on surface with saddles and clamps. Final connections to vibrating the equipment shall be made with metal flexible conduits. Entire work shall be carried out in work man like manner as per standard practice.

12.5 Earthing

Metal enclosures of all electrical equipment and devices including frames of motors, controllers, switchgear, conduits and raceways etc. shall be properly earthed so as to form an equvi-potential zone. Loop earthing of vibrating equipment shall be done with flexible copper earthing braid or flexible cables. The lift motor frame shall be connected to the building earthing system termination at the switchboard by duplicate loop earthing conductors of appropriate size.

13. ASSOCIATED CIVIL & STRUCTURAL ITEMS

All civil and structural items of work associated with erection and operation of lifts shall be provided by the Contractor at his cost including (but not restricted to) the following.

- _ Hook for lifting lift equipments in the top of shaft.
- _ Temporary scaffoldings and safety barricades during lift installation in and around lift Lift wells
- _ Sill angels
- _ Bearing plates
- _ Buffer supports
- _ Checqured plates
- _ Fascia plates
- _ Ladders in pits (MS)
- _ Safety railing on car top
- _ Separator /stretcher beams if required .
- _ Dowels for terminal buffers in pit floor during casting.

The Contractor shall ensure erection and fixing of steel work in such a manner that no RCC wall or any other structural member is damaged.

13.1 INSTALLATION

a). The LIFT shall be installed as per IS : 1860.

Wiring and earthing shall be extended from the electrical shaft & lift shaft as per requirement.

Power cable & earthing point will be made available at power panel at one location for each lift by other agencies.

- b). All openings at the various landings shall be temporarily guarded during installation.
- c). All safety procedures associated with lifting of heavy equipment, operation of electrical tools

& earthing should be strictly complied with.

d.) All electrical wiring shall have flame resisting moisture proof insulation and will be run in heavy gauge metal conduit/ casing.

The trailing cable between the car and lift well will be multicore type designed for lift services and will have flame resisting moisture proof covering.

Cables should conform to relevant IS amended up to date.

The supply and erection of lift shall conform to the latest lift act in force and modern lift practice in all respects.

All wiring and earthing etc. shall conform to IE rules and regulations

13.2 **TESTING**

All equipment included in contractor's scope of supply shall be tested at Manufacturer's Works, before delivery and necessary Test Certificates shall be submitted for approval of Consultants.

The Contractor shall carry out all performance tests after installation, in the presence of the Architect/Engineer/DFCCIL, as per specification.

The Contractor shall bear all expenses for such tests.

The Contractor shall be responsible for executing the contract as per Indian Electricity Rules, Rules and Regulations of supply authorities and the Rules of the local Electrical Inspectorate.

Any changes/modifications pointed out by the authorities shall be carried out at no extra cost

OTHER TESTS

Each elevator shall be tested at site as per IS 4666 & EN 115. Among others, the tests shall include:

- a) Operational tests with functional check on safety devices
- b) Speed of operation at rated load
- c) Over speed tests.
- d) Leveling accuracy
- e) HV test
- f) Earthresistance.

14. TAKING OVER OF INSTALLATION

- 14.1 The equipment & installation shall be deemed to have been taken over by the Client, when the following are completed:
 - (x) The Consultants have certified that all contractual obligations have been fulfilled by

the Contractor.

- (xi) All performance tests shall be carried out in the presence of client / consultant and Test Certificates are furnished in requisite copies.
- (xii) The installation is approved by the lift inspectorate.
- (xiii) The 'As Built 'Drawings are submitted. (Hard and soft Copie s)

14.2 COMPONENTS & ACCESSORIES

The following components & accessories forming a part of the elevator installation shall be supplied and installed.

All the items shall conform to the requirements of the BIS listed above and the specification.

- (e) Guide rails of steel with working surfaces machined for the car and counter weight.
- (f) Spring buffers located in the lift pit.
- (g) Steel c ar f ram e with replac eable guide shoes .
- (h) Lift cars fitted with all interiors, false ceiling, flooring, ventilation fan, lights, operator's panel, floor indicator, Lift mirror, Handrails, emergency stop facility etc.
- (i) Motor operated sliding, center opening car doors wherever applicable.
- (j) Motor operated sliding, center opening landing doors wherever applicable.
- (k) Counterweight with guide shoes.
- (1) Safetygears.
- (m) Speed governors.
- (n) Suspension ropes
- (o) Sheaves & pullies
- (p) Liftmachines
- (q) Controllers & wiring materials

- (r) Terminal stopping and final limit switches.
- (s) Levelingdevices
- (t) Lifting beam for machines.
- (u) Any other accessories as required.

Lift Announcement :

The lift shall be provided with special announcements as follows:-

- (a) When supply is out and lift is working in ARD (Automatic rescue device) announcement shall be "supply is out you may alight from the lift as soon as the door opens"
- (b) When supply is out, ARD is not working, and the lift stops in between floors announcement shall be "ARD" is not working please ask help through intercom"

15. General Technical Specification

15.1 DETAILS OF LIFT WELL

- 15.1.1 The lift well shall be as per clause 5 of IS: 14665.
- 15.1.2 There shall be no other opening in the lift well except for the landing openings.

All landing openings in lift well enclosures shall be protected by doors/ collapsible doors, which shall extend to the full height and width of the landing opening

15.1.3 Light points shall be provided in the lift well at a spacing not exceeding 10m.

All the light points shall have control from the machine room.

socket outlet may also be provided at a suitable place for use by maintenance staff above the ground floor landing.

15.2 LIFT PIT:

The lift pit shall be provided proper water proofing treatment so that the same remains dry.

If the lift pit depth is more than 1 .6m, a ladder to the height of 0.75m above the lift pit floor shall be provided to reach the lift pit.

The lift pit shall have provision for a separate access.

In case of two lifts in the well, one access to the lift pit shall be adequate dividing beam and rigid metal screen to separate each lift from an adjacent lift or its counter weight

e) GUIDERAILS

The guide rails shall be as per IS: 14665.

Rigid steel guides shall be used for guiding lift car and counterweight throughout its travel.

The strength of the guides, its attachments and the joints shall be sufficient to withstand the forces imposed due to the operation of the safety gear and deflection due to uneven loading of the lift car.

Only machined guide rails shall be provided for passengers and hospital lifts.

The guide tracks shall he supported at suitable intervals and shall be embedded

into the walls. Wood or fiber blocks or plugs shall not be used for securing guide

brackets.

15.3 GUIDE SHOES

Two numbers of guide shoes at the top and two numbers at the bottom shall be provided on the lift car and counter weight.

Guide shoes shall be provided with adjustable mountings and shall be rigidly secured in accurate alignment at the top and bottom on each side of the car sling and counterweight frame construction.

When oil buffers attached to the bottom of the counterweight are used then additional guide shoes shall be provided on each side of the buffer frame.

For passenger lifts and bed-cum-passenger lifts, sliding guide shoes shall be provided for speeds up to 1.5 mps (meter per second.)

Sliding guide shoes for cars shall be flexible.

Solid guide shoes can be used for counter weights for speeds up to 1.0 mps.

When speed exceeds 1.5 mps, roller guide shoes shall be provided for car and the counterweight,

15.4 BUFFERS:

Buffers shall be provided at the bottom limit of travel for cars and counterweights.

Energy dissipation type buffers shall be used wherever the rated speed of the lift exceeds 1 mps but energy accumulation type buffers shall be preferred if the rated speed of the lift does not exceed 1 mps.

15.5 **COUNTER WEIGHT:**

The counterweights shall be of metal and it shall be in the form of multiple sections.

It shall be contained and secured within a steel frame and shall be equal to the weight of the complete car plus approx 50% of the rated load.

At least, four guide shoes, capable of being easily renewed or having renewable linings shall be provided on the counterweight.

15.6 SUSPENSION ROPES

Cars and counterweights shall be suspended from round strand steel wire ropes of best quality having a tensile strength not less than 12.5 tonnes/cm2.

The size and number shall be in accordance with standard Code of practice/BIS specifications.

Lubrications between the strands shall be achieved by providing impregnated hemp core. The nominal diameter of the ropes shall be at least 8mm.

15.7 COMPENSATION ROPES

For travels over 40 m and/or rated speed of the lift exceeds 2,5 mps, the proven of compensation ropes with tensioning pulleys shall be considered.

For speeds of 2.5 mps or below, quiet operating chains or similar devices shall be used as the means of compensation.

For speeds above 3,5 mps, an anti-rebound arrangement of idler tension pulley shall be provided to prevent the counterweight jumping with the application of the car safety gear.

15.8 CAR CONSTRUCTIO N

The lift car construction shall be in conformity with Code of Practices, BIS specifications and IE Rules.

CAR FRAME:

The lift car body shall be carried in a steel car frame sufficiently rigid to withstand the operation of the safety-gear without permanent deformation of the car frame.

The deflection of the members carrying the platform shall not exceed 1/1 000 of their span under static conditions with the rated load evenly distributed over the platform.

CAR ENCLOSURES:

The whole of the internal face of the car shall be of 1.5 mm thick stainless steel sheet lined.

A suitable backing shall be used to reinforce the car wall panels.

A stainless steel handrail shall be provided on three sides of the lift car, extended to within 150 mm of all corners and a stainless steel skirting panel approximately 100 mm deep shall be provided.

Stainless steel false ceiling with concealed fluorescent light fitting and ventilating fan complete with metal ceiling diffuser shall be provided.

The car ventilation fan shall be switched off within a period which shall be adjustable from 5 to 15 minutes after the last registered call is answered.

The lift car excluding linings, shall be constructed of non-combustible materials. The lift car shall have adequate illumination. The illumination level shall not be less than 150 lux on the lift floor level.

EMERGENCY LIGHTING:

The lift car shall also be provided with emergency lighting operated by a rechargeable battery supply.

The lighting shall be automatically switched on in the event of failure of normal power supply to the lift.

CAR PLATFORM:

The lift car platform shall be designed on the basis of rated load evenly distributed. The dimensions shall conform to IS: 14665 unless otherwise specified. The flooring shall be smooth and non-skid type.

The PVC/rubber flooring of minimum 3mm thickness shall be preferred for passenger and bed- cum-passenger lifts.

The flooring for goods lift shall be strong enough to take the rated load without any deformation or damage.

CAR ROOF:

The car roof shall be solid type and capable of supporting a weight of at least two persons (approx 140 kg) without causing permanent deformation.

Ceiling lights shall be of recessed type and be protected by stainless steel metal bars.

A recessed ceiling fan complete with heavy duty metal diffuser and capable of providing 20 air changes per hour in the car shall be provided.

CAR DOORS:

The doors for passenger lifts shall be of metal and the internal face of the car door shall be suitably lined as the same in the lift car.

The doors shall be in two panels and centre opening with automatic power opening and closing unless otherwise specified.

The car shall be equipped with an electronic door sensor which can detect an obstruction at the car entrances and control the closing of the doors.

The car door shall be provided with an electrical switch which will prevent the lift car from being started or kept in motion unless all car doors are closed.

DOOR RE-OPENING DEVICE:

Door re-opening device shall be fitted to the leading edge of both car door panels, which shall automatically initiate re-opening of the door in the event of a passenger being struck (or about to be struck) by the door in crossing the entrance during the closing movement.

It shall be so designed and installed that for centre opening doors the obstruction of either leading edge when dosing will cause it to function.

"DOOR-OPEN" ALARM FOR MANUALLY OPERATED DOORS:

For manually operated doors and were assisted doors, a 'door open' alarm shall be provided in the car to draw attention to a car or landing door which has been left open for an adjustable period up to 10 minutes.

LANDING DOORS

The car entrance shall be provided with a car door, which shall extend to the full height and width of the car opening.

The opening for the landing doors shall not be wider than that of the lift car. The top track of the door shall not obstruct the car entrance.

All landing openings in lift well enclosures shall be protected by doors / collapsible doors which shall extend to the full height and width of the landing opening.

LANDING DOOR LOCKING DEVICE

Every landing door shall be provided with an effective locking device so that it shall not normally be possible to open the door from the landing side unless the lift car door is in that particular landing zone.

It shall not be possible under normal operation to start the lift car or keep it in motion unless all landing doors axe in the closed position and locked.

TERMINAL STOPPING AND LIMIT SWITCHES

The lift shall be provided with normal terminal stopping switches and limit switches. They shall be positively operated by the movement of the car.

These switches shall either be mounted on the car frame or in the lift well.

The limit switches shall either open directly by mechanical separation of the circuits feeding the motor and brake, and provisions shall be made so that the motor cannot feed the brake solenoid, or open, by an electrical safety device, the circuit directly supplying the coils of the two contactors, the contacts of which are in series in the circuits supplying the motor and brake.

SAFETY GEAR

The lift (except service lift) shall be provided with safety gears capable of operating only in the downward direction and capable of stopping a fully laden car, at the tripping speed of the over- speed governor, even if the suspension devices break, by gripping the guides and holding the car there.

OVER-SPEED GOVERNOR

The car safety shall be operated by speed governor located overhead and driven by governor rope suitably connected to the car and mounted on its own pulley.

Over-speed governor shall operate the safety gear at a speed at least equal to 115% of the rated speed.

For rated speeds upto 1 mps maximum governor tripping speed shall be either 140% of the rated speed or 0.88mps, whichever is higher.

For rated speed exceeding 1 mps, maximum governor speed shall be 115% of the rated speed plus 0.25mps.

The means for adjusting the over-speed governor shall be sealed after setting the tripping speed.

GOVERNOR ROPES

The governor ropes shall not be less than 6 mm in diameter and shall be of flexible wire rope.

The rope shall be tensioned by a tensioning pulley and the pulley (or its tension in weight) shall be guided.

The breakage or slackening of the governor rope shall cause the motor to stop by means of an electrical safety device.

The device shall be of bi-stable type requiring manual reset.

OVERLOAD DEVICE AND FULL LOAD DEVICE

The lift shall be provided with an overload device which shall operate when the load in the car is 10% or more in excess of the rated load of the lift.

The overload device, when in operation, shall:-

prevent any movement of the car,

prevent the closing of any power operated door whether fitted to the car or To the landing at which the car is resting, and

give audile and visible signals inside the car.

The lift shall resume normal operation automatically on removal of the excessive load. The overload device shall be inoperative while the Lift car is in motion.

FULL LOAD DEVICE

The lift (other than a service lift) shall be provided with a full load device having an adjustable setting range from 80% to 100% of the rated load and when operated, it shall by-pass all landing calls.

When the load in the car is reduced, the car shall stop for landing calls as normal.

EMERGENCY ALARM DEVICE

An emergency alarm push button together with a buzzer (or an alarm bell) shall be provided in the lift car and connected to the machine room and the main entrance lift lobby and backed up by an emergency supply. The pattern of lift alarms shall be distinguishable from that of fire alarms.

An intercom system connecting the lift car and the machine room /guard room (if manned) shall be provided.

EMERGENCY EXIT

The lift car shall be provided with an emergency exit in the roof of minimum size 500 mm x 350 mm x 400 mm in diameter.

Panels for emergency exits shall: -

be clear of any apparatus mounted above the roof of the lift car

be capable of being opened, re-closed and re-locked without a key

be provided with an electric safety device which will prevent operation of the lift

When the panel is not locked, operate the buzzers (or alarm bells) and also switch off the car ventilation fan.

CONTROL AND INDICATION IN CAR

The lift car shall have a control faceplate made of stainless steel with thickness of not less than 25mm and comprising :-

- (i) Call buttons with acceptance signals to correspond with the landing served
- (ii) An alarm push button with protection from being operated accidentally
- (iii) "Door open" and "Door close" push buttons
- (iv) Audible and visible signals in connection with the over load device
- (v) light switch, alarm reset switch, fan switch and cleaner's " Stop-switch" keeping the car door open in the form of key switches or housed in a recessed metal box with hinged or sliding lid which will be key-locked,
- (vi) Two- way intercom speaker (optional),
- (vii) The control faceplate shall be fixed onto the car panel by stainless steel screws.

For lifts equipped with attendant control, the control faceplate shall also incorporate a non-stop button for the purpose of bypassing landing calls, but the calls shall remain registered until answered. This button shall be inoperative unless the lift is operated by an attendant.

The car direction and position indicator shall be of digital type display with LED's actuated by solid state circuitry unless otherwise specified. The position indicator shall have a minimum height of 50 mm and easy to read even from distance and properly illuminated.

15.9 <u>LIFT MACHINERY FOR ELECTRIC LIFT</u>

15.10 LIFT MOTOR

The induction motor shall be designed to operate for an unlimited period according to the expected duty of the lift.

The motor may be supplied and controlled by static elements when A.C. variable speed system is specified.

15.11 MOTOR GENERATOR SET(Not Applicable)

The motor generator set shall comprise a motor and a generator built as a complete unit directly coupled.

The motor and the generator shall be suitably rated to deal with the load and speed specified.

Controls shall be provided so that the set shall start up on the registration of a landing call or car call and shall continue to run for a period which shall be adjustable from 5 to 15 minutes, after the last registered call is answered.

15.12 BEARING AND GEAR CASE

Bearings shall be of the ball bearing type or sleeve ring type with oil ring bearings Gear cases shall be provided with thrust bearings suitable for the application.

15.13 EMERGENCY OPERATION BY MANUAL DEVICE

For geared lift machines, the hoisting machine shall be provided with a smooth wheel which may be fitted to the shaft to move the lift car up or down by manual operation.

The direction of movement of the car shall be clearly indicated on the machine.

15.13.1 EMERGENCY OPERATION BY ELECTRICAL SWITCH

For machines where the manual effort to raise the car together with its rated load exceeds 400N, an electrical switch for emergency operation shall be installed in the machine room.

Directional push buttons protected against accidental operation shall be provided in the machine room such that when the emergency electrical switch is operated,

The car can be moved up or down by applying constant pressure on the buttons. The car peed under the emergency operation shall not exceed 0.63 m/s. The emergency electrical switch and its push buttons shall be so placed that the machine can readily be observed during operation.

15.13.2 <u>ELECTRO-MECHANICAL BRAKE</u>

Every lift machine shall be provided with a brake which is capable of stopping the machine when the car is traveling at its rated speed and with the rated load plus 25%.

It shall also be fitted with a manual emergency operating device capable of having the brake released by hand while a constant manual pressure is required to keep the brake open.

16. <u>GOODS LIFT</u>

16.1.1 DETAILS OF THE GOODS LIFT CAR

The side and rear wall panels shall each be provided with three-equally-spaced full length lateral protective wooden battens of 200 mm wide by 25 mm thick.

The surface of the wooden battens shall be covered with 1.0 mm thick metallic sheet as required. The top battens shall be fixed at a height of 1100 mm above finished car floor level.

The car roof shall be able to support the weight of two persons without causing permanent deformation.

Ceiling lights shall be of recessed type and be protected by stainless steel metal bars.

A recessed ceiling fan complete with heavy duty metal diffuser and capable of providing 20 air changes per hour in the car shall be provided.

The car floor shall be constructed of metallic sheet of suitable thickness with 2 mm high multi-grip non-slip pattern.

The floor construction shall be in the form of a metal drain pan (optional).

In case of metallic floor being drain type, the rear and side edges shall be folded up by 100 mm from the floor to form the drain pan.

All joints and the comers of the pan shall be welded to prevent water leakage.

The goods lift cars may also be constructed as mentioned above except the floor drain system.

16.1.2 GOODS LIFT CARDOOR

The car doors shall be robust, manually operated, horizontally sliding and made of stainless steel / MS sheet. Power operated, automatic, horizontally sliding doors shall be multi-panel of stainless steel construction, similar to those for passenger lifts, but strong enough for goods lift use.

16.1.3 LIFT CAR AND METHOD OF DRIVE:

Service lift cars shall be of rigid construction and totally enclosed except for service openings and made of wood or metal and reinforced at the point of suspension.

The car shall not be made of inflammable materials. Two pairs of renewable guide shoes shall be fitted.

Unless otherwise specified, removable shelves shall be fitted inside the car and be so retained that they shall not be displaced by the movement of the car.

The car shall be constructed with openings on opposite sides and shall be provided with some form of protection to prevent the goods from projecting outside the car.

The method of drive for the lift shall be by traction i.e. sheaves and ropes or by positive drive using drum and ropes without counterweights,

16.1.4 <u>GUIDE :</u>

The car and counterweight shall each be guided by rigid guides.

Guides and their fixings shall be capable to withstand the application of the safety-gear (if provided) when stopping a fully loaded car or counterweight.

16.1.5 <u>BUFFER:</u>

Buffers shall be provided under all cars and counterweights.

A lift with positive drive shall be provided with additional buffers on the car top to function at the upper limit of travel.

The buffers used shall be one of the following types viz spring, rubber or resilient plastic.

16.1.6 <u>COUNTERWEIGHT</u>:

Counterweights shall be of metal.

A metal frame shall be provided to prevent their displacement. In the case of drum drive, there shall be no counterweight.

16.1.7 <u>SUSPENSION</u>

Cars and counterweights shall be suspended by means of round strand steel wire ropes. The factor of safety of suspension ropes shall not be less than 10,

The minimum number of ropes shall be two and they shall be independent.

The diameter of sheaves or pulleys shall not be less than 30 times the rope diameter.

16.1.8 <u>SAFETY GEAR</u>

Safety gear tripped by an over-speed governor shall be provided for the car where the rated capacity is 250 kg, accessible spaces exist beneath the lift well or gross car roof area equals to or greater than 0.37 m2.

Where there is an accessible space beneath the well, the counterweight shall be equipped with safety gear.

16.1.9 LOAD PLATE AND WARNING NOTICE

A load plate giving the contract load of the lift in kg shall be fixed in a prominent position at each landing entrance.

A warning notice in English, Hindi and local language shall be prominently fixed at each landing entrance.

16.1.10 CAR AND LANDING DOOR

All landing openings in the lift well shall be protected by doors.

Every car or landing door shall be provided with an electric safety device which shall prevent the lift from being operated when any car or landing door is open.

It shall not be possible during normal operation to open a landing door unless the car is in the unlocking zone.

The landing doors shall be provided with the facility of being unlocked from outside with the aid of a special purpose key provided for use only by a competent lift worker.

TERMINAL STOPPING SWITCHES

Service lifts shall be provided with terminal stopping switches to stop the car automatically at or near the terminal service levels.

PAINTING

All exposed metal parts especially iron parts shall be painted with 2 coats of approved synthetic enamel paint after 2 coats of synchromesh primer after erection and before commissioning the lift.

16.2 APPROVAL

The supplier shall obtain the approval of drawings & installation from the CEIG. Also approval shall be obtained from fire authorities for the features provided. **DOCUMENTATION**

The suppliers shall furnish the following documentation in requisite number of copies (one each group of buildings)

- (f) GA drawing of shaft & lift well giving all details to the civil contractors
- (g) Lifting hook size and locations.
- (h) Rail supporting and wall inserts
- (i) Bracket location, shaft ventilation opening size and location.
- (j) Control schematic GA of controllers
- (k) Operation and maintenance manual
- (I) Test certificates.
- (m) As Built drawings.

16.3 GUARANTEE

The equipment supplied and the installation shall be guaranteed for satisfactory performance and workmanship, for a Defect Liability period of 18 months from the date of handing over to the entire satisfaction of client in good working condition and liability of supplier under this guarantee include schedule maintenance as suggested by OEM, factored items repair or replacement of all defective parts if any, which may prove faulty during this period including such parts as may be tendered in operative by wear-and tear but exclude such parts as may be rendered inoperative by vandalism.

The contractor shall replace free of cost all equipment or parts supplied by him and found defective within this period.

In case the contractor fails to replace or render services for defective materials & parts, the client reserves the right to do so, at the contractor's risk and expenses without prejudice.
17 <u>WIRING</u>

17.1 <u>GENERAL</u>

Technical Specifications in this section cover the Internal Wiring Installations comprising of:

- Wiring for lights and convenience socket outlets etc. in concealed/surface conduit/raceways.
- Wiring for telephone outlets.
- Wiring for fire detection system
- Submain wiring.

17.2 <u>STANDARDS AND CODES</u>

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

660/1100 V grade PVC insulated wires.	IS 694 : 1990
Rigid steel conduits for electrical wiring.	IS 9537 : Part I 1980
	IS 9537 : Part II 1981
Accessories for rigid steel conduits	IS 3837 : 1990
Flexible steel conduits for electrical wiring	IS 3480 : 1990
Rigid PVC conduits	IS 9537 : Part-III
Switch socket outlets	IS 4615 : 1990
Switches for domestic and similar purposes	IS 3854 : 1997
Boxes for the enclosure of electrical accessories	IS 5133 : Parts I &II 1969
Code of practice for personal hazard	IS 1644: 1998
fire safety of buildings	

Code of practice for electrical installation	IS 1646 : 1997
fire safety of buildings	
Code of practice for electrical wiring installations	IS 732 : 1989

17.3 CONDUITS/ RACE WAYS

17.3.1 Steel Conduits

These shall be of mild steel 16 gauge upto 32mm and 14 gauge for sizes above 32mm, electric resistance welded (ERW), electric threaded type having perfectly circular tubing. Conduits shall be precession welded ERW and shall be fabricated from tested steel strips of thickness as per ISS by high frequency induction weld process. Weld shall be smooth and of consistent of high quality to ensure crack proof bending. The conduits shall be black enamel painted inside and outside in its manufactured form. Wherever so specified, the conduit shall be galvanized. All conduits used in this work shall be ISI embossed.

17.3.2 **PVC Conduits**

Conduits shall be heavy gauge rigid PVC of minimum thickness of 2mm. Conduits shall be ISI marked confirming to IS : 9537 (Part-3)-1983. All conduit and conduit accessories shall be of PVC. Conduits shall be joined together by a vinyle type cement / solvents. Minimum size of conduit shall be 25mm. Conduit shall be fixed on ceiling or wall. All conduits shall be concealed in wall ceiling etc. or fixed on surface of wall with clamps at regular interval as called for elsewhere. For termination of PVC conduits into switch outlet boxes, PVC female adopters shall be used. Wherever conduit run exceeds 10 metre, circular junction boxes shall be provided to facilitate pulling & inspection of wires. Inspection boxes shall be suitable located in co-ordination with the Engineer-in-charge. Conduits shall be bend using suitable size springs. Long radius bends shall be provided. Heating shall not be used to bend the conduits. Size of conduit shall depend upon number and size of wires to be drawn.

17.3.3 Steel Conduit Connections

Connections between steel conduits shall be with screwed couplers of approved quality and finish, ensuring screwed metal to metal contact. Length of threads shall be as per ISS and sufficient to accommodate pipes to full threaded portion of couplers or accessories. Threads and sockets shall be free from grease and oil. Conduits shall be connected to outlet boxes by means of M.S. hexagon checknuts fixed both inside and outside the box. Conduit edges shall be free of burrs and provided with screwed PVC bushes to avoid damage to insulation of conductors while pulling them through the conduits. Connections between M.S. and PVC conduits, if required, shall be through a junction box and never directly.

17.3.4 **Bends**

Large right angle bends (more than 75 mm radius) or non right angle bends in conduit runs shall be made by means of conduits bending machines carefully so as not to cause any crack in the conduit. Small right angle bends in conduits runs can be made by standard conduit accessories (solid/inspection

bends/elbows) no run of conduits shall have more than four right angle bends from outlet to outlet. Bends in multi runs of conduits shall be parallel to each other and neat in appearance, maintaining the same distance as between straight runs of conduits.

17.3.5 <u>Conduit Accessories</u>.

17.3.5.1 Standard accessories

Heavy duty black enamel painted standard conduit fittings and accessories like standard/extra-deep circular boxes, looping in boxes, junction boxes, normal/ inspection bends, solid/inspection elbows, solid/inspection tees, couplers, nipples, saddles, check nuts, earth clips, ball socket joints etc. shall be of superior quality and of approved makes. Heavy duty covers screwed with approved quality screws shall be used. Superior quality screwed PVC bushes shall be used Samples of all conduits fittings and accessories shall be got approved by Architect/Engineer/DFCCIL before use.

17.3.5.2 Fabricated accessories

Wherever required, outlet/junction boxes of required sizes shall be fabricated from 1.6 mm thick MS sheets excepting ceiling fan outlet boxes which shall be fabricated from minimum 2 mm thick sheets. The outlet boxes shall be of approved quality, finish and manufacture. Suitable means of fixing connectors etc., if required, shall be provided in the boxes. The boxes shall be protected from rust by zinc phosphate primer process. Boxes shall be finished with minimum 2 coats of enamel paint of approved colour. A screwed brass stud shall be provided in all boxes as earthing terminal.

17.3.5.2.1 Outlet Boxes For Light Fittings

These shall be minimum 75mm x 75mm x 50mm deep and provided with required number of threaded collars for conduit entry. For ceiling mounted florescent fittings, the boxes shall be provided 300 mm off centre for a 1200 mm fitting and 150 mm off centre for a 600 mm fitting so that the wiring is taken directly to the down rod. 3mm thick Perspex / hylam sheet cover of matching colour shall be provided.

17.3.5.2.2 Outlet Boxes For Ceiling

Outlet boxes for ceiling fans shall be fabricated from minimum 2 mm thick MS sheet steel. The boxes shall be hexagonal in shape of minimum 100 mm depth and 60 mm sides. Each box shall be provided with a recessed fan hook in the form of one 'U' shaped 15 mm dia rod welded to the box and securely tied to the top reinforcement of the concrete slab for a length of minimum 150 mm on either side. 3 mm thick Perspex/hylam sheet cover of matching colour shall be provided.

17.3.5.3 Boxes For Modular Wiring Accessories

17.3.5.3.1 Switch Boxes - Modular Type

Switch boxes suitable to house modular type switches of required ratings, and fan regulators as required shall be provided. In case the number of switches in one box is not tallying with that available in standard manufacture, the box accommodating the next higher number of switches shall be provided without any extra cost. In case fan regulator/regulators is /are to be provided at a later dated, suitable

provision for accommodating such regulators shall be made in the switch boxes and blank off covers shall be provided without any extra cost.

Switch boxes shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors, check-nuts and screwed bushes at conduit entries etc... The grid plates and M.S. boxes shall be fitted with a brass earth terminal. Boxes shall be attached to conduits by means of check-nuts on either sides of their walls. Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilised engineering plastics shall be fixed by means of counter sunk chromium plated brass machine screws. No timber shall be used for any supports. Switch boxes shall be located with bottom at 1200 mm above floor level unless otherwise indicated.

17.3.5.3.2 Modular Type Boxes For Socket/ Telephone/Call Bell Outlets

Outlet boxes shall be suitable for housing modular type switched socket outlets/ telephone outlets/ buzzers and any other outlet as required. These shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors, checknuts and screwed bushes at conduit entries etc. The grid plates and M.S. boxes shall be fitted with a brass earth terminal. These shall be attached to conduits by means of check nuts on either sides of their walls. Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilized engineering plastics shall be used to mount the outlets and shall be fixed to the outlet M.S. boxes by means of counter sunk chromium plated brass machine screws. No timber supports shall be used. Boxes shall be located at skirting level or bottom at 1200 mm from floor or inside raceways on laboratory work tables., as indicated in drawings and/or as directed.

17.3.6 Cross Section

The conduits shall be of ample sectional area to facilitate simultaneous drawing of wires and permit future provision also. Total cross section of wires measured overall shall not normally be more than half the area of the conduit. Maximum number of PVC insulated 660/1100 Voltage grade copper conductor cable conforming to IS - 694 - 1990 as per table give below.

Maximum no of PVC insulated 660/1100 V grade aluminium/copper

Conductor cable conforming to IS : 694 - 1990

Normal Cross Sectional area	20 mr	n	25 mm	l	32 mm	n	38 mr	n	51 mn	1	64 mr	n
of conductor in sq. mm	S	В	S	В	S	В	S	В	S	В	S	В
1	2	3	4	5	6	7	8	9	10	11	12	13
1.50	5	4	10	8	18	12	-	-	-	-	-	-
2.50	5	3	8	6	12	10	-	-	-	-	-	-

4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	3	4	8	7	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	6	5	10	7	12	8
25					3	2	5	3	8	6	9	7
35							3	2	6	5	8	6
50									5	3	6	5
70									4	3	5	4

Note :

- 1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
- 2. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw boxes and which do not deflect form the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect form the straight by an angle of more than 15 degrees.
- 3. Conduits sizes are the nominal external diameters.

17.4 <u>WIRES</u>

Wiring shall be carried out with PVC insulated 660/1100 volt grade unsheathed single core wires with electrolytic annealed stranded copper (unless otherwise stated) conductors and conforming to IS 694/1990. All wire rolls shall be ISI marked. All wires shall bear manufacturer's label and shall be brought to site in new and original packages. Manufacturer's certificate, certifying that wires brought to site are of their manufacture shall be furnished as required.

17.5 COAXIAL CABLES

The coaxial cables shall be of wideband type with operation up to 300 MHz capability. Aging resistance shall comply with DIM 472.52 part 2 e.i. maximum 5% increase in attenuation at 200 MHz measured by artificial aging (14 days at 80°C) cables shall meet all exceed following specifications

Center core Dia	0.8 mm
Diaelectric Dia	4.8 mm
Dielectric	PE
Outer Conductor Dia	5.4 mm
Outer Dia	7.0 mm
Bending radius	more than 30 mm
Impedance	75 ohms

D.C Resistance	50 ohms/KM
Screening factor	more than 50
Attenuation	
50 Mhz	6.5
100 Mhz	9
200 Mhz	13
300 Mhz	16

17.6 LAYING OF CONDUITS

- Conduits shall be laid either recessed in walls and ceilings or on surface on walls and ceilings or partly recessed and partly on surface, as required.
- Same rate shall apply for recessed and surface conduiting in this contract.
- Stranded copper conductor insulated wire of size as per schedule of quantities shall be provided in entire conduiting for loop earthing.
- GI wire of suitable size to serve as a fish wire shall be left in all conduit runs to facilitate drawing of wires after completion of conduiting.

17.6.1 Recessed Conduiting

Conduits recessed in concrete members shall be laid before casting, in the upper portion of slabs or otherwise as may be instructed, so as to embedded the entire run of conduits and ceiling outlet boxes with a cover of minimum 12 mm concrete. Conduits shall be adequately tied to the reinforcement to prevent displacement during casting at intervals of maximum one metre. No reinforcement bars shall be cut to fix the conduits. Suitable flexible joints shall be provided at all locations where conduits cross expansion joints in the building.

Conduits recessed in brick work shall be laid in chases to be cut by electrical Contractor in brick work before plastering. The chases shall be cut by a chase cutting electric machine. The chases shall be of sufficient width to accommodate the required number of conduits and of sufficient depth to permit full thickness of plaster over conduits. The conduits shall be secured in the chase by means of heavy duty pressed steel clamps screwed to MS flat strip saddles at intervals of maximum one metre. The chases shall then be filled with cement and coarse sand mortar (1:3) and properly cured by watering.

Entire recessed conduit work in concrete members and in brick work shall be carried out in close coordination with progress of civil works. Conduits in concrete members shall be laid before casting and conduits in brick work shall be laid before plastering. Should it become necessary to embedded conduits in already cast concrete members, suitable chase shall be cut in concrete for the purpose. For minimizing this cutting, conduits of lesser diameter than 25 mm and outlet boxes of lesser depth than 50 mm could be used by the Contractor for such extensions only after obtaining specific approval from Architects/Owners. For embedding conduits in finished and plastered brick work, the chase would

have to be made in the finished brick work. After fixing conduit in chases, chases shall be made good in most workmanlike manner to match with the original finish.

Cutting chases in finished concrete or finished plastered brick work for recessing conduits and outlet boxes etc shall be done by the Contractors without any extra cost.

17.6.2 Surface Conduiting

Wherever so desired, conduit shall be laid in surface over finished concrete and/or plastered brickwork. Suitable spacer saddles of approved make and finish shall be fixed to the finished structural surface along the conduit route at intervals not exceeding 600 mm. Holes in concrete or brick work for fixing the saddles shall be made neatly by electric drills using masonry drill bits. Conduits shall be fixed on the saddles by means of good quality heavy duty MS clamps screwed to the saddles by counter sunk screws. Neat appearance and good workmanship of surface conduiting work is of particular importance. The entire conduit work shall be in absolute line and plumb.

17.6.3 Fixing of conduit fittings and accessories

For concealed conduiting work, the fittings and accessories shall be completely embedded in walls/ceilings leaving top surface flush with finished wall/ceiling surface in a workman like manner.

Loop earthing wire shall be connected to a screwed earthstead inside outlet boxes to make an effective contact with the metal body.

17.6.4 Painting and Colour coding of conduits

Before laying, conduits shall be painted specially at such places where paint has been damaged due to vice or wrench grip or any other reason.

If so specified, surface conduits shall be provided with 20 mm wide and 100 mm long colour coding strips as below

Use	Code colour
Low Voltage	Grey
Fire alarm	Red
Telephone	Black
PA system	Brown
Earthing system	Green
Control system lighting	Purple

17.6.5 **Protection of Conduits**

To safeguard against filling up with mortar/plaster etc. all the outlet and switch boxes shall be provided with temporary covers and plugs which shall be replaced by sheet/plate covers as required. All screwed and socketed joints shall be made fully water tight with white lead paste.

17.6.6 Cleaning of Conduit Runs

The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in of cables.

17.6.7 **Protection Against Dampness**

All outlets in conduit system shall be properly drain and ventilated to minimize chances of condensation/sweating.

17.6.8 **Expansion Joints**

When crossing through expansion joints in buildings, the conduit sections across the joint shall be through approved quality heavy duty metal flexible conduits of the same size as the rigid conduit.

17.6.9 Loop Earthing

Loop earthing shall be provided by means of insulated stranded copper conductor wires of sizes as per Schedule of Quantity laid alongwith wiring inside conduits for all wiring outlets and sub-mains. Earthing terminals shall be provided inside all switch boxes, outlet boxes and draw boxes etc.

17.7 LAYING AND DRAWING OF WIRES

17.7.1 Bunching of Wires

Wires carrying current shall be so bunched in conduits that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit.

17.7.2 Drawing of Wires

The drawing of wires shall be done with due regard to the following precautions:-

- No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire is completed. Burrs in cut conduits shall be smoothen before erection of conduits. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Approved type bushes shall be provided at conduit terminations.
- Before the wires are drawn into the conduits, conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits if necessary..
- While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which cause breakage of conductors.
- There shall be no sharp bends.

• The Contractor shall, after wiring is completed, provide a blank metal/sunmica plate on all switch / outlet / junction boxes for security and to ensure that wires are not stolen till switches / outlets etc.. are fixed at no extra cost the contractor shall be responsible to ensure that wires and loop earthing conductors are not broken and stolen. In the event of the wire been partly / fully stolen , the contractor shall replace the entire wiring alongwith loop earthing at no extra cost to the Owners. No joint of any nature whatsoever shall be permitted in wiring and loop earthing .

17.7.3 <u>Termination /Jointing of Wires</u>

- Sub-circuit wiring shall be carried out in looping system. Joints shall be made only at distribution board terminals, switches/buzzers and at ceiling roses/connectors/lamp holders terminals for lights/fans/socket outlets. No joints shall be made inside conduits or junction/draw/inspection boxes.
- Switches controlling lights, fans or socket outlets shall be connected in the phase wire of the final sub circuit only. Switches shall never be connected in the neutral wire.
- Wiring conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any special reason shall be made by approved connectors. Specific prior permission from Architect/Engineer/DFCCIL in writing shall be obtained before making such joint.
- Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or wringing.
- Strands of wires shall not be cut for connecting terminals. All strands of wires shall be twisted round at the end before connection.
- Conductors having nominal cross sectional area exceeding 4 sq. mm shall always be provided with crimping sockets.
- At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used.
- Brass nuts and bolts shall be used for all connections.
- The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less.
- Switches controlling lights, fans, socket outlets etc. shall be connected to the phase wire of circuits only.
- Only certified valid license holder wiremen shall be employed to do wiring / jointing work.

17.7.4 Load Balancing

Balancing of circuits in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

17.7.5 Colour Code of Conductors

Colour code shall be maintained for the entire wiring installation - red, yellow, blue for three phases, black for neutral and green for earth.

17.8 MEASUREMENT AND PAYMENT OF WIRING

Wiring for lights, fans, convenience socket outlets etc. shall be measured and paid for on POINT BASIS as itemized schedule of quantities and as elaborated as below unless otherwise stated.

17.9 **Wiring**

All the wiring installation shall be as per IS: 694/IS:732 with latest amendment. FRLS PVC insulated copper conductor cables as specified in bill of quantities shall be used for sub-circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be twisted copper conductors with thermoplastic insulations of 660/1100 volts grade. Colour Code for wiring shall be followed.

Looping system of wiring shall be used, wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of the consultant. No reduction of strands are permitted at terminations. No wire smaller than 2.5 sq.mm shall be used or as per B.O.Q. Wherever wiring is run through trunkings or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and DB number shall be used for submains, sub-circuit wiring. The ferrules shall be provided at both ends of each submain and sub-circuit.

Where single phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain the wiring fed from more than one phase. In any one room in the premises where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply. Circuits fed from distinct sources of supply or from different distribution boards or through switches or MCBs shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phase, no two single phase switches connected to different phase shall be mounted within two meters of each other.

All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.

Metal clad sockets shall be of die-cast non-corroding zinc alloy and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have push on protective cap. Socket shall have MCB/ELCB/RCCB as specified in the schedule of work.

18. Luminaires/Fans

General

All the materials used in the construction of luminaires shall be of such quality, design and onstruction that will provide adequate protection in normal use, against mechanical, electrical failures/faults and exposure to the risk of injury or electric shock and shall withstand the effect of exposure to atmosphere.

Fluorescent/CFL Lamp Luminaires

Luminaire shall be supplied as per the design specified in the schedule of quantities. Luminaires shall be complete in all respects with basic mounting channel, shock proof insert contact rotor lamp holders, starter with holder for fl. lamp luminaries/standard holder for CFL, low watt loss copper wound polyester filled ballast, connector block, internal wiring and decorative attachments, if any. The mounting channel shall be made of CRCA steel sheets suitably rust inhabited and stove enamelled. A dust proof cover stove enamelled to white shade shall be provided to form the channel to protect the accessories and wiring from dust and vermin and to act as reflector. Ballast shall be silent in operation, ballast shall have a long life and shall be highly reliable. A suitable capacitor to improve the power factor of luminaire to atleast 0.9 lag shall be provided. Capacitors shall be hermetically sealed.

Diffusers, louvers, etc. shall be of opal acrylic or polystrene diffusers, louver and similar decorative attachments. The attachments shall be guaranteed against discolourisation, warping and deformation under continuous operation. Fluorescent lamps shall conform to BS:1853 in all respects. Fluorescent lamps shall be of bi-pin pattern. The colour of the light shall be white or cool day light as required. Unless otherwise specified, the lamps shall be of 40W or 36W and 1200mm long. Luminairies shall be provided with an earthing terminal for bonding the body of the luminaire to earth. Luminairies shall be installed as specified on the drawings. Wherever luminaires are fixed on the false ceiling, suitable supporting and fixing arrangements independent of the frame work of false ceiling shall be provided. Suspended luminaires shall be provided with swivel type hangers, comprising of suspension pipes, swivel sockets, screws, bolts etc. for installing the luminaires.

Luminaires shall be suspended true to alignment, plumb and level and capable of resisting all lateral and vertical forces Lead-in-wires shall be protected from abrasion. Erection of the fixtures shall include assembling of all components of the fixtures such as chokes, condensers, starters, decorative attachments etc. Where suspended ceiling are installed the contractor shall cooperate with the ceiling installer to ensure that the luminaires layout is compatible with the ceiling panel layout.

Incandescent Lamp Luminaires

Incandescent lamp luminaires shall be supplied as per the design and type mentioned in the schedule of quantities. Incandescent lamp luminaires shall be provided with lamp holders suitable for lamps with standard bayonet cap upto 200 watts. Incandescent lamp luminaires shall be complete with reflector shade, decorative attachment (if any) and cover as specified and required. Incandescent lamps shall conform in all respects to BS:161.

Fans

Ceiling Fans

Ceiling fans shall conform to IS:374 (latest edition) all respects and shall be smooth and silent in operation. The fan motor shall be a capacitor type motor with internal stator and external rotor pattern. The blades shall be made of aluminium sheets painted in white shade. The design and construction of blades shall be such that maximum quantity of air is displaced in smooth manner. The motor and blades shall be statically and dynamically balanced. The fans shall be provided with ball bearing only which are accessible for lubrication. The ceiling fan shall be provided with rubber shackle and a down rod shall be as per requirements. The suspension arrangement shall be provided with bottom cover and top canopy. Electronic stepless regulators shall be provided, with every fan. Ceiling fans shall be suspended from the special hooks or special fan hook boxes. Where hooks are used the wiring to the

fan shall be from a ceiling rose. Wherever special fan hook boxes are used, the fan wiring shall be terminated in porcelain/PVC three way connector. Lead-in-wires shall have cross-section area of not less than 23/.0076 (copper).

Exhaust Fan

Propeller type exhaust fan shall conform to IS:2312 (latest edition)in all respects. The motor shall be of die-cast aluminium case. The fan motor shall be of squirrel cage induction type single phase motors shall be capacitor start and run type.

Exhaust fans be provided with a special anticorrosive treatment to withstand normal concentrations of chemical fumes in the environment.

The fan shall be designed to withstand the effects of moisture under normal conditions of use. The design of motor and its windings shall be such that moisture in surrounding is not absorbed by the windings. Exhaust fans shall be complete with mounting rings, ring arms and a resilient suspension. The motor and blades shall be of mild steel and so designed that they operate smoothly with minimum noise. The fans shall be finished to be a glossy grey shade with an approved enamel paint. The fans shall also be provided with gravity louvers for exhaust arrangement or bird screen for inlet arrangement.

Exhaust fans shall be fixed at the locations shown on the drawings. The fans shall be fixed by means of rag bolts grouted in wall. Exhaust fan be connected to the exhaust fan point by means of a 3 core flexible cord.

19 MEDIUM VOLTAGE DISTRIBUTION BOARDS

GENERAL

This section covers specification of DBs.

STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Miniature Air Circuit Breakers for AC circuits	IS 8828 : 1978
Degrees of Protection provided by enclosures for low voltage switchgear	IS 2147 : 1962

Code of Practice for installation and maintenance of switchgear not exceeding 1000 volts	IS 10118 : 1982
General requirements for switchgear and controlgear for voltages not exceeding 1000 volts	IS 4237 : 1982

MINIATURE CIRCUIT BREAKERS

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.
- The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.f.
- The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with H.R.C. fuse/PVC cable characteristic.
- Type test certificates from independent authorities shall be submitted with the tender.

FINAL DISTRIBUTION BOARDS

- Final distribution boards shall be flush mounting, totally enclosed, dust and vermin proof and shall comprise of miniature circuit breakers, earth leakage circuit breakers, neutral link etc as detailed in the schedule of quantities.
- The distribution equipment forming a part of the Distribution Boards shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and as per detailed specifications included in this tender document.
- The board shall be fabricated from 14 gauge CRCA sheet steel and shall have a hinged lockable spring loaded cover. All cutouts and covers shall be provided with synthetic rubber gaskets. The entire construction shall give a IP 42 degree of protection.
- The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulated throughout the length.
- All the internal connections shall be with either solid copper PVC insulated or copper conductor PVC insulated wires of adequate rating.
- All the internal connections shall be concealed by providing a hinged protective panel to avoid accidental contact with live points.
- All outgoing equipment shall be connected direct to the bus bar on the live side. The equipment shall be mounted on a frame work for easy removal and maintenance.
- The sheet steel work shall undergo a rigorous rust proofing process, two coats of filler oxide primer and final powder coated paint finish.
- All the circuits shall have an independent neutral insulated wire, one per circuit, and shall be numbered and marked as required by the Owners.

• A sample of the completed board is to be got approved by the architects/owners before commencement of supply and erection.

SHEET STEEL TREATMENT AND PAINTING

- Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.
- All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

NAME PLATES AND LABELS

• Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

ROUTINE AND COMPLETION TESTS

INSTALLATION COMPLETION TESTS

At the completion of the work, the entire installation shall be subject to the following tests:

- (e) Wiring continuity test
- (f) Insulation resistance test
- (g) Earth continuity test
- (h) Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

Wiring Continuity Test

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energised.

Insulation Resistance Test

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance

measured as above shall not be less than 50 megohms divided by the number of points provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 11.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

Testing Of Earth Continuity Path

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

Testing Of Polarity Of Non-Linked Single Pole Switches

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Architect/Engineer/DFCCIL as well as the local authorities.

Earth Resistivity Test

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

Performance

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

Tests and Test Reports

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Architect/owners for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

20 MEDIUM VOLTAGE CABLES

GENERAL

Technical specifications in this section covers supplying and laying of :

• Medium voltage cables.

STANDARDS AND CODES

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

PVC insulated heavy duty cables	IS 1554 - 1988
Cross link polyethylene insulated PVC (sheathed XLPE cables)	IS 7098 - 1985
Code of practice for installation and maintenance of power cables	IS 1255 - 1983
Conductors for insulated electrical cables	IS 8130 - 1984
Drums for electrical cable	IS 10418 - 1982
Methods of test for cables	IS 10810 - 1988
Recommended current rating	IS 3961 - 1987
Recommended short circuit rating of high voltage PVC cables	IS 5891 - 1970

CABLES

Medium Voltage Cables

Medium voltage cables shall be aluminium conductor XLPE insulated, PVC sheathed armoured conforming to IS 7098. Cables shall be rated for a 1100 Volts. The conductor of cables from 16 Sq. mm. to 50 Sq. mm. shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq. mm and above. Conductors shall be made of electrical purity aluminium 3/4 H or H temper. Conductors shall be insulated with high quality PVC base compound. A common covering (bedding)

shall be applied over the laid up cores by extruded sheath of unvulcanised compound. Armouring shall be applied over outer sheath of PVC sheathing. The outer sheath shall bear the manufacturer's name and trade mark at every metre length. Cores shall be provided with following colour scheme of PVC insulation.

1 Core		:	Red/Black/Yellow/Blue
2 Core		:	Red and Black
3 Core		:	Red, Yellow and Blue
3 1/2 /4 Core	:	Red, Y	ellow, Blue and Black

Current ratings shall be based on the following conditions.

(a)	Maximum conductor temperature	70° C
(b)	Ambient air temperature	45° C
(c)	Ground temperature	30° C
(d)	Depth of laying	1000 mm

Short circuit rating of cables shall be as specified in IS 7098.

Cables have been selected considering conditions of maximum connected loads, ambient temperature, grouping of cables and allowable voltage drop. However, the contractor shall recheck the sizes before cables are fixed and connected to service.

Delivery, Storage and Handling

Cable drum shall be stored on a well drained, hard surface, preferably of concrete, so that the drums do not sink in ground causing rot and damage to the cable drum. The cable drum shall conform to IS 10418. During storage, periodical rolling of drums, in the direction of arrow marked on the drum, shall be done once in 3 month through 90°C Both ends of cables shall be properly sealed to prevent moisture ingress Drums shall be stored in well ventilated area protected from sun and rain. Drums shall always be rested on the flanges and not on flat sides. Damaged battens of drums etc. shall be replaced. Movement of drums shall always be in direction of the arrow marked on the drum. For transportation over long distance, the drums shall either be mounted on drum wheels and pulled by ropes or they shall be mounted on trailers etc. drums shall be unloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps. While transferring cable form 1 drum to another, the barrel of the new drum shall have diameter not less than the original drum. Cables with kinks or similar visible defects like defective armouring etc shall be rejected. Cables shall be supplied at site in cut pieces as per actual requirements.

LAYING OF CABLES

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for medium voltage cables. Cables shall be laid in masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts as elaborated below. Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement cannot be met, medium voltage cables shall be laid above HT cables.

In Masonry Trenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches to be provided by Owners. Cables shall be laid on MS supports fabricated from minimum 38mm x 38mm x 6mm painted / galvanized angle iron supports grouted in trench walls at intervals not exceeding 600 mm. If required, cables shall be arranged in tier formation inside the trench. Suitable clamps, hooks and saddles shall be used for securing the cables in position and dressing properly so that the clear spacing between the cables shall not be less then the diameter of the cable. Trenches shall be provided with chequered plate/RCC covers. Wherever so specified, trenches shall be filled with fine sand.

On Trays/Walls

Wherever so specified, cables shall be laid along walls/ceiling or on cable trays. Cable shall be secured in position and dressed properly by means of suitable clamps, hooks, saddles etc. such that the minimum clear spacing between cables is diameter of the cable. Clamping of cables shall be at minimum intervals as below.

Type of cables	Size	Clamping by	Fixing intervals
MV	Upto and including 25 sq mm	Saddles 1 mm thick	45 cm
MV & HV	35 sq mm to 120 sq mm	Clamps 3 mm thick 25 mm wide	60 cm
MV & HV	150 sq mm and above	Clamps 3 mm thick 40 mm wide	60 cm
			1 1.11.1

Note: The fixing intervals specified apply to straight runs. In the case of bends, additional clamping shall be provided at 30 cm from the centre of the bend on both sides.

Cable trays, of sizes as per schedule of quantities and drawings shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Cable trays shall comply with the following:

Trays shall have suitable strength and rigidity to provide proper support for all contained cables. Trays shall not have sharp edges, burrs or projections injurious to cable insulation. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalent structural members.

Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out ensuring the following :

Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the electrical contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Owners/Architects. Wherever embedded plates & structural beams are not available for welding the tray mounting structure electrical contractor to supply the MS plates & fix them to floor slab by four anchor fasteners of minimum 16 mm dia having minimum holding power of 5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be 120 Kg. metre of cable run. Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus

length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs to be 300 mm. Cable trays will be welded to their mounting supports. Minimum clearance between the top most tray tier and structural member to be 300 mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angels. Clamps to be fabricated from 3 mm thick aluminium strip at site by the electrical contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS : 226 & 808. Welding shall be as per latest revisions of IS: 816. All structural steel to be painted with one shop coat of red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected properly to present a neat and clean appearance. Trays shall be installed as a complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid. Each run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

Buried Directly In Ground

General

Cables shall be so laid that they will not interfere with under ground structures. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded as directed by Architects/Owners. Surface of the ground shall be made good so as to conform in all respects to the surrounding ground to the satisfaction of Architect/Engineer/DFCCIL.

Routing of cables

Before cable laying work is undertaken, the route of the cables shall be decided with the Architects/Owners. While shortest practicable route shall be preferred, cable runs shall follow fixed development such as roads, footpaths etc with proper off-sets so that future maintenance and identification are rendered easy. Whenever cables are laid along well demarcated or established roads, the LV/MV cables shall be laid further from the kerb line than HV cables. Cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted, LV/MV cables shall be laid above HV cables. Where cables cross one another, the cables of higher voltage shall be laid at a lower level than the cables of lower voltage. Power and communication cables shall as far as possible cross at right angles. Where power cables are laid in proximity to communications cables the horizontal and vertical clearances shall not normally be less than 60 cm.

Width Of Trench

The width of trench shall be determined on the following basis. The minimum width of trench for laying single cables shall be 350 mm. Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables except where otherwise specified shall be at least 200 mm. There shall be a clearance of at least 150 mm between axis of the end cables and the sides of the trench.

Depth Of Trench

The depth of trench shall be determined on the following basis:

- Where cables are laid in single tier formation, the total depth of the trench shall not be less than 750 mm for cables upto 1.1 kV and 1250 mm for cables above 1.1 kV.
- When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of trench shall be increased by 300 mm for each additional tier to be formed.

Excavation Of Trenches

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature of 12 times the overall diameter of the largest cable shall be provided. Where gradients and changes in depths are unavoidable these shall be gradual. Excavation should be done by any suitable manual or mechanical means. Excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. Adequate precautions shall be taken not to damage any existing cables, pipes or other such installations during excavation. Wherever bricks, tiles or protected covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Architects/ Owners. Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Architect/Engineer/DFCCIL. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled as required. If there is any danger of a trench collapsing or endangering adjacent structures the sides shall be well shored up with timbering and/or sheathing as the excavation proceeds. Where necessary these may even be left in place when back filling the trench. Excavation through lawns shall be done in consultation with the Architect/Engineer/DFCCIL. Bottom of the trench shall be level and free from stone, brick, etc. The trench shall then be provided with a layer of clean dry sand cushion of not less than 80 mm in depth.

Laying Of Cable In Trench

The cable drum shall be properly mounted on jacks or on a cable wheel at a suitable location. It should be ensured that the spindle, jack etc are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks or strains. The entire cable length shall, as far as possible, be laid in one stretch. However when this is not possible the remainder of the cable shall be removed by flaking i.e. making one long loop in the reverse direction. After the cable is uncoiled and laid over the rollers, the cable shall be lifted slightly over the rollers beginning from one end by helpers standing about 10 metres apart and drawn straight. The cable should then be taken off the rollers by additional helpers lifting the cables and then laid in the trench in a reasonably straight line. For short runs and cable sizes upto 50 sq mm 1.1 kV grade the alternative method of direct handling can be adopted with the prior approval of the Architect/Engineer/DFCCIL.

If two or more cables are laid in the same trench care should be taken to preserve relative position. All the cables following the same routes shall be laid in the same trench. Cables shall not cross each other as far as possible. When the cable has been properly straightened the cores shall be tested for continuity and insulation resistance. The cable shall be measured thereafter. Suitable moisture sealing compound/tape shall be used for sealing of the ends. Cable laid in trenches in a single tier formation shall have a covering of clean dry sand of not less than 170 mm above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid

a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid. If additional tiers are formed each of the subsequent tiers also shall have a sand cushion of 300 mm. The top most cable shall have a final sand covering not less than 170 mm before the protective cover is laid. A final protection to cables shall be laid to provide warning to future excavators of the presence of the cable and also to protect the cables against accidental mechanical damage. Such protection shall be with second class bricks of not less than 200 mm x 100 mm x 100 mm (normal size) laid breadth wise for the full length of the cable to the satisfaction of the Architect/Engineer/DFCCIL. Where more than one cable is to be laid in the same trench this protective covering shall cover all the cables and project at least 50 mm over the sides of the end cables. In addition bricks on edge shall be placed along the entire run on either side of the cable run. The trenches shall then be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered in successive layers not exceeding 300 mm. Unless otherwise specified a crown of earth not less than 50 mm in the centre and tapering towards the side of the trench shall be left to allow for subsidence. The crown of earth should however not exceed 100 mm so as not to be a hazard to vehicular traffic. Where road berms or lawns have been cut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Clients and all surplus earth and rocks removed to places as specified.

Laying In Pipes/Closed Ducts

In locations such as road crossings, entry to buildings/poles in paved areas etc., cables shall be laid in pipes or closed ducts. Spun reinforced concrete pipes shall be used for such purposes and the pipe shall not be less than 100 mm in diameter for a single cable and not less than 150 mm for more than one cable. These pipes shall be laid directly in ground without any special bed. Sand cushioning and/or brick tiles need not be used in such installations. Unless otherwise specified the top surface of pipes shall be at a minimum depth of 1000 mm from the ground level when laid under roads, pavements etc. The pipes for road crossings shall preferably be on the skew to reduce the angle of bend as the cable enters and leaves the crossing. Pipes shall be continuous and clear of debris or concrete before cable is drawn. Sharp edges at ends shall be smoothened to prevent injury to cable insulation or sheathing. No deduction shall be made for sand and bricks not used for cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles.

Laying Of Cables In Floors

Laying of cables directly in floors shall be avoided and GI pipes of adequate size shall be used wherever necessary. However if the cables have to be laid direct in the floor specific written approval of Architect/Engineer/DFCCIL shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

Cable Entry Into Buildings

Cable entry into buildings shall be made through RCC pipes recessed in the floor. RCC Hume pipes shall be provided well in advance for service cable entries. The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water. Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

TERMINATION/JOINTING OF CABLES

Soldered jointing/termination shall be totally avoided. Solderless terminations by using Dowel crimping tools and suitable legs shall be adopted for all cable terminations. Any terminations may without use of proper crimping tool is shall be liable to be rejected. In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper and

then a thin coat of tin is applied before pinching into any equipment. Heat shrinkable Raychem type or approved equivalent terminations shall be provided for High Voltage cables and Siemens make or approved equivalent make brass double compression glands shall be provided for Medium Voltage cable terminations. Straight through jointing of Medium Voltage or High Voltage cable shall normally be totally avoided. If absolutely unavoidable, such jointing shall be carried out as per procedure to be got specifically approved from Architect/Engineer/DFCCIL.

MEASUREMENT OF CABLE RUNS

The cable runs shall be measured upto the outer end of the boxes without any allowances for over lap in joints. The actual run of the cables shall be measured and the rate shall include all the above mentioned material, labour etc for laying as required.

CABLE LOOPS

At the time of the installation approximately 3 metres of surplus cable shall be left

- at each end of the cable
- on each side of underground straight through/tee/termination joints.
- at entries to buildings
- and such other places as may be decided by the architects/owners.

This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the architect/owners.

BONDING OF CABLES.

Where a cable enters any piece of apparatus it shall be connected to the casting by means of an approved type of armoured clamp or gland. The clamps must grip the armouring firmly to the gland or casting, so that in the event of ground movement no undue stress is placed on to the cable conductors.

TESTING

Tests At Manufacturer's Work

The cables shall be subjected to shop test in accordance with relevant standards to prove the design and general qualities to the cables as below (as per IS 10810) :

- Routine test on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot.
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

Site Testing

- All cables before laying shall be tested with a 500 V megger for 1.1 kV grade or with a 2500/5000 V megger for cables of higher voltages. The cables cores shall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors.
- All cables shall be subject to above mentioned test during laying, before covering the cables by protective covers and back filling and also before the jointing operations.
- After laying and jointing, the cable shall be subjected to a 1.5 minutes AC/DC pressure test.
- In the absence of facilities for pressure testing in accordance with clause___ above it is sufficient to test for one minute with 1000 V megger for cables of 1.1 kV grade and with 2500/5000 V megger for cables of higher voltages.

Test Witness

Tests shall be performed in presence of representative of Architect/Engineer/DFCCIL. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

MEDIUM VOLTAGE SWITCHGEAR

GENERAL

This section covers specification of Medium Voltage Switchboards incorporating items of switchgear like Circuit Breakers, SFUs, metering and protection

STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Low Voltage switchgear & controlgear

IS 13947 : 1993

Part I	:	General rules
Part II	:	Circuit Breakers
Part III	:	Switches, disconnectors, switch disconnectors
		and fuse combination units
Part IV	:	Contactors and Motor starters
DIT		

Part V : Control circuit devices and switching elements

Marking of Switchgear busbars	IS 11353 : 1985
Degree of Protection of Enclosures for low voltage switchgear.	IS 2147 : 1962
Electrical relays for power system protection	IS 3231 : 1986
Code of Practice for selection, installation and Maintenance of switchgear & controlgear	IS 10118 : 1982
Low voltage switchgear & controlgear assemblies	IS 8623 : 1993

SWITCHGEAR

Medium Voltage Air Circuit Breakers

Technical Parameters

• The circuit breaker shall be of the air break type, robust and compact design suitable for indoor mounting and shall comply with the requirement of IS: 13947 : 1993. Rupturing capacity shall be 25 MVA at 415 Volts or as per schedule of quantities.

Constructional Features

- The Circuit Breaker shall be flush front, metal clad, horizontal draw-out pattern, three/four pole as required and fully interlocked. Each Circuit Breaker shall be housed in a separate compartment enclosed on all sides.
- The Circuit Breaker cradle shall be designed and constructed to permit smooth withdrawal and insertion. The movement shall be free of jerks, easy to operate and positive.
- All current carrying parts in the breaker shall be silver plated and suitable arcing contacts shall be provided to protect the main contacts which shall be separate from the main contacts and easily replaceable. In addition, Arc chutes shall be provided for each pole, and these shall be suitable for being lifted out for the inspection of the main and the arcing contacts.
- Self aligning cluster type isolating contacts shall be provided for the Circuit Breaker, with automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle. Sliding connections including those for the auxiliary contacts and control wiring shall also be of the self aligning type. The fixed portion of the sliding connections shall have easy access for maintenance purposes.
- The cubicle for housing the Breaker shall be free standing dead front pattern, fabricated from the best quality sheet steel.

9.3.1.3 **Operating Mechanism**

- The Circuit Breaker shall be trip free with independent manual spring operated or motor wound spring operated mechanism as specified and with mechanical ON/OFF indication. The operating mechanism shall be such that the circuit breaker is at all times free to open immediately the trip coil is energised.
- The operating handle and mechanical trip push button shall be at the front of and integral with the Circuit Breaker.
- The Circuit Breaker shall have the following four distinct and separate positions which shall be indicated on the face of the panel.

"Service" -- Both main and secondary isolating contacts closed

"Test" -- Main isolating contacts open and secondary isolating contacts closed

"Isolated" -- Both main and secondary isolating contacts open

"Maintenance" -- Circuit Breaker fully outside the panel ready for maintenance

Circuit Breaker Interlocking

- Sequence type strain free interlocks shall be provided to ensure the following:
- It shall not be possible for the Breaker to be withdrawn from the cubicle when in the "ON" position. To achieve this, suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.
- It shall not be possible for the Breaker to be switched "ON" until it is either in the fully inserted position or, for testing purposes, it is in the fully isolated position.
- It shall not be possible for the Circuit Breaker to be plugged in unless it is in the OFF position.
- A safety catch shall be provided to ensure that the movement of the Breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due its weight.
- Mechanical and electrical antipumping devices shall be incorporated in the ACB's as required.

<u>Circuit Breaker Auxiliary Contacts</u>

The Circuit Breaker shall have minimum 6 N.O. and 6 N.C. auxiliary contacts rated at 16 amps 415 volts 50 Hz. These contacts shall be approachable from the front. They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.

Protective Devices

- The Circuit Breaker shall have protective devices as specified in the Schedule of Quantities. These will in general be:
- C.T. operated thermal overload releases with magnetic instantaneous short circuit release. The overload releases shall be such that each phase can be individually set depending on the phase unbalanced currents. The releases shall have inverse time current characteristics and the magnetic release shall be time delayed with a minimum setting of 25 ms varying upto 300 ms for discrimination without effecting the breaking current capacity of the ACB.
- Over voltage relay.
- Under/no voltage trip coil or Relay as required.
- Over current and earth fault IDMT relays with shunt/series trip coil operation as specified.
- The Circuit Breakers shall be suitable to accomodate one or more types of protection as specified.

Instrument Transformers

The Circuit Breaker shall have the required Current Transformers as specified for metering and protection mounted outside the Circuit Breaker compartment but within the free standing cubicle. The transformers shall comply to the relevant Indian Standards and the Class of Accuracy required for metering and protection. Separate sets of Current transformers shall be provided.

Metering

The metering required to be provided for each Circuit Breaker shall be as per the Schedule of Quantities. Such metering shall not be provided on the front panel of the Circuit Breaker compartment. A separate compartment shall be provided for the metering and Protective relays as required.

Square pattern flush mounting meters complying with the requirements of the relevant Indian Standards shall only be used.

Selector switches of the three way and OFF pattern complying to the relevant Indian Standards shall be used.

Indicating Lamps

LED type indicating lamps shall be provided for indication of phases and Breaker position as required in the Schedule of Quantities.

Control Wiring

All wiring for relays and meters shall be of copper conductor PVC insulated and shall be colour coded and labelled with appropriate plastic ferrules for identification. The minimum size of control wires to be used shall be 1.5 sq mm.

All control circuits shall be provided with protective H.R.C. fuses. Instrument testing plugs shall be provided for testing the meters.

Earthing

The frame of the Circuit Breaker shall be positively earthed when the Circuit Breaker is racked into the cubicle.

Type Test Certificates

The Contractor shall submit type test certificates from a recognised test house for the Circuit Breakers offered.

Switch Fuse Units

Switch fuse units, incorporated in switchboards wherever required shall conform in all respects to IS 13947 : 1993. Switch fuse units shall be suitable for 415 Volts 3 Phase 40 Hz AC supply.

Unit housing shall be of robust construction designed to withstand ardous conditions. Sheet steel used shall be given rigorous rust proofing treatment before fabrication and painting .Units shall have double break per phase in order to isolate fuse links when the switch is in OFF position.

Operating mechanism of units shall be crisp and positive in action with quick- make and quick-break silver plated contacts. Operating handle shall be suitable for rotary operation unless otherwise specified. Position of handle such as ON and OFF shall be clearly indicated.

All live parts inside the switch fuse units shall be shrouded to prevent any accidental contact.

All the terminals shall be liberally designed. All units above 100 A shall be provided with integral cable sockets.

All switch units shall be provided with suitable interlocks such that the door of the switchboard panel shall not open unless the switch is in OFF position. Provision for padlocking the switch in OFF position shall also be provided.

Routine and type tests as per IS 13947 : 1993 shall be conducted at works and test certificates furnished.

Moulded Case Circuit Breakers

Moulded case circuit breakers (MCCB) or fuse free breakers, incorporated in switchboards wherever required, shall conform to IS 13947 : 1993 in all respects. MCCBs shall be suitable either for single phase 240 Volts or 3 Phase 415 Volts AC 50 Hz supply.

MCCB cover and case shall be made of high strength heat resisting and flame retardant thermosetting insulating material. Operating handle shall be quick make/break, trip - free type. Operating handle shall have suitable ON, OFF and TRIPPED indicators. Three phase MCCBs shall have a common handle for simultaneous operation and tripping of all the three phases. Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be of thermal/magnetic type provided on each pole and connected by a common tripe bar such that tripping of any one pole causes three poles to open simultaneously. Thermal/magnetic tripping device shall have IDMT characteristics for sustained over loads and short circuits.

Contact trips shall be made of suitable arc resistant sintered alloy. Terminals shall be of liberal design with adequate clearances.

MCCBs shall be provided with following accessories, if specified in drawings/ schedule of quantities :

- Under voltage trip
- Shunt trip
- Alarm switch
- Auxiliary switch

MCCBs shall be provided with following interlocking devices for interlocking the door a switch board.

- Handle interlock to prevent unnecessary manipulations of the breaker.
- Door interlock to prevent door being opened when the breaker is in ON position
- Deinterlocking device to open the door even if the breaker is in ON position.

MCCBs shall have rupturing capacity as specified in drawings/schedule of quantities.

All MCCB shall be provided with adapter terminal for facilitates higher sizes of cable/ links

Metering, Instrumentation And Protection.

Ratings, type and quantity of meters, instruments and protective devices shall be as per drawings and schedule of quantities.

Current Transformers

C/Ts shall confirm to IS 2705 (part -I, II and III) in all respects. All C/Ts used for medium voltage application shall be rated for 1 kV. C/Ts shall have rated primary current, rated burden and class of accuracy as specified in schedule of quantities/drawings. Rated secondary current shall be 5A unless otherwise stated. Minimum acceptable class for measurement shall be class 0.5 to 1 and for protection class 10. C/Ts shall be capable of withstanding magnetic and thermal stresses due to short circuit faults of 31 MVA on medium voltage. Terminals of C/Ts shall be paired permanently for easy identification of poles. C/Ts shall be provided with earthing terminals for earthing chassis, frame work and fixed part of metal casing (if any). Each C/T shall be provided with rating plate indicating :

- Name and make
- Serial number
- Transformation ratio
- Rated burden
- Rated voltage
- Accuracy class

CTs shall be mounded such that they are easily accessible for inspection, maintenance and replacement. Wiring for CT shall be with copper conductor PVC insulated wires with proper termination works and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

Potential Transformer

PTs shall confirm to IS 3156 (Part-I,II and III) in all respects.

Measuring Instruments

Direct reading electrical instruments shall conform to IS 1248 or in all respects. Accuracy of direct reading shall be 1.0 of voltmeter and 1.5 for ammeters. Other instruments shall have accuracy of 1.5. Meters shall be suitable for continuous operation between -10° C to $+50^{\circ}$ C. Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel or phenolic mould. Design and manufacture of meters shall ensure prevention of fogging of instrument glass. Pointer shall be black in colour and shall have Zero position adjustment device operable from out side. Direction of deflection shall be from left to right. Selector switches shall be provided for ammeters and volt meters used in three phase system.

Ammeters

Ammeters shall be of Digital type. Moving part assembly shall be with jewel bearings. Jewel bearings shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks. Ammeters shall be manufacture and calibrated as per IS 1248.

Ammeters shall normally be suitable for 5 A secondary of current transformers.

Ammeters shall be capable of carrying substantial over loads during fault conditions.

Voltmeters

Voltmeters shall be Digital type range of 3 phase 415 volt voltmeters shall be 0-500. Volt meters shall be provided with protection fuse.

Watt meter

Wattmeter shall be of 3 phase Digital type and shall be provided with a maximum demand indicator if required.

Power factor meters

3 phase power factor meters shall be of Digital type with current and potential coils suitable for operation with current and potential transformers provided in the panel. Scale shall be calibrated for 50% lag - 100% - 50% loading. Phase angle accuracy shall be +40.

Energy and reactive power meters

Trivector meters shall be two element, integrating type, KWH, KVA, KVA hour reactive meters. Meters shall confirm to IEC 170 in all respects. Energy meters, KVA, and KVARH meters shall be provided with integrating registers. The registers shall be able to record energy conception of 500 hours corresponding to maximum current at rated voltage and unity power factor. Meters shall be suitable for operation with current and potential transformers available in the panel.

<u>Relays</u>

Protection relays shall be provided with flag type indicators to indicate cause of tripping. Flag indicators shall remain in position till they are reset by hand reset. Relays shall be designed to make or

break the normal circuit current with which they are associated. Relay contacts shall be of silver or platinum alloy and shall be designed to withstand repeated operation without damage. Relays shall be of draw out type to facilitate testing and maintenance. Draw out case shall be dust tight. Relays shall be capable of disconnecting faulty section of network without causing interruption to remaining sections. Analysis of setting shall be made considering relay errors, pickup and overshoot errors and shall be submitted to Architect/Engineer/DFCCIL for approval.

Over current relays

Over current relays shall be induction type with inverse definite minimum time lag characteristics. Relays shall be provided with adjustable current and time settings. Setting for current shall be 50 to 200 % insteps of 25%. The IDMT relay shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5 Amps.

Earth fault relay

Same as over current relay excepting the current setting shall be 10% to 40% in steps of 10%.

Under voltage relay

Under voltage relays shall be of induction type and shall have inverse limit operation characteristics with pickup voltage range of 50 to 90% of the rated voltage.

Power Factor Correction Capacitors

Power factor correction capacitors shall conform to IS 2834 in all respects. Approval of insurance association of India shall be obtain if called for. Capacitors shall be suitable for 3 phase 415 volts 50 Hz supply and shall be available in single and three phase units of 5,10,15,20,25 and 50 kVAR sizes. Capacitor shall be usable for indoor use, permissible overloads being as below.

- Voltage overloads shall be 10% for continuous operation and 15% for six hours in a 24 hours cycle.
- Current overloads shall be 15 % for continuous operations and 50% for six hours in a 24 hours cycle.
- Over load of 30% continuously and 45% for six hours in a 24 hours cycle.

Capacitors shall be hermetically sealed in sturdy corrosion proof sheet steel containers and inpregnated with non inflammable synthetic liquid. Every element of each capacitory unit shall be provided with its own built in silvered fuse. Capacitors shall have suitable discharge device to reduce the residual voltage from crest value of the rated voltage to 50 volts or less within one minute after capacitor is disconnected from the source of supply. The loss factor of capacitor shall not exceed 0.005 for capacitors with synthetic impregnants The capacitors shall withstand power frequency test voltage of 2500 volts AC for one minute. Insulation resistance between capacitors terminals and containers when a test voltage of 500 volts DC is applied shall not be less than 50 meg.ohms.

MEDIUM VOLTAGE SWITCH BOARDS

<u>General</u>

- All medium voltage switchboards shall be suitable for operation at three phase/three phase 4 wire, 415 volt, 50 Hz, neutral grounded at transformer system with a short circuit level withstand of 25 MVA at 415 volts or as per schedule of quantities.
- The Switch Boards shall comply with the latest edition with upto date amendments of relevant Indian Standards and Indian Electricity Rules and Regulations.

Switch Board Configuration

- The Switch Board shall be configured with Air Circuit Breakers, MCCB's, and other equipment as called for in the Schedule of Quantities.
- The MCCB's shall be arranged in multi-tier formation whereas the Air Circuit Breakers shall be arranged in Single or Double tier formation only to facilitate operation and maintenance.
- The Switch Boards shall be of adequate size with a provision of 25% spare space to accommodate possible future additional switch gear.

Equipment Specifications

All equipment used to configure the Switch Board shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and to the detailed technical Specifications as included in this tender document.

Constructional Features

- The Switch Boards shall be metal enclosed, sheet steel cubicle pattern, extensible, dead front, floor mounting type and suitable for indoor mounting.
- The Switch Boards shall be totally enclosed, completely dust and vermin proof. Synthetic rubber gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust and vermin proof to provide a degree of protection of IP 54. All doors and covers shall also be fully gasketed with synthetic rubber and shall be lockable.
- The Switch Board shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be constructed from CRCA sheet steel of thickness not less than 1.6 mm. Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal.
- All panels and covers shall be properly fitted and square with the frame. The holes in the panel shall be correctly positioned.
- Fixing screws shall enter holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in the construction of the Switch Boards.

Panel mounted lock to be proved on each compartment.

20.1 <u>Switchboard Dimensional Limitations</u>

- A base channel 75mm x 40mm x 5mm shall be provided at the bottom.
- A minimum of 200 mm blank space between the floor of switch board and bottom most unit shall be provided.
- The overall height of the Switch Board shall be limited to 2300 mm
- The height of the operating handle, push buttons etc shall be restricted between 300 mm and 2000 mm from finished floor level.

Switch Board Compartmentalisation

The Switch Board shall be divided into distinct separate compartments comprising

- A completely enclosed ventilated dust and vermin proof bus bar compartment for the horizontal and vertical busbars.
- Each circuit breaker, and MCCB shall be housed in separate compartments enclosed on all sides.
- Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker/switch fuse unit in "on" and "off" position.
- For all Circuit Breakers separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.
- A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections.
- Separate cable compartments running the height of the Switch Board in the case of front access Boards shall be provided for incoming and outgoing cables.
- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top.
- Adequate and proper support shall be provided in cable compartments to support cables.

Switch Board Bus Bars

• The Bus Bar and interconnections shall be of Aluminium and of rectangular cross sections suitable for full load current for phase bus bars and half rated current for neutral bus bar. Aluminium shall be 1/1 amp per Sq. mm. and suitable to withstand the stresses of a 25 MVA fault level or at 415 volts for 1 second or as per schedule of quantities.

- The bus bars and interconnections shall be insulated with insulation tape/ fiber glass.
- The bus bars shall be extensible on either side of the Switch Board.
- The bus bars shall be supported on non-breakable, non-hygroscopic insulated supports at regular intervals, to withstand the forces arising from a fault level of 31 MVA at 415 volts for 1 second.
- All bus bars shall be colour coded.
- All bus bar connections in Switch Boards shall be bolted with brass bolts and nuts. Additional cross section of bus bars shall be provided wherever holes are drilled in the bus bars.

Switch Board Interconnections

- All connections between the bus bars/Breakers/cable terminations shall be through solid copper strips of adequate size to carry full rated current and PVC/fibre glass insulated.
- For unit ratings upto 100 amps PVC insulated copper conductor wires of adequate size to carry full load current shall be used. The terminations of all such interconnections shall be crimped.

Drawout Features

Air Circuit Breakers shall be provided in fully drawout cubicles. These cubicles shall be such that drawout is possible without disconnection of the wires and cables. The power and control circuits shall have self aligning and self isolating contacts. The fixed and moving contacts shall be easily accessible for operation and maintenance. Mechanical interlocks shall be provided on the drawout cubicles to ensure safety and compliance to relevant Standards. The MCCB's shall be provided in fixed type cubicles.

Instrument Accommodation

- Instruments and indicating lamps shall not be mounted on the Circuit Breaker Compartment door for which a separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switch Board.
- For MCCB's instruments and indicating lamps can be provided on the compartment doors.
- The current transformers for metering and for protection shall be mounted on the solid copper/aluminium busbars with proper supports.

Wiring

All wiring for relays and meters shall be with PVC insulated copper conductor wires. The wiring shall be coded and labelled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 1.5 sq. mm.

Cable Terminations

- Knockout holes of appropriate size and number shall be provided in the Switch Board in conformity with the location of incoming and outgoing conduits/cables.
- The cable terminations of the Circuit Breakers shall be brought out to terminal cable sockets suitably located at the rear of the panel.
- The cable terminations for the MCCB's shall be brought out to the rear in the case of rear access switchboards or in the cable compartment in the case of front access Switch Boards.
- The Switch Boards shall be complete with tinned brass cable sockets, tinned brass compression glands, gland plates, supporting clamps and brackets etc for termination of 1100 volt grade aluminium conductor PVC/PVCA cables.

Space Heaters

The Switch Board shall have in each panel thermostatically controlled space heaters with a controlling 15 amp 230 volt switch socket outlet to eliminate condensation.

Earthing

A main earth bar of G.I./copper as required shall be provided throughout the full length of the Switch Board with a provision to make connections to the sub-station earths on both sides.

Sheet Steel Treatment And Painting

- Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.
- All sheet steel shall after metal treatment be spray or powder painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

Name Plates And Labels

Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

Installation

The foundations prepared as per the manufacturers drawings shall be levelled, checked for accuracy and the Switch Board installed. All bus bar connections shall be checked with a feeler gauge after installation. The able end boxes shall be sealed to prevent entry of moisture. The main earth bar shall be connected to the sub-station earths.

A 15mm thick rubber matting of approved make on a 100 mm high timber platform shall be provided in front of and along the full length of the Switch Board. The width of the matting shall be 1000mm. The rubber mat shall withstand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre.

After installation the Switch Board shall be tested as required prior to commissioning.

Testing & Commissioning at site by third party

- a) Alignment of panel, interconnection of Bus bars and tightness of bolts and connection.
- b) Inter panel wiring
- c) Free movement of ACB/MCCB/SFU
- d) Operation of breakers
- e) Insulation Tests
- f) Primary & secondary injection tests of relays.
- g) Interlocking function.

22. <u>CABLE TRAYS</u>

Cable trays, of sizes as per schedule of quantities and drawings shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Cable trays shall comply with the following:

Trays shall have suitable strength and rigidity to provide proper support for all contained cables. Trays shall not have sharp edges, burrs or projections injurious to cable insulation. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalent structural members.

Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out ensuring the following :

Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the electrical contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Owners/Architects. Wherever embedded plates & structural beams are not available for welding the tray mounting structure electrical contractor to supply the MS plates & fix them to floor slab by four anchor fasteners of minimum 16 mm dia having minimum holding power of 5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be 120 Kg. metre of cable run. Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs to be 300 mm. Cable trays will be welded to their mounting supports. Minimum clearance between the top most tray tier and structural member to be 300 mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angels. Clamps to be fabricated from 3 mm thick aluminium strip at site by the electrical contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS : 226 & 808. Welding shall be as per latest revisions of IS: 816. All structural steel to be painted with one

shop coat of red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected properly to present a neat and clean appearance. Trays shall be installed as a complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid. Each run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

23. <u>EARTHING</u>

GENERAL

All the non-current carrying metal parts of electrical installation shall be earthed properly. All metal conduits, trunking, cable sheaths, switchgear, distribution fuse boards, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All earthing shall be in conformity with Indian Electricity Rules.

The Earthing System shall in totally comprise the following:-

- (a) Earth Electrodes
- (b) Earthing Leads
- (c) Earth Conductors

All three phase equipment shall have two separate and distinct body earths and single phase equipment shall have a single body earth.

STANDARDS

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

EARTHING MATERIAL

Materials of which the protective system is composed shall be resistant to corrosion or be adequately protected against corrosion. The material shall be as specified in the schedule of quantities and shall comply to the following requirements:

• Copper - When solid or stranded copper wire is used it shall be of the grade ordinarily required for commercial electrical work generally designated as being of 98% conductivity when annealed, conforming to Indian standard specifications.
- Galvanised Steel Galvanised steel used shall be thoroughly protected against corrosion by hot dipped Zinc coating. The material coating shall withstand the test specified in IS 2309:1969.
- The strips to be used shall be in maximum lengths available as manufactured normally avoiding unnecessary joints.

EARTH ELECTRODES

Plate Earth Electrode

The plate electrodes shall be of copper/ GI as called for in the schedule of quantities. The minimum dimensions of the electrodes shall be $600 \text{ mm} \times 600 \text{ mm}$. Thickness of copper electrodes shall not be less than 3 mm and of GI electrodes not less than 6 mm.

The electrode shall be buried in ground with its face vertical and top not less than 4 metre below ground level.

Earth Electrode Pit

Method Of Installing Watering Arrangement

In the case of plate earth electrode, a watering pipe of 20 mm dia of medium class G.I. Pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided at the top of this pipe for watering the earth. The watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300mm. A RCC frame base with removable RCC cover slab M-25-4nos- 10mm dia -M.S. reinforcements bar at top & bottam both way shall be suitably embedded in the masonry enclosure enclosure

Location Of Earth Electrode

The following guidelines shall be followed for locating the earth electrodes

An earth electrode shall not be situated less than 2 metres from any building.

The excavations for electrode shall not affect the column footings or foundations of the buildings. In such cases electrode may be further away from the building.

The location of the earth electrode shall be such where the soil has reasonable chance of remaining moist, as far as possible.

Entrances, pavements and road ways shall not be used for locating the earth electrode.

Number Of Earth Electrodes

In all cases the relevant provision of rule 33, 61 & 67 of the Indian Electricity Rules 1956 as amended shall be complied with.

Metallic covers or supports of all medium or H.T. apparatus or conductors shall, in all cases be connected to not less than two separate and distinct earth electrodes.

EARTHING LEADS

The strip earthing leads shall be connected to the Earth Electrode at one end and to the metallic body of the main equipment at the other end. The earthing lead shall connect to the earthing network in the installation.

Earthing Lead Sizes

Strip earthing leads shall be of copper/GI and as per specifications.

Earthing Lead Installation

The length of buried strip earthing lead shall be not less than 15 metres and shall be buried in trench not less than 0.5 m deep.

If conditions necessitates use of more than one earthing lead they shall be laid as widely distributed as possible preferably in a single straight trench or in a number of trenches radiating from one point.

Method Of Connecting Earthing Lead To Earth Electrode

In the case of plate earth electrode the earthing lead shall be securely bolted to the plate with two bolts, nuts, checknuts and washers as required by IS 3043 : 1987.

All materials used for connecting the earth lead with electrode shall be GI in case of GI Pipe and GI plate earth electrodes or tinned brass in case of Copper plate electrode.

Protection Of Earthing Lead

The earthing lead from electrode onwards shall be suitably protected from mechanical injury and corrosion by a 15 mm dia GI pipe in case of wire and 100/40mm dia medium class GI Pipe

The portion of the G.I. pipe within ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing or pavements). The portion within the building shall be recessed in walls and floors to adequate depth.

EARTHING CONDUCTORS

Earthing conductors shall form the earthing network throughout the installation for earthing of all noncarrying metal parts.

• <u>Connection Of Earthing Conductors</u>

- Main earthing conductors shall be taken from the earth connections at the main switch boards to all other switchboards in the network.
- Sub-mains earthing conductors shall run from the main switch board to the sub distribution boards and to the final distribution boards.
- Loop earthing conductors shall run from the distribution boards and shall be connected to any point on the main/sub-main earthing conductor, or its distribution board or to an earth leakage circuit breaker.

Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to switch boards at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing, Switches, accessories, lighting fitting etc shall be effectively connected to the Loop Earthing Conductors. These though rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered earthed, even though the run of metallic conduit is earthed.

• <u>Earthing Conductor Installation</u>

The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size.

Joints shall be revetted and brazed in approved manner.

Sweated lugs of adequate capacity and size shall be used for termination. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned.

• Sizing Of Earthing Conductors

All fixtures, outlet boxes and junction boxes shall be earthed with Bare copper wires as specified.

All 3 phase switches and distribution boards upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper/6 mm dia GI wires. All 3 phase switches and distribution boards upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper/8 mm dia GI wires. All switches, bus bar, ducts and distribution boards of rating 200 amps and above shall be earthed with a minimum of 2 Nos. separate and independent 25 mm x 3 mm copper/25mm x 6 mm GI tape.

PROHIBITED CONNECTIONS

Neutral conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system.

RESISTANCE TO EARTH

No earth electrode shall have a greater ohmic resistance than 1 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be upto one ohms. The electrical resistance measured between earth connection at the main switchboard and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate fuses or circuit breakers, and shall not exceed one ohm.

Installation Completion Tests

At the completion of the work, the entire installation shall be subject to the following tests:

- 1. Wiring continuity test
- 2. Insulation resistance test

- 3. Earth continuity test
- 4. Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

Wiring Continuity Test

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energised.

Insulation Resistance Test

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 megohms divided by the number of points provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 12.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

Testing Of Earth Continuity Path

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

Testing Of Polarity Of Non-Linked Single Pole Switches

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Architect as well as the local authorities.

Earth Resistivity Test

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

Performance

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

Tests And Test Reports

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Architect/owners for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

Earthing System – specification

Earthing system should comply to the requirements specified below. Earthing system should offer a resistance less than 5 ohms throughout the year. In places where Soil resistivity is more, multiple earth electrodes are to be installed to get the required value. Length of the earthing rod also can be increased to achieve low and stable resistance value.

Solid rods are recommended as earth electrode than a pipe due to the fact that solid rods can be easily driven by hydraulic hammers. Deep driven rods provide more stable and less Earth Resistance. Doubling the length of the rod will reduce earth resistance up to 40 %, where as doubling the diameter will reduce the resistance by only 10 %, but may increase the cost by 4 times. Lower earth resistance can also be achieved by increasing the number of earth rods. E.g. 40 % reduction in earth resistance is possible if the rods are increased from 1 to 2. The minimum spacing between earth pits should be equal to the length of the rod. Increasing the spacing between earth pits also reduces the earth resistance significantly.

Need and importance of Earthing:

- Human and Personnel safety.
- Equipment protection.
- Provides low impedance path for fault currents.
- To ensure good quality power.
- Protection against lightning and transient currents, noise reductions, Limitation of EMI.

References:

IEC 60364: Low Voltage Electrical Installations-Part 5-54: Selection & Erection of Electrical equipment- Earthing arrangement & protective conductors.

IEC 62561: Lightning Protection system Components.

IEC 62305: Protection Against Lightning -Part 3: Protection of structures & life Hazards

UL 467: Grounding and Bonding Equipments

UL96: Lightning Protection System – Components

IS 2309: Code of practice for protection of buildings & allied structures from lightning IS 3043: Code of practice for earthing.

Components of earthing system:

- Earth electrode
- Couplers and Connectors
- Inspection Chamber (Earth Pit)
- Earth enhancement material
- Connecting cable/tape/strip with accessories.

Earth Electrode:

Copper coated Solid steel Rods shall be made of high tensile low carbon steel rod, with molecular bonded with 99.9% electrolytic copper with minimum coating thickness of 250 microns. The minimum length of the earth rod shall be 3 meters which is either a single rod or smaller rods with couplers or similar arrangement. For dry areas, length of the rods can go up to 9 meters. The vendor should quote price of the rod in length of 3 meters. The rod as well as the couplers should satisfy the requirements as per the above-referred standards. For Lightning protection application rods should have a diameter of 14.2 mm or 17.2 mm. Inorderto carry fault current, earth rods used in Power networks should be of diameter 20 mm or 25 mm. In case of applications more than 3 meters, diameter of the rod should be 20 or 25 mm. These rods also should have facility to drive with an electric/hydraulic hammer.

Interconnecting Strips / Earthing Conductor: Copper coated steel strips / tapes should be used to interconnect different earthing rods as well as horizontal earthing (Ring earthing). These strips should have a coating thickness of minimum 70 microns and have minimum cross sectional area of 90 Sqmm. (Eg 30 X 3 strip)

Couplers / Connecting clamps:

Couplers for interconnecting rods should be made of Brass or any other copper alloy, which is resistant to corrosion. For rods with diameters larger than 20 mm self locking arrangements are preferable instead of couplers. Connectors for connecting Electrode with Earthing conductor/strip should be of Brass/copper alloy or copper coated steel. Fasteners should be made of Stainless steel. Size should be selected according to the electrode and earthing conductor dimensions.Different arrangements should be as per the below fig.



Inspection Chamber :

Should have an inner dimension of 250 mmX 250 mm X 250 mm made of FRP material. Flush Mounted, removable and lockable cover of the earth pit should be able to withstand 15KN. The area inside the inspection chamber should be such that, the UNIVERSAL CLAMP/EBB/Bus bar is not too deep inside

the inspection chamber or projecting out of inspection chamber. The chamber should have facility for marking earth resistance and latest testing date by paint at the cover and previous recorded values inside the cover.

Earth Enhancement material:

This is a conductive compound producing low resistance of an earth termination system. Earth enhancing compound shall be so designed and constructed that in normal use their performance is reliable and without danger to persons and the surroundings. The material shall be chemically inert to sub soil and shall not pollute the environment. It shall provide a stable environment in terms of physical and chemical properties and exhibit low resistivity. It shall not be corrosive to the earth electrode itself. The material should have a resistivity less than 50 Ohm meter

Installation:

Normal soil in Marsh land: Electrodes can be hand driven or hammered into earth for the required length. Semi Hard Soil: Electrodes can be hammered electrically or hydraulically for the required length. Hard Soil: Bore a hole with a minimum diameter of 100 MM with at a depth of up to 3 meters. Place the electrode at the centre of the hole in such a way that bottom 100 mm of the electrode is in bond with the mother soil. For deep driven rods with depth more than 3 meters, remaining length of the rod should be driven into the mother soil. (ref fig) Fill the hole with earth enhancement compound.



Inspection & maintenance:

Maintenance of the earthing system has to be done at least once in 6 months, preferably before the monsoon period and a record should be maintained to verify earthing system conductors and components, electrical continuity, earth resistance value, re-fastening of components viz-nuts, bolts etc.

Drawing:

Layout of the complete earthing system with dimensions shall be submitted. Warranty: Earthing system should provide stable resistance for a period of 18 months after installation as well as for full season. During this period monthly readings are to be recorded by the end user.

Earth Enhancement Compound

Earth enhancement material is a superior conductive material that improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It

improves conductivity of the earth electrode and the ground contact area. It shall be tested and conform to the requirements of IEC 62561-7 having the following characteristics:-

- Shall be carbon based with min 95% of fixed carbon content premixed with corrosion resistant cement to have set properties. Cement shall not mix separately & shall not have Bentonite.
- Shall have high conductivity, improves earth's absorbing power and humidity retention capability.
- Shall be non-corrosive in nature having low water solubility but highly hygroscopic.
- Shall have resistivity of less than 0.12 ohms -meter.
- Shall be suitable for installation in dry form or in a slurry form.
- Shall not depend on the continuous presence of water to maintain its conductivity.
- Shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time.
- Shall be thermally stable between -100 C to +600 C ambient temperatures.
- Shall not dissolve, decompose or leach out with time.
- Shall not require periodic charging treatment nor replacement and maintenance.
- Shall be suitable for soils of different resistivity.
- Shall not pollute the soil or local water table and meets environmental friendly requirements for landfill, shall not be explosive & shall not cause burns, irritation to eye, skin etc. In this regard "Safety Data Sheets" shall be submitted by the manufacturers.

23.1 Earth Pit Cover

- An Earth Inspection pit cover is an inspection chamber used to give safety to an earthing arrangement and also provide an easy access to earth resistance testing.
- Earth Pit cover shall be made of Poly Plastic material.
- Earth pit cover shall be tested at 5 ton load.

23.2 ROUTINE AND COMPLETION TESTS

23.2.1 INSTALLATION COMPLETION TESTS

At the completion of the work, the entire installation shall be subject to the following tests:

- (a) Wiring continuity test
- (b) Insulation resistance test
- (c) Earth continuity test
- (d) Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

23.2.2 WIRING CONTINUITY TEST

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energised.

23.2.3 INSULATION RESISTANCE TEST

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 megohms divided by the number of points provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 11.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

23.2.4. TESTING OF EARTH CONTINUITY PATH

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

23.2.5. TESTING OF POLARITY OF NON-LINKED SINGLE POLE SWITCHES

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Architect/Engineer/DFCCIL as well as the local authorities.

23.2.6 EARTH RESISTIVITY TEST

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

23.2.7 PERFORMANCE

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

23.2.8 TESTS AND TEST REPORTS

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Architect/owners for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

SPECIAL INSTRUCTIONS TO TENDERERS

GENERAL

- Only the preferred makes of material as stipulated shall be accepted.
- For any fixtures and fittings required to be fixed to the RCC slab, the Contractor shall drill the required holes with the use of an appropriate drilling machine with drill bits and no extra charges shall be payable on this account.
- The rates quoted shall be for work to be carried out at all heights and levels as at site and no extra payment shall be made for the same.
- The rates quoted for wiring shall be applicable for concealed or surface conduiting as required

CONDUITING

The rates to be quoted by tenderers shall include any or all of the following. No additional costs shall be paid for tools etc. as required to complete the work.

- All cutting of chassis in brick walls shall be electric with chase cutting machine/ tools.
- Whenever required chases shall be cut in stone walls with a chase cutting machine and with specific tools as required prior to plastering.
- In case of exposed stone walls the conduits shall be laid alongwith the construction of the wall and coordinated with civil activity.

POINT WIRING

- The Point Wiring shall commence from the Distribution Board and shall include the circuit wiring of length as required via the switch to the fitting/socket outlet as called for unless otherwise specified.
- The rates for all point wiring shall include the supplying and fixing of:
 - (a) ISI approved & marked conduits.
 - (b) Conduit accessories conforming to IS
 - (c) MS draw, inspection and junction boxes.
 - (d) Zinc chromate passivated switch boxes, outlet boxes etc.
 - (e) All fixing accessories such as clips, brass screws etc.
 - (f) Embedding conduits and accessories in walls and floors etc during construction and/or cutting chases and making good as necessary in the case of concealed conduit work and/or providing and fixing saddles, hangers, stirrups etc. and grouting of the same as required for surface conduiting.
 - (g) Switches, wiring accessories and moulded cover plate as required.
 - (h) Painting all conduits, outlet boxes and junction boxes.
 - (i) Providing and fixing PVC connector at outlet box/junction box provided for light points.
 - (j) Providing PVC cover at outlet box/ junction box provided for light points.

24 <u>SWITCHES, OUTLETS AND ACCESSORIES</u>

All switches, socket outlets and other accessories shall be approved by the Owners prior to installation. The Contractor shall furnish samples of all materials within 7 days of the award of the work.

MAINS AND SUB-MAINS

The rate for all items shall include:

- (a) ISI approved & marked conduits.
- (b) Conduit accessories conforming to IS
- (c) MS draw, inspection and junction boxes.
- (d) Providing and fixing approved saddles, hangers, trays, etc., and grouting the same as required for exposed conduits.
- (e) Embedding conduits and accessories in walls and floors etc during construction and/or cutting chases and making good as necessary in the case of concealed conduit work and/or providing and fixing saddles, hangers, stirrups etc. and grouting of the same as required for surface conduiting.
- (f) Providing and fixing junction boxes with 3-mm thick Perspex sheet covers including painting covers on inner side to match the colour of the surrounding walls.
- (g) Effecting adequate and proper connections at termination.
- (h) Providing all fixing accessories such as clamping devices, nuts, bolts and screws.
- (i) Providing sealing compound thimbles, crimping etc., at joints and terminations as called for.

EARTHING

The rates for earthing items include:

- (j) All fixing accessories such as brass saddles, brass screws rawl plugs, etc.
- (k) Jointing by riveting/ soldering/ welding.
- (1) Cutting chases, holes and making good the same wherever required.
- (m) Effecting adequate and proper interconnections.
- (n) Excavation of earth, refilling, watering and ramming and making good as approved.

FIXING OF LIGHTING FIXTURES

The rates shall include the following:

- 1. All components that may be required to make the installation complete in all respects such as :
- a) Suitable length of down rod, hanger and connecting wires where called for. The Down rod shall be paid for separately on a running metre basis.
- b) Internal wiring between accessories.
- c) Wiring for connecting the fixtures to the point through connection blocks.
- d) All metal blocks to serve as base of fixtures.
- e) Bonding with earth wires.
- 2. Drilling holes in supports where required.
- 3. Fixing clamps, GI bolts and nuts, brass screws, saddles, rawl bolts and other fixing accessories as required.

24.1 DRAWINGS

General Arrangement drawings with constructional details shall be submitted to the Architects/ Engineer-in-charge for all Distribution Boards etc and their approval obtained prior to commencement of fabrication. Equipment shall not be accepted unless the drawings have been approved by the Architect/Engineer/DFCCIL. These drawings shall be prepared and submitted within one month of the award of work.

WIRES AND CABLES

ALL WIRES AND CABLES USED SHALL BE OF THE STIPULATED MAKE.

We confirm that the Special Instructions to Tenderers have been understood and our tender complies to the above in its entirety.

25. <u>MEDIUM VOLTAGE DISTRIBUTION BOARDS</u>

GENERAL

This section covers specification of DBs.

STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Miniature Air Circuit Breakers for AC circuits	IS 8828 : 1978
Degrees of Protection provided by enclosures for low voltage switchgear	IS 2147 : 1962
Code of Practice for installation and maintenance of switchgear not exceeding 1000 volts	IS 10118 : 1982
General requirements for switchgear and controlgear for voltages not exceeding 1000 volts	IS 4237 : 1982

26. <u>MINIATURE CIRCUIT BREAKERS</u>

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.
- The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.f.

- The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with H.R.C. fuse/PVC cable characteristic.
- Type test certificates from independent authorities shall be submitted with the tender.

27. FINAL DISTRIBUTION BOARDS

- Final distribution boards shall be flush mounting, totally enclosed, dust and vermin proof and shall comprise of miniature circuit breakers, earth leakage circuit breakers, neutral link etc as detailed in the schedule of quantities.
- The distribution equipment forming a part of the Distribution Boards shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and as per detailed specifications included in this tender document.
- The board shall be fabricated from 14 gauge CRCA sheet steel and shall have a hinged lockable spring loaded cover. All cutouts and covers shall be provided with synthetic rubber gaskets. The entire construction shall give a IP 42 degree of protection.
- The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulated throughout the length.
- All the internal connections shall be with either solid copper PVC insulated or copper conductor PVC insulated wires of adequate rating.
- All the internal connections shall be concealed by providing a hinged protective panel to avoid accidental contact with live points.
- All outgoing equipment shall be connected direct to the bus bar on the live side. The equipment shall be mounted on a frame work for easy removal and maintenance.
- The sheet steel work shall undergo a rigorous rust proofing process, two coats of filler oxide primer and final powder coated paint finish.
- All the circuits shall have an independent neutral insulated wire, one per circuit, and shall be numbered and marked as required by the Architect/Engineer/DFCCIL.
- A sample of the completed board is to be got approved by the architects/owners before commencement of supply and erection.

SHEET STEEL TREATMENT AND PAINTING

- Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.
- All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

NAME PLATES AND LABELS

• Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

ROUTINE AND COMPLETION TESTS

INSTALLATION COMPLETION TESTS

At the completion of the work, the entire installation shall be subject to the following tests:

- (a) Wiring continuity test
- (b) Insulation resistance test
- (c) Earth continuity test
- (d) Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

Drawings and Documentation

The contractor shall submit the following shop drawing before start of execution.

- (a) List of all types of components and equipments to be used.
- (b) Descriptive installation, operational, maintenance and trouble shooting write-ups and manuals and design study material.
- (c) Preparing of shop drawings based on Consultant basic layout drawings co-ordinating with other services such as Civil/Architectural, HVAC, Plumbing, Piping and Plant System Supplier and Electrification Contractors etc. and submit to the Engineer-in-Charge for approvals prior to commencing the work.

SPECIAL CONDITIONS OF ELECTRICAL WORK

- 1 GENERAL
 - 1.1 All electrical work shall be carried out in compliance with specifications given hereunder in this section and in compliance with Indian Standard Specification and Indian Electricity Acts and Rules in force. The works shall also conform to any special requirement of local State Electricity Board. In any case, the above mentioned rules, regulations etc are not in accord, the decision of the Architect/Engineer/DFCCIL regarding rules to be followed or manner of execution of work shall be final and binding.
 - 1.2 Work shall be executed through licensed electrical contractor approved by the Architect/Engineer/DFCCIL.

These Conditions of Contract shall be read in conjunction with the General Conditions of Contract, Special condition of Contract, Schedule of Quantities, Technical Specifications, Drawings and other documents relating to the work and shall have preference over laid down general conditions and specifications.

- 1.3 Notwithstanding the sub-division of the documents into these separate sections and volumes, every part of each shall be deemed to be supplementary and complementary to every other part and shall be read with and into the contract, so far as it may be practicable to do so.
- 1.4 The contractors shall mobilize and employ sufficient resources to achieve the detailed schedule within the broad frame work of the accepted methods of working and safety. The contractor shall provide

everything necessary for the proper carrying out of the work, including tools, plants and other materials.

- 1.5 No additional payment will be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedules even though the time schedule is approved by the Architect/Engineer/DFCCIL.
- 1.6 The work shall be executed as per the programme drawn or approved by the Architect/Engineer/DFCCIL and it shall be so arranged as to have full coordination with any other agency employed at site. No claim for idle labour shall be entertained nor shall any claim on account of the delay in the completion of the building work to be tenable except extension of time secured by the contractor as stated elsewhere.
- 1.7 The contractor shall permit free access and afford normal facilities and usual conveniences to other agencies or departmental workmen to carry out connected work or other work services under separate arrangements. The contractor will not be allowed any extra payment on this account.
- 1.8 All soil, filth or other matter of any offensive nature taken out of any trench, sewer drain, caspool or other place shall not be deposited on the surfaces, but shall at once be carted away by the contractor free of charge to a suitable pit or place to be provided by him.
- 1.9 The contractor shall provide all equipment, instruments labour and such other assistance required by the Architect/Engineer/DFCCIL for measurement of the work, materials etc.

2 Materials

2.1 All materials, equipments, fittings and fixtures used in electrical works shall conform to the BOQ attached as "Form 4". All material shall be new, sound and robust in construction and well finished. Surplus material after completion of work shall be taken back by the contractor and the cost shall be recovered if the advance payment has been made earlier by the Client.

Unless otherwise stated in the conditions of contract, samples of all materials, fittings and fixtures to be supplied by the contractor shall be submitted to the Architect/Engineer/DFCCIL for approval. The contractor shall not commence the work until the samples are approved, in writing from the Architect/Engineer/DFCCIL. The contractor shall ensure that all the materials incorporated in the work are identical in all respects with the approved sample. The samples not destroyed in testing shall be returned to the contractor after completion of contract. No payment shall be made for samples destroyed in testing.

3 Drawings

The drawings, specifications and bill of quantities shall be considered as a part of this contract. Any work or materials shown on the drawings but not included in the schedule of quantities or vice versa, shall be executed as if specifically called drawings indicate the extent and general arrangement of various equipments and their wiring etc and are essentially diagrammatic. The work shall be installed if found essential to coordinate the installation of this work with other trades shall be made without any additional cost to the Client. The data given herein and on the drawings is as could be secured, but its complete accuracy is not for the assistance and guidance of the contractor, the exact locations, distance and levels will be governed by the space conditions. The contractor shall be responsible to check exact location of all electrical outlets, the routes and lengths of cables etc.

4. Clarifications of Discrepancies

In case of any discrepancy between specifications and drawings etc furnished by the Consultant or disputes in respect thereof, the interpretation of Engineer/DFCCIL shall be final and binding.

5. Work and Workmanship

The work shall be of the highest standard and confirm to the technical specifications both as regard its design and workmanship. Modern tools and first class, latest techniques shall be employed for its execution.

Any damage done to the building during the execution of work shall be responsibility of the contractor and it shall be made good by him, at his cost, to the entire satisfaction of the Engineer/DFCCIL.

All electrical work shall be executed by skilled and duly licensed electricians under the direct supervision of whole time, fully qualified Electrical Engineers and Supervisors. The contractor shall produce requisite evidence regarding the qualifications of his Engineers, Supervisors and other workers.

The contractor shall possess all the relevant and valid licenses as per the regulations as per the regulations of the Indian Electricity Rules and the Local Electrical Inspector's requirements.

The work shall have to be coordinated with the building work and other allied jobs/ trades to the entire satisfaction of the Architect/Engineer/ DFCCIL.

6. Certificate of Inspection

The contractor shall be responsible for getting the installation inspected and approved by the Electrical Inspector and other local electric supply company as required.

The contractor shall obtain and deliver to the Owner the certificate of final inspection and approval of the local electrical authorities concerned. The inspection fees etc shall be borne by the contractor which shall be reimbursed by the client on producing documentary proof.

In case of any defects are pointed out by the Electrical Inspector, the contractor shall remove these defects at his own cost and arrange for reinspection or inspection by the Electrical Inspector, till such time the installation is finally approved and the required certificate is issued. The contractor shall bear all expenses and deposit the necessary fees for subsequent inspection by the Electrical Inspector.

The Consultant/Engineer/DFCCIL shall have full powers to get the material or workmanship etc inspected and tested by an independent agency, at the contractor's expenses in order to ascertain their soundness and adequacy.

7. Miscellaneous

A site order book will be maintained at site which will be in the custody of the Engineer/DFCCIL or his representative and all instructions given to the contractor will be recorded in the site order book and the same has to be signed by the contractor to comply with the instructions given therein.

After completion of the work the whole installation shall be tested by the contractor in the presence of the Architect/Engineer/DFCCIL. The tests shall comply the following I.E.E. Regulations and shall be submitted alongwith the final bill.

- (a) The result of the insulation test shall comply with the I.E.E. Regulations 1101 to 1108A and 1008B as may be applicable.
- (b) Test shall be carried out to ascertain that all the non-linked SP switches have been connected to the phase conductor.
- (c) The continuity test of the earthing system shall comply with I.E.E. Regulations 1108 to 1109 to the latest addition.

If the result of the above tests does not comply with the I.E.E. Regulations, the contractor shall be bound to rectify the faults so that the required results are obtained.

The contractor shall be responsible to provide all the necessary testing instruments, such as magger insulation tester, earth tester multi-meter, AVO meter etc for carrying out the above tests.

The work will not be considered as complete and taken over by the employer till all the components of the work after being completed at site in all respects have been inspected/tested by the Architect/Engineer/DFCCIL to his entire satisfaction and a completion certificate issued by the Engineer/DFCCIL to this effect.

Shop drawing for electrical work e.g. equipment, cable earthing and conduit layout for all systems shall be prepared by the contractor and got approved before starting of the work.

At the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit 6 sets of drawing and two tracing of each drawing and 2 Nos. soft copies CDs to Client of each layout drawings drawn at approved scale indicating the complete conduit wiring/cabling/earthing as installed. The contractor will submit within 15 days of the award of work, a detailed schedule of programme of work.

8. **Preamble to schedule of quantities:**

Tender shall be on the basis of item rates which shall include the cost of materials, labours, all taxes, duties and all other services required for the complete installation, testing and commissioning in accordance with the relevant NEC/IER and code in practice including the fees for inspection together with the liabilities and obligations as detailed in the general conditions of contract. It will also be the responsibility of the tenderer to obtain all types of sanctions etc like power/light connections and the drawings etc if any, required by the concerned local authorities.

Prices shall remain firm and free from variation due to rise and fall in the cost of materials and labours or any other price variation whatsoever whether during extended period of completion, if any. Item rates shall remain valid for any variation in the estimated quantities given in schedule of quantities.

In order to facilitate the technical scrutiny of the various quotations, the tenderer must supply with their quotations detailed technical particulars make catalogues and erection drawings for various items under different parts specified in the schedule of quantities.

Power supply shall be 3 phase, 4 wire, 415 and single phase 230 volts A.C. and frequency of 50 cycles per second. All consuming devices shall be suitable for voltage and frequency mentioned above.

The drawing and specifications lay down minimum standard of equipment and workmanship and the deviations. In the absence of any deviations, it will be deemed that the tenderer is fully satisfied with the intents of the specifications and drawings and their compliance with the statutory and fire insurance

provisions including local codes, where the drawings and specifications conflict, the more stringiest shall apply.

All equipments and the installations shall be tested as specified and a test certificate in the prescribed form as required by the local supply authorities shall be furnished.

The entire installation shall be guaranteed against defective materials or workmanship for a period of 18 months from the take over by the Client. During the guarantee period all the defects shall be rectified by the contractor free of cost.

The successful tenderer shall submit the shop drawings for wiring LT boards, distribution boards and any other to the Consultant for approval prior to start the work. The approval of these drawings will be general and will not absolve the contractor of the responsibility of the correctness of these drawings. Atleast 6 copies of the approved drawings shall be supplied to the Consultant for their distribution to the various agencies at site at no cost to the Client.

The position of distribution boards and switch boards may require some minor adjustments due to either site requirements or change in structural layout. All such changes from the position, shown in the drawings, shall be required to be incorporated without any extra payment or deduction for change in length of wiring etc.

The tenderers must see the site conditions and take all the aforesaid and foregoing factors while quoting the rates, as no extra will be allowed on any ground arising out of or relating to the aforesaid and foregoing.

In single phase (230 V) A.C. supply system circuit wires of same phase shall be drawn in same conduit. For 3 phase, 4 wire wiring system wires of different colour shall be used and for insulated neutral only black colour wire shall be used.

The Contractor shall include in his rates for painting with three coats of synthetic enamel paint to match the surroundings or as directed by the Architect/Engineer/DFCCIL for all down rod hangers pertaining to light fixtures, fans, steel structure used for electrical work at no extra cost.

The contractor shall supply completion drawings of the entire installation as well as three prints of each drawing showing the complete wiring diagram as executed at site drawn to scale after the completion of work but before completion certificate.

After laying and jointing the cables shall be subject to necessary tests as stipulated in IS:5959 (Part-I): 1970.

All samples of all electric fittings and other accessories shall be approved by the Architect/Engineer/DFCCIL prior to their installation.

No alteration whatsoever is to be made to the text of quantities of this schedule of quantities, unless such alteration is authorised in writing. Any such alteration or addition shall, unless authorised in writing, be dis-regarded when tender documents are considered.

Any error in description or in quantity or omission of items from the contract shall not vitiate this contract but shall be corrected.

All measurements shall be taken in accordance with the Indian Standard Electrical Installation in buildings method of measurements of IS:5908:1970, unless otherwise specified.

The contractor shall provide, within one month after completion of the work or alongwith the final bill, three sets of manuals properly bound which shall contain the following information:

- (a) Description of installation items using main items of equipments.
- (b) Description of all equipments and system operation with trouble shooting manuals.
- (c) Line diagram of each system including main feature of equipments and showing method of setting controls.
- (d) Method of fault finding, routine, adjustment and wiring diagram.
- (e) Description of routine maintenance, oil and greasing points and recommended lubricants.
- (f) Manufacturer service manuals for all equipments.
- (g) Spares reference manuals.
 - The contractor shall provide the following at no extra cost to the Client:
- (a) Danger Notice Boards
- (b) Treatment for electric shock giving details of FIRST AIR TREATMENT with chart diagrams (mounted in suitable frame).
- (c) Line wiring diagrams of the electrical system mounted in suitable frame.

The contractor will remove all the debris and surplus earth from work site (belonging to his work) free of cost.

9. TESTING OF INSTALLATION

9.1 General

Inspection and testing of the installation shall be carried out as per Section 10 Part-I of the National Electrical Code 1985 such as:

- (a) Insulation resistance and wiring continuity test.
- (b) Earth resistivity and continuity test
- (c) Test of polarity of non linked single pole switches.

Besides the above any other test specified by the Local Authorities shall also be carried out by the contractor.

All tested and calibrated instruments for testing, labour, materials and incidentals necessary for conducting the test shall be arranged by the contractor at his own cost.

9.2 Insulation Resistance Test

The insulation shall be measured between the earth and whole system of conductors or any section there of with all fuses in place and all switches closed except in concentric wiring, all lamps in position or both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 660 volts for medium voltage circuits.

Where the supply is derived from the 3 wire (AC or DC) or from a poly phase system. The neutral pole of which is connected to earth, either direct or through added resistance. The working pressure shall deemed to be that which is mentioned between the phase conductor and the neutral.

The insulation resistance measured as above shall not be less than 50 divided by the number of points on the circuit provided that the whole installation shall not be required to have an insulation resistance greater than one megohm.

The insulation resistance shall also be measured between all conductors connected to one pole or phase conductor of the supply and all the conductor connected to the middle wire or the neutral or to the other pole or phase conductor of the supply and its value shall not be less than that specified in above clause.

9.3 Testing of Earth Continuity Path

The earth continuity conductor including metal conduit and metallic envelopes of cables in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earth lead but excluding any added resistance or earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

9.4 Testing of Polarity of Non-Linked Single Pole Switches

In a two-wire installation the test shall be made to verify that all non-linked single pole switches have been fitted in the same conductor through out and such conductor shall be labelled or marked for connected to outer or phase conductor or to the non earthed conductor of the supply.

In a three wire or a four-wire installation a test shall be made to certify that every non-linked single pole switch is fitted in a conductor which is labelled or marked for a connection to one of the outer or phase conductor of the supply.

9.5 Load Balancing Tests

After satisfactory completion of the project the contractor has to check balancing of loads by actual measurements for lighting loads only.

TECHNICAL SPECIFICATIONS FOR PLUMBING WORKS

(SECTION-5)

SECTION-I: BASIS OF DESIGN

1. **BASIS OF DESIGN**

The internal Plumbing, Sanitary, Drainage System for the project is designed keeping in view the following:

- 1.1 Requirement of adequate and equal pressure availability of hot and cold water lines in public/common toilets and kitchen (sinks) will be already installed.
- 1.2 Adequate storage of water in underground raw and treated domestic water tanks, already exist at the site. The works execution and materials used shall be as per the latest relevant I.S. specifications.

Wherever reference has been made to International Standards or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or in Schedule of Quantities.

2. CONCEPT OF THE SYSTEM

The following services are envisaged for the tender:

- 2.1 Soil/waste & water supply lines are already exist at the fixture level.
- 2.2 All sanitary items to be supplied & installed considering drawings & site conditions.
- 2.3 The Contractor shall visit the site and shall satisfy himself as to the conditions under which the work is to be performed. He shall also check and ascertain the location of any existing structure or equipment, or any other situation which may affect the work. No extra claim as a consequence of ignorance or on ground of insufficient description will be allowed at a later date.

3. PLUMBING/SANITARY WORKS:

3.1 **GENERAL:**

- 3.1.1 The work shall be carried out in the accordance with the drawings and design as would be issued to the Contractor by the Architect/Design Consultant.
- 3.1.2 The work shall be executed and measured as per metric dimensions given in the Bills of Quantities, drawings etc.
- 3.1.3 The Contractor shall acquaint himself fully with the partial provisions for supports that may or may not be available in the structure and if they are available then he utilize them to the extent possible. In any case the Contractor shall provide all the supports regardless of provisions that they have been already made. Nothing extra shall be payable for situations where insert plates (for supports) are not available or are not useful.
- 3.1.4 Shop coats of paint that may be damaged during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.

- 3.1.5 The Contractor shall protect/handle the material carefully and if any damage occurs while handling by the Contractor then the sole responsibility shall be of the Contractor. Such damages shall be rectified/ recovered by the Contractor at no extra cost whatsoever.
- 3.1.6 The Contractor shall, where applicable, complete the submission of shop drawings to the Architect/Engineer/DFCCIL for approval in order to conform to the contract schedule.

3.1.7 Measurements: All measurements shall be taken in accordance with relevant codes, unless otherwise specified.

4. SANITARY FIXTURES & PIPE FITTINGS

4.1 **SCOPE:**

Work under this section shall consist of transportation, furnishing, installation, testing and commissioning and all labour as necessary as required to completely install all sanitary fixtures, brass and chromium plated fittings, and accessories as required by the drawings and specified hereinafter or given in the Bills of Quantities.

4.2 General Requirements

All fixtures and fittings shall be fixed with all such accessories as are required to complete the item in good working condition, whether specifically mentioned or not in the Bills of Quantities, specifications, and drawings.

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per architectural design requirements. Wherever necessary the fittings shall be centered to dimensions and patterns desired.

Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required as per directions of Architect/Engineer/DFCCIL.

All fittings and fixtures shall be fixed in a neat workmanlike manner true to levels and heights shown on the drawings and in accordance with the manufacturers' recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, wall or ceiling surfaces, shall be made good at Contractor's cost.

All fixtures of the similar materials shall be by the same manufacturers.

All fittings shall be of chromium plated materials.

Without restricting generally to the foregoing, Sanitary Fixtures shall include all sanitary fixtures, C.P. fittings, and accessories etc. necessary and required for the building.

Whether specifically mentioned or not, all fixtures and appliances shall be provided with approved fixing devices, nuts, bolts, screws, hangers, etc. as required. These supports shall have the necessary adjustments to allow for irregularities at the construction site. For the installation of the CP fittings, Teflon tape shall be used.

4.3 **EUROPEAN W.C:**

European W.C. of glazed vitreous china shall be wash down, single or double siphonic type, floor or wall mounted set, flushed by means of flush valve as specified in the Bills of Quantities. Flush pipe/bend shall be connected to the W.C. by means of suitable rubber adopter. Wall hung W.C. shall be supported by C.I. floor mounted chair.

Each W.C. seat cover shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C. Seat cover shall be of white solid plastic, elongated open front with heavy duty hinges. Exposed fixture trims shall be Chrome plated, and trims of similar function shall be by the same manufacturer.

Flush valves shall be of the best approved quality procurable with C.P. control valve and C.P. flush pipe.

The flush pipe/bend shall be connected to the W.C. by means of a suitable rubber adopter.

4.4 **FLUSHING CISTERN:**

Alternatively flushing cistern to be used shall conform to the requirements. High level cisterns shall be of cast iron unless otherwise specified. Low level cistern shall be of the same material as the water closet or as instructed by the Architect/Engineer/DFCCIL. The cisterns shall be mosquito proof & shall fulfill the requirements of the local Authority.

The levels of the W.C. should be checked by placing sprit level on the W.C. W.C. should be tested on completion of fixing by putting small paper balls and flushing out. If all the paper balls are not flushed out. The fixing will have to be rectified / re-aligned.

4.5 **URINALS:**

Half stall wall hung urinals of glazed vitreous china shall be provided with 15mm dia. C.P. brass spreader, 32mm dia. C.P. domical waste, and C.P. cast brass bottle trap with pipe and wall flange, and shall be fixed to wall by one C.I. bracket and two C.I. clips as recommended by manufacturers and as directed by the Architect/Engineer/DFCCIL.

Urinals shall be flushed by means of "NO-TOUCH" infrared operated flush valves.

Waste pipes for urinals shall be any one of the two below given materials and as directed by the Architect/Engineer/DFCCIL:

- G.I. Pipes
- Rigid PVC/High density polyethylene.

Waste pipes may be exposed on wall or concealed in chase as directed by the Architect/Engineer/DFCCIL.

4.6 URINAL PARTITIONS:

Urinal partitions shall be white glazed vitreous china, marble, granite or any other material selected by the Architect/Engineer/DFCCIL.

Urinal partitions shall be fixed at proper heights with C.P. brass bolts, anchor fasteners, and M.S. Clips as recommended by the manufacturer and directed by Architect/Engineer/DFCCIL.

4.7 WASH BASINS:

Wash basins shall be of white vitreous china of best quality manufactured by an approved firm and sizes, and as specified in the list of makes.

Wash basin shall be of table top / under counter drop in type shall be supported on a pair of rolled steel brackets of approved design and shall be mounted on a countertop so that rim and basin bowl are exposed from top.

Wash basin shall be provided with chromium plated brass bottle trap of approved quality, design and make, where hot water required. Single tap where hot water is not required.

Wash basin shall be fixed at proper location and height and truly horizontal as shown on drawing or as directed by Architect/Engineer/DFCCIL.

4.8 **BOTTLE TRAPS**

Bottle trap (for wash basins, sinks, urinals etc.,) shall be deep seal (minimum 60mm water seal) cast brass Bottle, heavy chromium plated. All bottle traps shall be provided with suitable cleaning eye, extension Piece, flare nuts, all chromium plated. Bottle traps shall be of approved make and design. Traps for washbasins, urinal and sinks shall be 32mm

4.9 **PILLAR COCK / BASIN MIXTURE**

As per OEM (Original Equipment Manufacturer) / Manufacturer's standards.

Wash basin shall be provided with single lever mixer where hot water required. Pillar cock where hot water is not required.

4.10 **SINKS**:

Sinks shall be of stainless steel material as specified in the Bills of Quantities/Drawings.

Each sink shall be provided with R. S. brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be provided with 40 mm dia. Chromium Plated waste with chain and plug or P.V.C. waste with Escutcheon plates. Fixing shall be done as directed by Architect/Engineer/DFCCIL.

Supply fittings for sinks shall be mixing fittings or C.P. taps, angle cocks etc. all as specified in the Bills of Quantities/Drawings.

4.11 SINK BIB COCK / SINK MIXTURE

These shall be chromium plated brass heavy quality and shall be easy type with capstan head. The size shall be as specified in the Bills of Quantities.

Supply fittings for sinks shall be mixing fittings where hot water required or long body bib cock where hot water is not required, all as specified in the Bills of Quantities/Drawings.

4.12 HEALTH FAUCET/SPRAY

A chromium plated spray with integral hand control valve and connected to a flexible pipe and angle valve with wall flange and hook are fixed as shown on the drawings or as directed by the Architect/Engineer/DFCCIL. The angle valve and flange shall be paid under relevant item.

4.13 ANGLE VALVE

As per OEM (Original Equipment Manufacturer) / Manufacturer's standards.

4.14 HOSE CONNECTION

As per OEM (Original Equipment Manufacturer) / Manufacturer's standards.

4.15 **2 WAY BIB TAP**

These shall be chromium plated brass heavy quality of "EGO" type or equivalent, and shall be easy type with capstan head. The size shall be as specified in the Bills of Quantities.

5.0 **ELECTRICAL WATER HEATER:**

The Electric Water Heater shall be a complete package unit ready for plumbing and electrical service conditions. It shall be insulated with heavy duty 50 mm thick fiberglass blanket insulation and high gloss enamel finish outer shell. Electric Heating Coil rating and storage capacity shall be as shown on drawings.

Vertical pressure type electric water heaters shall be suitable for a minimum working head of 10 bars.

Construction: Inner containers shall be coated with glass, fused to steel at 870°C. This glass should provide corrosion resistance for steel.

Elements brazed to detachable brass heater plate, the whole being easily replaceable when required.

Heating elements constructed of a nickel chromium resistance wire, sheathed in a mineral filling, the whole being encased in a copper tube and subjected to a high voltage test of 1750 volts. Heater shall be supplied with adjustable setting thermostat including high temperature safety cut-out and over-pressure relief valve, drain point, electrical point, temperature indication, pilot indication, and necessary ancillaries.

SECTION-II: SOIL, WASTE VENT & FITTING

1 Noise Insulated Piping System

1.1 SOCKET PIPES

Three Layer sound insulated Polypropylene piping (PP) system as per ON EN 1451-Part 1-6 & EN 12056 Part 1-5 with 3 layer pipe made of PP-C + PP-MV + PP-C in Blue Ral 5014 (halogen and calcium free) colour, push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 21 dBA with POLO clip HS/ 22 dBA with Bismat 2000 clamp /equivalent and 16 dBA with Bismat 1000 clamp/equivalent as per DIN 4109 at a flow rate of 4 l/s and having pipe ring stiffness as per 1S0/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density = 1.25gms/cm3,

elongation = 0.05 mm/m0K and tensile strength > 24 N/mm2, with all necessary fittings in blue colour, fitted with factory fitted lip ring, having 3 layers, pipes to be painted with ordinary cement paint for external installation:

> INTERNAL LAYER:

Of PP-C, hot water resistant to 97 degree C, tested in accordance to ON EN 1451-1 and DIN 19560, good heat and corrosion ageing stability as well as high chemical resistance and a smooth pipe inner-surface.

Color: Blue (halogen and calcium free)

> INTERMEDIATE LAYER:

Of PP-MV compound reinforced with mineral aggregate, which guarantees greater stiffness and stability.

Color: Grey.

EXTERNAL LAYER:

Of PP-C. With high impact resistance and good weathering resistance.

Color: Blue (halogen and calcium free)

1.2 **PIPE RING STIFFNESS:**

Pipe ring stiffness would be in accordance with IS0/DIS 9969 and TIGHTNESS as per EN 1277/B and C and DIN 19560.

1.3 MARKINGS:

All pipes shall carry the following markings: Batch number; year and week of manufacture; company name; dimension application class; stiffness class, test mark and material details.

1.4 **FITTINGS:**

Single- Layered fitting reinforced with mineral aggregate, made of a Halogen free PP-C-KV synthetic material, a reinforced wall and factory fitted lip ring, hot water resistant upto95 degree C in accordance to ON EN 1451-PART 1-6 EN 12056 PART 1-5.Color: Blue (halogen and calcium free)

1.4 **INSTALLATION:**

The piping system must be clamped properly as required, pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material internally (between pipe and sleeve) covering the pipe to avoid transfer of body and structural borne sounds (refer manufacturer's installation guide lines). The piping must not touch any wall, structure, paneling, false ceiling etc.

Minimum supporting:

Nominal outer diameter	Bracket distance		
DNOD	Horizontal pipe routing")	Vertical pipe routing")	
mm	D max. m (max. 15 x da)	D max. m	
32	0,5	1,50	
40	0,6	1,50	
50	0.75	1,50	
75	1,10	2,00	
90	1,35	2,00	
110	1,65	2,00	
125	1.85	2.00	
160	2,40	2,00	
200	3,00	2,00	
25/3	3.00	2.00	

2.0 Traps

2.1 Floor Traps

Floor traps where specified shall be siphon type full bore PP (WHITE), having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

2.2 Urinal Traps

Urinal traps shall be siphon type full bore PP (WHITE), having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

2.3 Cleanout Plugs

Floor Clean Out and line clean out plugs

Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, "Y" and on straight runs at such intervals as required as per site conditions. Clean out plugs shall terminate flush with the floor levels. Line clean outs shall be supported with manufacturer provided bracket. They shall be of push fit type.

- 3.0 Drainage under floor/above floor (service floors, basement ceiling etc.)
- 3.1 All drainage lines passing under building, in exposed position above ground e.g. service floors, basement ceiling etc. shall be Multilayered as per details given in sub-clause 3.10 above or shall be as per details given below. Position of such pipes shall generally be shown on the drawings.

3.2 SOCKET PIPES

3 layer technology Polo-Eco Plus Premium 10 pipes and fittings for underground/misc. drainage applications having external layer of PP-Blend + mineral reinforcement, supporting layer of PP + magnesium silicate and internal in PP with chemical resistance between 2-13pH and ring rigidity of =/> 10kN/m2 having OFI certification for longitudinal stability & impermeability of pie connection in line with EN 14741.

3.3 **FITTINGS**

3-layered reinforced polypropylene (PP) sewage pipes, halogen and lead free, with integral push-fit socket and factory-fitted lip ring, tested and monitored according to the Product Standard EN 1852 – 1. Fittings upto dimension DN/OD 200 are manufactured by injection molding (1-layer), above DN/OD 200 (250 and above)the fittings are butt or extrusion welded by the manufacturer. Fabrication of fittings at site shall not be permitted.

3.4 **Pipe Joints**

Field-proven push-fit connection with improved and modified lip ring of high ageing-resistant shall be provided with the pipes and fittings for easy push-fit installation, installation procedure as given in clause 3.10 above shall be followed.

4.0 Air Admittance Valves (AAV)

Air admittance valves shall be made in ABS/PVC capable of operating at temperatures between 0 degree c and 60 degree c. The AAV shall be of suitable flow rate and installed in main discharge stacks and / or branches. Design based on air flow capacity required in proportion to the discharge unit capacities. The vendor is to supply data sheet showing relevant calculations and drawings indicating location and type of AAV as required.

AAV's to have following performance parameter:

- Temperature range: -20 degree Celsius to 60 degree Celsius.
- Open pressure: -70 pa (-0.010 psi)
- Max. Pressure rating tightness: 10,000 pa (1 m/40" h2o) at 0 pa or higher

5.0 SS GRATING

Floor gratings shall be hinged type cast/ sheet stainless steel with matching recessed rim. Each grating will be provided with a cockroach trap. Each floor drain shall be provided with a specially fabricated sheet metal stainless steel double anti-cockroach internal grating to prevent ingress of cockroaches inside the building.

SECTION-III: RAIN WATER PIPES & FITTINGS

RAIN WATER PIPES

All open terraces shall be drained by rain water down takes.

Rainwater down takes are separate and independent of the soil and waste system and will discharge into the open ground Storm water Drainage system of the Complex.

Rain water in open courtyards shall be collected in catch basins and connected to the storm water drainage line.

PVC Pipes & Fittings

Pipes and fittings shall be uPVC. All pipes shall be straight and smooth as specified in Schedule of Quantities.

Pipes and fittings for main vertical stacks and branches 110 mm. & 160 mm. dia., shall be RainwaterSystem known in the short form as drainage system with injection moulded fittings and approved type of socket & 'O' rubber ring joints.

Joints shall be done as per the manufacturer's recommendations. The pipes and fittings must have matching dimensions for perfect joints in the system. 'O' ring fittings must have sufficient gap (approx. 10 mm.) for thermal expansion of pipes.

PVC pipes shall be clamped to the wall with approved type saddle clamps/U clamps and G.I. rod fixed to the angle iron support system within the shaft.

Use proper uPVC pipe adapters for connections between traps & uPVC pipes where necessary. Such joints shall be made of an approved type of 'Putty'.

MEASUREMENT:

Sanitary fixtures shall be measured by numbers.

Rates for all items mentioned above shall be inclusive of cutting holes and chases and making good the same, stainless steel screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning.

Engineer/DFCCIL decision with respect to the correct interpretation regarding mode of measurement shall be final and binding on the contractor.

SECTION- IV: WATER SUPPLY SYSTEM

Scope of work

Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified here-in -after and given in the Schedule of Quantities.

Without restricting to the generality of the foregoing, the water supply system shall include the following:-

Distribution system from main supply headers to all fixtures and appliances for cold & hot water. Cold water supply lines from city water connections to Under Ground Water Tank. Garden irrigation system Excavation and refilling of pipes trenches. Pipe protection and painting. Control valves, masonry chambers and other appurtenances. Connections to all plumbing fixtures, tanks, appliances and municipal mains Inserts for R.C.C. tanks

General requirements

All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Architect/Engineer/DFCCIL.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.

Pipes shall be fixed in such a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified.

Clamps, hangers and supports on RCC walls, columns & slabs shall be fixed only by means of approved made of expandable metal fasteners inserted by use of power drills.

All pipe clamps, supports, nuts, bolts, washers shall be galvanised MS steel throughout the building. Painted MS clamps & MS nuts, bolts & washers shall not be accepted.

Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

Water Supply System

Contractor should study the site plan and the water supply systems including one for domestic water supply.

Source Water supply will be acquired from Municipal Corporation water mains (as available) to a service connection and collected in water storage tanks located underground.

The system has been connected to a gravity feed system from overhead tanks to all parts of the building

It is proposed to provide flushing cistern for all WCs. Infrared NO-TOUCH flush valves shall be provided for Urinals. These will be fed from overhead tank by gravity.

Domestic water supply shall be provided with cold water system only. Hot water provisions to kitchen and all toilets connected to a local electric hot water storage geyser other than add on solar system at terrace for inlet of geyser in kitchen etc.

(CPVC) G.I. pipes & fittings

All pipes inside the buildings for domestic hot and cold water supply shall be CPVC conforming to CTs SDR-13.5 at a working pressure of 320 PSI at 23 deg.C. and 80 PSI at 82 deg.C.

Solvent welded CPVC fittings etc. tees, elbows, couplers, unions, reducers, brushing etc. including transition fittings (connection between CPVC and metal pipes/G.I. ie. Brass adopters conforming to ASTM D-2846) shall be provided.

All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. G.I. pipes inside toilets shall run above false ceiling with vertical drop in wall chases for all fixtures. No pipes to run inside sunken floor as far as possible. Pipes may run under the ceiling or floors and other areas as shown on drawings.

Joining Pipes & Fittings

Cutting

Pipes shall be cut either with a wheel type plastic pipe cutting or hacksaw blade and care shall be taken to make a square cut. All burrs should be removed for proper contact between pipe and fittings during jointing.

Solvent Cement Application

Only CPVC solvent cement conforming to ASTM-F-493 should be used for joining pipe with fittings. An even coat of solvent cement should be applied on the pipe end and a thin coat inside the fitting socket.

Assembly

After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 30 seconds, and rotating the pipe ¹/₄ to ¹/₂ turn while inserting so as to ensure even distribution of solvent cement with the joint. The assembled system should be held for 10 seconds (approximately) in order to allow the joint to set up.

Testing

The system should be hydrostatically pressure tested at 150 psi (10 Bar) for one hour. During pressure testing, the system should be fitted with water and if a leak is found, the joint should be cut out the replaced with new one.

Transition of Flow guard CPVC in metals

When making a transition connection to metal threads, special brass/plastic transition fitting (Male and female adapters) should be used. Plastic threaded connections should not be over torque.

Threaded sealants

Teflon tape shall be used to make threaded connections leak proof.

Solvent Cement

Only CPVC solvent cement conforming to ASTMF 493 should be used for joining pipe with fittings and valves.

Hangers and supports

For horizontal runs, support should be given at 90 cm. intervals for diameters of 25mm. and below and at 1.2 m. intervals for larger sizes.

Supports should be as per the below mentioned table: (Change sizes into mm.)

Size of pipe	20°C	49°C	71°C	82°C
Inch (mm)	Ft. (mm)	Ft. (mm)	Ft. (mm)	Ft. (mm)
¹ /2" (15mm)	5.5 (420mm)	4.5 (340)	3.0 (230)	2.5 (190mm)
³ / ₄ " (20mm)	5.5	5.0 (380)	3.0	2.5
1" (25mm)	6.0 (460mm)	5.5	3.5 (270)	3.0
1¼" (32mm)	6.5 (500mm)	6.0	3.5	3.5
1¼" (40mm)	7.0 (530mm)	6.0	3.5	3.5
2" (50mm)	7.0	6.5	4.0 (305mm)	3.5

Please confirm above physical (mm) dimensions in practice

Anchor Fasteners

All pipe supports, hangers and clamps to be fixed on RCC walls, beams, columns, slabs and masonry walls 230mm. thick and above by means of galvanised expandable anchor fasteners in drilled holes of correct size and model to carry the weight of pipes. Drilling shall be made only by approved type of power drill as recommend and approved by manufacturer of the anchor fasteners. Failure of any fastening devices shall be the entire responsibility and contractor shall redo or provide additional supports at his own cost. He shall also compensate the DPL for any damage that may be caused by such failures.

Unions

Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock, or check valve and on straight runs as necessary at appropriate locations as required and/or directed by Architect/Engineer/DFCCIL.

Flanges

Flanged connections shall be provided on pipes as required or where shown on the drawings, all equipment connections as necessary and required or as directed by the Architect/Engineer/DFCCIL. Connections shall be made by correct number and size of GI nuts, bolts & washers with 3mm thick gasket. Where hot water connections are made insertion gasket shall be of suitable high temperature grade and quality approved by the Architect/Engineer/DFCCIL. Bolt hole dia. for flanges shall conform to match the specification for C.I. sluice valve and C.I. butterfly valve.

Trenches

All water supply pipes below ground shall be laid in trenches with a minimum cover of 60 cms. The width and depth of the trenches shall be as follows:-

Dia. of pipe	Width of trench	Depth of trench
15 mm to 50 mm	30 cm	75 cm
65 mm to 150 mm	45 cm	100 cm

Sand filling

G.I. pipes in trenches shall be protected with fine sand 15 cms all round before filling in the trenches. Painting (Painting for CPVC pipes not required)

All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard colour code given in this document or specified by Architect/Engineer/DFCCIL.

Pipe protection (Protection for CPVC pipes not required)

All G.I. pipes in wall chase /below floors or laid under-ground shall be protected against corrosion by the application of two coats of bitumen paint covered with polythene tape and a final coat of bitumen paint.

G.I. waste pipes buried in ground or sunken slab shall be protected with multilayer bitumen membrane tape 3mm thick with a final coat of hot or cold applied bitumen.

Ball Valves

Valves upto 40 mm dia. shall be screwed type Ball Valves with stainless steel balls, spindle, teflon seating and gland packing tested to a hydraulic pressure of 20 kg/cm2, and accompanying couplings and steel handles.(to BS 5351)

Butterfly Valves

Valves 50 mm dia and above shall be cast iron butterfly valve to be used for isolation. The valves shall be bubble tight, resilient seated suitable for flow in either direction and seal in both direction with accompanying flanges and steel handle.

Motorised Water Valve:

The Motorized Water Valve shall consist of gunmetal valve body with stainless steel trim and equal percentage flow characteristics, modulating motor and linkage.

Testing

All pipes, fittings and valves after fixing at site, shall be tested by hydrostatic pressure of 1.5 times the working pressure or 10 kg/cm2 whichever is more.

Pressure shall be maintained for a period of at least thirty minutes without any drop.

A test register shall be maintained and all entries shall be signed and dated by Contractor (s) and Engineer/DFCCIL.

In addition to the sectional testing carried out during the construction, Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all

leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and fixtures shall be made good by the Contractor during the defects liability period without any cost.

After commissioning of the water supply system, Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.

Measurement

CPVC or G.I. pipes above ground shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends, elbows, unions, flanges and U clamps with nuts, bolts & washers fixed to wall or other standard supports.

Jointing with teflon tape, white lead and insertion gasket of appropriate temperature grade. Cutting holes, and chases in walls, floors, any pipe support required for pipes below ground & making good the same. Excavation, back filling, disposal of surplus earth and restoring the ground & floor in original condition.

Pipe Supports.

Fabricated and galvanised supports shall be measured by weight. Weight for each type of clamp shall be calculated on basis of the quantity of structural and MS used from the theoretical weight calculated on basis of the components theoretical weight of the sections.

Rate quoted for supports & hangers shall be inclusive of:-Expandable anchor fastens. Galvanising of all supports & hangers. Cutting holes in walls, ceilings on floors and making good where permitted. Nuts, bolts and washers for fixing and assembling. Wooden/PVC pipe saddles for vertical or horizontal runs.

5 LAYER TECHNOLGY, having:

- 1st layer of specially stabilized PP-r of UV protection.
- 2nd and 4th layer of HPCE glass fibre compound for greater stability and a 75% lower linear expansion as compared to single layer pipes.
- 3rd and 5th layer of PP-RCT provides high temperature stability and improved long term resistance.

AVAILABLE IN SIZES: 20MM TO 63MM.

TECHNICAL SPECIFICATIONS FOR FIRE FIGHTING WORKS (SECTION-6)
Section I Hand Appliances

1 Scope of work

- 1.1 Work under this section shall consist of furnishing all labour, material, appliances and equipment necessary and required to install fire extinguishing hand appliances.
- 1.2 Without restricting to the generality of the foregoing the work shall consist of the following: -

Installation of fully charged and tested fire extinguishing hand appliances CO2 foam, dry chemical powder type as required by these specifications and/drawings.

2 General requirements

- 2.1 Fire extinguishers shall conform to the following Indian Standard Specifications and shall be with ISI approved stamp as revised and amended up to date:-
- 2.2 Fire extinguishers shall be installed as per Indian Standard "Code of Practice for Selection, Installation and Maintenance of Portable First Aid Appliances" I.S.2190-1962.
- 2.3 Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fasteners.
- 2.4 Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.
- 2.5 All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations.

3 Measurement

Fire extinguishers shall be measured by numbers and include installation and all items necessary and required and given in the specifications.

Section II SPRINKLER SYSTEM

1. Sprinkler Heads

Sprinkler heads shall be quartzoid bulb type with gunmetal body fully approved and having current certification of the fire laboratory of the C.B.R.I. Roorkee, Underwriter's laboratory (UL) and under the approved certified list of the Fire Office Committee (FOC) of U.K. or NFPA of USA. Any one of the certifications as acceptable to the local fire authorities obtained prior to the procurement and approved and accepted by the Architect/Engineer/DFCCIL.

Sprinkler heads shall be installed in conformity with approved shop drawings and in co-ordination with electrical fixtures, ventilation ducts, cable galleries and other services along the ceiling. Following type of sprinklers shall be used:

S.No.	Type of Sprinkler	Temp rating
a)	Pendent /Upright type	68°C

b) Sidewall

68°C

Spacing and coverage of sprinkler shall be in accordance with risk classification of area in which they are installed, design density and TAC regulation

Annunciation Panel

- a) Provide one solid state electronic annunciation panel, fully wired with visual display unit to indicate:
- b) Flow condition in any flow indicating valve
- c) The panel should give a visual and audible alarm for any of the above conditions.
- d) The panel should be standard manufacturer's factory made. All details shall be submitted with the tender.

Testing

All piping in the system shall be tested to a hydrostatic pressure of 1.5 times the working pressure or 14 kg/sq.cm (whichever is more) without drop in pressure for at-least 2 hours.

Rectify all leakages, make adjustments and retest as required and directed.

Cables

Contractor shall provide control cables from supervisory valves and switches to the annunciation panels.

All control cables shall be copper conductor PVC insulated armoured and PVC sheethed 1100-volt grade.

All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.

All cable joints shall be made in an approved manner as per standard practice.

Cable Trays

All cables shall be routed in approved locations in coordination with all other services in a proper manner.

Cable trays shall be of galvanized steel and hung from the ceiling by galvanised rods supported by appropriate size and type of expandable expansion fasteners drilled into the slabs and walls by an electric drill.

2. Flow Switch

Flow switch shall have a paddle of suitable width to fit within the pipe bore. The terminal box shall be mounted over the paddle/ pipe through a connecting socket. The switch shall have potential free contact of suitable rating with N O or N C position as required. The switch shall be able to trip and make / break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Annunciation panel. The seat shall be stainless steel. The flow switch enclosure shall have IP:65 protection.

The flow switch shall work at a minimum flow rate of 100 LPM. Further, it shall have a 'Retard' to compensate for line leakage or intermittent flows.

3. **Installation Valve**

Installation valves shall be installed on the sprinkler circuits as shown on the drawings.

Contractor shall submit his detailed shop drawings showing the exact location, details of installation of the valve and alarm in all its respects.

Installation valve shall comprise of a cast iron sluice valve with gunmetal trim, pressure gauge, double seated clapper check valves as alarm valve with pressure gauge, test valve and orifice assembly and drain pipe with pressure gauge, bye pass on check valve to regulate differential pressure and false alarm, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system.

4. Measurement

Mild steel pipes shall be measured in linear metres of the finished length correct upto one cm.and shall include all fittings, flanges, welding, jointing, clamps for fixing to walls or hangers, anchor fasteners, painting and testing complete in all respects.

Sluice and fullway valves, check valves, installation valves, air valves & flow switches shall be measured by numbers and shall include all items necessary and required for fixing and as given in the specifications and bill of quantities.

Fire hydrants, hose reels, fire brigade connections, orifice flanges shall be measured by number and include all items given in the specifications and bill of quantities.

Fire hose and boxes specified shall be measured by number and include all items given in specifications and Bill of Quantities.

Cables and cable trays shall be measured in linear metre correct upto cm shall include clamps, hangers, anchor fasteners complete in all respects.

Hand Appliances

1 Scope of work

- 1.1 Work under this section shall consist of furnishing all labour, material, appliances and equipment necessary and required to install fire extinguishing hand appliances.
- 1.2 Without restricting to the generality of the foregoing the work shall consist of the following: -

Installation of fully charged and tested fire extinguishing hand appliances CO2 foam, dry chemical powder type as required by these specifications and/drawings.

2 General requirements

- 2.1 Fire extinguishers shall conform to the following Indian Standard Specifications and shall be with ISI approved stamp as revised and amended up to date.
- 2.2 Fire extinguishers shall be installed as per Indian Standard "Code of Practice for Selection, Installation and Maintenance of Portable First Aid Appliances" I.S.2190-1962.
- 2.3 Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fasteners.
- 2.4 Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.
- 2.5 All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations.

3 Measurement

Fire extinguishers shall be measured by numbers and include installation and all items necessary and required and given in the specifications.

SPRINKLER SYSTEM

1. **Sprinkler Heads**

Sprinkler heads shall be quartzoid bulb type with gunmetal body fully approved and having current certification of the fire laboratory of the C.B.R.I. Roorkee, Underwriter's laboratory (UL) and under the approved certified list of the Fire Office Committee (FOC) of U.K. or NFPA of USA. Any one of the certifications as acceptable to Architect/Engineer/DFCCIL.

Sprinkler heads shall be installed in conformity with approved shop drawings and in co-ordination with electrical fixtures, ventilation ducts, cable galleries and other services along the ceiling. Following type of sprinklers shall be used:

S.No.	Type of Sprinkler	Temp rating
a)	Pendent /Upright type	68°C
b)	Sidewall	68°C

Spacing and coverage of sprinkler shall be in accordance with risk classification of area in which they are installed, design density and TAC regulation

Spare Sprinklers

Provide a lockable enamel painted steel cabinet including following type of spare sprinklers

a) Pendent /Upright type 20b) Sidewall 10

The cabinet should also contain one pair of wrenches (of each size of the same are different) for the

sprinklers.

Spare sprinklers shall be of the same specifications as that of the original sprinklers specified.

Annunciation Panel

- a) Provide one solid state electronic annunciation panel, fully wired with visual display unit to indicate:
- b) Flow condition in any flow indicating valve
- c) The panel should give a visual and audible alarm for any of the above conditions.
- d) The panel should be standard manufacturer's factory made. All details shall be submitted with the tender.

Testing

All piping in the system shall be tested to a hydrostatic pressure of 1.5 times the working pressure or 14 kg/sq.cm(whichever is more) without drop in pressure for at-least 2 hours.

Rectify all leakages, make adjustments and retest as required and directed.

Cables

Contractor shall provide control cables from supervisory valves and switches to the annunciation panels.

All control cables shall be copper conductor PVC insulated armoured and PVC sheethed 1100 volt grade.

All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.

All cable joints shall be made in an approved manner as per standard practice.

Cable Trays

All cables shall be routed in approved locations in coordination with all other services in a proper manner.

Cable trays shall be of galvanized steel and hung from the ceiling by galvanised rods supported by appropriate size and type of expandable expansion fasteners drilled into the slabs and walls by an electric drill.

2. Flow Switch

Flow switch shall have a paddle of suitable width to fit within the pipe bore. The terminal box shall be mounted over the paddle / pipe through a connecting socket. The switch shall have potential free contact of suitable rating with N O or N C position as required. The switch shall be able to trip and make / break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Annunciation panel. The seat shall be stainless steel. The flow switch enclosure shall have IP:65 protection.

The flow switch shall work at a minimum flow rate of 100 LPM. Further, it shall have a 'Retard' to compensate for line leakage or intermittent flows.

3. Installation Valve

Installation valves shall be installed on the sprinkler circuits as shown on the drawings.

Contractor shall submit his detailed shop drawings showing the exact location, details of installation of the valve and alarm in all its respects.

Installation valve shall comprise of a cast iron sluice valve with gunmetal trim, pressure gauge, double seated clapper check valves as alarm valve with pressure gauge, test valve and orifice assembly and drain pipe with pressure gauge, bye pass on check valve to regulate differential pressure and false alarm, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system.

4. Measurement

Mild steel pipes shall be measured in linear metres of the finished length correct upto one cm.and shall include all fittings, flanges, welding, jointing, clamps for fixing to walls or hangers, anchor fasteners, painting and testing complete in all respects.

Sluice and fullway valves, check valves, installation valves, air valves & flow switches shall be measured by numbers and shall include all items necessary and required for fixing and as given in the specifications and bill of quantities.

Fire hydrants, hose reels, fire brigade connections, orifice flanges shall be measured by number and include all items given in the specifications and bill of quantities.

Fire hose and boxes specified shall be measured by number and include all items given in specifications and Bill of Quantities.

Cables and cable trays shall be measured in linear metre correct upto cm shall include clamps, hangers, anchor fasteners complete in all respects.

TECHNICAL SPECIFICATION FOR HVAC & BMS WORKS (SECTION-7)

CONTENT OF TECHNICAL SPECIFICATION

1.0	SCOPE
1.1	Standards
1.2	Conformity to Statuary Acts
1.3	Safety Codes
1.4	System Requirements
1.5	Design Parameters
1.6	Drawings
1.7	Guarantee
2.0	VRV/VRF SYSTEM
2.1	Outdoor Units
2.2	Indoor Units
2.3	Refrigerant Piping & Insulation
2.4	Drain Piping & Insulation
2.5	Remote Controllers
2.6	Touch Screen Controllers
2.7	UVC
2.8	MESF Filter
2.9	REFNETS
3.0	AIR DISTRIBUTION SYSTEM
3.1	AHU
3.2	Duct & Insulation
3.3	Fresh/Exh. Louvers
3.4	Canvas
4.0	VENTILATION SYSTEM
4.1	Propeller Fan
4.2	In line Fans
4.3	Tube Axial Flow Fans
4.4	Air Washer
4.5	Air Scrubber
4.6	Air Curtains
5.0	ELECTRICAL WORK
5.1	Panels
5.2	Motors
5.3	Starters
5.4	LT Cables
5.5	Control Cables
6.0	PAC
7.0	INSPECTION, TESTING & COMMISSIONING
8.0	CAMC
9.0	BMS

1.0 GENERAL

1.1 SCOPE OF WORK

The Scope of Work covers the design, drawing submission, drawing approval, supply, installation, testing, commissioning, training, warranty and maintenance of HVAC system, BMS and services provided for the same. The HVAC system must be able to integrate seamlessly with BMS and provide all available data on Ethernet/BACnet or other open platform.

1.2 REFERENCES / STANDARDS:

- ✤ National Building Code of India –2016
- HVAC Specifications from CPWD
- * ANSI: American National Standard institute (Wherever applicable)
- ✤ BIS: Bureau of Indian Standards (This code will supersede in case of any ambiguity or misinterpretation)
- * ASHRAE: American Society of Heating Refrigeration and Air conditioning Engineers
- * ISHRAE: Indian Society of Heating Refrigeration and Air conditioning Engineers
- ✤ ASME: American Society for Mechanical Engineers
- SMACNA / BIS: For Duct construction standards.

IS Number	Title	
IS 196	Atmospheric conditions for testing	
IS 325	Three phase induction motors	
IS 8148	Packaged Air Conditioners	
IS 2360	Voltage bands for electrical installations including preferred	
	voltages and frequency	
IS 3615	Glossary of Terms Used In Refrigeration And Air	
	Conditioning	
ISO 5151	Non- ducted air conditioners and heat pumps — Testing and	
	rating for performance	
ISO 15042	Multiple split system air- conditioners and air-to- air heat	
	pumps — Testing and rating for performance	
ISO 16358 – 1	Air cooled air conditioners and air-to-air heat pumps —	
	Testing and calculating methods for seasonal performance	
	factors — Part 1: Cooling seasonal performance factor	
ISO 16358 – 2	Air-cooled air conditioners and air-to-air heat pumps —	
	Testing and calculating methods for seasonal performance	
	factors — Part 2: Heating seasonal performance factor	
ISO 16358 – 3	Air-cooled air conditioners and air-to-air heat pumps —	
	Testing and calculating methods for seasonal performance	
	factors — Part 3: Annual performance factor	

ISO 5149 – 1	Refrigerating systems and heat pumps – Safety and
	environmental requirements – Part 1: Definitions,
	classification and selection criteria
ISO 5149 – 2	Refrigerating systems and heat pumps – Safety and
	environmental requirements – Part 2: Design, construction,
	testing, marking and documentation
ISO 5149 – 3	Refrigerating systems and heat pumps – Safety and
	environmental requirements – Part 3: Installation site.
ISO 5149 – 4	Refrigerating systems and heat pumps – Safety and
	environmental requirements – Part 4: Operation,
	maintrenance, repair and recovery
EN 14825	Air conditioners, liquid chilling packages and heat pumps
	with electrically driven compressors for space heating and
	cooling - Testing and rating at part load conditions
EN 145111 – 1	Air conditioners, liquid chilling packages and heat pumps
	with electrically driven compressors for space heating and
	cooling – Part 1: Terms, definitions and classification
EN 145111 – 2	Air conditioners, liquid chilling packages and heat pumps
	with electrically driven compressors for space heating and
	cooling - Part 2: Test conditions
EN 14511 – 3	Air conditioners, liquid chilling packages and heat pumps
	with electrically driven compressors for space heating and
	cooling - Part 3: Test methods
EN 14511 – 4	Air conditioners, liquid chilling packages and heat pumps
	with electrically driven compressors for space heating and
	cooling - Part 4: Operating requirements, marking and
	instructions
IS / ISO 817	Organic refrigerants – Number designation
ISO 3744	Acoustics Determination of sound power levels and
	sound energy levels of noise sources using sound pressure
	Engineering methods for an essentially free field over a
	reflecting plane
ISO 9614 – 1	Acoustics - Determination of Sound Power Levels of Noise
	Sources Using Sound Intensity - Part 1: Measurement at
	Discrete Points
ISO 9614 – 2	Acoustics - Determination of Sound Power Levels of Noise
	Sources Using Sound Intensity - Part 2: Measurement by
	Scanning
AHRI 1230	Performance Rating of Variable Refrigerant Flow (VRF)
	Multi-Split Air-Conditioning and Heat Pump Equipment
BS 4718 : 1971	Method of test of silencer for air distribution systems.
BS 2750: Parts 1-9:1980	Laboratory and field measurement of airborne sound
	insulation of various building element.

BS 3638 : 1987	Method of measurement of sound adsorption in a
	reverberation room.
BS 4773: Part 2: 1976	Acoustic performance without additional ducting of forced
	fan convection equipment.
BS 4954: Part 2:	Acoustic testing and rating of induction units.
1978(1987)	
BS 5643:1984	Glossary of Refrigeration, Heating Ventilation and Air
	Conditioning terms

1.3 SUBMITTALS:

To cross check the Heat Load Estimations / Design Data Summary and point out any discrepancy at the time of bidding.

- a. Under provisions of sample approval before the commencement of the project.
- b. Includes products mentioned in the Approved list of manufacturers as per the mode of approval mentioned in the list.
- c. Submit shop drawings and product data grouped to include complete submittals of related Systems products, and accessories in a single submittal.

1.4 SHOP DRAWINGS

Submit a copy of the shop drawings, including:

- a. Actual duct routes after the site survey.
- b. Automatic temperature /Pressure control system.
- c. Inertia pads and foundations for the various equipments.
- d. Fire protection systems (Fire / Smoke dampers: Motorized) (Relief dampers, smoke extract system, pressurization system)
- e. Layout of the AHU/IDU / Plant room including dimensions of the room and the foundations and the sizes and all necessary construction details required on site.
- f. Location of the allied equipments and the requirements from other agencies.
- g. Trench locations if any.
- h. Sump location and size.
- i. Sleeve location if any.
- j. Ventilation air / exhaust air locations.
- k. Location of wall mounted equipment (If any)
- 1. Any structural inputs.

1.5 Brochures:

- a. Submit manufacturer's product data and brochure including :
- b. Complete description.
- c. Illustrations.
- d. Rating data, accessories, dimensional data.
- e. Capacities stated in the terms specified.
- f. Performance curves of the fans and pumps.

1.6 PROJECT/SITE CONDITIONS

Mechanical layouts indicated on drawings are diagrammatical. Co-ordination (final) shall be required with other trades prior to installation. Install all works as shown on the drawings, unless prevented by project conditions.

Prepare drawings showing proposed rearrangement of work to meet the project conditions, obtain permission from Engineer before proceeding.

Place anchors, sleeves and supports prior to pouring concrete on installation of masonry works.

Keep roads and site clear of debris and scrap.

1.7 DESIGN PARAMETERS

Air Handling Units

Maximum face velocity across cooling coil	155 m/min
Maximum velocity across filters	155 m/min
(Ordinary/Micro-vee)	
Maximum outlet air velocity	610 m/min
Maximum fan speed for fans upto 300 mm dia	1450 RPM
Maximum fan speed for fans above 300 mm dia	1000 RPM

Centrifugal Fans

Maximum fan outlet velocity for fans upto 450 mm dia	550 m/min.
Maximum fan outlet velocity for fans above 450 mm dia	700 m/min
Maximum fan speed for fans upto 450 mm dia	1450 RPM
Maximum fan speed for fans above 450 mm dia	1000 RPM

Duct Design

	Main Duct	Branch Duct
Maximum flow velocity	400 m/min	250 m/min
Maximum Velocity at supply air grills/diffusers	150 m/min	
Maximum friction in duct	1 cm WG/100 m run	

1.8 PAINTING AND SERVICE IDENTIFICATION

The scope of this section comprises of identification of service for each piece of equipment and allied works.

Duct work service :

For duct work service and its insulation the colour of the triangles shall comply with **BS. 1710 : 1971**. the size of the symbol will depend on the size of duct and the viewing distance but the minimum size should not be less than **150 mm** length per side. One apex of the triangle shall point of the direction of air flow.

Service	Color	BS 4800 Color Reference
Conditioned air	Red and Blue	04 E 53/ 18 E 53
Ward air	Yellow	10 E 53
Ventilation air	Green	14 E 53
Exhaust / extract Recalculated air	Gray	AA 0 09
Foul air	Brown	06 C 39
Dual duct system hot Supply air	Red	04 E 53
Cold supply air	Blue	18 E 53

In addition to the color triangle specified above all duct work shall be legibly marked with black or white letter to indicate the top of service identified as follows:-

Supply air	S
Return air	R
Ventilation air	F
Exhaust air	E

The color banding and triangle shall be manufactured from self-adhesive cellulose tape laminated with a layer of transparent ethyl cellulose tape.

1.9 GOOD ENGINEERING PRACTICES FOR HVAC WORKS

- a. **Mechanical noise control:** All good engineering practices involved in controlling the noise of equipment within permissible limits shall be adopted by the contractor.
- b. **Vibration Control:** All good engineering practices involved in controlling the vibrations of equipment within permissible limits shall be adopted by the contractor.
- c. Equipment at the best operating parameters and acoustical performance alongwith the necessary isolation devices for vibration control shall be adopted by the manufacturer and the contractor.

1.9.1 INTENT in general pertaining to this section is as follows:

The vibration isolators for certain equipment have been specified and quantified in the BOQ, however, if any additional safeties are required to fulfill the intent of this basic mechanical requirement, then the same shall be provided by the manufacturer/contractor at no additional cost.

Mechanical service shall generally be designed and installed with provisions to contain noise and the transmission of vibration generated by moving plant and equipment schedules to achieve acceptable noise rating specified for occupied areas.

In addition to the provision specified in the specification, particulars attention must be given to the following detail at time of ordering plant and equipment and their installation:-

- a. All moving plant, machinery and apparatus be statically and dynamically balance at manufactures work and certificate issued.
- b. The isolation of moving plant. Machinery and apparatus including lines equipment from the building structure.
- c. Where duct work and pipe work service pass through walls floor and ceiling or where supported shall be surrounded with a resilient acoustic absorbing material to prevent contact with the structure and minimize the outbreak of noise from plant room.
- d. The reduction of noise breakout from plant room and the section of externally mounted equipment and plant to meet ambient noise level requirement of the specifications.
- e. Electrical conduits and connection to all moving plant and equipment shall be carried out in flexible conduit and cable to prevent the transmission of vibration to the structure and nullify the provision of anti-vibration mountings.

- f. All duct connection to fans shall incorporate flexible connections. Except in cases where these are fitted integral within air handing unit.
- g. All resilient acoustic absorbing materials shall be non flammable vermin and rot proof and shall not tend to break up or compress sufficiently to transmit vibration or noise from the equipment to the structure.
- h. Where practicable silencer shall be built into walls and floor to prevent the flanking of noise the duct work system (If Any) and their penetrations sealed in the manner previously described.
- i. Where this is not feasible the exposed surface of the duct work between the silencer and the wall subjected to noise infiltration shall be acoustically clad as specified.

1.10 TENDER DRAWINGS, DRAWINGS FOR APPROVAL & COMPLETION DRAWINGS

1.10.1 Tender Drawings

The drawings appended/ uploaded with the tender documents are intended to show the areas to be conditioned, space allotted for various equipments, tentative duct, cable and pipe routes. The equipments offered shall be suitable for installation in the spaces shown in these drawings.

1.10.2 Drawings for approval on award of the work

The contractor shall prepare & submit three sets of hard copy & one Digital/ soft copy in AutoCAD format of following drawings and get them approved from the Engineer-in-Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipments/ materials as per contract, if there is any contradiction between the approved drawings and contract.

- a. Lay out drawings of the equipments to be installed in various rooms such as ODU, IDU, AHU rooms, ducts and other equipments.
- b. Drawings including section, showing the details of erection of entire equipments including their foundations, layout, etc.
- c. Ducting drawings showing sizes, locations of dampers, grilles & diffusers.
- d. Electrical wiring diagrams for all electrical equipments and controls including the sizes and capacities of the various cables and equipments,
- e. Dimensioned drawings of all electrical and control panels,
- f. Drawings showing the details of all insulations works,
- g. Drawings showing details of supports for pipes, cable trays, ducts etc.
- h. Any other drawings relevant to the work.

The contractor shall, use the soft copy of such drawings to prepare and examine the integrated services layout, resolve conflicts, and modify the execution drawings suiting & adjusting to all the services requirements. The contractor shall be bound to modify & execute accordingly.

1.10.3 Completion Drawings

One set of Digital/ soft Copy and one set of the following laminated drawings shall be submitted by the contractor while handing over the installation to the DFCCIL. Out of this one of the sets shall be laminated on a hard base for display in the control room. In addition one set will be given on compact disc.

- a. Plant installation drawings giving complete details of all the equipments, including their foundations,
- b. AHU room installation drawings,
- c. Duct layout drawings with their sizes and locations, and sizes and locations of all dampers, grills & diffusers,
- d. Line diagram and layout of all electrical control panels giving switchgear ratings and their disposition, cable feeder sizes and their layout,
- e. Control wiring drawings with all control components and sequence of operations to explain the operation of control circuits,
- f. BMS drawings

1.11 SAFTEY CODES

The following IS codes shall be followed in reference to the Safety:

Safety code for mechanical refrigeration	IS 660
Safety code for air conditioning	IS 659
Safety code for scaffolds & ladders	IS 3696
Code of practice for fire precaution in Welding & cutting operations	IS 3016
Code for safety procedures and practices In electrical works	IS 5216
Code of practice for safety and health Requirements in electrical & gas welding and cutting operations.	IS 3696

2.0 VARIABLE REFRIGERANT VOLUME/FLOW SYSTEM

2.1 SCOPE

The scope of this section comprises the supply, erection, testing and commissioning of Variable Refrigerant Flow System conforming to these specifications and in accordance with the requirements of Drawings and Schedule of quantities.

2.2 TYPE

Unit shall be air cooled heat pump type, variable refrigerant volume/flow air conditioner consisting of one outdoor unit and multiple indoor units. Each indoor unit shall have capability to cool or heat. The indoor units on any circuit can be of different type and also controlled individually. Compressor installed in each modular outdoor unit shall be equipped with 100% inverter Scroll compressors for higher reliability, improved life, better backup and duty cycling purpose. Outdoor unit shall be suitable for mix match connection of all type of indoor units and capable of connecting minimum ten different types of indoor units to one refrigerant circuit and controlled individually. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling and heating load.

The refrigerant piping between indoor units and outdoor unit shall be possible to extend up to a minimum of 165m with maximum 50m level difference without any oil traps.

Both indoor units and outdoor unit shall be factory assembled, tested and filled with first charge of refrigerant before delivering at site.

Following type of indoor units shall be connected to the system:

- ✤ Ceiling mounted ductable type.
- Ceiling mounted cassette type.
- Floor mounted ductable type
- ✤ Wall mounted Hi-Wall type.

Oil recovery system shall be managed without disturbance to normal operation cycle of the system / compressor.

In the piping work, minimal brazing shall be done.

Only the best manufacturing practices i.e. the units with maximum ISEER as per ISHRAE will be accepted. The contractor shall study the best available design and offer the best ISEER available in industry. The minimum ISEER should be as below:-

ODU Capacity	ISEER (Minimum)
Up to 10 HP	30
12HP to 14 HP	25
16HP & Above	21

The formula used for the calculation of ISEER shall be as follows: ISEER= [(0.06* COP at 100% loading) + (0.48*COP at 75% loading) + (0.36*COP at 50% loading) + (0.10* COP at 25% loading)]* 3.41. Contractor shall furnish the following information:

Sr. No	Parameters of VRF system	COP data as per ISHRAE
1	COP at 100% Loading	
2	COP at 75% Loading	
3	COP at 50% Loading	
4	COP at 25% Loading	

Separate data is to be provided for different VRF models such as 16 HP, 24 HP etc.

The COP values as indicated are required to be furnished in Original by the tenderer directly from the original equipment Manufacturer (OEM).

2.3 OUTDOOR UNIT

- a. The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels powder coated finish. The unit should be completely factory wired, tested with all necessary controls and filled with first charge of refrigerant before delivering at site.
- b. The outdoor unit shall have multiple inverter scroll compressors and be able to operate even in case of breakdown of one of compressors. The defective compressor can be bypassed on failure and rest ODU shall work with remaining compressor(s).
- c. The O/D units shall be capable to operate at ambient temperature range upto 49° C. The noise level shall not be more than 60 dB(A) at normal operation measured horizontally 1m away and 1.5m above ground.
- d. The outdoor unit shall be modular in design and shall be allowed for side by side installation.
- e. Each modular outdoor unit shall have multiple inverter Scroll type compressors with top throw. The compressors shall be designed and coordinated to achieve the highest efficiency. The unit shall be provided with its own microprocessor control panel. The outdoor units shall have anti-corrosion paint.
- f. The machine must have a sub cool feature to use coil surface more effectively thru proper circuit / bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings. The unit shall provide at least 10 % higher heating capacity than cooling capacity at nominal conditions.
- g. The outdoor unit should be fitted with low noise aero spiral design fan with aero fitting grill for spiral discharge airflow to reduce pressure loss and should be fixed with DC/AC fan motor for better efficiency.

- h. The unit shall be designed in such as way that cleaning of drain Pan should be easy & inspection/ replacement of compressor should be easy.
- i. The outdoor unit shall have suitable cooling mechanism for better operation at high ambient temperature.
- j. The outdoor unit shall have feature to change the evaporative temperature with respect to load for better comfort.
- k. The systems shall have free phase technology & operation shall be continuous in case of phase reverse in supply electricity.
- 1. The system shall have automatic refrigerant charge function for optimal charging of additional refrigerant.
- m. The fan static pressure of the outdoor unit shall be minimum 60-75 Pa to avoid hot air recirculation.
- n. The compressors, inverters and all electronics in outdoor units must withstand reliable operation in high ambient temperatures. The units must operate reliably without any safety device tripping.
- o. The Outdoor machines shall be preferably compact machines for purpose of space saving and smaller foot print shall be preferred.
- p. The outdoor unit control shall possess following features:
 - The controls must ensure duty rotation between connected outdoor units for run time equalization.
 - In case of multiple compressors in an outdoor unit, the electronics must have an algorithm to rotate the compressor cycling for run time equalization.
 - All necessary safety devices shall be provided to ensure safe operation of the system. Following
 safety devices shall be part of outdoor unit: High pressure switch, High Discharge Gas
 temperature switch, Fan motor overload protection, Inverter drive overload protection, Inverter
 Temperature monitoring and safety cut off, Over load protection for compressor motor.

2.3.1 COMPRESSOR

- a. The compressor shall be inverter type Scroll based control. The inverter shall be IGBT (insulated gate bipolar transistor) type for efficient and quiet operation. The inverter compressor shall change the speed in accordance to the variation in cooling or heating load requirement.
- b. All outdoor units shall have multiple steps of capacity control from 15%-100% to meet load variations / fluctuation and indoor unit individual control.
- c. PCB Chamber of outdoor unit should be refrigerant cooled.
- d. All parts of compressor shall be sufficiently lubricated stock.
- e. Forced lubrication may also be employed.
- f. Oil heater shall be provided in the compressor casing.

2.3.2 HEAT EXCHANGER

- a. The Heat Exchanger shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross fin coil and larger surface area.
- b. The aluminum fins shall be covered by anti-corrosion resin film. The treatment shall be suitable for areas of high pollution, moisture and salt laden air. The condensing coils shall also have anti corrosion treatment.

- c. The casings, fans, motors etc. shall also be with anticorrosion treatment as a standard features.
- d. The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical / horizontal discharge. Each fan shall have a safety guard.
- e. The heat exchanger shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by extruded collars forming an integral part of fins. The tubes shall be staggered in the direction of airflow. The tubes shall be mechanically expanded for thermal bonding with fins. Each coil shall be factory tested for leaks using dry nitrogen at a pressure at least 1.5 times the maximum working pressure.

2.3.3 **REFRIGERANT CIRCUIT**

- a. The refrigerant circuit shall include liquid and gas shut-off valves and a solenoid valves at condenser end.
- b. The equipment must have inbuilt refrigerant stabilization control for proper refrigerant distribution.
- c. All necessary safety devices shall be provided to ensure the safe operation of the system.
- d. The system should be able to generate an alarm in case of refrigerant leak.
- e. Unit shall be equipped with an oil recovery and oil management system to ensure reliable operation of the system for its useful life.

2.3.4 SAFETY DEVICES

All necessary safety devices shall be provided to ensure safe operation of the system. Whatever safety devices are required shall be part of the outdoor unit:

- High pressure switch,
- Low pressure switch,
- Fuse,
- Crankcase heater,
- Fusible plug,
- Fan drive overload protector,
- Over load relay,
- Over current protection for inverter, and
- Short recycling guard timer.

2.3.5 OIL RECOVERY SYSTEM

- a. Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration piping lengths. The system shall have oil recovery cycle of 8 or more hours.
- b. The system must be provided with oil balancing circuit to avoid poor lubrication.
- c. The outdoor unit must include an oil recovery device to limit the oil flowing with refrigerant to the indoor units. The device shall separate oil from compressor discharge gas and return it back to compressor
- d. The system should have inbuilt oil balancing circuit to avoid poor lubrication.

2.4 INDOOR UNITS

- a. The type, capacity and size of indoor units shall be as specified in detailed Bill of Quantities. Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or any other type. Units shall be factory assembled, wired, piped and tested.
- b. Each unit shall have electronic control valve to control refrigerant flow rate in response to load variations of the room. The fan shall have highly efficient BLDC (Brushless Direct Current) motor and statically and dynamically balanced direct driven DIDW multi-blade type blowers to ensure low noise and vibration free operation. The fan motors shall be thermally protected.
- c. The system should be designed such that in case of failure/trip of one indoor unit, the working of ODU and other indoor units should not be affected.
- d. Grills shall have auto swing feature for proper Air distribution.
- e. Units shall have DX coils made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Each coils shall be factory tested at 21kg/sqm air pressure under water. Anticorrosion treatment shall be provided for avoiding corrosion of coils.
- f. Unit shall have cleanable type filter fixed to an integrally moulded plastic /aluminium frame. The filter shall be easily serviceable.
- g. Each indoor unit shall have computerized control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling and heating.
- h. Each unit shall be with wired/Remote LCD type remote controller (as per BOQ). The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.
- i. Concealed indoor units shall have sensor mounted on supply air grilles / diffusers which can be controlled with wireless remotes.
- j. All units shall have adequate insulation or Lining to avoid condensation.
- k. All interconnecting Copper piping, joints, U bends and Aluminum fins within the condensing/ evaporator unit shall be coated with two component, polysiloxane based coating with dry film thickness of about 25-35 microns on Cu and Upto 5 microns on Al fins. The coating shall be strong, flexible and durable. It shall have good adhesion and abrasion resistance. It shall be resistant to moisture, UV, acid - alkali and other chemicals. The coating shall be applied using air assisted Spray gun or brush.
- 1. The indoor unit shall have a printed circuit board complete with address switches for a variety of operation controls, emergency operation switch and fault/ operation indication LEDs. The address of the indoor unit shall be set automatically in case of individual and group control.

2.4.1 CEILING MOUNTED DUCTABLE TYPE UNIT

Unit shall be suitable for ceiling mounted type. The unit shall include pre-filter, fan section & DXcoil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for ductable arrangement.

2.4.2 HIGH WALL MOUNTED UNITS

The units shall be high wall mounted type. The unit shall include pre-filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

2.4.3 CEILING MOUNTED CASSETTE TYPE UNIT (MULTI FLOW TYPE)

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be possible to suspend from four corners. The cassette type unit having some parts in non-mettalic construction must be UL-94-V0 certified.

The fan shall be aerodynamically designed diffuser turbo fan type. Unit shall have an external attractive panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in center. Each unit shall have high lift drain pump, fresh air intake provision, low gas level detection system and very low operating sound. All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view.

2.5 **REFRIGERANT PIPING**

- a) All interconnecting pipe-work between the condensing unit & indoor units shall have quality seamless copper tubes with brazed connections and the appropriate distribution joints and headers shall be used. The piping should be routed at site in such a manner, that brazed joints in the Refrigeration Piping are kept to a minimum.
- b) All Copper Pipes must be coated with polysiloxane based coating for better anti corrosion coating properties.
- c) The Refrigerant pipe work shall be insulated with XLPE Class-O tubular insulation/ Class-O closed cell elastometric Nitrile rubber tubular sleeves sections to avoid condensation and shall have low thermal conductivity, high mechanical strength, non-combustible, resistance to Fungi, ozone, UV and any other environmental pollutant. Moulded tee joints of thermal insulating material shall be used at bends y-joints etc. Test certificate for the same shall be submitted.
- d) To protect nitrile rubber/XLPE insulation of exposed copper piping from degrading due to ultra violet rays & atmospheric condition, it shall be covered with polyshield coating with at least two coats of resin and hardener above nitrile rubber/XLPE insulation. Fiberglass tape shall be helically wound & coated with two coats of resin with hardener to give smooth & plain finish.
- e) The refrigerant piping shall be extendable up to minimum 165 m with 50 m level without any oil trap. Distribution refrigeration pipe joints and headers shall be installed in an appropriate orientation to enable correct distribution of refrigerant. The Distribution joints shall be factory/site insulated. All pipe-work must be kept clean and free from contamination to prevent

breakdown of the system. All pipe ends shall be kept sealed until immediately prior to making a joint.

- f) All joints in copper piping shall be sweat joints using low temperature brazing and or silver solder. For Copper to Copper joints,15% Ag brazing rod shall be used. For Copper to other metal joints, 45% Ag brazing rod shall be used. Before jointing any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall be thoroughly blown out using nitrogen.
- g) All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.
- h) Refrigerant charge must be calculated based on the actual length of the refrigerant pipe work. The refrigerant charging process must be carried out with an appropriate charging station and under supervision of manufacturer or his representative.
- i) The insulated refrigerant piping and control wiring (in conduit) shall run on GI tray properly supported by GI rods. The exposed tray shall be covered by openable GI covers.
- j) Bend of copper piping shall be done by proper mechanical bending machine.
- k) The copper tubes shall be of two types: Soft drawn and Hard drawn as specified in BOQ. The chemical composition will confirm to grade C12200 designated as "Phosphorus Deoxidized High Residual Copper" grade having minimum Copper % of 99.9 % with Phosphorus % of 0.015 to 0.040%. The Mechanical properties should also be as per ASTM B280. Test certificate for the same shall be submitted.
- 1) The OD and wall thickness of the refrigerant piping should be as specified in BOQ. Minor variation as per recommendation of OEM may be allowed. The air-conditioning system supplier shall design piping sizes and erect proper interconnections of the complete refrigerant circuit.
- m) The copper tubes shall be supplied with end Caps at both ends.
- n) The copper tubes must be packed & sealed in polyethylene bags to protect them from any atmospheric degradation/contamination.
- o) All copper tubes shall be 100% eddy current tested.
- p) All the Tubes shall be RoHS (Restriction of Hazardous Substances) Complaint and each lot of supply shall be provided with routine test certificate.

Testing Max. Permissible Con	ntent Limit (PPM)
Cadmium (Cd)	100ppm
Lead (Pb)	1000ppm
Mercury (Hg)	1000ppm
Chromium	1000ppm

- q) Each lot of copper tubes shall be inspected physically for any physical defects and the sizes shall be checked as per specification.
- r) All connections, tees, reducers etc. shall be standard make fittings. The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm /13 mm thick elastomeric nitrile rubber Class-O insulation. For individual Piping 50 / 100 mm wide Aluminium Tape shall be used at joints of Piping with Bands for identification.
- s) After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 38Kg per sq. cm. Pressure shall be maintained in

the system for 24 hours. The system shall then be evacuated to minimum vacuum of 700mm hg and held for 24 hours.

2.6 UPVC DRAIN WATER PIPE

Providing and fixing in position UPVC drain plumbing pipes of APPROVED Make or equivalent as per ASTM D-1785 (SCH-80) including cost of Specials as per ASTM D-2466 (SCH-80) including jointing with approved solvent cement, chase, cutting holes in walls roofs or floors etc. and making good to its original condition complete as per manufacturer's specifications and satisfaction of Engineer In-charge.

The condensate drain pipe connection of each fan coil unit to the main header should be rigid PVC pipe of heavy gauge with 25 mm dia /32mm dia as required. The header pipe should be of 50 mm dia/32 mm dia as required. The drain piping should be insulated with 9 mm thick tubular nitrile rubber insulation. For proper drainage of condensate U trap shall be provided in the drain piping wherever required. All pipe supports shall be prefabricated and pre-painted slotted angle supports, properly installed with clamps. The condensate drain pipe arrangement for disposal of condensate water be made in such a way that there should not be any leakages of condensate water inside rooms as well in the route of drain water pipe line & water should be discharged at the location jointly decided with Engineer-in-Charge of work.

All associated Civil Engineering works as per requirement at site in above connection like making chase in the wall & restoring it original shape by re -plastering & repainting, etc. are included in the scope of work. The arrangement of drain- pipe shall be made in such a way that it should not affect the aesthetic of the building as well as is maintenance friendly & easily accessible.

2.7 CENTRAL REMOTE CONTROLLER

A multi-functional compact centralized controller (central remote controller) shall be supplied with the system. The System Controller shall provide proven air conditioning management system to give complete control of VRF Air Conditioning equipment. It should be user friendly. It shall be able to control minimum no of indoor units specified in BOQ.

The Centralized Remote Controller shall perform the following minimum functions.

- a. Starting/stopping of Air-conditioners as a zone or group or individual unit.
- b. Temperature setting for each zone, or group, or indoor unit.
- c. Switching between temperature control modes, switching of fans speed and direction of airflow.
- d. The address of the indoor unit shall be set automatically in case of individual and group control.
- e. Monitoring of operations status such as operation mode and temperature setting of individual indoor units, maintenance information, trouble shooting information.
- f. Scheduling of both indoor and outdoor units as per the requirement.
- g. Indication of operating condition.
- h. Select ON of all operation modes for each zone.
- i. The controller shall have user friendly color LCD Touch screen display. The centralized remote

controller should be able to control the indoor units with control wiring upto a total distance of 1 KM.

- j. In case of power fluctuation or power failure, the addressing and other settings such as temperature of individual indoor units should not be affected. Alpha-numeric addressing of each indoor unit should be possible to facilitate the location of individual indoor unit.
- k. The controller shall be integrated to BMS system through software for monitoring & controlling of all above parameters including start/ stop of each indoor / outdoor unit. All necessary interface cards / units should be supplied as a part of the system to integrate to the BMS Software.

2.8 Air Purifier For Floor Mounted /Ceiling Mounted AHU

The Micro electrostatic filter has to be accompanied with collector technology which shall comprise of 7 layers of filtration. Layer 1 shall be of a black honeycomb woven polypropylene. Layer 2 shall be of a white honeycomb woven polypropylene. Layer 3 shall be polyether 45ppi foam. Layer 4 shall be same as layer 1 and Layer 5 shall be same as layer 2.

The media shall consist of material which have high electrostatic potential. Airflow across the filter will cause the layer of self-charge with an higher electrostatic charge to enhance filtration capabilities. The media retainer shall consist of $\frac{1}{2}$ " back powder painted 20 gauge welded wire on both the up stream and down side of the filter.

The 5th and 6th filtration shall be ionized and charged collection plate. The Average Dust Holding capacity shall be greater than equal to at least 190 grams (in accordance to ASHARE Standard) having an efficiency of MERV 14. The performance of the filter has to be as per ASHARE 52-76 or 52.1-92 and shall carry UL certification.

2.10 UVGI SOLUTION

- a. UVGI Solutions shall be modular in design with modules rated 1000 and 2000 CFM which interconnect with each other. CFM capacity may vary depending upon the manufacturer to suit the HVAC requirements.
- b. UVC lamps shall comply with UL/CE compliant standard as applicable to usage of UVGI Solutions in HVAC equipments.
- c. Fixtures shall be manufactured in ISO 9001:2000 registered facility.
- d. Independent certified testing shall indicate that when emitter first installed total output per one inch length shall not be less than 9 micro W/cm^2 at one meter in 400 fpm (122 meter/min) air stream of 10° C and the end of manufacture tube warranty period or 9000 hours, whichever is longer.
- e. Initial UVC intensity on the coil face shall not be less than 1,200 micro W/cm^2 and at the end of life intensity on extreme corners of the coil face must exceed 750 micro W/cm^2 .
- f. The coil shall be substantially free of mold at the end of the manufacturer's emitter warranty period or 9000 hours, whichever is longer.

- g. Units shall be high output HVAC type germicidal UVC light source, factory assembled and tested. Components shall include a housing, reflector, high efficiency electronic power source, emitter sockets and emitter tube, all constructed to withstand HVAC environments.
- h. Single/Double ended unit housing shall be made of 304 stainless steel with DE units having electrical connectors on both ends to simplify gang wiring and wiring to power. They shall include mounting holes to assist in securing the fixture.
- i. DE reflectors shall be constructed of high spectral finished aluminium alloy with a minimum 85% reflectance of 254 nm UVC energy.
- j. High efficiency electronic power supplies shall be a class P2 with a power factor greater than 0.90 and a power conversion of greater than 90%. The power supply design shall include RF and EMI suppression. The power supply shall be designed to maximize photon production, irradiance and reliability in cold air stream of 0-140°F, 100% RH. The power supply shall be available in 110-270V, 50 Hz, single phase. Power source shall be UL/CE listed.
- k. UVGI Solution germicidal lamp tube shall be a hot cathode that produces UVC at 253.7 nm and no ozone or other secondary contaminants. The UVGI Solution germicidal lamp shall be tested by an independent test laboratory to provide UVC of 253.7 nm output per one inch of length of no less than 9 micro W/cm2 at 1 meter in a 400 fpm (122 meter/min) air stream of 50oF (10^oC). The UVGI Solution lamp shall be designed to maximize photon productions, irradiation and reliability in cold or moving air stream of upto 2000 fpm and temperatures of 35-140oF (2-60^oC) and 100% RH. UVGI Solutions shall produce no ozone or other secondary contaminants.

2.10.1 Installation of UVGI Solution

- a. Coordinate with installation of HVAC equipment and install UVGI system as indicated after such equipment is properly installed.
- b. Provide an interlock switch on the access to the UVGI Solutions to turn the lights off when the access is opened.
- c. Install provided Caution Labels on all accesses to the UVGI.
- d. Irradiation Emitters and fixtures are to be installed in sufficient quantity and in such an arrangement so as to provide an equal distribution of UVC energy on the coil and in the drain pan. To maintain energy efficiency, the UVC energy produced shall be of the lowest possible reflected and shadowed losses.
- e. To effectively irradiate the cooling coil surface and maximize the UVGI irradiation onto the coil, each UVGI lamp will be mounted on a dish antenna shaped parabolic reflector made of of anodized aluminum with high spectral reflectivity. This ensures maximum efficiency and focuses all the UV energy onto the coil. It also ensures that stray UVC intensity is leaked onto surfaces and parts located behind the UVGI lamps, which can result in rapid degradation of the fan blower belts and other plastic/rubber parts.
- f. The UVC make being offered shall have power consumption equal to or below 3.0 + 10% watt per inch of UVGI Solution length.

2.11 **REFNET Joint (Y Branch Fitting)**

VRF system shall not allow the use of a standard refrigeration T joints. The VRF system shall use specialty fitting that is called a Refnet or Y-Branch Fitting (terminology depends on manufacturer). In addition to the specialty fitting itself each manufacturer has specific piping requirements for this fitting that must be adhered to for proper system function. In view of this, REFNET joints along with insulation shall be supplied by OEM only.

Use of the particular branch fitting (Refnet) appropriate to each individual unit type not only permits the pipes to be laid with ease but also increases the reliability of the system as a whole.

Units can be added by connecting them directly to the REFNET header or REFNET joint. Further branches cannot be included in the system below the REFNET header branch.

Special purpose REFNET pipe components must be used for all the pipe work. For realiable and efficient system, selection of components shall be made from REFNET and Piping Selection Rules of the OEM.

REFNET kits shall be supplied with insulation intended to fit over the main body of the REFNET joint after installation of the REFNET kit is complete.

3.0 AIR DISTRIBUTION SYSTEM

3.1 AIR HANDLING UNITS

The AHU shall be self-supporting type, factory fabricated & assembled made of extruded anodised aluminum and double skin Air Handling units of sectionalized construction comprising of:

Fan section with DIDW centrifugal fan outlet velocity not more than 550 MPM,

DX type Cooling coil section complete with distributors as per number of expansion valves, copper pipe dia 12.5mm and at least 0.41mm thick having 4-6 FPCM rated for 150 MPM velocity & cooling coil, cooling coil should be AHRI certified & tested at factory at 550 PSIG.

Filter section with synthetic fiber filters in corrugated shape rated for filter face velocity 150 MPM, Filters should be of Al. construction with medium sandwiched between Al. expanded wire wish & HDPE mesh, filters should have efficiency 99% down to 3 microns (MERV-13 or better).

TEFC induction motor, belt drive package/Direct Driven or plug fan, limit switch, marine light, vibration eliminators and suitable trap doors as required.

Drain Pan shall be constructed of 18 gauge polished stainless steel sheet with all corners welded with uniform slope from all sides leading to drain pan ensuring no stagnation of condensate water. Drain Pan shall be sandwich type insulated with 10 mm thick nitrile foam. The entire AHU shall be on extruded aluminum base.

AHU type (ceiling suspended or floor mounted), fan direction (Front discharge, top discharge, etc) air handling capacity, number of rows, static pressure & type of fan (Forward curve or backward inclined) shall be as per schedule of quantity.

In addition to above other necessary accessories required along with AHU are:

3.1.1 Motor and starter panel –

The fan motors shall be $415 \pm 10\%$ volts, $50 \pm 5\%$ HZ, 3 phase TEFC SQ. Cage induction motor. The motor shall be specially designed for quiet operation & motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through belt drive arrangement. Belts shall be of the resistant type only.

The casing shall have heavy gauge GI construction forward curved DIDW imported fan statically & dynamically balanced mounted on EN8 solid shaft or C 40 carbon steel. The supply air DIDW fan shall be forward curved. The fan impeller shall be supported to housing with angle iron frame & pillow block heavy duty ball bearing. The fan shall be selected for a fan outlet velocity below 10.2 meter / sec. The fan housing with TEFC Sq. Cage motor shall be mounted on a common adjustable

base frame on vibration isolators in case the impeller diameter is exceeding 450 mm & rubber turret mounts vibration isolators for fan dia upto 450 mm.

The fan motor shall be installed inside the housing of air handling unit to keep low noise level. The fan & motor assembly shall be of aluminum extruded section only.

Depending upon the capacity, Starter shall be DOL type upto 7.5KW & shall be star delta above 7.5KW. The panel should be able to receive signal from Remote Control (RC) for switching On or switching OFF of fan motor with inter connecting wiring. The panels shall be able to integrate with BMS.

3.1.2 REFRIGERANT COIL

The Refrigerant Coil shall be made of aluminum fins and copper tubes of $\emptyset 3/8$ " coil is with Inner Grooved Tube material (IGT). The minimum no. of fins / cm for cooling coils shall be 4.72. The bonding of aluminum fins with copper should be done hydraulically. The tube thickness shall be 0.50 mm & fin thickness shall be 0.15 mm the cooling coil should be tested for leaks at a hydraulic pressure of at least 10 Kg / sq.cm. for a minimum period of 3 hours at works. The velocity across face should be limited to 152 meter / minute.

3.1.3 FILTERS:

Each unit shall be provided with a factory assembled filter section containing washable synthetic tube air filters having extruded aluminum frame having filtration capacity of 10 micron particle size with an efficiency of 90% efficiency. Filters shall fit so as to prevent by pass. Holding frames shall be provided for installing a number of filters cells in banks. These cells shall be held within the frames by sliding the cells between guiding channels. Face velocity across filters shall not exceed 152 MPM.

Sr. No.	AIR-FILTER TECHNICAL	
(A)	Pre Filter (3 Micron)	
	Efficiency	99% down to 3 Micron
	IPD	8 - 9 mm WG
	FPD	20 - 21 mm WG
	Casing	Aluminium Frame
		Non Woven Synthetic Media Supported by Al.
	Media	Mesh on one side and finished with HDPE mesh
		on the other side
	Eurovent Class	EU – 7
	Filter Class	F – 7
	MERV Rating	MERV -13
	Temperature	Ambient
	Gasket	Food Grade

3.1.4 Expansion device –

Expansion of refrigerant R-410A should be handled by Electronic Expansion valve OR Thermostatic Expansion Valve depending upon the size and the part load operation of Compressors should be controlled by superheat of Expansion Device at Cooling Coil outlet Upto 10hp EEV, from 8hp to 42hp TXV. This expansion device should be able to communicate the temperature conditions at Cooling Coil Inlet and Outlet to the VRF outdoor and will be installed on the AHU itself for better efficiency. Also this expansion device shall be designed to work with heating as well as cooling cycle depending upon the customer requirement.

3.1.5 Communication kit –

The controller should be able to control the Set Temperature by sensing the air temperature at Return Air path and also should be capable to receive and give signal commands to outdoor unit and indoor unit for increasing or decreasing the capacity output.

Apart from this controller must read the superheat levels at Cooling Coil outlet and must communicate with VRF outdoor.

3.1.6 Remote control complete –

The remote should be corded with wide screen display and able to show the Outdoor Status at any given point of time. Also it shall have different modes like Fan Mode, Heat Mode ,Cooling Mode etc.

It should be possible to give address to each AHU with the help of corded remote and finally it should be possible to control it centrally also as well as through BMS.

3.1.7 Heat Recovery

The Heat Recovery section shall include enthalpy wheels and shall have minimum recovery of 75 % of total heat, i.e both sensible and latent (each being 75 %). Necessary computerized selection of the wheel should be provided along with the bid to justify the same. The wheel shall be made of pure aluminium foil coated with molecular sieve desiccant with pore diameter of 3°A. The cross contamination between the two air streams shall be nil and leakage less than 0.04%. The vertical and radial run of the wheel shall be less than 1 mm per meter of diameter. The wheels shall have non-contact labyrinth seals for effective sealing between the two air streams.

Heat Recovery Wheel specifications:

Rotor/wheel matrix shall have following Matrix:

The substrate: The substrate or wheel matrix should be made of pure aluminum foil so as to allow.

- > Quick and efficient uptake of thermal energy.
- Sufficient mass for optimum heat transfer
- Maximum sensible heat recovery at a relatively low rotational speed of 20 to 25 rpm.

The substrate shall not be made from any material which is combustible or supports combustion like synthetic fibrous media.

The wheel shall have minimum 75% both Sensible and Latent Balanced Effectiveness as per AHRI 1060.

The wheel has to be certified as per DIN EN ISO 846 with 0% fungal and bacterial growth at 95% Relative humidity and above.

Fire rating: NFPA - 90A certification with 0% for Flame spread classification should be confirmed by manufacturer.

The Wheel shall be AHRI/Eurovent certified in accordance with standard 1060 and carry the AHRI/Eurovent certification stamp.

The product shall be produced in an ISO certified facility

Necessary software selection of the wheel has to be enclosed to justify the pressure drop and efficiency calculations. The selection software shall show hrw performance in summer, monsoon & winter.

a. **The Desiccant:** The desiccant should be water molecule selective and non-migratory.

The desiccant should be molecular sieve 3Å, (certified by a third party lab to have an internal pore diameter of 3Å), so as to keep the cross contamination to absolute minimum and also ensure the exclusion of contaminants from the air streams, while transferring the water vapour molecules.

The desiccant, of sufficient mass which should not be less than 5 kg per 1000 cfm of air, should be coated with non-masking porous binder adhesive on the aluminum substrate so as to allow quick and easy uptake and release of water vapour. A confirmation has to be provided by manufacturer of wheel to this effect. A matrix with desiccants impregnated in nonmetallic substrates, such as synthetic fibre, glass fibre, etc. will not be accepted.

The rotor/wheel matrix shall have equal sensible and latent recovery.

The weight of desiccant coating and the mass of aluminum foil shall be in a ratio so as to ensure <u>equal</u> recovery of both sensible and latent heat over the operating range. Accordingly, a rotor matrix which has an etched or oxidised surface to make a desiccant on a metal foil and results in insufficient latent recovery and hence unequal recovery, or a rotor matrix made from desiccant integrated in a synthetic fibre matrix which result in insufficient sensible recovery, high rotation speed, and unequal recovery, will not be accepted.

b. **Rotor:** With optimum heat and mass through matrix formed by desiccant, of sufficient mass, coated on an aluminum foil, the rotor should rotate at lower than 20 to 25 RPM, thereby also ensuring long life of belts and reduced wear and tear of seals.

The rotor shall be made of alternate flat and corrugated aluminum foil of uniform width.

The rotor honeycomb matrix foil should be so wound and adhered (full node line adhesive to be provided) so as to make a structurally very strong and rigid media which shall not get cracked, deformed etc. due to change of temperature or humidity.

The rotor having a diameter up o 2400 mm shall have spokes to reinforce the matrix. The internal threaded rod type spokes shall not be acceptable as it weakens the wheel structural strength thereby

reducing the service life. From 2000 mm diameter upwards, the option of a special wing structure, to prevent the rotors from wobbling or deforming due to the successive pressure differentials, will be available.

Sectioned wheels, with pie segments, capable of being assembled in the field, shall be available as an option, above 2600 mm in diameter.

Wheels above 3400 mm in diameter shall be segmented and provided with wing structures spokes and flanged rim. The segmented wheels shall be provided with field rotation adjustment mechanism.

The HRW hub shall be fabricated out of heavy duty steel in order to have high mechanical strength. Light duty Aluminum hub shall not be accepted.

The surface of the wheel/rotor should be highly polished (FACED) to ensure that the <u>vertical</u> run out does not exceed ± 1 mm for every 1 meter diameter, thereby ensuring, negligible leakage, if labyrinth non-contact seals are provided, and minimal drag, if contact wiper seals are provided.

The radial run out also shall not exceed ± 1 mm for every 1 meter diameter, thereby minimising the leakage/drag on the radial seals, and minimise the fluctuation in the tension of the drive belt.

The number of wraps (of alternative corrugated and flat foil) for every inch of rotor radii shall be very consistent so as to ensure uniform air flow and performance over the entire face in the air stream. Flute height and pitch will be consistent to a very tight tolerance to ensure uniform pressure drop and uniform airflows across the rotor face.

The rotor shall be a non clogging aluminum media, having a multitude of narrow aluminum foil channels, thus ensuring a laminar flow, and will allow particles upto 800 microns to pass through it.

The media shall be cleanable with compressed air, or low pressure steam or light detergent, without degrading the latent recovery.

c. The Cassette / casing

The recovery wheel cassette/casing shall be manufactured from tubular / sheet metal structure to provide a self-supporting rigid structure, complete with access panels, purge sector, rotor, bearings, seals, drive mechanism complete with belt. The sheet metal should be coated with a special corrosion inhibitor coating and a certificate for the same should be provided.

The rotor/wheel should have a field adjustable purge mechanism to provide definite separation of airflow minimising the carryover of bacteria, dust and other pollutants, from the exhaust air to the supply air. It shall be possible, with proper adjustment, to limit cross contamination to less than 0.04% of that of the exhaust air concentration.

The face and radial seals shall be four (4) pass non-contact labyrinth seals / brush seals for effective sealing between the two air streams, and also for a minimum wear and tear ensuring long life of the seals.

d. Performance Testing

The HRW manufacturer shall have test facilities for performance testing of HRWs. If required the manufacturer shall be able to offer type testing of HRWs at their works and submit a type test report.

The manufacturer shall have test facilities for carry over testing at the same facilities where HRWs are manufactured.

3.2 DUCT WORKS

3.2.1 GENERAL

Sheet Metal Duct Works shall be carried out in accordance with either SMACNA or B.I.S. (IS 655) guidelines, as asked for in BOQ. SMACNA guidelines (upward modified in this specification) shall be adopted for factory fabricated ducts, and BIS Codes shall be adopted for site fabricated ducts.

3.2.2 Duct Material

- a. All ducts shall be fabricated either from Galvanised Sheet Steel (GSS) conforming to IS: 277 or aluminium sheets conforming to IS:737. The steel sheets shall be hot dip galvanized with MAT finish with coating of minimum 120 grams per square meter (GSM) of Zinc, GI sheets shall be lead free, eco friendly and RoHS compliant
- b. The thickness of sheets for fabrication of rectangular ductwork shall be as under. The thickness required corresponding to the longest side of the rectangular section shall be applicable for all the four sides of the ductwork.

Longest side (mm)	Minimum sheet thickness	
	For GSS	For Al.
750 mm and below	0.63	0.80
751 mm to 1500 mm	0.80	1.00
1501 mm to 2250 mm	1.00	1.50
2251 mm & above	1.25	1.80

- c. Contractor shall prepare shop drawings, coordinated with the working drawings and the ceiling plans made by Architect.
- d. Contractor shall fabricate, supply, install, test and balance air system and establish the air balance schedule.

- e. Contractor shall include in his costing all supporting, suspension and air balancing devices.
- f. Supply/ return air outlets, F.A. grilles and accessories shall be constructed from extruded aluminium sections.
- g. Flanges for matching duct sections, stiffening angles (braces) and supporting angles shall be of rolled steel sections, and shall be of the following sizes:

Application	Duct Width	Angle size
Flanges	Upto 1000 mm	35 mm x 35 mm x 3 mm
-do-	1001 mm to 2250 mm	40 mm x 40 mm x 3 mm
-do-	More than 2250 mm	50 mm x 50 mm x 3 mm
Bracings	Upto 1000 mm	25 mm x 25 mm x 3 mm
-do-	More than 1000 mm	40 mm x 40 mm x 3 mm
Support angles	Upto 1000 mm	40 mm x 40 mm x 3 mm
-do-	1001 mm to 2250 mm	40 mm x 40 mm x 3 mm
-do-	More than 2250 mm	Size and type of RS section
		shall be decided in
		individual cases

- h. Hanger rods shall be of mild steel and of at least 10 mm dia for ducts upto 2250 mm size, and 12 mm dia for larger sizes.
- i. All nuts, bolts and washers shall be zinc plated steel. All rivets shall be galvanised or shall be made of magnesium aluminium alloy. Self tapping screws shall not be used.

3.2.3 LIST OF BUREAU OF INDIAN STANDARDS CODES

IS:	1234 (Part - I) - 1474	Mild steel tube
IS:	1234 (Part - II) - 1482	Mild steel Tubulars and other Wrought steel pipe fittings
IS:	4736 - 1468	Hot-dip zinc coatings on steel tubes
IS:	823 - 1464	Code of procedure for manual metal arc welding of mild steel
IS:	780 - 1480	Sluice valves for water works purposes
IS:	778 - 1480	Copper alloy gate, lobe and checks Valves for water works purposes
IS:	1536 - 1476	Flanges configuration
IS:	5312 (Part-I) - 1484	Swing - check type reflux Non Return valves for water works
IS:	2374 - 1463	Colour code for the identification of pipelines

IS:	554 - 1475	Dimensions for pipe threads where pressure tight joints are required on the threads.	
IS:	655 - 1463	Metal air ducts	
IS:	277 - 1477	Galvanized steel wire for fencing.	
IS:	4064 - (Part -II) - 1478	Specific requirements for the direct switching of individual motors.	
IS:	3854-1464	Switches for domestic & similar Purpose	
IS:	644-1477	PVC insulated (HD) electric cables For working voltage upto and Including 1100 Volts.	
IS:	4224 (Part II) - 1474	HRC cartridge fuse links upto 650 volts.	
IS:	8544 (Part-I to IV)-1474	Starters	
IS:	732 (Part-III)-1482	Inspection and testing of installation.	
IS:	654-1464	Air Conditioning (Safety Code)	
IS:	660-1463	Mechanical Refrigeration (Safety Code)	
IS:	4844-1487	Test Code for Centrifugal Fan.	
IS:	3103-1475	Code of practice for Industrial Ventilation	
IS:	7240-1481	Application & Finishing of thermal insulation material	

In case of any revision in above BIS code. The REVISED one shall only be applicable.

a. DUCT DESIGN PARAMETERS (Rectangular / Square)

Maximum Flow Velocity	1100/1500 FPM	450 MPM
Maximum Friction	0.08 WG/100 FT Run	5MM WG/100 M Run
Maximum Velocity at SA outlet	500 FPM	150 MPM
Maximum flow velocity in exhaust duct	1800 FPM	550 M

3.3 CONSTRUCTION

a. Ducts

- i) Ducts shall be fabricated at site or factory fabricated and shall be generally as per IS: 655 "Specifications for metal air ducts", unless otherwise deviated in these General Specifications.
- ii) The interior surfaces of the ducting shall be smooth.
- iii) All the ducts upto 600 mm longest side shall be cross broken between flanges by a single

continuous breaking. Ducts of size 600 mm and above shall be cross broken by single continuous breaking between flanges and bracings. Alternatively, beading at 300 mm centres for ducts upto 600 mm longest side, and 300 mm centres for ducts above 600 mm size shall be provided for stiffening.

- iv) As far as possible, long radius elbows and gradual changes in shape shall be used to maintain uniform velocity accompanied by decreased turbulence, lower resistance and minimum noise. The ratio of the size of the duct to the radius of the elbow shall be normally not less than 1:1.5.
- v) Flanged joints shall be used at intervals not exceeding 2500 mm. Flanges shall be welded at corners first and then riveted to the duct.
- vi) Stiffening angles shall be fixed to the sides of the ducts by riveting at 1.25 meters from joints for ducts of size 600 mm to 1500 mm, and 0.6 mm from joints for ducts of size larger than 1500 mm. Bracings for ducts larger than 1500 mm can alternatively be by diagonal angles.
- vii) Plenums for filters shall be complete with suitable access door of size 450 mm x 450 mm.
- viii) All factory fabricated duct shall be supplied in L sections, the length of any piece shall not be more than 1800 mm for duct with longest side of cross section as 600 mm and above and 3000 mm for rest.

b. Air Outlet and Inlets (Supply and Return)

- i. All air outlets and intakes shall be made of extruded aluminium sections & shall present a neat appearance and shall be rigid with mechanical joints.
- ii. Square and rectangular wall outlets shall have a flanged frame with the outside edges returned or curved 5 to 7 mm and fitted with a suitable flexible gasket between the concealed face of the flanges and the finished wall face. The core of supply air register shall have adjustable front louvers parallel to the longer side to give upto 22.5 degrees vertical deflection and adjustable back louvers parallel to the shorter side to achieve a horizontal spread air pattern to at least 45 degrees. Return air grilles shall have only front louvers. The outer framework of the grilles shall be made of not less than 1.6 mm thick aluminium sheet. The louvers shall be of aerofoil design of extruded aluminium section with minimum thickness of 0.8mm at front and shall be made of 0.8mm thick aluminium sheet. Louvers may be spaced 18 mm apart.
- iii. Square and rectangular ceiling outlets/intakes shall have a flange flush with the ceiling into which it is fitted or shall be of anti smudge type. The outlets shall comprise an outer shell with duct collar and removable diffusing assembly. These shall be suitable for discharge in one or more directions as required. The outer shell shall not be less than 1.6 mm thick extruded section aluminium sheet. The diffuser assembly shall not be less than 0.80 mm thick extruded aluminium section.
- iv. Circular ceiling outlets/intakes shall have either flush or anti smudge outer cone as specified in the tender specifications. Flush outer cones shall have the lower edge of the cone not more than 5 mm below the underside of the finished ceiling into which it is fitted. Anti smudge cones shall have the outer cone profile designed to reduce dirt deposit on the ceiling adjacent to the air outlet. The metal sheet used for construction of these shall be minimum 1.6 mm thick extruded aluminium sheet.
- v. Linear diffusers shall have a flanged frame with the outside edges returned 3.5 mm and shall have one to four slots as required. The air quantity through each slot shall be adjustable. The metal sheet used for the construction of these shall be minimum 1.6 mm thick extruded aluminium sheet.
- vi. Grilles and diffusers constructed of extruded aluminium sections shall have grille bars set straight, or deflected as required. These shall be assembled by mechanical interlocking of components to prevent distortion. These grilles and diffusers shall have a rear set of adjustable blades, perpendicular to the face blades for deflection purposes.
- vii. All supply air outlets shall be fitted with a volume control device, made of extruded aluminium gate section. The blades of the device shall be mill finish/ block shade pivoted on nylon brushes to avoid rusting & rattling noise, which shall be located immediately behind the outlet and shall be fully adjustable from within the occupied space without removing any access panel. The volume control device for circular outlets shall be opposed blade radial /shutter type dampers, or two or more butterfly dampers in conjunction with equalizing grid. Opposed blade dampers shall be used for square and rectangular ceiling/wall outlets and intakes.
- viii. All the products supplied by contractor should supplement in performance by selection curves of product ratings from the manufacturer.
- ix. Laminar supply air diffusers shall be made of 2mm thick powder coated aluminium sheet duly insulated with 5mm thick closed cell polyethylene foam insulation having factory laminated aluminium foil and joints covered with self adhesive aluminium tape and having holes 2/3 mm dia including frame work.

c. Fresh Air Intakes Louvers with Bird Screen

- i. Fresh air intake louvers at least 50 mm deep shall be made of powder coated extruded aluminium sections.
- ii. A flanged frame using RS sections shall be provided on front face to conceal the gap between the louvers and the adjoining wall face. Corners of frame shall be welded. The frame shall be made structurally rigid.
- iii. Louvers made from extruded aluminium section shall be in modular panel form for ease of handling. These shall be free from waves and buckles. Vertical blades shall be truly vertical and horizontal blades shall be truly horizontal. Butt joints in blades shall not be accepted.
- iv. Additional intermediate equally spaced supports and stiffeners shall be provided to prevent sagging/ vibrating of the louvers, at not more than 750mm centres where the louver's length is longer than 750mm.
- v. A bird wire screen made of 12 mm mesh in 1.6 mm steel wire held in angle or channel frame shall be fixed to the rear face of the louver frame by screens.
- d. Flexible Ducting

Flexible Duct is a round, flexible light weight duct and is preliminary used for

- i. Speedy completion of project
- ii. Offers a high degree of flexibility, which allows it to be easily connected to any desired position.
- iii. A quick and economical means of correcting misalignment between system components.
- iv. Allows ducting around obstacles where fabricated and fitted ducts would be difficult and costly to install.

Flexible duct is constructed as described below:

- i. An uninsulated flexible duct shall be made of double lamination of metalized polyester film permanently bonded to a coated spring steel wire helix. Duct shall be in tear & puncture resistant construction.
- For insulated flexible duct where specified, inner core for the same should be made of double lamination of metalized polyester film permanently bonded to a coated spring steel wire helix. Fiberglass insulation of minimum 14 kg/cu.m density, 25 mm thickness shall be wrapped over the inner core & covered with strong outer jacket cum vapour barrier made of fibre glass reinforced metalized polyester film laminate.
- iii. Care must be taken to install all the flexible duct in fully extended position & bends made with adequate radius as per manufacturer recommended practices.

3.3 FIRE DAMPERS

- i) Fire dampers shall be provided in all the supply air ducts and return air ducts (where provided), return air passage in the air-handling unit room and at all floor crossings. Access door will be provided in the duct before each set of fire dampers.
- ii) Fire dampers shall be multi blade louvers type. The blade should remain in the air stream in open position & shall allow maximum free area to reduce pressure drop & noise in the air passage. The blades and frame shall be constructed with minimum 1.6mm thick galvanised sheet & shall be factory fitted in a sleeve made out of 1.6mm galvanised sheet of minimum 400mm long. It shall be complete with locking device, motorised actuator & control panel.
- iii) Fire dampers shall be motorised smoke & fire dampers type. It shall be supplied with spring loaded UL stamped fusible link to close fire damper in the event of rise in duct temperature. Fire damper shall also close on receipt of fire alarm signal to cut off air supply instantaneously. An electric limit switch shall also be operated by the closing of fire damper, which in turn shall switch off power supply to AHU blower motor as well as strip heaters.
- iv) Fire dampers shall be CBRI tested & certified for 90 minutes rating against collapse & flame penetration as per UL 555-1995.(Under writers laboratories)
- v) Fire dampers shall be compatible with the fire detection system of building & shall be capable of operating automatically through an electric motor on receiving signal from fire alarm panel.
- vi) Necessary wiring from fire alarm panel up to AHU electric panel shall be provided by the department & further from AHU electric panel to fire damper shall be provided by air conditioning contractor.

3.4 INSTALLATION OF METALLIC DUCT

a. Ducting

- i. The fabrication and installation shall be in a workmanlike manner. Duct work shall be rigid and straight without kinks.
- ii. All exposed ducts within the conditioned space shall have slip joints. Flanged joints shall not be used.
- iii. All joints shall be airtight.
- iv. Ducts shall be supported independently from the building structure and adequately, to keep the ducts true to shape. The support spacing shall be not more than 2 m. where ducts cannot be suspended from ceiling, wall brackets or other suitable arrangements, as approved by the Engineer-in-charge shall be adopted. Neoprene or other vibration isolation packing of minimum 6 mm thickness shall be provided between the ducts and the angle iron supports/brackets. Vertical duct work shall be suitably supported at each floor by steel structural members.
- v. Where metal ducts or sleeves terminate in woodwork, tight joints shall be made by means of closely fitting heavy flanged collars. Where ducts pass through brick or masonry openings, wooden frame work shall be provided within the openings and the crossing ducts shall be provided with heavy flanged collars on either side of the wooden frame work, so that duct crossing is made leak-proof.
- vi. Duct connections to the air-handling unit shall be made by inserting a double canvas sleeve 100 mm long. The sleeve shall be securely bonded and bolted to the duct and unit casing.
- vii. Dampers shall be provided in branch duct connections for proper volume control and balancing the air quantities in the system, whether indicated in the drawings or not. Suitable links, levers and quadrants shall be provided for proper operation, control and setting of the dampers. Every damper shall have an indicating device clearly showing the position of the dampers at all times.
- viii. Where electrical heaters are mounted in the duct, these shall be of low temperature totally enclosed type fitted with radiation fins. A removable panel for access to the heaters shall be provided in the duct. Any hole in the duct for electrical wiring must be provided with suitable bushes to avoid leakage. 6 mm thick asbestos board lining shall be provided all around the inside of the duct for a distance of 30 cms. on either side of the electrical heaters. A manually reset thermostatic safety switch shall be provided near the duct section having heaters. In addition, the heaters must be interlocked with the connected fan motor of the AHU.

b. Air Outlets and Inlets

i. The locations of the air outlets and intakes shall be shown in the tender drawings and necessary openings and the wooden framework for fixing the grilles shall be provided by the air conditioning contractor. The location of these outlets/ inlets is subject to change and the approval of the Engineer-in-Charge shall be obtained before finally fixing the grilles/diffusers in position.

- ii. In installing fresh air intakes, no fixing device shall be visible from the face of the frame. Where louvers are to be fixed in masonry or concrete, fixing shall be with either expanding plugs or raw plugs. Where the louvers are to be fixed in steel or wood, non-ferrous screws or bolts shall be used.
- iii. Supply air outlets and return air intakes shall be anodized/ powder coated aluminium to the desired colour to match the surroundings wall/ceiling. The fresh air intakes shall be anodized/ powder coated aluminium as approved by the Engineer-in-Charge. The paint colour shall be approved by the Engineer-in-Charge.
- iv. All damages to the finish of the structure during the installation work shall be made good by the air-conditioning contractor before handing over the installation to the Department.

3.5 Access Doors

- a. All main work shall be accessible throughout using tight fitted hinged access doors. Doors shall be provided with neoprene rubber gaskets. Angle joints shall be provided with neoprene rubber gaskets for leak-tightness of the joints.
- b. Access door / panels shall be provided at following places.
- **c.** Any other places specifically mentioned in the drawing or if envisaged by the owner / consultants during execution stage.
- d. In case access doors are to be installed in the insulated ducts, the access door panel shall be double skin construction with insulation filled in such that it can be operated without damaging the duct insulation.

3.6 Balancing

Air systems shall be balanced in a manner to minimize throttling losses. The entire air distribution system shall be balanced with the help of an anemometer. The measured air quantities at fan discharge and at the various outlets shall be within \pm 5 percent of those specified/quoted. For fans greater than 0.75 KW (1.0 HP), fans must then be adjusted to meet design flow conditions. Branch duct adjustments shall be permanently marked after the air balancing is completed so that these can be restored to their correct position if disturbed at any time.

3.7 Measurement

- i) Duct measurements (for insulated ducts) shall be taken before application of insulation.
- ii) Duct work shall be measured section wise on the basis of external surface area by multiplying the axial length from flange face to flange face for each section by the corresponding duct perimeter in the centre of that section length.
- iii) Uniformly tapering straight sections shall also be measured as in (ii) above. However, for special pieces like tees, bends etc. area computations for surface areas shall be done as per the shape of such pieces.

- iv) The quoted unit rate for external surfaces of ducts shall include all wastage allowances, flanges, gaskets for joints, vibration isolators, bracings, hangers and supports, inspection chambers/access panels, splitter dampers with quadrants and levers for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the specifications. These accessories shall not be separately measured.
- v) Grilles and diffusers (except linear diffusers) shall be measured by the cross sectional areas, perpendicular to the airflow, and excluding the flanges. Volume control dampers, where provided shall not be separately accounted for.
- vi) Linear diffusers shall be measured by linear measurements only, and not by cross-sectional areas, and shall exclude flanges for mounting of the linear diffusers. The supply air plenum for linear diffusers shall be measured as described above for ducting.
- vii) Fire dampers shall be measured by their cross sectional area perpendicular to the direction of the airflow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, fusible link/solenoid with wiring, but excluding the fire detectors, etc.

3.8 Leakage Test

Test duct for leakage by using test kits containing test blowers, two U tube manometers, and calibrated curve attached to the orifice tube assembly.

The above mentioned test would be a pilot test, and subsequently, if the construction manager / consultant asked for then Halogen / Metal Halide damp test / smoke test could be carried out, prior to branch / collar works.

3.9 Mechanical Noise and Vibration Control

- a. Flexible connections shall be provided on all duct work connections to fans, rotating plant and equipment isolated from structure and anti-vibration materials or mountings. Pipe work and duct work crossing building movement or construction joints shall be installed with flexible connections.
- Flexible connection on duct work to fans etc. Shall be a minimum/ maximum free length of 100mm / 200mm respectively to minimize noise transmission and noise break out. They shall be completely free from stress and shall not be required to accept any weight.
- **c.** Thickness and strength of flexible connection materials shall be suitable to withstand the positive and negative fan pressure to which they swill be subjected to and shall not allow perceptible leakage. The materials shall be durable, non flammable having food acoustical quality.

3.10 Silencers

- a. Duct sound attenuators / silencers of the following specifications would be installed wherever asked for in the drawings and the BOQ.
- b. All plant attenuators shall be selected to maintain noise criteria given in this specification.
- c. The outer casing shall be out of min. 22G galvanised steel in accordance with ASHRE (ISI) recommendations for high pressure rectangular duct work. Seams shall be lock formed on pittsburg lock machine.
- d. Interior elements of silencers shall be out of min. 22 G galvanised perforated steel.
- e. Acoustic fill shall be Fibre glass of density not less than 48 kg/m3 sufficient to obtain specified acoustic performance and shall be packed under 10% compression to eliminate voids due to vibration and setting. Material shall be inert, vermin and moisture proof. All material of construction and acoustic fill shall be incombustible as per IS 3144.
- f. All silencer shall be selected against a maximum allowable air pressure drop of **10mm**. Air tight construction shall be provided by use of duct sealing compound at site by the air conditioning contractor.
- g. Acoustic Performance Silencer acoustic ratings shall include insertion loss and self-noise power levels and shall meet or exceed minimum performance. Contractor shall provide computer selection for the silencer supplied at site which will indicate db reduction at different octave band frequency.
- h. Aerodynamic Performance Static pressure drop through silencers shall not exceed those listed in the silencer schedule at the indicated airflows.
- i. Transitions Where transitions are required to adapt silencer dimensions to connecting duct work, they would be supplied by the installing contractor.

3.11 AIR REGISTERS

Scope included following:

- a. Air Distribution Registers, grilles, diffusers.
- b. Fire / Smoke Dampers
- c. Access Doors
- d. Outside Air Louvers
- e. Flexible Ducts

The quality control of these items are governed as specified below:

- a. Air Diffusers/Grilles: As per ratings by Air Diffusion Council / As per approved manufacturer.
- b. Fire / Smoke / Combination dampers : UL , NFPA 90A / 90 B.

a. Air Register

The scope of this section includes supplying, installation, testing, balancing and commissioning of various air distribution products as specified here under. All air distribution products shall have guaranteed performance rating as regards to air quantity, throw, noise level and pressure drop etc. Contractor has to provide selection curves at the time of supply.

b. Supply and Return Registers and Ceiling Terminals

Supply and return air registers and ceiling terminals shall be made of extruded aluminum section as specified in BOQ. The registers/terminals shall be either anodized or powder coated in finish as given in BOQ. Supply air registers/terminals shall be provided with screw operated opposed blade volume control device of extruded aluminum in mill finish. The registers shall be suitable for fixing arrangement concealed or visible screw as approved by architect/consultant.

All registers shall be selected as per selection curves and in consultation with architect/consultant. All registers shall have soft continuous rubber/ foam gasket between the periphery of the registers/terminals and the surface on which it has to be mounted.

c. Linear Registers

Linear continuous supply or return air register shall be extruded aluminum construction with fixed horizontal bars at 0 $^{\circ}$ or 15 $^{\circ}$ inclination with one way or two way deflection and flanges on both sides. The thickness of fixed bar louvers shall be 5 mm in front and the flange shall be 20 mm wide with round edges. The register shall be suitable for concealed fixing and horizontal bars of the register shall be mechanically crimped from the back to hold them.

Volume control device of extruded aluminum construction in mill finish shall be provided in S.A. duct collars.

d. Single Individual Adjustable Louvered Supply or Return Air Register

Single individual adjustable horizontal /vertical supply or return air register shall be made of extruded aluminum construction. The louvers shall hold deflection settings under all conditions of velocity and pressure since mounted on Nylon bushes. The register shall have 20 mm wide flange all around with front screw fixing. Volume control device of extruded aluminum / GI construction in mill finish shall be provided in S.A. duct collars.

e. Double Adjustable Louvered Supply/Return Air Register with Horizontal / Vertical or Vertical/Horizontal Louver Arrangement

The register hall be adjustable as each louver shall be pivoted to provide pattern with 0° to plus or minus 15° arc up to 30° deflection down towards. The louver shall hold deflection settings under all conditions of velocity and pressure. The Rear louver of the register shall be in black shade.

Volume control device of extruded aluminium construction with mill finish shall be provided in S.A. duct collars.

f. Rectangular Fixed Bar Register

Supply/Return air all side flange air register shall be extruded aluminium construction with fixed horizontal bars at 0° or 15° inclination with one way or two way deflection and flanges on both sides. The thickness of fixed bar louvers shall be 5 mm in front and the flange shall be 20 mm wide with roundedges. The register shall be suitable for concealed fixing and horizontal bars of the register shall be mechanically crimped from the back to hold them.

g. Exhaust Air Register

Exhaust air register shall be made of extruded aluminium with fixed horizontal louvers at 40° angle setting on a 20 mm louver pitch. The register shall have 20 mm wide flange with round edges all around. The register shall be suitable for front screw fixing.

Volume control device of extruded aluminium construction in mill finish shall be provided in S.A. duct collars.

h. Square Ceiling Air Terminals

Square/Rectangular ceiling air terminals shall be made of extruded aluminium construction with flush fixed pattern. The terminals shall have Anti-Smudge ring and spring loaded removable central core in various pattern for air flow direction. The terminal shall be mounted by concealed screw fixing arrangement. The supply air terminal to be supplied with Volume control device of extruded aluminium construction in mill finish.

i. Curved Blade Ceiling Terminals

Square /rectangular curved blade ceiling terminals shall be made of extruded aluminium. The terminals shall have individual adjustable blades mounted on nylon bushes which facilitate to adjust the direction of air as per site conditions. The terminals shall have 20 mm wide flanges all around and concealed screw fixing arrangement. The supply air register to be supplied with Volume control device of extruded aluminium construction in mill finish.

j. Volume Control Device

Opposed blade volume control device shall be made of all extruded aluminium construction in mill finish. Opposed blades shall be pivoted to extruded aluminium frame with Nylon bushes. Specially designed blade have an overlapping lip which ensure a tight closure.

k. Ventilation Air Intake Louvers

Ventilation air intake louvers 50 mm deep wherever required as per shop drawing will be made of extruded aluminium construction duly Anodised or Powder coated. Bird/insect screen will be provided with the intake louvers. The blades are inclined at 45 °on a 40 mm blade pitch to minimise water ingress. The lowest blade of the assembly shall extended out slightly to facilitate disposal of rain water without falling in door/wall on which it is mounted.

Wherever specified, the intake louvers shall be provided with factory fitted all aluminium construction volume control dampers in mill finish.

I. Storm Proof Louvers

80mm deep wherever required as per shop drawing will be made of extruded aluminium construction. The blades are inclined at 45 degree on 75 mm blade pitch to minimise water ingress. The lowest blade of the assembly shall extended out slightly to facilitate disposal of rain water without falling in door / wall on which it is mounted.

m. Air Transfer Door Register

Extruded aluminium construction air transfer door register will be provided as per approved shop drawings. The register will be complete with single /double register frame to be mounted on door panel from both sides. The central core shall be NO- SEE-THRU type. The register shall be anodised or powder coated as per Architect's requirement. The register shall be provided with insect screen to prevent movement of insects from inside to outside or vice versa.

n. Motorised Combined Smoke & Fire Dampers - Spring Return

All Supply and Return Air Ducts at AHU room crossings and at all floor crossings shall be provided with approved make fire and smoke dampers of atleast 120 minutes fire rating certified by CBRI Roorkee as per UL 555:1973.

- o. Fire Damper blades & outer frame shall be formed of 1.6MM galvanised sheet steel. The damper blade shall be in pivoted on both ends using chrome plated spindles in self lubricated bronze bushes. Stop seals will be provided on top and bottom of the damper housing made of 16 G galvanised sheet steel. For preventing smoke leakage side seals will be provided.
- p. In normal position damper blade shall be held in open position with the help of a 24V operated electric actuators thereby providing maximum air passage without creating any noise or chatter.
- q. The damper shall be actuated through electric actuator. The actuator shall be energised with the help of a signal from smoke detector (supplied by others) installed in AHU Room/R.A.Duct/Damper. The Fire Damper shall also close due to Temp.rise in S.A. Ducts thru the Electric Temp.sensor factory set at 165° F micro switches with bakelite base will be provided to stop fan motor and give open & close signal at remote panel in case of motorised actuator.
- r. Each Dampers in case of motorised Smoke-cum-Fire Damper shall have its own panel which will incorporate necessary circuit required to step down voltage available from UPS or Emergency Power Supply to shown status of the damper (open or close), to allow remote testing of damper & indication in event of damper closure due to signal from smoke sensor/Temp.sensor & reset button. Additional Terminal will be provided to have signal (sound beep or visual) in Central Control Room.

- s. Damper Actuator shall be spring return so as to close the damper in the event of power failure automatically and open the same in case of power being restored.
- t. The Fire Dampers shall be mounted in fire rated wall with a duct sleeve 400MM long. The sleeve shall be factory fitted on fire damper. The joints at sleeve end shall be Slip on type. Minimum thickness of G1 Sheet shall be 18 G.
- u. The damper shall be installed in accordance with the installation method recommended by the manufacturer.
- v. After installation of Fire Dampers, contractor will co-ordinate with the civil contractor on site and get the extra openings sealed, and then finally finish the installation by sealing the area, using approved make of mastic fire sealant.

3.12 INSULATION

This scope covers the specifications for insulation of Exposed, Concealed, Outdoors and Underground works.

Insulation, adhesives, coatings, sealant, tapes, shall have a flame spread rating of 25 or less and smoke development of 50 or less in accordance with UL 723.

a. Pipe and Equipment Insulation

Provide factory pre-molded of material specified in section type insulation material for pipes and equipment.

- ➤ The Pipe insulation basic material shall be cross linked closed cell Class-O Oxide Acetate Foam or Class-O closed cell elastometric nitrile rubber. Insulation should be of minimum thickness as mention in the BOQ.
- ➤ The Pipe insulation shall be with Factory pre-laminated Aluminum foil for mechanical protection where the men approach to damages the Oxide Acetate foam surface. Insulation should be of minimum thickness as mention in the BOQ.
- > Density of Material shall be between $30 \pm 3 \text{ Kg/m3}$.
- > Thermal conductivity of Oxide Acetate foam shall not exceed 0.029 W/mK at mean temperature of 0° C and 0.35 W/mK at 27±2 Deg C.
- Insulation material shall be UV resistive, anti-microbial and anti-fungal with zero rating fungal growth as per ASTM –G -21
- > Insulation material should not have any effect of acids and alkalis as per IS:9845-1998
- The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O'.
- > Water vapor permeability shall be negligible as per DIN EN ISO : 12572, i.e. Moisture Diffusion Resistance Factor or ' μ ' value should be minimum 12800.
- The insulation material passes Smoke and Toxicity test as per (IMO Resolution MSC -307 (88) (2010 FTP Code): Annex 1: Part 2
- > Material shall be CFC/ HCFC free as per US EPA 5021 A(2014).

b. Recommended Adhesive

Adhesive used for sealing the insulation shall be based on polychloroprene with special rosin and tacky fire. The adhesive shall be R-242 grade nonflammable in dry form and solid 26% (\pm 2%) with heat, water & chemical resistance with the determination of ASTM-D 903, ASTM-D 3960 (\leq less than or equal to 264 gm/ltr.). The application method of adhesive strictly follows as per adhesives manufacturer's technical data sheet.

Following installation procedure should be adopted:

- The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.
- > The pipes shall be treated with coats of adhesive properly.
- The insulation preformed section shall be fixed tightly to the surface taking care to seal all joints with 50mm wide aluminum adhesive tape (transverse and circumferential). (If any)
- The insulation shall be tied with PVC band not less than 6mm width and 25 Gauge 4 bends per meter or equivalent plastic band using G.I. sheet clamp crimped at the joints.

c. Duct-in-Line Thermal Insulation

External thermal insulation shall be provided as follow:

- The duct insulation Basic material shall be cross linked closed cell Oxide Acetate Foam. Insulation should be of minimum thickness as mention in the BOQ.
- The duct insulation shall be with Factory pre-laminated Aluminium foil for mechanical protection where the men approach to damages the Oxide Acetate foam surface. Insulation should be of minimum thickness as mention in the BOQ.
- > Density of Material shall be between $30 \pm 3 \text{ Kg/m3}$.
- ➤ Thermal conductivity of Oxide Acetate foam shall not exceed 0.029 W/m.K at mean temperature of 0□C and 0.35 W/mk at 27±2 Deg C.
- Insulation material shall be UV resistive, anti-microbial and anti-fungal with zero rating fungal growth as per ASTM –G -21
- > Insulation material should not have any effect of acids and alkalis as per IS:9845-1998
- The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O'.
- > Water vapor permeability shall be negligible as per DIN EN ISO : 12572, i.e. Moisture Diffusion Resistance Factor or ' μ ' value should be minimum 12800.
- The insulation material passes Smoke and Toxicity test as per (IMO Resolution MSC -307 (88) (2010 FTP Code): Annex 1: Part 2
- > Material shall be CFC/ HCFC free as per US EPA 5021 A(2014).

Following installation procedure should be adopted:

The thickness of the cross linked closed cell Oxide Acetate Foam shall be as mentioned below and in the in the schedule of quantity. Following installation procedure should be adopted:

- Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work.
- One coat Adhesive must be allowed to tack on the surface of the ducts to dry and then press surface firmly together starting from one end and working towards centre.
- Measurement of surface dimensions shall be taken properly to cut Oxide Acetate Foam sheets to size with sufficient allowance in dimension.
- > Material shall be fitted under compression and no stretching of material should be allowed.
- A thin film of adhesive shall be applied on the back of the insulating material sheet and then on to the metal surface.
- When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond.
- > All longitudinal and transverse joints shall be sealed as per manufacturer recommendations.
- > The adhesive shall be strictly as recommended by the manufacturer.
- > The detailed Application specifications are as per the manufacturer's recommendation.

RECOMMENDED THICKNESS OF CROSS LINKED CLOSED CELL OXIDE ACETATE FOAM BASED UPON DUTY CONDITIONS FOR COASTAL AREAS

Supply air duct (Line temperature : 14 Deg C)	Use 25 mm thickness
Return air duct (Line temperature : 22 Deg C)	Use 9 mm thickness

RECOMMENDED THICKNESS OF CROSS LINKED CLOSED CELL OXIDE ACETATE FOAM BASED UPON DUTY CONDITIONS FOR NON-COASTAL AREAS

Supply air duct (Line temperature : 14 Deg C)	Use 19 mm thickness
Return air duct (Line temperature : 22 Deg C)	Use 9 mm thickness
Supply Air Duct in Return Air Path	Use 9 mm thickness
(Line Temp. 14 Deg.C)	

d. Acoustic Duct Lining

Acoustic material for Duct Acoustic Lining basic material shall be open cell oxide acetate foam. The Thermal conductivity of Oxide acetate foam for air-conditioning application shall not exceed 0.029 W/m K at 0 deg C mean temperature and 0.35 W/mk at 27 ± 2 Deg C and average Noise Reduction Coefficient (NRC=0.50 for 10mm, NRC =0.65 for 15mm and NRC =0.84 for 25mm thickness at frequency range from125 Hz to 4000Hz). The density of Acoustic material shall between 30 to 60 kg/m3.

The installation guideline for Acoustic Isolate Foam in Duct Acoustic Lining:

- ➤ The inside duct surface should be cleaned with suitable solvents and rendered free from all physical and chemical impurities. Thoroughly clean the entire surface with denatured alcohol. This must be done for new sheet metal in order to remove the oil residue off the entire surface.
- > The Use of retaining pins is not required when using Rubber based adhesive.
- Measure all sides of the duct, then adding 5 mm approximately to the measurement to ensure a compression fit, cut isolate foam accordingly.
- Using an adhesive roller or a short, stiff bristle brush, apply a thin, uniform coat of adhesive to both the isolate foam as well as to the metal duct surface. Be certain there is 100% coverage on both surfaces.
- Once the adhesive is tacky (finger nail test) the top piece should be adhered. Start at one edge of the duct & align the outside edge of the Acco foam down to the duct. Continue along, applying pressure to the entire length & press firmly. When approximately 90% adhered, align the opposite edge tightly against the duct & press firmly, then press balance of foam flat.
- > This will ensure a tight compressed fit at the edges when all the Acco foam has been applied.
- Be certain to apply full, even pressure along the entire surface with your hands or a weighted roller for best adhesion.

e. Exposed Duct Thermal Insulation

Duct insulation shall be applied as follows:

- > Apply hot bitumen 85/25 over the surface after cleaning the ducts.
- Rigid extruded polystyrene 50 mm thick insulation material to be fixed tightly to the surface with joints well butted and secured.
- Cover the insulation with 24 gauge x 19 mm GI wire mesh with necessary overlapping.
- Apply 2 layers of 1:3 sand cement plaster mixed with water proofing compound each of 10 mm thickness achieving smooth surface finish.
- > Apply 2 coats of synthetic paint of approved shade.

f. Exposed Roof Thermal Insulation

- The Under Deck insulation basic material shall be cross linked closed cell Oxide Acetate Foam
- > Insulation should be of minimum thickness as mention in the BOQ.
- > The insulation material shall be with Factory pre-laminated Aluminium foil.
- > Density of Material shall be between $30 \pm 3 \text{ Kg/m3}$.
- Thermal conductivity of Oxide Acetate foam shall not exceed 0.029 W/m.K at mean temperature of 0 C and 0.35 W/mk at 27±2 Deg C
- Insulation material shall be UV resistive, anti microbial and anti fungal with zero rating fungal growth as per ASTM –G -21
- > Insulation material should not have any effect of acids and alkalis as per IS:9845-1998
- The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O'.

- > Water vapour permeability shall be negligible as per DIN EN ISO : 12572, i.e. Moisture Diffusion Resistance Factor or ' μ ' value should be minimum
- The insulation material passes Smoke and Toxicity test as per (IMO Resolution MSC -307 (88) (2010 FTP Code): Annex 1: Part 2
- > Material shall be CFC/ HCFC free as per US EPA 5021 A(2014).

Application

Under-deck surface of ceiling shall be cleaned with brush to remove all dirt, cement etc. If the surface is uneven it should be made smooth prior to carry out Insulation work. A layer of rubber based adhesive (Zero flame , UL listed – Pedilite SR 998 or Magic 81-10) should be applied on the ceiling with help of brush so that all the pores are filled & surface becomes smooth & allow it to dry.

Insulation material sheet of specific size (1.5mtr x 2mtr) & ceiling surface shall have all over adhesive coverage.

A thin film of adhesive shall be applied on the ceiling with brush & then on the plain side of the insulating material with brush/small piece of sheet metal having smooth edges. When adhesive is tack dry, insulating material sheet shall be placed in position, pressed firmly & no gap shall be left.

During installation avoid air bubbles. Always apply pressure while fixing the insulation sheet, this action will ensure maximum bond strength.

Insulation material shall be fixed under compression, no stretching of material shall be permitted.

Once insulation material sticks with ceiling, fastener shall be applied at gap of every 400 to 500 mm distance to provide the permanent fixing of insulation material with ceiling. To avoid the risk of screw head going right through the insulation material, insulation fixing washer of minimum 60 mm diameter shall be used.

g. Fire Breaks in Insulation

Fire breaks shall be provided in all ducts (for internal lining / External thermal insulation) after a run of 10 M (Centre to Centre). Fire breaks in insulation simply mean that there will be a discontinuity of the insulating material in form of a MS angle of a minimum of 50mmx50mm x 3mm size. At the interface of the MS angle and the insulating material, proper care of tucking in of the insulating material shall be taken, so as to prevent erosion.

h. Preamble to Mode of Measurement

IS 655 / SMACNA (AS ASKED FOR IN THE BOQ) SHALL BE ADOPTED FOR THE CONSTRUCTION PROCEDURES/ SPECIFICATIONS IN DUE ESSENCE OF THESE GUIDELINES ALSO.

- All equipment described hereafter, shall be in accordance with the specifications.
- All equipment shall be selected and installed for the lowest Operating noise level.
- Supply of various equipment shall include all expenses for correspondence with manufacturers, submission of shop drawings, documents and their approval by the Consulting Engineer, procurement of equipment, transportation, shipping, payment of all taxes and levies, storage, supply of equipment at the point of installation, furnishing all technical literature required, replacement of defective components, and warranty obligations for the individual equipment.
- Installation of various equipment shall include all material and labor associated with hoisting and lowering of equipment in position, insulation of the components and vibration isolation as required, grouting and anchoring or suspension arrangements and all incidentals associated with the installation as per the specifications and manufacturer's recommendation.
- Vibration isolators as specified or as recommended by the manufacturer shall be installed with each component. Performance ratings, power consumption and power data for each component shall be verified at the time of testing and commissioning of the installation, against the data submitted with the tenders.
- Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirit, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop painted surfaces.
- Testing and commissioning shall include furnishing all labour, materials, equipments, instruments, and incidentals necessary for complete testing of each component as per the specifications and manufacturer's recommendations, submission of test results to the Consulting Engineer and obtaining their approval and submission of necessary documents and completion drawings.
- All ducts shall be fabricated and installed conforming to the relevant Indian standards, approved shop drawings and the specifications.
- Duct installation shall include fabricating and installing the ducts, splitter dampers, turning vanes, and distribution grids within the ducts in position, and providing, installing and making air tight all joints with slips, bonded felt insertions, nuts, bolts and screws as required. In addition multi-louvered manually adjustable dampers shall be provided in various branch ducts as required or shown on drawings for proper balancing of air flows.
- All registers and diffusers shall be provided with a soft continuous rubber gaskets between their periphery and the surface on which these have to be mounted.
- Registers and diffusers shall be given, at the factory, a rust resistant primer coat and enamel paint finish of approved color.
- After completion of the installation, the entire air distribution system shall be tested for air leaks and balanced in accordance with the specifications.

i. Mode of Measurement

The mode of measurement for the various item, unless otherwise specified, shall be as follows:

Ducting

- Payment for ducting shall be made on the basis of the external surface area of the ducting including all material and labor for installed duct.
- The rates per sq. ft. of the external surface shall include flanges, gaskets for joints, bolts and nuts, duct supports and hangers, vibration isolation pads or suspenders, flexible connection, inspection doors, dampers, turning vanes, and any other item which will be required to complete the duct installation except external insulation and acoustic lining.

- The external area shall be calculated by measuring the overall width and depth (including the corner joints) in the center of the duct section and overall length of each duct section from flange face in case of duct lengths with uniform cross section. Total area will be arrived at by adding up the areas of all duct sections.
- In case of taper pieces average width and depth will be worked out as follows;

W1 = Width of small cross section W2 = Width of large cross section D1 = Depth of small cross section D2 = Depth of large cross section Average width = (W1 + W2)/2

Average Depth = (D1 + D2)/2

- Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct sections fitted with angle iron flanges, otherwise at the bottom of the flange where flanges are of duct sheet.
- For the circular pieces the diameter of the section mid-way between large and small diameters shall be measured and adopted as the mean diameter for calculating the surface at the taper piece.
- For the face length of taper piece shall be the mean of the lengths measured face to face from the centre of the width and depth flanges.
- Duct measurements for calculation of area shall be taken before application of insulation.
- For the special pieces like bends, branches, and tees etc. same principle of area measurement as for linear lengths shall be adopted except for bends and elbows, the length of which shall be the average of the lengths of inner and outer periphery along with curvature or angle of the piece.

Duct Insulation

This item is provided separately for various thickness and shall be paid for on area basis of uninsulated duct. The area of the duct to be insulated shall be measured before application of insulation.

4.0 VENTILATION SYSTEM & ASSOCIATED WORKS

4.1 **PROPELLER FAN**

a. Fans shall be of the ring-mounted type and the blades constructed from heavy gauge metal. An

aerodynamically designed bell mouth constructed from heavy gauge metal shall be provided. The fan speed shall not exceed 1450RPM at 50Hz operation.

- b. Propeller fans shall be direct driven type, the motor either a single-phase capacitor start-run or a three-phase squirrel cage induction type. The motor shall have inbuilt inherent protection against overloading. Motor with shaded pole or centrifugal switch type is not acceptable
- **c.** Bearings shall be maintenance free permanently lubricated type. Fans shall be complete with wire guards. External grilles, fan chambers and volume control damper shall be provided where indicated in the specification drawings.

4.2 IN-LINE CENTRIFUGAL DUCT FAN

- a. Fan shall be of SISW, **backward** curved centrifugal, direct driven type.
- b. Casing shall be of Galvanized steel with Oven-baked epoxy coating. Impeller material shall be either Galvanized Steel or Glass Reinforced Polypropylene
- c. Motor shall be external rotor type for power supply 220~240V/50Hz/Single Phase.

4.3 AXIAL FLOW FANS (DIRECT DRIVE)

- a. Fans shall be licensed to bear the AMCA Air and Sound Certified Ratings Seal.
- b. The test standard used shall be ANSI/AMCA 210-85, ANSI/ASHRAE Standard 51- 1985 "Laboratory.
- c. Method of Testing Fans for Rating" and AMCA 300 "Reverberant Room Method for Sound Testing of fans".
- d. Casing shall be constructed of heavy gauge sheet steel. Casing shall be provided with hinged door enabling easy replacement of wheel, shaft and bearings. A small inspection door with handle and neoprene gasket shall also be provided. Casing shall have flanged connection on both ends for ducted applications. Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts.

Straightening vanes shall be aerodynamically designed for maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be de-rusted, cleaned, primed and finish coated with enamel paint.

- e. Motor shall be of 3 phase squirrel-cage totally enclosed, fan cooled type. Motor and starter shall be in accordance with applicable standards. The speed of fan shall be as per OEM. However it is desired that speed shall not exceed 1000 RPM for fans with impeller diameter above 450 mm, and 1450 RPM for fans with impeller diameter of 450 mm and less.
- f. Base shall be provided for each fan. Base for both fan and motor shall be built as an integral part and shall be mounted on a concrete foundation through cushy foot vibration isolators. The concrete foundations shall be at least 15 cm above the finished floor level and shall be further isolated from the structural floor through 5 cm. Thick layers of sand all around, topped with bitumen. In case ceiling hung fan within the ceiling shall be provided Vibration Isolation Suspension (VIS) shall be provided in each of string.
- g. Fans shall be oven-baked with polyester coating for minimum thickness of 60 microns or hotdipped galvanized.
- h. Fan motor base support shall be properly secured (locked and sealed) to the fan housing and be of adjustable type to have precise control of motor shaft central position as well as running clearance between blade tips and casing.
- i. Fans supplied shall be complete with factory fabricated mounting bracket (ceiling or foot mounted) and suction/discharge matching flanges as accessories.
- j. All hubs shall be cast Aluminium alloy (Grade LM2) unless for Smoke spill Fans where high

temperature (250°C, 2.0 Hr. Fire Duty) air is expected then Aluminum alloy or steel fan impeller blades are required. Otherwise impeller blade material with Polypropylene (PP), Glass-reinforced Polypropylene (PPG) and Glass-reinforced Polyamid (PAG), to provide self-balancing, anti-static, anti-sparking characteristic is preferable. Fan blade mounting on the hub shall be statically and dynamically balanced. Extended grease leads for external lubrication shall be provided.

- k. Running clearance between blade tips and casing shall not exceed 1% of the impeller diameter, and 2% for smoke spill high temperature fan where mechanical expansion coefficient is different from normal ambient temperature. Fan manufacturer shall provide the fan assembled with the dame clearance between blade tips and casing of the tested prototype. Note that the air performance and pressure loss are greatly affected by this clearance.
- I. Impellers shall be secured to the drive shaft by a key and keyway. Axial location shall be provided by a collar or shoulder on the drive shaft together with a retaining washer and screw fitted into a tapped hole at the end of the shaft and locked in position. Blades shall be secured in place to the angle setting by setscrews, locking nuts or setting pins.

4.4 AIR WASHER–PACKAGED TYPE

4.4.1 Scope of Work

Supply, installation, testing and commissioning of packaged type air washer as per specifications. Manufacturer' product date for review shall be supplied for certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4.4.2 General Requirements

- a. Statically and dynamically balance rotating parts
- b. Construction to permit complete servicing without breaking any connections
- c. Provide flanged pump connections
- d. Provide mono-block pumps/submersible and strainers of adequate capacity.

4.4.3 General

The Evaporative Cooling Machine will be self contained and will consist of the following component parts listed in the following paragraphs. The entire unit shall be WEATHER PROOFED and Highly CORROSION PROTECTED with 18 Ga SS 304 with FRP lining shall be provided to all the sections or automotive paint, as hereinafter specified. The unit shall have a horizontal submersible/monoblock self priming pump assembly to provide recirculate tank water and a pressurized flow via a piping system for proper pad (Munter) and media water distribution. The unit shall be factory fabricated.

4.4.5 Blower Section

The blower section shall include Centrifugal Forward Curved DIDW fan wheel of totally GI Construction with Inlet Cones and shall be complete with individual motor and drive and shall be mounted C Channel frame and Cushy Foot Mounts or as per OEM standard. The fan shall have a capacity not less than the one specified in the catalogues and shall be constructed and rated based on

delivery against the rated static pressure with the media and filters in place. The fan will be of riveted construction and made with GI sheet of required thickness. The fan wheel will be of the multiblade type and mounted on two self aligning pillow block bearings of the requisite size. The fan shall be run with the help of "V" Groove drives as per the recommendation of the drive supplier. The blower housing will of the pittsburg joint construction and the drive will be provided by a motor of adequate capacity. The motor plate will be constructed out of 12 Ga MS or heavier metal with slotted holes which permit belt adjustment in both the directions. The material used will be 16 Ga GI. The outlet velocity of the blowers will be kept low.

4.4.6 Evaporative Section

The wet section will have 16 Ga GI Tank with folded construction with the bolted openable sides in 16 Ga GI sheet. The section will be of welded construction. 300 mm thick Cooling pads (Munter) will be provided designed @ 2.5 m/s to give 90% adiabatic efficiency. 2mm thick FRP specially fabricated header will be provided for the water distribution using 20 mm PVC perforated piping. All wet sections will include 5 layer 30 micron Aluminum Wire mesh filters of 50 mm thickness including the mounting channels for the same. 15 mm Brass Bleed off cock, 20 mm heavy duty Brass Float. PVC drain/overflow and bleed off outlet are standard on all wet sections.

18 Ga SS 304 with FRP lining shall be provided to all the sections or automotive paint.

Double/Single skin construction similar to air handlers (except for internal sheet which shall be SS 304 with FRP lining/automotive steel) shall be provided. If double skin than Panel will be 43+/-2 mm thick. Wherever exposed to atmosphere., otherwise the panel thickness shall be 23 +/-2 mm thick.

4.5 AIR SCRUBBER DRY TYPE (KITCHEN SCRUBBER)

4.5.1 Scope of Work

The specification for package type dry scrubber for kitchen exhaust covers the design requirement, constructional feature, supply, installation, testing & commissioning. It shall have electrostatic air cleaner, Activated Carbon Filter Bank Unit as Odor Absorber Section, Automatic Wash Unit & Detergent Tank as specified in the BOQ. Odor Absorber Section.

4.5.2 Type

The unit shall be modular in construction and shall have individual sections of inlet, pre-filter, Dust collector section. Unit shall be supplied with control panel and one point wiring.

4.5.3 **Principle of Operation**

The pre-filter shall remove of large grease particles. The electronic filter shall remove the smaller grease and smoke particles. The principle of operation shall be based on electrostatic deposition. The particle shall pass by an ionizing wire, which will induce a positive charge on the particle. The particle then shall pass between closely spaced aluminum plates, which are held at a positive charge

and a ground. As the charged particle travels between the two aluminum plates it shall be forced away from the plate held at the identical polarity and drawn towards the grounded plate. Once attached the particle shall remain on the plate until cleaned off during washing.

4.5.4 Equipment Specification

The air filtration system shall be a modular system. Multiple units can be joined together for increased volume. The system shall be a single pass. Particulate filtration efficiency shall be evaluated on the basis of ASHRAE 52-72 & DOP Test Method. The specified unit shall have demonstrated a removal efficiency of at least 95% and above. Ozone Generation concentration shall not exceed 0.05 PPM.

4.5.5 Housing

Housing shall be 16 gauge (1.6mm) Electro galvanized steel with powder coat / PU paint finish construction. Each section shall include single door access, located on one side of the unit. The access door shall be mounted on hinges and secured with appropriate arrangement allowing for component access and removal. All doors shall be gasketed to prevent air and water leakage. High voltage contacts on the housing shall be made of appropriate material like phosphor/bronze etc. Enclosure for electrical components shall be included to prevent leaks to the power supply. Unit shall have flanges / collar on the inlet and outlet for connecting ductwork. Unit shall be provided with appropriate drainage arrangement. Electrical contacts shall be in the door for ease of maintenance. Each unit shall have track guides for proper alignment of cell, making it possible tochange the direction of airflow by reversing the orientation of electronic collector cell(s).

4.5.6 Finish

The external casing finish shall be a durable industrial grade semi gloss Baked on epoxy ester / PVC / Nylon, not less than 3-mil minimum thickness or PU paint finish with same thickness. The pre-filter shall be Washable type Honeycomb filters of Aluminum mesh are used to optimally remove larger particles of grease and dust before the main filter and shall be secured in stainless steel frame. Face of each prefilter shall be min 2.75 square feet.

4.5.7 Pre-filter

Access to the prefilter shall be from the side through the same hinged door to gain access to the electronic cells. Separator section shall be designed for an equal airflow across the entire Air cleaning unit.

4.5.8 Electronic Cells

Electronic cells described in this section refer to a full size cell. Half size shall not be acceptable. Ionizing-Collecting cell shall be of one-piece construction min 254 mm deep in direction of airflow. Face area of each cell shall be min 0.24 square meters and the effective collecting area min 44 square feet (4.1 square meters). Frame- All support framing, end plates and ionizer ground electrodes shall be 0.080-inch (2.03-mm) thick stainless steel 316 and the distance between each plate should not be more than 7 mm. Handle shall be located on the side of the cell for removal of the cell from the air cleaner. The handle shall be grounded to the frame of the cell. Contacts shall be made of any suitable material like phosphor bronze or eq. on the front of the cell. They shall make contact with the ionizing, collector and ground sections of the cell.

4.5.9 Ionizer Section

Ionizing wires shall be minimum of 8 per electronic cell, with a length of min15.35 inches (390 mm) each. Ionizing wires shall be constructed of 0.010 inches diameter (0.25 mm) Tungsten for prevention of corroding or breaking. Wires shall be fixed at one end and spring mounted on the other for ease of maintenance. There shall be min7 grounding plates between the wires stabilize the ionization field for better performance. Grounding plates shall be no greater then 1.89 inches (48 mm) apart, and 0.07 inches (1.8 mm) thick. Insulators for the Ionizer shall be made of Teflon.

4.5.10 Collector Section

Grounding plates shall be a minimum of 0.02 inches (0.5 mm) thick aluminum. The plates shall be 9.65 inches (245 mm) deep in the direction of airflow.

Grounding plates shall be a minimum of 23 quantities per cell. Spacing between grounding plates shall be at 0.67 inches (17 mm). Spacing between the grounding plates and the charged plates shall be at not more than 7 mm. Charged plates shall be a minimum of 0.02 inches (0.5 mm) thick of Stainless Steel 316. The plates shall be 7.68 inches (195 mm) deep in the direction of airflow. Separator rods shall be made of Stainless Steel 316 with notches to hold the ground and charged plates apart at given lengths. Rods shall be 0.47 inches (12 mm) in diameter. The separator rods shall run the length of the cell to the frame of the cell. There shall be at least 12 rods total per cell. Insulators for the collector shall be made of PTFE (Teflon). Markings shall be on the cell to inform indicating direction of the airflow.

4.5.11 Power Supply

Power supply shall be of a 100% solid state type. Power supply shall be mounted within the air cleaner out of the air stream. Input voltage shall be 220 Volt, 50 HZ, 1 phase. Output High frequency with built in short circuit and arc protection, providing a dual high voltage output of (+)12 KVDC for the ionizer and (+) 6 KVDC for the collector. The Power Supply shall be of capable of min120 watts and 10 mA. The power supply shall operate over a temperature range of -20 to 140 degrees F (-38 to 85 degrees C).

4.5.12 Fan

The blower shall be Centrifugal Backward Curved DIDW fan wheel of totally GI Construction with Inlet Cones and shall be complete with individual motor and drive and shall be mounted on C Channel frame and Cushy Foot or Spring Mounts. Each Scrubber shall comprise of one / two no. fans to handle air quantities as stipulated in BOQ. Each fan shall be driven by suitable HP TEFC motor. The fan wheel will be of the multiblade type and mounted on two self-aligning pillow block bearings of the requisite size. The fan shall be run with the help of "V" Groove drives as per the recommendation of the drive supplier.

4.5.13 Motor

The TEFC motor shall be suitable for $415 \pm 10\%$ volts, 3 phase, 50 Hz $\pm 5\%$, A.C supply. The motor shall be with class B/E insulation confirming to IS 325. The motor speed shall be 1440 RPM maximum designed and guaranteed for continuous operation at the nameplate rating. It should confirm to IP 55.

4.5.14 Installation

The fans, scrubber etc. shall be provided with necessary vibration isolation cushy foot mounts. All necessary accessories such as nut bolts etc. shall be arranged by the contractor. The contractor shall arrange his own labour with material for completion of assembly.

The contractor, if specifically specified in bill of quantities, shall cast the RCC foundations for equipment. Anti-vibration pads of adequate efficiency shall be provided.

4.5.15 Testing

The AC contractor shall compute the unit air quantity with the help of velocity meter. The computed results shall be tallied with specified capacities and power consumption shall be tallied with the indicated figures in the technical data furnished with the bid by the contractor.

All necessary instruments of proper accuracy and services needed for the tests required for the computation of capacities and power consumption as required by the Engineer shall be provided by the contractor at his own cost.

It shall also be the responsibility of the Contractor to supply the motors and starters to satisfy the local regulations pertaining to the limitation of starting current and indemnify the Department from all liabilities arising out of any objections raised by the local authorities in this regard.

4.6 Air Curtain

- a. Air curtains shall be AMCA certified models.
- b. They must meet ASHRAE Standard 90.1-2019 and the NBC code.
- c. Air curtains shall help promote the perfect environment whether warm, cool or ambient.
- d. Air curtains shall promote open door trading in building and provides uninterrupted access for passing trade.
- e. Air curtains shall over open doors promote significant energy savings.
- f. Air curtains shall help to ensure a clean and healthy environment.
- g. Air curtains shall be easy to install and also easy to maintain throughout their serviceable life.

4.6 **VENTILATION FANS**

The contractor shall supply install, test and commission ventilation fans wherever shown on the drawings and as scheduled. The system shall be complete in all respects and comply with the specification given.

- a. Fans shall be of the type, size, arrangement and capacity as indicated in the schedule and/or as shown on the drawings
- Unless specified, fans performance rating data shall be tested accordance with AMCA Standard 210-85 (Air Moving and Conditioning Association), ANSI/ASHRAE Standard 51-1985 "Laboratory Methods of Testing Fans for Rating". Sound ratings shall conform to AMCA

Standard 300-85, "Reverberant Room Method for Sound Testing of Fans"

- **c.** A computer printout of fan performance rating corresponding to the AMCA licensed data, with corrected ratings for altitude and temperature, fan operating speed, bearing life, etc. shall be submitted for approval.
- d. All fans shall be dynamically trim-balanced to ISO1940 and AMCA 204/3 G2.5 quality grade after assembly. A computer printout with the vibration spectrum analysis shall be attached to the fans.
- e. Fan motors shall comply in all respects with continuous rating in accordance with IEC34 or equivalent. Motor bearings shall be of ball or roller type, grease or lubricant sealed for life. Fan and drive shall be earthed to prevent accumulation of static charge.
- f. Kitchen exhaust fan shall be of bifurcated axial or SISW centrifugal direct or belt driven type. DIDW centrifugal and direct drive axial flow fan where belts or motor are in the air stream are not acceptable.
- g. Fans for elevated temperature (smoke spill duty) with components rated for high temperature (250°c, 2.0 hrs duty, tested and certified by any independent international fire laboratory, certificate of conformity shall be provided for the same) service shall be provided.

4.7 CENTRIFUGAL FANS

- a. Fans, forward or **backward** curved, SISW or DIDW, shall be licensed to bear the AMCA Air and Sound Certified Ratings Seal. The test standard used shall be ANSI/AMCA 210-85, ANSI/ASHRAE Standard 51- 1985 "Laboratory Method of Testing Fans for Rating" and AMCA 300 "Reverberant Room Method for Sound Testing of fans".
- b. All fans shall be dynamically trim-balanced to ISO1940 and AMCA 204/3 G2.5 quality grade after assembly.
- c. Fans shall be oven-baked with polyester coating for minimum thickness of 60 microns, unless the housing scroll and side frame is constructed from galvanized steel sheet (G.I.), Stainless Steel, Aluminum and etc.
- d. Fans must be physically capable of operating safely at every point of rating at or below the "minimum performance" limit for that class as defined in AMCA standard 99-2408-69 "Performance Class of Operating Limits for Centrifugal Fans".
- e. Shafts shall be made of carbon steel (C45) machined and polished to tolerance of standard ISO 286–2–grade g6. Protective coat of anti-rusting shall be applied to all bare surfaces of the shafts at the factory.
- f. Bearings shall be of self-alignment (concentric) type with adaptor sleeve bearing. Bearings of eccentric locking collar with grub screw type are not acceptable. Bearing shall be maintenance free with permanently lubricated sealed ball bearing type. Bearing life shall be at least 75,000 hours based on basic rating life, L10 of ISO 281 standard. Calculation sheet of Bearing Life shall be submitted for approval.
- g. Motor installed shall be of a minimum 130% of the fan power absorbed (Brake horsepower) and shall have sufficient torque available for starting and continuous operation.
- h. Belts and pulleys shall be sized for a minimum 150% of the installed motor horsepower. The belt speed shall not exceed 30m/s. The pulley shall be of Taper Lock SPZ, SPA, SPB or SPC type. Conventional type of pulley is not acceptable. Both fan and motor pulley shall be balanced to the quality grade G.2.5.

4.8 VENTILATION UNITS (FAN SECTIONS)

- a. The scope of this section, comprises the supply, erection, testing and commissioning of double / single skin construction Ventilation units, conforming of these specifications and in accordance with requirements of Drawings & of the Schedule of Quantities.
- b. The Ventilation units shall be double /single skin construction, draw-thru type comprising of various sections such as plenum chamber (wherever the Exhaust Air is ducted) filter section and filter, fan section as per details given in Drawings and Schedule of Quantity.

4.8.1 Capacity

The air handling capacities, maximum motor H. P., static pressure shall be as shown on Drawing and in Schedule of Quantity

4.8.2 Housing / Casing (Single Skin)

The housing/casing of the air handling unit shall be of Double skin construction. The Frame work shall be of Extruded Aluminum hollow sections.

Frame work for each section shall be jointed together with soft rubber gasket in between to make the joints air tight. Suitable air tight access doors/panels with Nylon hinges and locks shall be provided for access to various sections for maintenance. The entire housing shall be mounted on Rolled Formed GSS channel frame work .

4.8.3 Motor and Drive

Fan motors shall be 415 for 10% volts, 50 cycles, 3 phase, squirrel- cage, totally enclosed fan cooled with IP - 55 protection. Motor shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through belt-drive arrangement. Belts shall be of the oil-resistant type.

4.8.4 Fan

The fan shall be **backward** curved, double inlet double width type. The wheel & housing shall be fabricated from heavy gauge galvanised steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame & pillow block heavy duty ball bearings.

The fan shall be selected for a noise level less than 80 db (A). The impeller & fan shaft shall be statically and dynamically balanced. The Fan outlet velocity shall not be more than 10.0 Meter/Sec. Fan housing with motor shall be mounted on a common base mounted in side the air handling housing on anti-vibration mounts. The fan outlet shall be connected to casing with the help of fire retardant fabric acting as a flexible connection for anti-vibration.

4.8.5 Filters

Each unit shall be provided with a factory assembled filter section containing washable synthetic type air filters having extruded aluminium frame as specified in BOQ. The media shall be supported with HDP mesh on one side and aluminium mesh on other side. Filters face velocity shall not exceed 150

meters per minute. Filter shall fit so as to prevent by pass. Whenever fine filter are required to be installed, unit shall be provided with factory fabricated plenum chamber in double skin construction as described above for casing specification. The fine filter shall incorporate pocket filters which will have an efficiency of not less than 95% by ASHRAE standard corresponding to Eurovent standard EU-5.

4.8.6 Safety Features

Each Ventilation Unit must have safety features as under:

- a. The Fan Access Door shall be equipped with micro-switch inter locked with fan motor to enable switching off the fan motor automatically in the event of door opening.
- b. The Access Door shall further have wire mesh screen as an added safety feature bolted on to the unit frame.
- c. Fan and motor base shall be properly earthed from the factory
- d. All screws used for panel fixing and projecting inside the unit shall be covered with PVC caps to avoid human injury.

4.8.7 **Performance Data**

Ventilation units shall be selected for the lowest operating noise level of the equipment. Fan performance rating and power consumption data, with operating points clearly indicating shall be submitted and verified at the time of testing commissioning of the installation.

4.8.8 Testing

Air-flow measurements shall be made by an anemometer and computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

5..0 ELECTRICAL ITEMS

This section deals with supply, installation, testing & commissioning of Motor Control Center (MV panel) & shall be manufactured by CPRI approved venders. The power / control cabling & earthing work shall be carried out as per the specification given below:

5.1 SCOPE

All work shall confirm to Indian Electricity Act (amended up to date), I.S. code of practices local rules and regulations etc. Power cabling shall be carried out with approved make of cables as indicated in the **List of approved make of equipment / materials** and shall be of grade 1100 volts, PVC insulated & sheathed, armored aluminum conductors cables. Control cabling shall be of approved make and shall be of grade 1100 volts, PVC insulated & sheathed, copper conductor armoured multicore cables as specified in B.O.Q

5.2 MOTOR CONTROL CENTER (MV PANEL)

Motor control center (MV Panel) floor mounted extendable type & wall mounted AHU sub-panel shall be fabricated out of 14G C.R.C.A. Sheet. These panels shall be cubical sectionalized type, totally enclosed dust & vermin proof. Gaskets shall be provided in all joints to prevent dust to reach the internals of the panels to make it completely dust proof. The degree of protections for panels shall be IP 52 for indoor applications and IP 55 for outdoor applications as per IS:2147.

These panel (MV) shall be suitable for voltages up to 500 volts, three phase 50 Hz, 4 wire supply capable of functioning satisfactorily in temperature ranging up to 45 to 50 degree centigrade and rupturing capacity suitable for connected load & design should be type tested for 42 KA fault level. All joints of panels shall be welded and braced as necessary to provide a rigid support for all components. The base channel provided in the floor mounted MV panel shall be 75mm high & a clear space of 200mm between the floor and the bottom most part of the unit shall be provided. The panel shall be correctly positioned. Self- threading screws shall not be used in the construction of control panels. Appropriate knock-out holes of proper sizes shall be provided for incoming and outgoing cables. The facility for bottom or top entry of cables in the panels shall be provided. Necessary cables clamps shall be provided for holding the cables in position.

All power/control wiring inside the panel shall be color coded and control wiring ferruled for identification purpose. All labeling shall be provided in engraved anodized aluminum strips on the front face of the panel.

Each circuit breaker shall be housed in separate compartments. It shall have steel sheets on top and bottom of compartment. The steel sheet hinged door shall be interlocked with the circuit breaker on the "ON" position. When the breaker is on the "ON" position, suitable preventive measures shall be provided, such as interlocks, to prevent the breaker from being drawn out. When the breaker is in "ON" position steel sheet shall be provided between the tiers in the vertical section. The door of this compartment shall not form part of the draw out arrangements.

5.2.1 BUS-BARS

The bus-bar and its connections shall be Copper Electrolytic grade and shall be of rectangular section. The amperage capacity of Copper bus bar shall 1.25A / Sq. mm. These should be suitable for full load current for phase bus-bar and neutral bus-bar shall be of half rated current capacity. The bus-bar should have provision on either side for extension. The bus-bar should be sleeved with color coded heat shrinkable PVC sleeve. Bus-bar supports shall be of fibre glass reinforced thermosetting polyester having in built and tracking barriers to break the path of conducting dust through molded ribs.

In panels bus-bar connections shall be done by drilling holes with cadmium coated bolts and nuts. Extra cross section shall be provided to compensate drilling of the holes. Insulated aluminum strips of suitable size of full rated current capacity shall be used for interconnecting bus-bar and breaker.

A horizontal / vertical wire way shall be provided for interconnecting control wiring between different vertical sections.

The terminal blocks shall be used for outgoing terminals and neutral link at a suitable located place in the control panel. Separate compartments for outgoing and incoming cable shall be provided. The current transformers of all instruments shall be mounted with terminal blocks.

All live parts including incoming and outgoing link / terminals should be totally shrouded by means of non-hygroscopic and fire retardant material.

5.4 ROTARY SWITCH / SELECTOR SWITCH / SWITCHES / HRC FUSES / STARTERS / SINGLE PHASE PREVENTERS / TOGGLE SWITCH.

These shall be of approved make and conforming to relevant ISI standard. The rupturing capacity of HRC fuses should not less than 80 KA and in case of switches it should be 60 Amps maximum.

5.5 CURRENT TRANSFORMER

The current transformers shall have accuracy of class I and 5P10 / 10P10 and suitable VA burden for operation of the connected meters and relays.

5.6 OVERLOAD RELAYS

All the motors shall have overload relay protections conforming to relevant IS.

5.7 TIME DELAY RELAYS

These shall be adjustable type with time delay adjustments of 0-180 or as per manufacturer's standards.

5.8 INDICATING LAMPS AND METERING

These shall confirm to BS37 & BS39. All meters shall be flush mounted and draw-out type. The indicating lamp shall be LED type.

5.9 MULTI FUNCTION METER

Motor Control Center (MV Panel) shall have flush type MFM of class 1.0 as detailed in B.O.Q.

5.10 PUSH BUTTON STATIONS

These shall be suitable for panel mounting and accessible from front without opening. These shall be provided for manual starting and stopping of motors/equipment as per normal practices. The contacts shall be suitable for 6A current capacity.

5.11 CONDUITS

These shall be preferable made of mild steel, stove enameled from inside and outside with minimum wall thickness of 1.6 mm for conduits up to dia of 25mm and 2 mm for conduits above 25 mm diameter.

5.12 CABLES

These shall be PVC insulated, pre-sheathed, copper conductor armored cables as per IS:694 and as per **list of approved make of equipment / materials.** Control Cables shall be multi-core PVC-insulated PVC sheathed copper conductor and armoured cables of approved make only.

5.13 LAYING OF CABLES

These shall be laid as per Indian Standard code of practice. All cables shall be laid on existing cable trays. In case more than one cable is running, then proper space in between the two cables shall be provided to avoid loss of current carrying capacity. While cables are running on walls, proper saddles must be provided. Necessary accessories like cable termination Glands, requisite size Lugs and Ferrules for proper cable connection shall be provided.

5.14 WIRE SIZES

Single stand PVC-copper conductor wires shall be used inside the control panel for interconnecting different components. All wires shall be neatly dressed and colored beads shall be provided for easy identification in control wiring. The minimum size of control wiring shall be 1.5 sq.mm, each HVAC ODU shall be given power supply through 16 sqmmX4C copper cable (by laying new cable) and each AHU shall be provided with a newly laid 6 sqmmX4C copper cable. Testing of panels as per code of practice shall be done at works by AC contractor before inspection & dispatch to site.

5.15 DRAWINGS

Necessary drawings of all control panels and wiring of equipment etc., shall be submitted by the A.C contractor for approval of the Engineer in Charge. On final completion of job and before handing over of AC System As Built Drawings shall be submitted to the Department.

5.16 TESTING

The complete electrical installation shall be tested in accordance with relevant ISI codes in presence of Electrical Supervisor of the Department before commissioning of plant.

5.17 PAINTING OF PANELS

All sheet metal enclosures shall be powder coated only after de-rusting & hot-dip phosphate degreasing etc. at works only.

DFCCIL shall provide 3-phase 415V, 50Hz power at a single point ((ie. Sub-AC panel on terrace) for all VRF outdoor units. The tenderer shall lay all required XLPE armored cables, cable trays, necessary protection to connect all equipment on rooftop including VRF Outdoor Units from Sub AC Panel to ODUs. Electrical connections to individual IDUs shall be carried out with FRLS cables from DB on each floor.

5.18 CAPACITY OF RELAYS AND CONTACTS

The following capacity relays and contacts shall be used for various rating of motors:

a)	50/60 HP Motor	Star Delta Starter	65 Amp.	30 - 50 Amp.
b)	40 HP Motor	Star Delta Starter	45 Amp.	20-33 Amp.
c)	30 HP Motor	Star Delta Starter	45 Amp.	20-33 Amp.
d)	25 HP Motor	Star Delta Starter	32 Amp.	14-23 Amp.
e)	20 HP Motor	Star Delta Starter	32 Amp.	14-23 Amp.
f)	15 HP Motor	Star Delta Starter	25 Amp.	9-15 Amp.
g)	10 HP Motor	Star Delta Starter	16 Amp.	6-10 Amp.
h)	7.5 HP Motor	D.O.L. Starter	16 Amp.	9-15 Amp.
i)	5 HP Motor	D.O.L. Starter	16 Amp.	6-10 Amp.

5.19 EARTHING

System shall be complete with electrical panel board with cabling & earthing. The earthing of all equipments shall be carried out by Copper strips / wires. All panels / three phase motors shall be earthed with two number distinct and independent Copper strips / wires. HVAC ODU modules & AHU units shall be provided with 8 SWG GI wire for body earthing (double earthling to be provided). The earthing connections shall be connected to main earth station or main earth grid. The earth connections shall be connected to paint, grease etc.

The earthing of all equipment's shall be carried out by Copper strips / wires. All HVAC ODUS's and F.A.H.U's shall be provided with two different visible G.I Earthing wires of 8 SWG and the same wires shall be connected to the nearby earthing grid/mesh available. All panels / three phase motors shall be earthed with two number distinct and independent Copper strips / wires of the following sizes:

1.	Motor upto 5.5 KW	3 sq. mm Copper Wire
2.	Motor 7.5 to 12 KW	4 sq. mm Copper Wire
3.	Motor 12 to 50 KW	25x3 mm Copper Strip
4.	Motor 51 to 89 KW	32x6 mm Copper Strip

The earthing connections shall be connected to main earth station or main earth grid. The earth connections shall be connected to equipment's after removal of paint, grease etc.

6.0 **PRECISION AIR CONDITIONER (PAC)**

6.1 SCOPE OF WORK

The Scope of Work covers the supply, installation, testing, commissioning and warranty of Precision Air conditioner (herein referred to as "product") and services provided for the same.

6.2 GENERAL

The AC Units should have high sensible heat ratios, to match the low latent loads of Computer/Server Rooms/ Switch room/UPS/VFD rooms. A Microprocessor controlled package AC system with **R-410A/407C refrigerant** shall have de-humidified air quantity of minimum 500 to 650 CFM/TR.

The cold aisle temperature shall be maintained at 22 Deg C and RH at 45% + -5% at ambient temperature of 44 Deg C DBT.

The Indoor unit complete with Digital Scroll compressor with individual circuit (Mandatory), Evaporator blower & coil, Heater, Humidifier, Microprocessor controller, electrical switchgear components and Thermostatic expansion valve (TXV) and shall be housed in a single cabinet. The outdoor unit shall be comprised of Condenser fan, motor, fan speed controller (if applicable) & cooling coil.

Inside Design condition	21 deg C to 23 Deg C and 50% \pm 5% RH
Ambient air design	44 Deg C
temperature	
Actual Capacity	As per requirement
Flow Direction	Bottom discharge, tor return, based on BOQ
Air inlet Temp & RH	Set Point ± 1 Deg C (DB) & Set Point ± 5%
	Return Air
Air Quantity	500 to 650 CFM/TR
Filters	Filters to be provided on the Package unit, having
	95% efficiency down to 5 microns
No of Compressor	12 kW to 34.2 kW - One Circuit (One
	Compressor)
	37.6 kW to 68.4 kW - Two Circuit (One
	Compressor in each circuit)
Type of load	High sensible heat load (Sensible head factor
	above 0.95)

The air-cooled precision Package unit shall be designed as per following conditions:

- The Units shall be designed for 68-69 DBA at 1.5 meter from the unit outlet quiet operation with all moving parts mounted on anti-vibration mounting and carefully balanced to ensure minimum vibration.
- The unit shall be tested at site for performance rating before acceptance. Performance test shall be a heat load test using heater supplied by the Precision unit supplier.

6.3 SYSTEM DESCRIPTION:

Customer is proposed to have High Performance Precision type DX air-cooled units, which is of Floor discharge type. Precision AC units shall be of Variable capacity type. The cold & de-humidified air shall be pumped into the space between true floor and false floor and fed to the Equipments thru' floor grilles with Volume control damper.

The capacity of Equipment, specified is actual capacity at operating condition during peak summer. Package shall have the air-cooled condenser for 45 deg C ambient condition to avoid any de-ration during peak summer condition.

Room shall be air-conditioned with Variable Capacity Precision Air-conditioning Unit each ofTR actual capacity (As per BOQ) & De-humidified air quantity ofCfm.(As per BOQ). The air-conditioning unit shall be designed specifically for high sensible heat ratio (>0.90) applications.

The system shall contain Digital Scroll compressor, Evaporator blower (Backward curved Centrifugal Fan with EC Motor) & coil, Heater, Humidifier, Specific De-humidification cycle, Microprocessor & electrical and Expansion valve all of which shall be contained within the cabinet of the unit. The outdoor condenser unit shall be air-cooled type comprising of coil, fan, motor and fan speed controller (Variex).

6.4 TECHNICAL SPECIFICATIONS

The Precision Environmental Control Systems shall be of self contained factory assembled unit with down flow air delivery. The Precision Air conditioner shall be High sensible cooling capacity and high Sensible Heat Ratio (i.e. the sensible to total cooling capacity ratio).

a. FRAME & CASING:

The frame shall be constructed of 2.5, 2.0 and 1.2 mm folded galvanized steel. The external panels shall be constructed of 1.2mm zinc coated sheet steel. Front, rear and end panels shall be fitted with 25 mm glass fiber insulation, fire rated to Australian Standard 1530 (indices 0,0,0,3). The cabinet shall powder coated with charcoal grey color and have a texture finish. The hinged front panels shall be removable and include captive ¹/₄ turn fasteners. The cabinet shall be assembled with pop rivets providing ease of disassembly.

b. FILTER:

The filter chamber shall be an integral part of the system and withdraw able from the front of the unit. Filtration shall be provided by dry media disposable filters capable of filtering air to 95% down to 5 micron efficiency and shall be replaceable from the top of the unit. Filtration shall be provided by deep V form G4 performance dry disposable media to ASI324.

c. EVAPORATOR FAN:

Units should be offered with backward curve direct drive Fan, High efficiency, external rotor electronically commutated (EC) motor with integrated electronics, True soft start characteristics (inrush current lower than operating current), Backward curve, corrosion resistant aluminum fan wheel, Maintenance free design and construction. The fan section shall be designed for higher air flow. The unit shall be fitted with one (two, three) direct-driven, high efficiency, single inlet, backward curved; the fan motors shall be Electronically Commutated (EC), IP54, with internal protection and speed regulation via controller signal. They shall be statically and dynamically balanced.

d. COMPRESSOR:

One refrigeration circuit, incorporating a high efficiency, fully hermetic Variable Capacity Scroll Compressor (Digital Scroll) with crankcase heater. Two compressor machines must have independent circuit for each compressor. The compressor shall be charged with R407C. The compressor solenoid valve shall unload the compressor & allow the variable capacity operation, i.e. the Scroll compressor shall modulate its capacity from 20% to 100% without any frequency variation. Each compressor is equipped with pre-set high and low pressure switches for protection against high condensing and low evaporating temperatures. Each compressor shall have internal motor protection and be mounted on vibration isolators.

e. REFRIGERATION CIRCUIT:

The refrigeration system shall be of the direct expansion type and incorporate one compressor, complete with crankcase heaters for each circuit. The system shall include a manual reset high pressure control, auto reset low pressure switch, externally equalized expansion valve, high sensitivity refrigerant sight glass, large capacity filter drier and charging/access ports in each circuit. Each refrigeration circuit shall include rigidly mounted isolation valves in the discharge and liquid lines to aid servicing and installation.

f. EVAPORATOR COOLING COIL:

The evaporator coil shall be incorporating draw-through air design for uniform air distribution. The coil shall be constructed of rifled bore copper tubes and louvered aluminum fins, with the frame and drip tray fabricated from heavy gauge aluminum. All metal parts in contact with condensate shall be the same material to prevent electrolytic corrosion. The drip trays shall ensure the collection of condensate and be accessible for cleaning. The cooling coil shall be maximum of 4 rows and minimum 11 fins per inch and the face velocity shall not be more than 2.5 m/s.

g. REMOTE AIR-COOLED CONDENSER:

The Air-cooled condenser shall be the low profile, weatherproof type incorporating high efficiency, direct drive, external rotor motors with axial blade fans & fan speed controller. The condenser shall be constructed from heavy duty aluminum and corrosion resistant through special anti corrosive epoxy coatings for any specific polluted areas. Heavy duty mounting legs and all assembly hardware shall be included. Condensers shall be suitable for 24 hours operation and be capable of providing vertical or horizontal discharge. The condenser shall be fully factory wired and require a 230 volt, single phase, 50 Hz electrical service. The high performance heat exchanger shall include

mechanically expanded cross-hatched copper tubes and louvered aluminum fins for maximum heat transfer.

h. HUMIDIFIER:

The humidifier shall be of the infrared type consisting of high intensity quartz lamps mounted above and out of the water supply. The humidifier pan shall be stainless steel and arranged to be removable without disconnecting high voltage electrical connections. The complete humidifier section shall be pre-piped, ready for field connection to water supply. The humidifier shall be equipped with an automatic water supply system and shall have an adjustable water-overfeed to prevent mineral precipitation. A high-water detector shall shut down the humidifier to prevent overflowing.

i. ELECTRICAL HEATING:

The electrical heating elements shall not operate at a level exceeding 60 W/Sq. m. The low watt density elements shall be of finned tubular construction. The heating circuit shall include dual safety protection through loss of air and high temperature controls. Electric heating shall be provided in a single stage. The elements shall be low watt density, 304/304 stainless steel fin tubular construction, protected by thermal safety switches. The heating system shall include dual safety protection through loss of air and manual reset high temperature controls.

j. UNIT SIZE:

Precision AC Indoor units shall be placed inside the Equipment room only. Hence the Footprint area of the Unit is extremely important to accommodate the same inside the existing Equipment Room. The unit shall require front access only for routine service and installation work.

k. MICROPROCESSOR CONTROLLER:

The unit control shall be factory-set for Intelligent Control which uses "fuzzy logic" and "expert systems" methods. Proportional and Tunable PID shall also be user selectable options. Internal unit component control shall include the following:

SYSTEM AUTO RESTART

The auto restart feature will automatically restart the system after a power failure. Time delay is programmable.

SEQUENTIAL LOAD ACTIVATION

On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush current

PREDICTIVE HUMIDITY CONTROL

Calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature. The control shall be

compatible with all remote monitoring and control devices. Options are Available for BMS interface via Modbus, BACNet and SNMP. The control processor shall be microprocessor based with a 128x64 dot matrix graphic front monitor display and control keys for user inputs mounted in an ergonomic, aesthetically pleasing housing. The controls shall be menu driven. The display & housing shall be viewable while the unit panels are open or closed. The display shall be organized into three main sections: User Menus, Service Menus and Advanced Menus. The system shall display user menus for: active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in % of each function, date and time), total run hours, various sensors and display setup and service contacts. A password shall be required to make system changes within the service menus. Service menus shall include: set points, standby settings (lead/lag), timers/ sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. A password shall be required to access the advanced menus.

USER MENUS SHALL BE DEFINED AS FOLLOWS:

ACTIVE ALARMS

Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm

EVENT LOG

Unit memory shall hold the 400 most recent events with id number, time and date stamp for each event

GRAPHIC DATA VIEW

Two graphic records shall be available: return air temperature and return air humidity

UNIT VIEW - STATUS OVERVIEW

Simple or Graphical. Unit View summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.

TOTAL RUN HOURS

Menu shall display accumulative component operating hours for major components including compressors, fan motor, humidifier and reheat.

MICROPROCESSORS SHOULD BE INTELLIGENT ENOUGH TO DO THE FOLLOWING TASK:

- Save Energy using Predictive Humidity Control
- Built-in Lead/Lag Functions for enhanced system reliability
- > Wellness Calculation alerts service personnel before problems occur
- Unit to Unit (U2U) Communications allows Lead/Lag and optional teamwork settings for maximum flexibility and control
- Optional IntelliSlot cards offer external monitoring through Modbus RTU and HTTP/SNMP protocols

STANDBY SETTINGS/LEAD-LAG

Menu shall allow planned rotation or emergency rotation of operating and standby units.

TIMERS/SLEEP MODE

Menu shall allow various customer settings for turning on/off unit.

TEAMWORK MODES OF OPERATION

It saves energy by preventing operation of units in opposite modes multiple units.

AUXILIARY BOARDS

Menu shall allow setup of optional expansion boards.

1. DIAGNOSTICS/SERVICE MODE

Control input and output values and status shall be displayed to aid in unit diagnostics and troubleshooting.

Control inputs shall be indicated as on or off at the front display. Control outputs shall be able to be turned on or off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.

The unit shall also incorporate the following protections:

- Single phasing preventers.
- Reverse phasing
- Phase unbalancing
- Phase failure
- Overload tripping (MPCB) of all components

m. SAFETY INTERLOCKS:

Operation of heaters & humidifiers shall be possible only when blower fan is in operation.

Fire detection signal from fire detector system shall be able to switch off the package unit operation in event of fire in conditioned space.

n. REFRIGERANT PIPING:

Each refrigerant circuit shall be suitable for operation on R-410A/407C and shall include the following items:

- a. Expansion valve with pressure equalization;
- b. Removable liquid line drier / filter.
- c. Liquid line sight glass with moisture indicator.
- d. Hand shut off valves.

6.5 SEQUENCING OF OPERATION OF UNIT:

The Precision AC units for the room shall be clubbed in individual group, so that Stand-by unit should start on after specific time of operation of working unit, as well as during break down of working unit. This sequencing operation feature should be integral part

6.6 ELECTRICAL WORK:

Each Precision AC unit should be provided with in-built electrical panel. Necessary 415 Volts +/- 10%, 3 Phase, 4 Wire (With Neutral), 50 Hz +/- 5% Power shall be provided by Customer at each unit's electrical panel. Balance distribution of Power is in the Scope of Bidder. All Electrical cabling should be of armored Copper.

6.7 OEM of PAC:

- Manufacturer should have experience in manufacturing & installation of Precision AC units in India for last 10 (Ten) years;
- Manufacturer should have ISO 9001, ISO 14001 Certification;
- Manufacturer should have fully equipped Service center (For Precision AC units) to give prompt & efficient service.

7.0 INSPECTION, TESTING AND COMMISSIONING

7.1 SCOPE

This scope covers initial inspection and testing of VRV/VRF system & AHUs at manufacturer's works, initial inspection of other equipments/ materials on receipt at site, final inspection testing & commissioning of all equipment at site & description of testing requirements & procedure.

7.2 INITIAL INSPECTION AT MANUFACTURER'S WORKS

7.2.1 Scroll Compressor

- a) Salient features such as model, capacity control, type of lubrication etc. shall be verified against the requirements visually without opening the compressors.
- b) Manufacturer's internal test certificates shall be scrutinised to check compliance with the requirements as specified in the contract.
- c) Free running test shall be carried out at the speed for which the motor is available with manufacturer but the speed shall not be less than that specified in contract. This test shall be carried out for 30 minutes in open space. During this running test following operations are to be noted :
 - a) Manual operation of capacity control
 - b) Lubrication oil pressure

7.2.2 Condenser

- a) Salient features like number of tubes, inside diameter of tubes (from which the gauge of the tube can be verified), no. of passes, material of fins, length of condenser, provision of fittings like safety valve, water, gas connection shall be verified during stage inspection. The tube thickness shall be checked.
- b) Manufacturer's internal test certificates shall be furnished and it shall be verified against contract requirements.

7.3 Factory Testing:
The complete unit shall be factory tested at 25%, 50%, 75% and 100% capacity and witnessed by *Representatives of the Engineer or as given in bid document* for performance at the rated conditions by simulating the actual design conditions. One unit of each capacity shall be tested.

All controls and switchgear shall be tested for proper functioning and set of design values.

The capacity in TR / kcal/hr shall be calculated from measurements. The power consumption shall be checked from current measurement of the motor. All calculated and checked results shall match the specified data within tolerances as stipulated by ARI.

All instruments and personnel for tests shall be provided by the contractor. Contractor shall inform the client about the testing schedule min. 10 to 15 days before the machine is ready for factory testing.

7.4 Air Handling Units :

- a) Salient features such as model, size, physical dimensions, and other details of various sections, fan motor details, fan dia, static pressure etc. shall be verified against the contract requirements.
- b) Manufacturer's internal test certificates for the motor and air handling unit shall be furnished and scrutinized as per contract requirements.
- c) Test certificate for static and dynamic balancing of the fan/ blower should be furnished. Fan balancing may be witnessed by Engineer-in- Charge or his authorized representative.
- d) Salient features like, type, material, no. and gauge of fins and tubes and no. of rows of cooling coil shall be furnished and verified with reference to contract requirements during stage inspection.
- e) Hydraulic pressure to the extent of 10 Kgf/sq.cm or pneumatic pressure of 21 kgf/ sq.cm shall be applied to cooling coil and this pressure should be maintained for 1 hour and no drop should be observed indicating any leaks.

7.5 INITIAL INSPECTION AT SITE

7.5.1 Ducting:

- a) The sheet used for ducting shall be checked for physical test at site. The physical test should include the sheet thickness and bend test as per relevant IS specifications.
- b) Zinc coating of GSS sheet as mentioned in the tender documents may be got tested from a laboratory to verify that same meets the contract requirements.

7.5.2 Switch Gear, Control Gear, and Measuring Instruments

These

should be of specified make. For air circuit breaker manufacturer's test certificate shall be furnished by contractor and the same shall be verified as per contract requirements.

7.5.3 Electric Motors

Electric motors should be of specified make, manufacturer's test certificate for electric motor shall be furnished.

7.5.4 Refrigerant Pipes

- a) It should be checked that the same is as per makes specified in contract.
- b) Dimensions shall be checked for pipes against the requirements of contract.
- c) Insulation and acoustic lining
- d) Physical verification for thickness and make should be made as per contract before application of insulation.
- e) Manufacturer's test certificate for density, thermal conductivity, sound absorption and class of fire retardation wherever applicable should be furnished.

Note: Accuracy of testing instruments shall be as mentioned in the final inspection procedure.

7.6 FINAL INSPECTION

- i) After completion of the entire installation as per specification in all respects, the AC contractor shall demonstrate trouble free running of the AC equipments and installation for a period of minimum 120 hours of running. The plan will be said to have successfully completed the running-in period, if no breakdown or abnormal/unsatisfactory operation of any machinery occurs during this period.
- ii) The equipment capacity computations shall be carried out to verify the Tender Document requirements.
- iii) The Input KW of the unit / TR at full load shall also be checked against contract requirements, if any.
- iv) All instruments for testing shall be provided by the AC contractor. The accuracy of the instruments shall be as follows:
- a. Temperature: Liquid in glass thermometer having accuracy ± 1 deg. C as per IS: 4825.
- b. Wet bulb Temperature : Sling psychrometer conforming to IS:6017.

Scale Error: For less than 0 deg. C : $0.3 \text{ deg C} \pm 0.2 \text{ deg. C}$. For over 0 deg. C : $0.2 \text{ deg. C} \pm 0.1 \text{ deg. C}$.

c. Pressure Gauge: With the accuracy of \pm 1% for maximum scale value from 10 to 90%, and \pm 1.9% for maximum scale value for rest of the scale conforming to IS: 3695.

7.7 TESTING REQUIREMENTS AND PROCEDURES

7.7.1 Balancing of all air and water systems and all tests as called for in the specification shall be carried out by the HVAC contractor in accordance with the specifications and relevant local codes if any. Performance tests of individual equipment and control shall be carried out as per manufacturer's recommendation. All tests and balancing shall be carried out in the presence of Engineer-in-charge or his authorized representative.

The whole system balancing shall be tested with microprocessor based hi-tech instruments with an accuracy $\pm 0.5\%$.

The instrument shall be capable of storing data and then down loading into a P.C. The HVAC contractor shall provide a minimum but not limited to the following instruments:

- i) Microprocessor based calculation meter to measure DB and WB temperature, RH and Dew point
- ii) Velo meter to measure air volume and air velocity
- iii) Pitot tube
- iv) Electronic rotary vane Anemometer
- v) Accubalance flow measuring hood

The contractor shall be responsible to provide necessary sockets and connections for fixing of the testing instruments, probes etc.

7.7.2 Air Systems:

Systems are to be balanced by first adjusting the total flow at the fan, then by adjusting main dampers and branch dampers. Only final minor adjustments are to be made with register and diffuser dampers. Balancing of the air system shall be accomplished without causing objectionable air noise. Baffles and orifice plates required for proper air balance shall be furnished and installed by the contractor. Basically the following tests and adjustments are required.

- a) Test all fan systems to provide proper cfm/ cmh.
- b) Adjust fresh air, return air and exhaust dampers to provide proper air quantities in all modes of control.
- c) Test and record fresh air, return air and mixed air temperature at all air handling units. Test and record data at all coils after air and hydronic systems are balanced. Measure wet and dry bulb temperature on cooling coils.
- d) Make point tube transverse at all main supply and return ducts to set proper air quantities. Adjust all zone and branch dampers to proper cfm/cmh.
- e) Test and adjust each register, grills, diffuser or other terminals equipment to within 5% of design air quantity. Each opening shall be defined on the test report by size, manufacturer's model, room location, design cfm and actual cfm. Outlets shall be adjusted to minimize objectionable drafts.
- f) Test and record static pressure drop across all filters and major coils.
- g) High velocity duct systems shall be tested for leakage. If excessive or audible leakage is detected, the defect shall be repaired by the contractor. Sufficient static pressure readings shall be taken from the air handling units to the terminal units to establish system static pressure.

7.7.3 Balancing Tolerance:

Systems shall be balanced within the following tolerances;

i)	Duct leakage Rates (at operating pressures) :	
•	Low pressure ducts	5% of full flow (0 to 0.5 kPa)
	Medium Pressure Ducts	1% of full flow (0.5 to 3 kPa)
	High Pressure Ducts	1% of full flow (Greater than 3 kPa)
ii)	Air flow rates :	
,	Under 70 L/S	10% of flow
	Over/ at 70 L/S	5% of flow
iii)	Heat flow rates :	
	Heat exchangers	5% of design capacity

Procedure:

Review all pertinent plans, specifications, shop drawings and other documentation to become fully familiar with the systems and their specified and intended performance.

Furnish equipment and instruct sheet metal trade on proper use for conducting duct leakage tests. Conduct first test as a way of instructing the above trades in the presence of the Department's representative.

Test relative barometric pressures in various building area, as deemed necessary by the Department's representative and at least in all areas served by different systems.

Test performance and continuously record on a 24 hour basis, temperature and humidity levels where control equipment is provided for that purpose in certain critical areas.

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS codes and test report shall be furnished by a qualified and authorized person.

7.7.4 Reports

Provide 3 copies of the complete balancing and testing reports to the department. Report shall be neatly typed and bound suitable for a permanent record. Report forms shall contain complete test data and equipment data as specified and safety measures provided to ensure safety of the operating personnel at all times.

7.7.5 Final documentation

The contractor shall leave the system operating in complete balance with air quantities as shown on drawings. Set stops on all balancing valves and lock all damper quadrants in proper position. Secure all automatic damper and valve linkages in proper positions to provide correct operating ranges. Proper damper positions shall be marked on ducts with permanent indication. Notify the department of any areas marginal or unacceptable system performance.

The above tests and procedures are mentioned herein, for general guidance and information only, but not by way of lamination to the provisions of conditions of contract and design/ performance criteria.

Upon commissioning and final handover of the installation, the HVAC contractor shall submit (within 4 weeks) to the engineer-in-charge/ department 6 (six) portfolios of the following indexed and bound together in hard cover ring binder (300 x 450 mm) in addition to the completion drawings.

- a) Comprehensive operation and maintenance manual
- b) Test certificates, consolidated control diagram and technical literature on all controls.
- c) Equipment warranties from manufacturers.
- d) Commissioning and testing reports
- e) Rating charts for all equipment
- f) Log books as per equipment manufacturers standard format
- g) List of recommended spares and consumables.
- h) Any special tools required for the operation or the maintenance of the plant shall be supplied free with the plant.

At the close of the work and before issue of final certificate of completion by the Engineer-in-charge, the contractor shall furnish a written guarantee indemnifying the department against defective materials and workmanship for the Defects liability period. The contractor shall hold himself fully responsible for reinstallation or replace free of cost to the department.

- i) Any defective material or equipment supplied by the contractor
- ii) Any material or equipment supplied by the department which is proved to be damaged or destroyed as a result of defective workmanship by the contractor.

8.0 COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT (CAMC)

8.1 The scope of comprehensive annual maintenance contract carrying out all sort of Scheduled/unscheduled maintenance of complete air-conditioning system including all items related with comprehensive maintenance of the HVAC system as per OEM specified maintenance schedule/National Building Code (NBC) 2016 guidelines. Repair & replacement of defective components, providing of spares and all other associated accessories which are not covered otherwise and attention of all types of defects, necessary for smooth operation of the HVAC system to the satisfaction of Engineer-in Charge/DFCCIL. The Contractor should also carry out any other schedule jointly decided by Engineer-in-charge/DFCCIL and the Contractor for any equipment of the HVAC system to ensure smooth and trouble-free functioning.

This work includes Comprehensive AMC for Seven (07) years for Complete VRF based HVAC system including accessories, consumable item like oil, compressor and Refrigerant etc. after completion of 18 months warranty period (defect liability period) of VRF based HVAC system including BMS.

8.2 The Contractor shall carry out Comprehensive, Preventive & Breakdown maintenance including Daily, Weekly, Monthly, Quarterly and Yearly maintenance of the VRF HVAC system including BMS at DFCCIL Corporate office site at Sector 145, Noida in terms of OEM guidelines & relevant NBC 2016 standards. The maintenance schedules and the work to be done in each schedule & report format shall be jointly decided by the Engineer-in-Charge/DFCCIL & the Contractor. Maintenance of complete HVAC system so that performance of the plant remains satisfactory.

8.3 The CAMC work includes all HVAC installation including BMS covered in the Schedule of HVAC work (Schedule-III). It shall inter-alia include but not limited to following:

a. Indoor Units (**IDUs**) of various type/size complete with electric/electronic components, wiring, power cord, remote & accessories.

- b. Regular cleaning of IDU filters and AHU filters (every 21 days) and replacement as prescribed by **OEM**. Wet cleaning of IDU's shall be done once in every 06 (Six) months and complete Dry cleaning of IDU, once in every 03 (three) month. Record of filter cleaning shall be maintained.
- c. Outdoor Units (**ODUs**) of various capacities complete with, compressors, piping, electric/electronic components, consumables, supports & any other associated work for proper & specified functioning of outdoor units.
- d. Refrigerant piping along with all joints etc. including detection/repairing of leakage, pressure testing, vacuum purging, gas recharging/ topping including supply of refrigerant.
- e. The repair work shall be carried out in a professional manner. This shall also include restoration of insulation after repair. Any other associated work for proper & specified functioning of air conditioning system. The scope also includes supply & charging of refrigerant due to any unforeseen circumstances.
- f. Condensate drain water pipe cleaning, detection/repairing of pipes for any leakages, insulation etc. Any other associated work for proper functioning of drain water disposal system.
- g. All control & power wiring between indoor & outdoor units. Any other associated work for proper & specified functioning of air conditioning system.
- h. Maintenance & upkeep of sub-AC panels on the roof including switchgear, cabling from sub-AC panel up to outdoor units, feeder pillars, consumables etc (excluding incoming cables to sub-AC panels).
- i. Maintenance of BMS, including all CENTRALISED CONTROLLER's of HVAC, displays, hardware & software etc. including central remote control. Any other associated work for proper & specified functioning of complete HVAC monitoring/control system.
- j. Any other item/activities associated with proper functioning of complete HVAC system deemed to have been included in the scope of work.
- k. In order to attend breakdown of the HVAC system, minor engineering works (eg. False ceiling, any kind of structural/masonry work, opening and closing) required if any, shall be in the scope of work.

8.4 Deployment of CAMC Staff:

- a. The contractor shall depute technically qualified, competent and experienced staff in adequate number for the schedule maintenance. It may however be noted that normally scheduled maintenance should be carried out on Saturday & Sunday or any Gazetted Holidays for which the contractor will give at least 24 hours advice to the Engineer-in-Charge/DFCCIL.
- b. For health check, operational assistance, quick redressal of complaints regarding HVAC system and to maintain CAMC work record, one experienced Graduate/Diploma Supervisor along with one Technician with necessary tools shall remain present in DFCCIL-CO Building site during all working days.
- c. Additional staff shall be deputed to reduce the downtime for attending major breakdowns as desired by DFCCIL.
- d. The work is to be carried out as per OEM guidelines/best industry practices and in such a manner that all premises always look Neat & Clean.

8.5 Attending to complaints:

- a. List of minimum spares to be available at site for smooth operation shall be prepared by the Contractor and Engineer-in-charge within 07 days of **commissioning of HAVC system (in part or full)** and accordingly all spares shall be available within **07 days.**
- b. After handing over of work, the Contractor shall submit list of authorised contact person in ascending order of hierarchy (Escalation Matrix) to whom complaints can be lodged.
- c. All defects and deficiencies should be rectified promptly after lodging of complaint. The complaint can be lodged through intercom, telephonic message or through complaint register kept in BMS Room. A Ticket would be raised for every complaint in which any/ all parts of the HVAC system is defective. The ticket will be closed when complaint is resolved to the satisfaction of the Engineer-in-Charge.
- d. Response Time (Max) 30 Minutes, to reach the site of complaint.
- e. Rectification Time (Max.) 03 Hrs. If Max. 03 IDU and ODUs/per FAHUs (except leakage, compressor, condenser failure) are involved.
- f. Rectification Time (Max.) 12 Hrs. If 04 to 10 IDU and ODUs/per FAHUs (except leakage, compressor, condenser failure) are involved.
- g. Rectification Time (Max.) 48 hrs. for Leakages in refrigerant circuit, defect in compressor, condenser and IDU/ODU.
- h. The quantum of work involved should be decoded within 30 minutes of the complaint received and recorded jointly with the representative of the Contractor and Engineer-in-charge/DFCCIL.
- i. Status of spares shall be jointly signed on every Friday at 17.00 hrs & timeline submitted for replenishment, if required.
- j. For expeditious disposal of complaints, the contractor shall maintain following minimum spares & consumables at site. These spares shall be replenished as soon as the designated quantity will get used:

SN	Description	Quantity
1	Refrigerant 410A	4 cylinders
2	Nitrogen Gas	02 Cylinders
3	Condenser fan motor	05
4	Condenser fan blade	05
5	PCB – ODU	05
6	PCB – IDU	02 of each type
7	IDU Motor – Ductable	01 (each type)
8	Blower Ductable	01 set each type
9	MCB 63A or as required	10
10	Contactor	05
11	Inverter/Digital compressor	02 each type
12	FAHU Motors of Different ratings	02 of each type

13	Water pump for IDU	02 each type
14	Water level sensor	02 each type
15	Capacitors ODU/IDU	05 each type
16	IDU motor (Cassette)	1% of the holding. 1 motor for each type
17	IDU display	02 each type
18	Terminal Block	02 nos
19	Thimbles	06 nos each type

- a. The spares shall be of OEM/same make. Where the 'Make' of item is not identified/ defined, it shall be of reputed make with the approval of Engineer in-charge/DFCCIL.
- b. In case the above spares (quantities) are not maintained at site, by the Contractor, the spares may be purchased by DFCCIL and the cost of purchase shall be deducted by DFCCIL while certifying the bills for payment to the Contractors.

8.6 Maintenance of Records:

- a. The contractor shall maintain proper log sheets for recording of temperature/Relative Humidity at nominated places as decided by Engineer-in-Charge.
- b. Separate log sheets shall be maintained for Routine/Preventive/Breakdown maintenance. Format shall be approved from Engineer-in-Charge/DFCCIL.
- **c.** Joint recording of temperature & Humidity shall be done every Monday, preferably 15.00 hrs to check performance of the system.
- d. Joint recording of compressor currents & refrigerant temperatures shall be done on fortnightly basis to cover entire circuits in a month.
- e. A record of tripping of safety devices should be maintained. The Contractor shall provide a report to the Engineer at the end of every week indicating the defect of the system and target date of rectification/replacement.
- f. Proper record of maintenance schedule to be maintained & should be available for check anytime.
- g. Quarterly Payment for <u>CAMC</u> Contract shall be made after submission of service report during the quarter jointly signed by the Contractor and signed by Engineer-In-Charge/DFCCIL. All the reports shall be got approved by Contractor in a format decided DFCCIL.

8.7 Penalty for delay in Comprehensive Maintenance work:

- a. as soon as any defect of technical nature is noticed by the Contractors staff, it shall be informed to the Engineer-in-Charge/DFCCIL in writing with details, whether it is of minor or major fault and possible time of rectification.
- b. A penalty will be imposed in case any complaint remains unattended after the rectification time is over, as under:
 - i. @ Rs. 500/- per IDU, ODU and FAHU per 03 hrs, towards clause no. 8.6 (e)
 - ii. @ Rs.2,500/- per 5hp/16hp ODU and FAHU per 12 hrs, towards clause no. 8.6 (f).

iii. @ Rs.5,000/- per 5hp/16hp ODU per 24 hrs, towards clause no. 8.6 (g).

- c. Payment to Contractor for CAMC Contract shall be certified by the Engineer-in-Charge/DFCCIL on the basis of CAMC contract condition as specified in contract document.
- d. After report of failure, if maintenance personnel does not start work at site & advice the action plan to attend the failure, penalty @ Rs. 500/- per hour or part thereof shall be levied to ensure that proper cooling is maintained in the entire premise & there shall be no discomfort to the occupants.
- e. After 7 days of non-rectification of a failure without any valid & justifiable reason, the cost of damage to HVAC system or DFCCIL property, if any due to failure of system will be sole responsibility of the contractor & the cost of damage of the same shall be borne by the contractor. After which, DFCCIL has right to carry out the work on risk & cost of contractor without further intimation.
- f. In case the defective HVAC systems are not rectified within a period of 7 days after expiry of rectification time mentioned in para 8.6 above, a penalty of additional amount as mentioned above equal to the 7 day period will be levied.
- g. The decision regarding penalty and imposition of penalty shall be solely under the discretion of the Officer In-charge of the DFCCIL. The total amount of liquidated damages under this condition shall not exceed 5% of the contract value.

9. DEFECT LIABILITY PERIOD

All terms and conditions mentioned in Para 8 for CAMC including deployment of staff shall also apply during Defect Liability Period except that the Contractor shall not get any payment during DLP for maintenance of HVAC system.

TECHNICAL SPECIFICATIONS FOR BMS SYSTEM

Building Management System (BMS)

10.0 SYSTEM DESIGN (BMS)

The technical specification covers the system & equipment to be supplied for comprehensive integrated Microprocessor based Direct Digital Controller (DDC) Building Management System (BMS). The equipment shall be suitable for continuous operation at the stipulated ambient conditions.

The BMS would comprise the integration of various independent systems on a common system. The proposed sub-system includes:

- \geq HVAC (VRF) System
- \triangleright Internal Lighting
- \triangleright External Lighting
- Facade Lighting
- Lifts
- Access Control
- CO & CO2 Monitoring
- PM 2.5 & PM10 Monitoring
- **A A A A A A A A** Ventilation System
- Fire Alarm & Fire Fighting System.
- DG Sets
- \triangleright HSD Fuel Tank
- \triangleright **Electrical System**
 - o HT Panels
 - Transformers \circ
 - o LT Panels
 - **Capacitor Panels** 0
- Water Supply & STP

10.1 **STANDARDS**

10.1.1 Building Management System (BMS)

The BMS Vendor shall execute for the works as required for implementation of the system, which generally comprise:

- The complete design, supply, configuration, documentation and commissioning of the BMS • including all hardware, software and supply of all connected sensors and actuators.
- Controls wiring including the provision of conduit and trunking.
- Commissioning ٠
- Testing

The system shall comply in all respects with this equipment specification and with the particular controls specifications appended as drawings and schedules and all current legislation and standards.

The BMS system must offer forward and backward compatibility.

Also, the BMS vendor should offer obsolescence support for 10 years.

10.1.2 BMS Schedules

The BMS Vendor shall provide the following schedules relevant to the requirements of the system:

- A points schedule showing each proposed connected point to the system. The points shall be arranged as schedules showing the points allocated on a plant-by-plant basis, the controller specification(s) selected, I/O capacity supplied and the spare I/O available for future use. Any points schedule supplied with this specification shall be considered as supporting information only. The BMS vendor shall be responsible for ensuring the correct allocation of points required for meeting the performance specification.
- A schedule summarizing the field hardware and indicate the quantities, types, manufacturer and duties of the devices. Field devices from the BMS vendor shall be used where possible.
- A Description of Operation detailing the operation of the proposed system.
- Where a system comprises more than a single network the BMS vendor shall include a diagram within the tender showing the layout of the LAN's and interconnections.

The BMS vendor shall supply the necessary hardware and software as below:

10.2 SOFTWARE

10.2.1 Management Station

10.2.2 Management level requirements

(a) General

All information comes together at the management level. The management level is the graphical, interactive interface for the operator to the automation station and the integrated plants and plant parts. The operator can display, query, process, save, or print any plant information via the peripheral units at the management level. System operation must be simple, i.e. dialog-driven. The plants are displayed in synoptic images and the values and states are presented and displayed dynamically. Special programs are used for higher control, optimization functions, maintenance and energy management.

(b) Multi-discipline

The system must be able to handle natively different disciplines in a building: Building Automation, Fire, Access Control, Intrusion, Video...The disciplines must allow distribution across independent servers if required. Scope of access for controlling and monitoring discipline data must allow customization per user in every client station. Each client station must be able to be assigned one or more disciplines, allowing customizable single or multiple discipline access mode.

(c) System openness

The control system support standard protocols used in building technology, including BAC net, OPC server/client, Modbus, and S7.

(d) Exchange of data to external system via web services

The exchange of data (values, events, and trend data) between other building systems, corporate applications, or other supplemental services, must be supported via web services.

(e) Data exchange via various subsystems

If several subsystems are used, various data must be exchanged between the automation stations (outside temperature, demand and coordination signals, etc.).

(f) Automate recurring tasks

The building automation and control system must take care of recurring tasks to lower the operator's workload. This includes, for example, cyclical report generation triggering, plant release at various conditions, or automatic adjustment of set points or alarm limits.

(g) Reactions

The system must allow automatically executable actions to be programmed at the management station when set conditions are verified. Conditions can be time-based, event-based, on change of values or on a combination of some or all. When conditions are met, the system shall execute a pre-configured list of commands.

(h) Scripting

The system must provide a Script Editor to create scripts based on a known scripting language. The script engine must allow the manual execution of scripts manually by the operator, or automatic execution triggered by the system based configurable conditions. Among others the scripts must support:

- Commanding of objects
- Reading attributes of object
- Subscription to value changes
- Read/Write text files
- Loading of external DLL's
- Mathematical / logical operations

(i) Drafted for use by fire detection and security systems (UL certified)

The management station must have passed Underwriters Laboratories (UL) performance and environmental tests. The management station must offer all relevant functions to connect comfort and fire detection systems:

- Display and handle events
- Graphically monitor and control the fire detection system
- Highlight the highest priority events.
- Direct navigation to the element triggering an event.
- Quickly go to user-defined instructions and graphically display event locations.
- Save and query activity data from the fire detection system.

- Distribute fire monitoring and control capabilities.
- Provide operating instruction checklists for operators during stressful situations for handling fire events.
- Send automatic remote messages of impacted device per e-mail.
- Display and plan automatic history reports.

(j) System-wide self-monitoring

The system must be capable of monitoring running applications, printers, and all connected subsystems. The system must report an event in case of an exceptional state.

10.2.3 System analysis

Detailed analysis on system and user activities must be available in chronological order.

10.2.4 SCADA platform

The management station must be based on a SCADA platform that is compatible with the BACnet B-AWS profile. It must permit integration of any building installation including HVAC and lighting.

(a) Operating system for building automation and control system

All data servers, operator stations, etc., for the BAC system must be compatible with the most current, generally available Windows 64-bit operating system. As a result, the current version of Windows (at least 6 months after release by Microsoft) as well as a minimum of the last Version is supported. Modifications to the customer network must be possible. The BAC system must therefore be installable on any common PC and offer a multitasking environments where a user can run multiple applications simultaneously.

(b) Ecosystem

The system must provide the means to develop proprietary drivers, not supported by the system natively for communication with 3rd party subsystems and devices, or exchange of data with external applications.

The system must also provide possibilities to extend the functionality by adding new libraries containing scripts, graphic symbols, graphic templates or object models to support subsystem integration or optimize automated tasks.

(c) Long term storage

The system must be able to store and archive data for a period of more than 10 years, allowing as an option segregation of stored data in different groups that can be tuned individually with different recording frequencies. Remounting of offline archived data must also be allowed.

(d) Validated environments

The system must allow compliance to regional certifications for validated environments, such as GMP Annex 11, US FDA 21 CFR Part 11 or similar.

(e) Distributed architecture

The platform must allow a distributed architecture across different systems to enable scalability (up to 500,000 objects) and separation by discipline and / or location. The distributed architecture must provide a single system image to the end user. The functionality that is available in a single system must be also available in a distributed architecture.

(f) Front-End Processor

The system must support the separate installation of communication drivers for subsystem communication on a different server.

(g) Help functions

The software includes an online help, context sensitive as well as indexed, a glossary, and can be searched by terms or sentences.

10.2.5 System up-to-dateness

(a) Product lifecycle

The system provider must offer a transparent product lifecycle to ensure the required consistency. All equipment offered for this project must be contained in the current product portfolio. The existing system environment must allow for easy and smooth integration of devices and extensions.

(b) System continuity

Products employed must be labels with a brand for a global standard that secures the interaction of products from various manufacturers. Products bearing these brands can also be employed together when manufactured at a interval of more than 10 years.

10.2.6 Hardware requirements

Minimum hardware requirements

(a) Standalone system (one client)

A full installation on one single computer machine is required. The hardware and software environment must fulfill the following definition:

- Type: Workstation Tower
- Processor: Intel Core i7 or Intel(R) Xeon(R) Processor
- Memory: 4 GB or above as per BMS Software requirement
- Harddisk: 1 TB (for example Western Digital Green / Red) 2
- Network card: Gigabit speed
- Graphic Card: On board graphics adapter (for example Intel 4600HD), or Mid-range graphics card (for example GeForce GT 730, AMD Radeon, Radeon R7 250)

(b) Recommended software environment

- Windows 10 Professional (64 bit)
- Windows Server 2012 R2 or 2016
- Microsoft SQL Server 2012, SQL Server 2014, SQL Server 2016 (Express, Standard or Enterprise)

(c) Server system (up to 10 clients)

One client/server system for mid-sized sites with a high data transfer rate is required. The hardware and software environment must fulfill the following definitions:

- Type: Server tower
- Processor: Core i7 4th generation (for example Intel Core i7-4770K), Intel Xeon (for example Intel Xeon E5-1630 v3, Intel Xeon E5 1620 v2)
- Memory: 32GB
- Hard Disc: 2 * 1 TB hard disk (for example Western Digital Red, Seagate Constellation ES.3)
- Network card: Gigabit speed
- Graphics card: On board graphics adapter (for example Intel 4600HD), or Mid-range graphics card (for example GeForce GT 730, AMD Radeon, Radeon R7 250)

(d) Recommended software environment

- Windows 10 Enterprise, multilingual, 64 bit or Windows Server 2016, multilingual, 64 bit
- Microsoft SQL Server 2012, SQL Server 2014 or SQL Server 2016 (Standard or Enterprise)

(e) Network requirements

- Local network
- 1000 Mbps up/down
- Latency less than 10 ms

10.2.7 User profiles

(a) **Plant overview**

Individual views

Individual, specific or user defined views must be adjustable for the plant overview. The views must cover various electrical and mechanical installations or follow geographic or organizational criteria and permit a customized, hierarchy view that depicts the management station, control systems, plant geographic layout as well as relationship of the mechanical facilities.

(b) User privileges

The building automation and control system must allow users to define, change, or delete predefined reactions as per their user privileges.

(c) Multi-lingual

The user interface must support a minimum of 3 languages at the same time.

10.2.8 Graphics

10.2.9 General

(a) Operating interface to CAD system

The user interface must allow users access to various system diagrams and floor plans using graphical depictions, menu selections, and data point assignments. The graphics software must also permit the import of CAD symbols (DWG, DXF format) or scanned images for use in the system.

(b) **Operating messages**

Operating message must be able to be displayed and evaluated on the management level. Graphics must be able to display data point states that are overwritten by a local priority switch. This on data points that were developed to supplying by local override.

(c) Full graphics mode

A fully graphics-based management level with ergonomic and freely scalable images must be available. The system must be developed to operating, monitor, optimize, and log all connected automation stations in real time.

10.2.10 Graphics generation

Operators must be able to add, delete, and edit system graphics and state texts for digital data points from the standard user interface without external or special tools.

(a) Navigation

A hierarchy tree can support as option navigation to the various graphic images. Graphic displays must include the ability to dynamically zoom and switch among various layers with different information.

(b) In graphics commanding

The system must offer graphic objects which can be used to command or control the system. At a minimum, sliders, buttons, text boxes, dropdown lists and radio buttons must be included

(c) Visualize the quality state in the plant graphics

A violation of energy efficiency limit values for measured values of primary plants (e.g. centralized air handling, energy generation) must also be displayed in the plant graphic directly on the application components or function. The parameters for monitoring, evaluating and forming the quality state can be set directly in the plant graphic based on read and write access rights. As an alternative: Make possible the simple navigation to an appropriate user program.

10.2.11 Pictures

(a) Graphic symbols and standards

Plant graphics must meet the ergonomic needs of the operator. The displayed graphic symbols must correspond to the generally valid standard for HVAC symbols (DIN EN 62424 (VDE0810-24)) and ASHRAE guidelines. The symbols must be supported as 2 and 3 dimensional graphics. The ability is required to create colored floor displays and system diagrams for each mechanical facility including AHU, chilled water plants, hot water boiler systems, and room operator units. Associated print outs of standardized plant images must be added to the bid.

(b) **Object-oriented graphics**

The building automation and control system must offer dynamic, high-resolution graphics. The graphics must be object-oriented. Each symbol must be able to display several states in the same, consistent format. At the same time, several views must be able to be open concurrently, and all views must be updated dynamically.

(c) Continuous update and display

Measured values, set points, user settings, and alarms must be displayed immediately and continuously. State changes must be indicated via symbol, e.g. using animation or changing the color, in general, however, graphic presentation, or text.

10.3 ENERGY MANAGEMENT

10.3.1 Energy measuring functions

(a) Monitor control process quality

The entire system must be monitored for control deviations. A corresponding alarm message must be generated if a measured value exceeds or drops below a specified setpoint for an extended period of time for a given control process.

(b) Counter values, pulse count

Pulse inputs must support implementation and display in real process values for further processing in the building automation and control system. Operators must be able to set start values, correction values, and limit values via the operator units.

(c) Counter values, pulse count, and absolute value acquisition

Pulse inputs must support implementation and display in real process values or direct readout of absolute values for further processing in the building automation and control system. Operators must be able to set start values, correction values, and limit values via the operator units.

(d) Managed Meters

The system must be able to detect energy meter rollover and react to it showing the real figure of the accumulated energy consumed. It must also support the exchange of energy meters taking into account the latest reading of the replaced meter so that the energy values for the new meter continue adding up on it.

(e) Integration of power meters

The system must support the integration of energy switchgears and power meters and provide standard electrical symbols as well as dedicated graphics and templates for meters or electrical components commonly used in data centers, such as PDUs and UPSs.

(f) Energy and Power reports

The system must be able to provide energy and power reports to visualize:

- Load profiles
- Maximum power
- Energy consumption
- Comparison of consumptions

Analysis of the data must be done on the local machine, not on a cloud based solution.

10.3.2 SCHEDULER PROGRAMS

10.3.3 General

(a) Management via central scheduler programs

Operate all scheduler programs online from the management level to achieve consistent, transparent operation of all integrated systems and subsystems.

(b) Scheduler programs

The system must offer the ability to operate schedulers on automation stations as well as support management station-based time scheduling.

Each currently used plant image must offer user-friendly scheduler operation.

(c) Scheduling and override

Providing calendar type formats to simplify time and data planning and override building operation is required. Time definitions must be located on the PC workstation and building controller to ensure scheduling even if the PC is offline. Providing override access through menus, graphical mouse, of function keys. Providing the following operations at a minimum:

- Comprehensive support of all BAC net objects for scheduler, calendar, and commands.
- Daily and weekly schedules
- Ability to compile multiple data points into a logical command group to simplify scheduling (e.g. Building 1 Lighting)
- Planning predefined reports.
- Ability to plan at least 10 years in advance.
- Provide filters for schedulers by name, time, frequency, and schedule.
- Provide sorting schedulers by name and schedule type.

10.3.4 SCHEDULER PROGRAM TYPES

(a) Customized scheduler program

The user can customize the schedule defining the operating mode for each plant. Switching times are defined via weekly schedule. Overriding recurring weekly schedules via local or global exceptions as well as operation via any operator unit must be possible.

(b) Customized calendar

Local or global calendar exceptions must be able to override the plant-specific weekly scheduler program. Equal calendars must be assigned priority over each other. Calendar operation must be possible via all operator units.

10.3.5 BUILDING AUTOMATION AND CONTROL SYSTEM OPERATION

(a) Multiple user system

• Create calendar online

Calendar programs must be able to be remotely created online to provide service personnel a high level of flexibility.

• Create scheduler online

Scheduler programs must be able to be remotely created online to provide service personnel a high level of flexibility.

• Create offline trend online

Trends, that also trend offline, must be able to be remotely created online to provide service personnel a high level of flexibility.

(b) Multiple, concurrent users

Multiple users must be able to work concurrently on various workspaces on the building automation and control system for efficient and comprehensive work. Plants must simultaneously be analyzed and e.g. monitored or operated via a remote station.

10.3.6 SECURITY

10.3.7 Access protection

Different persons maintain and operate the plant. For this reason, passwords must be assigned to authorized persons to guarantee transparency for tracking or authorization purposes. A minimum of four different rights must be assignable.

- Administrator.
- Program and graphics creation.
- Operation to change or adjust set points.
- Guest.

10.3.8 Windows authentication

The building automation and control system password management must meet the customer's IT guidelines. In other words, the customer's corporate standard also apply to the BAC system. As a consequence, password management and the associated properties must comply with standard Windows log on and "track" the operator on each workstation.

10.4 ALARM HANDLING

10.4.1 General

(a) Alarm function

The automation station contains an image of the physical data points. Each data point must be alarmable. Parameterization via operator units must be possible. The alarms require acknowledgement.

(b) Alarm message

Alarms from the automation station must be displayed on the operator units within 1 second. Alarms must be acknowledged or acknowledged and reset dependent on access rights. Delay times (e.g. feedback supervision, triggering of differential pressure monitor, filter) must be changeable via operator units.

(c) Alarm suppression

Lower priority messages, undesired reactions from objects or entire plants must be capable of being suppressed during commissioning, plant servicing or automation station start up.

10.4.2 System safety

(a) High availability

High availability is expected from the building automation and control system. This results in greater data availability, greatly reducing any down times.

(b) Alarm generation

Message handling

The building management system must support alarms generated at the automation level (substations).

10.4.3 Alarm routing

(a) Media independent formats

Current alarms may need to be routed independent of media at certain times to a central service (printer, email, SMS, and mobile apps). The number of data points that can be configured for remote messaging of alarm conditions as well as the number of remote devices that may receive system messages may not be limited. The system must support the sending of encrypted e-mails.

(b) Alarm message escalation list

The system be able to be configured to send messages to individuals or a group of people and various messages to different remote devices by message priority. It must also be able to send to an escalation list so that a message is second to a second device if there is no response from the first device after a configurable time.

10.4.4 ACKNOWLEDGMENT

10.4.5 Operator units for acknowledgement

All alarms (alarms and faults, errors) must be acknowledgeable after issue of individual rights from all connected workstations. For tracking reason, a time stamp and assignment (based on user account) is required.

This includes:

- Local acknowledgement (control cabinet, automation station)
- Management level
- Remote operating equipment

10.4.6 ALARM MANAGEMENT STRATEGY

The software must permit configuration of alarm management strategy for each data point. The editor provide a way to edit data points directly, online via the building management system. The software for the user interface is also able to make batch changes to data point definitions and attributes to one or more data points selected by the user.

10.4.7 Alarm display

Color display

Incoming alarms must be colored for quick and easy interpretation. Both order and state as well as alarm priority must be recognizable. The alarm window must be displayed as per operator needs. Alarm window displays must be added to the bid.

10.4.7.1Alarm message content

The message texts must contain all information necessary to allocate and resolve the error. This includes at least the following attributes:

- Clear text.
- Control cabinet name
- Plant name
- Priority
- Timestamp
- Time.
- Status (acknowledged, unacknowledged).
- Instructions on how to resolve the problem must be available in the background.

10.4.7.2Filter alarms

The building automation and control system must offer alarm filtering. Filtering must be possible by alarm lists or priorities. Alarms are displayed in popup windows. Step-by-step instructions on handling each alarm help the building automation and control system operator to find a solution.

10.5 EVENT MANAGEMENT

10.5.1 Event routing and sorting

Event messages can be displayed on each workstation in a table application and must include the following information: Name, value, event time and date, state, priority, acknowledge information, and alarm counter. The system must also be able to send out an acoustic message appropriate to the event category

10.5.2 Event message

Event messages can be displayed on each workstation in a table application and must include the following information on each event: Name, value, event time and date, state, priority, acknowledge information, and alarm counter. Each event must also be able to send out an acoustic message appropriate to the event category

10.5.3 Event acknowledgement

The user can acknowledge each event directly from the list, suppress the acoustic notification, print or

delete it. The interface must also have an option to deleted active, acknowledged events until it is reset to the normal state. The user must be able to navigate to information associated with a data point, start an associated graphic or trended graphic diagram, or run a report for a data point selected directly from the event list.

10.5.4 Event treatment

The system must provide multiple alarm-handling options. These are to be configured in alignment the standard operating procedures.

10.6 FAST TREATMENT

The user must be able to acknowledge each event directly from the event list, suppress the acoustic notification, print or delete it. The interface must also have an option to deleted active, acknowledged events until it is reset to the normal state. The user must also be able to navigate to information associated with a data point, start an associated graphic or trended graphic diagram, or run a report for a data point selected directly from the event list.

10.6.1 Investigative Treatment

From the event list, operators shall have the ability to quickly focus on the source of the event, and all information (live and recorded video streams, recent history, schedules, and so on.) related to the event source.

10.6.2 Assisted Treatment with Operating Procedures

The system shall have the ability to program operating procedures consisting of a sequence of steps or actions, which the operator must perform. For each step of a procedure, the system shall provide instructions and operating tools. With appropriate permissions, a user shall have the ability to create, view, edit, or delete operating procedures. Each operating procedure shall be composed of steps - some of which may be mandatory - for the user to complete (for example, view the graphic of the object in alarm, view live and recorded video streams, or complete an event handling form) while some others shall have the ability to be configured to be executed automatically by the system (for example, send emails to recipients or print on paper the information of the event).

10.6.3 REPORT GENERATION

10.6.3.1Reports

(a) **Report generation**

Must generation spontaneous or predefined reports to provide important plant data at any time. The reports must be printable and exportable as a PDF file. The data must be able to be edited in other programs (Microsoft Excel or Microsoft Access) for further analysis.

(b) Standard report templates

Template to generate detailed reports at little effort. At least three different report templates must be available.

- Reports to record alarm and fault states
- Reports to record logbook entries
- Reports to record plant and control cabinet states.
- List of all current data points in an override state

- List of all disabled data points
- List of alarm strategy definitions
- Overall data point report
- Data point trend data listing
- Initial value report
- User activity report
- Event history report

(c) Customized report templates

The system must permit generated, specific reports as well as individual report templates that may include graphics and trend views.

10.7 Remote operation

(a) **Operating options**

User requirements on operation

The web based user interface offers the same functionality as those on other workstations including operation and configuration. All user functions be available on clients via browser, installed client console, or Windows desktop App.

(b) Via web browser

User must be able to remotely operate and engineer plants regardless of location. Of course, this openness cannot place the plant security at risk. The client must run on a browser as a full trust client application.

(c) Dedicated Desktop Installed client

User must be able to remotely operate and engineer plants regardless of location. Of course, this openness cannot place the plant security at risk. The client must operate as a fully installed software installation, locked with a desktop and prevents in this manner software from being minimized or hidden by other applications.

(d) Windows Desktop APP

User must be able to remotely operate and engineer plants regardless of location. Of course, this openness cannot place the plant security at risk. An App must be loadable by the server PC on the client that operates like an installed application and is automatically updated as soon as new apps are available on the server.

(e) Mobile App

An App, optimized for smart phones and tablets, must be available for the management. The App shall contain tools to see and command events as well as a System Browser to read and command all objects based on the security privileges of the operator as defined at the management station. The App shall be available for both Apple and Android operating systems.

10.8 TREND DATA

10.8.1 Analyses

(a) Simultaneous, multiple trends

Multiple trend views must be possible simultaneously to provide a comprehensive plant overview. Standard plants from medium to higher complexity (as in this project) require a simultaneous display of up to 10 trend curves on the current page view to assess the plants. Multiple trend curves must thus be recorded at the same time.

(b) Freely assign trend data

For greatest possible flexibility, operators must be able to assign and thus record max. 4 additional data points individually for each plant.

The assignment must be carried out from the management station.

(c) Decentralized data storage

None of the trend data may be lost during communications failure to achieve gap-free trend documentation. For this reason, all trend data must be created and saved to the automation station. After communications are restored, all values saved on the management station must be updated automatically.

(d) Record history data, trend

Vital data points and set points must be saved for each building services plant. The polling time is oriented to the signal type, i.e. analog values are recorded cyclically while digital or multistate values are recorded by event.

(e) Intermediate storage of history data

Trend data are collected in the automation station and transferred to the management level after a specific time has expired or specific number of data has been recorded. Trend data may not be lost if the management station is unavailable temporarily.

(f) Trend comparison

The system must offer a time adjusted trend view to run analysis of changed conditions at various times.

10.8.2 COMMUNICATION

10.8.2.1General

(a) Interfaces

The building automation and control system must be extendible to ensure long-term operation and provide all standard interfaces commonly available on today's market.

(b) Fire detection system, BAC net-based

BAC net-based fire detection systems supporting BAC net BIBB AE-LS-B as well as objects Life Safety Point and Life Safety Zone as per the PICS (Protocol Implementation Conformance Statement) document must be able to be integrated for best deployment of a building automation

and control system. The following functions must be supported:

- Alarms and events from the fire detection system must be identified clearly and unambiguously.
- Signalling device states must be displayed as per the BAC net standard.
- Instruction texts must be able to be added to detectors and zones.
- Situational and floor plans as well as dynamic symbols must be used for visualization.
- A technical hierarchy, e.g. building, building part, zone, detector, must be provided to the operator for ease of operation.

(c) Integrate third-party devices via OPC

The OPC Foundation must test and certify the system, which must be able to integrate and edit OPC data, and yet supply real time OPC data as an OPC server. System processing must include alarming, trend, scheduler, reporting, and be able to communicate with other devices. The system must support the OPC specification:

• OPC data access

(d) Integrate via IEC 61850

A native integration with an electrical power network via IEC 61850 protocol must be supported.

(f) Integrate via Modbus

The management station must support communication to Modbus TCP/IP devices and sub systems directly from the management station.

10.8.3 Standard BAC net / AMEV

(a) DIN EN ISO 16484-5 / AMEV

AMEV (Management station) AMEV Profile MBE-A and MBE-B

The management stations must meet AMEV profiles MBE-A and MBE-B as per AMEV guideline "BACnet 2011" V1.1.

(b) **B-AWS** (management station)

The required management stations match the BAC net profile B-AWS (advanced management station) as per BTL Listing and ANSI / ASHRE 135 guidelines. They must also support BAC net data points and BAC net personal safety security zone functionality. The BAC net protocol revision must be at least 13.

(c) ONVIF video standard

The management system must be capable of video operations fully integrated into the same user interface with the following capabilities:

- Live video, Recording and Video Search and Replay
- Live video, Recording and Video Search and Replay
- Video display of multiple cameras
- Status and Commands
- PTZ and predefined PTZ Positions
- Remote Control of Video Monitors

- Video Events and Video Event Treatment including video tagging with alarm information
- Diagnostic information of Video Devices
- Video as Operating Procedure step

10.8.4 OPERATOR PANEL

10.8.4.1 Operator Panel definitions

(i) Graphical plant operation via network-capable touch panel

The building management system is operated via a networked touch panel. They must inform the operator without log on using plant graphics on the present state of the plant.

Multiple plants must be able to be operated via the touch panel.

It must be capable of displaying and acknowledging alarms.

The operator should be informed about faults directly by a common alarm display via faults even when the display is switched off.

At the same time, functions to control the plant must be supported, so that plants must be able to be graphically operated and displayed using select data points, schedulers as well as trend views.

(ii) Integrated system component

The Touch panel must be part of an integrated solution, without external, additional hardware required.

The Touch panel must be a BAC net standard device with a B-OD certification.

(iii) Various purposes

The supplier must be able to offer a wide range of different sizes and various versions as wall or control cabinet mounted devices.

(iv) Local plant operation

The system must provide scalable touch panels for control panel installation. The product range must include three different touch panel sizes between 7" to 15".

The touch panel must have a modern "state of the art" design, what means a capacitive touch screen supporting multi touch gestures, wide screen format and LED for status indications. The device must be powered by a 24V AC supply.

(v) Local room operation

The system must provide scalable touch panels for room installation. The product range must include two different touch panel sizes between 10" to 15".

The touch panel must have a modern "state of the art" design, what means a capacitive touch screen, supporting multi touch gestures, wide screen format and LED for status indications.

To meet the room design requirements the touch panel must have aluminum frame and provides a wall mounting kit.

(vi) Power Supply

The touch panels must be protected against theft. The device must be powered either via Ethernet (PoE) or 24V AC supply.

(vii) 3rd party device operation

To provide an open Platform the touch panel must also be able to operate and monitor 3rd party BACnet devices.

(viii) Remote access to the touch panel

Remote access to the touch panel must be available In order to support remote access to the touch panel via a browser, or any other end device, the touch panel must fully support HTML 5.0 standard.

(ix) Remote access to the building control system

Remote access to the touch panel must be available in order to support remote operation of the building automation control system, via standard devices with HTML 5.0 web browsers (e.g. Smart phones, tablets etc.)

(x) User management

User management must be possible on the touch panel itself. The system admin don't need to use any other platform, all changes regarding user profiles can be managed on the panel itself.

User name and password is required to run functions that can change to plant settings in order to protect the plant. Authentication must be able to be disabled as an option.

(xi) Alarming

The system must be able to log and forward alarms to email recipients. Alarm forwarding must be priority wise and or time scheduled and individually assigned to multiple recipients.

To support fast alarm detection, the email subject line and the alarm message content must be configurable.

(xii) Trending

The touch panel must show predefined BACnet trends, running on automation stations.

It must be possible to display multiple trends, summarized in one chart.

The user must be supported to individually set up new trends on the device itself.

It must be possible to export trend data manually via a CSV file

It must be possible to export trend data automatically to an FTP server or email recipient, based on a predefined time schedule.

Local operator units must support temporary recording of trend data to allow local operators to record a trend at the control cabinet for diagnostic purposes.

(xiii) Reports

The touch panel must support system wide status indications (such as manual switches, error messages, manual set point adjustments etc.)

The filter function must help to sort data points by alarm or BACnet object status and type.

Several export functions are required to export reports as a CSV file or to an FTP server or email recipient.

(xiv) Heating curve

Graphical visualization and operating of the heating curve must be supported.

(xv) Plant graphics

The touch panel must provide the function that all plants and rooms can be visualized with graphics including animated 2D and or 3D symbols.

The user has the ability to modify the graphics on the device, online, via an embedded graphic

editor, via a standardHTML5.0 web browser.

The system must include a large library of symbols and graphic components to cover the most common applications.

Templates for primary plants, rooms, and dashboards shall be provided with the device.

(xvi) List viewer

All BACnet objects and the properties of selected devices must be operated and monitored via an embedded list viewer function. The system must also support customized point lists.

10.8.5 CONTROLLERS System description

10.8.5.1General

Building automation and control system requirements

(a) System requirements

General requirement including energy monitoring

Include a digital (DDC) building technology control system to operate technical equipment in buildings. The system must be able to carry out comprehensive measuring, control, optimization, and monitoring functions. All applications deployed must have been tested, documented, and used multiple times.

All systems deployed supply information on operating states and energy use to render current energy efficiency transparent or to display weaknesses. Measures can be made pursuant to this information that contributes to increased energy efficiency.

(b) General requirement

Include a digital (DDC) building technology control system to operate technical equipment in buildings. The system must be able to carry out comprehensive measuring, control, optimization, and monitoring functions. All applications deployed must have been tested, documented, and used multiple times. The possibility for free programming of individual system components should be available to individually modify customer-specific requests.

(c) User designation

The entire system (management, automation level including room automation) must be designed to define a clear, user designation UD encompassing 80 characters. The UD must be fully usable in the user programs on the management level. On the automation level as well, the UD must at a minimum be able to query details via local operating units.

(d) Requirement for a project as per BACnet

Communications through the entire building automation and control system must be based on the BACnet standard valid at the time of the bidding.

10.8.6 System up-to-dateness

(a) **Product lifecycle**

The system provider must offer a transparent product lifecycle to ensure the required consistency. All equipment offered for this project must be contained in the current product portfolio. The existing system environment must allow for easy and smooth integration of devices and extensions.

(b) System continuity

Products used must be have a label for a global standard that ensures inaction with products from various manufacturers. Products with these labels can also be combined if manufactured at intervals of more than 10 years.

(c) Architecture

Three system levels

A building automation and control system featuring system architecture as per ISO EN 16484-3 is required. The three system levels must be interconnected via communications.

- Management level
- Automation level (automation stations/individual room control)
- Field level (field device)

(d) Automation stations

The system offered must provide largely decentralized intelligence to achieve high operational and plant availability. The devices are autonomous components that can independently execute assigned automation and control.

(e) Implement third-party systems

Third-party systems must be able to be integrated on both management and automation levels to ensure full system consistency. Default interfaces must be provided. Third-party protocol implementation must be possible and require little effort. To do this, all hardware and software required for integration, all required services, clarifications with other technical and mechanical building installations, interface testing, data transmission testing, data point generation/integration as well as plant picture creation, backup, test protocol generation and specific documentation must be included in total costs.

(f) Location-independent operation

The building automation and control system technology must allow for location-independent operation and management of all messages and trends on all available types and views for the entire building automation and control system.

10.8.7 Consistency

(a) Uniform system

The supplier must prove that the required functions originate from a single manufacturer and using one automation and control system, where the hardware and software are developed in a manner that allow for simply modification while operational for subsequent function extensions or changes.

(b) Implement new data points

Building automation and control must be coherent to ensure possibility of future extensions and changes. This means that data points must be acquired once only, and then be provided automatically as needed to operator units and management level.

10.9 INTEGRATION OF OPEN STANDARDS

10.9.1 General

(i) Interfaces

The building automation and control system must be extendible to ensure long-term operation and provide all standard interfaces commonly available on today's market.

(ii) Implement via BACnet

Default protocols and suitable physical communications media must guarantee interoperability (ISO standard). Use only listed protocols and communications media. Third-party systems are integrated via BACnet. Provide only data required to efficiently and economically operate building services plants.

(iii) Implement via KNX

Default protocols and suitable physical communications media must guarantee interoperability (ISO standard). Use only listed protocols and communications media. Third-party systems are integrated via KNX. Provide only data required to efficiently and economically operate building services plants.

10.9.2 Decentralized integration of communicating pumps

A decentralized interface module must allow for connecting communicating pumps to a BACnetcapable automation station. The automation station provides the following functions:

- Event-oriented communications
- Peer-to-peer (cross communication)
- Alarm and message processing, distribution to local operator units and building automation and control system.
- Scheduler with days of the week
- Calendar function
- local trend recording in device buffer (long-term trend).

10.9.3 Electrical substations

Automation and control systems to monitor decentralized electrical installations are used in electrical substations. To this end, the most important information (messages/monitoring) from the existing systems (fire detection plants, doors, elevators, etc.) is activated for takeover.

All technical installations in the building are joined in one building automation and control system and operated and optimized via the management station. The building automation and control system as a whole enables the building operator to acquire and influence processes and their effects throughout the building.

10.9.4 Integrate fire detection systems

(a) Fire detection system, BACnet-based

BACnet-based fire detection systems supporting BACnet BIBB AE-LS-B as well as objects Life Safety Point and Life Safety Zone as per the PICS (Protocol Implementation Conformance Statement) document must be able to be integrated for best deployment of a building automation and control system. The following functions must be supported:

- Alarms and events from the fire detection system must be identified clearly and unambiguously.
- Signalling device states must be displayed as per the BACnet standard.
- Instruction texts must be able to be added to detectors and zones.
- Situational and floor plans as well as dynamic symbols must be used for visualization.
- A technical hierarchy, e.g. building, building part, zone, detector, must be provided to the operator for ease of operation.

(b) Integrate Modbus devices

Integrate third-party devices via Modbus

Modbus-capable devices must be able to be connected to a BACnet-capable automation station for bidirectional data exchange. This connection must be direct via RS232 or RS485 interface and without conversion. The data points of the third-party system are mapped to input/output functions in BACnet and are then available as fully communicating data points for further processing and connection, e.g. for:

- Alarm handling and prioritization
- Override control, priority control and commands for central operation.
- Grouping
- Scheduler
- Trend recording

(c) Decentralized integration of third-party devices via Modbus

Modbus-capable devices must be able to be connected to a BACnet-capable automation station via decentralized interface module for bidirectional data exchange. The automation station provides the following functions:

- Event-oriented communication
- Peer-to-Peer (cross communication)
- Alarm and message processing, distribution to local operator units and building automation and control system.
- Scheduler program with weekdays
- Calendar function
- local trend recording in device buffer (long-term trend).

(d) Integrate M-bus devices

Integrate third-party devices via M-bus

M-bus-capable devices must be able to be connected to a BACnet-capable automation station for bidirectional data exchange. The data points of the M-bus system are mapped to input/output functions in BACnet and are then available as fully communicating data points for further processing and connection, e.g. for:

- Alarm handling and prioritization
- Override control, priority control and commands for central operation.
- Trend log.

(e) Decentralized integration of third-party devices via M-bus

M-bus-capable devices must be able to be connected to a BACnet-capable automation station via a decentralized interface module. The automation station provides the following functions:

- Event-oriented communication
- Peer-to-Peer (cross communication)
- Alarm and message processing, distribution to local operator units and building automation and control system.
- local trend recording in device buffer (long-term trend).

(f) Integrate LonWorks® devices

Integrate LonWorks®-compatible third-party devices

LonWorks® devices must be able to be connected for bidirectional data exchange to a BACnetcapable automation station to integrate higher LonWorks® functions, e.g. room and supplyoriented groups, scheduled control, and system functions such as changeover, summer/winter compensation, etc. Integration is direct and without conversion. The data points of the LonWorks® system are mapped to input/output functions in BACnet and are then available as fully communicating data points for further processing and connection, e.g. for:

- Alarm handling and prioritization
- Override control, priority control and commands for central operation.
- Grouping.
- Scheduler programs.
- Trend log.

10.9.5 Power failure

(i) Data backup

The data must be saved for extended periods of time in case of power failure or extensions or removal of automation stations.

The applications and all vital operating parameters (including set points, scheduler values, etc.) must not be lost due to a power outage. Other operating values such as alarms, trend data, etc. must be capable of being saved locally on the automation station.

(ii) Power restoration strategy based on backup power supply in case of power failure

Important and vital plant data including controls (automation station) must continue to run during power failure (switch-off via power switch or control fuse, etc.).

The backup power supply continues to provide power to the power portion as well as plant control including automation station. Power failure must be signaled via software, vital plants must continue to operate, non-vital plants and their aggregates and components must be switched to a safe operating mode or shut down immediately. After power returns, all automation stations and plants including their aggregates and components must start automatically. The various plants must be switched on and released at intervals to prevent switch-on peak loads. The current status for all switching and positioning commands, set points, manual interventions, etc. remains saved in the automation station and/or is renabled following power restoration and used for the current operating mode.

(iii) Power restoration strategy in case of power failure

All plants and their aggregates and components as well as all automation stations fail during a power failure (switch-off via power switch or control fuse, etc.).

After power returns, all automation stations and plants including their aggregates and components must start automatically. The various plants must be switched on and released at intervals to prevent switch-on peak loads. The current status for all switching and positioning commands, setpoints, manual interventions, etc. remains saved in the automation station and/or is reenabled following power restoration and used for the current operating mode.

10.10 SYSTEM TIME

10.10.1 Time format

(i) Time synchronization in BACnet: Local time

The building automation and control system must have a uniform system time. To this end, a time master supporting BACnet BIBB DM-TS-A as per the PICS document must be defined. The time master must receive the DCF77, GPS or Internet NTP signal and provide it synchronized to all remaining system devices.

(ii) Time synchronization in BACnet: UTC time (coordinated universal time)

The building automation and control system must have a uniform system time. To this end, a time master supporting BACnet BIBB DM-UTC-A as per the PICS document must be defined. The time master must receive the DCF77, GPS or Internet NTP signal and provide it synchronized to all remaining system devices.

(iii) Time synchronization in KNX

The building automation and control system must have a uniform system time. To this end, a time master is defined that supports data and time on KNX. It must receive the DCF77, GPS or Internet NTP signal and provide it synchronized to all remaining system devices.

(iv) Subsystem autonomy

The automation stations must autonomously run their own time if the time master fails. The building automation and control time must be resynchronized automatically after the time master becomes available again.

10.10.2 Self monitoring and self diagnosis

(a) Watchdog

The building automation and control system must monitor itself to always know its latest and current status. A watchdog function helps detect and signal failed system devices and restarts them in a defined mode.

(b) Self diagnosis

Self diagnosis must be available to quickly detect errors. It must provide information on system function and load. e.g. CPU and memory load must be displayed.

10.11 GENERAL PLANT OPERATING STATES

(i) **Overview of operating modes**

There alre five higher operating modes for all plants:

- Local emergency operation without automation station functionality (direct via I/O module or directly on the control cabinet as agreed to with owner).
- Local manual operation with automation station functionality (control panel in the control cabinet).
- Local manual operation via visualization on the management level (all functions on the local automation station are set to Auto).
- Scheduler program under the condition that all plants are enabled for automatic operation.
- Automatic detection.
- •

All control functions of the automation stations must be set to and remain on automatic for highest plant availability, if a plant or aggregate is switched to MANUAL. In individual cases, automatic mode must change over to this unit in case of redundancies when a plant or aggregate is switched off locally. All safety and interlocking functions must take highest priority for operation independent of operating mode.

(ii) Automatic detection

The plants of the building automation and control system are switched on and off either automatic, or dependent on time or event. The following functions apply to the actual plant descriptions. All control loops, safety and interlocking functions must be guaranteed to work regardless of operating mode.

(iii) Controlled via scheduler program

All plants must be set to automatic for this operating mode. The plants of the building automation and control system must be switched on and off by individual use via a day, week, month, or annual scheduler program.

(iv) Manual operation

Different options are required for manual operation.

- Manual operation via management level (remote operation)
- Manual operation via local operator unit or laptop directly at the control cabinet.
- Manual operation via operator unit or directly at the control cabinet.

Manual operation generally is possible only if the corresponding automation station is running. Manual operation allows for manually overriding scheduled plant switchings. Plants switched off by schedule can be switched on via plant switching command. Manual control of the plant switching command is equal to automatic control, i.e. the scheduled control is retained for as long as the scheduler remains active.

(v) Emergency operation

Local priority override takes place directly via the I/O modules. To this end, the I/O modules must have an integrated local override priority as per ISO 16484-2. All aggregates on the module must be able to be switched via this operation. To this end, the I/O modules must feature pre selection switches Automatic - Manual as well as LED status displays or LCDs.

Valves, dampers, etc. must allow for continuous manual adaption. All interventions are signaled
to the management station via automation station, and are then logged and visualized accordingly.

A manual operating level at the control cabinet must be included in the unit price if no integrated local priority override can be offered due to the system type.

10.12 Energy efficiency and references to applicable standards

10.12.1 General

The building is constructed under strict energy guidelines. The control technology deployed must contain all functions required to efficiently consume energy.

10.12.2 Monitoring and evaluation

• Automation level

• Key performance indicators on the automation level

Monitoring and evaluation of measured values for primary plants (components and plant parts, software/program/system functions, set points, et.) must occur directly on the automation level. Monitoring and evaluation is intended to recognize unfavorable operations of plants/components early on and thus lower or optimize energy consumption and wear and tear.

10.12.3 Monitoring and evaluating analog measured values

The following monitoring and evaluation must be able to be implemented for analog measured values (sensors, setpoint, modulating control of valves, dampers, variable speed drives, etc.):

- Determine the minimum value (lowest value) within a defined timeframe.
- Determine the maximum value (lowest value) within a defined timeframe.
- Determine the average value (lowest value) within a defined timeframe.
- Determine the linger period (in hours) during which the measured value moves between freely definable limit values.
- •Determine deviation that the measured value deviated from the upper and lower setpoint within a defined timeframe.

The determined value is monitored to a minimum and maximum and displayed as quality state for breach and/or exceeding thereof. The value from the current timeframe is displayed; the value from the previous timeframe is also displayed and made available to the trend data. The evaluation ceases for a fault to the measured value (sensor interrupt, module fault, etc.), until the measured value once again assumes a reliable state. This fact must also be recognizable in the trend data.

10.12.4 Monitoring and evaluation of digital and multi-stage measured values

Digital measured values (messages, switching commands, operating modes, etc.) must be definable as key performance indicators and make possible the following evaluation and monitoring:

- Determine the runtime (operating hours) within a defined timeframe.
- Determine the switch-on frequency within a defined timeframe.
- Determine the runtime (operating hours) for each stage within a defined timeframe.
- Determine the switch-on frequency for each stage within a defined timeframe.

The determined value is monitored to a minimum and maximum and displayed as quality state for breach and/or exceeding thereof. The value from the current timeframe is displayed; the value from the previous timeframe is also displayed and made available to the trend data. The evaluation ceases for a fault to the measured value (sensor interrupt, module fault, etc.), until the value once again assumes a reliable state. This fact must also be recognizable in the trend data.

10.12.5 Monitoring and evaluating metered values

Metered values (consumption meters, pulse meters, etc) must be definable as key performance indicators and make possible the following evaluation and monitoring:

• Determine the difference value (consumption value within a defined timeframe.

The determined value is monitored to a minimum and maximum and displayed as quality state for breach and/or exceeding thereof.

The value from the current timeframe is displayed; the value from the previous timeframe is also displayed and made available to the trend data. The evaluation ceases for a fault to the measured value (sensor interrupt, module fault, etc.), until the value once again assumes a reliable state. This fact must also be recognizable in the trend data.

10.12.6 Evaluation over different timeframes

Monitoring and evaluation must be able to occur over definable timeframes (annually, monthly, weekly, daily, hourly, 15-minutes).

10.12.7 Weighting of monitoring and evaluation criteria

Since an aggregate or component may include multiple evaluations, it is required to be able to weigh them so that they are included differently in the calculation of the resulting quality state.

10.13 NETWORK SECURITY

10.13.1 Network hardware

In general

• Specification and selection of required network devices

The supplier specifies and selects required network devices, required to build BACS network and interfaces to other networks as well as implementation of specified IT security functions. All network devices must have the latest available firmware.

10.13.2 Engineering tools and engineering efficiency

Engineering efficiency

• System and tool platform

Creating solutions must be as efficient as possible, i.e. programming on construction sites; use of pre-defined application blocks, fast exchange of standard functions, etc. The goal is to achieve the maximum required level of flexibility at as little expense as possible.

10.13.3 Preloaded application on devices

• Applications portfolio

Prefabricated and tested must be loaded in a fix manner on the devices prior to commissioning. They can be used in the basic functions without the use of additional engineering tools.

10.13.4 Harmonized tools and workflows

• Consistent tools

Uniform data and functions must be used by the building automation and control system in a consistent manner throughout all tools to achieve a high level of data consistency. In other words, all data is only entered once in the system. Consistent tool processes avoid a manual exchange of data (Import/Export).

10.13.5 Transparency for customers

• Data backup

A data backup concept must be presented that provides the current state of a project in a form that is useable and complete to the customer. In includes raw data from plants, applications, engineering data (e.g. DP, labeling, links, parameters), documentation.

• Customer changes

The technical operator at the customer be able independently make simple changes to the project. Potential training proposals must be appended to the bid.

10.14 CORPORATE PERFORMANCE

10.14.1 Performance on bid

• eu.bac system certification

The bid for building automation and control includes an filled out eu.bac system checklist. Providing a manufacturer-neutral eu.bac system checklist contributes to rendering building automation and control and its quality comparable to the user.

10.14.2 Automation level

• Requirements on the automation level General

• Automation station standard

Automation stations must be intelligent. They must be autonomous. They must be built to go from high decentralization into small units (DDCC).

Automation stations must be freely programmable and feature graphical programming optimized for building automation and control. The following functions must be possible with it: Control, measure, signal at various priorities and by event, monitor, alarm, count, calculate, schedule, save trend values, and log as per DIN EN ISO 16484-5. BACnet server (automation stations) certificates must be added to the bid.

• System design

Manufacturer must prove that they have various scalable automation stations to ensure optimal

automation station design. Associated system documentation must be added to the bid and included in system evaluation. Documentation must show that the hardware (DDC and I/O modules) is designed optimally for the number of the required data points.

• Delineation, automation to management level

All management level functions must be fully engineered in the automation station to increase plant availability. Delineation is defined to ensure that no additional engineering is required at the management level (BACnet client).

• Delineation, room automation to management level

All management level functions must be fully engineered in the room automation station to increase plant availability. Delineation is defined to ensure that no additional engineering is required at the management level (BACnet client).

10.14.3 Direct digital Controller Hardware Requirement :

1) DDC controllers shall be capable of fully "stand- alone" operation i.e. In the event of loss of communication with other DDC's or Control Station, they shall be able to function on their own.

2) The DDC controller to be 32 bit controller with BTL certification. The decentralized small units (DDC) to have UIO concept for configuration of inputs & outputs to suite the project specific requirement and the last minute changes at site.

- 3) The memory available to the controller board should serve as working space and there should not be any limitation of using function block other than the memory.
- 4) The controllers shall be UL listed and conforming to CE.
- 5) The controller shall support RAM for minimum of 1 weeks in the event of a power failure and it shall be possible to fit any battery thus expanding the time limit. An alarm shall be generated on low battery voltage. The battery shall not be required to supply power to actuators, valves, dampers etc.
- 6) DDC shall have embedded **IP connectivity** so that it can be hooked into the Local Area Network (LAN) provided by the client / can be on dedicated network created by the vendor.
- 7) Controller shall have capability to communicate with other controllers for any interlock or data sharing using peer to peer technology. The Controller which route the messages or data sharing through the system or any intermediate hard ware / controller shall not be acceptable.

Vendor to demonstrate this capability during the commissioning time and the same shall be verified at the time of handing over.

- 8) Each controller shall have RS485 port built for integration with third party systems so that any trouble shooting required at field level can be carried out without removing the controller from the network (LAN).
- 9) All controllers shall accept **24V**, **50Hz** Uninterrupted power supply, provided by end user, directly so that the in between hardware such as transformers and SMPS are avoided.
- 10) The controller shall be capable of expanding its IO points capacity to 40 points max. All expandable controllers shall have capability to provide 24V DC auxiliary power supply for the sensor which requires power, however the same shall not be required to high power consuming devices / equipment's such as actuators, dampers etc.

10.15 OPERATION CONCEPT AT AUTOMATION LEVEL

10.15.1 Local operation

• General

Local operation with access for the corresponding automation station, or network operation via BACnet to all or selected automation stations, or simple room operation must be available.

10.15.2 Operator and monitoring units

• Requirements planned on operator and monitoring units

(i) Local operator and monitoring unit

Local operation must be possible via a locally usable operator unit. All vital operating parameters of the automation station must be displayed in clear text. All current plant values, setpoints, and parameters must be displayed on the operator units. All operator units must be configured to allow for acknowledging maintenance and fault messages.

(ii) Networkable operator and monitoring unit

Plant operation must be possible both locally and via management level. Local operation must be location-independent and allow for maintenance staff work from any automation station or be integrated in the control cabinet door.

Operation must allow for access to all values (current values, setpoints, parameters, maintenance

and fault messages) without special engineering as well as plant-specific composition of vital values.

Operation must allow for graphic display of weekday and exception programs, heating curves and trends set up individually. Local operator units must support temporary recording of trend data to allow local operators to record a trend at the control cabinet for diagnostic purposes.

(iii) Graphical plant operation via network-capable touch panel

The building management system is operated via a networked touch panel. They must inform the operator without log on using plant graphics on the present state of the plant. Multiple plants must be able to be operate via touch panel. Is must be capable of displaying and acknowledging alarms. The operator should be informed about faults directly by a common alarm display via faults even when the display is switched off. At the same time, functions to control the plant must be supported, so that plants must be able to be graphically operated and displayed using select data points, schedulers as well as trend views. A capacitive display is used to operate. The touch panel as be added as an integral component of the overall system via a scalable web interface as well as a pleasant form of polished aluminum frames. User name and password is required to run functions that can change to plant settings in order to protect the plant. Authentication must be able to be disabled as an option.

(iv) Web operation independent of hardware

Operation must allow for graphic display of weekday and exception programs, heating curves and trends set up individually. Local operator units must support temporary recording of trend data to allow local operators to record a trend at the control cabinet for diagnostic purposes.

(v) Operation via web browser or mobile clients

Vital functions must be viewable regardless of plant location. To this end, access is required via mobile clients (mobile phone, pocket PC, PDA, etc.) to all actual values and setpoints, plants and operating states.

(vi) Operator intervention via operator units

Plant operators must be able to switch via operator units the plant and individual aggregates and components and deactivate Auto mode via operator units. Read/write access rights must be considered in this regard.

(vii) Manual intervention signal

An alarm message must be generated following manual operator intervention as the plants are designed and controlled for highest possible energy efficiency.

(viii) Online trends

Local operator units must support temporary recording of trend data to allow local operators to record a trend at the control cabinet for diagnostic purposes.

• Monitoring

(i) Manual intervention (override), switching frequency

Monitoring, evaluation, and display of switching frequency is required for manual interventions over a defined timeframe. The determined value is monitored to a minimum and maximum and displayed as quality state for breach and/or exceeding thereof. The determined value from the current timeframe is displayed; the value from the previous timeframe is also displayed and made available to the trend data.

(ii) Manual intervention (override), runtime

Monitoring, evaluation, and display of runtime is required for manual interventions over a defined timeframe. The determined value is monitored to a minimum and maximum and displayed as quality state for breach and/or exceeding thereof. The determined value from the current timeframe is displayed; the value from the previous timeframe is also displayed and made available to the trend data.

10.16 I/O MODULES

10.16.1 General

• Construction

As highly flexible I/O modules are needed for complex and large technical equipment in buildings, they must be composed individually for each plant. To this end, modules must be configurable for various signal types, grouped, labeled per channel with clear text, two-sided readable, and distributed or set across several control cabinets/panels.

The entire module electronics must be protected by a stable plastic housing against touch and soiling.

• Diagnostic function

A status diagnosis for each channel is required to quickly locate installation or plant errors. The status is displayed by LED or on the module.

• LED display

The color of the status LED must be configurable to correspond with message type to provide and easy overview in the control cabinet. Feedback: green, maintenance: yellow, warning: red.

10.16.2 Remote I/O modules

Remote I/O modules must be able to be used for small plants or parts thereof to keep the size and number of control cabinets/panels as low as possible. The modules must be able to be as far as 200 m from the automation station. The maximum number of data points edited this way may only be limited by the maximum capacity of the automation station.

• Isolating terminal functionality

The electronic modules must have isolating terminals to simplify hardware tests and commissioning. As a result, connected field devices can be measured at the test plug sockets without module electronics influence. At the same time, the connection terminals must act as cabinet/panel terminal strips. If the bidder cannot provide proof for this function, all inputs and outputs must be run via separate isolating terminals. The resulting costs must be included in the unit prices.

10.16.3 Local priority control

• Level for manual local priority control

All module outputs must be able to be switched manually for fast and system-independent local priority control. Operation must be possible and available for data point testing without software as soon as power is supplied to the module. The module must have an optical status message facility to avoid faulty positions.

• Monitoring local priority control

The building automation and control system must be able to indicated any intervention via the local priority control. This indication must be well displayed at the management level.

10.16.4 Connection

• Short-circuit proof

Field devices and motors must be connected directly without requiring coupling relays or other proprietary hardware. All terminals are protected against short circuit and incorrect wiring using AC/DC 24 V. Field device errors must be recognized and displayed reliably to retain high plant availability.

• Broken wire interlock

Interlocks (hardware) and fault messages must be designed for possible wire breaks or loose terminals under closed-loop rules, i.e. the automation station then has status "1" OK (closed monitoring loop) or no fault, and status "0" (interrupted monitoring loop) or fault.

10.16.5 Connect field devices

• Field device standards

The automation stations or I/O modules must support all common sensors (e.g. temperature, humidity) and actuators (valves, damper actuators) without requiring additional conversion hardware. The bidder must provide proof that the field devices used for the project were tested under the entire system and documented accordingly.

• Use of I/O modules on the automation level

Functionality for the I/O system must be implemented on the automation level.

10.16.6 Updates and adaptions

• Updates

(i) Changes during operation

Customer-specific plant programs must allow for minor adjustments without having to switch off unrelated plants and without changing set parameters and set points.

(ii) Changes to applications during operation

Minor program changes must be able to be introduced without operational interruptions.

Adaptations

(i) Access to system network

Operators must be able to enter adapted parameters, set points, times etc. in each automation station via the system network under their password.

10.16.7 Communication

Standard BACnet / AMEV

DIN EN ISO 16484-5 / AMEV

BACnet conformance and BTL logo

The BACnet servers (automation stations) used must support at least BACnet standard Version 1, Revision 12(1.12) or higher.

B-BC (automation station)

Automation stations must match the BACnet Profile B-BC (Building Controller) as per the BTL Listing.

AMEV AS-A and AS-B (Automation station)

The automation stations must meet AMEV profiles AS-A and AS-B as per AMEV guideline "BACnet 2011" V1.1.

10.16.8 Conformance declaration

• Protocol implementation and conformance statement (PICS)

Manufacturer self-declaration PICS is required prior to executing work to gain information on the type of communication for the building automation and control system.

10.16.9 Communication via LonTalk

• BACnet over LonTalk

The automation stations must allow for communication via LonTalk and work on simple twowire cabling in a freely selectable bus topology with a total possible length of 900 m. Ethernet/IP must serve as the backbone.

10.16.10 Communication via BACnet / IP

(i) **BACnet/IP(v4-v6) to BACnet/MS/TP**

The automation station must be able to integrate, using a route manufactured in house, the MS/TP protocol via BACnet/IP.

(ii) **BACnet/IP(v4-v6) to BACnet/MS/TP or BACnet/LonTalk**

The automation station must be able to integrate, using a router manufactured by the same vendor, the BACnet/MS/TP protocol via BACnet/IP as well as BACnet/LonTalk.

(iii) BACnet/IPv4 to BACnet/IPv6

The building management system must be able to connected the BACnet/IPv4 protocol with BACnet/IPv6 protocol using a router manufactured by the same vendor.

(iv) BACnet LonTalk to BACnet MS/TP

The building management system must be able to connected the BACnet/LonTalk with BACnet/MS/TP protocol using a router manufactured by the same vendor.

10.17 PHYSICAL STRUCTURE

(i) Network structure

• Structure

The offered network must be flexible and allow for all types of networks (line, star, ring, tree, etc.) to satisfy all owner/operator needs.

Building automation and control system - Automation stations

(ii) **Openness**

• Integration of third-party systems

If possible, the same communication protocol must be used as for the existing technical equipment in the building to integrate third-party systems (refrigeration machines, lighting and building automation and control systems, etc.). Building automation and control systems not offering this integration as specified must include and clearly declare any additional conversion hardware (gateways) in their price.

• Open and neutral communication via BACnet

Automation stations are connected to the management level via communication bus. System structure must allow open, neutral and manufacturer-independent communication. Communications must take place in principle via BACnet even if proprietary communications would be possible based on the automation stations used. Intermediate OPC servers are not allowed.

10.18 Automation station - Automation station

• Standard protocol

• Uniform protocol

Communication must also be standardized even between individual modules and automation stations. All devices must communicate on the same protocol on the entire room level.

Automation station - Field level

• Field device connection

• Connect field devices

The automation stations or I/O modules must support all common sensors (e.g. temperature, humidity) and actuators (valves, damper actuators, lighting control, blinds drives) without requiring additional conversion hardware. The bidder must provide proof that the field devices used for the project were tested under the entire system and documented accordingly.

• Connect communicating field devices

Common manufacturers must be integratable to connect third-party devices and subsystems. (e.g. communicating pumps, Modbus subsystems, M-bus capable heat meters, etc.).

Third-party system connection

A interface is required to connect various third-party devices that supports communication protocols such as Modbus, M-Bus, Genibus and USS.

10.19 PORTABLE OPERATORS TERMINAL (POT)

- 1) POT shall be provided to allow operator readout of system variables, override control and adjustment of control parameters. The POT shall be portable and plug directly into individual controllers for power and data.
- 2) The minimum functionality of POT shall include :
- Set points to a fixed value or state.
- Display diagnostic results.
- Display sequentially all point summary and sequentially alarm summary.
- Display/change digital point state, analog point value.
- Display/change time and date.
- Display/change analog limits.
- Display/change time schedule.
- Display/change run time counts and run time limits.
- Display/change time and/or event initiation.
- Display/change programmable offset values.
- Access DDC initialization routines and diagnostics.
- Enable/disable points, initiators and programs.
- Display/change minimum ON/OFF and maximum OFF times.
- 3) The POT shall be complete with command keys, data entry keys, cursor control keys or liquid crystal display (LCD). Access shall be via self prompting menu selection with arrow key control of next menu/previous menu and step forward/backward within a given menu.
- 4) Connection of a POT to a controller shall not interrupt or interfere with normal network operation in any way, prevent alarms from being transmitted, or interfere with Control Station commands and system modifications.
- 5) Connection of POT at any controller shall provide display access to all controllers on that bus. In case the controller has a fixed LCD display and entry keyboard, then the display access shall be available on each screen.
- 6) It should be possible to override the commands given through POT by the Operator Control Station.
- 7) POT shall have touch screen color display and it shall possible to hook this to Local area Network so that the entire system data can be visualized.
- 8) POT shall have self learning capability so that it can recognize the DDCs on the network and update all points without any manual programming.
- 9) Plant operators must be able to switch via operator units the plant and individual aggregates and components and deactivate Auto mode via operator units. Read/write access rights must be considered in this regard.

ELECTRIC AND ELECTRONIC CONTROLS RELATED EQUIPMENT

General Requirements

ALL CONTROLS SHALL BE CAPABLE OF OPERATING IN AMBIENT CONDITIONS VARYING BETWEEN 0-55 DEG. C AND 90% R.H. NON-CONDENSING.

ALL CONTROL DEVICES SHALL HAVE A 20 MM CONDUIT KNOCKOUT. ALTERNATIVELY, THEY SHALL BE SUPPLIED WITH ADAPTORS FOR 20 MM CONDUIT.

Ancillary Items

WHEN ITEMS OF EQUIPMENT ARE INSTALLED IN THE SITUATIONS LISTED BELOW, THE BAS CONTRACTOR SHALL INCLUDE THE FOLLOWING ANCILLARY ITEMS:

(I) WEATHER PROTECTION

All devices required to be weatherproofed are detailed in the Schedule of Quantities. IP ratings for the equipment are mentioned in the respective section.

(II) **PIPEWORK IMMERSION**

Corrosion resisting pockets of a length suitable for the complete active length of the device, screwed $\frac{1}{2}$ " (13 mm) or $\frac{3}{4}$ " (20 mm) NPT suitable for the temperature, pressure and medium.

(III) DUCT MOUNTING (METAL OR BUILDERS WORK)

MOUNTING FLANGES, CLAMPING BUSHES, COUPLINGS, LOCKNUTS, GASKETS, BRACKETS, SEALING GLANDS AND ANY SPECIAL FITTINGS NECESSITATED BY THE DEVICE.

10.21 TEMPERATURE SENSOR

TEMPERATURE SENSORS FOR SPACE, PIPES AND DUCTS, SHALL BE OF THE RESISTANCE TEMPERATURE DETECTOR (RTD) TYPE OR THERMISTOR. THESE SHALL BE TWO WIRE TYPE AND SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS :

- 1) Immersion sensors shall be high accuracy type with a high resistance versus temperature change. The accuracy shall be at least At -30...130 °C: ± 1.3 K.
- 2) Immersion sensors shall be provided with separate Brass thermo well. These shall be manufactured from bar stock with hydrostatic pressure rating of at least 10 kgf/cm^2 .
- 3) The connection to the pipe shall be screwed type. An aluminum sleeve shall be provided to ensure proper heat transfer from the well to the sensor. Terminations to be provided on the head. Flying leads shall not be acceptable.
- 2.
- 4) The sensor housing shall plug into the base so that the same can be easily removed without disturbing the wiring connections.
- 3.
- 5) Duct temperature sensors shall be with rigid stem and of averaging type. These shall be suitable for duct installation.
- 4.
- 5. 6) Outdoor air temperature sensor shall be provided with a sun shield.
- 6.
- 7) The sensors shall not be mounted near any heat source such as windows, electrical appliances etc.

The temperature sensors may be of any of the following types :

- 7. 1) PT 100, PT 1000, PT 3000
- 8. 2) Thermistor

10.22 HUMIDITY SENSOR

SPACE AND DUCT HUMIDITY SENSORS SHALL BE OF CAPACITANCE TYPE WITH AN EFFECTIVE SENSING RANGE OF 10% TO 90% RH. ACCURACY SHALL BE + 3% OR BETTER. DUCT MOUNTED HUMIDITY SENSORS SHALL BE PROVIDED WITH A SAMPLING CHAMBER. WALL MOUNTED SENSORS SHALL BE PROVIDED WITH A HOUSING. THE SENSOR HOUSING SHALL PLUG INTO THE BASE SO THAT THE SAME CAN BE EASILY REMOVED WITHOUT DISTURBING THE WIRING CONNECTIONS. THE SENSORS SHALL NOT BE MOUNTED NEAR ANY HEAT SOURCE SUCH AS WINDOWS, ELECTRICAL APPLIANCES ETC.

1.

10.23 FLOW METER

WATER FLOW METERS SHALL BE EITHER ELECTRO MAGNETIC OR ULTRA SONIC TYPE. FOR ELECTROMAGNETIC FLOW METER, TEFLON LINING WITH 316 SS ELECTRODES MUST BE PROVIDED. THE HOUSING SHALL HAVE IP 55 PROTECTION. VENDORS SHALL HAVE TO GET THEIR DESIGN/ SELECTION APPROVED BY THE CONSULTANT, PRIOR TO THE SUPPLY.

THE EXACT RANGES TO BE SET SHALL BE DETERMINED BY THE CONTRACTOR AT THE TIME OF COMMISSIONING. IT SHOULD BE POSSIBLE TO 'ZERO' THE FLOW METER WITHOUT ANY EXTERNAL INSTRUMENTS, WITH THE OVERALL ACCURACY OF AT LEAST \pm 2% FULL SCALE.

10.24 PRESSURE TRANSMITTER FOR WATER

Pressure transmitters shall be piezo-electric type or diaphragm type. (Bourdon Tube type shall not be acceptable). Output shall be 4-20mA or 0-10V DC and the range as specified in the data sheet depending on the line pressure. Power supply shall be either 24 V AC, 24 V DC or 230 V AC. Connection shall be as per manufacturer's standards. The pressure detector shall be capable of withstanding a hydraulic test pressure of twice the working pressure. The set point shall fall within 40%-70% of the sensing range and detector shall have sensitivity such that change of 1.5% from the stabilized condition shall cause modulation of the corrective element. The sensor must be pressure compensated for a medium temperature of -10 o C to 600 C with ambient ranging between 0 o C to 55 o C.

10.25 DIFFERENTIAL PRESSURE SWITCH FOR PIPE WORK

THESE SHALL BE USED TO MEASURE PRESSURE DIFFERENTIAL ACROSS SUCTION AND DISCHARGE OF PUMPS. THE RANGE SHALL BE AS SPECIFIED IN THE DATA SHEET. SWITCH SHALL BE ON WITH INCREASE IN DIFFERENTIAL. HOUSING FOR THESE SHALL BE WEATHER PROOF WITH IP 55 PROTECTION. THE PRESSURE SWITCH SHALL BE CAPABLE OF WITHSTANDING A HYDRAULIC TEST PRESSURE OF 1.5 TIMES THE WORKING PRESSURE. THE SET POINT SHALL FALL IN 40-70% OF THE SCALE RANGE AND SHALL HAVE DIFFERENTIALS ADJUSTABLE OVER 10%-30% OF THE SCALE RANGE. THE SWITCHES SHALL BE PROVIDED WITH SITE ADJUSTABLE SCALE AND WITH 1 NO/NC CONTACTS.

10.26 DIFFERENTIAL PRESSURE SWITCH FOR AIR SYSTEMS

THESE SHALL BE DIAPHRAGM OPERATED. SWITCHES SHALL BE SUPPLIED WITH AIR CONNECTIONS PERMITTING THEIR USE AS STATIC OR DIFFERENTIAL PRESSURE SWITCHES.

THE SWITCH SHALL BE OF DIFFERENTIAL PRESSURE TYPE COMPLETE WITH CONNECTING TUBE AND METAL BENDS FOR CONNECTIONS TO THE DUCT. THE HOUSING SHALL BE IP 54 RATED. THE PRESSURE SWITCHES SHALL BE AVAILABLE IN MINIMUM OF 3 RANGES SUITABLE FOR APPLICATIONS LIKE AIR FLOW PROVING, DIRTY FILTER, ETC. THE SET POINT SHALL BE CONCEALED TYPE. THE CONTACT SHALL BE SPDT TYPE WITH 230 VAC, 1A RATING.

THE SWITCH SHALL BE SUPPLIED SUITABLE FOR WALL MOUNTING ON DUCTS. IT SHOULD BE MOUNTED IN SUCH A WAY THAT THE CONDENSATION FLOW OUT OF THE SENSING TIPS. PROPER ADAPTOR SHALL BE PROVIDED FOR THE CABLES.

THE SET POINT SHALL FALL WITHIN 40%-70% OF THE SCALE RANGE AND L HAS DIFFERENTIALS ADJUSTABLE OVER 10%-30% OF THE SCALE RANGE.THE SWITCHES SHALL BE PROVIDED WITH SITE ADJUSTABLE SCALE AND WITH 1 NO/NC CONTACTS.

10.27 AIR FLOW SWITCHES

AIR FLOW SWITCHES SHALL BE SELECTED FOR THE CORRECT AIR VELOCITY, DUCT SIZE AND MOUNTING ATTITUDE. IF ANY SPECIAL ATMOSPHERIC CONDITIONS ARE DETAILED IN THE SCHEDULE OF QUANTITY THE PARTS OF THE SWITCHES SHALL BE SUITABLY COATED OR MADE TO WITHSTAND SUCH CONDITIONS. THESE SHALL BE SUITABLE FOR MOUNTING IN ANY PLANE. OUTPUT SHALL BE 1 NO/NC POTENTIAL FREE. SITE ADJUSTABLE SCALE SHALL ALSO BE PROVIDED.

10.28 AIR PRESSURE SENSOR

THE PRESSURE SENSOR SHALL BE DIFFERENTIAL TYPE. THE CONSTRUCTION SHALL BE SPRING LOADED DIAPHRAGM TYPE. THE MOVEMENT OF THE MEMBRANE IN RELATION TO THE PRESSURE SHOULD BE CONVERTED BY AN INDUCTIVE ELECTROMAGNET COUPLING WHICH WOULD GIVE AN OUTPUT SUITABLE FOR THE CONTROLLER. THE PRESSURE SENSOR SHALL BE IN A HOUSING HAVING IP 54 RATINGS IN ACCORDANCE WITH IEC 529. SUITABLE MOUNTING ARRANGEMENT SHALL BE AVAILABLE ON THE SENSOR. THE SENSOR SHALL COME COMPLETE WITH THE PVC TUBES & PROBES.

10.29 WATER FLOW SWITCH

THESE SHALL BE PADDLE TYPE AND SUITABLE FOR THE TYPE OF LIQUID FLOWING IN THE LINE. OUTPUT SHALL BE 1NO/1NC POTENTIAL FREE.

10.30 CO SENSOR

CO SENSOR SHALL BE INTEGRATED SURFACE MOUNTED TYPE ON THE FIELD. THESE SHALL WORK ON 24V AC/DC SUPPLY WITH THE OUTPUT BEING STANDARD TYPE I.E. 4-20 MA / 0- 10 VOLTS ETC. RESPONSE TIME OF THE DETECTOR SHALL BE <10 MINUTES

10.31 AIR VELOCITY SENSOR

AIR VELOCITY SENSOR SHALL BE INTEGRATED SURFACE / DUCT MOUNTED TYPE ON THE FIELD. THESE SHALL WORK ON 24V AC/DC SUPPLY WITH +/- 10% VARIATION THE OUTPUT BEING STANDARD TYPE I.E. 4-20 MA / 0- 10 VOLTS ETC WITH AN ACCURACY OF +/- 3%. IT SHALL BE POSSIBLE TO SELECT THE DIFFERENT RANGES BY CHANGING THE JUMPERS ON THE SENSOR. AT LEAST 3 SELECTION RANGES ON THE SENSORS ARE REQUIRED.

10.32 CO2 SENSOR – Duct Type

CO2 SENSOR SHALL BE WALL / SURFACE MOUNTED TYPE ON THE FIELD. THESE SHALL WORK ON 24V AC/DC SUPPLY WITH THE OUTPUT BEING STANDARD TYPE I.E. 4-20 MA / 0- 10 VOLTS ETC. THE SENSING RANGE REQUIRED SHALL BE 0-2000 PPM WITH GOOD RESOLUTION.

THE PREFERRED TYPE OF SENSING ELEMENT / METHOD IS NDIR TYPE WITH ACCURACY OF +/-50PPM OR +/-2 % OF MEASURED VALUE. TIME CONSTANT OF SENSOR SHALL BE <5 MINUTES.

10.33 LEVEL SWITCH

9.

The level switches shall have to meet the following requirement:

Туре :		:	Float Type/Capacitance type/Conductivity type		
Mounting :		:	To suit application.		
Connection		:	Flanged ANSI 150 lbs RF Carbon steel		
Float material		:	316 SS		
Stem Material :		:	316 SS		
Output	t	:	1 NO, 1 NC potential free		
Switch Enclosure		ure	: IP 55		

10.34 LEVEL TRANSMITTER

10.34.1 Description :

Level Transmitter to be an ultrasonic non-contacting level meter which will increase the effectiveness of your liquid management process. It is designed its sensor and controller in one compact housing. L.T. is two-wire loop-powered instrument and its measurement range is 5 meters. menu makes the user easy and simple for calibration. All functions are optimized which enables you to effectively monitor the liquid level and keep your facilities running safely and reliably.

10.34.2 Principle of Operation :

The sensor transmits ultrasonic pulses to the measurement target. The pulses are

reflected from the surface of the target and received back by the sensor.

The running time is converted in to the distance and it shows as level or volume on the

10. display.

10.34.3 Technical Specification :

Measurement Type	Ultrasonic non-contacting		
Measuring Range	5m/10m/15m/20m/30m/40m/50m/60m/70m/		
Accuracy	0.25F.S, 0.5%F.S, 1%F.S		
Resolution	3mm or 0.1% of F.S		
Output Analog	4-20mA-2wire[load Resistance=510Ω]		
	4-20mA-4wire[load Resistance=250Ω]		
Output option	RS485, Relay/Alarm		
Power Supply	24VDC, 220VAC+/-10% option		
Display	LCD, 4-digit		
Display Units	mm, cm, m		
Dead Band	25cm[min.]		
Process Temp.	-20~+70°C(Sensor), -20~+60°C(LCD)		
Temp. Comp	-20~+60°C		
Pressure	<1bar		
Protection Class	IP65		
Process Mount	Screwing with thread M48x2 / M60x2 / M78x2/G2 or Flange		
Relay/Alarm Output(option)	Alarm for high and low level		
	AC 250V/8A or DC 30V/5A		
Weight	~3kg(not include cable)		

10.35 ENCLOSURES FOR CONTROLLERS AND ELECTRICAL PANELS

ALL THE CONTROLLERS SHALL BE HOUSED IN LOCKABLE VANDAL PROOF BOXES WHICH SHALL EITHER BE FLOOR MOUNTED OR WALL MOUNTED. THESE SHALL BE FREE STANDING, TOTALLY ENCLOSED, DUST AND VERMIN PROOF AND SUITABLE FOR TROPICAL CLIMATIC CONDITIONS.

THE PANEL SHALL BE METAL ENCLOSED 18 SWG CRCA SHEET STEEL CUBICLE WITH GASKETS BETWEEN ALL ADJACENT UNITS AND BENEATH ALL COVERS TO RENDER THE JOINTS DUST PROOF. ALL DOORS AND COVERS SHALL BE HINGED AND LATCHED AND SHALL BE FOLDED AND BRACED AS NECESSARY TO PROVIDE A RIGID SUPPORT. JOINTS OF ANY KIND IN SHEET METAL SHALL BE SEAM WELDED WITH WELDING SLAG GROUNDED OFF AND WELDING PITS WIPED SMOOTH WITH PLUMBER METAL.

ALL PANELS AND COVERS SHALL BE PROPERLY FITTED AND SECURED WITH THE FRAME AND HOLES IN THE PANELS CORRECTLY POSITIONED. FIXING SCREWS SHALL ENTER INTO HOLES TAPPED INTO AN ADEQUATE THICKNESS OF METAL OR PROVIDED WITH NUTS. SELF-THREADING SCREWS SHALL NOT BE USED IN THE CONSTRUCTION OF CONTROL PANELS. KNOCKOUT HOLES OF APPROVED SIZE AND NUMBER SHALL BE PROVIDED IN THE PANELS IN CONFORMITY WITH THE LOCATION OF INCOMING AND OUTGOING CONDUITS/CABLES. LAMPS SHALL BE PROVIDED TO SUPPORT THE WEIGHT OF THE CABLES. THE DIMENSION OF THE BOXES SHALL DEPEND ON THE REQUIREMENT WITH THE COLOUR DECIDED IN CONSULTATION WITH THE ARCHITECT/CONSULTANT.

Note: All panel enclosures used in plant room spaces and external to building shall be suitable for outdoor application (IP 54 protection).

10.36 CONDUITS AND WIRING

Prior to laying and fixing of conduits, the contractor shall carefully examine the drawings indicating the layout, satisfy himself about the sufficiency of number and sizes of conduits, sizes and location of conduits and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of Architect/Engineers any modifications suggested by the Contractor shall be got approved by the Architect /Engineers before the actual laying of conduits is commenced.

10.37 CONDUITS/TRUNKER

Conduits and accessories shall conform to relevant Indian Standards. PVC conduits of required dia shall be used as called for in the schedule of quantities. Joints between conduits and accessories shall be securely made, with help of adhesive.

The conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

10.38 CONNECTIONS

All jointing methods shall be subject to the approval of the Architect/Engineer. Separate conduits shall run for all power wiring.

The threads and sockets shall be free from grease and oil. Connections between conduit and controller metal boxes shall be by means of brass hexagon smooth bore bush, fixed inside the box and connected through a coupler to the conduit. The joints in conduits shall be smooth to avoid damage to insulation of conductors while pulling them through the conduits.

10.39 BENDS IN CONDUIT

Where necessary, bends or diversions may be achieved by means of bends and/or circular inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system each junction box shall be provided with a cover properly secured and flush with a finished wall surface. No bends shall have radius less than 2-1/2 times the outside diameter of the conduit.

10.40 FIXING CONDUITS

The conduits, junction boxes, outlet boxes and controller boxes once installed in position, shall have their outlets properly plugged or covered so that water, mortar, insects or any other foreign matter does not enter into the conduit system. Surface conduits shall be fixed by means of spacer bar saddles at intervals not more than 500 mm.

The saddles shall be 2 mm x 19 mm galvanized steel flat, properly treated, primer coated & painted, securely fixed to supports by means of nuts and bolts/rawl bolts and brass machines screws.

10.41 DRAWING OF CONDUCTORS

While drawing insulated wires/cable into the conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. No joint shall be allowed in case of breakage of any conductor. No joint shall be shaved off like length of the conductors. Insulation shall be shaved off like sharpening of a pencil and it shall not be removed by cutting it square to avoid depression/cutting of conducting material.

Strands of wires shall not be cut to accommodate & connect to the terminals. Terminals shall have sufficient cross-sectional area to take all the strands.

No wire shall be drawn into any conduit until all work of any nature that may cause injury to wire is completed. Before the wires are drawn into the conduit, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction. Where wires are connected to detectors, or panel, sufficient extra length of wires shall be provided to facilitate easy connections and maintenance.

Only licensed supervisors/wiremen shall be employed for cabling and other connected work. Only approved make of cables shall be used. The cables shall be brought to the site in original packing.

10.42 MODE OF MEASUREMENT

(i) Signal Cable

The cabling running between DDC controllers to the field devices shall be termed as signal cabling. This cabling along with conduits shall be payable on per I/O point basis.

(ii) LAN Cable

The cable connecting various system integration units to the control station shall be termed as LAN cable. These cable along with conduits shall be measurable on unit length basis.

10.43 SIGNAL CABLING & COMMUNICATION CABLING

The signal cable shall be of the following specifications:

a.	Wire	:	Annealed Tinned Copper
b.	Size	:	1.0 sq. mm, stranded type
c.	No. of conductors	:	Two (One pair)
d.	Shielding	:	Overall beld foil Aluminium polyester shield.
e. f.	Jacket Nominal DCR	:	Chrome PVC 17.6 ohm/km for conductor 57.0 ohm/km for shield
g.	Nominal capacitance	:	130 pF/m between conductors at 1 KHz 180 pF/m between one conductor and
	other		Conductors connected to shield.

10.44 LOCAL AREA NETWORK CABLE

Depending on the type of LAN system being used by the contractor, standard, manufacturer's specification shall apply.

10.45 BMS DELIVERABLES-

The deliverables expected from the BMS in broadly defined here under. However it is understood that the I / O summary detailed in this specifications will be reckoned while designing the system

(a) Electrical monitoring and data logging:

Parameters relevant to Automatic Transfer Switches (ATS) at the origin of utility supply and standby sources and Multi Data Meters (MDM) in outgoing feeders as per following.

(Through integration as all MDMs shall be provided with communication ports)

Data Points to be monitored & trended for MDMs: kW, kWh, kV Ar.p.f, V, A, Power outages, DG run

Data Points to be monitored & trended for KWH Meters: kW, kWh

- 10.46 3rd Party System Integrator Units:
 - A. The 3rd party Integration unit shall provide the interface between Ethernet LAN and the 3rd party field control devices such as DDC or PLC or any other devices which need to be integrated. These shall also provide supervisory capability of functions over the devices connected to it. The purpose of using these units should be limited to integrate devices only, not for any DDC interface with GUI, provided by others.
 - A. The Unit must provide the following hardware features as a minimum:
 - a. One no. on board RS-232 port
 - b. One No. on Board RS-485 port
 - c. Provision to include / add additional communication card
 - d. Battery Backup
 - e. Minimum RAM of 64MB SDRAM / 32MB FLASH (96MB total)
 - B. The Integration unit shall have built in drivers for open protocol such as
 - a. Modbus over 485
 - b. Mbus Serial

If the above drivers are add-on products, it shall be made available / considered while selecting the unit & the same to be confirmed in writing.

- C. The Integration unit should have inbuilt memory for program storage.
- D. The Integration unit should automatically backup its database for the user defined interval.
- E. All units shall have LEDs for fault / status identification such as
- a. LAN active (one per port in case of multiport units)
- b. LED to display proper functionality / Status of the unit.
- c. LED to display healthiness of CPU of the unit

SECTION B

10.47 SPECIAL CONDITIONS OF CONTRACT

SCOPE :

The scope of all items in LV sub-system is SITC – Supply, Installation, Testing and Commissioning.

The agency that is bidding for the total project shall be called as "LV Integrator".

All and entire responsibility towards the successful execution of the LV sub-systems of the project

shall remain with the LV Integrator.

The entire SITC scope of all items falling under LV sub-systems shall be executed by a single LV

Integrator.

The LV Integrator shall be certified and authorized to supply, commission and provide services at site as may be required, including warranty and post-warranty support, as being the Original Equipment Manufacturer's authorized partner for the project. The LV Integrator shall have to formally submit the Manufacturer's Authorization as per the prescribed format annexed to this specification before commencement of the work.

The OEMs whose products are getting commissioned should have service centers for service and support of their respective products, preferably with toll-free nos. The OEMs whose products are getting commissioned by LV Integrator shall be direct manufacturers having their manufacturing facility.

The passive components of fiber optic cables and fiber optic components, options and accessories shall be from a single manufacturer / make / brand.

The passive cabling system consisting of fiber optic cables and accessories, the active networking components, i.e., networking switches and other such equipment's, the Pbx/communication systems shall be installed by a manufacturer's certified partner.

The fiber optics cabling system shall be duly certified with test reports submitted by the manufacturer or their authorized partners for a period of 25 years minimum.

The active components of networking and distribution such as networking switches, their options and modules shall be also from a single manufacturer/make/brand, to ensure that software and firmware images and functionality is identical. The upgrades or enhancement of core/operating software images and firmware & management applications for switches, options and modules shall be free (without any extra cost) to the client for the entire life cycle of these switches.

For all LV systems, the core software, operating software, application software and GUI etc. shall be of the latest versions. The upgrades and enhancements of the software images, core software and firmware for all network or networkable devices - such as controllers, interfaces, network camera, ip telephones,

pabx, fire alarm panels, PA main units etc. – shall be free (without any extra cost) to the client for the entire life cycle of these products.

The LV Integrator carrying out the SITC of Works shall provide defects-free supply, commissioning and operation of goods supplied by them for a period of 12 months from the date of hand-over, to be called as Warranty Period. During this period any goods and items supplied by them developing defects or becoming non-operational and downgraded in service shall be replaced free of any cost to the client. Such items shall include goods, software and applications and any other such items becoming a part of total solution.

The LV Integrator carrying out the SITC of Works of Building Management solution as per CPWD Guideline.

At the end of execution or at the time of hand-over, for all equipment's that are covered in SITC, the integrator shall transfer all warranties and guaranties from OEM – original equipment's manufacturer – to the client. The respective OEMs shall be bound to honour any and all warranties, guaranties and support commitments as agreed and committed by the LV Integrator.

The LV Integrator is advised to provide technical datasheets and specification sheets for approval for all items prior to initiating any supply. Any items having deviations, in absence of specific approval from Client / Architect / Consultant shall be returned whether installed or uninstalled at the risk, liability and expense of the LV Integrator.

The LV Integrator is advised to inform the Client / Architect / Consultant of any specific equirements for equipment's such as heat dissipation, earthing, ventilation etc. before supply so as to incorporate the same at site by other agencies.

At the time of project hand-over, the Client shall nominate personnel for O&M of LV systems. The LV Integrator shall depute a qualified and well trained engineer to impart proper training to client personnel on all aspects of operation, use, programming, administration and management of items under SITC scope.

The LV Integrator shall operate in complete cooperation with other agencies and contractors or their subcontractors to achieve harmony of work and maintaining the overall functionality of each systems and aesthetics.

The LV Integrator is advised to specifically use items only from the make list and provide information on compliance of performance specifications.

The LV Integrator shall not use any unknown or local items as a substitute for listed brands and makes that may degrade system performance.

Make of components required to be used by LV Integrator to complete the installation, if not mentioned anywhere, shall be required to be GET APPROVED from Client / Architect / Consultant in writing before installation. Within 4 weeks of work order, the LV Integrator shall submit the sample of each item / component of above mentioned approved make for the approval of the Client / Architect / Consultant.

10.48 MANUFACTURER'S AUTHORIZATION (MAF)

MAF Letter Format (On OEM Letter head with seal)

Date: _____

To,

____<<< NAME OF CLIENT/ORGANIZATION>>_____

Subject: Manufacturer's Authorization Certificate

Tender Ref.: << PLEASE SPECIFY SPECIFIC TENDER REF.NO.>>

Dear Sirs,

This is with reference to the above mentioned Tender.

We hereby authorize <</NAME AND ADDRESS OF INTEGRATOR>> to offer our range of product in their tender bids. Being authorized <</NAME AND ADDRESS OF INTEGRATOR>> may make techno-commercial and commercial proposal for this tender.

Upon being awarded the work <<NAME AND ADDRESS OF INTEGRATOR>> are authorized to install and commission our range of products falling under <<SECTION/PRODUCT CATEGORY>> of this tender.

We as Original Electronic Manufacturers will provide all the techno-commercial and service support necessary to <<NAME AND ADDRESS OF INTEGRATOR>>for this project during the commissioning phase of the equipment's and until hand-over.

We also confirm that the items would be serviceable during the warranty period of 12 months and for at least five years thereafter.

Thanking and assuring best of our services at all times.

Yours faithfully

(Seal & Signature)

TECHNICAL SPECIFICATION FOR LOW VOLTAGE WORKS (SECTION-8)

TECHNICAL SPECIFICATION FOR CONSTRUCTION. LOW VOLTAGE WORKS

ADDRESSABLE FIRE DETECTION & ALARM SYSTEM

A. General Fire Alarm System Description

- 1. Fire detection and Alarm System shall consist of Fire Alarm Control Panels, various types of equipment' slike Detectors, hooters, Strobes, monitor & control modules, Repeater panel, and different types of cables located at various strategic locations of the building.
- 2. In case of a Fire alarm initiation by an alarm initiating device, the audio-visual fire alarm shall be generated at the respective Fire Alarm Control Panels and at Repeater panel located in the Control Room, various location and also initiate signal to operate hooters located in various locations.
- 3. All types of addressable detectors / interface units shall be compatible with the fire alarm panel.
 - (i) All the alarm initiating devices that are asked for to be self-addressable type shall be of self- addressable type. In case of non-addressable detectors the detector status shall be monitored through a Conventional Zone Interface Module (CZIM) to send the analogue information available from the detector to FACP. The BIDDER shall clearly indicate what are all the device /detectors which are not self-addressable in type and shall include CZIM module to make that device / detector addressable. The CZIM module cost shall also be considered as included in the detector cost.
 - (ii) The detector shall be suitable to connect to the control unit via a four-wire circuit (Class –A wiring) as per NFPA.
 - (iii) The Fire Alarm System envisaged for this Building is "2-Wire Analog Addressable" type.
 - (iv) The communication between detectors and the FACP is by means of digital communication over 2-wire, which further provides power to the detectors, devices & Sounders. There shall be A/D and D/A conversion happening inside the detectors and FACP.
 - (v) All the detectors shall be incorporated with microprocessors and shall be provided with Analog to Digital Converter (ADC), which enables the detector to provide linear output corresponding to the quantity of smoke or fire, the detector encounter.
 - (vi) All types of detectors offered will be of restorable type i.e. suitable for operating afresh after each actuation on alarm without replacement oradjustment.
 - (vii) The sensitivity of each sensor shall be individually adjusted from the FACP to suit the conditions of each location. Each detector shall have self-test facility, which is monitored in the FACP. Each detector shall have drift compensation.
 - (viii) The response sensitivity shall also be field adjustable and not only from fire panel over a wide range to suits it econditions. It shall be possible to test the sensitivity of adetector in

the field. The sensitivity / threshold value of detectors which are cross zoned must becompatible.

- (ix) The FACP shall also check each sensor for contamination of dust/dirt and give signal for "Service" in case of accumulation of dust/dirt reaches a preset limit.
- (x) The fire alarm system shall work without any problem both in networked mode and in standalone mode.
- (xi) The electronic circuit shall be of solid state and of failsafe design and virtually hermetically sealed to have resistance to humidity and corrosion and to prevent its operation from being impaired by dust anddirt.
- (xii) The circuit shall be protected against usual electrical transients, electromagnetic and electrostatic interference (EMI & RFI) present in the Building.
- (xiii) Reverse polarity or fault in the field wiring shall not damage the detector.
- (xiv) No moving parts subject to wear & tear shall be provided.
- (xv) All types of detectors & devices offered shall have a inbuilt fault isolator. The fire detectors shall be plug in type. Suitable locking device shall be supplied along with each detector. It shall be inserted into or removed from the standard base by simple push twist mechanism to facilitate easy exchange / cleaning and maintenance.
- (xvi) The system shall have following self-diagnostic features:
 - (a) Detector cabling shall be completely supervised for open circuit and short circuit and exact location of fault shall be displayed in the panel underTrouble/Faults.
 - (b) Un-authorized removal of a detector head from its base shall be supervised to give an alarm on the connected control panel.
 - (c) Annunciation shall be provided for DC fuse blown and loss of main AC supply etc.
 - (d) Alarm verification features.
- **B.** Analogue Addressable Fire Alarm Control Panel (FACP)

The FACPs used in the Building shall confine to the EN54 standards having the following features.

Features:

- 1) All the FACPs provided shall have the capacity to expand from 1 to 32 loops for Future expansion.
- 2) Each loop shall accommodate maximum 254 detectors and devices with a loop length capable up to 1.6 kms with 2C x 1.5 sq mmcable.
- 3) It shall have facility to discriminate between a real fire alarm and a false alarm.
- 4) FACP will function as fully stand-alone panel & also networked to other FACPs with peer to peer communication.

- 5) Each FACP shall have a possibility of accommodating redundant controller to takeover in case of a Failure in the Primary Controller and also redundant loop card for each loop to takeover in case of a Failure in the Primary Loop Card.
- 6) It shall have a provision for battery storage.
- 7) In case of a Loop Card Failure, the FACP shall allow to replace the Loop card without switching off the panel and reprogramming.
- 8) The FACP shall have facility such that alteration or access to the stored program shall be done through a pass-code, for protection against unauthorized personnel interference.
- 9) The FACP shall be capable of PA Integration with the use of RS232 module or with the use of relays.
- 10) FACP shall have provision to accept 230V single phase, 50 Hz supply.
- 11) All the major components like processor, memory, etc., shall be available as spare in case of emergency requirement.
- 12) FACPs shall have inbuilt buzzer to alert the personnel in case of maintenance requirement.
- 13) FACP shall be programmed for sequence of events to happen in case of fire like closing of fire dampers, shutting down supply fans for HVAC, Deactivating the access control system and activating the hooters with the help of a control relay module provided near the system to be activated.
- 14) The fire alarm control panel shall be suitable for Class-A type of wiring as per NFPA-72.
- 15) The fire alarm control panel shall work on positive sequence as per NFPA -72.
- 16) The fire alarm control panel shall be capable of disabling an individual detector, a group and or zone of for building maintenance purposes. Facility shall be provided on the FACP for simulating the fire condition to enable testing of the various alarm circuits.
- 17) The fire alarm control panel normal power supply failure shall be annunciated audiovisually.
- **18)** In case of multiple alarms, the multiple alarm indication shall be ON. The multiple alarm indication shall be displayed in chronological order.
- 19) FACP shall have the facility such that each detector can be identified as a separate zone.
- 20) The FACP shall be reset only by authorized users after the clearance of a fault.
- 21) Whenever there is a third party actuation to happen, like closing of fire dampers, switching off supply /exhaust units etc, the actuation shall happen only when the fire signal is received from two different initiating devices located in a zone connected to different fire alarm panels. The communication between the FACPs shall happen with two pair cables and the fire alarm status of one panel shall be communicated to the second panel in which the control relay module of the third-party device is connected to. Inter panel communication is a must and needs to be provided for controlled actuations. All the necessary systems to ensure reliable communications between panels are to be built into the FACPs.
- 22) FACP shall have the facility to silence / acknowledge / reset the alarm. Apart from the

FACP, Repeater panel present in the control room shall have the facility to silence / acknowledge / reset the alarm of all FACP's.

- 23) The FACP shall have FALSE ALARM REDUCTION algorithms like
- Alarm Verification, Dual Detector/Group Dependency, and Intermediate Alarm Storage to eliminate False alarms due to Dirt/Dust/Disturbance values.
- 24) When fire condition is confirmed, the following sequence of annunciation will take place on the FACP:

Alarm Condition	Audible Alarm	Visual Alarm
First Fire Condition	ON	ON FLASHING/Description of area of fire origin with detector type
Acknowledge (first Alarm)	OFF	ON STEADY
New Fire Alarm Condition (after acknowledging of first alarm)	ON	ON FLASHING
Acknowledge (New fire alarm)	OFF	ON STEADY
Back to normal	OFF	ON STEADY
Reset	OFF	OFF
Reset Before Normal	OFF	ON STEADY

A. Construction details

- 1) The housing containing the fire alarm control panel shall be of 2 mm thick steel construction finished in colour as per relevant standard.
- 2) It shall be capable of being surface, semi-flush or fully flush mounted with additional bezel. The fully flush bezels shall be painted to specification, stainless steel or brass as required.
- 3) The FACPs shall be provided with triplicated earthing terminals on the either side. The grounding terminal G1 shall be for safety grounding, G2 shall be for shield grounding and G3 shall be for signal grounding.
- 4) The panel shall be completely factory wired, absolutely ready-in all respects for installation at site and termination of all external cabling. The internal wiring of the panel shall be carried out with 650 V grades, stranded copperwires of size rated for the

current in the corresponding circuit. The minimum size of the wire shall not be less than 0.8 sq. mm for electronic circuits and 1.5 sq. mm for electrical circuits &16 SWG for grounding.

- 5) All the wiring shall be done using ferrules having indeliblemarking.
- 6) Cable entry for the FACP from thebottom
- 7) FACP shall mount inwall.

B. CPU

- 1) The FACP shall have a processor which shall be of at-least 32 bit, which shall be designed to accept all the inputs and process the outputs within the time stipulated by the standards.
- 2) A redundant CPU shall be provided with the same configuration which shall be made as hot standby in case of failure of the main CPU, the standby shall takeover without interrupting the system.
- 3) The CPU shall have the facility to communicate with other FACPs and process the fire signals received from other FACPs to actuate a third party device.
- 4) The capacity of the processor shall be adequately designed include all input / output signals and various functional requirements.
- 5) The process or shall be designed in such a way that the parameters in there peater panels shall be refreshed in 1sec.
- 6) It shall have its own, built in advanced microprocessor, sophisticated software and extensive memory for storing the logs of alarms, times and action taken report.

C. Loop Modules

The loop module shall have a microprocessor inbuilt & shall be capable of handling 254 detectors/devices.

It shall have a line length up to 1600m or 3000m depending upon the configuration & cable type.

It shall have an LED test button.

The front fascia of the loop cards shall be visible for easy identification of faults. In case of the failure of loop card, it should be replaced without the need of any additional programming.

D. Repeater Panels

- 1) It shall be a LCD displays same as main panel. The MMI shall be the same as the main Controller.
- 2) Repeater panels shall be suitable for Wall mounting which will be displayed all the major entrances and stair cases which will enable the staff and fire fighting personnel to exactly locate the fire.
- 3) It shall be compatible to receive data fromFACPs.
- 4) Audio visual Alarms during fire shall be generated in case offire.
- 5) It shall connect to any of the Fire Panels in the Network using a 2 core 1.5 sq.mm wire.

- 6) The Repeater Panel shall display Messages like Alarm & Fault similar to the Main Panel and shall be accessed only by Authorized Users through a passcode.
- 7) The Repeater Panel shall be connected to the Main Panel and other repeater panels in such a way -1 pt Failure in the cable shall not affect the performance and shall intimate the exact location of failure in all Panels.
- 8) The Repeater Panel shall be equipped with a Key switch that allows Authorized users to Acknowledge / Reset Alarms.
- 9) The Repeater Panel shall be equipped with 2 different power inputs. On failure of primary power, the secondary shall takeover.
- 10) The Repeater panel shall allow the users to login locally or login to the remote FACP.
- 11) The Repeater panel shall allow to create users with different access levels locally and shall also allow users of panels to login based on access levels.
- 12) The repeater panels shall integrate with the main panels without any additional interface or the bidder shall consider necessary accessories required to complete the system and quote as part of this model.
- E. Intelligent Addressable Dual Optical Smoke/Heat (Multisensor)Detector

The Intelligent Addressable Multisensor Detector with 2 LED's used in this Building shall confine to the relevant standards having the following features

- 1) It shall be combination of Smoke detection and heat detection. The smoke detection system shall work on Light scattering type principle using Infrared & Blue Led's, and the Heat detection system shall be of Rate of rise of temperature and Fixed Temperature.
- 2) The Intelligent Addressable Multisensor Detector shall be of Spot type and Addressable type.
- 3) The Intelligent Addressable Multisensor Detector shall be addressed either by DIP switches or through Programming from thePanel.
- 4) The Detector shall monitor EMC/EMI values in the surroundings on a continuous basis and report the current & average values to the panel. The detector and the panel shall together avoid the possibility of false alarm caused due to interferences from sources such as Motors, power cables, Wi-Fi routers, fluorescent lamps, network switches, mobile signals etc.
- 5) All the detectors shall have a visible multi-color LED to indicate the healthiness / trouble / alarm condition of the detector. The LED shall be located in such a way that it shall be visible from all the 360 degree from below. In some cases where the visibility of the detector is obstructed by cable trays, false ceiling etc. Facility for connecting the detector to a response indicator has to be present. The response indicator derives the power to glow from the loop.
- 6) It shall possess False alarm immunity and a superior signal to noise ratio
- 7) It shall have a Built-in signal processor
- 8) It shall have drift compensation facility built in.
- 9) The detectors shall communicate the ambient treading to the FACP on time to time basis, and the FACP shall make the decision about the current status of the detector, whether it is in fire/pre-alarm/maintenance requirement etc.
- **10)** The detector shall have atleast 15 levels of sensitivity settings based on the application and room where it is installed.
- 11) The detector shall provide a chamber maid plug to blow out the dust/dirt using a blower.

- 12) In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming
- 13) The detector shall be programmed to work as Optical only or Thermal only detectors. It shall a provision to switch off any component (optical or thermal) of the detector.
- 14) The detector shall work with 2 different sensitivity settings at any point of time and the User shall have access to choose the desired settings without programming or Laptop/PC for configuration.
- **15)** The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.
- **16)** The detector shall have Intermediate Alarm Storage, Dual Detector Dependency, Dual group Dependency features that shall be programmed based on site application.
- 17) The detector shall be capable of detecting both smoldering fires and open fires and shall be EN54 /VdS/ULapproved.
- F. Intelligent Addressable Optical Smoke/ Heat(Multisensor)Detector

The Intelligent Addressable Multisensor Detector used in this Building shall confine to the relevant standards having the following features

- 1) It shall be combination of Smoke detection and heat detection. The smoke detection system shall work on Lights cattering type principle using Infra red and the Heat detection system shall be of Rate of rise of temperature and Fixed Temperature.
- 2) The Intelligent Addressable Multisensor Detector shall be of Spot type and Addressable type.
- 3) The Intelligent Addressable Multisensor Detector shall be addressed either by DIP switches or through Programming from the Panel.
- 4) The Detector shall monitor EMC/EMI values in the surroundings on a continuous basis and report the current & average values to the panel. The detector and the panel shall together avoid the possibility of false alarm caused due to interferences from sources such as Motors, power cables, Wi-Fi routers, fluorescent lamps, network switches, mobile signals etc.
- 5) All the detectors shall have a visible multi-color LED to indicate the healthiness /trouble / alarm condition of the detector. The LED shall be located in such away that it shall be visible from all the 360 degree from below. In some cases where the visibility of the detector is obstructed by cable trays, false ceiling etc. Facility for connecting the detector to a response indicator has to be present. The response indicator derives the power to glow from the loop.
- 6) It shall possess False alarm immunity and a superior signal to noiseratio
- 7) It shall have a Built in signal processor
- 8) It shall have drift compensation facility built in.
- 9) The detectors shall communicate the ambient reading to the FACP on time to time basis, and the FACP shall make the decision about the current status of the detector, whether it is in fire/pre-alarm/maintenance requirement etc.
- 10) The detector shall have at least 15 levels of sensitivity settings based on the application and room where it isinstalled.
- 11) The detector shall provide a chamber maid plug to blow out the dust/dirt using ablower.
- 12) In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming
- 13) The detector shall be programmed to work as Opticalonly or Thermalonly detectors. It

shall a provision to switch off any component (optical or thermal) of the detector.

- 14) The detector shall work with 2 different sensitivity settings at any point of time and the User shall have access to choose the desired settings without programming or Laptop/PC for configuration.
- 15) The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.
- **16)** The detector shall have Intermediate Alarm Storage, Dual Detector Dependency, Dual group Dependency features that shall be programmed based on site application.
- 17) The detector shall be capable of detecting both smoldering fires and open fires and shall be EN54 /VdS/UL approved.
- G. Intelligent Addressable Dual Optical Smoke Detector with 2 LED's-Infrared &Blue

The Intelligent Addressable Photo electric smoke Detector with 2 LED's-Infrared & Blue used in this Building shall confine to the relevant standards having the following features:

- 1) The smoke detection system shall work on Lights cattering type principle using Infrared & Blue Led's.
- 2) The Intelligent Addressable smoke Detector shall be of Spot type and Addressable type.
- 3) The Intelligent Addressable Smoke Detector shall be addressed either by DIP switches or through Programming from thePanel.
- 4) The Detector shall monitor EMC/EMI values in the surroundings on a continuous basis and report the current & average values to the panel. The detector and the panel shall together avoid the possibility of false alarm caused due to interferences from sources such as Motors, power cables, Wi-Fi routers, fluorescent lamps, network switches, mobile signals...etc.
- 5) All the detectors shall have a visible multicolor LED to indicate the healthiness /trouble / alarm condition of the detector. The LED shall be located in such away that it shall be visible from all the 360 degree from below. In some cases where the visibility of the detector is obstructed by cable trays, false ceiling etc. Facility for connecting the detector to a response indicator has to be present. The response indicator derives the power to glow from the loop.
- 6) It shall possess False alarm immunity and a superior signal to noiseratio
- 7) It shall have a Built in signal processor
- 8) It shall have drift compensation facility built in.
- 9) The detectors shall communicate the ambient reading to the FACP on time to time basis, and the FACP shall make the decision about the current status of the detector, whether it is in fire/pre-alarm/maintenance requirement etc.
- 10) The detector shall have at least 3 levels of sensitivity settings based on the application and room where it is installed.
- 11) The detector shall provide a chamber maid plug to blow out the dust/dirt using ablower.
 - (a) In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming
 - (b) The detector shall work with 2 different sensitivity settings at any point of time and the User shall have access to choose the desired settings without programming or Laptop/PC for configuration.
 - (c) The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.
 - (d) The detector shall have Intermediate Alarm Storage, Dual Detector Dependency,

Dual group Dependency features that shall be programmed based on site application.

- (e) The detector shall be capable of detecting both smoldering fires and open fires and shall be EN54 /VdS/UL approved.
- **H.** Intelligent Addressable Optical SmokeDetector

The Intelligent Addressable Photo electric smoke Detector with Infrared LED used in this Building shall confine to the relevant standards having the following features

- (a) The smoke detection system shall work on Light scattering type principle using Infrared Led's.
- (b) The Intelligent Addressable smoke Detector shall be of Spot type and Addressable type.
- (c) The Intelligent Addressable Smoke Detector shall be addressed either by DIP switches or through Programming from the Panel.
- (d) The Detector shall monitor EMC/EMI values in the surroundings on a continuous basis and report the current & average values to the panel. The detector and the panel shall together avoid the possibility of false alarm caused due to interferences from sources such as Motors, power cables, Wi-Fi routers, fluorescent lamps, network switches, mobile signals...etc.
- (e) All the detectors shall have a visible multicolor LED to indicate the healthiness /trouble / alarm condition of the detector. The LED shall be located in such away that it shall be visible from all the 360 degree from below. In some cases where the visibility of the detector is obstructed by cable trays, false ceiling etc. Facility for connecting the detector to a response indicator has to be present. The response indicator derives the power to glow from the loop.
- (f) It shall possess False alarm immunity and a superior signal to noiseratio
- (g) It shall have a Built in signal processor
- (h) It shall have drift compensation facility builtin.
- (i) The detectors shall communicate the ambient reading to the FACP on time to time basis, and the FACP shall make the decision about the current status of the detector, whether it is in fire/pre-alarm/maintenance requirement etc.
- (j) The detector shall have at least 3 levels of sensitivity settings based on the application and room where it is installed.
- (k) The detector shall provide a chamber maid plug to blow out the dust/dirt using a blower.
- (1) In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming
- (m) The detector shall work with 2 different sensitivity settings at any point of time and the User shall have access to choose the desired settings without programming or Laptop/PC for configuration.
- (n) The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.
- (o) The detector shall have Intermediate Alarm Storage, Dual Detector Dependency, Dual group Dependency features that shall be programmed based on site application.
- (p) The detector shall be capable of detecting both smoldering fires and open fires and shall be EN54 /VdS/ULapproved.
- I. Intelligent Addressable HeatDetector

The Intelligent Addressable Heat Detector used in this Building shall confine to the relevant standards having the following features

- 1. The Heat detection system shall be of Rate of rise of temperature and Fixed Temperature.
- 2. The Heat Detector shall be of Spot type and Addressable type.
- 3. The Heat Detector shall be addressed either by DIP switches or through Programming from the Panel.
- 4. The Detector shall monitor EMC/EMI values in the surroundings on a continuous basis and report the current & average values to the panel. The detector and the panel shall together avoid the possibility of false alarm caused due to interferences from sources such as Motors, power cables, Wi-Fi routers, fluorescent lamps, network switches, mobile signals...etc.
- 5. All the detectors shall have a visible multicolor LED to indicate the healthiness /trouble / alarm condition of the detector. The LED shall be located in such away that it shall be visible from all the 360 degree from below. In some cases where the visibility of the detector is obstructed by cable trays, false ceiling etc. Facility for connecting the detector to a response indicator has to be present. The response indicator derives the power to glow from the loop.
- 6. It shall possess False alarm immunity and a superior signal to noise ratio
- 7. It shall have a Built in signal processor
- 8. It shall have drift compensation facility built in.
- 9. The detectors shall communicate the ambient reading to the FACP on time to time basis, and the FACP shall make the decision about the current status of the detector, whether it is in fire/pre-alarm/maintenance requirement etc.
- 10. In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming
- 11. The detector shall work with 2 different sensitivity settings at any point of time and the User shall have access to choose the desired settings without programming or Laptop/PC for configuration.
- 12. The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.
- 13. The detector shall have Intermediate Alarm Storage, Dual Detector Dependency, Dual group Dependency features that shall be programmed based on site application.

The detector shall be capable of detecting both smoldering fires and open fires and shall be EN54 /VdS/ULapproved.

J. Addressable Ventilation Duct SmokeDetectors

The detector shall have housing for accommodating a special detector that detects smoke in ventilation ducts, with input and output for air sample extraction, streamlined connection pipes for optimum air flushing of the detector, with dust-proof connection board for the loop outside the air flow, with air intake and exhaust pipe, seals and the required installation material

- (a) The Duct smoke Detector used in this Building shall confine to the relevant standards having the following features
- (b) The smoke detection system shall work on Light scattering type principle using Infrared. The detector shall better false alarm immunity and shall have a processor inbuilt with ISP.
- (c) Duct Detector shall be Addressabletype.
- (d) The Dual Detector shall be loop powered and addressed either by DIP switches or through Programming from the Panel.
- (e) All the detectors shall have a visible multicolor LED to indicate the healthiness /trouble / alarm condition of the detector. The LED shall be located in such away that it shall be visible from all the 360 degree from below. In some cases where the visibility of the detector
is obstructed y cable trays, false ceiling etc. Facility for connecting the detector to a response indicator has to be present. The response indicator derives the power to glow from the loop.

- (f) It shall possess False alarm immunity and a superior signal to noise ratio
- (g) It shall have a Built in signal processor
- (h) It shall be with inbuilt fault isolators.(Detectors without Inbuilt Isolators may be considered with separate Isolator Base)
- (i) It shall have drift compensation facility built in.
- (j) The detectors shall communicate the ambient reading to the FACP on time to time basis, and the FACP shall make the decision about the current status of the detector, whether it is in fire/pre-alarm/maintenance requirement etc.
- (k) The detector shall have at least 3 levels of sensitivity settings.
- (1) The detector shall provide a chamber maid plug to blow out the dust/dirt using a blower.
- (m) In case of a failure, panel shall allow to replace the detector with the same type without the need of additional programming
- (n) The detector shall work with 2 different sensitivity settings at any point of time and the User shall have access to choose the desired settings without programming or Laptop/PC for configuration.
- (o) The detector shall change sensitivity settings based on day/night mode or with schedules based on the programming.
- (p) The detector shall have Intermediate Alarm Storage, Dual Detector Dependency, Dual group Dependency features that shall be programmed based on site application.
- (q) The detector shall have Air intake and exhaust pipe , extendable up to3m
- (r) The detector shall have necessary filters in the air intake and exit pipes.
- (s) The detector considered shall be a special detector designed for Duct applications and not a Spot type Optical detector.
- (t) The detector shall be EN54 /VdS/UL approved.
- **K.** Manual Call Points

The Manual call points (MCP) used in the building shall confine to the relevant standards having the following features

- 1) Manual call points shall be of Double action break glass type with Push Button.
- 2) The mounted arrangement shall be such that it can be either surface mounted or flush mounted.
- 3) Each addressable MCP will comprise of an electronic circuit built into it to provide addressing capability.
- 4) The MCPs shall be provided with inbuilt fault isolator. (the bidder shall consider a external isolator if not in built)
- 5) The MCP shall have a LED to indicate Alarms
- 6) The MCP shall be EN54/VdS/UL approved
- **L.** Control relay module (CRM)

The Control Relay Modules used in this Building shall confine to the relevant standards having the following features

1) The CRM shall provide a dry potential contact o/p for activating a variety of auxiliary devices and other fire fighting / ventilation equipment.

- 2) The CRM shall have inbuilt fault isolator module. (bidder shall consider external isolators if not in built)
- 3) It shall have a capability of handling at least 1A @ 30VDC to integrate with third party system.
- 4) The CRM shall be addressable either by Dip switch or by the Panel.
- 5) The CRM shall be EN54/VdS/UL approved.
- M. Monitor Module (Input module) (MM)

The Monitor Modules used in this Building shall confine to the relevant standards having the following features.

- 1) The MM shall provide 2 inputs and these inputs shall work independently to monitor 3rd party devices and shall allow to program with different parameters.
- 2) The MM shall have inbuilt fault isolator module.(bidder shall consider external isolators if not in built)
- 3) The MM shall be programmed to monitor contacts, Voltage and EOL resistor as per site applications.
- 4) The MM when programmed to monitor contacts shall also allow to program to monitor either open/close contacts.
- 5) The MM shall be addressable either by Dip switch or by the Panel.
- 6) The MM shall be EN54/VdS/UL approved.
- N. Addressable interface (Conventional Zone Interface module -CZIM)

The CZIM Modules used in this building shall confine to the relevant standards having the following features.

- 1) Addressable interface units will be provided for all non-addressable detectors/devices such as **beam detectors or to integrate existing conventional detectors, etc.** to assign an address to such detectors and to be compatible with addressable FACP.
- 2) Each conventional detector will have its own addressable unit in the form of CZIM Modules for individual address. The addressable unit will facilitate connection of non-addressable detectors in the same circuit/loop consisting of addressable detectors.
- 3) It shall supervise the circuit of open dry contact I/P device & signal alarms during change of state of detectors.
- 4) The interface device shall have an LED, which flashes during polling of the FACP.
- 5) It shall have inbuilt fault isolator module or the bidder shall consider additional isolator modules.
- 6) The CZIM shall be capable of powering the Detectors through the Aux Source and shall supervise the cable, aux power and the external power supply. The CZIM shall communicate Faults and Troubles related to Detector, Power supply to the Panel.
- 7) The CZIM shall allow to reset conventional detectors from the panel.
- 8) The CZIM shall offer 2 separate zones, 2 Aux power circuits and shall monitor the external power supply and supervise the zone cables.
- 9) The CZIM shall allow Intermediate Alarm Storage, Dual detector & Dual group dependency based on site applications.
- **10)** The CZIM shall allow configuring the conventional zones with Different EOL and Alarm resistor based on the existing detector type.
- 11) The CZIM shall either be din rail mount or Surface mount.
- 12) The CZIM shall have the intelligence to detect faults like 4 wireshort...etc.
- 13) The CZIM shall be EN54 /VdS approved

O. Beam (Optical Beam) Smokedetector

The Beam detectors used shall confine to the relevant standards having the following features

- 1) The beam detectors shall having a separate Transmitter (Tx) & receiver(Rx)
- 2) Beam detectors shall be externally powered via Conventional Zone Interface module (CZIM). The module shall supervise the External Power Supply, Aux Power to the Transmitter and Receiver.
- 3) It will communicate to FACP through addressable CZIM so that each detector will have individual address. The CZIM shall have inbuilt fault isolators.
- 4) The beam detector shall be suitable to protect the distance from 10 meters to 100 meters range.
- 5) The beam detectors shall communicate the ambient reading to the FACP on time to time basis, and the FACP shall make the decision about the current status of the detector, whether it is in fire/pre-alarm/maintenance requirement etc.
- 6) It shall have provision for Wall / ceiling mounting.
- 7) Beam detector shall have Response time less than 20 sec.
- 8) The response threshold values, tests shall be as per NFPA72.
- 9) It shall have feature such that in case of accidental change of alignment, it shall report an error, it shall raise a maintenance request to the FACP.

P. Sounder

The Sounder used in this Building shall confine to the relevant standards having the following features

- 1) The Sounder shall have audible sound of (Bidder shall consider external power supply, cable, conduits, modules required for activating externally powered sounders and include the costing as part of the item –Sounders)
- 2) The Sounder shall either be addressed by Dip switch or by the Panel.
- 3) The Sounder shall be placed in the detection loop only and a separate loop or cables for sounders shall not be used
- 4) The sounder shall have a sound pressure level of 90dB and the volume shall be adjusted from the Fire Alarm Panel
- 5) The sounder shall be capable of programming at least 32 different tones for alarm detection in different floors or at different time intervals.
- 6) The sounder shall be tested and maintained with ease from the FACP
- 7) The Volume levels for Testing and Drill shall be programmed as per site conditions.
- 8) The Sounder shall consume a minimal current of <5mA and thus allowing to connect at least 25 loop powered sounders in the same loop.
- 9) The Sounder shall be capable of either accommodating a Flasher or a Detector and shall work as Sounder cum strobe or Sounder cum detector base.
- 10) The Sounder shall have a feature of synchronizing with other sounders in the loop.
- 11) The Sounder shall be loop powered and shall be EN54/VdS approved.
- Q. Strobe

The Strobe used in this Building shall confine to the relevant standards having the following features:

1) The Bidder shall consider external power supply, cable, conduits, modules required for

activating externally powered Strobes and include the costing as part of the item - Strobes)

- 2) The Strobe shall either be addressed by Dip switch or by the Panel.
- 3) The Strobe shall be placed in the detection loop only and a separate loop or cables for Strobe shall not be used
- 4) The Strobe shall have a red flash light and shall flash at minimum of 1Hz
- 5) The Strobe shall be tested and maintained with ease from the FACP
- 6) The Strobe shall also be part of Testing and Drill and shall be programmed as per site conditions.
- 7) The light output shall be at least 2cd
- 8) The Strobe shall consume a minimal current of 10mA and thus allowing to connect at least 10 loop powered strobes in the same loop.
- 9) The Strobe shall be capable of either fixing it in a Sounder and shall work as Sounder cum strobe as per site conditions.
- 10) The Strobe shall be loop powered and shall be EN54/VdS approved.
- **R.** Remote Indicator

The Remote indicator used in this Building shall confine to the relevant standards having the following features.

The remote indicator is used when the automatic detector is installed in a place hidden or not visible like in closed rooms, false ceilings or walls.

II. <u>PA System:</u>

The system shall provide new and unique features for the market. Each component in the system shall be designed to suit the system needs as required.

The system shall have the following features:

• Easy configuration, but without losing the ability to solve complex requests. A configuration wizard and an expert program interface shall be provided. Fast and correct installation shall be possible, but it shall also be possible to handle complex and specific application requirements.

A free programmable Task Engine shall be available via the expert mode program interface. The configuration wizard shall be able to provide a step-by-step configuration guide that creates a complete IRIS-Net system configuration file.

- Due to its flexibility, the system shall eliminate the project risk right from the start. The matrix structure shall be evident throughout the system. Dynamic routing and intelligent audio power distribution shall make the system suitable for almost any application. The system shall be designed to ensure system-wide intelligent power management architecture. The system shall raise the bar and creates a PA/EVAC system that uses the lowest power consumption for the application. It shall save batteries and maintenance costs.
- The system shall add pro-sound audio quality level to the PA/EVAC system. This highquality level shall enable combined use of Fire/EVAC with applications that requires highquality audio, such as presentation rooms, school stages, etc. The excellent sound quality

shall ensure excellent intelligibility in all kind ofsituations.

- The new call station shall be designed as a modern device. The new call station shall provide a green LED on the Microphone to show that a call is going acrossfrom the call station. The system shall be able to handle up to 16 callstations.
- The system shall be capable to address up to 492 zones with a total speaker load up to 50.000 Watt.
- It shall be able to handle 4 system program sources and 12 local program inputs.
- It shall be possible to have one or more spare amplifiers in the system to take over from a duty amplifier in case onefails.
- Brackets shall be mounted on rackets

System Controller

The system controller shall be an EN54-16 compliant and certified device in a 2 RU, 19"-cabinet. The TCP/Ipcapable network device shall contain all controlling and monitoring functions of a voice evacuation system.

The controller shall manage the supervision of its own operation and that of the connected devices. It shall control and activate the connected amplifiers and spare amplifier and shall replace the amplifier routing and channel that has reported a fault.

The controller shall support single line switching or redundant group A/B switching.

Network connectivity status and fault conditions shall be displayed via LEDs on the front panel.

At least 8000 fault, warning and event conditions shall be logged internally and it shall be reported with the possibility to look real-time into the logging and save the log with logging tools. Four 100V audio inputs shall be routed to 12 speaker line outputs. Each cluster of 6 loudspeaker zones shall allow separate two-channel operation to ensure continuous business music or it shall allow to be configured to double the amount of power in a 6 zone 1 channel cluster. It also shall have an option to have multiple calls in parallel in a 2 channel operation mode.

It shall be possible to share the amplifier power with multiple routers

The controller shall provide an internal 14x 4 Audio matrix with full DSP functionally on each of the 8 inputs and 4 outputs. The controller shall operate as a four channel output matrix.

A single system controller shall be able to manage up to 20 routers, 16 call stations and up to 492 loudspeaker circuits.

It shall allow up to 4 controllable program inputs.

A built in message manager shall be able to store up to 100 emergency- or business-calls, with a total storage time up to 85 minutes.

It shall be possible to send two different messages simultaneously to individual destinations. In combination, license free spoken word evacuation sound files shall be provided in 7 languages. A separate included tool shall provide on the fly replacing non-evacuation messages at any time without system interruption or system restart - so called hot swappable messages.

Loudspeaker supervision shall be fully controlled by the controller and executed from the router. The user shall be able to choose between no supervision, impedance measurement, simple EOL boards with pilot tone supervision (requires return wires) or via advanced addressable EOL supervision boards, which requires a ground connection but no additional return wires.

Zones outputs shall be able to handle a load from 2-500 Watt. Max. 1000 Watt per 6 zones shall be provided.

The controller shall be able to handle up to 2000 Watt load. It shall be possible to connect to a FPA5000 via Ethernet.

System Router

The system router shall be an EN54-16 certified device in a 2 RU, 19"cabinet. The device shall extend thenumber of zones in a system and shall contain all the necessary controlling and monitoring functions.

The internal supervision system shall monitor the functions and operation of both itself and the connected devices. It shall be capable of re-routing a spare amplifier channel and shall replace an amplifier channel that has reported a fault.

Fault conditions shall also be reported to the connected system controller for operational control and logging purposes. The router shall support single line assignment or redundant group A/B switching.

Connectivity status and fault conditions shall be displayed via LEDs on the front panel, including a zone status LED.

It shall be possible to route at least 4 channels into eight 100V audio inputs to 24 loudspeaker line outputs. The router loudspeaker outputs shall be divided in clusters of 6 loudspeaker line outputs. Each cluster of 6 zones shall allow the same or a different two-channel operation mode to ensure continuous and/or different business music into different zones.

It shall be possible for each router cluster to operate as a 2-in-6 matrix (4 channel input matrix to 2-in 6 cluster).

Zone outputs shall be able to handle a load from 2-500 Watt. Max. 1000 Watt per 6 zones shall be provided.

The Router shall be able to handle up to a 4000 Watt load.

Integrated loudspeaker supervision shall eliminate the need of amplifier power for supervision, which shall result in very low power consumption.

Fechnical Specifications	
Zone Router	Router including routing and supervision
Audio inputs (100 V)	AMP IN: 4 × 6-pin port
– Max.voltage	120 Veff
– Max.current	7.2 A
– Max.power	500 W
Audio outputs (100 V)	SPEAKER OUT: 4 × 12-pin port
– Max.voltage	120 Veff
– Max.current	7.2 A
– Max.power	500 W
CONTROL IN	4×10 -pin port
 Controlinputs 	$- 10 \text{ supervised inputs (0-24V,} U_{\text{max}} = 32$
CONTROL OUT	4×10 -pin port
– Controloutputs	24 Low Power outputs (open collector, $U_{max} =$
– Controlrelay	2 (NO/NC relay contacts, U _{max} = 32 V,I _{max} =
Interfaces	
– CAN BUSport	2 X RJ-45, 10 to 500 kbit/s (for controller, router, amplifier
DC power input	21–32 V DC
Power consumption	5-60W
Maximum supply current	– Standby < 250mA
Operating temperature	-5 °C to 45 °C
Electromagnetic environment	E1, E2, E3

Standards:

The device meets the following standards (as of February 2015):

- IEC60065
- EN61000-6-3
- EN50130-4
- EN60945
- EN50581

System Amplifier

The 2x 500W Class D, high efficiency amplifier shall be an EN54-16 compliant and certified system device in a 2 RU, 19"cabinet. It shall provide 70/100V loudspeaker output voltages that are galvanically separated. The amplifier shall be permanently monitored by the system controller.

A special stand by mode shall be provided for saving energy during the time the amplifier is not in use with respect to all economical and super vision aspects.

System control and audio interconnections shall be done via RJ45 connectors.

The amplifier shall be used as a system amplifier, but it shall also be possible to use the amplifier standalone.

As a system amplifier, four automatic selectable audio inputs via RJ45 shall be available. It shall also be possible to use a local input without losing system and line supervision.

It shall be a requirement that local input is used in case of standalone mode.

The local input shall be configur able in away that it can be used as source input for in an installed system, for example for an external PA or local source in put. The amplifier shall have the following specifications:

- Max amplifier load: 2x 500Watt
- Class Damplifier
- 4 channel input on RJ45 connector, amp link in and out (4 channel dynamic input channel switching for each amplifier)
- Local input on amplifier: Enabled via software configuration or automatically selected when amplifier address is set to address System channel 4 will be used as supervision channel in case local inputs are used.
- Loop through on RJ45 connector (4channels)
- Build inLimiter
- AC Power switch on rearside
- 24V DCInput
- Front to rear airventilation

Technical Specifications

Rated load impedance (output power)		
• 100V	20 Ω (500 W)	
• 70V	10 Ω (500 W)	
Rated output power, 1 kHz, THD $\leq 1\%$	$2 \times 500 \mathrm{W}^1$	
Rated input voltage	+6 dBu	
Max. RMS voltage swing, 1 kHz, THD \leq 1%, without load		
• 100V		

"0".

• 70V		
Voltage gain, ref. 1 kHz, fixed		
• 70V	33.2 dB	
• 100V	36.2 dB	
Maximum load capacitance	2 µF	
Input level, max.	+18 dBu (9.75 V _{rms})	
Frequency response, ref. 1 kHz, rated load, -3 dB	50 Hz to 25 kHz	
Input impedance, active balanced	20 kΩ	
Signal-to-noise ratio (A-weighted)	> 104 dB	
Output noise (A-weighted)	< -62 dBu	
Crosstalk, ref. 1 kHz	< -85 dB	
Output stage topology	Class-D, transformer, floating	
Power requirements		
• AC	115–240 V(-10/+10%) ²	
• DC	21-32 V	
Power consumption, AC and DC	See section "Power consumption" in operation manual	
Inrush current	2 A	
Inrush current, after five-second power cycle	1.3 A	
Mains fuse	T6.3A (internally)	
DC fuse	30A (internally)	
Ground fault	$R < 50 \text{ k}\Omega$	
CAN BUS port	$2 \times \text{RJ-45}$, 10 to 500 kbit/s	
Dustastion	Audio input loval limitar DMS	
Protection	output power limiter, RMS temperature, DC, short circuit, mains under voltage protection, DC supply	

	temperature, DC, short circuit, mains under voltage protection, DC supply under voltage protection, in rush current limiter, ground fault	
Cooling	Front-to-rear, temperature- controlled fans	
Operating temperature	-5 °C to +45 °C	
Safety class	Class I	

	Electromagnetic environment	E1, E2, E3
--	-----------------------------	------------

- 1. In DC mode and in continuous alarm-signal operation, output signal limited by 3dB max.
- 2. Reduced output power at mains voltages below 115V

Standards

- EN50130-4
- EN50581
- EN55103-1/2
- EN61000-3-2/3
- EN61000-6-3
- IEC60065
- EN60945

Call Station

The call station shall be an EN54-16 compliant and certified user interface. It shall be designed in a modern and robust chassis with a graphical display.

As standard, the call station shall have a gooseneck microphone with pop shield and permanent monitoring, an illuminated LC-display and an integrated loudspeaker to be used for system sounds. The operation status shall be permanently supervised by the system controller.

It shall be possible to modify the call station to suit the user's requirements by connecting up to five remote call station keypads, each with 20 free customizable functions and selection buttons.

It shall be possible to extend the call station at the right and at the left side. Is shall be possible to mount a maximum of 3 additional emergency buttons on the call station. Optionally it shall be possible to mount a key switch to lock or enable call station functions with a key switch or to give access to a second access level.

The call station shall have a built-in numerical keypad; it shall be possible to enable or disable the keypad during configuration.

The call station shall have the following specifications:

- Five menu/function keys (pre-programmed) four buttons shall provide each 1 LED (2 LEDs shall be green and 2 LEDs shall beyellow).
- Green led on the microphone which is active during acall.
- 15 function and speed dial buttons (customizable), two LEDs (green/red) perbutton.
- Button functions shall be programmable suchas:
- Zone select, source select, level control, emergency on/off, message on/off, failure acknowledge/reset.
- Switching output trigger on/off or 0 to 10V, select scheduled events, scheduled event on/off.
- Fascia cover with transparent areas for customizablelabels.
- Multilanguage LCD display informs about system status, system faults, selected zones, source select, clock, different kind of additional (failure) messages shall be freeconfigurable.
- Supervised electret microphone, with limiter and a speech filter for excellent speech intelligibility.

- CAT5 cable for data and audio connection to controller (CAN bus, up to 1000meter).
- It shall be possible to daisy chain 4 callstations.
- It shall receive audio and operational control signals from the controller and report its status to the system controller.
- Internal monitoring with error logging complying with all relevant national and international standards.

CAN BUS port	10, 20, or 62.5 kbit/s, 1× RJ-45, max. length 1000m
Maximum mic input level	-21 dBu
Maximum line input level	+4 dBu
Maximum NF output level	+12 dBu
Buttons	5 pre-programmed, 15 programmable zone/function keys
Color	RAL 9017 (traffic black)
Indicator lights	Power (green), Fault (yellow), Alarm (red) Green or yellow LED per pre- programmed menu button Green and red LED per
LC display	Back-lit LC display (122 × 32 pixel)
Ports	 1 CST BUS port (Control data + Audio + Power supply, RJ-45) 1 audio source (line level, phone jack)
DC power input	15–58 V

Technical Specifications

Standards:

- – IEC60065
- – EN61000-6-3
- – EN50130-4

III. CCTVSystem

Technical Specifications:

DOME CAMERA		
General Specification	Technical Specification	Compliance (Yes / No)
Camera		

Sensor	1/3", progressive scan, 4.0 megapixel, CMOS	
Lens	2.8~12 mm, AF automatic focusing and motorized zoom lens	
Angle of View (H)	91.0°~27°	
Angle of View (V)	54.4°~13.7°	
Angle of View (O)	118.3°~33.2°	
	Pan: 0°~360°	
Adjustment angle	Tilt: 0°~90°	
	Rotate: 0°~360°	
Shutter	Auto/Manual, 1 ~ 1/100000s	
Minimum Illumination	Colour: 0.005 Lux (F1.4, AGC ON) 0 Lux with IR	
Day/Night	IR-cut filter with auto switch (ICR)	
Digital noise reduction	2D/3D DNR	
S/N	>55 dB	
IR Range	Up to 30m (98 ft) IR range	
Defog	Digital Defog	
WDR	120dB	
	Video	
Video Compression	Ultra 265,H.265, H.264,MJPEG	
H.264 code profile	Baseline profile, Main Profile, High Profile	
Frame Rate	Main Stream:4MP(2592×1520): Max. 20 fps, 4MP(2560×1440): Max. 25 fps, 3MP(2048×1520): Max. 30 fps; Sub Stream:2MP (1920×1080): Max. 30 fps; Third Stream:D1(720×576) : Max. 30fps	
HLC	Supported	

BLC	Supported	
9:16 Corridor Mode	Supported	
OSD	Up to 8 OSDs	
Privacy Mask	Up to 8 areas	
ROI	Up to 8 areas	
Motion Detection	Up to 4 areas	
	Audio	
Audio Compression	G.711	
Two-way audio	Supported	
Suppression	Supported	
Sampling Rate	8 KHZ	
	Storage	
Edge Storage	Micro SD, up to 256 GB	
Network Storage	ANR	
	Network	
Protocols	IPv4, IGMP, ICMP, ARP, TCP, UDP, DHCP, PPPoE, RTP, RTSP, RTCP, DNS, DDNS, NTP, FTP, UPnP, HTTP, HTTPS, SMTP, 802.1x, SNMP	
Compatible Integration	ONVIF(Profile S, Profile G), API	
	Interface	I
	Audio cable	
Audio I/O	Input: impedance 35 kΩ; amplitude 2 V [p-p]	
	Output: impedance 600 Ω; amplitude 2 V [p-p]	
Alarm I/O	(1/1)	
Network	1 RJ45 10M/100M Base-TX Ethernet	
Video Output	1 BNC, impedance 75 Ω; amplitude 1 V [p-p]	

General		
	DC12V±25%, PoE (IEEE802.3 af)	
Power	Power consumption: Max 7.2 W	
Dimensions (Ø x H)	Φ148 x 111.3 mm (Ø5.8" x 4.4")	
Weight	0.75 kg (1.7 lb)	
Working Environment	-40°C ~ +60°C (-40°F ~ 140°F), Humidity:10% ~ 95% RH(non- condensing)	
Ingress Protection	IP67	
Vandal Resistant	IK10	
Reset Button	Supported	
Certification	UL, RoHS,CE,FCC,IP67,IK10,LAB TEST Reports	
BULLET CAMERA		
Item	Minimum Specification	Compliance (Yes/No)
Sensor	1/2.8", progressive scan,4.0 megapixel, CMOS	
Lens	2.8~12mm, AF automatic focusing and motorized zoom lens	
Angle of View(H)	91° ~ 27°	
Angle of View (V)	54.4°~13.7°	
Angle of View (O)	118.3°~33.2°	
Adjustment angle	Pan: 0°~360° Tilt: 0°~90° Rotate: 0°~360°	
Shutter	Auto/Manual, 1~1/100000 s	
Minimum Illumination	Colour: 0.001 Lux (F1.4, AGC ON) 0 Lux with IR on	
Day/Night	IR-cut filter with auto switch (ICR)	
Digital noise reduction	2D/3D DNR	
S/N	>52 dB	
IR Range	Up to 50m (164 ft) IR range	

Defog	Digital Defog	
WDR	120dB	
	Video	
Video Compression	Ultra 265,H.265, H.264, MJPEG	
H.264 code profile	Baseline profile, Main Profile, High Profile	
Frame Rate	Main Stream:4MP (2592×1520): Max. 20 fps , 4MP (2560×1440): Max. 25 fps, 3MP (2048×1520): Max. 30 fps; Sub Stream:2MP (1920×1080): Max. 30 fps; Third Stream:D1(720×576) : Max. 30fps	
9:16 Corridor Mode	Supported	
HLC	Supported	
BLC	Supported	
OSD	Up to 8 OSDs	
Privacy Mask	Up to 8 areas	
ROI	Up to 8 areas	
Motion Detection	Up to 4 areas	
	Smart	
Behavior Detection	Intrusion, cross line, motion detection	
Intrusion cross line	Enter and loiter in a pre-defined virtual region Cross a pre-defined virtual line	
motion detection	Moving within a pre-defined virtual region	
Recognition	Face detection Audio detection	
Intelligent Identification	Defocus, Scene Change, Object Left, Object Moving	
Statistical Analysis	People counting	
General Function	Watermark, IP Address Filtering, Tampering Alarm, Alarm input,	

	Alarm output, Access Policy, ARP Protection, RTSP Authentication,	
	User Authentication	
	Audio	
Audio Compression	G.711	
Two-way audio	Supported	
Suppression	Supported	
Sampling Rate	8 KHZ	
	Storage	
Edge Storage	Micro SD, up to 256 GB	
Network Storage	ANR	
	Network	
Protocols	IPv4, IGMP, ICMP, ARP, TCP, UDP, DHCP, PPPoE, RTP, RTSP, RTCP, DNS, DDNS, NTP, FTP, UPnP, HTTP, HTTPS, SMTP, 802.1x, SNMP	
Compatible Integration	ONVIF(Profile S, Profile G, Profile T), API	
Interface		
Audio I/O	Audio cable Input: impedance 35 kΩ; amplitude 2 V [p-p] Output: impedance 600 Ω; amplitude 2 V [p-p]	
Alarm I/O	(1/1)	
Network	1 RJ45 10M/100M Base-TX Ethernet	
	General	
Power	12 V DC±25%, PoE (IEEE802.3 af) Power consumption: Max 9W	
Dimensions (L \times W \times H)	253.4 ×86 ×71.7 mm (9.98" × 3.4" × 2.8")	
Weight	1.0 kg (2.2 lb)	
Working Environment	-35°C ~ +60°C (-31°F ~ 140°F), Humidity:10% ~95% RH(non- condensing)	
Ingress Protection	IP67	
Certificate	UL,FCC,CE,IP67,IK10	

PTZ CAMERA					
General Specfication	Technical Specification	Compliance (Yes / No)			
Camera					
Sensor	1/1.8", 4.0 megapixel, progressive scan, CMOS				
Lens	5.7 ~ 216.6mm, AF automatic focusing and motorized zoom lens				
Digital Zoom	16				
Optical Zoom	38				
Angle of View (H)	58.5° ~ 2.1°				
Angle of View (V)	34.9° ~ 1.2°				
Angle of View (O)	72.0° ~ 2.5°				
Shutter	Auto/Manual; shutter time: 1 ~ 1/100000s				
Minimum Illumination	Colour: 0.0005Lux (F1.3, AGC ON) 0Lux with IR				
Iris	Auto/Manual; F1.3 ~ F4.6				
Day/Night	R-cut filter with auto switch (ICR)				
Digital noise reduction	2D/3D DNR				
S/N	>55dB				
IR Range	UP to 250m (820ft)				
Defog	Optical Defog & Digital Defog				
WDR	120dB				
Video					
Video Compression	Ultra 265, H.265, H.264, MJPEG				
H.264 code profile	Baseline profile, Main Profile, High Profile				
Frame Rate	Main Stream: 4MP (2688*1520), Max 60fps; Sub Stream: 2MP				

	(1920*1080), Max 60fps; Third Stream: D1 (720*576), Max 60fps			
HLC	Supported			
BLC	Supported			
EIS	Supported (Gyroscope)			
OSD	Up to 8 OSDs			
Privacy Mask	Up to 24 areas			
ROI	Up to 8 areas			
Motion Detection	Up to 4 areas			
	Audio	-		
Audio Compression	G.711			
Two-way audio	Supported			
Suppression	Supported			
Sampling Rate	8KHZ			
Storage				
Edge Storage	Micro SD, up to 256GB			
Network Storage	ANR			
	Network			
Protocols	IPv4, IGMP, ICMP, ARP, TCP, UDP, DHCP, PPPoE, RTP, RTSP, RTCP, DNS, DDNS,NTP, FTP, UPnP, HTTP, HTTPS, SMTP, 802.1x, SNMP,QoS			
Compatible	ONVIF (Profile S, Profile G,			
Integration	Profile T), API			
Pan & Liit				
Pan Range	360° (endless)			
Pan Speed	0.1°/s ~ 74°/s			
	Preset speed: 300°/s			

Tilt Range	$-20^{\circ} \sim 90^{\circ}$ (auto reverse)	
	0.1° ~ 74°/s	
Tilt Speed	Preset speed: 240°/s	
Number of Presets	1024	
Patrol	Preset patrol, route patrol, recorded patrol	
Home Position	Supported	
	Interface	
	Audio cable	
Audio I/O	Input: impedance 1kΩ; amplitude 2V [p-p]	
	Output: impedance 600Ω; amplitude 2V [p-p]	
Alarm I/O	(2/1)	
Serial Port	1 RS485	
Network	1 RJ45 10M / 100M Base-TX Ethernet	
	General	
Power	AC 24V ±25%, DC 24V ±25%, PoE++ (IEEE 802.3bt) (IEEE802.3bt switch required) Power consumption: 16 ~ 51W	
Dimensions (Ø x H)	Φ270 x 496.7mm (Φ10.6" x 19.6")	
Weight	9.69kg (21.4lb)	
Working Environment	-40°C ~ 70°C (-40°F ~ 158°F), Humidity: ≤95% RH (non-condensing)	
Ingress Protection	IP66	
Reset Button	Supported	

NVR SYSTEM				
General Technical Specific	cation Compliance(yes /no)			
Video/Audio Input :				

IP Video Input	32-ch			
Two-way Audio	1-ch, RCA			
Input	Network ·			
Incoming Bandwidth	320Mbps			
Outgoing Bandwidth	320Mbps			
Remote Users	128			
Protocols	IPV4, IPV6, SNMP,P2P, UPnP, NTP, DHCP, PPPoE, HTTP, SMTP, TCP/IP, RTSP			
HDMI/VGA Output	HDMI1 VGA : 1920x1080p /60Hz, 1920x1080p /50Hz, 1600x1200 /60Hz, 1280x1024 /60Hz, 1280x720 /60Hz, 1024x768 /60Hz HDMI2: HDMI2 :			
	HDM12 : 4K (3840x2160) /60Hz, 4K (3840x2160) /30Hz, 1920x1080p /60Hz, 1920x1080p /50Hz, 1600x1200 /60Hz,1280x1024 /60Hz, 1280x720 /60Hz, 1024x768 /60Hz			
CVBS Output	1-ch, BNC			
Recording Resolution	12MP/8MP/6MP/5MP/4MP/3MP/1080p/960p/720p/ D1/2CIF/CIF			
Audio Output	1-ch, RCA			
Synchronous Playback	16-ch			
Corridor Mode Screen	3/4/5/7/9/10/12/16/32			
Decoding format	Ultra 265, H.265, H.264			
Live view/ Playback	12MP/8MP/6MP/5MP/4MP/3MP/1080p/960p/720p/ D1/2CIF/CIF			
Capability	3 x 12MP@25, 4 x 4K@30, 8 x 4MP@30, 16 x 1080P@30, 32 x 960P@25, 36 x 720P@30, 64 x D1			
Hard Disk :				
SATA	8 SATA interfaces			

Capacity	up to 10TB for each HDD	
eSATA	1 eSATA interface	
VCA Detection	Face detection, Intrusion detection, Cross line detection, Audio detection, Defocus detection, Scene change detection, Auto tracking	
VCA Search	Face search, Behavior search	
Statistical Analysis	People counting	
Array Type	RAID 0, 1, 5, 6, 10	
Network Interface	2 RJ45 10M/100M/1000M self-adaptive Ethernet Interfaces	
Serial Interface	1 x RS232, 1 x RS485	
USB Interface	Front panel: 2 x USB2.0,Rear panel: 1 x USB3.0	
Alarm In	16-ch	
Alarm Out	4-ch	
	1	
Power Supply	100 ~ 240 VAC	
r ower Suppry	Power Consumption: ≤ 20 W(without HDD)	
Working	-10° C ~ + 55°C (+14°F ~ +131°F), Humidity \leq	
Environment	90% RH(non-condensing)	
Dimensions(W× D×H)	442mm ×425mm× 86mm (17.4" × 16.7"× 3.4")	
Weight (without HDD)	\leq 5.13 Kg (11.31 lb)	
Certification	CE, FCC, ISO9001, ISO14001	

IV. ACCESS CONTROL SYSTEM

General Specification

- OEM should be ISO 9001:2008, ISO 14001:2004, ISO 13485:2003 company (Need to submit ISO certificate) and comply the EU Directive 2002/95/EC on Restriction of Hazardous Substances (RoHS)
- Tenderers are advised that preference will be given to systems employing access control hardware, UHF reader and software design developed and manufacture by same OEM.
- Physical access to the premises is proposed to be controlled right from the main entry to

the premises at the periphery level.

- The system should support seamless integration with CCTV & Fire Alarm Systems.
- Communication Speed 9600, 19200, 57600, and 115200bps
- It is possible to issue maximum 15 cards per user under single user id to create uniformity in data base.
- DB format SQL Express Server 2012, password protected.
- DB Backup, Backup now option or clear all now option Complete DB export configuration or by event (selectable backup and restore) for easy set up and configuration.
- The system is intended to ensure situational awareness by displaying relevant information like events or devices in a Map.
- The access control system application software shall be client server architecture.
- Bidder has to submit OEM authorization letter to insure service and support.

AC-225IP Specification

- Description: 2 reader 2 door Intelligent I.P Controller with TWO READERS, FOUR RELAY OUTPUTS AND FOUR SUPERVISED INPUTS TO THECONTROLLER.
- Expandable to 4 Reader with 2 Reader ExpansionBoard
- UL Listed
- Microprocessor: 32Bit.
- Memory: 30000 User and 20000Logs
- Communication Protocol: Ethernet Port to connect to TCP/IP & RS 485 for downstream panels
- Card Holder Capacity : 30,000Min
- Event Buffer : 20,000Min
- Database Retention: Real-time clock keeps time for up to 2 weeks without power. No batteries toreplace
- Inputs : 4 Supervised, dual-resistor, 2 state end-of-line inputs, Hi-impedance, active low 5 VDC 8 supervised expandableinputs
- Outputs : 4 fully programmable 5 A, N.O. and N.C. relay outputs 4 expandableoutputs
- Interface to Reader : 02 WiegandPort
- Operating Humidity: 0 to 85% (non-condensing).
- RFI Protection > 20 V/m up to 1000MHz
- Operating temperature : $32^{\circ}F$ to $120^{\circ}F$ ($0^{\circ}C$ to $49^{\circ}C$)
- Wiegand Card Format : Two Wiegand 26/32/34/37/40 bit /C&D
- Facility Code: 08Min
- Operation Mode : Card Only/PIN Only/Card Or PIN/Card & PINSelectable
- Anti pass back: Local &Global
- Regulatory Approvals :UL/CE/ROHS/TUV
- Cable cut tamper detection function for readers, and cover tamper detection for the enclosure
- Audio/Visual Built-in sounder (Alarm, Chime, Bell), 11 on-board and 3 P.S.LEDs
- Controller shall also confirm the following Standard:
- <u>CE(EU)</u>
 - EMC:EN50130-4(95)+A1(98)+A2(03)EN55024:98+A1(01)+A2(03)
 - EN61000-3-3:95+A1(01)RADIO: EN55022:98+A1(00)+A2(03)
 - SAFETY: EN60950-1:2006,IEC60950-1:2005

Software - Axtrax Ng - Access control management software

1. System Description

- Software shall be basedona standard Client-Server architecture:
- The server connects to the database; the clients draw the information from the server.
- Clients connect to the server using a LAN remote communication.
- The server runs as a Windows service by default.
- The server operates using an SQL server 2012 database.
- The clients of twareis base dondynamicdocking technology.
- The Software Access Control System is a user- friendly, intuitive, and rich in functionality. Using Software, you can configure door functionalities based on are as and time frame for different types of personnel and for varying alarm situations.
- The Software Access Control System can integrate with Video management, a Video Surveillance software application. The main purpose of the integration is to enable video recording based on access control events and convenient play back.
- Badges can be designed form as sprinting and connectivity with digital cameras for image capture support.
- 2. Functionality

Software makes it possible to control and monitor every aspect of access on a site. The system includes a built-in software security system that controls access to the system database, and logs all performed operations. In addition, the system shall have the following features of professional grade:

- User-friendly PC software with intuitive layout reduces the complexity of access control
- Manages user data, photo and information fields, access rights, alarms, strike time, and door mode, all from one central location.
- Produces reports from acquired data, such as entry and exit times, as well as alarm types initiated by user, location, and time events
- Available in multiple languages and date formats
- Compatible with additional video management software modules
- Password controlled login in which it is possible to grant individually based restricted Security rights for different operators, with access to only specified elements of the system or with read-only access.
- The Software graphic user interface (GUI) shall allow users to configure, monitor, and control every aspect of a facility's access control network.
- When a user selects an element from the TreeView, its contents are shown in the main display area, and the toolbar icons change to suit the selected element.

The Software shall consist of the following major features:

Intelligent Network Configuration

- Monitors and configures all panels connected to the server with auto-detection
- Links between those devices connected to thepanels
- Firm wareupgrades

Camera Interaction

• Real-time viewing of anycamera

- Viewing recorded events
- Automated Video management camera activation options

Time Zone Management

- Time Zones Door access rights, alarms, and input and output behavior can all be set to behave differently with in each time zone.
- Holidays–Sets special access behaviors for holiday time.

Group Management

Each of the 5 kinds of groups (Access Groups, Access Areas, Output Groups, Input Groups, Card+ Card Groups) shall be configureable by the Software to provide features such as:

- Creating links between groups
- Assigning personnel to appropriate Access Groups to limit access to certain areas
- Dividing a facility into several Access Areas to configure and manage it more effectively. Each access area can be assigned an it passes backs rules to prevent one user's card or entry code from being used for two subsequent entries, and to prevent a second entry without a previous exit.
- Defining a set of inputs and outputs as Input and Output groups to control and manage them together with in a panel.
- Configuring Card+Card groups for access to high-security doors, which requires two users to present their cards in order to prevent entrance with a stolen card.

Car Parking Management

• Limits and controls the number of users who can access a specified area such as a parking area

User Management

Each of the five elements (Departments/ Users, Visitors, User Filter, Cards, and Operators) shall be configurable by the Software:

- List of all departments and users, as well as any visitors registered in the system.
- Each user is assigned to a department for easier navigation between user properties.
- For each user, can assign cards and/ or a PIN code, set access rights, and include personal details and an identification photograph.
- User Filter to find users in the data base based on various search parameters, such as name, user number, and access group.
- List of all cards in the system with their statuses, allowing manual or automatic addition of cards to the system.

Visitor Management

• Hosting department of the visitor and a list of all visitors registered in the system who can also be assigned specific access rights can be defined.

- Automatic Visitor Cards deactivation–After exiting the premises, the visitor card automatically becomes in active.
- Access Groups Authorization Removal–The designated access group changes to un authorized up on exit.

Card Design (PhotoID)

- Create badges form assprinting.
- Design the background, size, colour and layout of the card.
- Add photo either from a file or from a PC camera.

Various Reader Outputs

- Supports various pre-set Wieg and formats that can be chosen for the communication format between the proximity card reader and controller.
- A custom reader output format can also be created.
- Desktop enroller allows programming of transmission form at of Smart card readers.

3. Reports

Software can produce various reports, including usage reports, attendance records, visitors, and rollcalls. The Software Report Wizard shall allow users to design their own custom reports based on their needs.

- Software supports two report categories:
- Immediate Reports-List details of recent movements (within the last few hours). They are shown in the display are a and can be exported.
- Archive Reports–List all events in the data base

Immediate Reports

There are four types of immediate reports:

- Who's been in today–Lists where and at what time each user was granted access for the first time today.
- Last known Position–Lists where and at what time to day each user was most recently granted access.
- **Roll-Call Readers**—Lists the last time each reader was given access, and by whom, within the last 1–99hours.
- Roll-Call Areas–Lists all users currently within the selected area, sorted by department and entry time. The report lists all personnel who entered the facility within the last 1– 99 hours.

Archive Reports

You can produce three types of archive reports:

- Panels Event Reports
- System Software EventsReports
- Interactive Reports
- Panels Events Reports

Panel event reports display detail so fall recorded panel events. There are six available panel event reports:

- Attendance Report-Lists the attendance hours for selected users, sorted by date. Results include hours present, time in, and time out.
- Panel's Report–Lists all the events recorded by the selected panels, sorted by date.
- Access Report-Lists all access events recorded by the selected readers, sorted by reader and date.
- Readers Report-Lists all users who have accessed the selected readers, sorted by department and date.
- **Finger print Report**-Lists specific finger prints reader's events, sorted by reader and date.
- Visitors Report-Lists visitors who have madea visit to a certain user or department, or lists all related visitors.

System Software EventsReport

System Software events reports list details of system and operator activity. There are three available system event reports.

- System Report–Lists all operations performed by the Software server, sorted by date.
- **Operators Report**-Lists all the operations performed by registered system operators, sorted by operation event type and date.
- Alarm and Anitpass back Handler Report- Lists all raised system alarms, sorted by operator and date.

Interactive Report

Interactive reports list details of users and their access activity. There are two available interactive reports:

- User Access Rights Report-Lists site access details for selected users, with full details of readers accessed and in which time zones.
- Not Responding Users Report Lists users for whom there have been no access events for a selected period of time.

<u>Vitrax Video Integration Software – B Add on License need to consider base on number of camera to be integrate.</u>

- Digital video recording and remote surveillance client/server software for Microsoft® Windows.
- The software supports live view, video recording and playback from major brand IP cameras of multiple local and remote sites in multi-client/multi-server installations, enabling the export of digital recordings for storage.
- DVR Watchdog Recovery Restarts the server automatically to resume local and remote data flow providing high level of reliability.
- Multi-Server, Multi-Client Support Supports an unlimited number of cameras connected to the IP network on any geographical area. Proprietary Multi-media Database Provides compact storage and efficient export of selected recordings for evidence preservation (own metadata).
- Real-time multi-channel streaming video ISO MPEG-4, Intel IPP, and Direct Show formats for effective compression and bandwidth savings
- Support for console multi-screen viewing Advanced OSD control and presence

triggered by access control systems.

- Full support of all video parameters such as frame per second (fps), bit rate resolution, brightness and contrast; support up to 64 preset locations for PTZ cameras".
- The VMS shall support interoperability with IP camera standards including, at a minimum, the Open Network Video Interface Forum (ONVIF).
- When a camera is linked to Software, video events can be linked to access control events and viceversa.
- The customer can select the source, destination, and period of recordings using Conditioned Recording sequences programmed via the Panel Links screen.
- In the Camera Properties window, the customer can view live streaming, view recorded events, and edit various camera properties.
- The following properties of the Video management can be controlled and changed by the customer:
- Motiondetector
- Timelapse
- Framerate
- Live audiovolume
- Audio tocamera
- Microphone device
- Cameraproperties
- PC archive
- Localarchive
- Snapshot

V. <u>BOLLARD SYSTEM</u>

Technical Specifications

Automatic Bollards

Also known as pop-up, rising, telescopic, or automatic bollards – retractable bollards provide greater flexibility in environments where security and access control may be of equal importance. These bollards shall be placed in are as that need to be secure, but also need to have occasional vehicle or traffic access. The bollards shall be designed for heavy duty applications and recommended for the protection of special areas, such as: military bases, airports, embassies, consulates, banks, prisons, etc. and all those are as where a high level of security and perimeter protection is needed.

Construction

The foundation casing shall be completely hot dip galvanized while the inner structure shall be electrolytically zinc-coated. The bollard shall have a diameter of 275 mm, a thickness of 4 - 10 mm and a height of 800 mm from ground level in standing deterrent position, and is kept 50cm (constraint) inside the foundation casing ensuring in this way a higher resistance grade to impact and crash.

Drive Unit

It shall be in the upper part of the bollard foundation casing which shall be oil-hydraulic drive unit, made up of pump. An oil-hydraulic locking device shall be incorporated to keep the post in standing position all the time, even in case of power failure. The bollard shall be equipped with: two magnetic limit switches, one for the post in raised position and one for the post in down position, LED lights, type approved reflecting sticker, quick-release connector (protection grade IP 66) for the power supply cable. It shall be pre-wired, and all the inner electrical connections shall be factory-made to a water-tight junction box, fitted with a quick release connector, IP 66 grade.

Command & Pedestrian Safety

In case of impact with a vehicle, the bollard may be damaged, but it shall still be able to operate properly.

Pedestrian safety shall be ensured in a way that the head of the bollard shall be completed with a rubber edge as a protection in case of accidental impacts by pedestrians. The bollard shall have ant scratching design of the post by the means of diameters of the top (head) and cylinder are different being different in size.

Accessories

- 1. 24 Vdc solenoid valve that allows for the post to lower in case of electric power failure.
- 2. Obstacle detector (pressure switch) that shall sense the presence of an obstacle on the post prevents & it from rising, or, should it be in rising phase, travel is reversed until the post is flat with ground level.
- 3. Beeper acoustic device that shall be emitting a warning intermittent sound.
- 4. Option for heating device ensuring correct and proper functioning of the bollard in very low temperature conditions, down to -40°C.
- 5. Special release spanner for manual lowering of thepost.

S.No.	Item	Description
1	Application	Outdoor
2	IP Rating	67
3	Post Height	800 mm
4	Post Diameter	275mm
5	Post Thickness	4 to 10 mm
6	Material of Construction	AISI 304 SS STEEL
7	Finish	Brushed Steel
8	Rising Time	3-5 seconds
14	lowering Time	3 -5 seconds
15	Voltage Supply	230+/- 10% VAC, 50 Hz.
16	Maximum absorbed power	1200 watts
17	Operating Temperature (with	-20 °C to +80 °C
	heating device)	
16	Protection Standard	IP 67
19	Duty Cycle	Intensive
20	Impact Resistance	50000-55000 J
21	Crash Resistance	300000-325000 J
22	Static Load	20000 kg
	Minimum Connecting cable	
20	length to be supplied	50 meters
21	Weight	190 to 220 kgs
22	Crash Rating	K4

VI. <u>BOOM – BARRIER SYSTEM</u>

General:

Hydraulics' Drive Mechanisms with internal locking feature circuit controller for Auto off in fully raised & lowered position with limits witches and manual operation in case of Power failure. PCB Electronic to automatically switch off motor in case of fault.

Technical:

•	Blockingheight	-	110cm
•	Blockingdimensions	-	125 mm x 75mm
•	Opening/Closingtime	-	5-8sec
•	Steel Structure–Complied	-	K4, K8 &K12
•	CorrosionProtection	-	Galvanized
•	IngressProtection	-	IP 54
•	DutyCycle	-	100%
•	Operatingtemperature	-	15 + 55 degC
•	OperatingHumidity	-	98%
•	PowerConsumption	-	1300W
•	PowerSupply	-	3 Phase, 400-440 V, AC 50-60Hz
•	AbsorbedCurrent	-	3-5 A

Supported Optional Accessories:

Remote & Receiver

- Photocell
- Buzzer

VII. FlashingLight

IT –Passive

Technical Specification

A) Cat 6A (U/UTP) IndoorCable.

	Minimum Specifications	Compliance Yes/No	Remark
1	UTP Cable, TIA-568C.2, Category-6A (U/UTP), (305 Mtrs./1000 feet per Box)		
1.1	All cables shall be 4-pair 100 ohms balanced paired cables. They are unshielded twisted pair cables (U/UTP) meeting or exceeding the quality and performance requirements for Category 6A cables stipulated in EIA/TIA-568-C standard, and ISO/IEC 11801		

1.2	ANSI/TIA-568-C.2 Category 6A (U/UTP).	
1.3	Meets EIA/TIA 568-C.2 Category 6A specifications. Cat 6A 4 Connector Channel Performance ETL Report need to be submitted to validate the cable channel performance.	
1.4	The cable shall have Centre filler to maintain pair twisting, and optimum NEXT (Near End Crosstalk) and ELFEXT (Equal Level Far End Crosstalk) performance.	
1.5	The cable shall be accompanied with traceable serial numbers from the manufacturer indicated on the packaging to assist in quality validation of the installed cables	
1.6	Conductor: Solid Bare Copper	
1.7	AWG: 23	
1.8	Filler: PE	
	1.0-500.0MHz Delay Skew (ns/100m): <= 45	

B) <u>Faceplate Single with Mounting/GangBox</u>

	Minimum Specifications	Compliane Yes/No	Remark
1	Faceplate Simplex		
1.1	Shall be Single Port or Dual port (RJ45) square plate, dimension as per commercially available modular office furniture.		
1.2	Shall have spring shuttered front access for preventing ingress of dust		
1.3	Face Plate Shall be supplied with Gang Box of the same OEM if manufactured by OEM or equivalent Brand (Legrand, Anchor & Havells) if not manufactured by OEM.		
1.4	Shall have Write on labels in transparent plastic window along with the plate		
1.5	Shall have Screw hole covers along with the plate		
1.6	Shall be able to support variety of jacks (Cat6 & Cat6A) – UTP and STP Information outlets		

C) UTP/FTP Patch Panel 24 ports unloaded multipurpose for Cat6AJack

S. No.	Minimum Specifications	Compliance Yes/No	Remark
1	UTP Jack Panel, Unloaded with Individual Replaceable Jack 24 nos. UTP ports for PCB based IO Jacks		
1.1	Shall be unloaded individually replaceable 24 nos. Category-6 AI/O Jacks complying with TIA-568.C		
1.2	Shall be 19" rack mountable and of 1U height & complete with all mounting accessories.Shall be UL Listed, ETL Verified and RoHS Compliance.		
1.3	Shall have labels for identification of ports		
1.4	Shall have Comprehensive port numbering on front		

D) Information Outlet (I/O) RJ45CAT6A

S. No.	o. Minimum Specification		Remark
1	Information Outlet (I/O) RJ45 CAT6A		
1.1	The modular jack should comply with EIA/TIA-568-C standard, and ISO/IEC 11801 Class Ea standards;		
1.2	The modular jack should have universal color coding for T568A and T568B standard cable termination;		
1.3	Contact pins are copper alloy gold-plated with 50u inch;		
1.4	IDC connectors of modular jack shall support insulation slicing of 22 to 24AWG.		
1.5	Comply to Cat6A component level;		
1.6	UL Listed		
1.7	Spring Wire/Contact Pins: Phosphor Bronze Alloy Plated with 50μ " of Gold over 70~100 μ " of Nickel		
1.8	IDC: IDC Wire Gauge should be 22-24 AWG.		
1.9	RJ-45 Pin Connector: IEC 60603-7 compliant		
1.10	Insertion / Extraction Life: 750 Cycles Min.		
1.11	Insulation Resistance: 500MOhm at 100 V DC		

1.12	Contact Resistance: 20m Ohm	
1.13	Colors (any 4)- Blue, Grey, Yellow & Red (As required IITK)	
1.14	Comply to below standard PoE+ 30W (Power over Ethernet Plus) 4PPoE 100W (Power over Ethernet)	

E) <u>Cat 6A UTP/FTP Patch Cord 1Mtr.</u>

S. No.	S. No. Minimum Specifications		Remark
1	Cat 6A UTP/FTP Patch Cable, TIA-568C Category-6A		
1.1	All patch cords shall exceed the performance requirements in EIA/TIA and ISO/IEC Category 6A /Class specifications or equivalent; and the copper patch cords shall be used to cross- connect the Category 5 and Category 6 cables in the racks/frames within the IT Rooms and the Central Server Room.		
1.2	The patch cords shall provide air-tight connections and shall comply with ISO/IEC 11801 Class Ea and EIA/TIA 568-C-2 Category 6A requirement and Power SUM NEXT requirement.		
1.3	Patch cords shall be available in 1.0, 2.0, 3.0, and 5.0 metres, excluding modular plugs at both ends; The RJ45 plugs are shielded with brass alloy. The assembly boot ensures excellent strain relief and together with the insert, ensures that performance is stable when using the Patch Cord.		
1.4	Patch cords colour shall be available in Blue, Grey, and White colours, with matching boots to help with circuit identification in cabinet.		
1.5	All cordage shall be round, and shall consist of 22-24 AWG copper, stranded conductors, tightly twisted into individual pairs;		
1.6	Comply with Cat6A UL/ETL Listed;		
1.7	Rated Temperature (1) min 60		
1.8	Reference Standards TIA/EIA 568B.2-10 & ISO/IEC 11801 Class Ea		
1.9	AWG 26		
1.10	PairCount 4-Pair Individually Color with Fillerand		

1.11	Durability 750 Mating CyclesMin.	
1.12	PlugHousing Polycarbonate,UL94V-0	

H) 6 Core MM Fiber Cable

		06 CORE FIBER CABLE SPECIFICATION	Compliance Yes/No	Remark
1.1	Cable Type	6-core, Multi-Mode HDPE Sheath, Armored, loose-tube, Uni Tube, CST armour, Gel Filled		
1.3	No. of cores	6		
	Cable Type	OM4		
	Attenuation			
	@1310nm	< = 0.36 dB/Km		
	@1550nm	< = 0.22 dB/Km		
	Tensile rating	1000N		
	Maximum Crush resistance	2000N		
	Operating Temperature	-10 Degree C to +60 Degree C		
	Armor	Corrugated Steel tape Armor for anti - termite, anti - rodent		
	Colour	Natural		
	Outer jacket	High density polyethylene		
	Secondary Buffer Material	Gel filled Loose Tube.		
	Loose Tube Outer Dia	1.9 mm +/-0.1mm		
	Cable Weight	75 +/- 20 KG per KM		
	Min Bend	20 XD		
	Marking	Identification marking at regular intervals of 1 meter		

	Length of cable drum	standard factory length and can be supplied is max 4 Kms		
2		12 Port & 48 port LIU	Compliance Yes/No	Remark
2.1		Rack Mount Sliding Fiber Panel is essentially a fiber distribution box wherein the fiber cables and the equipment cables are terminated and managed. This panel is unloaded (with no blank plate by default). It can accept optional 4 blank plates or adaptor plates with choice of SC, LC, ST, FC. Splice tray is pre-installed to support fusion splicing on site. Sliding mechanism ease he installation. Together they function as an excellent interfacing unit for cables coming in from field and those originating from the equipments, providing cross-connectioncapability.		
2.2	Material	Powder Coated Aluminium Alloy		
2.3	Dimensions (HxWxD)	U: 44 x 482 x 330mm		
2.4	Max. fibercount	U: 24 fibers (SC), 48 fibers (LC)		
2.5	Fusion Tray & Cable Disc	BS Plastic Grey		
2.6	Fusion Capacity	4 Fiber (Max) Per Splice Tray		
2.7	Heat ShrinkTube	E + EVA Plastic (Transparent)		
3		Fiber Pigtails	Compliance Yes/No	Remark
3.1	Outer Diameter	.6mm Simplex		
3.2	Minimum Cable Retention Strength 1.6mm Jacket	1.24 lbs (50N)		
4		Fiber Patch Cords	Compliance Yes/No	Remark

4.1	Outer	.6mm x 3.0mm (Duplex)		
	Diameter			
4.2	Minimum			
	Cable	1.24 lbs (50N)		
	Retention			
	Strength			
4.3	Jacket	SZH		
4.4	On creating	1000	_	
4.4	Temperature	10°C~ +60°C		
	TYPE	C to SC) 3m - OM4 50/125		
S. No.		Minimum Specifications	Compliance Yes/No	Remark
1		27U Rack - Cabinet		
1.1	Basic Structure	Four Pillars of CRCA Steel Folded		
	Top & Bottom	Bolted to Frame With Cable entry exit cut		
1.2	Cover	outs		
1.3	Construction	Welded or CKD		
1.4	Doors Front	Lockable Glass Door OR Lockable Perforated steel Door		
1.5	Doors Rear	Lockable Steel Door Plain/Perforated		
1.6	Colour	Black or Light Grey		
17	Stondord Einish	Powder Coated as Per Required, Colour		
1./		(Black, Light Grey)		
1.8	Certifications	DIN- 41494,EIA-310,IEC-60297		
1.9	Capacity	/50 Kg with caster &1250 Kg with levelers/Plinth		
	Ordering	Height-27U, Width 600 MM & Depth		
1.10	Information	600MM		
2	42	U Rack - Cabinet		
2.1	Basic Structure	Four Pillars of CRCA Steel Folded		
	Top & Bottom			
2.2	Cover	CRCA Steel Sheet		
2.3	Side Panel	CRCA Steel Sheet		
2.4	Doors Front & Rear	Option Hex Perforated (Single or Double		
2.5	Construction	Bolted Construction		
2.6	Colour	Black or Light Grey		
2.7	Standard Finish	Powder Coated (RAL 7035)		
2.8	Certifications	DIN- 41494,EIA-310,IEc-60297		
2.9	Load Bearing Capacity	500 Kg with caster & on base Frame 750 Kg		

	Ordering	Height-42U, Width 800 MM & Depth	
2.10	Information	1000MM	
3		15 U Rack - Cabinet	
3.1	Basic Structure	Four Sides of CRCA Steel	
	Top & Bottom		
3.2	Cover	CRCA Steel Sheet	
3.3	Construction	Welded	
3.4	Colour	Standard Light Grey	
3.5	Standard Finish	Powder Coated (RAL 7035)	
3.6	Certifications	DIN- 41494,EIA-310,IEc-60297	
	Load Bearing		
3.7	Capacity	40 KG	

Technical Specification for (Network Rack)

VIII. <u>IT –Active</u> <u>MINIMUM TECHNICAL SPECIFICATIONS FOR IT ACTIVE SYSTEM</u> IT ACTIVE SYSTEM

1 - Specification for Core Switch for Corporate Block: -

Standard Compliance	Compliance (Yes / No)
Performance The unit shall have the following minimum specification.	
General	
--	--
Should be chassis based	
Having minimum 9 payload slots	
Should be equipped with 2 x 40G QSFP module	
Should have capability for redundant management module	
Shall have distributed non-blocking architecture.	
Must have power supply redundancy.	
Should support 10/100/1000 base T, 10G, 25G, 40G, 100G from day	
1 Shall have layer 2 switch port and vlan trunk.	
Shall have IEEE 802.3 ad Link aggregation and port Trunking across	
line cards	
Shall have IEEE 802.1Q VLAN encapsulation	
Shall support display and clear MAC address information in	
MAC Address Table	
Shall have IEEE compliance for 802.1Q VLAN, 802.1p, 802.1d	
STP, 802.3ad, 802.1w	
RSTP, 802.1s MSTP, 802.3ad LACP	
Shall have 64000 system wide MAC addresses	
Shall have minimum 4,000 active VLAN	
support	
Shall have basic Routing-Static IP routing, RIP v1/v2, OSPF, BGP,	
RIPng, OSPFv3, Policy based routing.	
Shall have IGMP v1, v2, v3	
Shall have IP multicast routing protocols PIM	
Performance:-	
2.5 TBPS crossbar switching fabric	
Throughput should be 700 million pps	

Quality of Service (QoS)	
Advanced classifier-based	
QoS Traffic prioritization	
Bandwidthshaping	
Port-based rate limiting	
Classifier-based rate	
limiting Reduced bandwidth	
Management	
Remote intelligent mirroring	
Mandatory GUI and CLI based management	
RMON and sFlow v5	
IEEE 802.1AB Link Layer Discovery Protocol (LLDP)	
Security	
Access control lists (ACLs)	
Multiple user authentication methods	
IEEE 802.1X	
users per port	
Web-based authentication	
MAC-based authentication	
Concurrent IEEE 802.1X, Web, and MAC authentication schemes	
per port	
DHCP protection	
Secure management access	
Switch CPU protection	
ICMP	
Port security	
RADIUS/TACA	
CS+	
Secure Shell	
Secure Sockets Layer (SSL)	
Switch management logon security	
IEEE 802.1AE MAC sec	
Resiliency and high availability	
Virtual Router Redundancy Protocol	
(VRRP) Nonstop switching & Routing	
Redundant management and power	
IEEE 802.1s Multiple Spanning Tree Protocol	
IEEE 802.3ad Link Aggregation Control Protocol	
(LACP) Hot-swappablemodules	
Uplink FailureDetection	
Layer 3 Routing	
Policy-based routing, Border Gateway Protocol (BGP),	
Routing Information Protocol (RIP), Static Routes, OSPF	
Layer 3 Service	
UDP, Loopback Interface address, DHCP Server, Route	
Maps, Bidirectional Forwarding Detection (BFD)	

2 - Specification for Core Switch for Admin and HostelBlock:-

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum specification.	
Performance The unit shall have the following minimum specification. Layer 3 routing protocols like Static, RIP, OSPF, RIPnG, OSPFv3 from day 1 for the solution. minimum 8 number of hardware queues per port IGMP v1,v2,v3, IGMP snooping, PIM SM/DM, SNMP v1, v2, v3, SSH, telnet, GUI, Web management Switch should support Link Aggregation Minimum 40 1/10Gig SFP+ and 6 x QSFP ports. Rack mountable and should provide stacking (with single IP Management) Should have 8GB RAM or better Flash memory minimum 2 GB Latency of less than 650ns or better Switch should support minimum 1.4TB switching capacity with 1000 MPPS forwarding rate	
Support for at least 2500 VLANs & 32k MAC	
address Switch should be stackable for easy	
management	

3 - Specification for 48 Port Access SwitchPOE+:-

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum specification.	
Layer3 routing protocols like Static RIP, RIPnG, from day 1 for	
the solution.	
minimum 8 number of hardware queues per port	
IGMP v1,v2,v3, IGMP snooping, PIM SM/DM,	
SNMP v1, v2, v3, SSH, telnet, GUI, Web	
management Switch should support Link	
Aggregation	
Minimum 48 ports of 10/100/1000 base-T and 4SFP+ uplink ports.	
It should support backup power supply	
It should support static route for IPv4 & IPv6 and RIP Ver 1, 2 for IPv4	
& Ipv6	
Rack mountable and should provide stacking (with single	
IP Management)	

200 Gbps or higher Backplane capacity and minimum 160 Mbps of	
forwarding rate	
Support for at least 2500 VLANs & 16k MAC	
address Minimum 780W POE in 48 Port POE+	
switches.	
Should support 2GB Flash and 1 GB	
RAM Switch should be stackable with 8	
switch.	
It should be EAL2+ certified	

4 - Specification for 48 Port Access Switch:-

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum specification.	
Layer3 routing protocols like Static RIP, RIPnG, from day 1 for the solution. minimum 8 number of hardware queues per port IGMP v1,v2,v3, IGMP snooping, PIM SM/DM, SNMP v1, v2, v3, SSH, telnet, GUI, Web management Switch should support Link Aggregation Minimum 48 ports of 10/100/1000 base-T and 4SFP+ uplink p orts. It should support backup power supply It should support static route for IPv4 & IPv6 and RIP Ver 1, 2 for IPv4 & Ipv6 Rack mountable and should provide stacking (with single IP Management) 200 Gbps or higher Backplane capacity and minimum 160 Mpps of forwarding rate Support for at least 2500 VLANs & 16k MAC address Should support 2GB Flash and 1 GB RAM Switch should be stackable with 8 switch. It should be EAL2+ certified	

5 - Specification for 10G SFP Module:-

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum specification.	
10G Ethernet SFP+ Module, 850nm, MMF upto 300m, LC	

6 - Specification for 10G Ethernet SFP+ passive cable assembly, 1m

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum	
specification.	
10G Ethernet SFP+ passive cable assembly, 1m	

7 - Specification for 10G Ethernet SFP+ passive cable assembly, 3m

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum specification.	
10G Ethernet SFP+ passive cable assembly, 3m	

8- Specification for Wireless Controller:-

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum specification.	
ArchitectureRedundant Controller should be appliance or server (physical or virtual) based to support upto 4000 AP or more. The proposed solution should be premise based and not cloud based Access Control, Authentication and Encryption For this "large deployment" scenario, the WLAN solution shall include a built-in RADIUS server for 802.1x and MAC authentication that shall not be proposed as a separate product. The built-in RADIUS server shall support at least following EAP types: EAP-PEAP, EAP-GTC, EAP-TLS, EAP-TTLS. The wireless LAN solution shall support following link layer encryption standards: WPA2_AES, WPA2_TKIP, WPA_AES, WPA_TKIP	

DYNAMIC WEP, WPA PSK AES, WPA PSK TKIP,	
WPA PSK AES TKIP. WPA2 PSK AES.	
WPA2 PSK TKIP.	
The wireless LAN solution shall support following 802.1x	
supplicants: Windows 7, 10, MAC OS, IOS, Android.	
Chromebook	
The wireless LAN solution shall propose a "Guest" management	
solution based on an embedded and built-in Captive Portal	
providing web based authentication for guests and visitors.	
The Guest management solution shall allow non-IT staff	
(e.g., a receptionist) to create temporary guest accounts.	
The WLAN solution shall allow guest self-registration and	
employee sponsored access.	
the Guest management solution shall allow setting a validity	
period for an authenticated device, in order to avoid entering	
credentials each time a guest access the network	
the WLAN solution shall support BYOD and be able to provide	
device onboarding that is as simple as possible and without	
requiring additional third party components	
The on-boarding process of employee devices shall be	
based on employee corporate accounts.	
The BYOD application shall allow setting the validity	
period for the device, and the maximum number of devices	
per account.	
The licensing model of the BYOD application shall be	
based on the number of on-boarded devices.	
Intrusion Detection and Prevention	
The WLAN solution has wIDS/wIPS capabilities with no	
additional and dedicated equipment nor additional license.	
The WLAN solution shall be able to identify Interfering APs.	
The WLAN solution shall be able to identify and contain	
Rogue APs. The WLAN solution shall allow the definition	
of flexible policies to classify an AP as a Rogue AP.	
The WLAN solution shall be able to blacklist a WLAN	
client, either manually or automatically after a client	
attack has been detected. The WLAN solution shall allow	
configuring blacklist duration.	
The WLAN solution shall allow to configure an	
authentication failure times threshold.	
RF Management	
The WLAN solution shall allow automatic and/or	
manual RF management (channel and power).	
The WLAN solution shall support Short Guard Interval.	
If no band/channel (2.4GHz/5GHz) is overloaded (high medium	
utilization) or crowded (high client count), an AP shall by default	
guide a new client to the 5GHz band.	
Even if the 5GHz band is not overloaded but is crowded	
(high client count), an AP shall guide a new client to the	
2.4GHz band.	
If all bands/channels (2.4GHz/5GHz) are overloaded (high	
medium utilization) and the 5GHz is crowded, an AP shall	

guide a new client to	
the 2.4GHz band.	

When a new client discovers multiple APs to associate to, the	
new client shall be guided to the AP that has the fewest	
associated clients, thus allowing smart/dynamic load balancing.	
The WLAN solution shall deny connection to an AP when the	
signal of the client becomes too weak and disconnect a client	
when the signal becomes too weak.	
The WLAN solution shall propose APs that have the ability to	
scan the air in order to provide interfering/rogue APs and	
wireless attacks detection, and shall not rely on dedicated	
scanning equipment.	
The scanning function of the APs shall not impact active voice	
or video calls (SIP and H.323).	
Mobility	
The WLAN solution shall support both Opportunistic Key	
Caching (802.11k).	
The WLAN solution shall comply to the 802.11r standard.	
The centralized management function shall allow to display the	
Wi-Fi	
coverage quality within a given area ("Heat Map").	

9- Specification for Indoor Access Point: -

Standard Compliance	Compliance (Yes/No)
Performance The unit shall have the following minimum specification.	

The WLAN solution shall propose an outdoor 802.11ac wave2	
MU- MIMO indoor dual radio AP Access Point (2.4, 5G) with at	
least one working at 2x2 MIMO	
Supports up to 800 Mbps in the 5GHz band and up to 400 Mbps in the	
2.4 GHz band	
Built-in Bluetooth Low-Energy (BLE)	
radio Advanced Cellular Coexistence	
(ACC)	
Supports priority handling and policy enforcement for unified	
communication apps, including Microsoft Skype for Business	
with encrypted videoconferencing, voice, chat, and desktop	
sharing.	
Adaptive Radio Management (ARM)	
technology Intelligent app visibility and control	
Integrated wireless intrusion protection	
Integrated Trusted Platform Module	
Intelligent Power Monitoring	
Support for up to 512 associated client devices per AP, and up to 16	
SSIDs per radio	
Dynamic frequency selection/ Adjustment optimizes the use of available	
RF spectrum.	
_	

10 - Specification for Network Management Solution:-

Standard Compliance		Compliance (Yes/No)
Perf	formance	
The	unit shall have the following minimum specification.	
1.	The proposed solution should be premise based and not cloud	
	based. This should be based on standard server	
	(Physical/Virtual)	
2.	Redundant solution shall be proposed. The centralized	
	management function shall allow to display the physical topology	
	of the network.	
3.	The centralized management function shall be able to handle	
	wired equipment (switches) and wireless (Access Point)	
	management for a "unified management" approach.	
4.	The solution shall be able to automatically discover new Switch	
	or APs added to the network.	
5.	The solution shall be able to blacklist a client, either manually or automatically after a client attack has been detected	
6.	The centralized management function shall allow per equipment	
	configuration and software backup and restore, and bulk backup	
	and restore.	
7.	The centralized management function shall allow access to all	
	wIPS/wIDS features.	
8.	The centralized management function shall offer, on the basis of	

	an application signature file, insight at application layer (e.g.	
	facebook.com, youtube.com, salesforce.com) even if the	
	applications run on top of the HTTP or HTTPs protocols. It shall	
	also allow control of those applications.	
9.	The solution should allow the admin to easily provision,	
	manage and maintain a network infrastructure with alarms,	
	unified access security policies	
10.	The solution should provide full visibility into wireless, devices	
	and applications, as well as predictive analysis for	
	forward planning	
11.	The management solution should act as comprehensive tools for	
	infrastructure configuration, monitoring, security, device	
	configuration, alert management, to accelerate, downtime	
	resolution, and overall management.	
12.	It should be web based interface with customizable dashboard	
12.	Provide details about problematic devices including	
	temperature, memory etc.	
13.	Monitor network bandwidth and end device traffic pattern	
12.	Provide top applications/users usage analytics real time and	
	historical	
13.	Port utilization details and threshold limits	
14.	Provides threat mitigation through a secure perimeter against	
	intrusion and malware attacks	
15.	Should support third party network devices for basic SNMP	
	and report	
16.	Port utilization details and threshold limits	
17.	Provides threat mitigation through a secure perimeter against	
	intrusion and malware attacks	
18.	Should support third party network devices for basic SNMP	
	and report	

Specification for NGW:-

	Standard Compliance	Compliance (Yes/No)
	Firewall	(105/100)
1.	The Firewall should be Hardware based, Reliable, purpose-built security	
	appliance with hardened operating system that eliminates the security risks	
	associated with general-purpose operating systems	
2.	The Proposed Firewall Vendor should be in the Leader's in Quadrant of	
	Gartner Magic Quadrant for Enterprise Network Firewall.	
3.	Firewall appliance should have at least 20x 1GE interface, 6x 10G SFP+	
	interfaces and 2 GE RJ45 Management ports	
4.	The solution should support minimum 9 Gbps of NGFW (FW + IPS +	
	AVC) throughput for Mix / production traffic	
5.	The solution should support minimum 5 Gbps of Threat Prevention (FW	
	+ IPS + AVC + AV) throughput for Mix / production traffic	
6.	Firewall should support minimum 30 Gbps of VPN throughput	

7.	Firewall should support 20000 site-to-site & client to site VPN Tunnels	
8.	Firewall should support minimum 5,000 concurrent SSL VPN users and	
	should be scalable in future	
9.	Firewall should support 480,000 new sessions per second	
10.	Firewall should support 20 Million concurrent sessions	
11.	The Firewall solution should support NAT64, DNS64 & DHCPv6	
12.	The proposed system shall be able to operate on either Transparent	
	(bridge) mode to minimize interruption to existing network	
	initrastructure or NAI/Route mode. Both modes can also be	
13	The proposed system should have integrated Traffic Shaping	
15.	functionality.	
14.	The Firewall & IPSEC VPN module shall belong to product family	
	which minimally attain Internet Computer Security Association	
	(ICSA) Certification.	
15.	The proposed system should support	
	a) IPSEC VPN	
	b) PPTP VPN	
	c) L2TP VPN	
16.	The device shall utilize inbuilt hardware VPN acceleration:	
	a) IPSEC (DES, 3DES, AES) encryption/decryption	
	b) SSL encryption/decryption	
17.	The system shall support the following IPSEC VPN capabilities:	
	a) Multi-zone VPN supports.	
	b) IPSec, ESP security.	
	c) Supports NAT traversal	
	d) Supports Hub and Spoke architecture e) Supports Redundant	
10	gateway architecture	
18.	The system shall support 2 forms of site-to-site VPN	
	a) Route based IPSec tunnel	
	h) Policy based IPSec tunnel	
19	The system shall support IDSEC site to site VDN and remote user VDN in	
17.	transparent mode.	
20.	The system shall provide IPv6 IPSec feature to support for secure IPv6	
	traffic in an IPSec VPN.	
	Virtualization	
21.	The proposed solution should support Virtualization (Virtual Firewall,	
	Security zones and VLAN). Minimum 5 Virtual Firewall license should be	
	provided.	
22	The IDS conshility shall minimally attain NSS Cartification	
22.	The IFS capability shall minimally attain NSS Certification	
23.	The IDS detection methodelesis and the first of the first	
24.	I ne IPS detection methodologies shall consist of:	
	a) Signature based detection using real time updated database	

	b) Anomaly based detection that is based on thresholds	
	The IPS system shall have at least 7,000 signatures	
25.	IPS Signatures can be updated in three different ways: manually, via pull	
	technology or push technology. Administrator can schedule to check for	
	new updates or if the device has a public IP address, updates can be	
	pushed to the device each time an update is available	
26.	In event if IPS should cease to function, it will fail open by default and is	
	configurable. This means that crucial network traffic will not be blocked	
	and the Firewall will continue to operate while the problem is resolved	
27.	IPS solution should have capability to protect against Denial of Service	
	(DOS) and DDOS attacks. Should have flexibility to configure threshold	
	values for each of the Anomaly. DOS and DDOS protection should be	
	applied and attacks stopped before firewall policy look-ups.	
28.	IPS signatures should have a configurable actions like terminate a TCP	
	session by issuing TCP Reset packets to each end of the connection, or	
	silently drop traffic in addition to sending a alert and logging the incident	
29.	Signatures should a severity level defined to it so that it helps the	
	administrator to understand and decide which signatures to enable for	
	what traffic (e.g. for severity level: high medium low)	
	Antivirus	
30.	Firewall should have integrated Antivirus solution	
50.	The wan should have integrated 7 million as solution	
31.	Firewall antivirus should have minimally attain Internet Computer	
	Security Association (ICSA) Certification.	
32.	The proposed system should be able to block, allow or monitor only using	
	AV signatures and file blocking based on per firewall policy based or	
	based on firewall authenticated user groups with configurable selection of	
	the	
	following services:	
	a) HTTP, HTTPS	
	b) SMTP, SMTPS	
-	c) POP3, POP3S	
	d) IMAP, IMAPS	
	e) FTP, FTPS	
33.	The proposed system should be able to block or allow oversize file based	
	on configurable thresholds for each protocol types and per firewall policy.	
	Web Content Filtering	
	0	
34.	The proposed system should have integrated Web Content Filtering	
	solution without external solution, devices or hardware modules.	
35.	The proposed solution should be able to enable or disable Web Filtering	
	per firewall policy or based on firewall authenticated user groups for both	
	HTTP and HTTPS traffic.	
36.	The proposed system shall provide web content filtering features:	
	a) which blocks web plug-ins such as ActiveX. Java Applet, and Cookies.	

	b) Shall include Web URL block	
	c) Shall include score based web keyword block	
	d) Shall include Web Exempt List	
37.	The proposed system shall be able to queries a real time database of over	
	110 million + rated websites categorized into 70+ unique content	
	categories.	
	Application Control	
38.	The proposed system shall have the ability to detect, log and take action	
	against network traffic based on over 3000 application signatures	
39.	The application signatures shall be manual or automatically updated	
40.	The administrator shall be able to define application control list based on	
	selectable application group and/or list and its corresponding actions	
	High Availability	
41.	The proposed system shall have built-in high availability (HA) features	
	without extra cost/license or hardware component	
42.	The device shall support stateful session maintenance in the event of a	
	Fail-over to a standby unit.	
43.	High Availability Configurations should support Active/Active or Active/ Passive	
	Logs and Report	
44.	The Logs and Reporting platform must be a dedicated same OEM	
15	appliance and VM/software running on server will not be accepted.	
43.	The Logs and Reporting platform support running on-demand and scheduled reports	
46	Scheduled reports	
40.	please quote separate appliance	
47.	Real-time display of information allows you to follow real-time trends in	
	network usage such as the source IP address and the destination URL for	
	HTTP traffic or IM message traffic.	
48.	All log files and messages are searchable and can be filtered to drill down	
	and locate specific information.	

IX. IPPBX System

IPPBX Technical Specifications

Sl. No	Technical Qualitative Requirements/ Specifications		Compliance (Y/N)
1	System Architecture	The telephony system should be designed with IP at the core Server & Gateway type communications system, allowing fully distributed IP solutions across data networks. The system will be call servers based and it should support traditional TDM or mixed IP- TDM or full 100% IP configurations, telephony,	

	gateway, end points & all telephony application should be from same OEM& PRI card should not be	
	installed in any PC/ Server	
	It should support the following devices :-	
	(i) IP Communication Devices e.g. IP Phones, Video	
	Phones, Multimedia PCs, SIP phones, Softphones	
	or H.323 terminal devices etc.	
	(ii) Legacy TDM communication devices (Digital	
	and analog 2 Wire telephone instruments with	
	Caller-ID	
	The <u>call control servers should be fully redundant</u>	
	solution The solution must provide geographical	
	$I \Delta N/W \Delta N$	
	Laiv waiv.	
	server which is installed at geographically different	
	location over LAN/WAN should take over the entire	
	communication network load.	
	The proposed system should support both industry	
	standard OEM servers (HP, Dell, Lenovo) and	
	Proprietary hardware as Call control server	
	The system should be capable of supporting analog	
	and IP Telephones. System should support up to 5000	
	users on the same hardware that is supplied as part of	
	The system should manage CAC (Call Admission Control) mechanisms to optimize the usage of the	
	bandwidth in the WAN for multi-site configurations	
	The system should be capable of supporting a very	
	high traffic and should support a Busy Hour	
	Completion (BHCC) of 3, 00,000 per hour.	
	The IPPBX should be day one ready with full	
	telephony Feature/ Functionality; all necessary	
	hardware should be provisioned from day one for this.	
	Full SIP (able to connect 3rd Party SIP Phone & SIP	
	Trunk Public & Private) capability. The main	
	functions of SIP capability should provide SIP	
	Support SID and points in a conversed	
	communications network	
	All the users to be managed in a single database	
	Which is managed centrally no multiple databases &	
	bundling of Telephony system will not consider to	
	meet Specification & scalability.	
	The voice network architecture and call control	
	Functionality should support both SIP & H.323.	
	The system should be based on server gateway	

	Architecture with external server running on Linux	
	The system should be able to operate with H.323/SIP	
	compliant device and it should be able to support	
	internal gatekeeper for the same.	
	The SIP proxy, SIP registrar should be inbuilt in the	
	system and should support open SIP stack compliant	
	hard phones or soft phones also.	
	IPv6 support from day one & The quoted model	
	should be TEC approved. Vendor to submit TEC	
	approval certificate along with the bid	
	The system should have non-blocking architecture at	
	all levels & must support more than 512 time slot	
	The system should support for voice encoding using	
	following standards:-	
	(i) G.711	
	(ii) G.729A	
	(iii) G 722	
	Coll Switching Internal calls - Decad on the C 711	
	<u>can switching</u> . Internal calls : Based on the G./11	
	Uncompressed PCM standard.	
	The System should support Network Time Protocol	
	V4.1.2 (RFC 1305) to synchronize the system	
	date/time of network devices.	
	The system should be suitable to accommodate both	
	Decadic Pulse (DP) and DTMF telephones. The	
	system should support outgoing DIMF transmission	
	even from Digital phones.	
	The system should have <u>non blocking architecture a</u>	
	tan levels like System processing, Switching fabric,	
	power supplies, other resources like DIMF receivers,	
	R2 Receivers, unlimited 3 or more party conference	
	circuits.	
	<u>VoIPSupport</u> . System should support VoIP	
	solutions as an integral part of the system.	
	(1) The system should be fully compliant to VoIP	
	standards like H.323 and SIP (Session Initiation	
	Protocol). Vendor to give clear compliance for the	
	requested standards.	
	(11) The system should be able to operate with any	
	H.323/SIP compliant device and it should be able	
	to support internal gatekeeper for the same. If	
	required, it should be able to inter operate with	
	H.323 standard based external gatekeepers.	
	(111) The SIP proxy, SIP registrar should be inbuilt in	
	the system and should support any open SIP stack	
	compliant hard phones or soft phones.	
	(iv) System should support the QOS features for the	
	VOIP implementation. It should be compliant with	
	both QOS standards (Layer $2 - 802.1 \text{ p/q}$) and	
	Layer 3- Diffserv/TOS).	

		IP v6 IPv6 support from day one & The quoted	
		model should be TEC approved. Vendor to submit	
		TEC approval certificate along with the bid	
		The proposed system should Support Automatic	
		Poute Selection (APS) and Least Cost Pouting (LCP)	
		Koule Selection (AKS) and Least Cost Routing (LCR)	
		features to route the calls based on priorities related to	
		user profile and network availability, along the most	
		cost- effective path. This service should be	
		transparent for users and irrespective of the physical	
		carrier connection.	
		Should provide a cloud-based, enterprise-grade,	
		Communication Platform thus delivering a free	
		collaborative business application extending features	
		viz Instant Messaging/Telephony Presence click to	
		call (dial by name answer release) Call Log P2P	
		Audio/Screen Sharing	
		The system must support on ID Softphone application	
		the system must support an IF Solupione application	
		that allows the users to manage their calls from a PC	
		or NIAC/ IPnone/ IPAD/ Android . Inis user must	
		have access to the full set of telephony services	
		without any degradation. The voice should be	
		managed by the multimedia resources of the PC.	
		Offered solution must support at least 50 remote	
		media gateways	
2	System Security		
		The System must support Syslog services for both	
		internal and external command and configuration	
		control accounting with a minimum of 30 day history	
		The Call Server must be provided adequate protection	
		from possible virus worm and Trojan infestation	
		The Call Server must be provided adequate protection	
		from possible virus worm and Traign infactation	
		from possible virus, worm and frojan mestation	
		points such as internal e-mail servers and they must	
		be updated every month. In case customized hardened	
		linux distributions are being provided this clause will	
		not be applicable.	
		The password and access control must include at	
		least:-	
		(i) Management console access to be provided by dual	
		role based authentication (one of user rep and one	
		of administrator rep).	
		(ii)Management console access must allow only	
		access to level of viewing of running	
		configuration and status of current configurations	
		and syslogs	
		(iii)For any configuration changes again a dual role	
		based authentication system for write access fully	
		integrated with the management console	
		application for carrying out the authorized	

		(iv)Logs of all activities to include configuration	
		change, housekeeping activities and any other	
		action on the system grouped user wise and	
		specifying the time of activity must be available	
		for each day.	
		(v) Account access authentication/ restriction using	
		external RADIUS/ LDAP/ AD resources.	
		Media Gateways should not host services such as	
		proxy, FTP or local dynamic routing except those	
		required for software Up-gradation /backup etc. to	
		prevent exploitation in Distributed Denial of Service	
		attacks.	
		IP Phones should not support direct, external initiated,	
		connections via HTTP, telnet, FTP, TFTP or any	
		other protocol as means to prevent distributed Denial	
		of Service attack exploitation, except those required	
		for software Up gradation/backup etc.	
		IP Phone must support 802.1x (EAP-MD5orbetter)	
		for authentication and access control to the network,	
		this mechanism must allow the user to be connected	
		to the call server once he has passed the	
		authentication process, not before.	
		The system should have the capability to, based on	
		standard mechanism (such as 802.1Q and DHCP),	
		assign automatically the corresponding voice VLAN	
		number to the IP station clients during IP station	
		initialization, allowing for the separation of voice and	
		Data traffic at IP station.	
		Commercial grade optional encryption security with	
		minimum 128 bit key security for both signaling and	
		voice with in a node for all IP subscribers – IP	
		subscriber communications.	
		Commercial grade optional secrecy with minimum	
		128 bit key encryption security for both signal ingand	
		voice for inter-node communication between same	
		type of exchs over IP trunks in which all traffic	
		between analog/digital/IP over the IP trunk must been	
		crypted for both signaling and data.	
		System should use randomly generated keys derived	
		from base keys for every voice and signaling session	
	~	Established by the system.	
3.	System		
	Management		
		The system should provide a dedicated management	
		server/platform that will be based on the latest	
		technologies. This server should support a minimum	
		of five or more clients having different access rights	
		to the applications.	
		The management platform should provide to provide	
		a single graphical client (Graphical User Interface	

	(GUI)) as well as a web based interface for all	
	network elements used in the IP PBX network.	
	The Management platform should provide web access	
	allowing the administrator to manage the system to	
	use any PC with an internet browser	
	The management plotform should provide the	
	following tasks as per the ask :	
	(i) Configuration and measureming	
	(1) Configuration and programming	
	(aa)Services, users, categories and all system Parameters and features.	
	(ab)Provide centralized management in local or	
	remote environments of a single system or a	
	network.	
	(ac)The network manager will be able to quickly and	
	easily edit. create or delete any subscriber	
	profile/network object by the use of import/export	
	functions and multiple operations.	
	(ii) Faults and Alarms management	
	(aa) All the incidents and fail reports generated by the	
	System itself informing date, hour and severity.	
	(ab) This module must be able to centralize the alarms	
	and Events of the System and give colors	
	according to the severity level of the alarm. (ac)	
	Notify an alarm depending on the severity level	
	sending an e-mail or activating a script performing	
	a specific action.	
	(ad)Register and generate statistics for the alarms and	
	events in the network on a daily basis.	
	(iii) Fault diagnosis Generate reports and graphics	
	about the statistics of the alarms.	
	(iv) Accounting of all external calls generated by the	
	users including cost, date, hour. Must provide	
	different options to group the monitoring of the	
	calls (cost center, extension number, trunk, user,	
	city/area associated to dialed numbers). IP PBX	
	system should have buffer of last 2500 tickets of	
	call details in case of Call billing system/	
	management system failing	
	(v) Directory module should support to manage the	
	telephone directory. This must be LDAP	
	compatible and the exchange directory should be	
	available on web. The LDAP server and web	
	server application should be integral to the	
	exchange synchronized with other directory	
	applications, must also allow web access and	
	provide information on all desktops allowing click	
	to call features to the users.	
	(v1) Web Interface to Directory Should support	
	exchange directory available on web. The LDAP	
	server and web server application should be	

		integral to the exchange. This feature should be	
		available for all type	
		of users extensions	
		(viii) Integrated Directory. It shall be possible to	
		(vii) <u>Integrated Directory</u> . It shall be possible to	
		provide display equipped voice terminals with	
		access to system directory on digital and IP	
		phones. Also System should support internal and	
		external LDAP directory. Any internal user can	
		use it by browsing the URL link from his laptop/	
		PC to see the directory and	
		Dial the required no by select in gunder LDA	
		Pdirectory.	
		(viii) <u>Call Metering and Accounting</u> The log of	
		local to local call should be supported. The logo	
		flocal to trunk call in both directions (incoming as	
		well as outgoing) should be maintained in the	
		exchange in the hard disk. Should support	
		Malicious Call Trace.	
		(ix) Performance of Trunk operators The system	
		should support to report clearance of calls by	
		operators and evaluate performance index of each	
		operator.	
		(x) <u>Reports</u> The management platform must allow the	
		administrator to generate reports and graphics of	
		the activity per period of time in terms of traffic,	
		accounting and alarms and giving the possibility to	
		generate statistic of all this analysis. Those reports	
		must be predefined but the option to personalize	
		the reports must be also available. These reports	
		should be exportable in HTML, pdf, excel and	
		LDAP (.ldif) formats.	
		(xi) Monitoring Module which allows the	
		administrator to easily monitor the accounting	
		thresholds of the users of cost centers in graphical	
		interface and must allow to send an e-mail or an	
		alarm in case of threshold crossing.	
		Network Topology. The management server should	
		support an application that offers a topological view	
		of the all network elements in graphical form such as	
		main, remote unit and connectivity.	
4	Security		
	-	(i) Administration users connection directly to the call	
		server (Console) must be authenticated via server	
		Before gaining access to the call server.	
		(ii)All management traffic between a remote	
		console/session and the call server must be	
		secured. (SSH for direct command line session,	
		HTTPS (SSL) for web sessions, SFTP for file	
		transfer, etc.)	
		(iii)The management platform must provide Role	

		based account management to define the different	
		Levels of administrator access depending on	
		specific function responsibility.	
5	System	-	
-	Survivability		
	Survivaonity	The system should offer maximum availability with	
		the switchover of call control processing functions to	
		an alternate or redundant processor in the event of	
		significant fault. The redundancy scheme should	
		conform to the model used in most computer systems:	
		the complete "mirroring" of the information (both	
		static and dynamic data.) The switch over between 2	
		call servers in LAN or WAN location over L2 or L3	
		Network should not interrupt existing and	
		established communications to include all analog,	
		digital, hard, soft and Video IP Phones. The complete	
		set of programs and software modules must be	
		duplicated in real time. In case of failure of the main	
		Server (hardware or software), the standby Server	
		(emergency mirror) must take over the control of	
		communications instantaneously.	
		All critical resource elements (call server, hard disks,	
		data bases, IP interfaces, DSP resources, clocking	
		sources, Processor, RAM, Tone generators, All the IO	
		generators resources like DTME receivers. Tone	
		detectors etc.) must be redundant and in a hot-	
		standby configuration	
		Remote Media Gateway should support survival	
		mechanism that allows them to maintain 100% of	
		the telephony services for their users, in case of	
		failure in the WAN links where the signaling with the	
		call server drops.	
		The management platform must provide a backup	
		mechanism for all critical system information in a	
		both annual and an automatic/ schedule archival and a	
		Disaster Recovery Mechanism.	
		<u>Replacement of cards</u> without switching off	
		exchange (hot swappable) including the control cards	
		and peripheral/interface cards.	
		All the tone generation and tone detection should be	
		The system should be able to restart automatically	
		without human intervention when the external ac	
		nower supply is resumed after complete power failure	
		i.e Even after batteries are discharged.	
		The call server should support the two or more	
		different Geographically locations more than 10 Kms	
		in the network.	
		Life Cycle of entire exchange system being provided	
	1		

		should be minimum Five years, 1 year warranty & 5	
		year AMC support	
		Subscriber ports	
		Main Location Should have minimum 24 universal	
		slots in single cabinet/chassis. Other locations should	
		have minimum 8 slot chassis.	
		System shall have backup batteries powering it for 4	
		Hrs.	
6	Environmental	-	
	Conditions		
		The equipment offered shall be capable of maintain	
		its guaranteed performance when operating	
		continuously for 24 hours a day and 365 days a year	
		Operating temperature : 0 to 45 degree C	
		Storage 5 degree C to 145 degree C	
		Humidity 20% to 80% without condensation	
		The avaluate control to 80% without condensation	
		(integrated with system) for cooling the system	
		rack/cabinet	
		Calling line identification restriction for internal calls	
		Camp on busy telephone/hunting group/voice mail,	
		Controlled private call by Pin code and password.	
		Do not disturb, Dynamic call baring General night	
		service Hunting group (fix head cyclic, longest idle	
		time, parallel)	
		Internal/external music on hold internal/external	
		inquiry call individual hold instrument locking to	
		28 Party Maat ma Conformating 28 Party Plast Dial	
		Conferencing	
		Last internal/external number redial Personal code	
		modification. Priority call. Priority cut in. Store and	
		redial external number, Transfer in conversation on	
		free/busy telephone.	
		CLI coming in from ISDN PRI trunks should be	
		displayed on Analog Telephones, Digital Telephones	
		and IP Telephones.	
		External Holding Tone The offered system should	
		be ready to accept music on hold from an external PC	
		of CD player.	
		When all attended consoles are engaged, the external	
		caller shall be informed of this situation by voice	
		inessage. The call should be routed to the least loaded	
9	System Network		
,	System network	-	
	Support		

		Should Support Q SIG standards over IP/ TDM/	
		WAN trunks.	
		Heterogeneous, open numbering plan.	
		Calling/Connected Line Identification Presentation	
		and Restriction.	
		Calling/Connected Name Identification Presentation	
		and Restriction.	
		Call Forwarding Unconditional, Busy, No Reply ,Call	
		Transfer.	
		Call Completion to Busy Subscriber, on No Reply,	
		call Offer.	
		The system should have options to network over any	
		of MPLS, IP, ISDN	
		The system must support the following external	
		telephony interface signaling:-	
		EI CCS PRI	
		E1 CAS (R2 MFC)	
		ISDN PRI (ETSI)	
		Analog Loop Start and Ground Start	
10	Voice Mail	-	
	Features		
		General. The system should support a software based	
		voice mail of the same OEM, offering the best	
		interactivity with user. The voice mail must work as a	
		centralized resource in case remotes are connected to	
		the main exchange.	
		The voice Mail supported by the vendor should be	
		on OEM server bardware. Card based or 3^{rd} party	
		Voice Mail solution are not Accentable/Disqualified	
11	Service	Voice Mail solution are not Acceptable/ Disquanticu	
	Support		
	Bupport	(i) Must support Voice messaging features allowing	
		the owner of a mailbox to send messages to other	
		mailbox users, whether they are part of the same	
		system or remote users.	
		(ii) Should support Automated attendant	
		(automatic switchboard) features allowing the	
		voice mail system to act like an attendant: answer	
		incoming calls, transfer them to a requested or	
		predefined number or mailbox, using addressing	
		by name or by number.	
		(iii) Shall support e-Messaging service, allowing	
		mailbox owners to access their voice mail from a	
		remote PC (e-mail client) via the IP network.	
		(iv) <u>Should support E Mail Messenger</u> - A client-	
		server application dedicated to Lotus Notes and	

		Microsoft Outlook for voice message manipulation	
		right from the e-mail client.	
		Mailboxes and Access Control.	
		(i) Number of mailboxes as per requirement.	
		Voice Messaging System.	
		(i) Call answering or call/record answering function	
		with time stamp.	
		(ii)Customization of an announcement.	
		(iii)Call forwarding to the voice mail.	
		(iv)System should support on line live conversation	
		recording.	
		(v)Message notification.	
12	Analog Subscriber		
	card.	Should have 24/22 on month	
		Freeh port should support CLID factures (ECK or	
		DTMF)	
		Loop Resistance >1700 ohms	
13	Digital	^ 	
	Subscriber card.		
		Should have 24/32 or More ports.	
		Each port should support CLIP features (FSK or	
		DTMF).	
		Loop resistance > 400 Ohms	
		Provide digital ports for connecting digital telephones	
14	IP Phone Type		
	I		
		Display: 128 x 64 B&W graphical display	
		Gigabit Ethernet 10/100/1000 connectivity for LAN and PC	
		802.3AF Power over Ethernet (PoE) - Class 0	
		2 SIP account keys	
		Conference key	
		Redial key	
		Transfer key	
		Hold key	
		• 4-way navigation and OK key	
		• QoS	
		• 802.1p (SIP and RTPQoS)	
		• DSCP	
		Phonebook	
		Individual phonebook (300entries)	
		LDAP/XML directory service	
		Phone should be from same EPABX OEM.	

15	IP Phone Type	Display: 3.5 inch color,	
	II		
		240 x 320 pixels, effective display area	
		size 70.08 x 52.56 mm2, LD Backlight, Ambient light	
		sensor, back shell busy light indicator	
		Gigabit Ethernet 10/100/1000 connectivity for LAN	
		Class 2 Power over Ethernet (IEEE 802 3af) Energy	
		Efficient Ethernet 802.3 a z support	
		Full-duplex speakerphone, acoustic echo cancellation	
		Wideband G722, G711 (A-law and Mu-law), G729	
		AB, voice activity detection(VAD), comfort noise	
		generation (CNG)	
		Support DHCP and static IP	
		QoS support: IEEE 802.1p/Q tagging (VLAN), Layer	
		Magnetic Alphabetic Keyboard	
		Operating Temperature: 5C to 145C	
		Inv//IPv6 support	
16	Operator	Display: 3.5 inch color	
10	Console (IP	Display: 5.5 men color,	
	Phone)		
		240 x 320 pixels, effective display area	
		size 70.08 x 52.56 mm2, LD Backlight, Ambient light	
		sensor, back shell busy light indicator	
		Gigabit Ethernet 10/100/1000 connectivity for LAN	
		and PC	
		Class 2 Power over Ethernet (IEEE 802.3af), Energy	
		Efficient Ethernet 802.3 az support	
		Full-duplex speakerphone, acoustic echo Cancellation	
		Support for Wideband BLUETOOTH handset	
		Wideband G/22, G/11 (A-law and Mu-law), G/29	
		AB,	
		generation (CNG)	
		Support DHCP and static IP	
		OoS support: IEEE 802 1p/O tagging (VLAN) Laver	
		3	
		TOS, and DSCP	
		IEEE 802.1 AB/LLDP-MED client (IPv4/ IPv6,	
		automatic VLAN acquisition, PoE management,	
		inventory information)	
		It should be possible to expand the attendant set	
		maximum of 42 additional programmable keys The	
		add-on modules keys must be associated to an	

		electronic icon and label. Each key should be	
		programmable as a resource or supervision key. It	
		should be possible for the system manager. To lock	
		some of the keys.	
		Magnetic alphabetical keyboard, Adjustable foot	
		stand ranging from 25° to 60°	
		Function Keys: On/off hook, dial pad, mute with	
		LED, volume keys ±, hands-free with LED, 2	
		personal keys/LED, redial, info and message with	
		LED	
17	PC Based		
	Attendant		
	consoles		
		a) system should support PC Based Attendant	
		consoles:	
		• A professional Multimedia Attendant Console to	
		efficiently manage calls and information on a	
		Windows based PC.	
		It should be IPV6compliant	
		b) The attendant console must provide following	
		dedicated keys to managing call flow:	
		• Store and redial	
		· Redial	
		· Cancel consultation(inquiry)	
		· Release call	
		• Broker call	
		· Call selected party	
		· Answer internal call	
		Transfer/hold call	
		• End of dialing	
		· Next call	
		c) Additionally, a set of Programmable Keys with	
		LEDs must be also available on the console to	
		program other optional services. The Tenderer	
		must describe the kind of services that can be	
		programmed for the keys for each type of	
		allendant console.	
		u) The Multimeura Allendani Console option must support to run on Microsoft Windows OS	
		Windows 7 (32- and 64-bit) Windows $8/81$ (64-	
		bit), or Windows 10 (64-bit) operating system The	
		PC must not be dedicated solely to this application	
		and must be able to handle telephone applications	
		and business software simultaneously. The	
		attendant console color screen must allow the	
		operator to take advantage of user interface based	
		in, icons and buttons to activate the different	
		functions.	

	e) The console should be associated with any IP Phone for voice communication	
	f) In case of DC failure the attendent should still be	
	able to handle calls through IP Phone	
	g) This attendant application must be LDAP	
	compliant. To permit access to company directory	
	servers or databases, or ODBC databases (Oracle,	
	Access, Excel, etc.), to allow call/dial by name and	
	Directory pop-up in an attendant console window.	
	the operator to monitor the telephone status of the	
	following objects:	
	· IP and analog phones	
	Attendant consoles	
	· Fax	
	· Hunt groups	
	Trunk groups	
	Trunk lines	
	i) The following services must be available:	
	1) The following services must be available.	
	or do not disturb modes on a phone	
	· Called Party Call Resources - When the called	
	party is busy or does not answer, the following	
	call resources should be available on attendant	
	Collback request	
	o Tayt message	
	o Voice mail	
	UASSISTANT	
	messages to IP/Digital users with display:	
	o Programmed message	
	o Pre-programmed message completed by entering	<u> </u>
	digit: date, hour	
	o Pre-programmed message completed by any	
	variable part (text and digits)	
	o Fully programmable message (twenty characters	
	maximum)	
	Call Pick-up	
	Transfer on no Answer	
	Transfer on Busy	
	Barge-in on Busy or Partially Busy	
	Three-party Conference	
	o An attendant must be able to set up a three-party	
	conterence, and then transfer the conference to	

	another user.	
	 Trunk Assignment with/without Restriction (Transfer with Privilege) - This feature enables an attendant to transfer a trunk and public dial tone to an internal user. The user can then dial an external number with or without restriction. The attendant can request the call charges at the end of the call. 	
	· Call Transfer to other Attendant	
	· Chained Call	
	Charging Recall	
	• Phone Reservation - This feature allows the attendant to reserve a phone to, for example, transfer an important external call.	
	• Class of Service - The attendant console (in idle state) must be able to change the class of service for any phone.	
	• Public Trunk Access Restriction - The attendant console (in idle state) must be able to change the public trunk access and restriction for any phone.	
	 Input of Directory Name in Phone Book - The attendant console can create or modify directory names in its personal phone book. 	

X. <u>AUDIO AND VIDEO SYSTEM</u>

Technical Specifications

Category	Description
Audio Visual	8x1 4KDCI 4:4:4 MultifOrmat presentation switcher and control system (either
Management	built-in or additional hardware) from the same OEM. It should have 4 x HDMI
System	input, 4XVGA + 4XAUD IN and 1 x HDMI Scaled out. It should have Audio
	Embedder & De-embedder with 1 x Audio out to be fed to Audio system. It
	should have (inbuilt or additional) control system having 1 GB RAM, 4GB
	Storage, 1 RS232 Ports, 1 IR Ports. It should be able to execute multiple
	programs and control AV equipment, accessoires, Lighting, HVAC etc from
	Touchscreens and keypads. It should also offer BACnet/IP for interfacing with
	BMS. It should have ethernet control for all the slave AV devices.

	AV over IP Encoders-Full HD over IP Extension, Supports point-to-point, point- to-multipoint and multipoint-to-multipoint configurations , Up to 120m over a single Cat.5e/6 cable in point-to-point connection, with 1x looping HDMI output for daisy chaining, TCP/IP protocol compliant with selectable streaming bit rate up to 15Mbps per stream, H.264 compression encoding that support resolution up to 1080p@60hz, HDCP Compliant, IR Remote control, with LED display to show the Group ID. Fully operating just out of the box without the need of PC connection ,Integrated web server for configuration, PC tool control and Telnet control (EclerNet Manager and third party remote control compatible, Supports LPCM audio format , Wide-band IR pass through to control the source (38kHz to 56kHz), 2 way UART/RS-232 (Up to 115200) pass-through, with remote control function to select 8 group Baud rate options , Dual power input: 802.3af compliant POE & DC 5V (No need of external power supply when encoders and decoders are connected to a POE Switch Inputs : 1x HDMI, 1x RS-232, 1x IR , Outputs : 1x HDMI, 1x H.264 Streaming, 1x RS-232, 1x IR , Resolution 1080p@24/25/29.97/30/50/59.94/60Hz, 1080i@50Hz, 720p@50/59.94/60Hz, 576p, 576i@50Hz, 480p, 480i@59.94/60Hz Vesa 640×480,800×600,1024×768,1280×768, 1280×960,1280×1024,1680×1050, 1920×1080,1280×720,1360×768,1400×1050 , Features : Downscaling, HDCP Support, RS-232/IR Extension, PoE, Control Options :Web, Telnet, IR
	1 x HDMI IN and 1 x Twisted pair OUT. RX should have 1 x Twisted Pair IN and 1 x HDMI OUT. Should support Resolution of up to 4K DCI 4:4:4 and Distance at least 70m using same OEM Cable. Same pair should extend IR and RS232 using dedicated input and output port at TX and RX . $+$ 8 channel power switch, supports 240 volt 50/60 Hz lighting and Motor loads for Shades / Projection screens / Lifts and Lighting control from the same OEM as Control systems.
	 Low susceptibility to interference from mobilephones. The microphone shall have the following controls and indicators: Red or green illuminator. Red shall indicate that the microphone is active; green shall indicate that the request-to-speak is accepted. Frequency Bandwidth 100 Hz – 15 kHz accordingIEC60914 Dynamic range > 96 dB
Control Processor	Control Processor- SD RAM 512 MB, Flash 4 GB, 10/100 Mbps, auto- switching, auto-negotiating, auto-discovery, full/half duplex, industry-standard TCP/IP stack, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH File Transfer Protocol), FIPS 140-2 compliant encryption, IEEE 802.1X, SNMP, BACnet/IP [1], IPv4 or IPv6, Active Directory authentication, IIS v.6.0 Web Server, SMTP e-mail client Supports USB mass storage class devices via rear panel USB 2.0 host ports, supports computer console via front panel USB 2.0 device port RS-232/422/485 For 2-way device control and monitoring, all ports support RS-232 up to 115.2k baud with software handshaking, one port also supports RS-422 or RS-485 and hardware handshaking IR/Serial Supports 1-way device control via infrared up to 1.2 MHz or serial TTL/RS-232 (0-5 Volts) up to 115.2k baud,RELAY OUTPUT 1 – 8,I/O 1 – 8,IR - SERIAL OUTPUT 1 – 8

5 Inch Touch panel with Table mount kit and POE power supply. It should be from the same OEM and should support custom graphics programming. It should have auto-brightness control, in-built microphone, speakers and camera. Should support SIP intercom feature, streaming H.264 videos, web browsing, multitouch. Resolution - 960x540, Brightness - 400 nits or higher. 2 GB RAM and 4GB storage.

Delegate Unit-The discussion device shall have the following features and benefits:

- Supports star and loop-troughconnection.
- Dual-use functionality enabled by use of software.
- Audio mutebutton
- Encryption ensures that information within the system remains confidential

The device shall have a headphone connection and independent volume control (on both sides of the device), so the speaker can be heard clearly even when there is excessive background noise

Frequency response 100 Hz - 20 kHz (-3 dB at nominal level) THD at nominal level < 0.1%

Dynamicrange > 90 dB Signal-to-noiseratio > 90dB

Operating temperature 5 °C to +45 °C The 'pluggable high-directive

microphone' shall be a stylish high-directive microphone that shall give the user a clear view of the meeting room, due to its unobtrusive design. The high-directive microphone shall contain two precisely positioned capsules to give it a high-directive response. This shall make it possible to have a larger speaking distance than normal from the microphone, even in noisy conditions.

The microphone shall have the following features and benefits:

- Discrete microphone for userconvenience.
- High-directive response.
- Ultra-low noise.
- Low susceptibility to interference from mobilephones.

The microphone shall have the following controls and indicators:

• Red or green illuminator. Red shall indicate that the microphone is active; green shall indicate that the request-to-speak is accepted. Frequency Bandwidth 100 Hz – 15 kHz accordingIEC60914 Dynamic range > 96 dB

License-Server Software, Participant Database , Identification at seat License for above conferencing system

Powering Switch- Additional power switching device for Chairman Unit and Delegate Units

AV over IP Decoders-Supply of full HD over IP Extension, Supports point-to- point, point-to-multipoint and multipoint-to-multipoint configurations, Up to 120m over a single Cat.5e/6 cable in point-to-point connection, with 1x looping HDMI output for daisy chaining, TCP/IP protocol compliant with selectable streaming bit rate up to 15Mbps per stream, H.264 compression encoding that support resolution up to 1080p@60Hz, HDCP Compliant, IR Remote control, with LED display to show the Group ID. Fully operating just out of the box without the need of PC connection, Integrated web server for configuration, PC tool control and Telnet control remote control, compatible), Supports LPCM audio format,

Wide-band IR pass through to control the source (38kHz to 56kHz), 2 way UART/RS-232 (Up to 115200) passthrough, with remote control function to select 8 group Baud rate options, Dual power input: 802.3af compliant POE & DC 5V (No need of external power supply when encoders and decoders are connected to a POE Switch). Inputs 1x H.264 Streaming, 1x RS-232, 2x IR, Outputs 1x HDMI, 1x RS-232, 1x IR, Features : Downscaling, HDCP Support, PoE, Control Options Web,Telnet, IR.

AV over IP Encoder	AV over IP Encoders-Full HD over IP Extension, Supports point-to-point, point-to- multipoint and multipoint-to-multipoint configurations, Up to 120m over a single Cat.5e/6 cable in point-to-point connection, with 1x looping HDMI output for daisy chaining, TCP/IP protocol compliant with selectable streaming bit rate up to 15Mbps per stream, H.264 compression encoding that support resolution up to 1080p@60hz, HDCP Compliant, IR Remote control, with LED display to show the Group ID. Fully operating just out of the box without the need of PC connection, Integrated web server for configuration, PC tool control and Telnet control (, Supports LPCM audio format ,Wide-band IR pass through to control the source (38kHz to 56kHz), 2 way UART/RS-232 (Up to 115200) pass-through, with remote control function to select 8 group Baud rate options , Dual power input: 802.3af compliant POE & DC 5V (No need of external power supply when encoders and decoders are connected to a POE Switch
	Inputs : 1x HDMI, 1x RS-232, 1x IR, Outputs : 1x HDMI, 1x H.264 Streaming, 1x RS-232, 1x IR, Resolution 1080p@24/25/29.97/30/50/59.94/60Hz, 1080i@50Hz, 720p@50/59.94/60Hz, 576p, 576i@50Hz, 480p, 480i@59.94/60Hz Vesa 640×480,800×600,1024×768,1280×768, 1280×960,1280×1024,1680×1050, 1920×1080,1280×720,1360×768,1400×1050, Features : Downscaling, HDCP Support, RS-232/IR Extension, PoE, Control Options :Web, Telnet, IR
Ceiling Mounted Document Camera	Ceiling Mounted Document Camera- Supply of Full HD 1080p high definition output resolution One button optimization function, Intelligent time stamp on saved les, High-definition USB image transmission in real time, Plug & Play, no need to install USB driver, Customized video splash screen, Projector type (DLP/LCD) select mode, Free multi-functional cross platform software support, Compatible with all major IWB brands.
Conferencing Sound Bar with Camera	 VC-Conferencing Sound Bar with Camera Inbuilt Wide View Full HD, 1/2.7" CMOS camera minimum 110degree Inbuilt Microphone array with echocancellation HDMI, Bluetooth and USB connectivity supportBYOD. Remote control for Volume control, disconnect, source select, MicMute etc. WallMountable USB connectivity with Laptop / Wireless collaboration device (Skype for Business) / Interactive display / any other device to use Camera, Microphone andSpeaker.

Control Processor	 Control Processor- Supply of SD RAM 512 MB, Flash 4 GB, 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, industry- standard TCP/IP stack, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH File Transfer Protocol), FIPS 140-2 compliant encryption, IEEE 802.1X, SNMP, BACnet/IP [1], IPv4 or IPv6, Active Directory authentication, IIS v.6.0 Web Server, SMTP e-mail client Supports USB mass storage class devices via rear panel USB 2.0 host ports, supports computer console via front panel USB 2.0 device port RS-232/422/485 For 2-way device control and monitoring, all ports support RS-232 up to 115.2k baud with software handshaking, one port also supports RS-422 or RS-485 and hardwarehandshaking IR/Serial Supports 1-way device control via infrared up to 1.2 MHz or serial TTL/RS-232 (0-5 Volts) up to 115.2k baud, RELAY OUTPUT 1 – 8,I/O 1 – 8,IR - SERIAL OUTPUT 1 – 8
HDMI Switcher	HMDI Switcher 2x1-Suppy Of HDMI 2.0 4x1 18 Gbps SWITCHER with audio de-embedder ,4x1 Ultra High Definition sources selector compliant with HDMI 2.0a standards , Video formats up to 4Kx2K(4096x2160@60Hz YUV 4:4:4) and all HDMI 3D video formats and all HDMI , Supports HDR and 3D contents , HDCP2.2/1.4 Compliant , Supports 36 bit Deep Color , Smart EDID management (Auto/2CH/5.1CH/7.1CH selectable), PCM, Dolby TrueHD, DTS-HD Master Audio up to 7.1CH, Supports Audio Return Channel (ARC), Digital and analog audio output, RS-232 Control, Supports up to 18Gbps video data rate.
	Inputs 4xHDMI, Outputs 1xHDMI, Resolution Up to 4096x2160@60Hz 4096x2160@24/25/30/50/60Hz, 3840x2160@24/25/30/50/60Hz, 2048x1080p 1080p@23.98/24/25/29.97/30/50/59.94/60Hz, 1080i@50/59.94/60Hz, 720p@50/59.94/60Hz, 576p, 576i, 480p, 480i, Features : EDID Management, HDR, HDCP, CEC, ARC, Control Options RS- 232, IR
Microphones	Wired Handheld MicrophoneWireless Handheld Mic along with stand -Supply of Handheld Wireless Mic with Cardiod polar pattern for transmitter, Dynamic microphone with Neodymium magnet , Receiver frequency response 80Hz-18kHz,Receiver RF sensitivity < 1.0 μ V, Receiver Image rejection>55dB,Receiver Dyanmic range >95dB and receiver having 32 channels possible, Receiver S/N ratio >100dB A, distortion <1 %, Transmitter sensitivity - 3.2 mV/Pa, modulation:+/-40kHz
	Wireless Handheld Mic-Supply of Handheld Wireless Mic with Cardiod polar pattern for transmitte, Dynamic microphone with Neodymium magnet, Receiver frequency response 80Hz-18kHz,Receiver RF sensitivity < 1.0 μ V, Receiver Image rejection>55dB,Receiver Dynamic range >95dB and receiver having 32 channels possible, Receiver S/N ratio >100dB A, distortion <1 %, Transmitter sensitivity - 3.2 mV/Pa, modulation:+/-40kHz

	Wireless Lapel Mic-Supply of Wireless Lapel Mic with Cardiod polar pattern for transmitter , Receiver & Transmitter frequency response 100Hz-18kHz or better, Receiver RF sensitivity < 1.0 μ Receiver Image rejection>55dB,Receiver Dynamic range >95dB and receiver having 32 channels possible, Receiver S/N ratio >100dB A, distortion <1 %,Transmitter sensitivity - 5.6 mV/Pa, modulation:+/-40kHz.
Touch Panel	Enterprise level Touch Panel with Dock featuring streaming H.264 video, Web browsing. Security Features such as 802.1x, TLS, FIPS-140-2, SSH & SFTP, Ambient Light Sensor, Backlit capacitive Buttons
VC	Table Top UC 7" Video Conferencing System with 16 MP camera; AEC; Full range Speaker;360 degree quad mic array microphone; Occupancy sensor; Real time scaling, F/2.8; 720P @ 30FPS, 3D noise reduction,120 degree horizontal & 90 degree vertical FOV;
Wireless Presenter	 Wireless Presenter The Wireless presentation device allows users with laptops or mobile to connect andpresent. The Wireless Presenter should have 1 HDMI or 1 Mini DP/VGA output, and 1 HDMI input The Wireless Presenter should present minimum 1 users' laptopsor handheld devices The Wireless Presenter Should be able to share uninterrupted HD video with minimum 30fps The Wireless Presenter should have feature to put random ordefined passcode to validate user authentication 1 x USB 2.0, 1 x RJ45 GBEthernet. It should have RS232 and IR port for control and supportCEC

XI. <u>Server Room PAC, Room temperature and humidity monitoring Unit, Fire Rated Doors:</u>

- 1 Floor insulation with 13mm thick UV laminated cross linked polyethelene
- 2 Server Room 2 hour fire rated Metal door for server room only, including all fitting.
- 3 Temperature & humidity monitor sensor with 2 inch display size

XII. <u>VESDA:</u>

- a. The system should have Early warning smoke detection system control Panel with Display, Single Zone, Power supply (To be supplied by the Panel Manufacturer) & all required accessories. The panel should have the capability to be integrated to the Intelligent Fire AlarmSystem.
- b. The system should also include Aspiration sampling nozzles / Sampling tubes/ Hooter complete with required stickers & necessaries elbows & joints.

XIII. <u>Rodent Repellent:</u>

- 1. The system having Master Console Capable of connecting to 12 satellites units completes asrequired.
- 2. The Wire to be used should be 2C x 1.5 sq.mm.Armored.

XIV. UPS System:

- 1. The should be energy efficient and capable of achieving upto a 99% efficiency rating and should still provide maximum load protection.
- 2. Should also provide surge suppression for theload.
- 3. Should also detect the location of faults (utility or load) and takes the appropriate action.
- 4. Should have large LCD Display.
- 5. Should consist Software capability to Monitor and manage multiple power devices.

1	True Online Double Conversion UPS System with new energy efficient IGBT Rectifier & IGBT Invertor along with Battery Circuit Breaker(BCB), Battery Rack, Exide/Quanta Batteries with Min VAH 31200 with each UPS, Interlinks & DC-DC Cable with complete accessories with below mentioned key features, 2x40 KVA / 36 KW True Online Double Conversion UPS System along with 65 AH, 80 No batteries & Accessories for 30 min backup on 40 KVA load	
а	Input Power Factor: 0.99	
b	Output Power Factor: 0.9	
c	Input THDi: < 5%	
d	AC-AC Efficiency: Up-to 94%	
e	Hot Sync paralleling: Inbuilt	
f	Inbuilt ABM :Inbuilt	
g	SNMP : Inbuilt	

TECHNICAL SPECIFICATION FOR WEB CONFERENCING AND LECTURE HALL

1. CAMERA

Super-low-light 2M pixel sensor for clear and natural imaging in low-light conditions Resolution: (16:9) 1920 x 1080, 1600 x 900, 1280 x 720, 960 x 540, 848 x 480, 800 x 448, 640 x 360, 424 x 240, 320 x 180; (4:3) 800 x 600, 640 x 480, 480 x 360, 320 x 240 at 60, 30, 15fps

- SmartFrame for automatic FOV adjustment to fit all participants
- True WDR up to 120dB: Superb backlight compensation technology for optimizing light balance in high-contrast conditions
- Zoom: 18X total zoom (12X optical zoom)
- Wide field of view (DFOV): 82°
- Lens focal length: 3.9 mm (wide) ~ 47.3 mm (tele)
- Lens F#: 1.8 (wide) ~ 2.8 (tele)
- Mirror, Flip, AE, white balance: aut o, manual override via PTZApp
- Minimum focus distance: 1.5 m
- Standard tripod screw holes and Kensington slot
- Motorized Pan & Tilt Movement
- Pan: $\pm 170^{\circ}$
- Tilt: $+90^{\circ}$ (up) -30° (down)
- camera presets (through remote control)
- Fast and quiet pan & tilt movement
- Video Format
- YUV, MJPEG, H.264
- Network video compression format: H.264
- Network protocols: RTSP, RTMP

- Audio Format
- AAC-LC
- Network protocol: RTSP, RTMP
- LAN
- 10/100/1000 Mbps

2. SPEAKER PHONE

Full duplex microphone array with echo cancellation

Advanced noise suppression

Dual-microphone array

- 3.5 mm phone-in jack
- 3.5 mm line out
 - Speaker: 6W, Adjustable to 90dB SPL at 0.5 m
 - Microphone frequency response: 120Hz–16kHz
 - Microphone sensitivity: -34± 2 dBV @1KHz, 94dBSPL
 - Microphone distortion: < 1% from 150Hz
 - Microphone support range: Diameter 6M
 - Touch controls for volume down/up, mute, phone input, call, and hang-up
 - Bridge phone-in and USB into one call
 - Security: Kensington slot

3. WEB CAM WITH IN BUILT MICROPHONE

SITC of Web Cam with sensor: 1/2.5"Sony Exmor 4K CMOS sensor

- Frame rate: 4K 30fps; 1080p , 720p , 960x540, 848x480, 800x448, 640x480, 640x360, 424x240, 320x240, 320x180 at up to 60fps
- 120° Wide field of view
- Lens iris, focus, zoom: fixed
- AE, white balance: auto, manual override by PTZApp
- Minimum working distance: 80cm
- Back light compensation and 2D noise reduction technology for optimizing light balance in different conditions
- Standard tripod screw holes
- Zoom, Pan, and Tilt Movement
- Zoom: up to 4X leveraging 4K sensor (not available in 4K or 60fps)
- Pan and tilt: when zoomed in leveraging 4K sensor
- Microphone
- 1 uni-directional microphones
- Frequency response: 100~12K Hz
- Sensitivity: -37dB

4. DIGITAL LECTURN

INTERACTIVE DIGITAL PODIUM made of COLD ROLLED STEEL (PAINT COATED) with 21.5" finger touch monitor, Touch Button Source Switching & Control and Power Built-in 2x2 HDMI Switching Matrix. Supports Desktop/Laptop (4K/2K) Supports 2 Channel Audio Input & 2 Channel Mic Input. 1 Audio Output Projector Switch On/Off. Supports Projector Power Switch Delay while Switching Off Projector Built-in Infrared Learning Function. 1 independent programmable RS232 Control Interface and 1 infrared control interface. One built-in electric screen power control, one 220V power socket. Supports connection of IC Card Reader System. 21.5" TFT

LCD Monitor. 16:9 Aspect Ratio. 1920 x 1080 (Resolution). 200 Brightness: cd/m2. Contrast Ratio:1000:1. Colour: 16.7million Surface Treatment: Tempered Glass AG. Touch Solution: Finger Touch & wireless pen. Digital Resolution: 2000+ ppi Pressure Level: 2048 Level. Pen Tip: Switch Freely. OS: Windows Certification: RoHS, CCC , Microphone (50+ cm long), Double soft metal pole mic Frequency response: 100 HZ to 15 KHZ, Cardoid Directed Output Impedence: 600 OHMs, Sensitivity: -36 db Voice Assistance: 20-50 cm, Power: DC 12V/1A , Four channel 80HMs Stereo, 120W x 4, Durable Speakers Set. 30W x 2. Volume and Level Controls. Switch for Mono/Stereo. RCA/EP Inputs. A3 Visualizer. 8MP/1080P @ 30FPS. HDMI/VGA Output. 11 LED Lights Autofocus. Supports Direct Interactivity. Live Video Recording. PC Less Operation. Supports Up to 32GB SD Card. IR Remote. Built-in Mic.

5. PROJECTOR

- Projection Technology-3LCD Technology
- LCD: 0.76 inch with C2 Fine
- Video Output:
- 4K enhancement
- Lightsource:
- Laser
- Brightness
- Colour Light Output:
- 7,000 Lumen- 4,900 Lumen (economy) in accordance with IDMS15.4
- Portrait Mode:
- 7,000 lm
- White Light Output:
- 7,000 Lumen 4,900 Lumen (economy) in accordance with ISO 21118:2012
- Connectivity
- USB 2.0 Type B (Service Only), RS-232C, Wired Network, Wireless Network (2x), VGA in, VGA out, DVI in, HDMI in, BNC in, HDBaseT, Stereo mini jack audio out, Stereo mini jack audio in (3x), HDMI (HDCP 2.2), Wireless LAN IEEE 802.11b/g/n (WiFi 4) (optional)
- Contrast Ratio:
- Contrast Ratio:
- Over 2,500,000 : 1
- Projection Lens
- Focal Length:
- 24 mm 38.2 mm
- F-number: 2.3
- Lens Shift:
- Motorized Vertical \pm 67 %, horizontal \pm 30 %
- Screen Size:
- 50 inches 1,000 inches
- Zoom:
- Motorized, Factor: 1 1.6
- Screen Size (Projected Distance):
- Zoom : Wide: m 31.6 m (50 inch screen)
- Zoom : Tele: m 50.4 m (50 inch screen)

5. MOTORISED SCREEN

Sizes: 200" diagonal

- Installation Options: Floating Wall Mount / Ceiling Mount / Suspended Mount,
- Control Options: IR / RF / RS485 + Dry Contact Control / 3-12 Voltage Trigger Control / Central Control
- Tension Adjustment Mechanism
- Colour: White
- Aluminum Casing

TECHNICAL SPECIFICATIONS OF AUDIO

Loudspeaker which shall consist of a 4" woofer and 1" dome tweeter. The loudspeaker shall have an impedance of 8 Ohm and contain a passive built-in crossover network. It shall have 100 Volt built-in line transformer with power taps for 24 Watt, 12 Watt, 6 Watt shall be provided. The connection and installation of the loudspeaker shall be performed using OEM mounting bracket. The direction of the speaker shall be continuously adjustable in all four directions. It shall have an RMS powerhandling of 35 Watt with a maximum power handling of 70 Watt and the frequency response (±3 dB) shall range from 100 Hz to 20kHz. The sensitivity shall be 86 dB when measured with an input signal of 1 Watt at a distance of 1 meter, while the maximum continuous sound pressure level shall be 101 dB. OEM MAF Required

Mixing Channel Amplifeir which shall be 240 Watts or more. It shall have Balanced Audio output. It shall have frequency response of 50Hz- 20000Hz or better. It shall have 4 or more line inputs. It shall have 100V line, 70V line as well as 4 to 16 ohm impedance output. OEM MAF Required. It shall have 4 numbers individual phantom power for all microphone inputs. It shall have minimum impedance load bridged of 4 ohms per channel. It shall have 4 or more balanced microphone inputs.

Bass cabinet which shall be active bass reflex type incorporating a 8" transducer with 2.4" voice coil. One channel shall be used for powering the integrated low frequency transducer. The integrated amplifier shall use audio processing technology and contain three independent controllable channels. The other two channels with an output power of 2 x 150 Watt RMS @ 8 Ohm are used for powering external satellite speakers. It shall have DSP functionalities with filters selectable between low-pass, high-pass and band-pass with Butterworth, Linkwitz-Riley or Bessel characteristics. It shall be supplied with an included wall mounting bracket. It shall have a power handling of 200 Watt, with a frequency response (-10 dB) ranging from 45 Hz to 350 Hz. It shall have 3-pin terminal block connectors for connecting input. The active bass cabinet shall operate on a 100~240 V AC -50/60 Hz mains network and shall be equipped with a removable power cord. The sensitivity shall be 83 dB when measuring with an input signal of 1 Watt at a distance of 1 meter, while the maximum continuous sound pressure level shall reach 108 dB. The integrated amplifier shall be passive cooled, resulting in zero additionally produced acoustic noise. Integrated circuitry shall protect against short-circuits or mismatched loads and overheating. The load shall be protected against DC faults and a clip limiter shall automatically reduce the input gain at onset.

Audio source which shall be all-in-one digital audio player, containing an AM/FM tuner and and media player supporting WAV, MP3 and WMA file types. Simultaneous operation of tuner and media playback on individual outputs shall be possible. It shall have USB connection, SD/MMC memory card slot and slot-in CD loader allowing playback from the inserted media. It shall have RS-232 Port for Control. The audio source shall operate on a
110~240 V AC / 50~ 60 Hz mains network and shall be equipped with a removable power cord. OEM MAF Required. It shall have frequency response of 20Hz to 20000 Hz or better. It shall be compatible with FAT sixteen and FAT thirty two systems. It shall support playback of wav, mp3 and wmv files. It shall have a power consumption of 10 W or less. It shall have standard 19 inches rack mount chassis. It shall support ID3 and RDS information display. OEM MAF required.

Loudspeakers with Drivers1x5"LF/1x1"HF;Frequencyrange90-20000Hz; Power capacity programm/peak: 250 / 500 W ; Impedance - 8 Ohm; Coverage range (h x v) 110° radial;Sensitivity 1 W / 1 m- 91 dB; SPLmax / 1 m / peak 117 dB with OEM brackets. OEM MAF Required.

Two Channel amplifier with inbuilt DSP, 500W @2ohm , 400W @4 ohm;400W @8ohm ; 1000W @4Ohm and 800W@8Ohm in bridge mode; Maximum output voltage 115Vpeak and 45Apeak current; Frequency Response 20Hz-20KHz;S/N Ratio- 106dBA; Crosstalk <70dB@1Khz;THD+N < 0.1%; Slew Rate->50V/microSec; Damping Factor >500@ 20-100Hz; A/D and D/A Converters of 24bit/48KHz; DSP Inbuilt Preset Memory; Crossover Filters - linear phase (FIR), Butterworth, Linkwitz-Riley, Bessel: 6 dB/oct to 48 dB/oct (IIR);Input Equalizers - Raised-cosine, custom FiR, parametric iiR: peaking, hi/lo-shelving, all-pass, band-pass, band- stop, hi/lo-pass; Output Equalizer ; Limiters - P TruePowerTM, RMS voltage, RMS current, Peak limiter; Signal output; Network/data 1 x USB plug - Separate input and output DSP, wth OEM presets and dante ready. OEM MAF Required.

Four Channel amplifier with inbuilt DSP, 1500W @2ohm , 1200W @4 ohm; 1200W @8ohm and 3000W @4Ohm and 2400W@8Ohm in bridge mode; Maximum output voltage 140Vpeak and 45Apeak current; Frequency Response 20Hz-20KHz;S/N Ratio- 110dBA; Crosstalk >70dB@1Khz;THD+N < 0.2%; Slew Rate- >50V/microSec; Damping Factor >500@ 20-100Hz; A/D and D/A Converters of 24bit/48KHz; DSP Inbuilt Preset Memory; Crossover Filters - linear phase (FIR), Butterworth, Linkwitz-Riley, Bessel: 6 dB/oct to 48 dB/oct (IIR);Input Equalizers - Raised-cosine, custom FiR, parametric iiR: peaking, hi/loshelving, all-pass, band-pass, band-stop, hi/lo-pass; Output Equalizer ; Limiters - P TruePowerTM, RMS voltage, RMS current, Peak limiter; Audio signal input 1 x 12 pin Phoenix MC 1.5/12-ST-3.81 - Signal input – MAIN; Loudspeakers 1 x 8 pin Phoenix DFK-PC 4/8-G-7.62 - Signal output; Network/data 1 x USB plug -speakers presets, separate input and output DSP. OEM MAF Required.

Subwoofer with Drivers 2x 10" LF; Fequency range 40 - 400 Hz, Power capacity-programm / peak: 700 / 1400 W; Imopedance - 2x12Ohm or 1x6 Ohms , Sensitivity 1 W / 1 m - 91dB Passive ; SPLmax / 1 m / peak 123dB. OEM MAF Required

Active stereo loudspeakers set comprising 5.25" or more low frequency woofer and 1/2" or more high frequency tweeter. The speaker system shall operate on a 100-240 V, ~50/60 Hz, switchable mains network and shall be equipped with a removable power cord. It shall have RCA or 3.5 mm jack connections for the unbalanced stereo line inputs, It shull have Balanced Mic/ line input on XLR allows connectivity for balanced sources and should have link output to connect to other active speaker. It shall have an maxpower handling of 100W and the frequency response (-10 dB) shall range from 60 Hz to 20 kHz. It should come with Original OEM wall mount bracket.

maximum continuous sound pressure level of 102 dB (1W/1M) or better. OEM MAF Required.

Central Control Unit-Supply of The Audio Powering Switch shall be responsible for routing, controlling and processing the audio and supplies power to the multimedia devices. It includes an intelligent adaptive acoustic feedback suppressor, echo cancellation and two 5 -band parametric equalizers for optimal speech intelligibility.

- Zero network configuration
- Fully compatible to the Ethernet (IEEE802.3) and OMNEO standard
- Supports loop-through connection with cable redundancy
- Standby mode to be environment friendly
- Mains switch on the rear to power on the audio powering switch.
- Ground-lift switch.

- Led on the front to show: green (power on), amber (standby), blinking (no connection to the system).

- Ethernet led's yellow and amber for each socket.

- Independent powered sockets; a short circuit on one socket does no influence the other sockets.

- Supports hot plug and play.

Chairman Unit- The extended discussion device shall have a 4.3 inch touch screen and it shall be completely software upgradable. It shall have a lot of features including independent dual-use for language selection and voting. It shall have a simple software setting to enable two participants to share a device and listen to proceeding in two different languages.

The 4.3 inch capacitive touch screen shall inform participants of the proceedings and increases meeting efficiency by displaying the current speaker and delegates in the request list.

The device shall have the following features and benefits:

• Single-use and chairperson can be configured via the PC configuration software application.

- Supports star and loop-trough connection.
- capacitive multi-touch screen for displaying:
- Multiple user interface languages in original characters.

Speaker list and Request list.Screen size 109.22 mm (4.3 inch)
Screen type capacitive multi-touch
Supply voltage 48 Vdc
Power consumption Max 5W
Frequency response 100 Hz - 20 kHz (-3 dB at nominal level)
THD at nominal level < 0.1 %
Dynamic range > 90 dB

Signal-to-noise ratio > 90 dB The 'pluggable high-directive microphone' shall be a stylish high-directive microphone that shall give the user a clear view of the meeting room, due to its unobtrusive design. The high-directive microphone shall contain two precisely positioned capsules to give it a high-directive response. This shall make it possible to have a larger speaking distance than normal from the microphone, even in noisy conditions.

The microphone shall have the following features and benefits:

• Discrete microphone for user convenience.

• High-directive response.

• Ultra-low noise.

• Low susceptibility to interference from mobile phones.

The microphone shall have the following controls and indicators:

 \bullet Red or green illuminator. Red shall indicate that the microphone is active; green shall indicate that the request-to-speak is accepted. Frequency Bandwidth $100~{\rm Hz}-15~{\rm kHz}$ according IEC60914

Dynamic range > 96 dB

Delegate Unit-Supply of The discussion device shall have the following features and benefits:

- Supports star and loop-trough connection.
- Dual-use functionality enabled by use of software.
- Audio mute button
- Encryption ensures that information within the system remains confidential

The device shall have a headphone connection and independent volume control (on both sides of the device), so the speaker can be heard clearly even when there is excessive background noise

Frequency response 100 Hz - 20 kHz (-3 dB at nominal level)

THD at nominal level< 0.1 %</th>Dynamic range> 90 dBSignal-to-noise ratio> 90 dB

Operating temperature 5 °C to +45 °C The 'pluggable high-directive microphone' shall be a stylish high-directive microphone that shall give the user a clear view of the meeting room, due to its unobtrusive design. The high-directive microphone shall contain two precisely positioned capsules to give it a high-directive response. This shall make it possible to have a larger speaking distance than normal from the microphone, even in noisy conditions.

The microphone shall have the following features and benefits:

- Discrete microphone for user convenience.
- High-directive response.
- Ultra-low noise.
- Low susceptibility to interference from mobile phones.

The microphone shall have the following controls and indicators:

 Red or green illuminator. Red shall indicate that the microphone is active; green shall indicate that the request-to-speak is accepted. Frequency Bandwidth 100 Hz – 15 kHz according IEC60914 Dynamic range > 96 dB Wired handheld mic with mic stand

Handheld Wireless Mic with Cardiod polar pattern for transmitter, Dynamic microphone with Neodymium magnet , Receiver frequency response 80Hz-18kHz, Receiver RF sensitivity < 1.0 μ V, Receiver Image rejection>55dB, Receiver Dynamic range >95dB and receiver having 32 channels possible, Receiver S/N ratio >100dB A, distortion <1 %, Transmitter sensitivity - 3.2 mV/Pa, modulation:+/-40kHz

Wireless Lapel Mic with Cardiod polar pattern for transmitter , Receiver & Transmitter frequency response 100Hz-18kHz or better,Receiver RF sensitivity $< 1.0~\mu V$,Receiver Image rejection>55dB,Receiver Dyanmic range >95dB and receiver having 32 channels possible,Receiver S/N ratio >100dB A,distortion <1~%, Transmitter sensitivity - 5.6 mV/Pa,modulation:+/-40kHz .

Wireless Presenter

- The Wireless presentation device allows users with laptops or mobile to connect and present.
- The Wireless Presenter should have 1 HDMI or 1 Mini DP/VGA output, and 1 HDMI input
- The Wireless Presenter should present minimum 1 users' laptops or handheld devices
- The Wireless Presenter Should be able to share uninterrupted HD video with minimum 30 fps
- The Wireless Presenter should have feature to put random or defined passcode to validate user authentication
- 1 x USB 2.0, 1 x RJ45 GB Ethernet.
- It should have RS232 and IR port for control and support CEC

Ceiling Microphone which shall be a designed for fixed installation. The microphone shall fit within the space of a standard six hundred mm2. Ceiling panel and shall be mountable either onto or flush with the ceiling itself. The microphone shall consist of at least 26 pre-polarized condenser microphone capsules and shall use beam forming technology that automatically focuses on whoever is speaking in the room. The microphone shall be supplied complete with a ceiling suspension kit for ceiling installation, an external power supply unit, a power cable for connection to the external power supply unit, an audio cable for connection to the DSP and a control cable. The microphone shall also feature an RJ-45 network socket for connecting a computer for configuration purposes, a Reset button for performing a restart of the microphone, and a Reset LED that lights up when mains voltage is present. The microphone shall also be able to configure through a PC /Tablet via configuration software for easy changes if any required. The microphone sensitivity shall be 0 dBV/Pa (nine hundred eighty eight mV/Pa). The maximum sound pressure level shall be one hundred four dB SPL, equivalent noise level shall be twenty dB(A). The dynamic range shall be ninety three dB (A). Operating voltage shall range from twenty to twenty eight Volt Direct Current. It shall have automatic beam forming technology, it automatically detects the active speaker in the room with integrated microphone capsules and follows him. It shall have DanteTM interface with two RJ-45 sockets Primary and Secondary. OEM MAF Required.

Digital Signal Processor which should be having Six AEC enabled Microphone/ line inputs. The DSP should support noise reduction, Microphone mixing, Low, Mid and high frequency Equalization, Input gain control, individual Microphone Input phantom power control. The DSP should have additional two line inputs which may be used for future applications. The DSP should be having Six Audio line outputs. The DSP should have USB Audio Port which should get integrated with the unified for Echo free communication between the locations.

A. Displays

1. 4K LED Display which shall have Screen Size of 42 inches or more. It shall have an aspect ratio of 16:9, 4:3 or better. It shall have native resolution of 3840X2160 or more. It shall have brightness of

400cd/m2 or more. It shall be with static contrast ratio of 1200:1 or more. It shall have viewing angle of 178X178 or more. It shall have 3 or more HDMI 2.0 Input, 1 or more USB Port or better. It shall have optical Audio Out. It shall have Speaker output of 10W+10W or better. It shall have RS-232 control port. It shall have RJ-45 port. It shall support Time Scheduler, RJP Mode, One Channel Map and Embedded Content Manager. It shall support Functions like USB Cloning, IR Out, Multi IRCL on. It shall have CI Slot interface. It shall have RF Port, Debug Port and Optical Audio Out Port. It shall have Web browser, soft app, wi-fi (ac), bluetooth audio playback. It shall support mobile connection overlay. It shall have a Dynamic CR of Ten Lakh to One or better. It shall have min/max Energy Conservation of Sixty Eight/Thirty Three or better. It shall have a typical Power consumption of 93 Watts or less. It shall be supplied with Remote controller, Power cord as included accessories. It shall be supplied with 5 meters HDMI Type A to Type A which shall support data rate of up to 18 Gbps. It shall support resolutions of up to 3820x2160@60 Hz or better. It shall have Gold Plated Contacts for Signal Integrity. It shall have an insulation resistance of 100 ohms or better. It shall have a Dielectric Strength of 500V/minute or better. It shall be HDMI 2.0 or better. It shall have up to 1536 KHz or better Audio Sample Frequency for highest audio fidelity. It shall be highly resistant with RF and EMI interference. It shall work without the use of External Power Supplies. 400 or +/- 50 nits. OEM MAF required. Requirements of the color graphic sub system include:

- 2. 4K LED Display which shall have Screen Size of 42 inches or more. It shall have an aspect ratio of 16:9, 4:3 or better. It shall have native resolution of 3840X2160 or more. It shall have brightness of 400cd/m2 or more. It shall be with static contrast ratio of 1200:1 or more. It shall have viewing angle of 178X178 or more. It shall have 3 or more HDMI 2.0 Input, 1 or more USB Port or better. It shall have optical Audio Out. It shall have Speaker output of 10W+10W or better. It shall have RS-232 control port. It shall have RJ-45 port. It shall support Time Scheduler, RJP Mode, One Channel Map and Embedded Content Manager. It shall support Functions like USB Cloning, IR Out, and Multi Inclining. It shall have CI Slot interface. It shall have RF Port, Debug Port and Optical Audio out Port. It shall have Web browser, soft app, wi-fi (ac), bluetooth audio playback. It shall support mobile connection overlay. It shall have a Dynamic CR of Ten Lakh to One or better. It shall have min/max Energy Conservation of Sixty Eight/Thirty Three or better. It shall have a typical Power consumption of 93 Watts or less. It shall be supplied with Remote controller, Power cord as included accessories. It shall be supplied with 5 meters HDMI Type A to Type A which shall support data rate of up to 18 Gbps. It shall support resolutions of up to 3820x2160@60 Hz or better. It shall have Gold Plated Contacts for Signal Integrity. It shall have an insulation resistance of 100 ohms or better. It shall have a Dielectric Strength of 500V/minute or better. It shall be HDMI 2.0 or better. It shall have up to 1536 KHz or better Audio Sample Frequency for highest audio fidelity. It shall be highly resistant with RF and EMI interference. It shall work without the use of External Power Supplies. 400 or +/- 50 nits. OEM MAF required.
- 3. 4K LED Display which shall have Screen Size of 65 inches or more. It shall have an aspect ratio of 16:9, 4:3 or better. It shall have native resolution of 3840X2160 or more. It shall have brightness of 350cd/m2 or more. It shall be with static contrast ratio of 1300:1 or more. It shall have viewing angle of 178X178 or more. It shall have 3 or more HDMI 2.0 Input, 1 or more USB Port or better.

It shall have optical Audio Out. It shall have Speaker output of 10W+10W or better. It shall have RS-232 control port. It shall have RJ-45 port. It shall support Time Scheduler, RJP Mode, One Channel Map and Embedded Content Manager. It shall support Functions like USB Cloning, IR Out, Multi IR CLoning. It shall have CI Slot interface. It shall have RF Port, Debug Port and Optical Audio Out Port. It shall have Web browser, soft app, wi-fi (ac), bluetooth audio playback. It shall support mobile connection overlay. It shall have a Dynamic CR of Ten Lakh to One or better. It shall have a typical Power consumption of 179 Watts or less. It shall be supplied with Remote controller, Power cord as included accessories. It shall be supplied with 10 meters HDMI Active Optical Cable Type A to Type A which shall support data rate of up to 18.2 Gbps. It shall support resolutions of up to 3820x2160@60 Hz or better. It shall have a Power Consumption of 250mV or better. It shall support lossless signal transmission up to 100 meters or better. It shall be HDMI 2.0 or better. It shall support HDCP 2.2 or better. It shall have an outer cable diameter of 4mm or less. It shall be highly resistant with RF and EMI inter.

- 4. 4K LED Display which shall have Screen Size of 65 inches or more. It shall have an aspect ratio of 16:9, 4:3 or better. It shall have native resolution of 3840X2160 or more. It shall have brightness of 350cd/m2 or more. It shall be with static contrast ratio of 1300:1 or more. It shall have viewing angle of 178X178 or more. It shall have 3 or more HDMI 2.0 Input, 1 or more USB Port or better. It shall have optical Audio Out. It shall have Speaker output of 10W+10W or better. It shall have RS-232 control port. It shall have RJ-45 port. It shall have response time of 9ms or better. It shall support Time Scheduler, RJP Mode, One Channel Map and Embedded Content Manager. It shall support Functions like USB Cloning, IR Out, and Multi IR Cloning. It shall have CI Slot interface. It shall have RF Port, Debug Port and Optical Audio Out Port. It shall have Web browser, soft app, wi-fi (ac), bluetooth audio playback. It shall support mobile connection overlay. It shall have a Dynamic CR of Ten Lakh to One or better. It shall have min/max Energy Conservation of Sixty Eight/Thirty Three or better. It shall have a typical Power consumption of 179 Watts or less. It shall be supplied with Remote controller, Power cord as included accessories. It shall be supplied with 10 meters HDMI Active Optical Cable Type A to Type A which shall support data rate of up to 18.2 Gbps. It shall support resolutions of up to 3820x2160@60 Hz or better. It shall have a Power Consumption of 250mV or better. It shall support lossless signal transmission up to 100 meters or better. It shall be HDMI 2.0 or better. It shall support HDCP 2.2 or better. It shall have an outer cable diameter of 4mm or less. It shall be highly resistant with RF and EMI interference. It shall work without the use of External Power Supplies 400 or +/- 50 nits. OEM MAF required.
- 5. LED display which shall have Screen Size of 98 inches or more. It shall have IPS Panel Technology or better. It shall have an aspect ratio of 16:9. It shall have native resolution of 3840X2160 or more. It shall have brightness of 350cd/m2 or more. It shall be with static contrast ratio of 1300:1 or more. It shall have viewing angle of 178X178 or more. It shall have 3 HDMI Input, 1 or more Display Port, 1 or More DVI-D, Audio input Port or better. It shall have at least 1 Video output in the form of HDMI or DVI-D or Display Port. It shall have at least 1 Audio Output Port as well as external speaker out. It shall have RS-232 input as well as output port. It shall have RJ-45 port and IR receiver. It shall have a typical Power consumption of 318 Watts or less. It shall have 24*7 usage capability. It shall be IEC / EN / UL Sixty Thousand Nine Hundred Fifty

happen one certified for safety. It shall have real time monitoring and control and multi screen mode upto 4 screens along with PIP with both main screen and sub screen at the same time. It shall be supplied with Remote controller, Power cord, IR/Light sensor receiver, CD (Manual), RS232C as an included accessory. It shall be FCC Class A certified. it shall be CE and KC certified for EMC. It shall be supplied with 10 meters HDMI Active Optical Cable Type A to Type A which shall support data rate of up to 18.2 Gbps. It shall support resolutions of up to 3820x2160@60 Hz or better. It shall have a Power Consumption of 250mV or better. It shall have a dynamic bend radius of 80mm or better. It shall have a static bend radius of 40mm or better. It shall support lossless signal transmission up to 100 meters or better. It shall be HDMI 2.0 or better. It shall support HDCP 2.2 or better. It shall have an outer cable diameter of 4mm or less. It shall be highly resistant with RF and EMI interference. It shall work without the use of External Power Supplies 400 or +/- 50 nits. OEM MAF required.

LIST OF APPROVED MAKES

LIST OF APPROVED MAKES

INTERIOR & FURNISHING WORK

SL.No.	Description of Material	Approved Make /Manufacturers
1	Reinforcement Steel (HDSD TMT)	TATA / SAIL / RINL / TISCO
2	Cement OPC Cement PPC	Ultratech / Ambuja / J K / Wonder
3	White Cement	JK / Birla
4	Structural steel-MS Plates	TATA / SAIL / JINDAL / RNIL
5	Structural steel-Tubular sections/RHS/SHS/CHS	SAIL / JINDAL / RNIL / APL-APOLLO
6	Stainless steel	SAIL / JINDAL / TATA
7	Ply/Board/Veneer	Duro /Century/ Green Ply
8	MDF	Duro /Century/ Green Ply
9	Flush doors	Duro / Century /Green Ply
10	Toilet cubicle/Urinal partition	Stylam / Merino / Greenlam/Century
11	Glass	Asahi / Saint Gobain / Pilkington
12	Mirror	Asahi / Saint Gobain / Pilkington
13	Fire rated glass	Asahi / Saint Gobain / Glaverbal
14	Hardware for glass Patch Fittings	Dorma / Assa abloy / Blum/ Stronel
15	Hardware fitting for Flush doors	Dorma / Assa abloy / Blum /Stronel/Becker HS
16	Canopy / skylight Patch fittings / spider fittings	Dorma / Assa abloy / Blum/Ozone
17	Wooden / Metal Fire rated doors	Navair International Pvt. Limited / Shakti Horman / Kutty / ASES Security
18	Modular Glass Partition / Doors	Candorview / Aluslim/ Dorma
19	Modular Glass Sliding Partition	Candorview / Aluslim/ Dorma
20	Work Statation and Other Chairs	Rockworth / Haworth / Kokuyo
21	Water proofing	BASF /W.R.Grace /Penetron/Dr Fixit
22	Wooden laminated flooring	Kia / Parador / Quick step/Shephard Million
23	Vitrified Tiles (Double Charge)	HR Johnson / Orient Bell / Kajaria / Nitco / Somany
24	Ceramic glazed tiles	HR Johnson / Orient Bell / Kajaria / Nitco / Somany

25	Vinyl flooring	Gerflor / Vito/ LG hausys / Mohawk
26	Carpet	Milliken / Standard / Sumione/ Shaw
27	Plastic emulsion Paint	Oikos / Jotun / Asian / Dulux
28	Texture paint	Oikos / Jotun / Asian / Dulux
29	Fire Rated Paint	Hilti / Promat / Navair International/ Viper
30	Gypsum board/ Moisture resistance board for False ceiling	Saint Gobian Gyproc / USG Boral
31	Metallic ceiling	Durlum / Armstrong / SAS
32	Acoustic Ceiling/ Panellings	Anutone / Topakustik / Ideacoustic
33	Acoustic Strand	Anutone / Heradesign / Knauf
34	Strectch Fabric	Ferrari / Barrisol / Anutone/Yaal
35	Acoustic Materials	Anutone / Heradesign / Knauf
36	Magnesia Board	Winwin / Anutone / AMF
37	Acoustic Polyfibre	Anutone / Heradesign / Knauf
38	Acoustic Glass Fibre	Armstrong / Anutone / Accoustical i surface inc
39	Vvip,Vvip Visitor, GM, Ggm, Jgm, , Agm, ED , Dgm, Manager,Astt. Manager Chairs etc.	Herman Miller / Human Scale/ Vitra
40	SLS Fabric Paneling	Anutone / Barrisol / Ferrari
41	Strand /Synth ceiling	Anutone / Ecophon / Ftiange
42	Solid acrylic surface	Durlax / Novo / Dupont Corian / Krion/ Tranquil
43	Zinc Paneling	Rhienzinc / VMZinc / HALCOR / IEQSA
44	Kitchen Equipment	Good Life / Simple Kitchen / Relief
45	Corporate Building and Adminstration Building Furniture	Rockworth / Haworth / Steelcase
46	Window Blinds	Dkor / Livin / Wellborne / HunterDouglas / Rosselle
47	Window blinds motor	Dkor / Livin / HunterDouglas / Somfy / Rosselle
48	Silicon Sealant	Dow corning / Sikka / Wacker / McCoy / GE / Veber
49	Lacquered Glass Processor	Art N Glass/ Bharat Glass Co./ Shiv Shakti Glasses
50	Hanging Mural/ Stained Glass/Copper Mural	As approved by Architect
51	UPVC Door Window	Aluplast / Veka / Deceuninck / Fenesta / Schueco
52	Hostel Furniture	Spacewood / Forte / Wipro
53	Automatic Sliding Doors	Dorma / Autoingress/Stronel/Geze

54	Digital Lock	Stronel/Yale/ August/Schlage
55	Cam Action Door Closer	Stanum/Dorma/Assa abloy
56	G.I Partition System	Saint Gobain / USG Boral or approved equivalent
57	Acoustic Insulation	UP Twiga / Rockwool or approved equivalent
58	Resin panels	Lumicor India / 3Form Hunter Douglas/ Dècora
59	Double Charge Vitrified Tiles 1m x1m	HR Johnson / Glaze Rocks / Kajaria / Nitco / Somany
60	Signages	Egromax/ Rosselle/ ASES
61	Acoustic Panellings	Anutone / Barrisol / Ferrari
62	Fire door hardware	Becker FS/ Dorma/ Hettich
63	Entry Mat	3M/ Vito/ Tack Innovations
64	Graphic film	3M / Avery / Tack Innovations

PLUMBING WORK LIST OF APPROVED MAKE

SL.No.	Description of Material	Approved Make /Manufacturers
1	Vitreous China Sanitaryware (1st class quality)	Roca / Kohler / Ceramix / Vitra/ Duravit/Toto
2	C.P fittings	Roca / Kohler / Mozio / Ceramix
3	C.P Bottle Trap	Jaquar / Hindware / Parryware / Roca / Cera /Kohler / Ceramix
4	Stainless Steel Sink	Cera/ Neelkanth / Jayna
5	Bath Room C.P accessories	Roca / Kohler / Mozio / Ceramix
6	Health Faucet (With S/S)	Roca / Kohler / Mozio / Ceramix
7	G.I. pipes (Up to 150 mm dia)	Jindal Hissar / APL / Apollo / TATA
8	UPVC pipes & Fittings	Rallison / Aashirwad / SFMC
9	CPVC pipes & Fittings	Rallison / Aashirwad / SFMC
10	Poly propylene pipes	POLOPLAST / NU / WAVIN
11	P TRAP	McALPINE / Cera
12	G.I.Fittings (Malleable)	UNIK / DRP / TATA
13	Stoneware pipes & Gully Trap	Anand / Perfect
14	Horizontal Soil/Waste hanging supports	Chilly / Lovely / Camery
15	Ball valve	Deepak / LP / Zoloto
16	Butterfly Valve	Deepak / LP / Zoloto
17	Motorised valve	LP / Lehry
18	FRP Manhole cover	Thermodrain / Techno sales corporation
19	Grating for Floor Trap & Floor Drain	Chilly / Camry
20	Paints & Primer	J&N / Berger
21	Nut & Bolts	GKW

ELECTRICAL WORK LIST OF APPROVED MAKE

SL.No.	Description of Material	Approved Make /Manufacturers
1	MS black enameled/galvanized ERW conduits	AKG, BEC, Steelkraft
2	GI pipes	Tata, Jindal
3	PVC Conduit	Precision, BEC, AKG
4	PVC Conduit Accessories	Precision, BEC, AKG
5	MS Conduit accessories	AKG, BEC, Steelkraft
6	FRLS copper conductor wires	Finolex, KEI, RR
7	General Lights and lighting Fixture	Philips, Yaal, Orange, Zumtobel, Metalmek, Targetti, Waldmann
8	External Lighting, External Faca'ade	Signify (CK), LT, Regent, Traxon
9	Modular switches, socket outlets and wiring accessories with moulded cover plate	ABB(Ivie), Schneider(Zencelo), Legrand (Arteor), MK Honeywell (Blenze plus)
10	Heavy duty metal clad socket outlets with MCB in MS housing	Siemens-Betagard, ABB-SB series, Schneider- Acti9
11	Weather proof socket outlets	Legrand / Siemens / L&T Hager Hensel
12	Miniature Circuit Breaker	Siemens-Betagard, ABB-SB series, Schneider- Acti9
13	Earth Leakage Circuit Breaker	Legrand(DX3) / Schneider(Acti9) / Siemens
14	Timers	Siemens, ABB, Schneider, Legrand(DX3)
15	MCB Distribution Boards in sheet steel housing (double door)	Siemens-Betagard, ABB-ITUS, Legrand-Lexic, Schneider-Acti9
16	Single phase preventer (current base)	Minilec / Siemens / Legrand
17	Telephone wires / Co-Axial / T.V. Cable	Havells, Finolex, KEI
18	Telephone Tag Blocks	Krone / Pouyet / TVS / Hensel
19	Tap off / Splitter	Cat vision / Shyam
20	Cable TV wire	Commscope, Siemon, Belden, Cisco
21	Moulded Case Circuit Breakers (with rotary handle) (variable settings)	Siemens – 3VA / ABB (T-Max) / Schneider (CVS)
22	Air Circuit Breaker (ACB)	Siemens – 3WL / SCHEINDER- MTZ / ABB (E-MAX)
23	Switch fuse units (FN type)	Siemens / Schneider (MG) / GE / ABB
24	HRC fuses	Siemens / GE
25	Protective Relays (Microprocessor)	Alstom / Siemens / ABB

26	MV/LV Switchboards /Rising mains (powder coated)	Schneider, Legrand, Siemens, ABB
27	MV Contactors, Timers (Solid stat)	Siemens, ABB, Schneider / Legrand
28	1100 volts grade XLPE cables	Finolex, KEI, RR
29	1100 volts grade PVC control cables	Universal (Unistar) / Havells / KEI/ Finolex/RR Kabel
30	Cable lugs	Dowell's, Raychem, Comet
31	Cable compression glands	Dowell's, Raychem, Comet
32	Capacitors	Neptune-Ducati / Schneider / SIEMENS
33	Cast resin Current Transformers	Automatic Electric / Kappa / Gilbert Maxwell / Precise
34	Measuring Meters (Digital)	Siemens, ABB, Schneider (Conserv)
35	Special /Custumized Lighting Fixures, Office and Designer Lights	Philips / LT / Regent / Zumtobel
36	Selector Switches	Kaycee /Siemens
37	Indication lamps (LED type) and Push Buttons	Siemens, ABB, Schneider, Legrand
38	Cable tray	Indiana (Vadodara), MEM, Profab (PUK), Advance Power
39	Raceway	Legrand, Indiana / Advance Power
40	Energy analyzer meter	Siemens / Schneider / ABB
41	KWH Energy Meter	HPL / Genus / Siemens / Legrand
42	Lifts	Schindler / Mitsubishi / Otis
43	True Online Double Conversion UPS System	ABB, Schneider (APC), Numeric (Legrand)
44	Sealed Maintenance Free Batteries	Exide, Amar Raja, Hitachi, Panasonic
45	Power Distribution Panels (non-TTA)	Neptune, Advance Power, Ankit Electricals, Ambit, Adlec Systems Pvt. Ltd.
46	LT Fire survival Cables	Finolex, KEI, RR
47	LED Chip	Nichia, Cree, Osram, Lumiled, LG, APT
48	MF Earthing with GEM	Alkemee, Karytron, Taelman, Shubhra
49	Lightning Protection System as per IEC-62305	Dehn, OBO, ABB, Altec
50	AC Power Contactor, DC Power Contactor, Auxiliary contactors	Siemens, Schneider, Legrand
51	Current Transformer (Cast Resin Epoxy Coated)	Automatic Electric, Gilbert & Maxwell, Kappa

SL.No.	Description of Material	Approved Make /Manufacturers
1	Eine Entinguishans	Omey / Safegyard / Dadmini /Newson
1	Fire Extinguisners	Omax / Saleguard / Padmini /Newage
2	MS Pipes	Jindal Hisar / Tata / SAIL
3	Expansion Joint	Easyflex /
4	Hydrant Valve	Newage / Omax / Kalpex /G-Tech
5	Butterfly Valves	Zoloto / Advance / Kartar /G-Tech
6	Hydrant Valve	Newage / Omax / Kalpex /G-Tech
7	Check Valve/ NRV/ Ball Valve	Zoloto / Advance / Kartar /G-Tech
8	Hose pipe/ Branch Pipes	Newage / Omax / Kalpex /G-Tech
9	Fireman's Axe	Safeguard
10	Fire Brigade connection/ draw out	Newage / Omax / Kalpex /G-Tech
	connection	
11	Strainer	Kartar
12	Flow Detectors	System Sensor
13	Sprinklers	HD / Newage / G-Tech
14	FHC	ASES / Sehgal Door / G-Tech
15	Pumps	Kirloskar / ABB / Grundfos

FIRE FIGHTING LIST OF APPROVED MAKE

LIST OF APPROVED MAKES (HVAC & BMS)

Sl.No.	Description Of Material	Approved Make /Manufacturers
1	VRF Units	Daikin / Mitsubishi Electric/ O-General
2	Enthalpy Recovery Wheel (HRW/ERU)	DRI / Munters / Zeco
3	Air Filter	Thermadyne / Camfil / Airtech
4	Heavy Duty Drain Piping	Polypack / Supreme / Prince / Finolex
5	GI Sheets	Sail / Tata / Jindal
6	AHU/TFA	Edgeteck / Daikin / Zeco
7	Factory Fabricated Duct-Rectangular	Zeco / Ductofab / Projtech / Eco Duct
8	Extruded Aluminum Powder Coated Grilles / Diffusers / Slot Dampers / Volume Control Dampers / Factory Fabricated Diffuser Outlet Boxes With Diffusion Plate	Systemair / Carryaire / Green Air / Airflow / Pineair
9	Stick Pin	Airflow / Prima Seal
10	Fire Dampers	Systemair / Servex / Airflow / Belimo / Seimens
11	Fire Dampers Actuator	Belimo / Honeywell / Seimens / Airflow
12	Inline Fans/Propeller Fan	Systemair / Green Heck / Kruger / Caryaire
13	Axial Fans	Systemair / Kruger / Green Heck / Humidin
14	Centrifugal Fans	Systemair / Kruger / Green Heck / Humidin
15	Fan Section/Cabinet Fan	Systemair / Kruger / Green Heck / Humidin
16	Air-Washer	Symphony / Systemair / Zeco
17	Scrubber	Trion / Rydair / Zeco
18	Accosound Insulation For:Accoustic Lining Of Ducts, Ahu Room Accoustic Lining	Paramount / Armacell / K-Flex / Supreme
19	Cross Linked Closed Cell Oxide Acetate Foam Insulation For: Ducts Thermal Insulation and Underdeck insulation of	Paramount / Armacell / K-Flex / Supreme

	slabs	
20	Refrigerant Copper Piping	Rajco / Mandev / Maxflow / Indigo/Daikin-Jobu
21	Polysiloxane Coating	Oxycoats / Jemkon / Technocrats Polycoats
22	Adhesive	Foster / Paramount Polytreat / Fevicol
23	Cushy Foot Mounts	Dunlop / Resistoflex / Easyflex
24	Brazing Rods	Diamond / Totaline/ Harries
25	Paints	Dulex-ICI / Berger/ Asian
26	VI Pads	Resistoflex / Easyflex
27	Air-Curtain	Mitzvah / VTS / Almonard
28	Variable Speed Drives	Danfoss / ABB / Schneider/ Seimens
29	UVGI Air Purifier	Magneto / Honeywell / Alfaa
30	VSD / VFD Panels	Ambit/ Neptune/ Vidhyut/ Tricolyte
31	Air Difrential Pressure Swtich	Anergy / Siemens / Honeywell
32	Temperature And Rh Sensor And Adjuster Package	Anergy / Siemens / Honeywell
33	Air Differential Pressure Sensor And Adjuster Package	Anergy / Siemens / Honeywell
34	Precision Air-Conditioners (PAC)	Vertiv-Emerson / Stulz / Bluebox

LIST OF APPROVED MAKES FOR BMS

Sr.No	Equipment/Material	Approved Manufacturer
Α	Controller/Software	
1	Central Control BMS Server	HP/DELL/Lenovo
2	Printer	Epson/Brother/Canon
3	Video Wall	Delta/LG/Samsung
4	Building management System	Siemens/ALC/Honeywell EBI
5	Building Management Web Based Server Software	Siemens (Desigo)/ALC/Honeywell EBI
6	Programmable & Application Specifier Controller (DDC)	Siemens/ALC/Honeywell Comfort Point
7	System Intergration Units for 3RD Party software Integration	Siemens/ALC/Honeywell Comfort Point
8	Enclosure for DDC Controller	Rittal/Siemens/BCH
В	Sensor & Field Devices	
1	Immersion type temperature sensors	Siemens/Honeywell Comfort Point/ALC
2	Ultrasonic BTU Meter/Flow Meter	Siemens/Honeywell//Dwyer
3	Outside T+RH Sensor	Siemens/Honeywell Comfort Point/ALC
4	Differential pressure Switch Air	Siemens/Honeywell Comfort Point/ALC
5	Differential pressure Switch Water	Kele/Dwyer/Greystone
6	Differential Pressure Sensor-Air/Water	Siemens/Honeywell Comfort Point/ALC
7	Room/Duct Type Temp Sensor	Siemens/Honeywell Comfort Point/ALC
8	Room/Duct Type Temp + RH Sensor	Siemens/Honeywell Comfort Point/ALC
9	Pressure Sensor Water	Siemens/Honeywell Comfort Point/ALC
10	CO2 Sensor/VOC Sensor/PM2.5&10	Siemens/Honeywell Comfort Point/ALC
11	Water Level Switches	Veksler/Flipro/Dwyer
12	Flame Proof Level Transmitter	Veksler/Flipro/Dwyer
13	DC Voltage /Current/Power Factor Transducer	Greyston/Dwyer/Meco
14	Current Relay	Greyston/Dwyer/Meco
15	PH Anayser/ TDS Analyser	Hach/Forbes Marshall/ABB/Omicron
16	Valves and Actuators	Siemens/Oventrop/T&A
17	Thermostat	Siemens/Daikin/Danfoss
18	VFD Drives	Siemens/ABB/Schneider
С	Wiring & Conduting	
1	Signal Cable , PVC Insulated , tinned Copper	RR/KEI/Bonton/Skyton
2	Lan Cable	D-Link/Skyton/Bonton/Finolex
3	PVC Conduit of 20 & 25 mm dia	BEC/AKG/RMCON
4	MS/GI Conduit of 20 & 25 mm dia	BEC/AKG/RMCON

5	Hot dipped GI Cable Tray/Race way	Profab/Advance Power/Indiana/MEM
6	Network Passive	PENDUIT/AVAYA/LEGRAND/DLINK/HP
7	Network Active	CISCO/HP/JUNIPER

LOW VOLTAGE WORKS LIST OF APPROVED MAKE

SL.No.	Description of Material	Approved Make /Manufacturers
FIRE ALARM/PA SYSTEM		
1	addressable fire alarm control panel	Siemens (Cerberus), Bosch, Notifier
2	Active Repeater Panel.	Siemens (Cerberus), Bosch, Notifier
3	Intelligent addressable Multicriteria detector (Smoke + thermal).	Siemens (Cerberus), Bosch, Notifier
4	Intelligent addressable Smoke detector	Siemens (Cerberus), Bosch, Notifier
5	intelligent addressable Heat detector.	Siemens (Cerberus), Bosch, Notifier
6	Addressable Control Relay Module	Siemens (Cerberus), Bosch, Notifier
7	Addressable Module with one input & one output contacts,	Siemens (Cerberus), Bosch, Notifier
8	Response Indicator with matching screws	Siemens (Cerberus), Bosch, Notifier
9	addessable manual break glass unit (Double action)	Siemens (Cerberus), Bosch, Notifier
10	Stand alone Loop Powered sounder	Siemens (Cerberus), Bosch, Notifier
11	Stand alone Loop Powered Strobe with inbuilt isolators	Siemens (Cerberus), Bosch, Notifier
12	Addressable Duct detector	Siemens (Cerberus), Bosch, Notifier
13	Beam Detector	Siemens (Cerberus), Bosch, Notifier
14	Fire Survival Armoured cable	Finolex, KEI, RR
15	PA controller	Bosch, Biamp, Altas IED, Notifier, JBL
16	Router monitoring.	Bosch / Notifier / JBL
17	Amplifier.	Bosch, Biamp, Altas IED, Notifier, JBL
18	Call Station	Bosch, Biamp, Altas IED, Notifier, JBL
19	wall mount speaker	Bosch, Biamp, Altas IED, Notifier, JBL
20	ceiling mount certified speaker	Bosch, Biamp, Altas IED, Notifier, JBL
21	CD/DVD Player	Sony / Samsung
22	Volume control units 12,36,100W	Bosch / Notifier / JBL
23	Equipment Rack	MTS / Rittal / APW
24	Workstation (i-7 PC, with 8 GB RAM and 1 TB HDD, 10/100 Mbps Ethernet card	HP / DELL / IBM
25	Fire Rated Speaker Cable	Crestron, Extron, Belden
26	Graphics Software	Siemens (Cerberus), Bosch, Notifier

ACCESS CONTROL SYSTEM/PANIC BAR						
1	I.P Controller	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
2	Card Readers	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
3	Relay Boards	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
4	Biometric reader	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
5	Bluetooth smart card readers	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
6	electromagnetic locks/ electric lockset	Assa Abloy, Bel, Defikas, Kaba				
7	exit buttons	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
8	smart cards	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
9	Magnetic Door Contact	CWT, Security Exchange, Kaba				
10	Buzzer	CWT, Security Exchange, Kaba				
11	DFMD	Rapiscan, Astrophysics, Smiths, Safe-gate, Samarth Security				
12	Panic bar with electric latch retraction.	Dafikas / Dorma				
13	Hand held metal detector	Rapiscan, Astrophysics, Smiths, Safe-gate, Samarth Security				
14	Access Control Software	Bosch, Prowatch-Honeywell, Lenel, Rosslare				
15	Cables for ACS	Excel / Bonton/ KEI/				
16	PVC conduit	Precision, BEC, AKG, RMG				
	BOLLARDS AN	D BARRIERS				
1	1 Bollards Faac-Neptune, Automatic Systems, Frontier					
2	Boom barrier	Faac-Neptune, Automatic Systems, Frontier Pits				
	BAGGAGES	SCANNER				
1	Baggage X-Ray Scanner	Astrophysics, Rapiscan, Smith Detection				
CCTV SYSTEM						
1	Dome camera	Bosch, Pelco, Axis, Honeywell-Equip				
2	Bullet Camera	Bosch, Pelco, Axis, Honeywell-Equip				
3	Two-way Audio Input	Bosch, Pelco, Axis, Honeywell-Equip				
4	PTZ Camera	Bosch, Pelco, Axis, Honeywell-Equip				
5	Hard Drives	WD / Seagate				
6	LED Display	Samasung / LG / Sony				
7	Access Control Server	HP / DELL				
1	PASSIVE NETWORK	ING COMPONENTS				
	Unshielded Twisted Pair	Belden, Systemax, Siemon, Schneider				
2	24 Port Patch panels	Belden, Systemax, Siemon, Schneider				
3	Face Plate	Belden, Systemax, Siemon, Schneider				

4	CAT6A/ RJ45 Cable	Systemax, Siemon, Belden
5	Fiber Cable Multimode	Belden, Systemax, Siemon, Schneider

NETWORK RACKS				
1	Network Rack	APW-Vero President, Rittal, Valrack		
2	Chasis Based Core Switch	Alcatel / Cisco / Juniper		
3	Core switch	Alcatel / Cisco / Juniper		
4	Edge switch	Alcatel / Cisco / Juniper		
5	Modules 10GBASE-SX SFP, MMF 220 & 550 meters,	Alcatel / Cisco / Juniper		
6	Wireless Controller	Alcatel / Cisco / Juniper		
7	Dual radio 2x2, 4x4 802.	Alcatel / Cisco / Juniper		
8	Network Management System	Alcatel / Cisco / Juniper		
9	Server for NMS+Controller	HP / Dell		
10	1U RACK Server	HP / Dell		
11	Fire Wall, Unified Protection (UTM)	Fortinet, Cisco, Palo Alto		
Voice Solution				
1	IPPBX	Cisco, NEC, Alcatel, Mitel		
2	IP Phones	Cisco, NEC, Alcatel, Mitel		
Server Room PAC, Room temperature and humidity monitoring Unit				
1	9.5 Tr Precision AC Unit	Blue Box Swegon / Vertiv / Schneider		
2	Precision AC unit Blue Box Swegon / Vertiv / Schneider			
	VES	DA		
1	smoke detection system control Panel	Honeywell / Xtralis		
2	Aspiration sampling nozzles / Sampling tubes/Hooter	Honeywell / Xtralis		
	Rodent R	epellent		
1	Master Console Capable	Maser / CWT		
2	Satellite units	Maser / CWT		
3	Wire Bundles (2C x 1.5 sqmm armoured cable.	Frtek / Bonton / Polycab		
Water Leak Detection				
1	Water leak Detection Panel/Hooter/Sensing cable	Agni / Sontay		
2	Fire Survival Armoured Cable	Finolex, KEI, RR, Frtek		
	UP	Ś		
1	True Online Double Conversion UPS System	Eaton / APC / GE / Numeric		
Audio				

1	Wall mount loudspeaker	Audac / Aimline / Martin Audio	
2	Digital channel power amplifier	Audac / Labgrupen / Powersoft	
3	Professional Media Player	Audac / Coud Audio / Martin Audio	
4	Dual channel power amplifier	Audac / Labgrupen / Powersoft	
5	Sound Bar	Audac / Aimline / Bowers & Wilkins	
6	Power amplifier	Audac / Labgrupen / Powersoft	
7	Compact Powered Bass Reflex Cabinet	Audac / Coud Audio / Martin Audio	
8	Ceiling Speakers	Audac / Aimline / Martin Audio	
9	Central Control Unit Audio Conferencing	Senheiser / Brahler / Revolab	
10	Digital Chairman Unit	Senheiser / Brahler / Revolab	
11	Delegate Unit Discussion Devices	Bosch/Beyerdyanamics/Sennheiser	
12	Wireless handheld / lapel / headworn microphone	Sennheiser / Revolab / Clearone	
13	Wireless digital Handheld Microphone	Sennheiser / Revolab / Clearone	
14	Wireless Lapel Mic	Bosch/Beyerdyanamics/Sennheiser	
15	Wireless Presenter	Crestron/Clickshare/AMX	
16	Ceiling Microphone	Sennheiser / Clock Audio / Clearone	
17	Digital Signal Processor	Xilica / Sennheiser / Symmatrix	
	Unified Com	munication	
1	HD Video communication desktop system	Cisco/Polycom/ Lifesize	
2	AI powered video conferencing system	Cisco/Polycom/ Lifesize	
3	Video Conferencing system comprising of codec and quad camera bar	Cisco/Polycom/ Lifesize	
4	Ultra High Defitnition Video Conferencing system	Cisco/Polycom/ Lifesize	
5	premise conference call unit (MCU)	Cisco/Polycom/ Lifesize	
6	Conference Call Unit (MCU)	Cisco/Polycom/ Lifesize	
	Accesso	oories	
1	AV Connectivity FacePlate	Logic/Kramer/Crestron / Custom	
2	Pro Grade 2 Core Shielded Audio Cables - In Mtr	Crestron / Extron / Beldon	
3	Pro Grade 4 Core Control Cable - In Mtr	Crestron / Extron / Beldon	
4	Pro Grade 16 AWG Speaker Cable - In Mtr	Crestron / Extron / Beldon	
5	Rack 12 U	APW-Vero President, Rittal, Valrack	
6	Rack 24 U	APW-Vero President, Rittal, Valrack	
7	Patch Cord HDMI 2.0 - 2Mtr	Crestron / Extron / Beldon	
8	Patch Cord Audio - 2Mtr	Extron / Crestron / Beldon	

Lighting Control and Automotion				
1	Lighting Control (LMS)	Synapse, Zumtobel, Amerlux, Yaal		

Notes:

- 1 The brands/makes of the items would be executed as per the **"List of Approved Makes"** provided in the Tender Document.
- 2 In case of non-availability of the brand/make specified in the approved list, the agency shall be allowed to use alternate equivalent brands of the material subject to approval of the same from DFCCIL.
- 3 The agency has to submit requisite catalogues and samples of the material to DFCCIL before approval and ensure that the supply would only be taken by agency after the materials are duly approved by DFCCIL.
- 4 The agency has to produce Manufacturer Test Certificates (MTC), Warranty Certificates/Invoices for material/equipment supplied for certification and approval.
- 5 Submittals and samples before supply must be approved from PMC/Architect/DFCCIL

PART-III CHAPTER-I

MILESTONES AND TIME SCHEDULE

PART-III

CHAPTER - I

MILESTONES AND TIME SCHEDULE

1.1.1 Time Schedule:

1.1.1.1 Time of start and completion:

The time allowed for execution of the works is **18** (*Eighteen Months*) from the date of issue of letter of acceptance from DFCCIL.

If the contractor commits defaults in commencing execution of the works as afore stated, DFCCIL shall without prejudice to any other right to remedy, be at liberty to forfeit fully the Earnest Money Deposit and performance guarantee of the contractor.

1.1.1.2 Progress of works:

The contractor shall submit a programme of work in the form of a Bar Chart of all the activities in consistence with milestone target envisaged below. In case this bar chart requires to be modified, the DFCCIL and the contractor shall agree upon a time and progress chart. The chart shall be prepared in direct relation to the time stated as **18 months** for the completion of the works as the milestone targets specified below of these special conditions. It shall indicate the forecast of the dates of commencement and completion of various activities of the work and may be amended as necessary by agreements between the DFCCIL and the contractor within the limitation of **18 months** as overall completion period.

PART-III

CHAPTER-II

TENDER FORMS

TENDER FORMS

FORM No.	SUBJECT			
Form No. 1	Offer Letter			
Form No. 1B	Format for Certificate to Be Submitted / Uploaded by Tenderer Alongwith The Tender Documents			
Form No. 2A	Technical Eligibility Criteria Details			
Form No. 2B	Financial Eligibility Criteria Details			
Form No. 2C	Applicant's Party Information Form			
Form No. 3	Summary of Prices			
Form No. 4	Schedule of Prices and Total Prices			
Form No. 5	Contract Agreement			
Form No. 6	Format of Bank Guarantee for performance security			
Form No. 7	Standing indemnity bond for on account payment			
Form No. 7A	Indemnity Bond			
Form No. 8	ECS / NEFT / RTGS Mandate form			
Form No. 9	Draft MOU for Joint Venture Participation			
Form No.10	Format of JV Agreement			
Form No.11	Pro-forma of Participation from each partner of JV			
Form No.12	Format for Power of Attorney for authorized signatory of JV Partners			
Form No.13 Format for Power of Attorney to lead partner of JV				
Form No. 14	Proforma for Time Extension			
Form No. 15	Certificate of Fitness			
Form No. 16	Proforma of 7 days Notice for works as a Whole/In Parts			
Form No. 17	Proforma of 48 Hours Notice for Whole Work			
Form No. 17A	Proforma of 48 Hours Notice for Part of the Work			
Form No. 18	Proforma of Termination Notice			
Form No. 18A	Proforma of Termination Notice for Part of Work			

Form No. 19	Pre-Contract Integrity Pact
Form No. 20	Final Supplementary Agreement
Form No. 21	Format of Bank Guarantee for Security Deposit
Form No. 22	Format for Power of Attorney for Authorized representative
Form No. 23	No deviation Certificate
Form No.24	GUARANTEE BOND for water proofing works/Anti Termite Treatment Works
Form No.25	Agreement Towards Waiver Under Section 12(5) and Section 31A (5) of Arbitration and conciliation Amendment Act
Form No.26	Certification by Arbitrator appointed under Clause 63 & 64 of Indian Railways General Conditions of Contract

OFFER LETTER

Tender No: CGM/DFCCIL/NOIDA UNIT/INTERIOR & FURNISHING WORK/DFCCIL C. O. BUILDING /SEC-145 NOIDA/2020/01

Name of Work: Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

To, The Chief General Manager/Noida, DFCCIL

We, the undersigned, declare that:

1. I/We ______ have read the various conditions to tender attached hereto and agree to abide by the said conditions. I/We also agree to keep this tender open for acceptance for a period of **120 days** from the date fixed for opening the same and in default thereof, I/We will be liable for forfeiture of my/our "Earnest Money". I/We offer to do the work for DFCCIL, at the rates quoted in the attached schedule and hereby bind myself/ourselves to complete the work in all respects within **18 months** from the date of issue of letter of acceptance of the tender.

2. I/We also hereby agree to abide by the Indian Railways Standard General Conditions of Contract, with all correction slips up-to-date and to carry out the work according to the Special Conditions of Contract and Specifications of materials and works as laid down by DFCCIL in the annexed Special Conditions/Specifications, Schedule of Rates with all correction slips up-to-date for the present contract.

3. A sum of ₹ _____ has already been deposited online as Earnest Money. Full value of the Earnest Money shall stand forfeited without prejudice to any other right or remedies in case my/our Tender is accepted and if:

- (a) I/We do not submit the Performance Guarantee within the time specified in the Tender document;
- (b) I/We do not execute the contract documents within seven days after receipt of notice issued by the DFCCIL that such documents are ready; and
- (c) I/We do not commence the work within fifteen days after receipt of orders to that effect.

4. We have examined and have no reservations to the Bidding Documents, including Addenda;

5. We offer to execute the Works in conformity with the Bidding Documents and within Specified Time

6. We have not been blacklisted/banned neither Bankrupt/Insolvent nor in the process of winding-up nor there is a case pending before any Court on deadline of submission of the Bid in accordance with conditions mentioned in Part-I, Chapter-II (Preamble and General Instructions to tenderers) of Tender document.

7. If our bid is accepted, we commit to obtain a Performance Guarantee in accordance with the Bidding Documents;

8. If our bid is accepted, we commit to deploy key equipment and key personnel consistent with the requirements of the work.

9. We understand that this bid, together with your written acceptance thereof included in your notification of award/Letter of Acceptance (LOA), shall constitute a binding contract between us, until a formal contract is prepared and executed.

10. All information, statements and description in this bid are in all respect true, correct and complete to the best of our knowledge and belief and we have not made any tampering or changes in the bidding documents on which the bid is being submitted and if any tampering or changes/incorrect information are detected at any stage, we understand the bid will invite summarily rejection and forfeiture of bid security, the contract will be liable to be terminated along with forfeiture of performance security, even if LOA has been issued.

11. I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in DFCCIL in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the DFCCIL shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

12. I/We hereby declare that I/We shall treat the tender documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

13. (a) I/We am/are a Statup firm registered by Department of Industrial policy and Promotion (DIPP) and my registration number is valid upto (Copy enclosed) and hence exempted from submission of Earnest Money.

14. We are a 100% Govt. owned PSUs and hence exempted from payment of Earnest Money.

15. We are a Labour Cooperative Society and our Registration No. is with and hence required to deposit only 50% of Earnest Money.

16. Until a formal agreement is prepared and executed, acceptance of this tender shall constitute a binding contract between us subject to modifications, as may be mutually agreed to between us and indicated in the letter of acceptance of my/our offer for this work.

17. We understand that you are not bound to accept the lowest bid or any other bid that

you may receive.

Seal & Signature of Tenderer(s)

Date _____

Name		In the capacity of	
	Signed	D	ulv
authorized to sign the Bid for and on behalf of		Date	5
-			

FORMAT FOR CERTIFICATE TO BE SUBMITTED / UPLOADED BY TENDERER ALONGWITH THE TENDER DOCUMENTS

(To be executed in presence of Public notary on non-judicial stamp paper of the value of Rs. 100/-The stamp paper has to be in the name of the tenderer)

Tender No: CGM/DFCCIL/NOIDA UNIT/INTERIOR & FURNISHING WORK/DFCCIL C. O. BUILDING /SEC-145 NOIDA/2020/01

Name of Work: Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

(Name designation) I..... and appointed as the attorney/authorized signatory of the tenderer (including its constituents), M/s (hereinafter called the tenderer) for the purpose Tender documents of the for the work of per the tender as of (Railway)**, do hereby solemnly affirm and state on the No._ behalf of the tenderer including its constituents as under:

- 1. I/we the tenderer (s) am/are signing this document after carefully reading the contents.
- 2. I/We the tenderer(s) also accept all the conditions of the tender and have signed all the pages in confirmation thereof.
- 3. I/we hereby declare that I/we have downloaded the tender documents from Indian Railway website www.ireps.gov.in . I/we have verified the content of the document from the website and there is no addition, no deletion or no alteration to the content of the tender document. In case of any discrepancy noticed at any stage i.e. evaluation of tenders, execution of work or final payment of the contract, the master copy available with the railway Administration shall be final and binding upon me/us.
- 4. I/we declare and certify that I/we have not made any misleading or false representation in the forms, statements and attachments in proof of the qualification requirements.
- 5. I/We also understand that my/our offer will be evaluated based on the documents/credentials submitted along with the offer and same shall be binding upon me/us.

- 6. I/We declare that the information and documents submitted along with the tender by me/us are correct and I/we are fully responsible for the correctness of the information and documents, submitted by us.
- 7. I/we understand that if the certificates regarding eligibility criteria submitted by us are found to be forged/false or incorrect at any time during process for evaluation of tenders, it shall lead to forfeiture of the tender EMD besides banning of business for period of upto five year. Further, I/we (insert name of the а tenderer) ** ____and all my/our constituents understand that my/our offer shall be summarily rejected.
- 8. I/we also understand that if the certificates submitted by us are found to be false/forged or incorrect at any time after the award of the contract, it will lead to termination of the contract, along with forfeiture of EMD/SD and Performance guarantee besides any other action provided in the contract including banning of business for a period of upto five year.

SEAL AND SIGNATURE OF THE TENDERER

Place: Dated:

FORM No. 2

TENDERER'S CREDENTIALS

S. No	Description
1.	For Technical experience /competence, provide details of similar completed work(s) during the last Seven (07) years, ending last day of month previous to the one in which tender is invited in the proforma given in "Form-2A" . The bidder shall attach Certified completion certificates for each component of work issued by the client duly attested by Notary.
2.	For Financial capacity and organizational resources, provide details of contractual payments received in the last three financial years and the current financial year upto the date of inviting of tender as per audited balance sheet duly certified by Chartered Accountant/Certificate from Chartered Accountant duly supported by Audited Balance Sheet/Form 16A/26AS etc. in the proforma given in "Form-2B" . The bidder shall attach necessary documents in support of the above duly attested by Notary.
3.	For Bid capacity provide details of existing commitments and balance amount of ongoing works with tenderer as per the prescribed proforma "Form-2C" for statement of all works in progress and also the works which are awarded to tenderer but yet not started upto the date of inviting of tender. In case of no works in hand, a 'NIL' statement should be furnished. This statement should be submitted duly verified by Chartered Accountant and attested by Notary.

683 | Page

FORM No. 2A

TECHNICAL ELIGIBILITY CRITERIA DETAILS

Details of the similar works completed (as per Para 1.3.11 of Preamble and General Instructions to Tenderers)

Similar Contract No.			
Contract Identification			
Award Date			
Actual Completion Date			
Role in Contract	Prime Contractor		Member in JV
Total Contract Amount of Similar Work (Rs.)			
If member in a JV, specify participation in total Contract amount	[insert a percentage amount]	Total contract amount in Rs.	
Employer's Name: Address:			
Telephone/fax number			
E-mail:			
Descraption of the similarity in accord	lance with To	ohnical Flagihil	ty Critoria dofinad at Clausa

Descreption of the similarity in accordance with Technical Elegibility Criteria defined at Clause 1.3.11 of Part-I Chapter-III of Tender Document.

The bidder shall attach Certified completion certificates for the work issued by the client duly attested by Notary as per Eligibility Criteria of the tender documents.

In case of JV, the bidder shall attach Certified completion certificates for each member of JV issued by the client duly attested by Notary as per Para 1.3.11.1 of Part-I Chapter-III of the Tender Document.

Signature of the Tenderer with Seal

684 | Page
FINANCIAL ELIGIBILITY CRITERIA DETAILS

Each Bidder or each member of JV must fill in this form separately. Name of Bidder/JV Partner-

Details of contractual payments received during the last three financial years and current financial year upto the date of inviting tender.

Year	Value of gross contractual payment received in Rs.
Current Year (2020-2021)	
2019-2020	
2018 - 2019	
2017 – 2018	
Total Contractual Payment Received (Rs.)	

Note: 1. The details should be extracted from the audited balance sheet Certified by the Chartered Accountant or **Form 16-A/Form-26 AS** issued by the Employer/generated through TRACES duly attested by Notary as **defined at Clause 1.3.11.2 of Part-I, Chapter-III of Tender Document.**

2. In case of JV, each member of JV shall attach this certificate duly certified by the Chartered Accountant **as per Para 1.3.11.2 of Part-I Chapter-III of the Tender Document.**

3. The bidder shall attach necessary documents in support of the above duly attested by Notary.

This is to certify that we are the Chartered Accountant/ Auditors for M/sand the above mentioned contractual payments received is true and correct and this certificate is being issued for bidding purpose for the subject work. My client M/s is the tenderer for the above project.

Sign and Seal of the Chartered Accountant/Auditors

Signature of the

Tenderer with Seal

ICAI Registration No.

UDIN No. of the certificate issued as above.

FORM No. 2C

BID CAPACITY

Name of the Work: Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

NIT No: CGM/DFCCIL/NOIDA UNIT/INTERIOR & FURNISHING WORK/DFCCIL C. O. BUILDING /SEC-145 NOIDA/2020/01 DTD:

ESTIMATED COST PUT TO TENDER: Rs. 115,28,10,621/- (Rs. 97,69,58,153/- + GST @ 18%)

Bid Capacity: The bidding capacity of the contractor should be equal to or more than the total bid value of the present tender. The available bid capacity shall be calculated by the following formula:

Available Bid Capacity = $[A \times N \times 2] - B$

Where,

A = Maximum value of construction works executed and payment received in any one of the previous three financial years or the current financial year (up to date of inviting tender), taking into account the completed as well as works in progress (to be taken from "Form-2B").

N = Number of years prescribed for completion of work for which bids has been invited.

B = Value of existing commitments and balance amount of ongoing works with the tenderer to be completed in next 'N' years (Format enclosed)

Note: 1. In case of JV, the above statement should be submitted for each member of JV.

2. In case of JV, the arthematic sum of individual "Bid capacity" of all the members shall be taken as JV's "Bid capacity" to satisfy this requirement.

	ANNEXU	URE-A		
BII	O CAPACITY C	CALCULATIO	DN	
	BY BID	DER		
			SIGN & STAMP OF	BIDDER

LIST OF EXISTING COMMITMENT AND ONGOING WORKS AND THE WORKS WHICH ARE AWARDED TO TENDERER BUT NOT YET STARTED UPTO THE DATE OF INVITING THE TENDER.

Sr. No.	Name of Work	Client Name & Address	Awarded Value/Latest Assessment value of work depending upon approved variation (in Rs)	Work Executed till Tender submissio n date (Rs)	Balance Amount of work to be complete d (Rs)	Date of Awa rd of work	Completi on Date (as approved latest as per EOT)	Balance period to complet e the works (Total months)	Work to be complete d in 18 months (Rs)
1	2	3	4	5	6=(4-5)	7	8	9=(8-7)	10
		Balance	Commitments du	ring next 18 m	onths			Rs.	
T.	· · · · · · · · · · · · · · · · · · ·	1 1		1					
Iti	s certified that u	ne above particula	ars furnished are true	and correct.					
	1. The ab	ove statement sho	ould be submitted du	y verified by Ch	artered Account	tant.			
	2. In case	of no works in h	and, a "NIL" stateme	ent should be furr	nished.				
	3. In case	the tenderer faile	d to submit the bid c	apacity statemen	t along with the	offer, their/his	offer shall be c	onsidered as	
	incomp	blete and will be l	iable to be rejected.		· 11 C 11 1 1	4			
	4. Please	note that all the c	olumns in above tabl	e are to be essent	tially filled up b	y the tenderer.			10
	5. Value I months	an Column-10 wh 3.	n de taken same as C	olullin-o li exist	ing DOC is with	lin the comple	uon period of u	lis tender 1.e.	18
	6. If exist	ing DOC of tabul	ated works is beyond	l the DOC of ten	der under consi	deration, then	Pro-rata amount	t of total balar	nce
	amoun	t as shown in colu	umn no. 6 will be tak	en.					
	7. All per	iod of time for ca	lculation purpose be	round up to num	ber of months to	o nearest interi	or		
Sign	and Seal of t	he Chartered	Accountant/Aud	itors			Signatu	ire of the	
ICA	I Registratior	n No.					Tenderer	with Seal	
UDI	N No. of the c	ertificate issu	ed as above.						

SUMMARY OF PRICES

Name of work: - Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

S. No	DESCRIPTION OF SCHEDULES	COST (in Rs.)
Ι	SCHEDULE-I (INTERIOR & FURNISHING WORKS)	
(i)	Execution of all works as per "Schedule-Items" (as per CPWD DSR	8 12 08 371 00
	2016/2018/2019 without GST)	0,12,70,371.00
(ii)	Execution of all works as per "Non-Schedule-Items"	44,62,41,352.00
	Total (Schedule-I)	52,75,39,723.00
	Total (Schedule-I) Incl. GST @18%	62,24,96,873.00
Π	SCHEDULE-II (ELECTRICAL WORKS)	
(i)	Execution of all works as per "Schedule-Items" (as per CPWD DSR	8 21 73 538 00
	2016/2018/2019 without GST)	0,21,73,330.00
(ii)	Execution of all works as per "Non-Schedule-Items"	7,78,01,040.00
	Total (Schedule-II)	15,99,74,578.00
	Total (Schedule-II) Incl. GST @18%	18,87,70,002.00
III	SCHEDULE-III (HVAC & BMS WORKS)	
(i)	Execution of all works as per "Schedule-Items" (as per CPWD DSR	4 17 73 561 00
	2018/2019 without GST)	4,17,75,501.00
(ii)	Execution of all works as per "Non-Schedule-Items"	7,88,81,816.00
	Total (Schedule-III)	12,06,55,377.00
	Total (Schedule-II) Incl. GST @18%	14,23,73,345.00
IV	SCHEDULE-IV (LOW VOLTAGE WORKS)	
(ii)	Execution of all works as per "Non-Schedule-Items"	16,87,88,476.00
	Total (Schedule-IV)	16,87,88,476.00
	Total (Schedule-IV) Incl. GST @18%	19,91,70,402.00
	Grand Total (Schedule-I+ II+ III+IV)	97,69,58,153.00
	Grand Total (Schedule- I+ II+ III+IV) Incl. GST @ 18%	115,28,10,621.00

Notes:

- 1) This proforma is just for information and perusal. However, the rates are to be filled in Online mode in Financial Bid "Packet-B".
- 2) Schedule Items: The cost of Schedule items given above are as per CPWD DSR 2016/2018/2019 without GST. The rates of items for CPWD DSR 2016 are already exclusive of GST. However, the rates of items for CPWD DSR 2018/2019 as mentioned in BOQ have been worked out after deducting GST component from the CPWD DAR 2018/2019.

- 3) Non-Schedule Items: The cost of Non-Schedule items given above (*other than CPWD DSR* 2016/2018/2019) are as per current market rate analysis (*excluding GST, as GST would be paid extra by DFCCIL*).
- 4) The rates quoted by the tenderer shall be inclusive of all taxes and levies but excluding GST. The GST as legally leviable and payable by the Bidder under the provisions of applicable law/act shall be paid extra by DFCCIL to agency. Therefore, the Bidders should quote their rates after considering the Input Tax Credits on their input materials and services. Hence, Bidders should ensure that, full benefit of Input Tax Credit (ITC) likely to be availed by them is duly considered while quoting their rates.
- 5) *Price variation will not be applicable for this work.*
- 6) The bidder has to be registered under CGST/IGST/UTGST/SGST Act and should submit GSTIN along with other details required under CGST/IGST/UTGST/SGST Act to the Employer, without which, no payment shall be released to the contractor.

(Schedule of Prices and Total Prices)

Name of Work: Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

Form-	4
-------	---

		BILL OF QUANTITIES OF INTERIO	R & FUF	RNISHING W	ORKS	
BOQ Item No.	DSR 2016 Item No.	Item Description	Unit	Qty	Rate	Amount
		SCHEDULE-I				
		INTERIOR & FURNISHING				
(i)		WOKKS SCHEDIII ED DSP ITEMS				
		INTERIOR WORKS				
A						
		SUBHEAD 1: CONCRETE WORKS				
1	4.1	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level :				
2	412	1.2.4 (1 Compart + 2 pagence and + 4				
Z	4.1.5	raded stone aggregate 6-12 mm				
		nominal size) for Screeding on Floors	Cum	50.00	5,481,95	2.74.097.50
3	4.1.8	1:4:8 (1 Cement : 4 coarse sand (zone- III) : 8 graded stone aggregate 40 mm	Cum	100.00	1 178 15	4 47 815 00
			Cum	100.00	4,470.13	4,47,813.00
4	4.10	Providing and laying damp-proof course 40 mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size).	Sqm	20.00	263.10	5,262.00
						,
5	4.13	Applying a coat of residual petroleum bitumen of grade of VG-10 of approved quality using 1.7 kg per square metre on damp proof course after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene				
		oil.	Sqm	5.00	91.90	459.50
		Total of the Sub-Head - Concrete work :				7,27,634.00
		SUBHEAD 2: RCC WORKS				
6	5.3	Reinforced cement concrete work in beams, suspended floors, roofs having slope up to 15° landings, balconies, shelves, chajjas, lintels, bands, plain window sills, staircases and spiral stair cases up to floor five level, excluding the cost of centering, shuttering, finishing and reinforcement, with 1:1.5:3 (1 cement : 15 coarse sand (Zone III) : 3	Cum	50.00	7 300 80	3 69 540 00

		graded stone aggregate 20 mm nominal size).				
7	5.37	Providing and laying in position ready mixed M-25 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Architect. (Note :- Cement content considered in this item is @ 330 kg/cum. Excess/less				
		cement used as per design mix is				
		payable/recoverable separately).				
	5.37.1	All works upto plinth level	Cum	100.00	6,713.60	6,71,360.00
8		Centering and shuttering including strutting, propping etc. and removal of form for :				
8.1	5.9.5	Lintels, beams, plinth beams, girders, bressumers and cantilevers.	Sqm	15.00	342.90	5,143.50
0 0	5 0 10	Waathar shada Chailas corhala ata				
0.2	5.9.19	including edges	Sqm	15.00	521.75	7,826.25
8	5.34.1	Providing M-30 grade concrete instead of M-25 grade BMC/ RMC. (Note:- Cement content considered in M-30 is @ 340 kg/cum) Total of the Sub-Head - RCC Work :	Cum	40.00	69.50	2,780.00 10,56,649.75
		SUBHEAD 3: MASONRY WORKS				
9	6.38	Providing and laying autoclaved aerated cement blocks masonry with 100 mm thick AAC blocks in super structure above plinth level up to floor V level in cement mortar 1:4 (1 cement : 4 coarse sand). The rate includes providing and placing in position 2 Nos 6 mm dia M S	Cum	95.45	6 818 60	6 50 835 37
		placing in position 2 Nos 6 mm dia M.S.	Cum	95.45	0,818.60	0,50,835.37

		bars at every third course of masonry work.				
10	6.5	Extra for brick work / AAC block masonry / Tile brick masonry in superstructure above floor V level, for each four floors or part thereof by mechanical means.	Cum	35.79	205.45000	7,353.06
		Total of the Sub-Head - Masonry Work :				6,58,188.43
		SUBHEAD 4: FLOORING WORKS				
11	8.11	Providing and fixing machine cut, mirror/ eggshell polished, Marble stone work for wall lining (veneer work) including dado, skirting, risers of steps etc., in required design and pattern wherever required, stones of different finished surface texture, on 12 mm (average) thick cement mortar 1:3 (1 cement: 3 coarse sand) laid and jointed with white cement slurry @ 3.3 kg/sqm including pointing with white cement slurry admixed with pigment of matching shade, including rubbing, curing, polishing etc. all complete as per Architectural adrawings, and as directed by the Engineer-in-Charge.				
11.1	8.11.1	18 mm thick Italian Marble stone slab, Perlato, Bottachino Classico,Rosso Verona, Fire Red or Dark Emperadore etc. Stone to be approved by Architect.	Sqm	2905.27	6,647.35	1,93,12,346.53
11.2	8.2	Providing and fixing 18 mm thick gang saw cut, mirror polished, premoulded and prepolihsed, machine cut for kitchen platforms, vanity counters, window sills, facias and similar locations of required size, approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (a cement: 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, moulding and polishing to edges to give high gloss finish etc. complete at all levels.				
11.0.1	8.2.2	Granite of any colour and shade	ä	1 10 10	0.110.50	
11.2.1	8.2.2.1	Area of slab over 0.50 sqm	Sqm	142.49	3,113.30	4,43,614.12
12	11.51	Stone work in Wave Pattern/ Geometric				

		Design Pattern/ Abstract Pattern, Linear Pattern Straight Pattern as per Design/ Drawing. Machine cut, mirror/ diamond polish, Marble Combination stone work in Flooring, skirting and steps etc., stones of different finished surface texture, laid over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with white cement slurry @ 4.4 kg/Sqm, including pointing with white cement slurry admixed with pigment to match the marble shade, including rubbing, curing and polishing etc. all complete as specified.				
12.1	11.51.1	18 mm thick Italian Marble stone slab, Perlato, Bottachino Classico,Rosso Verona, Fire Red or Dark Emperadore	C and	2220.65	5 006 10	1 16 17 155 66
12.2	8.13.1	Polished Granite stone slab jet Black, Cherry Red, Elite Brown, Cat Eye or equivalent Stone to be approved by Architect.	Sqm Sam	1424 86	2.937 70	41.85 811 22
12.3	16.87	Providing and laying gang saw cut 30 mm thick, mirror polished pre moulded and pre polished machine cut granite stone of required size and shape of approved shade, colour and texture in footpath, flooring in road side plazas and similar locations, laid over 20mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand) including grouting the joints with white cement mixed with matching pigment, epoxy touch ups etc. complete as per direction of Architect.	Sqm	50.00	3,339.60	1,66,963.30
13	8.3	Providing edge moulding to 18 mm thick marble stone counters, Vanities etc., including machine polishing to edge to give high gloss finish etc. complete as per design approved by Architect.				
13.1	8.3.1	Marble work	Meter	76.80	144.70	11,112.96
14	8.5	Extra for providing opening of required size & shape for wash basin/ kitchen sink in kitchen platform, vanity counter and similar location in marble/ Granite/ stone work, including necessary holes for pillar taps etc. including moulding, rubbing and polishing of cut edges etc. complete.	Each	128.00	427.95	54,777.60

15	8.7	Providing and fixing cramps of required size & shape in RCC/ CC / Brick masonry backing with cement mortar 1:2 (1 cement :2 coarse sand), including drilling necessary hole in stones and embedding the cramp in the hole (fastener to be paid separately). Stainless steel cramps	Kg	500.00	521.10	2,60,550.00
16	11.26	Kota stone slab flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) :	Sam	272.20	1 159 10	2 15 250 62
17	11.27	Kota stone slabs 20 mm thick in risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement 3coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing complete.	Sqm	76.80	1,238.20	95,093.76
18	11.36	Providing and fixing 1st quality ceramic glazed floor and wall tiles conforming to IS : 15622 (thickness to be specified by the manufacturer) of approved make in all colours, shades except burgundy, bottle green, black of any size as approved by Architect in skirting, risers of steps and dados over 12 mm thick bed of cement Mortar 1:3 (1 cement: 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm including pointing in white cement mixed with pigment of matching shade complete.	Sqm	375.25	744.80	279486.20
10	11 41					
19	11.41	providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colors and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3 kg/ Sqm including grouting the joints with white cement and matching pigments etc., complete.				

	11.41.4	Size of Tile 1000x1000 mm	Sqm	12614.06	2,057.85	2,59,57,843.37
	11.46	Providing and laying Vitrified tiles in different sizes (thickness to be specified by manufacturer), with water absorption less than 0.08 % and conforming to I.S. 15622, of approved make, in all colours & shade, in skirting, riser of steps, over 12 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joint with white cement & matching pigments etc. complete.	2			
	11.46.1	Size of Tile 600x600 mm	Sqm	278.91	1135.20	3,16,679.75
20	11.48	Grouting the joints of flooring tiles having joints of 3 mm width, using epoxy grout mix of 0.70 kg of organic coated filler of desired shade (0.10 kg of hardener and 0.20 kg of resin per kg), including filling / grouting and finishing complete.				
	11.48.4	Size of Tile 1000x1000 mm	Sqm	12614.06	97.20	12,26,086.68
21	11.54.2	Providing and fixing removable raised/false access flooring with system and its components of approved make for different plenum height with possible height adjustment upto 50 mm, comprising of modular load bearing floor panels supported on G.I. rectangular stinger frame work and G.I. Pedestal etc. all complete, as per the architectural drawings, as specified and as directed by Architect consisting of a) Providing at required spacing to form modular framework, pedestals made out of GI tube of thickness minimum 2 mm and 25 mm outer diameter, fully welded on to the G.I. Base plate of size 100mm x 100mm x 3mm at the bottom of the pedestal tube, G.I. pedestal head of size 75mmx75mmx3.5 mm welded with GI fully threaded stud 16mm outer diameter with two GI Check nuts screwed on the stud for level adjustment upto 50mm, locking and stabilizing the pedestal head in position at the required level. The pedestals shall be fixed to the subfloor (base) through base plate using epoxy based adhesive of approved make or the				

b) Stringers system in all steel				
construction hot dipped galvanized of				
rectangular size 570x20x30x0 80mm				
thick having holes at both ends for				
securing the stringers on to the padestal				
band using fully threaded				
nead using fully inreaded screws				
ensuring maximum lateral stability in all				
directions, the grid formed by the				
pedestal and stringer assembly shall				
receive the floor panel, this system shall				
provide adequate solid, rigid support for				
access floor panel, the system shall				
provide a minimum clear uninterrupted				
clearance between the bottom of the				
floor for electrical conduits and wiring				
noor for electrical conduits and writing				
etc. an complete as per the architectural				
drawings.				
c) Providing and fixing Access Floor				
panel of 600x600x32 mm medium grade				
Filled Steel anti static high pressure				
Lamination of 800H grade (FS800H).				
Access Floor panel shall be steel welded				
construction with an enclosed bottom				
pan with uniform pattern of 64				
hemispherical cones. The top and bottom				
plates of Steel Gauges: top 0.6 mm and				
hattern 0.7 mm freed and welded				
bottom 0.7 mm lused spot welded				
together (minimum 64 welds in each				
dome and 20 welds along each flange).				
The panel should be corrosion resistant				
epoxy coated for lifetime rust protection				
and cavity formed by the top and bottom				
plate is filled with Pyrogrip				
noncombustible Portland cementitious				
core mixed with lightweight foaming				
compound				
The access floor shall be factory finished				
with Anti statio High Dressure lawingta				
with Anu-static High Pressure laminate				
with Non Warp technology upto Imm				
thickness for superior adhesion and				
Surface flatness within 0.75mm.The				
panel is to withstand a Concentrated				
Load of 363 kgs applied on area 25mm x				
25mm without collapse in the centre of				
the panel which is placed on four steel				
blocks The panel will withstand and				
Uniformly Distributed Load (UDL)				
minimum 1250 kg/Sam and an immast				
1 1 1 1 50 kg/Sqin and, an impact				
load of SUKg all complete as per the				
approved manufacturers specification.				
All specification must be printed on the				
side of the panel to ensure the quality of				
the product.450 mm Finished Floor	Sqm	249.69	4,275.40	10,67,524.63

		Height (FFH).				
		Total of the Sub-Head - Flooring :				6,53,10,396.37
		SUBHEAD 5: PLASTERING & FINISHES				
22	13.1	12 mm cement plaster of mix :				
22.1	13.1.1	1:4 (1 cement: 4 fine sand)	Sqm	2502.93	172.95	4,32,876.56
23	13.62	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade :				
23.1	13.62.1	Two or more coats on new work over an under coat of suitable shade with ordinary paint of approved brand and manufacture	Sqm	299.97	112.30	33,686.63
24	13.80	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer. Quote for each layer over the plastered wall surface to prepare the surface even and smooth complete.	Sqm	6999.93	87.35	6,11,441.27
25	13.45	Finishing walls with textured exterior				
23	15.45	paint of required shade :				
25.1	13.45.1	New work (Two or more coats applied @ 3.28 ltr/10 Sqm) over and including priming coat of exterior grade primer applied @ 2.20kg/10 Sqm	Sqm	501.11	150.65	75,492.22
26	13.37	White washing with lime to give an even shade :				
26.1	13.37.1	New work (three or more coats)	Sqm	5051.97	17.25	87,146.48
27	13.44	Finishing walls with water proofing cement paint of required shade :	Sqm	5490.89	58.80	3,22,864.18
27.1	13.44.1	New work (Two or more coats applied @ 3.84 kg/10 Sqm)				
28	13.82	Wall painting with acrylic emulsion paint, having VOC (Volatile Organic Compound) content less than 50 grams/ litre, of approved brand and manufacture, including applying additional coats wherever required, to achieve even shade and colour.				
28.1	13.82.2	Two coats	Sqm	6767.03	73.90	5,00,083.80
		Total of the Sub-Head - Plastering & Finishing :				20,63,591.00

		SUBHEAD 6: DOORS & WINDOWS				
29	9.1	Providing wood work in frames of				
		doors, windows, clerestory windows and				
		other frames, wrought framed and fixed				
		in position with noid fast lugs of with dash fasteners of required dia & length (
		hold fast lugs or dash fastener shall be				
		noid for separately)				
29.1	911	Second class teak wood	Cum	7 80	92 743 05	7 23 395 79
30	25.8	Design supply & installation of	Cum	7.00	72,745.05	1,23,375.17
50	23.0	suspended Spider Glazing system				
		designed to withstand the wind pressure				
		as per IS 875 (Part-III). The Suspended				
		System held with Spider Fittings of SS-				
		316 Grade Steel of approved				
		manufacturer with glass panel having 12				
		mm thick clear toughened glass held				
		together with SS- 316 Grade Stainless				
		steel Spider & bolt assembly with				
		laminated glass fins 21 mm thick. The				
		Glass fins and glass panel assembly shall				
		be connected to Slab/ beams by means				
		of SS- 316 Grade stainless steel brackets				
		& Anchor bolts and at the bottom using SS sharped of $50x25x2mm$ using				
		fostonor & anchor bolts non staining				
		weather sealants of approved make				
		Teflon/ nylon bushes and separators to				
		prevent bi-metallic contacts all				
		complete to perform as per specification				
		and approved drawings. The complete				
		system to be designed to accommodate				
		thermal expansion & seismic movements				
		etc. The joints between glass panels (6 to				
		8 mm) and gaps at the perimeter & in U				
		channel of the assembly to be filled with				
		non staining weather sealant, so as to				
		make the entire system fully water proof				
		& dust proof. The rate shall include all				
		design, Engineering and shop drawing				
		including approval from structural				
		incidental charges including wasters				
		enabling temporary services all fitting				
		fixers nut holts washer Ruffer plates				
		fastener, anchors, SS channel laminated				
		glass etc. all complete. For the purpose				
		of payment, actual elevation area of				
		Glazing including thickness of joints and				
		the portion of Glass panel inside the SS	Sqm	176.10	6,928.55	12,20,117.66

1	l	channel shall be measured		1	l	l
31	9.96	Providing and fixing aluminium sliding				
51	2.20	door bolts ISI marked anodized anodic				
		coating not less than grade $AC = 10$ as per				
		IS : 1868) transparent or dved to				
		required colour or shade with puts and				
		screws etc. complete :				
31.1	9 96 1	300x16 mm	Fach	12.00	212.45	2 549 40
51.1	7.70.1		Lacii	12.00	212.45	2,349.40
32	9.100	Providing and fixing SS handles, ISI				
		marked, anodized (anodic coating not				
		less than grade AC 10 as per IS : 1868)				
		transparent or dyed to required colour or				
		shade, with necessary screws etc.				
		complete :				
32.1	9.100.1	125 mm	Each	83.00	51.10	4,241.30
33	9.20	Providing and fixing ISI marked flush				
		door shutters conforming to IS: 2202				
		(Part I) decorative type, core of block				
		board construction with frame of 1st				
		class hard wood and well matched teak 3				
		ply veneering with vertical grains or				
		cross bands and face veneers on both				
		faces of shutters.				
33.1	9.20.1	35 mm thick including ISI marked				
		Stainless Steel butt hinges with				
		necessary screws.	Sqm	180.00	2,488.95	4,48,011.00
34	9.23	Extra for providing lipping with 2nd				
		class teak wood battens 25 mm				
		minimum depth on all edges of flush				
		door shutters (over all area of door				
		shutter to be measured).	Sqm	180.00	365.85	65,853.00
		· · · · · · · · · · · · · · · · · · ·	•			
35	9.26	Extra for cutting rebate in flush door				
		shutters (Total area of the shutter to be	~			
		measured).	Sqm	43.20	127.75	5,518.80
36	9 53	Providing 40x5 mm flat iron hold fast 40				
50	1.55	cm long including fixing to frame with				
		10 mm diameter bolts nuts and wooden				
		plugs and embedding in cement concrete				
		block 30x10x15cm 1.3.6 mix (1 cement				
		: 3 coarse sand · 6 graded stone				
		aggregate 20mm nominal size)	Each	426.00	118.60	50,523.60
37	9.76	Providing and fixing bright finished SS				
		100 mm mortice latch and lock with 6				
		levers and a pair of lever handles of				
		approved quality with necessary screws		50.00		20.020 55
		etc. complete.	Each	59.00	556.45	32,830.55

38	9.74	Providing and fixing bright finished SS tower bolts (barrel type) with necessary screws etc. complete :				
38.1	9.74.1	250x10	Each	24.00	313.20	7.516.80
38.2	9742	150x10	Each	59.00	251.50	14 838 50
50.2	2.11.2		Luch	37.00	251.50	11,050.50
39	9.82	Providing and fixing stainless steel hanging type floor door stopper with necessary screws, etc. complete.	Each	83.00	85.85	7,125.55
40	21.19	Filling the gap in between aluminium/ stone/ wood/ glass frame and adjacent RCC/ Brick/ Stone/ wood/ Ceramic/ Gypsum work by providing weather/structural non sag elastomeric PU sealant over backer rod of approved quality as per architectural drawings and direction of Architect complete, complying to ASTM C920, DIN 18540- F & ISO 11600				
40.1	21.19.1	Upto 5 mm depth and 5 mm width	Rmt	3116.20	96.65	3,01,180.73
		Total of the Sub-Head - Doors & Windows				28,83,702.68
		SUBHEAD 7: STRUCTURAL STEEL				
41	10.2	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	Kg	1000.00	67.60	67,600.00
42	10.19	Providing and fixing mild steel round holding down bolts with nuts and washer plates complete.	Kg	600.00	68.00	40,800.00
43	10.25	Steel work welded in built up sections/ framed work including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.				
43.1	10.25.1	In stringers, treads, landings etc. of stair cases, including use of chequered plate wherever required, all complete	Kg	500.00	65.80	32,900.00
44	9.48	Providing and fixing M.S. grills of required pattern in frames of windows etc. with M.S. flats, square or round bars				

		etc. including priming coat with approved steel primer all complete.				
44.1	9.48.1	Fixed to steel windows by welding	kg	800.00	104.65	83,720.00
45	10.18	Providing and fixing circular/ Hexagonal cast iron or M.S. sheet box for ceiling fan clamp, of internal dia 140 mm, 73 mm height, top lid of 1.5 mm thick M.S. sheet with its top surface hacked for proper bonding, top lid shall be screwed into the cast iron/ M.S. sheet box by means of 3.3 mm dia round headed caravas and back at the corract. Clamp				
		shall be made of 12 mm dia M.S. bar				
		bent to shape as per standard drawing.	Each	8.00	130.10	1,040.80
		Total of the Sub-Head - Steel Work :				2,26,060.80
		SUBHEAD 8: WATERPROOFING				
46	22.23	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage & water treatment plant, tunnels / subway and bridge deck etc., prepared by mixing in the ratio of 5 : 2 (5 parts integral crystalline slurry : 2 parts water) for vertical surfaces and 3 : 1 (3 parts integral crystalline slurry : 1 part water) for horizontal surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e. by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure on negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the engineerin-C129charge. The product performance shall carry guarantee for 10 years against any leakage.				
	22.23.1	For vertical surface two coats @0.70 kg	Sam	50.00	160 10	22 105 0
	22.23.2	For horizontal surface one coat @1.10	Squi	50.00	400.10	23,403.00
		kg per Sqm.	Sqm	50.00	362.35	18,117.50

47	13.18	Neat Cement Punning	Sqm	3549.40	42.60	1,51,204.44
		Total of the Sub-Head - Water				
		Proofing :				1,92,726.94
		SUBHEAD 9: FALSE CEILING				
48	12.45	Providing and fixing false ceiling at all				
		height including providing and fixing of				
		frame work made of special sections,				
		power pressed from M.S. sheets and				
		galvanized with zinc coating of 120				
		gms/Sqm (both side inclusive) as per IS :				
		277 and consisting of angle cleats of size				
		25 mm wide x 1.6 mm thick with flanges				
		of 27 mm and 37 mm, at 1200 mm				
		centre to centre, one flange fixed to the				
		ceiling with dash fastener 12.5mm dia x				
		50 mm long with 6 mm dia bolts, other				
		flange of cleat fixed to the angle hangers				
		of 25x10x0.50 mm of required length				
		with nuts & bolts of required size and				
		other end of angle hanger fixed with				
		intermediate G.I. channels 45x15x0.9				
		mm running at the rate of 1200 mm				
		centre to centre, to which the ceiling				
		section 0.5 mm thick bottom wedge of				
		80 mm with tapered flanges of 26 mm				
		each having lips of 10.5 mm, at 450 mm				
		centre to centre, shall be fixed in a				
		direction perpendicular to G.I.				
		intermediate channel with connecting				
		clips made out of 2.64 mm dia x 230 mm				
		long G.I.				
		wire at every junction, including fixing				
		perimeter channels 0.5 mm thick 27 mm				
		high having flanges of 20mm and 30				
		to well/contition with the help of read				
		to wail/partition with the help of fawl				
		dry well screws @ 230 mm interval				
		including fixing of gynsum board to				
		ceiling section and perimeter channel				
		with the help of dry wall screws of				
		size 3.5 x 2.5 mm at 230 mm c/c				
		including jointing and finishing to a				
		flush finish of tapered and square edges				
		of the board with recommended jointing				
		compound, jointing tapes, finishing				
		with jointing compound in 3 layers				
		covering upto 150 mm or both sides of				
		joint and two coats of primer suitable for				
		board, all as per manufacture's				
		specification and also including the cost				
		of making openings for light fittings,				
		grills, diffusers, cutouts made with frame				

		of perimeter channels suitably fixed, all complete as per drawings, specification but excluding the cost of painting with :				
48.1	12.45.1	12.5 mm thick tapered edge gypsum plain board conforming to IS: 2095- Part I.	Sqm	1502.90	806.20	12,11,637.98
		TOTAL False Ceiling				12,11,637.98
		SUBHEAD 10: WALL PANELLING				
49	9.154	Providing and fixing frame work for partitions/ wall lining/ paneling etc. made of 50x25x1.6 mm hollow MS tube, placed along the walls, ceiling and floor in a grid pattern with spacing @ 60 cm centre to centre both ways (vertically & horizontally) or at required spacing near opening, with necessary welding at junctions and fixing the frame to wall/ ceiling/ floors with steel dash fasteners of 8 mm dia, 75 mm long bolt, including making provision for opening for doors, windows, electrical conduits, switch boards etc., including providing with two coats of approved steel primer etc.				
		complete.	Kgs	44894	78.45	35,21,934.30
		TOTAL Wall Paneling				35,21,934.30
		SUBHEAD 11: DEMOLITION AND DISMANTLING WORKS				
50	15.3	Demolishing R.C.C. work manually/ by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 meters lead as per direction of Architect.	CUM	10.00	1,454.55	14,545.50
51	15.5	Extra for cutting reinforcement bars manually/ by mechanical means in R.C.C. or R.B. work (Payment shall be made on the cross sectional area of R.C.C. or R.B. work) as per direction of Architect.	Sqm	25.00	500.80	12,520.00
52	15.7.4	Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 meters lead as per direction of Architect. In cement mortar	CUM	10.00	842.75	8,427.50
53	15.8.3	Removing mortar from bricks and cleaning bricks including stacking within a lead of 50 m (stacks of cleaned bricks	Bricks	5000.00	2.79	13,950.00

54	15.60	shall be measured): From brick work in cement mortar Disposal of building rubbish / malba / similar unserviceable, dismantled or waste materials by mechanical means, including loading, transporting, unloading to approved municipal				
		dumping ground or as approved by Architect, beyond 50 m initial lead, for all leads including all lifts involved.	CUM	20.00	120.55	2,411.00
		Total of DISMANTLING & DEMOLISHING :				51,854.00
		Total of INTERIOR & FURNISHING WORKS (SCHEDULE ITEMS) – "A"				7,79,04,376.24
В	DSR 2018 Item No.	PLUMBING WORKS (DSR 2018)				
		SUBHEAD 12: SANITARY INSTALLATIONS				
55	17.78	Providing and fixing white vitreous china extended wall mounting water closet of size 780x370x690 mm of approved shape including providing & fixing white vitreous china cistern with dual flush fitting, of flushing capacity 3 litre/ 6 litre (adjustable to 4 litre/ 8 liters), including seat cover, and cistern fittings, nuts, bolts and gasket etc. complete.	Each	81.00	12,145.94	9,83,821.14
56	17.7A	Providing and fixing wash basin with C.I. brackets, 15 mm dia CP Brass single hole basin mixer of approved quality and make, including painting of fittings and brackets, cutting and making good the walls wherever required:-				
56.1		(a) White Vitreous China Wash basin size 550x400 mm with a 15 mm CP Brass single hole basin mixer	Each	36.00	3,861.29	1,39,006.44
57	17.7B	Providing and fixing wash basin with C.I. brackets, 15 mm dia pillar cock,32mm PTMT waste coupling of standard pattern painting of fitting and brackets ,cutting and making good the walls wherever required. White vitreous china flat back wash basin size 550x400mm with single	Each	56.00	2,103.20	1,17,779.20

1	l		l	1		
		15MM PTMT pillar cock.				
58	17 10	Providing and fixing Stainless Steel A				
50	17.10	ISI 304 (18/8) kitchen sink as per				
		IS:13983 with C.I. brackets and stainless				
		steel plug 40 mm, including painting of				
		fittings and brackets, cutting and making				
		good the walls wherever required :				
58.1	17.10.1	Kitchen sink with drain board				
58.2	17.10.1.3	510x1040 mm bowl depth 200 mm	Each	22.00	4,896.10	1,07,714.20
50	18 21	Providing and fixing plasticized PVC				
39	10.21	connection pipe with brass unions :				
59.1	18 21 2	45 cm length				
59.2	18.21.2.1	15 mm nominal bore	Each	244.00	72.78	17.758.32
						1.,.00.02
60	18.53	Providing and fixing C.P. brass angle				
		valve for basin mixer and geyser points				
		of approved quality conforming to				
		IS:8931				
60.1	18.53.1	15mm nominal bore	Each	244.00	466.46	1,13,816.24
(1	17.24					
01 61.1	17.34	Providing and fixing tollet paper holder :	Feeb	88.00	511.04	45 041 02
01.1	17.34.1	C.P. DIASS	Each	88.00	311.64	43,041.92
62	18.52	Providing and fixing C.P. brass stop				
02	10.02	cock (concealed) of standard design and				
		of approved make conforming to				
		IS:8931.				
62.1	18.52.1	15 mm nominal bore	Each	88.00	531.57	46,778.16
	1= 01					
63	17.31	Providing and fixing 600x450 mm				
		beveled edge mirror of superior glass (of approved quality) complete with 6 mm				
		thick hard board ground fixed to wooden				
		cleats with C P brass screws and				
		washers complete.	Each	92.00	1.124.99	1.03.499.08
					,	, - ,
64	17.69	Providing and fixing PTMT Waste				
		Coupling for wash basin and sink, of				
		approved quality and colour.				
64.1	17.69.1	Waste coupling 31 mm dia of 79 mm				
		length and 62mm breadth weighing not	F 1	114.00	07.46	0.070.44
		less than 45 gms	Each	114.00	87.46	9,970.44
65	17.22A	Providing and fixing CP Brass 32mm				
0.5	17,2211	size Bottle Trap of approved quality &				
		make and as per the direction of				
		Architect.	Each	178.00	774.27	<u>1,37,8</u> 20.06

66	17.71	Providing and fixing PTMT liquid soap container 109 mm wide, 125 mm high and 112 mm distance from wall of standard shape with bracket of the same materials with snap fittings of approved quality and colour, weighing not less than 105 gms.	Each	41.00	139.02	5,699.82
67	17.73	Providing and fixing PTMT towel rail complete with brackets fixed to wooden cleats with CP brass screws with concealed fittings arrangement of approved quality and colour.				
67.1	17.73.1	450 mm long towel rail with total length of 495 mm,78 mm wide and effective height of 88 mm, weighing not less than 170 gms	Each	22.00	486.94	10712.68
		TOTAL C/F SANITARY FITTINGS				
						18,39,417.70
		SUBHEAD 13: SOIL, WASTE, RAIN WATER PIPES				
68	12.41	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion i) Single socketed pipes				
68.1	12.41.1	75 mm diameter	Meter	20.00	176.33	3,526,60
68.2	12.41.2	110 mm diameter	Meter	468.00	267.86	1,25,358.48
69 69.1	12.42	Providing and fixing on wall face unplasticised - PVC moulded fittings/accessories for unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion. Coupler				
69.2	12.42.1.1	75 mm	Each	4.00	68.26	273.04
69.3	12.42.1.2	110 mm	Each	94.00	103.29	9,709.26
70	12.22	Making khurras 45x45 cm with average minimum thickness of 5 cm cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) over P.V.C. sheet 1 m x1 m x 400 micron, finished with 12 mm cement plaster 1:3 (1 cement : 3 coarse sand) and a coat of neat cement, rounding the edges and making and	Each	12.00	213.99	2,567.88

		finishing the outlet complete.				
71	12.44	Providing and fixing to the inlet mouth				
, 1	12	of rain water nine cast iron grating 15				
		cm diameter and weighing not less than				
		440 grams	Each	12.00	41 73	497 16
		TOTAL C/F SOIL WASTE RAIN	Luch	12.00	41.75	+77.10
		WATER & VENT PIPES.B				
		SCHEDULE ITEMS				1 41 932 42
						1,71,752.72
		SUBHEAD 14. WATED SUDDIV				
		INTERNAL				
70	187	Droviding and fiving Chloringtod				
12	10.7	Polyzinyl Chlorida (CDVC) nince				
		having thermal stability for hot & cold				
		water supply including all CPVC plain				
		water supply, including an CFVC plain & brood throaded fittings including				
		fixing the pipe with elemps at 1.00 m				
		includes isolution of pipes				
		spacing. This includes jointing of pipes				
		a fittings with one step CPVC solvent				
		cement and testing of joints complete as				
		per direction of Architect.				
72.1	1070	20 mm nominal outer dia Dinas	Matan	227.00	260.14	6 2796 19
72.1	10.7.2	20 mm nominal outer dia Pipes	Motor	195.00	209.14	50 888 20
72.2	10.7.3	23 mm nominal outer dia Pipes	Motor	133.00	323.72 421.25	51 404 70
72.3	10.7.4	40 mm nominal outer dia Pipes	Motor	122.00	421.33	92.461.50
72.4	18.7.5	40 mm nominal outer dia Pipes	Meter	143.00	308.70	71 208 00
12.3	18.7.0	50 mm nommai outer dia Pipes	Wieter	90.00	192.20	/1,298.00
70	10.0					
/3	18.8	Providing and fixing Chlorinated				
		Polyvinyl Chloride (CPVC) pipes,				
		having thermal stability for hot & cold				
		water supply, including all CPVC plain				
		& brass threaded fittings, 1/c fixing the				
		pipe with clamps at 1.00 m spacing. This				
		includes jointing of pipes & fittings with				
		one step CPVC solvent cement and the				
		the same including testing of				
		une same including testing of joints				
		Complete as per direction of Architect.				
		Concealed WORK, including cutting				
72.1	10.0.0	chases and making good the walls etc.	Mat	1002.00	410.25	4 5 4 0 47 75
/3.1	18.8.2	20 mm nominal outer dia Pipes	Meter	1083.00	419.25	4,54,047.75
13.2	18.8.3	25 mm nominal outer dia Pipes	Meter	566.00	492.72	2,78,879.52
73.3	18.8.4	32 mm nominal outer dia Pipes	Meter	16.00	595.48	9,527.68

74	DSR (E&M)- 16.2	Supplying, laying/ fixing, testing and commissioning of following nominal sizes of hot water piping inside the building (with necessary clamps, vibration isolators and fittings but excluding valves, strainers, gauges etc.) duly insulated with following closed cell elastometric nitrile rubber of minimum 45 Kg / cu m density, thermal conductivity 0.037 W/MK or better at 20 deg mean temperature class 'O' insulation applied by suitable adhesive complete including repairing of damage to building etc. as per specifications and as required complete in all respect.				
74.1	16.2.12	40mm dia. (32 mm thick insulation)	Meter	10.00	805.79	8,057.90
74.2	16.2.13	32 mm dia(19 mm thick insulation)	Meter	15.00	658.48	9,877.20
74.3	16.2.14	25 mm dia(19 mm thick insulation)	Meter	25.00	548.01	13,700.25
75	17.73	Providing and fixing PTMT towel rail complete with brackets fixed to wooden cleats with CP brass screws with concealed fittings arrangement of approved quality and colour. 450 mm long towel rail with total length				
		of 495 mm, less than 170 gms 78 mm wide and effective height of 88 mm, weighing not	Each	22.00	486.94	10,712.68
76	18.17	Providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end) :				
76.1	18.17.1	25 mm nominal bore	Each	65.00	435.91	28,334.15
76.2	18.17.2	32 mm nominal bore	Each	27.00	509.64	13,760.28
76.3	18.17.3	40 mm nominal bore	Each	40.00	594.83	23,793.20
76.4	18.17.4	50 mm nominal bore	Each	9.00	762.12	6,859.08
76.5	18.17.5	65 mm nominal bore	Each	4.00	1,304.78	5,219.12
76.6	18.17.6	80 mm nominal bore	Each	3.00	1,944.67	5,834.01
77	18.10	Providing and fixing G.I. pipes complete with G.I. fittings and clamps, i/c cutting and making good the walls etc.				
77.1	18.10.5	40mm dia nominal bore	Meter	40.00	560.81	22,432.40
78	18.40	Painting G.I. pipes and fittings with two coats of anti-corrosive bitumastic paint of approved quality :				
78.1	18.40.5	40mm dia nominal bore	Meter	40.00	17.01	680.40
78.2	18.40.7	65mm dia nominal bore TOTAL C/F WATER SUPPLY-C SCHEDULE LITEMS	Meter	42.00	25.38	1,065.96

		TOTAL OF PLUMBING WORKS (SCHEDULE-ITEMS) – "B"				32,02,970.00
С		SUBHEAD 15: STEEL REINFORCEMENT				
79	5.22	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.				
79.1	5.22.6	Thermo-Mechanically Treated bars of grade Fe-500D or more.	Kg	3375.00	56.60	1,91,025.00
		TOTAL OF STEEL REINFORCEMENT (SCHEDULE- ITEMS) – "C"				1,91,025.00
		TOTAL FOR INTERIOR & FURNISHING WORKS (SCHEDULE-ITEMS) (A+B+C) (SUBHEAD 1 to 15)				8,12,98,371.24

Explanatory Notes for BOQ:

- (i) All DSR items contain intem nos. and, if any discrepancy is found in nomenclature, then scheduled nomenclature of CPWD DSR 2016/2018/2019 will prevail.
- (ii) The rates of all CPWD DSR Items are already exclusive of GST. However, the rates of all items of DSR 2018 & 2019 are evaluated excluding GST component on DAR basis.
- (iii) The Quantity mentioned in the Schedules is approximate and the DFCCIL reserves the right to increase / discrease the same as per site requirement.

Ι		INTERIOR & FURNISHING				
		WORKS				
(ii)		NON SCHEDULE ITEMS				
Α		INTERIOR WORK				
		SUBHEAD 1: FLOORING				
		WORKS AND STONE WORK ON				
		WALLS				
1	NS	Providing and fixing stone work in				
		Wave Pattern/ Geometric Design				
		Pattern/ Abstract form, Linear Pattern				
		straight pattern as per Design/				
		Drawing. Machine cut, mirror/				
		diamond, Marble Combination stone				
		work for wall lining (veneer work)				
		including dado, skirting, risers of				
		steps etc., stones of different finished				
		surface texture, on 12 mm (average)				
		thick cement mortar 1:5 (1 cement : 5				
		white compart slurry $@$ 3.3 kg/Sam				
		including pointing with white cement				
		slurry admixed with nigment of				
		matching shade including rubbing				
		curing, polishing etc. all complete as				
		per Architectural drawings, stone to				
		be laid on a bed of chemical with				
		joints to be treated Nano chemical for				
		stainless joints. The chemical bed				
		thickness shall be 12 mm to 15 mm of				
		make Keracol/ Mapai. the chemical				
		bed to be spread with special trovel of				
		other tool to get even bed spread of				
		chemical.				
1.1	N.S	SATVARIO Original stone 18 mm in				
		combination with Black Markino				
		italian marble stone. Base price of				
		Satvario stone to be considered is				
		15000/ Sqm. Stone to be approved by	~			
		the Architect	Sqm	354.69	21,997.00	78,02,115.93
	NO	Ctopp mode an internet to it.				
2	IN.S	Stone work or inlay work in stone				
		work by machine / manual for stone				
		Work in wave Pattern/ Geometric				
		Linear Dattern Straight Dattern as por				
		Design/ Drawing Machine out				
		mirror/ diamond polish Marble				
		Combination stone work in Flooring				
		and wall dado steps etc. stopes of				
		different finished surface texture				
		laid/ fixed over 20 mm (average) thick				
		base of cement mortar 1:4 (1 cement :				
		mirror/ diamond polish, Marble Combination stone work in Flooring and wall dado steps etc., stones of different finished surface texture, laid/ fixed over 20 mm (average) thick base of cement mortar 1:4 (1 cement :				

1	1		I	I		1
		4 coarse sand) laid and jointed with				
		white cement slurry @ 4.4 kg/Sqm,				
		including pointing with white cement				
		slurry admixed with pigment to match				
		the marble shade, including rubbing,				
		curing and polishing etc. all complete				
		as specified and as directed by the				
		Architect. Stone to be laid on a bed of				
		chemical with joints to be treated				
		Nano chemical for stainless joints				
		The chemical bad thickness shall be				
		12 mm to 15 mm of moles Vorecol/				
		12 min to 15 min of make Keracol				
		Mapai. the chemical bed to be spread				
		with special trovel of other tool to get				
		even bed spread of chemical.				
2.1	N.S	18 mm thick Italian Marble stone				
		slab, Perlato, Rosso, Bottachino,				
		Verona, Fire Red or Dark Emperadore				
		etc. Stone to be approved by				
		Architect.	Sqm	64.80	7,757.00	5,02,653.60
3	NS	Stone work in Wave Pattern/				
		Geometric Design Pattern/ Abstract				
		Pattern, Linear Pattern Straight				
		Pattern as per Design/ Drawing.				
		Machine cut, mirror/ diamond polish,				
		Marble Combination stone work in				
		Flooring, skirting and steps etc.,				
		stones of different finished surface				
		texture. laid over 20 mm (average)				
		thick base of cement mortar 1:4 (1				
		cement · 4 coarse sand) laid and				
		jointed with white cement slurry @				
		4.4 kg/Sam including pointing with				
		white cement slurry admixed with				
		nigment to match the marble shade				
		including whing ouring and				
		notiching ata all complete as				
		poinsning etc. all complete as				
		specified, stone to be faid on a bed of				
		chemical with joints to be treated				
		Nano chemical for stainless joints.				
		The chemical bed thickness shall be				
		12 mm to 15 mm of make Keracol/				
		Mapai. the chemical bed to be spread				
		with special trovel of other tool to get				
		even bed spread of chemical.				
3.1	N.S	SATVARIO Original stone 18 mm in				
		combination with Black Markino				
		italian marble stone. Base price of				
		Satvario to be considered is 15000/				
		Sqm. Stone to be approved by the				
	1	architect	Sqm	430.13	21.997.00	94,60,909.70
			1			

3.2	N.S	Extra For Providing-V- Groove of Size 6 x 6 mm in Stone Wall Lining in Bottachino/Grey William at all levels as per architect drawing.	Mtr	638.99	124.00	79,234.68
4	N.S	Providing and laying at site 12mm thick wooden laminated floor having an inbuilt wear resistance, impact resistance The planks shall be placed on an under lay of foam and 0.2mm thick alkali resistant polyethylene sheet. All as per manufacturer specification. The wooden flooring shall be of AC-4 grade. Laminate should be high pressure laminate over MDF. The planks sizes shall be as per		140.00	0.707.00	4.05.05.00
5	N.S	Providing and fixing at site 10mm to 12mm thick 100mm high laminated wooden skirting/trim all complete as	Sqm	148.00	2,737.00	4,05,076.00
		Architect.	Rmt	50.00	587.00	29,350.00
6	N.S	Providing and fixing Carpet flooring using Carpet Tile of approved make, shade and pattern and of the following specification: High Cut – Low Loop Carpet tile, Premium Solution Dyed Nylon with Anti Stain Treatment, 1/10 gauge, minimum Pile height should be 8.0mm Cut and 3.5mm Loop or with acceptable tolerance, total minimum thickness 9.0mm, Tile size should be minimum 500mm x 500mm, Secondary Back Commercial 100% Re-cyclable. Wear Warranty– product should be warranted for10 Year Warranty with minimum weight loss of pile and colour. All yarns used are Solution dyed to minimize use of water and exclude any effluent production.	Sqm	3401.4	3,022.00	1,02,79,030.80
7	N.S	Entry Mat System Providing & Fixing entrance matting (Heavy Duty) with enhanced absorption. Construction - Looped pile carpet design with solid vinyl backing. Material - Polypropylene & Nylon with vinyl backing. Size - Standard/ as per site	Sqm	81.70	8,473.00	6,92,244.10

ο	NG	Draviding and laving of Course thick				I
ð	N.S	Providing and laying of omm thick PVC Vinyl flooring including form				
		backing vinyl floor covering of size				
		minimum1200 mm width x 6 meters				
		length of weight 4400 g/m^2 with wear				
		laver thickness of 1 mm Wear laver				
		should be treated with Protocol				
		(IW aurad Polyurathana surface)				
		(UV cured Foryurethane surface				
		maintenent) which facilitates ease of				
		acrulia comulsions Residual				
		indeptation should be loss than				
		0.25mm & should conform to EN ISO				
		24343 1(EN 433) The product should				
		have antibacterial properties. The				
		product should also fulfill dimensional				
		stability(FN ISO 23999(FN 434) &				
		effect of furniture $leg(EN 424)$ It				
		should also be suitable for underfloor				
		heating The product should have				
		excellent sound absorption of 24 db				
		and excellent shock absorbent				
		behavior. The laid flooring shall				
		confirm the fire rating Cfl-S1 class				
		as per EN 13501-1.	Sam	257.67	3.718.00	9.58.017.06
			~ -1		-,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
9	N.S	Providing & laying Polymer Modified				
		Cement Mortar (PMCM) "Acrylic				
		based				
		polymer".				
		Apply a passivating coat of				
		"passivator" & cement slurry in 1:1				
		proportion to the chemically.				
		Repeat the same coat after 4 hours of				
		the first coat.				
		Apply a priming cum bonding coat of				
		"Acrylic based polymer" & cement				
		slurry in 1:1 to the concrete by brush.				
		Immediately place Polymer Modified				
		Cement Mortar (PMCM) in C:S 1:3,				
		prepared by mixing "Acrylic based				
		polymer" of specified proportion.	a	100.00	14,000,000	14.00.000.00
		Cost to include two coats	Cum	100.00	14,000.00	14,00,000.00
		TOTAL for FLOORING WORKS				3,16,08,631.95
		SUBHEAD 2: DOORS &				
		WINDOWS				
1						

10	N.S.	Supply and installation toilet cubicles				
-		of width and depth as per				
		specifications/ site drawings Cubicle				
		height to be 2105 mm Made from				
		solid grade compact high pressure				
		lominate as per IS-2046 manufactured				
		laminate as per 15:2046 manufactured				
		under high specific pressure > 5 MPa				
		with bunch of Kraft papers				
		impregnated with thermosetting				
		phenolic resin and decorative papers				
		impregnated with thermosetting				
		melamine resin which provide				
		superior scratch, abrasion, heat,				
		chemical, impact, graffiti & moisture				
		resistance along with anti-bacterial				
		properties. Top Head frame fixed to				
		the wall on both sides using MS- wall				
		brackets. The pilaster is slotted &				
		affixed to the top head frame and				
		secured from the top leaving all clear				
		gap of 150mm and without any				
		support from the bottom The				
		intermediate panel shall be anchored				
		to the wall and pilasters				
		Panel thickness 12 mm Design no. as				
		specified by Arch in suede finish				
		Size of papels to be as per drawing				
		(The cost of protecting Tile work with				
		neluthin and a layer of POP or by any				
		other mean as required to be included				
		in the quoted price of this item)				
		LIADDWARE & ACCESSORIES				
		AND OLIED DETAILS.				
		AND OHER DETAILS:				
		• H snaped (1 op) nead frame structure				
		made of extruded Aluminium grade				
		6063 15-50 micron epoxy powder				
		coated for surface protection. Size to				
		be 125x/0x5T. Corner joinery				
		section, Size to be $40x16.5x1.8T$. U-				
		Channel Wall joinery section, Size to				
		be 22x16x1.6T. Door stopper section,				
		Size to be 21x12.5x1.6T.				
		• Spring loaded Butt Hinges made				
		from Stainless steel grade 304.				
		Surface finish to be matt type. Covers				
		to be lacquer coated. Cubicles-				
		Standard Sizes (W x D x H)- 900 mm				
		x 1550 mm x 2105 mm, (Height is				
		including 150 mm gap from bottom)				
		with one Door Size- 600 mm				
		• Conical shape Coat hook with				
		rubber stopper made from Stainless				
		steel grade 304. Surface finish to be	Each	73.00	29,416.00	21,47,368.00
L	I		-		,	, . ,

		 matt type/ as per Architect Round Door knob diameter 30 mm with grooves for better hand grip made from Stainless steel grade 304. Surface finish to be matt type. Rotating Thumb-turn locking system with privacy indicator made from Stainless steel grade 304. Surface finish to be matt type/as per Architect. Stainless steel grade 304 screws. Anti-rotation Nylon polyamide grade-6 expandable wall plugs. The cubicle to be fixed as per drawing layout and shall be completed as per drawing. 				
11	N.S	Supply, fixing and Installation of Slim Line Modular Aluminium Fixed partitioning frame of 100-105 mm x 25-30 mm which can accommodate 2 panels of glass of 10 mm thickness separated by 40-50 mm distance for better sound insulation and acoustic properties. The rate to include Design, Fabrication, Supply, Installation & Handover of slim line fixed partition system. the fixed partition system should accommodate openable door on Hinges. Door to be paid seperately.The system of fixed partition with openable door to be custom designed to with stand the design confirming to IS -875 part III. The system shall have two barrier gasket system to hold glasses . Microwave cured EPDM gaskets to accommodate glass thickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminium sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal	Sqm	3067.48	11,018.00	3,37,97,494.64

	1	visible surfaces shall have high				1
		Durability) / Super durable (Jotun)				
		Powder coating of 60 - 80 micron				
		confirming to ASTM E 283, ASTM E				
		anodizing shade as approved by				
		Architect with minimum 25 micron				
		The non visible aluminium surfaces				
		shall have minimum chromatizing				
		treatment.				
		Material shall be as per make list in				
		tender document.				
		All shade approval shall be as per				
		The system shall demonstrate				
		performance for air seal / water seal /				
		structural requirement. The system				
		performance test shall be mandatory.				
		The performance test shall be carried				
		out at an accredited laboratory having				
		fully atomized data acquisition system				
		with provision to capture all values in the test results sheet. The accurace of				
		test and standard shall be ASTM E				
		283 ASTM E 331 ASTM E 330				
		AAMA 501.1. Sequence of testing				
		and criteria shall be as per tender				
		Specification.				
		The quote rate shall include all design,				
		engineering & shop drawing approval				
		from architect.				
		Glass : 2 NO.10 mm clear Heat				
		Tolerance of 5 mm allowed in both				
		dimension of the cross section of the				
		slim line partition as per				
		manufacturers specification.				
12	N.S.	Supply, fixing and installation of Slim				
		Line Modular Aluminums single				
		glazed partition frame of 100-105 mm				
		x 25-30 mm with in bottom and top				
		channel with acoustic gasket as per				
		specification.				
		Fabrication Supply Installation &				
		Handover of Fixed partition frame.				
		The fixed partition should				
		accommodate 10mm HS GLASS.				
		Sliding Door to be paid separately.				
		The fixed partition to be custom	a	a 60.00		
		designed to with stand the design	Sqm	360.00	9,570.00	34,45,200.00

confirming to IS -875 part III. The system shall have barrier gasket system to hold the glass: Microwave curved EPDM gaskets to accommodute glass thickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extraded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved ey architectur with minimum 25 micron The non-visible aluminum surfaces shall have minimum 125 structural shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 23, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and citeria shall be as per tender Specification. The quote rate shall include all design, engineering as per daving /approval from architect Glass: 10 mm clear Heat			
system to hold the glass: Microwave cured EPDM gaskets to accommodate glass thickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extunded aluminum sections of Alloy 6063 TS / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved architectural sizes, from approved equivalent) Powder coating of 60 - 80 micron confirming to AAAMA 2604 or anofizing shade as approved equivalent) Powder coating of 60 - 80 micron confirming to AAAMA 2604 or anofizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum 25 micron The non-visible aluminum warfaces shall have minimum 25 micron The spre make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for airs and / water seal / structural requirement. The system performance test shall bave minimum system shall demonstrate performance test shall bave as per Architect's Approval. The system shall demonstrate performance test shall be as per Architect's Approval. The system shall demonstrate performance test shall be as per Architect's Approval. The system shall demonstrate performance test shall be as per Architect Baption and as acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 233. ASTM E 331. ASTM E 330. AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design. engineering as per drawing /approval from architect Glass: 10 mm clear Heat	confirming to IS -875 part III. The		
 system to hold the glass: Microwave cured EPDM gaskets to accommodate glass linkness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to L6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 mieron confirming to DAAMA 2604 or anodizing shade as approved by architect with minimum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be mandatory to verify performance test shall be performance test sha	system shall have barrier gasket		
Microwave cured EPDM gaskets to accommodate glass flickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / FN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum the system shall de monstrate performance for all sep re make list in tender document. All shade approval shall be as per Architects Approval. The system shall demonstrate performance test shall be madarony to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	system to hold the glass		
accommodate glass thickness as per structural requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr, against design & workmaship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anoldzing shade as approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anoldzing shade as approved shall have minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per Architect's Approval. The system shall demonstrate performance test shall be as per Architect's Approval. The system shall be manstrate performance test shall be madatory to verify performance test shall be carried out at an accedited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	Microwave cured FPDM gaskets to		
structural requirement, weather scalants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr, against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum thromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out an ancerdited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	accommodate glass thickness as per		
salactina requirement, weather sealants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6003 T5 / T6 & tolerances confirming to DIN / EN standard, of approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall hickness. All the internal visible surfaces shall have high Durability / Super durable (Jottu or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anolzing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be carried out at an accrdited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTIM E 283, ASTIM E 331, ASTIM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	accommodate glass intexness as per		
seatants, SS 310 grade screws of approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr, against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotan or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum thromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out at an accedited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	structural requirement, weather		
approved make, all in complete required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing (approval from architect Glass: 10 mm chear Heat	sealants, SS 310 grade screws of		
required to perform as per specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extrnded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DN / EN standard, of approved architectural sizes, from approved architectural sizes, from approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of lost and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1 Sequence of testing and crieria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm chear Heat	approved make, all in complete		
specification and drawing in conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved architectural sizes, from approved architectural sizes, from approved extructural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing (approval from architect Glass: 10 mm clear Heat	required to perform as per		
conjunction with BOQ. Complete system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved equivalent, Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-wisible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be carried out at an accredited laboratory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 231, ASTM E 330, AAMA 301.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm chear Heat	specification and drawing in		
system shall be warranted for minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes. from approved architectural sizes, from approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	conjunction with BOQ. Complete		
minimum 10 yr. against design & workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durabilty / Super durable (Joun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTIM E 283, ASTIM E 333, ASTIM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall be as per tender Specification. The quote rate shall be as per tender Specification. The quote rate shall be as per tender Specification.	system shall be warranted for		
workmanship defects. The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved actruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be carried out at an accredited laboratory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	minimum 10 yr. against design &		
The extruded aluminum sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance test shall be mandatory to verify performance test shall be carried out at accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTME 283, ASTME 231, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	workmanship defects.		
Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. </td <td>The extruded aluminum sections of</td> <td></td> <td></td>	The extruded aluminum sections of		
confirming to DIN / EN standard, of approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at na ccredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTME 283, ASTME 231, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall loce as per tender Specification. The given shall de as per tender Specification. The quote rate shall be das per tender Specification. The quote rate shall be das per tender Specification.	Alloy 6063 T5 / T6 & tolerances		
approved architectural sizes, from approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	confirming to DIN / EN standard, of		
approved extruder. The structural profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 6 0 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	approved architectural sizes, from		
profiles shall have minimum 1 to 1.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect	approved extruder The structural		
 I.6mm wall thickness. All the internal visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall be as per tender Specification. The quote rate shall be as per tender Specification. 	profiles shall have minimum 1 to		
 visible surfaces shall have high Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat 	1 6mm wall thickness All the internal		
Durability / Super durable (Jotun or approved equivalent) Powder coating of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTME 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	visible surfaces shall have high		
approved equivalent) Powder coaling of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	Durability / Super durable (Jotup or		
of 60 - 80 micron confirming to AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	approved equivalent) Devider costing		
AAMA 2604 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at an accredited laboratory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	approved equivalent) Fowder coating		
AAMA 2004 or anodizing shade as approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	of 60 - 80 micron commining to		
approved by architect with minimum 25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	AAMA 2604 or anodizing shade as		
25 micron The non-visible aluminum surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	approved by architect with minimum		
surfaces shall have minimum chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	25 micron The non-visible aluminum		
chromatizing treatment. Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	surfaces shall have minimum		
Material shall be as per make list in tender document. All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	chromatizing treatment.		
tender document.All shade approval shall be as per Architect's Approval.The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification.The quote rate shall include all design, engineering as per drawing /approval from architectGlass:10mmclearHeat	Material shall be as per make list in		
All shade approval shall be as per Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	tender document.		
Architect's Approval.The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification.The quote rate shall include all design, engineering as per drawing /approval from architectGlass:10mmclearHeat	All shade approval shall be as per		
The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	Architect's Approval.		
performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	The system shall demonstrate		
structural requirement. The system performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	performance for air seal / water seal /		
performance test shall be mandatory to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	structural requirement. The system		
to verify performance test shall be carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	performance test shall be mandatory		
carried out at an accredited laboratory having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	to verify performance test shall be		
having fully atomized data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	carried out at an accredited laboratory		
system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	having fully atomized data acquisition		
values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	system with provision to capture all		
sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	values in the test results sheet. The		
ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	sequence of test and standard shall be		
330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	ASTM E 283 ASTM E 331 ASTM E		
testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	$\begin{array}{c} 1 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\$		
tender Specification. The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	testing and criteria shall be as mar		
The quote rate shall include all design, engineering as per drawing /approval from architect Glass: 10 mm clear Heat	tender Specification		
engineering as per drawing /approval from architect Glass: 10 mm clear Heat	The quote rate shall include all deci		
from architect Glass: 10 mm clear Heat	i ne quote rate snall include all design,		
from architect Glass: 10 mm clear Heat	engineering as per drawing /approval		
Glass: 10 mm clear Heat	from architect		
	Glass: 10 mm clear Heat		
strengthened/Toughened	strengthened/ Toughened		

			Tolerance of 5 mm allowed in both dimension of the cross section of the slim line partition as per manufacturers specification.				
	13	N.S	Door shutter for Modular Aluminium partitioning frame should be of 44mm x 70mm using outer frame of 100-105 mm x 25-30 mm vertical 2 top frame and 50mm x 25mm as outer frame. Glass beads at horizontal top and bottom should accommodate Glass 11.52 mm thick acoustic glass of combination (5mm + two layers of 0.76 mm thick acoustic PVB + 5mm) HS glass for optimum sound insulation wherever required. Microwave cured EPDM gaskets to the glass as per requirement. Door to function on hinges. Tolerance of 5 mm allowed in both dimension of the cross section of the slim line partition as per manufacturers specification.	Each	131.00	64,695.00	84,75,045.00
Γ							
14	N.S.	Supply, fixing and installation of					
----	------	---------------------------------------	------	--------	-----------	--------------	
		Slim Line Modular Aluminum single					
		glazed SLIDING Door partition					
		SYSTEM unit width size of slider					
		door shall be 2.0 mtr to 2.4mt as per					
		site requirement with top outer frame					
		of 46x76mm, shutter with top and					
		bottom channel of 30mmx38mm and					
		vertical channels of 18mmX38MM					
		with acoustic gasket as per					
		specification.					
		The rate to include Design.					
		Fabrication, Supply, Installation &					
		Handover of slim Sliding door system					
		and Fixed partition frame system unit					
		Sliding Openable Door should be on					
		Sliding Mechanism Partition paid in					
		item age The system of Sliding door					
		and fixed partition to be custom					
		designed to withstand the design					
		confirming to IS -875 part III The					
		system shall have barrier gasket					
		system to hold the glass					
		Microwave cured EPDM gaskets to					
		accommodate glass thickness as per					
		structural requirement weather					
		sealants SS 310 grade screws of					
		approved make all in complete					
		required to perform as per					
		specification and drawing in					
		conjunction with BOO Complete					
		system shall be warrantee for					
		minimum 10 vr against design &					
		workmanshin defects					
		The extruded aluminum sections of					
		Allov 6063 T5 / T6 & tolerances					
		confirming to DIN / EN standard of					
		approved architectural sizes from					
		approved extruder. The structural					
		profiles shall have minimum 1 to					
		1 6mm wall thickness All the internal					
		visible surfaces shall have high					
		Durability / Super durable (Jotun or					
		approved equivalent) Powder coating					
		of 60 - 80 micron confirming to					
		AAMA 2604 or anodizing shade as					
		approved by architect with minimum					
		25 micron The non-visible aluminum					
		surfaces shall have minimum					
		achromatizing treatment Material					
		shall be as per make list in tender					
		document					
		All shade approval shall be as per	Each	120.00	79 154 00	94 98 480 00	
		The shade upproval shall be us per	Luch	120.00	77,151.00	31,30,100.00	

		Architect's Approval. The system shall demonstrate performance for air seal / water seal / structural requirement. The system performance test shall be mandatory to verify The performance test shall be carried out at an accredited laboratory having fully automised data acquisition system with provision to capture all values in the test results sheet. The sequence of test and standard shall be ASTM E 283, ASTM E 331, ASTM E 330, AAMA 501.1. Sequence of testing and criteria shall be as per tender Specification. The quote rate shall include all design, engineering & shop drawing approval from architect Specifications for Acoustic Glass : 11.52 mm thick acoustic glass of combination (5mm + two layers of 0.76 mm thick acoustic PVB + 5mm) HS glass for optimum sound insulation wherever required Tolerance of 5 mm allowed in both dimension of the cross section of the slim line partition as per manufacturers specification.				
15	N.S.	Providing and fixing of 10mm thick toughened glass in frames as per approved drawings/ instruction of the Architect. Cost of frames, gaskets and sealant will be paid separately in their respective items.	Sqm	103.28	1,642.00	1,69,585.76

1	1	1				
16	N.S.	Providing and fixing of Lacquered				
		Glass. 10 mm Extra Clear Glass				
		used for lacquered glass should be				
		of Saint Gobain/ ASAHI/ Pilkington				
		and should be toughened in horizontal				
		tempering line Lacquered glass to be				
		made industrially (via air brushing				
		process): opaque (if viewed against a				
		support wall) coated with WATER				
		BASED lacquer colour of brand				
		Colour Spray AOUA by Regaled				
		United Kingdom Or Equivalent Brand				
		Which is binded by None porticle				
		which is bilded by Nano particle				
		pure acrylic); Gloss Level -40 ;				
		where vOC < 1%; highly durable;				
		humid resistant (conforms to BS EN				
		1036 1999); environmentally friendly				
		(no lead, no arsenic, no copper, no				
		formaldehyde; compressive strength				
		(1000 MPa) & tensile strength (40				
		MPa), same as float glass as per the				
		detailed drawings, paid extra over				
		singlE1/good0mm HS glass in slim				
		partition and color as approved by				
		Architect. Colour to be checked and				
		tested via INDEX Colour shade card				
		used worldwide as a colour choosing				
		parameter. the lacquered glass should				
		be fixed in microwave cured EPDM				
		gasket provided in the partition				
		system. Lacquered glass shall not				
		loose its color and shall not fade in				
		colour even if it is placed exposed to				
		direct Sun light. It shall withstand heat				
		rains and sunlight and shall not lose				
		its colour and shall not fade away	Sam	1237.01	5 024 00	62 19 209 60
		its colour and shan not rade away.	Sqiii	1237.91	3,024.00	02,19,209.00
17	NS	Droviding and fixing Two 12mm				
1/	IN.D.	thick Acardia Solid surface complia				
		in place of Two 10mm class in				
		in place of two tolling glass in				
		aiuminum partitions in item N.S.				
		11,12.,13 as per drawing/Architect.				
		Acrylic surface should be joint less				
		and shall be duly fixed in a manner				
		that there is no buckling or warping.				
		Acrylic strips of 50 mm cut out of				
		same color and product width should				
		be inserted in the gap created between				
		two acrylic surfaces and fixed with				
		appropriate adhesive to ensure that the				
		acrylic surface are adequately				
		supported so that no buckling,				
		swelling or warping takes place and	Sqm	70.88	13,508.00	9,57,447.04

18	N.S.	 the surfaces remain true to its shape in the partition frame. Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified. Providing & Fixing Grade 2 Type IV of 9mm thickness and dimension of 1830x2450 mm Pre Laminated Board consisting of Synthetic resin bonded flat pressed three layer or multi layer or graded particle board used for the manufacture of prelaminated board shall conform to IS 3087:1985 For ECO Mark, tube particle board shall also conform to the requirements 				
		of ECO Mark specified in IS 3087:1985	Sqm	50.00	1,056.00	52,800.00
19	N.S	Providing and fixing of Wooden fire rated doors as per BS:476 Part- 20 & 22 & IS 3614 part-2 for stability, integrity and thermal insulation. 03 Criteria Wooden door confirming to IS 277 with the following specification. Recommended fire door shall have doors prior tested at CBRI for maximum rating of 2hrs tested either with or without vision panel. Individual Test certificates should be available for glass used in vision lites confirming the required fire ratings. Any deviation in specification other than what is mentioned in the test certificates are not allowed. Proper label confirming the type of door and the hourly rating is mandatory. Approved manufacturer should be ISO Certified company.				
		Door leaf shall be minimum 52mm thick fully flush door with or without vision lite. 52mm thick shutter, comprising of 75mm x 44mm hardwood internal timber frame work, with infill of 48 kg/m3, ceramic fiber blankets, coated with FR intumescent coating on both sides for insulation. The coated insulation shall be sandwiched between maximum 12mm thick Calcium Silicate Boards on both sides (edge to edge on internal Hardwood frame) having a maximum density of 900 Kgs/ Cum, cladded with 3mm ply commercial ply on both				

		faces. (The same can be pasted with Imm thick laminate (as per approved shade) or replaced with 4mm thick teak ply as per Architect requirement at an extra cost) on both sides of the shutter, with 50mm x 10mm hard wood lipping all round the shutter. The door frame will be made out of Hardwood of maximum section 120 x 70mm and coated with Fire retardant Primer. The rebate shall be of 20mm x 54mm in the Door Frame to accommodate the shutter . Both frame and shutter shall be fitted with intumescent Fire seal strips , The shutter fitted with 10x4mm Fire seal and Frame with 1 no. Fire seal of size 20x4mm on all the three sides of the except bottom. The pasting of the ply/veneer/laminate should be done using automatic machine and should be free from any nails or perforations				
19.1		a) Size 2000 X 2400mm with panic bar (Double Hung)	Each	56.00	31,899.00	17,86,344.00
20	N.S.	Providing and fixing overhead cam action door closer with adjustable closing force EN2-4.all as per specifications.	Each	83.00	7,324.00	6,07,892.00
21	N.S.	Supply and fixing of pull Handle back to back with 305mm CTC, adjustable fixing for glass, wood and metal doors in satin stainless steel. The pull handles should have supporting washer with raised beveling on the outer surface. Length =457mm, 32 mm dia.	Each	71.00	3,081.00	2,18,751.00
22	N.S	Providing and fixing of Eco resin translucent panel 10mm thickness floral or stone finished. as approved make Complete as per specification & approval of Architect as per tender drawing. These panels will be fixed to wall with SS studs/BB frame and maintain gap off 200mm from the wall. LED lights at the back as required	Sqm	12.00	1,23,252.00	14,79,024.00

						1
23	N.S	Supply and Installation of				
		Automatic sliding door operator				
		Automatic sliding door Set I				
		Compliant with European standards				
		Product should be TÜV test certified				
		for 1 Million cycles tested according				
		to the low voltage guidelines &				
		operator unit power consumption not				
		exceeding 100 W/Hr fulfils DIN				
		18650 standards The track profile				
		should be flexible for both surface				
		mounted & ceiling hung application				
		with additional profile for vibration &				
		sound dampening feature. It should				
		includes micro processor controlled				
		drive unit. with self learning				
		mechanism, program selector with				
		knob, motion detection sensor -2 nos				
		, 1 on each side , including passage				
		safety combi-sensor on one side,				
		mechanical components, toothed belt,				
		cover profile not exceeding 110mm				
		visible H, floor guide for frameless				
		glass (02 nos), glass clamping rail (02				
		nos), Body finish : standard silver				
		anodized operator profile				
		electromechanical lock with 12 mm				
		plain toughened frameless glass for				
		complete elevation - 2 moving panels.				
		UPS of 750 VA shall be provided by				
		others, which will give power backup				
		of 20 min. Only & if the duration of				
		power cut to the operator is more than				
		30 min., then separate arrangement				
		needs to be done for the same as				
		automatic operator requires				
		it should include Wall Cormer				
		Protoction (WCP)				
		The above work complete in all				
		respect as per approved drawings and				
		to the satisfaction of Architect				
23.1	N.S.	2000mmx2400mm/ 1800X2400				
	1110		Nos	30.00	2,16.436.00	64.93.080.00
				20.00	,,	
24	N.S.	PARTITION ABOVE FALSE				
		CEILING - FORMED OF METAL				
		FRAME WORK				
		Partition from false ceiling level till				
		true ceiling level				
		Framework -				
		To be formed Metal frame of				

I		minimum 1.5 mm thickness in tubular				
		sections				
		Infill - Layers of Fiber glass wool				
		insulation - 1000gms/m2				
		As an acoustic requirement, contractor				
		to affix 50mm thick 1 layers of Fiber				
		glass wool insulation of density				
		1000gms/m ² , of wrapped in GI				
		chicken mesh on both sides				
24.1		Cladding - First layer on both sides -				
		Fiber cement board Density				
		1400kg/M3	Sam	746.90	2.343.00	17.49.986.70
						,.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
25	N.S	Providing and fixing fiber glass wool				
	1.00	to be fixed between two panels of				
		lacquered glass/ acrylic etc				
		approximately 50mm thickness				
		Infill - Lavers of Fiber glass wool				
		insulation - 1000gms/m2				
		As an acoustic requirement, contractor				
		to affix 48-50mm thick 1 layers of				
		Fiber glass wool insulation of density				
		1000gms/m2	Sam	2240.70	1.137.00	25.47.675.90
			~ 1		_,	,,
26	N.S	Providing and fixing 600 mm deep				
		pantry cabinet below counter wooden				
		cupboards shutters with teak wood				
		shutter 20mm thick shutter fixed to				
		cabinet by means of necessary brass				
		fittings such as hinges tower bolt ball				
		catcher handle etc. complete including				
		19 mm thick vertical/ horizontal				
		partitions of commercial ply board				
		with drawer unit with guide rail				
		including locking arrangement and				
		knobs heavy duty ss hanger rail etc.				
		painting of wooden members with two				
		or more coats of synthetic enamel				
		paint of approved make in the inner				
		side and shade over over a coat of				
		primer complete and melamine polish				
		on the outer surface as per architects				
		design and drawings. All surfaces to				
		be covered with laminate 1mm thick.				
		All drawers to have necessary				
		stainless steel, grills, jaalis, utensil				
		holder and other stainless steel				
		accessories of reputed brand.	Sqm	72.24	7,352.00	5,31,108.48
		I I	1	ı – – – – – – – – – – – – – – – – – – –	,	, ,

27	N.S	Providing and fixing 450 mm deep pantry cabinet above counter wooden cupboards shutters with teak wood shutter 20mm thick shutter fixed to cabinet by means of necessary brass fittings such as hinges tower bolt ball catcher handle etc. complete including 19 mm thick vertical/ horizontal partitions of commercial ply board with drawer unit with guide rail including locking arrangement and knobs heavy duty SS hanger rail ext. painting of wooden members with two or more coats of synthetic enamel paint of approved make in the inner side and shade over over a coat of primer complete and melamine polish on the outer surface on per Architect's				
		design and drawings	Sqm	42.60	6,695.00	2,85,207.00
28	N.S	Providing and fixing 12 mm thick frameless toughened glass door shutter with glass of approved brand and manufacture, including providing and fixing top & bottom pivot & spring type fixing arrangement and making necessary holes etc. for fixing required door fittings, all complete as per direction of Architect (Cost includes providing & fixing of Door handle, lock . top patch , bottom				
		patch , Floor Spring Top and bottom pivot and stopper).(one set of hardware for one door. payment in Sqm of door size. minimum width of door 0.9 mtr)	Sqm	297.66	12,849.00	38,24,633.34
29	N.S.	Supplying and fixing mirror finish Digital Lock without cut-out. Digital door lock to be stand-alone systems with an electronic control mechanism. The lock to be enable to be operated with all three modes with fingerprint + password + IC card from the list of specified make with necessary accessories. Should have a capacity of 10 administrators and more than 300 ordinary users. Should have minimum 2 cards. Cost of two cards included. Locks to operate either on alkaline batteries or rechargeable lithium-ion cell ones. In both cases an alort or indicator should	Each	40.00	22.034.00	0 17 260 00

		dust of foreign materials.				
		TOTAL for DOORS & WINDOWS				8,52,03,692.46
		SUBHEAD 3: STRUCTURAL STEEL				
30	NS	Supplying, fitting and fixing steel rolling shutter with 18 swg. of approved type M.S sheet to the 75mm wide fitted with coil wire spring to necessitate the fitting of required number of CI pulley on heavy type solid drawn seamless steel tube complete with locking arrangement both inside and outside specially built up side guide channels including providing a hood for the steel rolling shutter in the room painting two coats of approved paint over a coat of red lead primer complete.	Sqm	46.20	4,886.00	2,25,733.20
31	NS	Providing and fixing in position of 1 mm thick Gl louvers shutters of desired profile and shape to MS framework. The job shall be completed in all respects as per Architectural Drawings including fixing, necessary locks, hardware and within the spacing required, one or more coat of approved quality steel primer and two or more coats of synthetic enamel paint.	Sqm	72.90	5,066.00	3,69,311.40
32	NS	Providing and fixing of Stainless Steel (Grade 304) cladding with sheet of thickness 1.5mm on MS built up sections	Kas	599.62	473.00	2 83 610 80
		TOTAL for STRUCTURAL STEEL	1120	577.02	773.00	0.50.000
						8,78,655.40
		SUBHEAD 4: WATERPROOFING				
1	1					

33	N.S	Providing and laying M20 concrete screed 50mm thick over broken AAC Block/Cinder Block in toilets and				
		sunken areas	Sqm	3283.12	397.00	13,03,390.70
		TOTAL for WATERPROOFING				13,03,390.70
		SUBHEAD 5: FALSE CEILING				
34	N.S.	Supply & installation of false ceiling made of pinewood E1/good grade				
		norforationa malamina laminated				
		finish size 595x595x12mm Square				
		edge volume density of base board				
		800Kg/m^3 weight 11 7 Kgs/m ²				
		(G5T16) which is suspended by using				
		0.3mm thick Skelet TrelisT15 metal				
		grid system.				
		TrelisT15 metal grid system of				
		600x600mm module includes Skelet				
		WA15W30 wall angle with unequal				
		flanges of 15/19mm, length 3000mm,				
		fixed along the perimeter of walls				
		with the help of nylon sleeves and				
		suitable fasteners at 300mm centers.				
		Then suspend the MT15W36 MainT				
		with flange width 15mm, height				
		32mm and length 3600mm, from the				
		soffit slab with help of soffit cleat and				
		wire rod with leveling spring clip at				
		1200mm centers. Cross with flange				
		width 15mm, height 26mm and length				
		1200mm is interlocked into the pre-				
		cut slots in the Main 115 at 600mm				
		to the Main T15 Finally Skalat				
		CT15W06 Cross with flange width				
		15mm height 26mm and length				
		600mm are interlocked into the precut				
		slots in the CT15W12 Cross T in				
		direction parallel to the Main T15 to				
		result in 600x600mm module. Ceiling				
		595x595x12mm shall be placed into				
		the grid size of 600x600mm.				
		The system is backline with slim				
		polyfiber 10x25.				
		Technical Parameters				
		• Fire (Class) – 1 & P (For FR grade)				
		• Acoustics – NRC upto 0.85				
		• Thermal conductivity (W/mk)- na				
		• Climate (°C, RH) – 40, 70				
		• Light reflectance (%) – Colour				
		dependent	Sqm	479.24	5,548.00	26,58,601.60

		• Green (VOC, RC %) – Low, 25		
35	NS	Supply and installation of Digitally		
55	14.5	Drinted Stretch EP Grade Selserane		
		fabria system with high performance		
		integrated age with a white matte		
		integrated core with a winte matte		
		lace covering, acoustically-transparent		
		textile of size 1./mx/5m. wooden		
		base 10mm is first installed to the true		
		slabs/grids on the marked lines with		
		metal fasteners at 300mm centers		
		embedded in plastic sleeves. Fix Strut		
		SE 25 half wrap / full wrap, Midseam		
		and Outer corner, rigid FR-PVC high		
		strength tracks square / bevel edge on		
		the wooden surface by using heavy-		
		duty fasteners at 150mm centers on		
		one/both sides of Strut Tracks.		
		Strand magnesite bonded		
		pinewoodfibre panels of size		
		600x1200x15mm, density 400kg/m3,		
		weight 6kg/m2 is installed/fastened to		
		slab or grid, inbetween tracks by using		
		suitable fasteners, Synthetic polyfiber		
		(SPF) 10x10mm is then adhered on		
		Strand using Stick 7 adhesive. Ensure		
		5mm airgap between SPF and fabric.		
		The Stretch acoustical membrane of		
		width 1.7m is stretched and tucked		
		into the Strut Tracks and secured to		
		the locking jaws with purpose-specific		
		tucking tools to obtain smooth, taut,		
		wrinkle-free finish. Ensure the weft		
		and weave of the fabric along with the		
		surface are all oriented in one		
		direction to achieve uniform shade.		
		Note: minimum 200mm additional		
		fabric is required for tucking hence		
		maximum module wall fabric width		
		would be 1.5 mtr.installed on MS		
		framework		
		Technical Parameters of fabric		
		• Fire (Class) – A		
		• Acoustics – na		
		• Thermal conductivity (W/mk)_01		
		• Climate (°C RH) – 49 90		
		• Light reflectance $(\%)$ – Color		
		dependent		
		acpendent		

ΔC_{reserv} (VaC DC 0/) $I = -25$	
• Green (VoC, KC %) – Low, 25	
Technical Parameters of Strand	
• Fire (Class) – 1 & P	
• A coustics $-$ NBC 0.9 (For 25mm thk	
F300* Mounting)	
• Thermal conductivity (W/mk) 0.07	
Climate (°C DH) 50.05	
= Uninate (0, Kir) = 50, 95	
• Light reflectance $(76) = 80$	15 09 072 42
• Green (VoC, RC %) – Low, 30 Sqm 124.18 12,809.00	5,98,072.42
36 N.S Supply and installation of LOOP®	
Type 2 system formed as an open	
metal ceiling with an open area of	
more than 50% and to the flare [5mm]	
of the perforation pattern the ceiling	
has a three-dimensional visual effect	
and hides the insight into the plenum.	
Bypassing the perforation, the S-	
shaped sides of the LOOP® interlock	
both the long and front side joint with	
a nonmagnetic suspension, the	
elements are installed with a	
circumferential 1 mm joint, thus	
compensating tolerances in x and y	
direction. The non-magnetic	
suspension system effectuates a self-	
alignment of the elements [puzzle	
effect]. The module size	
966x1115x1.0mm GMS is perforated	
with 60mm deep drawn holes .The	
substructure consists of a form	
perforated L profile [U1040] as a	
lateral grid which is suspended from	
the ceiling with nonius adjustable	
upper and lower parts or with threaded	
rods using official approved dowel	
plugs. The grid profiles are to be	
connected together at the ends by	
means of longitudinal connectors [U	
1041] [screw fasteners].	
The spacing of the grid profile is	
according to the requirements of DIN	
EN 13964 as well as the loads of the	
system and to be determined and	
checked by the contractor. The	
profiles are attached to the walls with	
U 1042 wall brackets. On profiles	
angles, C-band raster as secondary	

		profiles are bolted on by means of C channel hanger bracket with M6 bolts. The longitudinal connections of the C- profiles are made by C profile connectors. The attachment to the walls is made with wall brackets				
		The ceiling elements are provided with magnets at the back and are force-fitted to the C-profiles. Thus, they are removable without using tools. They are secured with ropes against swinging down in an uncontrolled way. Only construction parts approved by the manufacturer may be used. Provide necessary supports, provisions as per the				
		Finish of ceiling is in powder coated RAL 9016 white colour or RAL 9006 Silver Grey or Black colour	Sam	2965 83	15 356 00	4 55 42 824 80
37	NS	To Supply and Install "Braided" metal open ceiling is a decorative single blade open cell ceiling system manufactured from 1mm thick perforated aluminium blades pressed together, available in white, Black, Metallic silver. The unique process in which the aluminium blades are punched creates a interwoven structure finish resulting in daylight reflecting off the exposed edges producing a radiant effect which can be enhanced with illumination to create a reflected spacious modern ceiling. The ratio between cell dimension and cell height allows the technical elements of to effectively disappear in the ceiling void which guarantees maximum transparency. The panel having cell size of 33.33 x 33.33 mm.	Sqiii	2903.83	13,330.00	4,55,42,624.80
		The assembled ceiling shall be in size of 600x1200 made out of single blades in 1mm (W) x 40mm (H) having perforation of 3.5 x 3.5mm and open area of appx 90 % . The ceiling panels are then clipped into carriers in GMS, coated in black finished at 1200mm c.c. Wire clips shall hold the cell ceiling panels into the carriers. Once the carriers are installed then primary angles made out of GMS, type U1040 are cross connected to the				

a carriers at 1200mm c.c. for lateral bracing. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm c.c. The peacles are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm cc. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. 38 N.S. Supply , fixing and installation of hanging falss ceiling made of 120m thick Acrylic solid surface, the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The system with de cost of framing. The primary support frame shall be cost shall include the cost of shall include the cost of Haming. The primary support frame shall be cost shall include the cost shall include with yo as at carry the weight carrying capacity and its requirement of stability and weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel Structure. The edges of the Amerils crift surface shall be hore the Stainless Steel Structure. The edges of the Amerils crift surface shall be hore.								
bracing. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/Bat minimum 3 mm thick vore the MS tube frame as per requirement of stability and weight carrying capacity and its shall be so starty so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be strewed over the Stainless Steel Structure. The support structure of Stainless Steel and MS shall be so tarty or astructure and Acrylic surface stall touch only the Stainless Steel Structure. The edges of the Acretic only the structure and Acrylic surface stall touch only the Stainless Steel Structure. The edges of the Acretic only the structure and Acrylic surface stall touch only the Stainless Steel Structure. The edges of the Acretic structure the structure and A				carriers at 1200mm c.c. for lateral				
suspended by M6 threaded rods installed 1200m c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200m cc. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. 38 N.S. Supply , fixing and installation of haiging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of shall include the cost shall include the cost of stanles shall include the cost shall include the cost of stanling and weight carrying capacity and its requirement of subport. The support structure of Subiness Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acredite of the Acrylic here the sturing the structure and Acrylic surface shall houch only the Stainless Steel Str				bracing. The whole ceiling shall be				
installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "mon-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "mon-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. S8 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include the Cost of frame as all be of MS tube 40x40 mm minimum 3 mm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick 40x40 mm stainless Steel as per design requirement of stability and weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement for stability and weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement for stability and derive shall to chow the Acrylic surface shall to chow the Stainless Steel Structure. The edges of the Acrylic surface shall to chow the the Stainless Steel Structure. The edges of the Acrylic Structure of Stainless Steel shall torechow the Acrylic Structure and Acrylic surface shall to c				suspended by M6 threaded rods				
fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm cc. The panels are fully downward demountable / hinged from the morporteary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.31 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framining. The </th <th></th> <th></th> <th></th> <th>installed 1200mm c.c. The panels are</th> <th></th> <th></th> <th></th> <th></th>				installed 1200mm c.c. The panels are				
from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "mon-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm cc. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-81, d0 according to EN 13501-01 "mon-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. 38 N.S. Supply, fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mm thick so carry the weight of the Acrylic, lights and diffuser set. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength os sturdy so as to carry the weight of the Acrylic, lights and dirfuser set. as per site. The Acrylic Surface shall be of the Acrylic lights and Acrylic surface shall be of the Acrylic surface shall be so sturdy so as to carry the weight of the Acrylic, lights and dirfuser set. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall be of the Acrylic surface shall be of the Acrylic surface shall be of the Acrylic surface shalt buch only the Stainless Ste				fully downward demountable / hinged				
section using Č 94 spring panels. The system should be in accordance with Material class X-21, d0 according to EN 13501-01 "non-combustible", as per the Direction of Archin-charge. The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm cc. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class X-281, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqn 276.70 7,529.00 20,83,274.31 38 N.S. Supply , fixing and installation of hanging false celling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick May and its requirement of stability and weight of the Acrylic, lights and df flyers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement for stapport. The support structure of Stainless Steel as per design requirement of stability and drifties steel shall be of MS shall be so structure. The edges of the Acrylic Surface has to be screwed over the Stainless Steel as per design requirement for stability and drifties steel shall be of MS shall be so structure. The edges of the Acrylic Surface shall touch only the Stainless Steel Structure. The edges of the Acrylic Surface shall be of MS shall be so structure of stability and drifties steel staper design				from the proprietary U 94 carrier				
38 N.S. Supply fixing and installation of hanging false ceiling material standards. 38 N.S. system will meet fire retardant standards. system should be in accordance with Material class A2-s1, 40 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. 38 N.S. Supply fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in accordance with material include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mm thick 40x40 mm Stainless Steel as per design requirement of stability and strength to structure and Accrylic solid surface. the primary support frame shall be of MS tube frame as per requirement of stability and strength to structure and Accrylic solid surface. the ceiling could be in accrost shall include the cost of framing. The primary support frame shall be of MS tube false as per the design requirement of stability and the false scele as per the fire requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stability and structure of Stability and diffusers etc. as per site. The Acrylic Surface shall to choly the Acrylic solid surface should be in accrea should be in accrea the should be in accrea should be in accrea the should be in accrea should be in accr				section using C 94 spring panels. The				
38 N.S. Supply fixing and installation of the Direction of Arch-in-charge. 38 N.S. Supply fixing panels. The system should be in accordance with Material class A2-s1, d0 according to By M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stability and weight carrying capacity and its requirement to ensure maximum stability and strength to structure and Acrylic surface shall to do hy the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall to do hy the Stainless Steel Structure. The desy of the Acrylic aufface shall be or holy the				system should be in accordance with				
38 N.S. Support readiants 38 N.S. Support frame shall be of 12mm thick over the MS thall and the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing that have the cost of framing. The cost of framing the cost of framing. The cost of framing the cost of framing. The cost of framing that cost of framing. The cost of framing the cost of framing. The cost of the cost of framing and the cost of framing. The cost of the down of main minimum 3 mm thick wore the MS tube 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick cost of framing and the cost of framing. The cost of framing cost of the frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel as per design requirement for support. The cost of the cost of stability and diffusers etc. as and to cost of the cos				Material class A2 s1 d0 according to				
EN 15307-01 non-connousibility, as per the Direction of Arch-in-charge. The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200nm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrytic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/1at minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/1at minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel and MS shall be so sturdy so as to carry the weight carrying capacity and its requirement for support. The support structure of Stability and weight carrying capacity and and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall be of MS				EN 12501 01 "non combustible"				
The system will meet fire retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible"; as per the Direction of Archi-nc-harge. The system will meet fire retardant standards. 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrypic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as the cost the Acrylic Surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall he to the flate maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall he touch only the Stainless Steel Structure. The deges of the Acrylic surface shall he touch only the Stainless Steel Structure. The deges of the Acrylic surface shall he touch only the Stainless Steel Structure. The deges of the Acrylic surface shall he touch only the Stainless Steel Structure. The deges of the Acrylic surface shall he touch only the Stainless Steel Structure. The deges of the Acrylic surface shall he touch only the Stainless Steel				EN 15501-01 non-combustione, as				
The system will meet the retardant standards. The whole ceiling shall be suspended by M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, 40 according to EN 13501-01 'non-combustible', as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.3' 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Aerylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight or the Arylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Arentic exide surface sheall he charter				per the Direction of Arch-in-charge.				
38 N.S. Supply . fixing and installation of hanging false ceiling made of family. 38 N.S. Supply . fixing and installation of hanging false ceiling made of family. 38 N.S. Supply . fixing and installation of hanging false ceiling made of family. additional ceiling active the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick store the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per slice. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall be of the Acrylic surface shall be of the Acrylic surface has to be screwed over the Stainless Steel as the design requirement to ensure maximum stability and strength to structure and Acrylic surface shall be be structure. The edges of the Acrylic surface shall be be acreaded be a				The system will meet fire retardant				
The whole ceiling shall be suspended by M6 threaded rooks installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2=81, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.3' 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel Structure. The Acrylic Surface has to be screwed over the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the	-			standards.				
by M6 threaded rods installed 1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. 38 N.S. Supply, fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall louch only the Stainless Steel Structure. The edges of the Acrylic surface shall louch only the Stainless Steel Structure. The edges of the Acrylic surface shall louch only the Stainless Steel Structure. The edges of				The whole ceiling shall be suspended				
1200mm c.c. The panels are fully downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274,3 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all haspes and sizes. The cost shall include mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick wort the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall stude has be as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall be as the predice schedul has the stainless steel Structure. The edges of the Acrylic surface schedul has the stainless steel Structure. The edges of the Acrylic surface schedul has the stainless Steel Structure. The edges of the Acrylic surface schedul has the stainless Steel Structure. The edges of the Acrylic surface schedue has the stainless Steel Structure. The edges of th				by M6 threaded rods installed				
downward demountable / hinged from the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustle", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.3' 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic scridt artifice acide				1200mm c.c. The panels are fully				
the proprietary U 94 carrier section using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274,3' 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of				downward demountable / hinged from				
using C 94 spring panels. The system should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.3 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure.				the proprietary U 94 carrier section				
should be in accordance with Material class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.3' 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mm thick vor the MS tube frame as per requirement of stability and weight carrying capacity and its requirement of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface shall toxch only the Stainless Steel Structure. The edges of requirement to ensure maximum stability and strength to structure and Acrylic surface shall toxch only the Stainless Steel Structure. The edges of				using C 94 spring panels. The system				
class A2-s1, d0 according to EN 13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.3 38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick vover the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of				should be in accordance with Material				
13501-01 "non-combustible", as per the Direction of Arch-in-charge. The system will meet fire retardant standards. Sqm 276.70 7,529.00 20,83,274.3 38 N.S. Supply, fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/Iat minimum 3 mm thick with 3 mport. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure Structure Structure Structure Structure Structure Stru				class A2-s1, d0 according to EN				
38 N.S. Supply, fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mm thick stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure.				13501-01 "non-combustible" as per				
38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick 40x40 mm stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only				the Direction of Arch-in-charge The				
38 N.S. Supply , fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mm thick vore the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure. The deges of t				system will meet fire retardant				
38 N.S. Supply, fixing and installation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick ver the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and steength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The degs of the Acrylic surface shall touch only the Stainless Steel Structure.				standarda	Sam	276 70	7 520 00	20 83 274 30
36 N.S. Supply , fixing and instantation of hanging false ceiling made of 12mm thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick with 3 mmm thick doub frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The deges of the Acrylic surface shall touch only the Stainless Steel Structure.	-	29	NC	Standards.	Sqiii	270.70	7,329.00	20,03,274.30
hanging faile certain failed of 1210m thick Acrylic solid surface, the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the		30	IN.S.	banging folge spiling mode of 12mm				
thick Acrylic solid surface. the ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the				nanging false cering made of 12mm				
ceiling could be in curve or could be in linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the				thick Acrylic solid surface. the				
In linear geometric shape as per the design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface shall touch only the				ceiling could be in curve or could be				
design requirement and the cost shall include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface abseld here				in linear geometric shape as per the				
include all shapes and sizes. The cost shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic sulface worked be				design requirement and the cost shall				
shall include the cost of framing. The primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid curfere abuild her				include all shapes and sizes. The cost				
primary support frame shall be of MS tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				shall include the cost of framing. The				
tube 40x40 mm minimum 3 mm thick with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic surface should be				primary support frame shall be of MS				
with 3 mmm thick 40x40 mm Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic sufface should be				tube 40x40 mm minimum 3 mm thick				
Stainless Steel Tube/flat minimum 3 mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid curface aboutd by				with 3 mmm thick 40x40 mm				
mm thick over the MS tube frame as per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				Stainless Steel Tube/flat minimum 3				
per requirement of stability and weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				mm thick over the MS tube frame as				
weight carrying capacity and its requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				per requirement of stability and				
requirement for support. The support structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				weight carrying capacity and its				
structure of Stainless Steel and MS shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				requirement for support The support				
shall be so sturdy so as to carry the weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				structure of Stainless Steel and MS				
weight of the Acrylic, lights and diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				shall be so sturdy so as to carry the				
diffusers etc. as per site. The Acrylic Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				weight of the Δ crylic lights and				
Surface has to be screwed over the Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				diffusers etc. as per site. The Acrulic				
Stainless Steel as per design requirement to ensure maximum stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				Surface has to be sorowed over the				
stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				Stainloss Staal on man design				
stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				stanness steel as per design				
stability and strength to structure and Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				requirement to ensure maximum				
Acrylic surface shall touch only the Stainless Steel Structure. The edges of the Acrylic solid surface should be				stability and strength to structure and				
Stainless Steel Structure. The edges of the Acrylic solid surface should be				Acrylic surface shall touch only the				
the Acrylic solid surface should be				Stainless Steel Structure. The edges of				
the Actyle solid surface should be				the Acrylic solid surface should be				
given a border of 50 to 100 mm in all Sqm 1149.75 9,054.00 1,04,09,836.54				given a border of 50 to 100 mm in all	Sqm	1149.75	9,054.00	1,04,09,836.50
				Stainless Steel Structure. The edges of the Acrylic solid surface should be	G	1140 75	0.054.00	1.04.00.004.50

		edges. The entire Acrylic ceiling surface shall be joint less or shall have a grooves as per design requirement. The joints at the edges should be joint less and seam less. The acrylic solid surface shall have cutouts for strip lights and other lights as per design. The hanging arrangement shall be done as per the requirement of lights required as per the design and reflections of light as instructions of Arabitact performance about he mode				
		Architect. perforations shall be made for lights. The joints are to be treated to give a seamless and joint less finish as per the manufacturer's specifications. Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified. Cost of framing structure as above				
		and hanging included in the cost.				
39	NS	To Supply and Install linear hook-on ceiling System. The panels are made to 2100(L)x300(W) manufactured out of minimum 0.7 mm thick. Finish of the panels to be powder coated dur				
		graphics 3D effect digitally printed UV cured finish with minimum 60 microns base coating. All panels are hooked onto a secondary grid known installed at shorter side of the panel to				
		ensure individual demounting of panels for easy accessibility of services. A primary grid of L- Angle in 30x30x1.2mm thick galvanized				
		steel known is installed perpendicularly to hook on profiles at maximum centers at 1200mm. The entire ceiling shall be suspended with M6 threaded rod using Hilti M6				
		fastener with minimum load of at least 0.5kn per anchor. The suspension system shall be as per manufacturer specification. The panels shall include				
		the site cutting / making openings for services e.g. lights for information boards, smoke detectors, speakers, diffusers, grills etc. Measurement to be done on edge to edge basis without				
		any deductions for AC grills or any other services integrated within the false ceilings.	Sqm	301.36	4,771.00	14,37,778.18

1	1	1	I	, ,	1	
		A primary grid of L- Angle in				
		30x30x1.2mm thick galvanized steel				
		known is installed perpendicularly to				
		hook on profiles at maximum centers				
		at 1200mm. The entire ceiling shall be				
		suspended with M6 threaded rod				
		using Hilti M6 fastener with minimum				
		load of at least 0.5kn per anchor. The				
		suspension system shall be as per				
		manufacturar analification The				
		manufacturer specification . The				
		panels shall include the site cutting /				
		making openings for services e.g.				
		lights for information boards, smoke				
		detectors, speakers, diffusers, grills				
		etc. Measurement to be done on edge				
		to edge basis without any deductions				
		for AC grills or any other services				
		integrated within the false ceilings.				
40	NS	Supply and Installation of Clouds				
		NRC. square edge. FR grade NRC				
		fabric (colour as per approved by the				
		Architect wrapped grassfire core panel				
		of size 600x1200x25mm having				
		volume density 120K gs/m3 and				
		weight $2kg/m^2$ Each aloud is				
		provided with 4 sets of accessories				
		provided with 4 sets of accessories				
		containing spring nooks, levelling clip				
		and hanger wires. Springs to be				
		rotated and anchored at back of each				
		panel at four points to hold the panel				
		stable. Supplied hanger wires to be				
		first dropped from the beam/slab/truss				
		to desired height with suitable				
		cleats/anchor bolts. Subtex Clouds				
		NRC panels are then suspended using				
		spring hooks and hanger wires and				
		levelled into position with supplied				
		levelling clips.				
		Technical Parameters				
		• Fire (Class) – 1 & P	L			
		• Acoustics $-$ NRC 0.9				
		• Thermal conductivity (W/mk)_ 0.07				
		• Climate (°C RH) 40.00				
		• Childle (C, \mathbf{KH}) = 49, 90				
		• Light reflectance (%) – Colour				
			a	102.25	12 700 00	10 00 575 00
		• Green (VoC, RC %) – Low, 25	Sqm	102.25	12,700.00	12,98,575.00
<u></u>	NC	Providing and fiving Accustic				
41	C.VI	Providing and fixing Acoustic				
		rolyhoer Cening in snapes and design				
		to be fixed by suspending through the				
		ceiling with necessary angles, cleats,				
		etc. as per the instructions of the	_			
		Architect to form cloud ceiling as per	Sqm	1144.14	4,140.00	47,36,574.00

42	NS	the approved design. the frameless ceiling is to be anchored from the ceiling for which the framework and support system is to be of patented technology and after necessary approvals by the architect. To Supply and Install hook on expanded Metal Mesh Ceiling in 1.2mm GMS manufactured as per TIAM quality standards. The ceiling panels shall be in size of 600x600- 1200mmx1.2mm(thick) galvanized mild steel and Mesh size shall be 20(Length)x10(Width)x2.5mm(Web Width) x 1.2mm(Thickness) having open area more than 55%. All panels are hooked onto a secondary grid known as U1005 installed at 600mm. A primary grid of perforated L- Angle in 30x30x1.2mm thick galvanized steel known as U1040 is installed perpendicularly to hook on profiles at maximum centers at 1200mm. The entire ceiling shall be suspended with M6 threaded rod using Hilti M6 fastener with minimum load of at least 0.2				
		be in accordance with Material class A2-s1, do according to EN 13501-01 "non-combustible", as per the Direction of Architect	Sam	1783 63	3 603 00	64 26 417 90
		Direction of Architect.	Sqiii	1/05.05	3,003.00	04,20,417.90
43	NS	To Supply and Install The organic metal ceiling that creates elegant circles. This Ceiling counterpoints the strict lines of conventional ceilings Module size is 1204mm×1204mm				
		Joint width, 10mm Also available on request in the 600 or 900mm modules. S7 Linear ceiling system Module size is 1204mm×1806mm and Joint width is 10 mm. This Ceiling can be acoustically effective using perforated rectangular metal panels with acoustic fleece on the rear side. The ceiling elements are fitted on the rear side with bolts and magnets and screwed on a rectangular ceiling system suspended in rail channels in the [KS] system. The elements at the butt of plates are force-fitted. Security ropes				

		of the ceiling elements. The rail channels are tightened by means of screws to L-shaped primary carriers. The L-shaped primary carriers are used to enable lateral stiffening and are suspended to the structural slab using Nonius suspension elements or threaded rods. The area lightings are an integral part of the creative metal ceiling . The Lights should be available in the sizes 600, 900, 1200mm and determines the basic size of the ceiling. The translucent covering made out of				
		high-quality that gives the lamps a vivid character	Sqm	36.00	31,880.00	11,47,680.00
44	NS	To Supply and Install linear Hingeable cell ceiling made out of Aluminium. The assembled cell ceiling panels shall be in size of 600x1200. The assembled cell ceiling panels shall made out of main blades in 3mm (W) x 20mm (H) in 1200mm (L), installed at 30mm c.c. and cross connected to secondary blades in 9mm(W) x 22mm (H) in 600mm (L) with 375mm pitch. The assembled cell ceiling panels are				
		then clipped into carriers in GMS, coated in black enameled finished at 1200mm c.c. Wire clips shall hold the cell ceiling panels into the carriers. Once the carriers are installed then primary angles made out of GMS, are cross connected to the carriers at 1200mm c.c. for lateral bracing The whole ceiling shall be suspended by M6 threaded rods installed 100mm c.c.All panel modules must be hingeable through wire clips	Sqm	3184.70	4,140.00	1,31,84,658.00
45	N.S	Providing and fixing perforated steel sheet with fleece to improve sound absorption (in black or approved RAL colour). The perforation should be equal distance and both the surfaces shall be smooth. Perforation should be adequate to improve sound absorption	Sam	1765.00	1 047 00	18 47 955 00
		*			,	- , . ,

46	NS	Providing and fixing backlit Ceiling in				
		12 mm acrylic solid surface sheet of				
		approved make. Acrylic solid surface				
		shall have Antibacterial certificate and				
		TUV (Austria) FR grade certified,				
		Ceiling Installation to be done in				
		translucent glacier ice color, thickness				
		(12 mm), design backlit provision as				
		approved by Architect. The material				
		should be CNC cut to achieve the				
		desired design as per architect. The				
		CNC cut Acrylic solid surface sheet to				
		be fixed on ceiling . Adhesive of the				
		same color. The material used shall be				
		very translucent and the light shall				
		pass through the acrylic solid surface				
		enhancing the design and the lights				
		passing should be very visible. The				
		cost shall include the framing, the				
		frame should be of stainless steel or				
		wood as per requirement of stability				
		and weight carrying capacity and its				
		requirement for support. The				
		hanging/fixing arrangement and				
		boxing shall be done as per the				
		requirement of light translucency and				
		reflection of lights required as per the				
		design and instructions of Architect.				
		The backlit ceiling shall have the light				
		passing and shall have translucency.				
		Acrylic solid surface shall have				
		Antibacterial certificate and TUV				
		(Austria) FR grade certified. The cost				
		of framing and boxing included.	Sqm	100.00	10,969.00	10,96,900.00
		TOTAL for FALSE CEILING				9,34,69,158.08

		SUBHEAD 6: WALL PANELLING				
47	N.S.	PERFORATED ZINC TITANIUM CLADDING : Supply, & Installation of Titanium zinc Interlocking wall cladding panels in Pre Patina BLUEGREY/GRAPHITE GREY Finish. The wall cladding system shall comprise of the following described 0.8/1 mm interlocking panels of 250- 300 mm width and max 1000 mm length. The interlocking panels are to be fixed using necessary accessories as proposed by suppliers standard methodology and connected end to end. Screws should be of SS Grade 410.Rivets powder coated in same finish ans the sheets and made of Aluminium. The substructure should be erected using Aluminium box sections of 25/30 x 50/60 dimensions. The Zinc sheets shall be as per EN 988 standards and must have TUV Certifications. The sheets should be purely natural without addition of any pigmentations Approved Zinc Titanium Sheets make : Perforation : Custom CNC punching as per approved drawings . Circular perforation of varying diameters shall be done as per approved drawings to meet the façade intent .				
48	N.S	Providing and fixing of Lacquered Glass. 6 mm Extra Clear Glass used for lacquered glass should be of Saint Gobain/ ASAHI/ Pilkington and should be toughened in horizontal tempering line. Lacquered glass could be fixed with (Dow corning - 789) / Pentagon double sided tape @2-3 per Sqm) on a perfectly leveled 12mm thick water proof marine plywood / MDF / Mineral fiber board which is mounted on the RCC wall/any other structure Or installed using Stainless Steel Patch fitting Or Stainless Steel studs Or Aluminum frame. (Ply, MDF, MFB, SS Fitting, Aluminum Frame etc. to be paid separately) Lacquered glass to be made industrially (via air brushing	Sqm	2994.73	6,137.00	1,83,78,473.90

			process); opaque (if viewed against a support wall), coated with WATER BASED lacquer colour of brand Colour Spray AQUA by Regaled – United Kingdom Or Equivalent Brand ;Which is binded by Nano particle pure acrylic); Gloss Level – 40 ; where VOC < 1% ; highly durable ; humid resistant (conforms to BS EN 1036 1999); environmentally friendly (no lead, no arsenic, no copper, no formaldehyde; compressive strength (1000 MPa) & tensile strength (40 MPa),same as float glass as per the detailed drawings and as approved by Architect. Colour to be checked and tested via INDEX Colour shade card used worldwide as a colour choosing parameter.				
╞	40	NC	Supply and placing of Green W-11				
	49	11.3	supply and placing of Green Wall planting media of organic fertilizer like crop residue, vermin compost, wood ash, poultry manure ,cow urine etc., lighter than the soil, with good moisture capacity and used to ensure that load on vertical wall is minimized in Kg/Sqft. UV Stabilized ALIVE polypropylene planters of nominal size 19.6 Inches(Length)X6.2 inches(Height)X9 inches (Wide) of each module or equivalent make, specially designed to keep the centre of gravity of growing plants with in the planters with suitable Geo-Textile separator to separate the planting media with water reservoir and keep the perforation holes unclogged. The installation of planter will be such that to make it theft proof. Plants of minimum height 152mm(5 plants for each planter) such as Interim, Lal sag, Alternanthera Chlorophytum vareigated, Jade, Schafflera, etc. selected on the basis of temperature, incidence of sun light and humidity on site ;in pattern finalised in consultation with as per direction of Architect.	Sqm	19.95	11,751.00	2,34,432.45
			direction of Architect.	Sqm	19.95	11,751.00	2,34,432.45

		1	
Drip Irrigation - with BIS approved 50			
mm CPVC pipes, inlet supply of			
water, outlet pipe for distribution of			
water with 25mm Dia pipe and grid of			
dripper with 15mm Dia pipe with			
dripper. Nozzles can unscrewed and			
cleaned in case of clogging. The			
installation shall be without pump set.			
The watering should be as per			
Gravitational			
Force i/c fixing. The suitable pressure			
compensating device, valve, elbow.			
end cap and all other accessories			
required to complete the			
irrigation system			
Mild Steel pipe frame grouting in			
RCC of mix 1.2:4 @ 51cm center to			
center embedded with vertical MS			
square pipe size 2 5cmX2 5cm with			
MS rectangular Pipe of 5cmX 2 5cm			
of border frame with MS Flats			
25mm(W)X 2 3mm thick weight not			
less than 2.5 kg per mtr 15cm center			
to center horizontally and with MS			
flats to hang the planter with or			
without connecting plate on			
supporting well or standelone			
including cutting hoisting fixing in			
position welding etc. & frame painted			
with 2 costs of Black at corresive			
bitumestic point in all complete as per			
site requirement			
Suc requirement.			
complete maintenance of vertical			
garden with supply of water for			
irrigation through pump set/water			
tanker including watering through drip			
irrigation, cleaning/replacement of			
dripper, replacement of dripper,			
change of pot pattern after 15 days			
interval or as per requirement of site			
complete. T&P shall be provided by			
the Contractor. The cost of casualty of			
plants 25% as natural casualty for the			
tirst three years and also refilling of			
cup inside covered by Geotextile cloth			
of 250 GSM in bottom and further fill			
up 1:2 ratio with coco peat and soil			
rite mixture all complete.			

50	NS	Supply installation testing and commissioning of pump set for Green Wall Single phase submersible motor pump set - suitable HP, in underground tank with starter panel completer in all respect (KSB, Kirloskar, Techno, Texmo, Taro, Calama, Pluga, Crompton Greaves etc.) Note : motor pump shall be able to cover upto area of 1000 sqft comprising of 10 normal/standard panel of size 10ft x10ft =100ft each.	Each	5.00	6,885.00	34,425.00
	NS	Providing and installation of Moss Wall as per manufacturer's Specifications	Sqm	10.00	23,502.00	2,35,020.00
51	NS	Supply and installation of polyfiber panels customized to desired shapes, core-pigmented, high-density, SynthPF rigid panels of size 600/1200x600/1200x9/12mm, volume density 220/180kg/m3, weight 2kg/m2 and Strand, square edge Magnesite bonded pinewood fiber core tiles of size 600x1200x10mm, volume density 400kgs/m3, weight 4kg/m2 installed by using Strut framework system.Framework system having thickness 0.55mm, length 3600mm, knurled web 40mm, depth 10mm and equal flanges 15mm is fastened to wall or framework behind vertically/horizontally at every 600mm centers. Strand is installed on suitable fasteners at 600mm centers. Longer edges of the panel should be perpendicular to length of .Stick is adhesive applied on and at rearPrior to installation, ensure surface behind are flat, dry and free from dust or other contaminants and leveled. then adhered to Panels behind with stick adhesive. Edges of the Strand to	Sqm	432.36	9,223.00	39,87,656.28
52	NS	Supply and Installation of square edge with embossed patterns, magnesite bonded pinewood fiber core tiles of				
		size 600x600x20mm, volume density 600kgs/m3, weight 12kg/m2 installed				

1	1	by using Strut framework system and				
		Z bars.				
		The framework system includes thickness 0.55mm, length 3600mm, knurled web 40mm, depth 10mm and equal flanges 15mm is fastened to wall positioned vertically in a regular manner at 600mm centers. Z-Bar 40mm height, thickness 1mm is first fixed behind the panels by using suitable fasteners on cement spots, at 500mm centers. If cement spots are not provided on panel rear then consult to provide methodology for insitu provision of cement spots. Another length of Z-Bar to be fastened perpendicular to framing at spacing so as to match with that of Z- Bars rear to panels, square edge				
		panels with their Z-Bar on rear are then slided on to Z-Bar fixed on				
		The system is backlined with the acoustical infill				
		Technical Parameters				
		 Fire (Class) - 1 & P Acoustics - NRC Upto 0.5 Thermal (W/mk)- 0.07 Climate (°C, RH) - 50, 95 Light (%) - Colour dependent Green (VOC, RC %) - Low, 30 	Sqm	111.72	10,731.00	11,98,652.70
53	NS	Supply and installation of customized printed, polyfiber panels, high- density, rigid panels of size 1200x2400x9/12mm thk, volume density 220/180kg/m3, weight 2kg/m2. Prior to installation, ensure wall or surface behind are flat, dry and free from dust or other contaminants and leveled.				
		Panels are then adhered to wall or surface behind with suitable adhesive.				
		 Fire (Class) - A Acoustics - NRC 0.4 (For A mounting) Thermal conductivity (W/mk)-0.039 				
		 Climate (°C, RH) – 50, 99 Light reflectance (%) – Print 	Sqm	72.05	6,877.00	4,95,487.85

1			1			
		dependent				
		• Green (VoC, RC %) – Nil, 60				
54	N.S	Fiberboard core plain, unperforated				
		panels, veneer laminated finish,				
		tongue-groove edge 1200x600x12mm				
		thk - Wall Paneling- Supply and				
		Installation of Fiberboard core plain.				
		unperforated panels, veneer laminated				
		finish, square edge, FR Grade of size				
		1200x600x12mm having density				
		750K gs/m ³ weight 12 kg/m ²				
		installed by using GI framework and				
		Z-bars				
		The GI strut work includes Cross				
		channel having thickness 0.45mm				
		length 3600mm knurled web 40				
		denth 10mm and equal flanges 15mm				
		is fastened to wall positioned				
		vertically at 600mm centers GL 7				
		hars having 40mm height thickness				
		1 2mm is first fixed behind the panels				
		by using suitable fasteners @ 500mm				
		c/c Another length of GI 7-Bars are				
		then installed over Strut cross channel				
		horizontally so as to match spacing				
		with 7-bars installed behind panels				
		Panels are then slided into the 7 bars				
		fixed on cross channel I ong edged of				
		namels should be perpendicular to 7				
		bars				
		Tachnical Paramatars				
		• Core - Fiberboard				
		• Fire $-$ Class 1 & P				
		• $A_{\text{coustics}} = \text{NRC} 0.25$				
		• Climate (OC RH) 50.70				
		• Termite resistance Vac				
		• Light reflectance Colour				
		dependent				
		• Green (RC %) $= 25$				
		• Uteth (KC 70) = 25 • Hygiana (VaC Clean room) Law				
		$C \log 2$				
		Class J Strongth Lond composity (V =)				
		Antisag	Sam	202.00	13 162 00	28 68 211 00
		Anusag	Sqiii	293.90	15,102.00	30,00,311.80

55	N.S	Providing and fixing EXTERIOR GRADE medium density fiber board exterior grade (Grade-I) IS:14587:1998 marked, to frame, backing or studding with screws etc. complete (Frames, backing or studding to be paid separately). exterior Grade - I MDF Board 12 mm thick conforming to IS:14587	Sqm	3796.06	654.00	24,82,584.00
56	N.S	Supply & installation of Wooden Acoustic Ceiling made of pinewood E1/good grade fiberboard, with big circle perforations of 50mm dia, melamine/veneer laminated finish, size 600x1200x16mm, Square edge, volume density of base board 800Kg/m3, weight 8.8Kgs/m2 installed by using Strut framework system and Strut Z bar.				
		Strut framework system includes Strut CC25 having thickness 0.55mm, length 3600mm, knurled web 35, depth 20mm and equal flanges 15mm is fastened to wall positioned vertically in a regular manner at 600mm c/c. Strut Z bar having 40mm height, thickness 1mm is first fixed behind the panels by using suitable fasteners. Another length of Strut Z bar are then installed over Strut CC25 horizontally at spacing so as to match with Strut Z bar at rear of Sircle Circulo panels. Sircle Circulo panels of size 600x1200x12/16mm are then slided into the Strut Z bar fixed on Strut CC25. Long edges of panels should be perpendicular to Strut Z bar and Short edges of the panel are staggered.				
		Panels are backlined with Synthetic Polyfiber(SPF) 10x25 held in position with dab spots of Stick S7 Technical Parameters				
		 Fire (Class) - 1 & P (For FR grade) Acoustics - NRC upto 0.85 Thermal conductivity (W/mk)- na Climate (°C, RH) - 40, 70 Light reflectance (%) - Colour dependent Green (VOC, RC %) - Low, 25 	Sqm	166.39	5,548.00	9,23,131.72

57		Providing and fixing 12mm thick ply (BWP), to MS frame, backing or studding with screws etc. complete (
		separately).	Sqm	2400.00	1,642.00	39,40,800.00
		TOTAL for WALL PANELLING				3,88,39,598.87
		SUBHEAD 7: PAINT WORKS				
58		Heat reflective cool coating for roots				
		Finishing Terrace with a premium specially formulated roof and exterior coating which reflects the damaging UV rays and reduces the internal temp of the buildings.				
		Reflects damaging ultra violet rays from the structures. • Reduces internal energy demand. • Dirt pick-up resistant technology. • Excellent elongation and adhesion. • Carbonation resistant. • Breathable and waterproof.				
		SURFACE PREPARATION • Thoroughly abrade the surface to remove loose particles, dust and laitance incrustations and existing paint using coarse wire brushes and water jetting. • Fill up all the cracks and crevices with Putty.				
		No. of Coats:- 1 Primer + 2 top coats.	C	1400 71	210.00	
		TOTAL for PAINT WORKS	Sqm	1490.71	319.00	4,75,536.49
						4,75,550.47
		SUBHEAD 8: MISCELLANEOUS WORKS SUCH AS BLINDS, FILMS, RAILINGS ETC.				
59	N.S.	Roller blind fabric should be made up of 35% Fiberglass, 65% Vinyl on Fiberglass, it should have specific low emissivity treatment and Lead free with Greenguard Gold certification . Fabric approved by Melanoma International Foundation (MIF) , it should cut UV rays with 97% approximately and antimicrobial properties as per ASTM E 2180, ASTM G21 & G22, AATCC30 Part 3, ASTM D 3273, GREENGUARD Mold and Bacteria Standard ASTM 6329: includes Microban				

finish powder coated with min 60 micron coating, Size of 40 mm outer dia and wall thickness of min. 1.2mm, Special feature, it has end to end groove to hold fabric inside for better strength. Bottom Tube: Made of high strength extruded aluminium alloy, finish powder coated with min 60 micron coating, Size of 20 mm height and wall thickness of min. 1.2mm, Special feature, it has end to end groove to hold fabric inside for better strength. Control Unit: Made of high strength reinforced Nylon grade 6, consisting of outside sleeve and centre shaft, sleeve shall provide bearing surface of roller tube and rotate freely on centre shaft, providing smooth quiet and long wearing operations. Brackets: Fixing brackets is made of mild steel with zinc coating, made of thickness of min. 0.7mm. Ball Chain: Made of 2mm thickness polyester cord with moulded 4.5mm round plastic balls.	Sqm	578.88	1,572.00	9,09,999.36
antimicrobial additives. It should have 3% openness, fabric thickness should be 0.50-0.55 mm, fabric weight should be 478 grams per square meter, The fabric should be Flame retardant as per California U.S. Title 19 (small scale), NFPA 701 TM#1 (small scale), NFPA 101 (Class A Rating), IBC Section 803.1.1 (Class A Rating), BS 5867 Part 2 Type B Performance, NFPA 701 TM#2 (large scale), CAN/ULC-S 109 (large and small scale), CAN/CGSB2-4.162- M80 with 10 years of warranty against any distortion in fabric due to any reason. The Warranty certificate for fabric direct from the fabric manufacturer need to be submitted by the contractor.				

		fastness 6-7 grade				
		Roller Upper Tube: Made of high strength extruded aluminium alloy, finish powder coated with min 60 micron coating, Size of 40 mm outer dia and wall thickness of min. 1.2mm, Special feature, it has end to end groove to hold fabric inside for better strength. Bottom Tube: Made of high strength extruded aluminium alloy, finish powder coated with min 60 micron coating, Size of 20 mm height and wall thickness of min. 1.2mm, Special feature, it has end to end groove to hold fabric inside for better strength. Control Unit: Made of high strength reinforced Nylon grade 6, consisting of outside sleeve and centre shaft, sleeve shall provide bearing surface of roller tube and rotate freely on centre shaft, providing smooth quiet and long wearing operations. Brackets: Fixing brackets is made of mild steel with zinc coating, made of thickness of min. 0.7mm. Ball Chain: Made of 2mm thickness polyester cord with moulded 4.5mm round				
		plastic balls.	Sqm	2453.98	1,729.00	42,42,931.42
61	N.S	Providing & Fixing Automated (RF) remote for Blinds	Each	90.00	3,435.00	3,09,150.00
62	N.S.	Providing & Fixing Automated motor for Blinds with specification: Size-L1/L2- 564/577mm, Torque 6 NM, Speed 28 rpm, Rated, Current 0.5Amp, Rated Power 121 Watt, Rated Voltage 230 Volt, Rated Frequency 50HZ,Thermal Cutoff 4Minute, No of cables 3 Index Protection IP44,Average Running Noise 32-42 DBA	Each	256.00	5,654.00	14,47,424.00
63	N.S.	Supply of Crystal Glass film FROSTED effect with approved artwork, cut using digital plotter. Self- adhesive, bubble-free installation to be done on clean glass, by Authorized Installer's Warranty for a period of 180 months for interior application, 36 months for exterior application to be submitted along with invoice.	Sqm	1523.32	1,234.00	18,79,752.20

64	N.S	Providing & Fixing Digitally reproduced Film on Lift lobbies & Corridor partitions of Clear Graphics 114 make or approve equivalent. The film shall be Durable inkjet printed graphics on self adhesive vinyl, special CLEAR film to produce coloured imagery on glass. Customized imagery with approved graphics including providing company warranty, at all leads & lifts etc.	Sqm	72.00	3,326.00	2,39,472.00
65	N.S	Providing and fixing of 12mm thick toughened ceramic digitally printed glass. 12 mm annealed Glass used for digital printing and should be of Saint Gobain/ ASAHI/ Pilkington and should be toughened in vertical tempering line. Digitally printed glass must be and only be of ceramic ink and printed on DIPTECH/TECGLAS Plant; ink should be of ceramic and carrier should be terepthalene oil, Which is then tempered post printing so that the ceramic ink embeds inside the glass making it permanent and homogeneous;; highly durable ; water resistance , UV resistance; environmentally friendly (no lead, no arsenic, no copper, no formaldehyde; compressive strength (1000 MPa) & tensile strength (40 MPa),same as float glass as per the detailed drawings and as approved by Architect.	Sam	108.00	8.075.00	8.72.100.00
66	N.S	Staircase Railing Providing & Fixing Modular (weld free Components base) Balustrade & Handrail system, 50.8 mm dia x 1.6mm thick handrail fixed to the Balustrade of 50 .8 mm dia x 1.6 mm thick with top adapter(neck) type fixed with 2nos of M4x10mm Allen CSk Screw. The balustrade fixed to Top of the straight or staircase with Base plate with M12 x120mm long anchor fastener. The balustrade C/C 900 to 1000mm, The Ht. of the handrail 1000mm from FFL. Glass infill of 6,8 &10 mm thick toughened monolithic Glass or 13.52 thick laminated toughened glass is Fixed to the Balustrade with Glass Clamp	Rmt	140.76	12,305.00	17,32,051.80

		(Four per balustrade) by M8 avdel insert & M8 x25mm Allen cap screw, Complete with all End cap, Mid Span Sleeve, Elbows. All the material of handrail, balustrade and components should be of SS 304 grade satin finish.				
67	N.S.	Viewing Gallery & Terrace Railing Providing Modular (weld free, component base) Glass balustrade system (Frameless handrail) 50mm dia x 1.6 mm thick handrail fixed to 10 to 12mm thick monolithic T/G glass or 13.52 laminated glass with glass mounted handrail bracket at every 1000mm to 1200 mm C/C(two no per Glass), just below (75mm) top edge of the glass , Bottom of the glass is fixed with One pairs of Spigot (with out baseplate - D1 type 1200 mm C/C fixed to floor by m16 x 150mm long stud with epoxy grout or without base plate - D2 Two per each Glass Panel) Floor with M12 x120mm anchor fastener with domenut. Complete with End caps, Mid Span sleeve, Elbows. All the material of handrail				
68	N.S.	grade satin finish. Providing and fixing Lattice jaali partitions in 12mm thick acrylic solid surface sheet of approved make manufactured as per guidelines of ISO19712. The material should be CNC cut to achieve the desired design as per architect. The CNC cut Acrylic solid surface sheets to be fixed with the help of Aluminum/Metal Box section of 50x50x3mm from all the 4 sides/ teak wood/ oakwood frame Single jaali of approx. size of 0.75mtr x 1.5 mtr or as per design & metal frame to be supported with the help of Hilti/ or approved fasteners. Adhesive of the same color. The rate is inclusive of framework, material and required pattern approved. The Acrylic Solid Surfaces should be installed by	Rmt	56.25	13,960.00	7,85,250.00
		company authorized Quality	Sqm	49.98	18,946.00	9,46,921.08

		Fabricators. The 6mm routed CNC cut Acrylic solid surface sheets/ lattice jali to be fixed with the help of 25x25 mm Aluminum tube or 25x25mm aluminium frame/ 25x25mm teak wood or 75x75mm class teak wooden frame from all the 4 sides of the lattice jaali. Lattice jaali frame to be supported with the help of Hilti/ or approved fasteners as per requirement. The rate is inclusive of all operation, framework, material and required pattern. The material used shall be as per the Architect and the light shall pass through the acrylic lattice jaali cut solid surface enhancing the design . Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.				
69	N.S.	Designing, Enlarging, supplying, execution, fixing and installation of 3D copper mural with hammering to in panels in various sizes varies from 2 to 4.5 sqmtr. Concept of copper mural will be specially designed keeping in mind that the art mural will enhance the ambience and would improve its look aesthetically as per the design approved. Hammered and designed Copper to be encased over ply (12mm thick) and covering the edges of the ply with the copper sheet. Mannequins and other desired elements shall be as per the approved design and the mannequins shall be made out of copper sheet and encased around ply (12mm thick). the design elements of the mannequins/ reliefs/ objects shall be placed/ fixed over the 3D hammered copper battering surface as per the approved design. The painting of the mannequins and other elements shall be as per the color scheme of approved design and the final mild and thin coatings on top of the entire surface shall be of PU. The fixing details shall be as per approved design and the ply surface shall be fixed with suitable fasteners etc. to ensure stability of the elements, mannequins and hammered copper	Sqm	20.00	23,690.00	4,73,800.00

70	N.S.	mural with adequate hammering The copper mural relief shall enhance the aesthetic beauty of the vertical/ horizontal surface as per site. Transportation to site included. Installation and fixing the mural is included. Scaffolding and support system to all height included. Supply and fixing of prefabricated GI trap 600 mm x 600 mm doors of to be recessed in ceilings wherever required.	Each	200.00	7,175.00	14,35,000.00
71	N.S.	Providing and fixing designer Wall Paneling with 3D engraving in 18mm thick acrylic solid surface sheet of approved make or as approved by architect basic white color. Design & fixing arrangement as per direction of Architect. The material should be CNC 3D cut to achieve the desired design. The CNC cut Acrylic solid surface sheet to be fixed in a box frame or on a frame or on a flat surface as per the drawing and design and as per the instructions of the architect. The material used shall be very translucent and the light shall pass through the acrylic solid surface enhancing the design and the lights passing should be very visible. The cost shall include the framing and Boxing of wood / plywood and the frame should be of stainless steel or wood as per requirement of stability and weight carrying capacity and its requirement for support. The 3D shall be done as per the requirement of light translucency and reflection of lights required as per the design and shall have translucency. Acrylic solid surface shall have the light passing and shall have translucency. Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.the	Sqm	93.60	21,937.00	20,53,303.20
72	N.S.	Designing and placing Sliding name plate for dignatories				

		personalized acrylic desk nameplate Made with high quality acrylic Dimensions: 2"1 x 10"w x 1"h Produced without using liquid solvents. No VOC emissions. Made of ultra-durable acrylic	Nos.	223.00	1,165.00	2,59,795.00
73	N.S.	Paneling with acrylic solid surface. Providing and fixing wall cladding panels with 6mm acrylic solid surface, , non-porous and homogeneous seamless, stain resistant, repairable, durable, hygienic environment friendly surfacing material acrylic solid surface sheet of or approved make with a minimum thickness 06 mm in color, design, fixing in customize design arrangement as per direction of Architect. Acrylic solid surface sheet to be fixed on wall on top of 12 mm marine ply. Adhesive of the same color to provide inconspicuous joints. Grooves to be given at every 1mtr to give expansion & contraction movement to material. The rate is inclusive of all operation, material and required pattern. Cost of base like framework and 12mm thick ply will be paid under respective item.			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	2,00,0000
		Acrylic solid surface shall have Antibacterial certificate and TUV (Austria) FR grade certified.	Sqm	2066.68	7,626.00	1,57,60,501.68
		(Hustild) I R grude contined.	bqiii	2000.00	7,020.00	1,57,00,501.00
74	N.S.	Designing, Enlarging, supplying, execution, fixing and installation of stain glass mural sandwich panel in 5mm stain toughened glass panel+5 mm thick toughened clear glass facing outside. Concept of stain glass will be specially be designed keeping in mind that the art mural will enhance the ambience and would improve its look aesthetically. Material: The material used in making the stain glass will be lead, 5 stain toughened glass panel+5 mm thick clear toughened glass, Imported resins and staining chemicals, imported color dyes overall thickness of glass in 10mm,thw two panes will be sealed with silicon as/approved from all sides. Framing:				

		Cost includes frame of aluminum powder coating which runs around the glass panel fixed to wall/RCC column.				
		Designing, Enlarging, supplying, execution, fixing and installation of stain glass mural sandwich panel in 5mm stain toughened glass panel+5 mm thick toughened clear glass facing outside. Concept of stain glass will be specially be designed keeping in mind that the art mural will enhance the ambience and would improve its look aesthetically. Material: The material used in making the stain glass will be lead, 5 stain toughened glass panel+5 mm thick clear toughened glass, Imported resins and staining chemicals, imported color dyes overall thickness of glass in 10mm,thw two panes will be sealed with silicon as/approved from all sides. Framing: Cost includes frame of aluminum				
		powder coating which runs around the glass panel fixed to wall/RCC column.	Sam	42.83	16.253.00	6.95.628.40
75	N.S.	Supply and installation of Artificial Turf -40 mm thickness –	1			
		Supply and installation of Drain cells & application of Solvent below the Drain Cells.				
		brain cells functions as a highly efficient lightweight drainage system that rapidly captures and transports even high water volumes associated with torrential rain.				
		What goes under artificial turf other than Drain Cells:				
		from three-eighths to three-fourths of an inch are perfect for artificial grass sub-base.				
		2. Fine Materials. It is imperative to have a filler material, called fines, to surround the larger crushed rocks for overall turf stability				
		3.Ideal Mixture.4.Weed Fabric.	S	01.00	051.00	60 021 00
			Sqm	81.00	851.00	68,931.00

76		Supply of Plants with Planters for display of plants at Reception and diff area of Building indoor/Outdoor, highly resistant to breakage, harsh				
a	N.S	weathers and ultra violet rays.C896 Areca palm (3'-4' ht., bushy) & planter	Each	10	• • • • • • • •	2 1 0 10 00
h		size -13"X13"X18" with fillers	Fach	10	2,104.00	21,040.00
U		bushy) & FRP planter size -7.5"X7" with fillers	Eacli	40	1,067.00	42,680.00
с		Bosten fern (1'-2' ht. bushy) with & FRP planter size -7.5"X7" with fillers	Each	30	1,207.00	36,210.00
d		Drasaena marginata (2' ht. multibranch) & FRP planter size - 10"X10"X10" with Fillers	Each	20	1 366 00	27 320 00
e		Ficus lyrata (4' ht. branched) &	Each	20	1,885.00	5 655 00
f		Snake Plant (2.5' Ht.) & planter size - 10"X 10"X10" with Fillers	Each	55	788.00	43,340.00
g		Alocasia with 6" pvc (white) pot of 1' ht	Each	10	728.00	7,280.00
h		Raphis Palm 3-4' ht. multi tiller (4-5 tiller)	Each	10	3,729.00	37,290.00
i		Chamadora of 5-6' ht. bushy of 5-6' ht. bushy	Each	10	3,530.00	35,300.00
j		Japanese bamboo/ Black bamboo of 4'-5' ht. multi tiller (7-8 tiller)	Each	10	2,593.00	25,930.00
k		Ficus elastica of 2' ht. bushy	Each	9	1,067.00	9,603.00
77		Supplying, fabricating hoisting and fixing of MS pipe of varying diameters fixed by means of arc welding or flanges for hoisting the National flag. The flag is to be hoisted upto a height of 50m. MS Pipe, Concrete foundations, base plate, stiffner plate, holding down bolts to be as per the design and detail approved by the Architect/ Engineer In Charge. The cost of concrete, structural members, bolts and hoisting arrangement including flag, pulley, rope etc. to be paid in their respective heads.	Kgs	6000	110.00	6,60,000.00
		TOTAL for MISCELLANFOUS				
		WORKS SUCH AS BLINDS, FILMS, RAILINGS ETC.				3,55,39,195.63
		SUBHEAD 9: CORPORATE BUILDING FURNITURE				
1	1			I	1	
----	-----	--	------	------	-------------	-------------
		FURNITURE SHOULD BE				
		RIFMA GOLD RATED SCS				
		GLOBAL CERTIFIED FOR IN-				
		HOUSE AIR OUALITY AND				
		WITH 10 YEARS				
		REPLACEMENT WARRANTY.				
78	N.S	MD Cabin (With Natural Veneer)				
		Providing and placing in position MD				
		Cabin Table .Main Table is Size :				
		3300mm(L) x 1200mm(D) x				
		750mm(H), return storage of size				
		1500mm(L) x 480mm(D) x				
		550mm(H) and Back storage of size:				
		3600mm (W) x 480mm (D) x				
		2050mm(H). Main Table: Table is				
		made up of E1/good grade MDF /BB				
		with 0.45 mm natural veneer, 5mm				
		solid wood edge banding for				
		protection. Desktop thickness is 75-80				
		mm with leather pad and leather flip				
		wire box. E1/good grade				
		MDF/BBwith 0.45mm natural veneer,				
		5mm solid wood edge banding for				
		protection. Wiring management				
		system is introduced from floor and				
		side table to wire box. Including 3				
		cabinet with pulling doors and I CPU				
		cabinet. L snape design, Main desk on				
		Including multi-functional wire how				
		(2 power 1 HDML 1 Internet 1				
		Dhone 1 VGA) Waterborne Paint				
		Technology decrease 95% of VOC to				
		create more friendly environmental				
		space for health The Product should				
		be of Zero formaldehyde Release to				
		Create Friendly Environmental Space.				
		With 3 drawer mobile pedestal with				
		matching to table finish.				
		Back Storage :E1/good grade				
		MDF/BB with 0.45mm natural				
		veneer, 5mm solid wood edge banding				
		for protection. Doors constructed				
		0.45mm natural veneered MDF				
		/BBwith solid wood handles and Italy				
		FGV soft damping hinge, The door is				
		soft close. Including sliding cloth				
		hondlog Italy ECV soft domains				
		hinge The door is soft along				
		Waterborne Paint Technology				
		decrease 95% of VOC to create more	Fach	1.00	5 88 045 00	5 88 045 00
	1		Lati	1.00	5,00,045.00	5,00,045.00

		friendly environmental space for				
		health. The Product should be of Zero				
		formaldehyde Release to Create				
		Friendly Environmental Space.				
		All hardware shall be of reputed as				
		per sample finally approved by the				
		Architect.				
		Product should be BIFMA gold rated				
		SCS global certified for in-house air				
		quality and with 10 years warranty				
78.1	NS	Monting table in Natural Vencor in				
70.1	14.5	MD Cohin Sizo 2100mm (W) y				
		1050 mm (D) x 750 mm (H) (With				
		Vanaer Einish) Providing and placing				
		Pester sular share 8 Sector meeting				
		table of Size 2100mm(L)				
		table of Size 2100 mm(L) x				
		$1050 \text{mm}(\text{W}) \times 750 \text{mm}(\text{H}).1 \text{ able top}$				
		and legs are made of 60-70 mm thick				
		Particle Board (E-1/good Grade),				
		veneer finish with matched 2 mm				
		ABS edge-banding.E1/good grade in				
		veneer finish with zero urea				
		formaldehyde emissions (<or=< th=""><th></th><th></th><th></th><th></th></or=<>				
		8mg/100 g oven dry board-perforated				
		method) for better in-house quality.				
		This should comply with (EN 120-				
		1992).It has Netbox axial comfort 4				
		gang (UNIVERSAL Version).The				
		Modesty is Particle board wood Grade				
		E-1/good (Environmental Friendly)				
		thickness 25 mm in veneer finish				
		Edge-Banding(ABS) 2 mm.Product				
		should be BIFMA gold rated				
		SCSglobal certified for in-house air				
		quality and with 10 years warranty.	Each	1.00	1.45.678.00	1.45.678.00
					_,,	
79	N.S	Chairman Cabin (With Natural				
		Veneer)				
		Providing and placing in position				
		Chairman Cabin Table, The Main				
		Table is Size: 2700mm(L) x				
		1150mm(D) x 750mm(H), Return				
		Storage of size 1500mm(L) x				
		$480 \text{mm}(\text{D}) \times 550 \text{mm}(\text{H})$ and Back				
		storage of size:5000mm (W) x				
		480mm(D) x 2050 mm(H) & Free				
		standing swing door storage of size:				
		2100W 450D 750hmm Main Table				
		Table is made up of E1/good grade				
		MDF/BB with 0.45 mm natural				
		veneer 5mm solid wood edge banding				
		for protection Deskton thickness is				
		75-80 mm with leather pad and leather				
		13-60 mm with leather pad and leather				L

		flip wire box. E1/good grade				
		MDF/BB with 0.45mm natural				
		veneer, 5mm solid wood edge banding				
		for protection. Wiring management				
		system is introduced from floor and				
		side table to wire box. Including 3				
		cabinet with pulling doors and 1 CPU				
		cabinet. L shape design, Main desk on				
		right or left hand return cabinet.				
		Including multi-functional wire box.				
		(2 power, 1 HDMI, 1 Internet, 1				
		Phone, 1 VGA). Waterborne Paint				
		Technology decrease 95% of VOC to				
		create more friendly environmental				
		space for health. The Product should				
		be of Zero formaldehyde Release to				
		Create Friendly Environmental Space.				
		With 3 drawer mobile pedestal with				
		Inatching to table finish.				
		Back Storage :E1/good grade				
		MDF/BB with 0.45mm natural				
		for protection Doors constructed				
		0 6mm natural vanaered MDE/BB				
		with solid wood handles and Italy				
		FGV soft damping hinge the door is				
		soft close Including sliding cloth				
		hook can keep cloth Solid wood				
		handles Italy FGV soft damping				
		hinge, the door is soft close.				
		Waterborne Paint Technology				
		decrease 95% of VOC to create more				
		friendly environmental space for				
		health. The Product should be of Zero				
		formaldehyde Release to Create				
		Friendly Environmental Space.				
		All hardware shall be of reputed				
		make/brand as per sample finally				
		approved by the Architect.				
		Product should be BIFMA gold rated				
		SCSglobal certified for in-house air				
		quality and with 10 years warranty.	Each	1.00	5,00,570.00	5,00,570.00
80	NS	CVO Cabin (With Natural Veneer				
00	1110					
		Providing and placing in position				
		CEO Cabin, The Main Table:				
		2700mm(L) x 1150mm(D) x				
		750mm(H), Side Storage 1350mm(L)				
		x 480mm(D) x 550mm(H) and Back				
		storage of size: 3600mm (W) x				
		480mm(D) x 750mm(H) & Free				
		Standing swing door storage of size				

	make/brand as per sample finally approved by the Architect.		
	All hardware shall be of reputed		
	Friendly Environmental Space.		
	formaldehyde Release to Create		
	triendly environmental space for		
	decrease 95% of VOC to create more		
	close. Waterborne Paint Technology		
	soft damping hinge, the door is soft		
	cloth. Solid wood handles. Italy FGV		
	Including sliding cloth hook can keep		
	damping hinge the door is soft close		
	natural veneered MDF with solid		
	protection. Doors constructed 0.6mm		
	5mm solid wood edge banding for		
	MDF/BBwith 0.45mm natural veneer,		
	Back Storage :E1/good grade		
	matching to table finish.		
	With 3 drawer mobile pedestal with		
	Create Friendly Environmental Space.		
	be of Zero formaldehyde Release to		
	space for health. The Product should		
	create more friendly environmental		
	Technology decrease 95% of VOC to		
	Phone 1 VGA) Waterborne Paint		
	(2 power 1 HDMI 1 Internet 1		
	Including multi-functional wire here		
	cabinet. L snape design, Main desk on		
	cabinet with pulling doors and I CPU		
	side table to wire box. Including 3		
	system is introduced from floor and		
	for protection. Wiring management		
	veneer, 5mm solid wood edge banding		
	grade MDF/BB with 0.45mm natural		
	and leather flip wire box. E1/good		
	thickness is 65-70mm with leather pad		
	banding for protection. Desktop		
	natural veneer, 5mm solid wood edge		
	E1/good grade MDF/BBwith 0.45 mm		
	750mm(H) Table is made up of		

i i	i		I	1	1	
		Providing and placing in position				
		Director Cabin Table Set consisting of				
		Main table, Mobile Drawer Unit and				
		Side Unit. The Main Table is Size :				
		2400mm(L) x 1050mm(D) x				
		750mm(H), Side Unit of size				
		1350 mm(L) = x = 480 mm(D) = x				
		550mm(H) and Back storage of size:				
		2400 mm (W) x $450 mm$ (D) x				
		750 mm(H) Table is made up of				
		E1/good grade MDE/PP with 0.45				
		El/good glade MDF/BB with 0.43				
		min natural veneer, smin solid wood				
		edge banding for protection. Desktop				
		thickness is 65-/0mm with leather pad				
		and leather flip wire box. El/good				
		grade MDF/BB with 0.45mm natural				
		veneer, 5mm solid wood edge banding				
		for protection. Wiring management				
		system is introduced from floor and				
		side table to wire box. Including 3				
		cabinet with pulling doors and 1 CPU				
		cabinet. L shape design, Main desk on				
		right or left hand return cabinet.				
		Including multi-functional wire box.				
		(2 power, 1 HDMI, 1 Internet, 1				
		Phone, 1 VGA). Waterborne Paint				
		Technology decrease 95% of VOC to				
		create more friendly environmental				
		space for health The Product should				
		be of Zero formaldehyde Release to				
		Create Friendly Environmental Space				
		With 3 drawer mobile pedestal with				
		matching to table finish				
		Deals Storage (E1/2004) and			-	
		Back Storage :E1/good grade				
		MDF/BB with 0.45mm natural				
		veneer, 5mm solid wood edge banding				
		for protection. Doors constructed				
		0.6mm natural veneered MDF/BB				
		with solid wood handles and Italy				
		FGV soft damping hinge, the door is				
		soft close. Including sliding cloth				
		hook can keep cloth. Solid wood				
		handles. Italy FGV soft damping				
		hinge, the door is soft close.				
		Waterborne Paint Technology				
		decrease 95% of VOC to create more				
		friendly environmental space for				
		health The Product should be of Zero				
		formaldehyde Release to Create				
		Friendly Environmental Space				
		All hardware shall be of remoted				
		make/brond on non commute finally				
		approved by the Architect	Each	1.00	2 52 000 00	14 11 060 00
		approved by the Architect.	Each	4.00	5,52,990.00	14,11,900.00

		Product should be BIFMA gold rated				
		SCSglobal certified for in-house air				
		quality and with 10 years warranty.				
82	NS	ED CADIN (With Natural Vancar)				
02	11.5	ED CABIN (With Natural Veneer)				
		Providing and placing ED CABIN of				
		Size : 2400W X 1050D X /50mmH,				
		Side table Size: $1200W \times 450D \times 1200W$				
		/SUMMH and Back storage: 4300W X				
		450D X /50mmH. Side free standing				
		storage - 2400W X 400D X 750mmH.				
		Table is made up of El/good grade				
		MDF/BB with 0.45 mm natural				
		veneer, 5mm solid wood edge banding				
		for protection. Desktop thickness is				
		45-55mm with leather pad and leather				
		flip wire box. El/good grade				
		MDF/BB with 0.45mm natural				
		veneer, 5mm solid wood edge banding				
		for protection. Wiring management				
		system is introduced from floor and				
		side table to wire box. Including 3				
		cabinet with pulling doors and 1 CPU				
		cabinet. L shape design, Main desk on				
		right or left hand return cabinet.				
		Including multi-functional wire box.				
		(2 power, 1 HDMI, 1 Internet, 1				
		Phone, 1 VGA). Waterborne Paint				
		Technology decrease 95% of VOC to				
		create more friendly environmental				
		space for health. The Product should				
		be of Zero formaldehyde Release to				
		Create Friendly Environmental Space.				
		With 3 drawer mobile pedestal with				
		matching to table finish.				
		Back Storage :E1/good grade				
		MDF/BB with 0.45mm natural				
		veneer, 5mm solid wood edge banding				
		for protection. Doors constructed				
		0.6mm natural veneered MDF/BB				
		with solid wood handles and Italy				
		FGV soft damping hinge, the door is				
		soft close. Including sliding cloth				
		hook can keep cloth. Solid wood				
		handles. Italy FGV soft damping				
		hinge, the door is soft close.				
		Waterborne Paint Technology				
		decrease 95% of VOC to create more				
		friendly environmental space for				
1		health. The Product should be of Zero				
1		formaldehyde Release to Create				
1		Friendly Environmental Space.	_			
		All hardware shall be of reputed	Each	12.00	3,14,721.00	37,76,652.00

		make/brand as per sample finally				
		approved by the Architect.				
		Product should be BIFMA gold rated				
		SCSglobal certified for in-house air				
		quality and with 10 years warranty.				
	NC	CM (Obudaman CADIN (With				
85	11.5	GWI /ODUdSman CABIN (With Natural Vancor)				
		Providing and placing GM CABIN				
		Main table of Size $\cdot 2100(W)$ v				
		$1050(D) \times 750(H)$ Return table of				
		Size: $1000W \times 450D \times 750mmH$ and				
		Back storage of Size: 3600W x 450D				
		X 750H and Side storage of size				
		$\cdot 1650W \times 400D \times 750MmmH$				
		Table is made up of E1/good grade				
		MDF/BB with min 0.45 mm natural				
		veneer 5mm solid wood edge handing				
		for protection Deskton thickness is				
		45-55mm with leather pad and leather				
		flip wire box E1/good grade MDF				
		with 0.45mm natural veneer 5mm				
		solid wood edge banding for				
		protection. Wiring management				
		system is introduced from floor and				
		side table to wire box. Including 3				
		cabinet with pulling doors and 1 CPU				
		cabinet. L shape design, Main desk on				
		right or left hand return cabinet.				
		Including multi-functional wire box.				
		(2 power, 1 HDMI, 1 Internet, 1				
		Phone, 1 VGA). Waterborne Paint				
		Technology decrease 95% of VOC to				
		create more friendly environmental				
		space for health. The Product should				
		be of Zero formaldehyde Release to				
		Create Friendly Environmental Space.				
		With 3 drawer mobile pedestal with				
		matching to table finish.				
		Back Storage :E1/good grade				
		MDF/BB with 0.45mm natural				
		veneer, 5mm solid wood edge banding				
		tor protection. Doors constructed				
		0.0mm natural veneered MDF/BB				
		with solid wood handles and Italy				
		FGV soft damping hinge, the door is				
		soft close. Including sliding cloth				
		nook can keep cloth. Solid wood				
		hings the last in the				
		minge, the door is soft close.				
		decrease 95% of VOC to greate more	Fach	12 00	2 06 700 00	86 81 778 00
L		uccrease 95% of VOC to create more	Each	42.00	2,00,709.00	00,01,770.00

		friendly environmental space for health. The Product should be of Zero formaldehyde Release to Create Friendly Environmental Space. All hardware shall be of reputed make/brand as per sample finally approved by the Architect. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.		
84	N.S	CONFERENCE/MEETINGTABLES (With Natural Veneer)		
		Providing and placing Conference room table in Veneer finishes, where table top and legs are made of 60-70 mm thick MDF/B board (E-1/good Grade), veneer finishes(Minimum thickness of 0.45) with matched 2 mm thick ABS edge-banding. The E1/good grade laminate board should be used with zero urea formaldehyde emissions (<or= 100="" 8mg="" dry<br="" g="" oven="">board-perforated method) for better in-house quality. This should comply with (EN 120-1992).The height of worktop shall be 740mm from ground level. Veneer Flipper with wiring tray made of 1.5-2 mm thick CRCA duly powder cited of 60-70 micron with housing supported Veneer legs made of minimum 36-45mm thick with approved shade of natural Veneer(minimum thickness of 0.5-0.6 mm).An intelligence wiring system shall be hidden underneath the work surface, to deliver all wires and cables from wiring tray to floor, which make the working atmosphere looks more neat, harmony and aesthetic. The wiring tray shall be made of steel</or=>		
		sheet thickness 1.2mm Epoxy powder coated spray color, baked at temperature 200 C°coated of 80-90 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The Modesty shall be Particle board wood Grade E-1/good (Environmental Friendly) thickness 25 mm., cover		

		with Veneer Edge-Banding(ABS) 2				
		mm Complete as per the direction of				
		Architect				
		Product should be BIFMA gold rated				
		SCS global certified for in house air				
		subject of the second state of the second stat				
		quality and with 10 years warranty.				
84.1		40/24 Pax U Shape Conference Table				
		: 6500L x3700W x750Hmm		1.00	4,39,995.00	4,39,995.00
84.2		10 pax Rectangular/ Oval/round				
		Meeting table with round shape		1.00	1,54,022.00	1,54,022.00
85	N.S	CONFERENCE /MEETING				
		TABLES (Laminated Finish)				
		Providing and placing Meeting/				
		Conference tables :Worktop				
		:Worktop: Worktop shall be made out				
		of 25mm thick E-1/good grade				
		(Environmental Friendly) particle				
		board cover with laminate and all the				
		edges of workton shall be provided				
		with machine pressed 1.5-2 mm thick				
		ABS edge banding glued with hot				
		Abs edge ballding glued with hot malt EVA glue E1/good grade				
		limit EVA giue. E1/good giade				
		laminate with zero urea formaldenyde				
		emissions (<or= 100="" 8mg="" dry<="" g="" oven="" th=""><th></th><th></th><th></th><th></th></or=>				
		board-perforated method) for better				
		in-house air quality. This should				
		comply with (EN 120-1992). The				
		height of Worktop shall be 750 mm				
		from ground level. Understructure:				
		MS understructure with 50mm x				
		50mm C type square Straight leg,				
		well supported with MS beams under				
		table top to supported top &				
		connected to leg to leg				
		Wire management: Access Flap and				
		Switch Mounting Tray is provided in				
		the table. It is Made from Matt silver				
		Anodized Aluminium extrusion and				
		plastic moulded components to				
		facilitate access of				
		Electrical/Data/Voice sockets access				
		from Top. Powder coated switch				
		mounting tray made from 0.8mm and				
		1.2mm MS sheet(IS:513) which is				
		powder coated 80-90micron. Switches				
		to be mounted on trav as per				
		requirement. Provision for mounting				
		8 Module Switch plate on switch				
		mounting tray shall be provided				
		Flectrical/Data/Voice wire and IO to				
		be paid separately. The product should				
	1	Too para seperatory. The product should				

1	1	I	I	1	1	
		be complete and as per approved				
		sample and as per the direction of				
		Architect. Completely consoled wire				
		management with vertical wire uptake				
		from floor via middle leg having				
		removable cover one side and wire				
		separator for data and wire separation,				
		segregates to horizontal cable tray				
		Delow Access Flap.				
		Product should be BIFMA gold fated				
		subjects and with 10 years were net				
07.1		f par pare d Masting table 1050				
85.1		5 Pax Round Meeting table : 1050mm	Each	5.00	26.016.00	1 24 590 00
95.2		14 Day Deat Meeting table : 2000W	Each	5.00	20,910.00	1,54,580.00
85.2		14 Pax Rect Meeting table : 5000 w	Each	2.00	72 979 00	1 17 756 00
95.3		12 Day Deat Meeting table : 2250W	Each	2.00	75,878.00	1,47,730.00
05.5		12 Pax Rect Meeting table : 5250 w	Fach	1.00	72 577 00	72 577 00
85 /		42 Pax II Shape Conference Table	Lacii	1.00	12,311.00	12,511.00
03.4		42.1 ax O Shape Conference Table.	Fach	1.00	6 45 272 00	6 45 272 00
85.5		18 Pax Rect Meeting table 5000W	Lacii	1.00	0,43,272.00	0,43,272.00
05.5		x1350D x750Hmm	Each	1.00	1 05 219 00	1 05 219 00
85.6		34/20 Pax Rect Meeting table 5200W	Lucii	1.00	1,00,217.00	1,00,219100
		x2100D x750Hmm	Each	3.00	1,47,140.00	4,41,420.00
85.7		16 Pax Rect Meeting table 4200W			, ,	,
		x1350D x750Hmm	Each	4.00	90,429.00	3,61,716.00
85.8		29/24 Pax Rect Meeting table 6000W				
		x2100D x750Hmm	Each	1.00	1,83,258.00	1,83,258.00
85.9		20 Pax Rect Meeting table : 5700W				
		x1350D x750Hmm	Each	1.00	1,05,920.00	1,05,920.00
85.10		28/16 Pax Rect Meeting table :				
		4600W x1700D x750Hmm	Each	1.00	1,02,937.00	1,02,937.00
85.11		45 Pax U Shape Conference Table :		1.00		
		9/50 x 6300D x/50Hmm	Each	1.00	6,45,272.00	6,45,272.00
85.12		8 pax Rectangular Meeting table with				
		Boat Shape : 2500W x 1350D	Est	1.00	C1 701 00	(1.701.00
95 12		X/50Hmm	Each	1.00	61,791.00	61,791.00
85.13		10 pax Rectangular Meeting table :	Each	1.00	2 28 565 00	2 28 565 00
			Lach	1.00	2,36,303.00	2,30,303.00
86	NS	DGM Cubicals				
00	4.11	Providing and placing DGM				
		CUBICLE SIZE - 2400MM X				
		3500MM X 1200-1250MM H.				
		Workstations- Size of Main table -				
		1500MM X 600MM X 750MM H.				
		size of return table with extended top-				
		1450W1 x 2400(W2) x450(D1)				
		x450(D2) ,Swing door storage made				
		of Prelaminated finish - 1200W				
		x450D x 725Hmm Below the back				
		worktable . Worktop shall be made				

out of 25mm thick E-1/good Grade		
Pre-Laminated particle board. All the		
open edges of work surface shall be		
provided with machine pressed 2 mm		
thick ABS lipping glued with hot melt		
EVA glue. The work surface shall be		
provided with circular cut out of		
Dia.65mm as per the requirement, for		
passing of wires. These cut outs shall		
be provided with ABS covers. Work		
surfaces are fitted to the panels by		
work surface brackets, wooden legs &		
wooden modesty. Brackets are made		
of 2.0mm thick CRCA grade D steel		
as per IS : 513. Brackets are slide in		
between end trim and vertical		
extrusions.		
Panel: Frame work shall consist of		
main spine and return spine of		
aluminium extruded section of		
minimum thickness of 1.2 mm. The		
thinness of main & return Panel is		
60-70 mm . The panel will be hollow		
inside to accommodate wiring for		
electrical/data and outer frame of		
panel should be made of extruded		
aluminium, cladding with 3mm thick		
MDF both sides of the panel to create		
the hollow for the wire management.		
Panels could be shared or isolated as		
per layout. MDF 0.5-0.6 mm covered		
by fabric / Steel CR 0.5.06 mm EPC/		
EPF Foam 3-4 mm for pin up/		
magnetic as an option based on the		
requirement and as per approved by		
Architect. For the glass panel different		
aluminium profile (Top and bottom of		
the frame) with 60-70 mm thick		
which should accommodate the glass		
of thickness 4-6 mm.		
Finishes of panel: Above the top		
fabric pinup & Glass writable board		
with raceway in main spine (return		
table) & fabric pinup (Main table) &		
balance fabric finish for aisle side &		
return panel, below the top should be		
metal with MDF tile with one		
raceway at skirting level and etc.		
whichever required.		

Drawer Unit : 3 drawer Metal	1			
pedestal of overall dimensions internal				
and external dimensions 380-430 mm				
(W) x $430-480$ mm (D) x $600-620$				
$(W) \times 450-460 \text{ mm} (D) \times 000-020$ mm (H) Drawer body should be				
mill (11). Drawer body should be				
made of CRCA of thickness 0.7-0.8				
mm duly powder coated with 70-80				
micron. Each pedestal should be				
provided with pencil tray of 40-45				
mm(H) x 110-120 mm (D) x 300-310				
mm (W).				
Each pedestal should have 5 Nos				
castor fitted to it where in one castor				
will be fitted to lower most drawer to				
provide extra stability Product should				
be BIFMA gold rated SCSglobal				
contified for in house air quality and				
certified for in-house an quality and				
with 10 years warranty.				
Key Board Pullout Tray :				
• Supplying and Fixing of sliding				
computer key board tray of 550-				
570mm (L) X 280mm (D) X				
40mm(H) made out of CRCA steel of				
thickness 1-1.2 mm, duly Powder				
Coated of 60-70 Micron.				
CPU Trollev :				
• Supplying and Fixing of CPU				
Trollow of Size 345mm(W) y				
$110 \text{ Hey of Size - 345 \text{ min}(W) x}$ $226(D) = 180 \text{ mm}(U) \text{ is made of } 1.0$				
$220(D) \times 180 \text{mm}(H) \text{ is made of } 1.0$				
mm thick MS CRCA Sheet and Side				
support is made of 0.8 mm thick MS				
CRCA Sheet. It consists of 4Nos Non-				
lockable twin wheel castors made of				
injection moulded in Black Nylon.	Each	32.00	1,31,701.00	42,14,432.00

	I		I	
87	N.S	Manager Cubicals		
0.		Providing and placing Manager		
		Cubical, Overall size: 2100 W1x		
		3000(W2) x1200-1250Hmm L shape		
		Workstations of Size : 2100 (W1)		
		x1800(W2) x600 (D1) x 500 (D2) x		
		1200-1250 (H). L Shape		
		Workstations of size: 1800W 1050W		
		& rectangular worktop 1050W x		
		600D x750Hmm,Side Swing door		
		storage made of Prelaminated finish -		
		1200W X 500 X 750mmH . Worktop		
		shall be made out of 25mm thick E-		
		1/good Grade Pre-Laminated particle		
		board. All the open edges of work		
		surface shall be provided with		
		machine pressed 2 mm thick ABS		
		The work surface shall be movided		
		The work surface shall be provided		
		with circular cut out of Dia.o.511111 as		
		wires These cut outs shall be		
		provided with ABS covers Work		
		surfaces are fitted to the panels by		
		work surface brackets wooden legs &		
		wooden modesty. Brackets are made		
		of 2.0mm thick CRCA grade D steel		
		as per IS : 513. Brackets are slide in		
		between end trim and vertical		
		extrusions. Panel: Frame work shall		
		consist of main spine and return spine		
		of aluminium extruded section of		
		minimum thickness of 1.2 mm.		
		The thickness of main & return Panel		
		is 60-70 mm. The panel will be		
		hollow inside to accommodate wiring		
		for electrical/data and outer frame of		
		panel should be made of extruded		
		aluminium, cladding with 3mm thick		
		MDF both sides of the panel to create		
		the hollow for the wire management.		
		Panels could be shared or isolated as		
		per layout. MDF 0.5-0.6 mm fabric /		
		Steel CK 0.5.00 mm EPC/ EPF Foam		
		ortion based on the requirement and		
		as per approved by Architect For the		
		as per approved by Architect. For the		
		profile (Top and bottom of the frame)		
		with 60-70 mm thick which should		
		accommodate the glass of thickness Λ_{-}		
		6 mm Finishes of nanel. Above the		

1 1		1	1		
	top fabric pinup & Glass writable				
	board with raceway in main spine &				
	fabric pinup (Return Spine) & balance				
	fabric finish for aisle side & return				
	panel, below the top should be metal				
	with MDF tile with one raceway at				
	skirting level and etc. whichever				
	required.				
	Finishes of panel: Above the top				
	fabric pinup & Glass writable board				
	with raceway in main spine (return				
	table) & fabric pinup (Main table) &				
	balance fabric finish for aisle side &				
	return panel, below the top should be				
	metal with MDF tile with one				
	raceway at skirting level and etc				
	whichever required				
	Drawer Unit : 3 drawer Metal nedectal				
	of overall dimensions internal and				
	external dimensions 380-430 mm (W)				
	x 430-480 mm (D) $x 600-620 mm$ (
	H) Drawer body should be made of				
	CRCA of thickness 0.7-0.8 mm duly				
	powder coated with 70-80 micron				
	Each podestal should be provided with				
	paneil tray of 40.45 mm(H) x 110.120				
	pencil tray of 40-45 $\min(H) \ge 110-120$ mm (D) $\ge 200, 210$ mm (W)				
	Each modestel should have 5 Nos				
	Each pedestal should have 5 Nos				
	castor fitted to it where in one castor				
	will be fitted to lower most drawer to				
	provide extra stability. Product should				
	be BIFMA gold rated SCSglobal				
	certified for in-house air quality and				
	with 10 years warranty.				
	Key Board Pullout Tray :				
	• Supplying and Fixing of sliding				
	computer key board tray of 550-				
	570mm (L) X 280mm (D) X				
	40mm(H) made out of CRCA steel of				
	thickness 1-1.2 mm, duly Powder				
	Coated of 60-70 Micron.				
	CPU Trolley :				
	• Supplying and Fixing of CPU				
	Trolley of Size - 345mm(W) x				
	226(D) x 180mm(H) is made of 1.0				
	mm thick MS CRCA Sheet and Side				
	support is made of 0.8 mm thick MS				
	CRCA Sheet. It consists of 4Nos Non-				
	lockable twin wheel castors made of				
	injection moulded in Black Nylon.	Each	48.00	1,36,337.00	65,44,176.00

88	N.S	L Shape Workstations		
		Frame Work, Partition and Cable		
		management : Frame work shall		
		consist of main spine and return spine		
		of aluminium extruded section of		
		minimum thickness of 1.2 mm. The		
		overall thickness of Panel base		
		System should be 60-70 mm. The		
		panel will be hollow inside to		
		accommodate wiring for		
		electrical/data and outer frame of		
		panel should be made of extruded		
		aluminium. The panel shall be made		
		up of 3 mm thick MDF both sides of		
		the wooden frame to create the hollow		
		for the wire management. Panels		
		could be shared or isolated as per		
		layout. Finishes of panel above the		
		worktop: Above the top fabric phup		
		workstation. The hollow panel made		
		of MDE and 3mm thick foam which is		
		unpolstered with 0.5mm thick fabric		
		with half fabric pinup $+$ half glass		
		marker board The thickness of		
		partition panel should be 60-70 mm		
		for main & return spine.		
		Finishes of panel below the worktop:		
		Below the top the hollow panel should		
		be made of \hat{MDF} tile and $\hat{0.5}mm$ thick		
		steel sheet pasted on MDF which is		
		powder coated with EPC finish 80-90		
		microns for durability on the inside as		
		well on the outside. The thickness of		
		partition panel should be 60-70 mm		
		for main spine & 25mm thick return		
		spine.		
		The panel outer aluminium frame is		
		designed such a way that it can be		
		easily slide in to the columns/		
		Connectors by means of stacking one		
		over the other. Horizontal race way		
		snould be 150-170 mm height		
		auminium profile. There shall be		
		complete cable management		
		below workton with provision for		
	I	Delow worktop with provision for		

	1	1	I.	1	1
		fitting electrical/data switches and			
		holes for passing cable.			
		Connectors/ Post Description:			
		End Post: Aluminium 60-70 mm			
		width – 1200-1250 mm height.			
		One way post: Aluminium 60-70 mm			
		width – 1200-1250 mm height.			
		Two way post: Aluminium 60-70 mm			
		width – 1200-1250 mm height.			
		Three way post: Aluminium 80-120			
		mm width – 1200-1250 mm height.			
		Four way post: Aluminium 80-120			
		mm width $-1200-1250$ mm height.			
		Brackets:			
		Table top support: 50-60mm width			
		steel bracket.			
		Worktop: Worktop shall be made out			
		of 25mm thick E-1/good grade			
		(Environmental Friendly) particle			
		board cover with laminate and all the			
		edges of worktop shall be provided			
		with machine pressed 1.5-2 mm thick			
		ABS edge banding glued with hot			
		melt EVA glue. E1/good grade			
		laminate with zero urea formaldehyde			
		emissions (<or= 100="" 8mg="" dry<="" g="" oven="" td=""><td></td><td></td><td></td></or=>			
		board-perforated method) for better			
		in-house air quality. This should			
		comply with (EN 120-1992), The			
		work surface shall be provided with			
		circular cut out of Dia.65mm as per			
		the requirement, with 3 drawer metal			
		mobile pedestal with side recess			
		handle(400W 450D 600Hmm)			
1			1	1	

1	1					I
		Drawer Unit : 3 drawer Metal				
		pedestal of overall dimensions internal				
		and external dimensions 380-430 mm				
		(W) x $430-480$ mm (D) x $600-620$				
		mm (H). Drawer body should be				
		made of CRCA of thickness 0.7-0.8				
		mm duly powder coated with /0-80				
		micron. Each pedestal should be				
		provided with pencil tray of $40-45$				
		$\min(H) \ge 110-120 \min(D) \ge 300-310$				
		mm (w).				
		Each pedestal should have 5 Nos				
		will be fitted to lower most drewer to				
		provide extra stability. Droduct should				
		be DIEWA gold rated SCS global				
		cortified for in house air quality and				
		with 10 years warranty				
		Koy Boord Pullout Troy :				
		• Supplying and Fixing of sliding				
		computer key board tray of 550-				
		$\frac{1}{570}$				
		40mm(H) made out of CRCA steel of				
		thickness 1-1.2 mm duly Powder				
		Coated of 60-70 Micron.				
		CPU Trolley :				
		• Supplying and Fixing of CPU				
		Trolley of Size - 345mm(W) x				
		226(D) x 180mm(H) is made of 1.0				
		mm thick MS CRCA Sheet and Side				
		support is made of 0.8 mm thick MS				
		CRCA Sheet. It consists of 4Nos Non-				
		lockable twin wheel castors made of				
		injection moulded in Black Nylon.				
88.1	N.S	Providing and placing L shape				
		Workstations of Size: 1500(W1) x				
		1500(W2) 600 (D1) x 600(D2) x				
		1200-1250 (H).				
		Product should be BIFMA gold rated				
		SCSglobal certified for in-house air				
		quality and with 10 years warranty.	Each	178.00	37,314.00	66,41,892.00
88.2	N.S	Providing and placing L shape				
		Workstations of Size: 1800(W1) x				
		1800(W2) 600 (D1) x 600(D2) x				
		1200-1250 (H).				
		Product should be BIFMA gold rated				
		SCSglobal certified for in-house air	Each	22.00	41 461 00	12 26 752 00
<u> 99 2</u>	NS	Providing and placing L shape	Each	52.00	41,401.00	13,20,752.00
00.3	C.N1	Workstations of Size: 1500(W1) v				
		1200(W2) 600 (D1) v 600(D2) v				
		1200(112) 000 (D1) X 000(D2) X 1200-1250 (H)				
		Product should be BIFMA gold rated	Each	324.00	34,304.00	1,11,14,496.00
L	1				2 .,2 000	_,,, ., ., ., ., ., ., ., ., ., ., ., .,

		SCSglobal certified for in-house air			
		quality and with 10 years warranty.			
80	NS	P A Table For FD Cabin			
07	14.5	Droviding and fiving tables for DA to			
		FID Main Tables 1800(W) = 750(D) =			
		ED, Main Table: $1800(W) \times 750(D) \times 750(D) \times 750(D) = 450D$			
		/50(H) & Side Table:1000W X 450D			
		X/50H, Worktop: Worktop shall be			
		made out of 25mm thick E-1/good			
		grade (Environmental Friendly)			
		particle board cover with laminate and			
		all the edges of worktop shall be			
		provided with machine pressed 1.5-2			
		mm thick ABS edge banding glued			
		with hot melt EVA glue. E1/good			
		grade laminate with zero urea			
		formaldehyde emissions (<or=< th=""><th></th><th></th><th></th></or=<>			
		8mg/100 g oven dry board-perforated			
		method) for better in-house air			
		quality. This should comply with (EN			
		120-1992). The wiring tray is made of			
		steel sheet thickness 1.2mm. Epoxy			
		powder coated spray color, baked at			
		temperature 200 C°.Raceways contain			
		the horizontal cable channel that fitted			
		with a modesty panel tidily and			
		effectively.			
		The understructure is made of 2mm			
		thick Steel square pipe dimension 50			
		X 50 mm with Epoxy powder coated			
		spray paint, baked at temperature 200			
		C° coated of 70-80 micron thickness.			
		Powder coating should be scratch			
		resistance (cross hatch test 6x6 grid			
		method). The wooden access flap			
		(400x150mm) is made from 16mm			
		thick E-1/good grade (Environmental			
		Friendly particle board cover with			
		laminate with 0.45mm thick ABS			
		Edge banding			
		The modesty panel(wherever			
		required) is made of 16mm thick E-			
		1/good grade (Environmental			
		Friendly) particle board cover with			
		1mm thick laminate with 2mm thick			
		ABS and Brackets used are 3.2 mm			
		Powder Coated Steel of 80-90			
		microns All hardware shall be of			
		reputed make/brand as per cample			
		finally approved by the Architect			
		Product should be RIFMA gold rated			
L	1	Troduct should be Dirwik gold faled			

		SCSglobal certified for in-house air quality and with 10 years warranty. Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and wiki 10 ware warranty.	Each	12.00	72 262 00	8 68 214 00
		with 10 years warranty.	Each	12.00	72,362.00	8,68,344.00
90	N.S	P.A. Table For GM Cabin Providing and placing tables for				
		P.A.Table of GM Cabin of size 1800(W) x 600(D) x 750(H) & Side Table:1000W x 450D X750H & Back Storage : 1800W x 450D x 750Hmm, Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 100="" 8mg="" dry<br="" g="" oven="">board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at</or=>				

temperature 200 C°.Raceways contain		
the horizontal cable channel that fitted		
with a modesty panel tidily and		
effectively		
circenvery.		
The understructure is made of 2mm		
thick Steel square pipe dimension 50		
X 50 mm with Epoxy powder coated		
spray paint baked at temperature 200		
C° costed of 70.80 micron thickness		
Douvdar agosting should be garatab		
rowuel coalling should be scratch		
resistance (cross natch test oxo grid		
method). The wooden access flap		
(400x150mm) is made from 16mm		
thick E-1/good grade (Environmental		
Friendly particle board cover with		
laminate with 0.45mm thick ABS		
Edge banding. The modesty		
panel(wherever required) is made of		
16mm thick E-1/good grade		
(Environmental Eriendly) particle		
board cover with 1mm thick laminate		
with 2mm thick APS and Procleate		
with 211111 tiller ADS and Diackets		
used are 5.2 mm Powder Coaled Steel		
 of 80-90 microns.		
Back Storage : The storages should be		
made out of particle board of 25mm		
thick top and doors, sides and shelves		
should be made out of 16-19mm thick		
particle board in approved finished.		
E-1/good grade particle board finished		
with 2mm ABS edge banding.		
E1/good grade laminate with zero		
urea formaldehyde emissions (<or-< td=""><td></td><td></td></or-<>		
8mg/100 g oven dry board-perforated		
method) for better in-house air		
auglity This should comply with (EN		
quality. This should comply with (EN		
120-1992). The exposed edge of		
worktop shall be secured with 1.5mm-		
2mm thick ABS edge banding.		
Storages should be fitted with soft		
closing hardwares and anti-shock		
hinges. All hardware shall be of		
reputed make/brand as per sample		
finally approved by the Architect.		
Product should be BIFMA gold rated		
SCSglobal certified for in-house air		
quality and with 10 years warranty		
quanty and with 10 years wallanty.		

		Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and				
		with 10 years warranty.	Each	42.00	75,014.00	31,50,588.00
91	N.S	AGM Cabin				
		Providing and placing tables for AGM Cabin, Main Table: $1650(W) \times 600(D) \times 750(H)$ & Side Table: $1000W \times 450D \times 750H$ & Back Storage: $1650W \times 450D \times 750Hmm$, Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed $1.5 - 2$ mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The wiring tray is made of steel sheet thickness $1.2mm$. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50X50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test $6x6$ grid method). The</or= 				

	wooden access flan (400x150mm) is				
	made from 16mm thick $E_{-1/good}$				
	and (Environmental Eriondly				
	grade (Environmental Friendly				
	particle board cover with laminate				
	with 0.45mm thick ABS Edge				
	banding. The modesty panel(wherever				
	required) is made of 16mm thick E-				
	1/good grade (Environmental				
	Friendly) particle board cover with				
	1 mm thick laminate with 2mm thick				
	Thin the familiate with 2mil the k				
	ABS and Brackets used are 3.2 mm				
	Powder Coated Steel of 80-90				
	microns.				
	Back Storage : The storages should be				
	made out of particle board of 25mm				
	thick top and doors sides and shelves				
	should be made out of 16 10mm thick				
	should be made out of 10-19mm thick				
	particle board in approved finished.				
	E-1/good grade particle board finished				
	with 2mm ABS edge banding.				
	E1/good grade laminate with zero				
	urea formaldehyde emissions (<or=< td=""><td></td><td></td><td></td><td></td></or=<>				
	8mg/100 g oven dry board-perforated				
	method) for better in-house air				
	quality This should comply with (EN				
	120,1002) The exposed edge of				
	120-1992). The exposed edge of				
	worktop shall be secured with 1.5mm-				
	2mm thick ABS edge banding.				
	Storages should be fitted with soft				
	closing hardwares and anti-shock				
	hinges. All hardware shall be of				
	reputed make/brand as per sample				
	finally approved by the Architect				
	Product should be RIEMA gold rated				
	Floduct should be bli WA gold lated				
	SCSglobal certified for in-nouse air				
	quality and with 10 years warranty.				
	Drawer Unit : 3 drawer Metal				
	pedestal of overall dimensions internal				
	and external dimensions 380-430 mm				
	(W) x 430-480 mm (D) x 600-620				
	mm (H) Drawer body should be				
	made of CRCA of thickness 0.7-0.8				
	made of excert of unexitiess 0.7 0.0				
	min dury powder coated with 70-80				
	micron. Each pedestal should be				
	provided with pencil tray of 40-45				
	mm(H) x 110-120 mm (D) x 300-310				
	mm (W).				
	Each pedestal should have 5 Nos				
	castor fitted to it where in one castor				
	will be fitted to lower most drawer to				
	provide extra stability. Droduct should				
	be DIEMA gold metad SCC alabel				
	be diffinated goin rated subglobal	$\mathbf{D} \sim 1$	20.00	72 077 00	14 41 540.00
	certified for in-house air quality and	Each	20.00	/2,0/7.00	14,41,540.00

		with 10 years warranty.		
02	NS	ICM Cabin		
94	11.5	Droviding and placing tables for ICM		
		Cohine Maine Table 1800(W) r (00(D))		
		Cabin, Main Table $1800(W) \ge 000(D)$		
		x /50(H) & Side Table: 1000W x		
		450D X/50H &Swing shutter Back		
		Storage : 1800W x 450D x 750Hmm,		
		Worktop: Worktop shall be made out		
		of 25mm thick E-1/good grade		
		(Environmental Friendly) particle		
		board cover with laminate and all the		
		edges of worktop shall be provided		
		with machine pressed 1.5-2 mm thick		
		ABS edge banding glued with hot		
		melt EVA glue. E1/good grade		
		laminate with zero urea formaldehyde		
		emissions (<or= 100="" 8mg="" dry<="" g="" oven="" th=""><th></th><th></th></or=>		
		board-perforated method) for better		
		in-house air quality. This should		
		comply with (EN 120-1992).The		
		wiring tray is made of steel sheet		
		thickness 1.2mm. Epoxy powder		
		coated spray color, baked at		
		temperature 200 C°.Raceways contain		
		the horizontal cable channel that fitted		
		with a modesty panel tidily and		
		effectively.		
		The understructure is made of 2mm		
		thick Steel square pipe dimension 50		
		X 50 mm with Epoxy powder coated		
		spray paint, baked at temperature 200		
		C° coated of 70-80 micron thickness.		
		Powder coating should be scratch		
		resistance (cross hatch test 6x6 grid		
		method). The wooden access flap		
		(400x150mm) is made from 16mm		
		thick E-1/good grade (Environmental		
		Friendly particle board cover with		
		laminate with 0.45mm thick ARS		
		Edge handing The modesty		
		nanel(wherever required) is made of		
		paner (where ver required) is made of 16mm thick E 1/2004 and		
		(Environmental Eriondly) norticle		
		(Linvironmental Friendry) particle		
		board cover with finith thick faminate		

93	N.S	Theme Cabin Table				
		with 10 years warranty.	Each	26.00	/9,981.00	20,79,506.00
		certified for in-house air quality and	F 1	00.00	70.001.00	
		be BIFMA gold rated SCSglobal				
		provide extra stability. Product should				
		will be fitted to lower most drawer to				
		castor fitted to it where in one castor				
		Each pedestal should have 5 Nos				
		$\min(H) \ge 110-120 \min(D) \ge 300-310$ $\min(W)$				
		provided with pencil tray of $40-45$				
		micron. Each pedestal should be				
		mm duly powder coated with 70-80				
		made of CRCA of thickness 0.7-0.8				
		mm (H). Drawer body should be				
		(W) x 430-480 mm (D) x $600-620$				
		and external dimensions 380-430 mm				
		Drawer Unit : 3 drawer Metal				
		quality and with 10 years warranty.				
		SCSglobal certified for in-house air				
		Product should be BIFMA gold rated				
		finally approved by the Architect.				
		reputed make/brand as per sample				
		hinges. All hardware shall be of				
		closing hardwares and anti-shock				
		Storages should be fitted with soft				
		2mm thick ABS edge banding				
		120-1992). The exposed edge of				
		quality. This should comply with (EN				
		method) for better in-house air				
		8mg/100 g oven dry board-perforated				
		urea formaldehyde emissions (<or=< td=""><td></td><td></td><td></td><td></td></or=<>				
		E1/good grade laminate with zero				
		with 2mm ABS edge banding.				
		$F_{1/2}$ For the second state of the second				
		should be made out of 16-19mm thick				
		thick top and doors, sides and shelves				
		made out of particle board of 25mm				
		Back Storage : The storages should be				
		of 80-90 microns.				
		used are 3.2 mm Powder Coated Steel				

This should comply with (EN 120-			
1992).The wiring tray is made of steel			
sheet thickness 1.2mm. Epoxy powder			
coated spray color, baked at			
temperature 200 C°.Raceways contain			
the horizontal cable channel that fitted			
with a modesty panel tidily and			
effectively. The understructure is			
made of 2mm thick Steel square pipe			
dimension 50 X 50 mm with Epoxy			
powder coated spray paint, baked at			
temperature 200 C° coated of 70-80			
micron thickness. Powder coating			
should be scratch resistance (cross			
hatch test 6x6 grid method).The			
wooden access flap (400x150mm) is			
made from 16mm thick E-1/good			
grade (Environmental Friendly			
particle board cover with laminate			
with 0.45mm thick ABS Edge			
banding. The modesty panel(wherever			
required) is made of 16mm thick E-			
1/good grade (Environmental			
Friendly) particle board cover with			
1mm thick laminate with 2mm thick			
ABS and Brackets used are 3.2 mm			
Powder Coated Steel of 80-90			
microns.			
Back Storage : The storages should be			
made out of particle board of 25mm			
thick top and doors, sides and shelves			
should be made out of 16-19mm thick			
particle board in approved finished.			
E-1/good grade particle board finished			
with 2mm ABS edge banding.			
E1/good grade laminate with zero			
urea formaldehyde emissions (<or=< td=""><td></td><td></td><td></td></or=<>			
8mg/100 g oven dry board-perforated			
method) for better in-house air			
quality. This should comply with (EN			
120-1992). The exposed edge of			
worktop shall be secured with 1.5mm-			
2mm thick ABS edge banding.			
Storages should be fitted with soft			
closing hardwares and anti-shock			
hinges. All hardware shall be of			
reputed make/brand as per sample			
finally approved by the Architect.			
Product should be BIFMA gold rated			
SCSglobal certified for in-house air			
ю э.» до отно то		1	1
	This should comply with (EN 120- 1992). The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E- 1/good grade (Environmental Friendly) particle board cover with 1mm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns. Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade laminate with zero urea formaldehyde emissions (<orr 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm- 2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect. Product should be BIFMA gold rated SCS lobal cartified for in-house air quality approved by the Architect.</orr 	This should comply with (EN 120- 1992). The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E- 1/good grade (Environmental Friendly) particle board cover with Imm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns. Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade laminate with zero urea formaldehyde emissions (<0r= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm- 2mm thick ABS edge banding. Storages should be filted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample finally approved by the Architect. Product should be BIFMA gold rated SCStoled certified for in bouse air qualty approved by the Architect. Product should be BIFMA gold rated	This should comply with (EN 120-1992). The wiring tray is made of steel sheet thickness 1. Zmm. Epoxy powder coated spray color, baked at temperature 200 C°. Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method). The wooden access flap (400x150mm) is made from 16mm thick E-1/good grade (Environmental Friendly particle board cover with laminate with 0.45mm thick ABS Edge banding. The modesty panel(wherever required) is made of 16mm thick E-1/good grade (Environmental Friendly) particle board cover with Imm thick laminate with 2mm thick ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns. Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelv

		Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.	Each	6.00	71,954.00	4,31,724.00
	NG					
94	N.S	waiting Cabin TableProviding and fixing tables for				
		750(D) x 750(H) & Side Table:1400W x 450D X750H & free standing Swing shutter with laminated finish of size: 1800W 450D 750Hmm Worktop: Worktop shall be made out of 25mm thick E-1/good grade (Environmental Friendly)				
		particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea				
		formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy</or= 				
		powder coated spray color, baked at temperature 200 C°.Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively. The understructure is made of 2mm thick Steel square pipe dimension 50 X 50 mm with Ensure				
		powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross				

		hatch test 6x6 grid method) The				
		wooden access flan (400v150mm) is				
		mode from 16mm thick E 1/2004				
		made from forming unck E-1/good				
		grade (Environmental Friendly				
		particle board cover with laminate				
		with 0.45mm thick ABS Edge				
		banding.				
		The modesty panel(wherever				
		required) is made of 16mm thick E-				
		1/good grade (Environmental				
		Friendly) particle board cover with				
		Thendry) particle board cover with				
		Imm thick laminate with 2mm thick				
		ABS and Brackets used are 3.2 mm				
		Powder Coated Steel of 80-90				
		microns. Back Storage : The storages				
		should be made out of particle board				
		of 25mm thick top and doors, sides				
		and shelves should be made out of 16-				
		19mm thick particle board in				
		approved finished E 1/2004 and				
		approved ministed. E-1/good grade				
		particle board finished with 2mm				
		ABS edge banding. E1/good grade				
		laminate with zero urea formaldehyde				
		emissions (<or= 100="" 8mg="" dry<="" g="" oven="" th=""><th></th><th></th><th></th><th></th></or=>				
		board-perforated method) for better				
		in-house air quality. This should				
		comply with (FN 120-1992) The				
		even ada of workton shall be				
		exposed edge of worktop shall be				
		secured with 1.5mm-2mm thick ABS				
		edge banding. Storages should be				
		fitted with soft closing hardwares and				
		anti-shock hinges. All hardware shall				
		be of reputed make/brand as per				
		sample finally approved by the				
		Architect				
		Product should be RIFMA gold rated				
		SCS clobal contified for in house oir				
		SCSglobal certified for in-nouse air	E 1.	1.00	75 140 00	75 140 00
		quality and with 10 years warranty.	Each	1.00	/3,140.00	/3,140.00
05	NG					
95	N.S	Security/Dispatch /Travel Cabin				
		With Running desk				
		Providing and placing tables for				
		Security Room of size 1800(W) x				
		750(D) x 750(H) & Side				
		Table:1000W x 450D X750H, With				
		Running desk of size: 3000W x 600D				
		x 750Hmm.Worktop: Worktop shall				
		be made out of 25mm thick F-1/good				
		grade (Environmental Eriondly)				
		partials board sover with laminets and				
		particle board cover with laminate and				
		all the edges of worktop shall be				
		provided with machine pressed 1.5-2				
1	1	mm thick ABS edge banding glued				

with hot melt EVA glue. E1/good				
grade laminate with zero urea				
formaldehvde emissions (<or=< td=""><td></td><td></td><td></td><td></td></or=<>				
8mg/100 g oven dry board-perforated				
method) for better in-house air				
quality This should comply with (FN				
120 1002) The wiring trav is made of				
120-1992). The willing day is made of				
steel sneet thickness 1.2mm. Epoxy				
powder coaled spray color, baken at				
temperature 200 C. Kaceways				
contain the horizontal cable channel				
that fitted with a modesty panel tidily				
 and effectively.				
The understructure is made of 2mm				
thick Steel square pipe dimension				
50X50 mm with Epoxy powder				
coated spray paint, baked at				
temperature 200 C° coated of 70-80				
micron thickness. Powder coating				
should be scratch resistance (cross				
hatch test 6x6 grid method). The				
wooden access flap (400x150mm) is				
made from 16mm thick E-1/good				
grade (Environmental Friendly				
particle board cover with laminate				
with 0.45mm thick ABS Edge				
handing The modesty panel (wherever				
required) is made of 16mm thick E-				
1/good grade (Environmental				
Friendly) particle board cover with				
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
ADC and Dreakate used are 3.2 mm				
ABS and Drackets used are 3.2 mm				
Powder Coaled Sieer of 60-90				
microns. All nardware snall be of				
reputed make/brand as per sample				
finally approved by the Architect.				
Product should be BIFMA gold rated				
SCSglobal certified for in-house air				
quality and with 10 years warranty.				
Drawer Unit : 3 drawer Metal				
pedestal of overall dimensions internal				
and external dimensions 380-430 mm				
(W) x 430-480 mm (D) x 600-620				
mm (H). Drawer body should be				
made of CRCA of thickness 0.7-0.8				
mm duly powder coated with 70-80				
micron. Each pedestal should be				
provided with pencil tray of 40-45				
$mm(H) \ge 110-120 mm (D) \ge 300-310$				
mm (W).				
Each pedestal should have 5 Nos				
castor fitted to it where in one castor				
will be fitted to lower most drawer to	Each	3 00	75 981 00	2 27 943 00
will be littled to lower most didwer to	Lach	5.00	75,701.00	2,27,915.00

		provide extra stability. Product should		
		be BIFMA gold rated SCSglobal		
		certified for in-house air quality and		
		with 10 years warranty		
		with 10 years warranty.		
96	N.S	Control Room Cabin		
		Providing and placing tables for		
		Control Room, Main Table: 1800(W)		
		x 750(D) x 750(H) & Side		
		Table:1000W x 450D X750H & Back		
		Storage : 4050W x 450D x 750Hmm,		
		Worktop: Worktop shall be made out		
		of 25mm thick E-1/good grade		
		(Environmental Friendly) particle		
		board cover with laminate and all the		
		edges of worktop shall be provided		
		with machine pressed 1.5-2 mm thick		
		ABS edge banding glued with hot		
		melt EVA glue. E1/good grade		
		laminate with zero urea formaldehyde		
		emissions ($< 0r - 8mg/100$ g oven dry		
		board-perforated method) for better		
		in house air quality. This should		
		comply with (EN 120 1002)		
		The wiring tree is made of steel sheet		
		thickness 1.2mm Enovy powder		
		and a survey as a star baland at		
		town on the spray color, baked at		
		temperature 200 C ² . Raceways		
		contain the norizontal cable channel		
		that fitted with a modesty panel tidily		
		and effectively. The understructure is		
		made of 2mm thick Steel square pipe		
		dimension 50 X 50 mm with Epoxy		
		powder coated spray paint, baked at		
		temperature 200 C° coated of 70-80		
		micron thickness. Powder coating		
		should be scratch resistance (cross		
		hatch test 6x6 grid method). The		
		wooden access flap (400x150mm) is		
		made from 16mm thick E-1/good		
		grade (Environmental Friendly		
		particle board cover with laminate		
		with 0.45mm thick ABS Edge		
		banding. The modesty panel(wherever		
		required) is made of 16mm thick E-		
		1/good grade (Environmental		
		Friendly) particle board cover with		
		1mm thick laminate with 2mm thick		

		ABS and Brackets used are 3.2 mm Powder Coated Steel of 80-90 microns.				
		Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air quality. This should comply with (EN 120-1992). The exposed edge of worktop shall be secured with 1.5mm- 2mm thick ABS edge banding. Storages should be fitted with soft closing hardwares and anti-shock hinges. All hardware shall be of reputed make/brand as per sample</or= 				
		Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.				
		Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.	Each	1 00	82.731.00	82,731.00
				1.00	02,701.00	02,731.00
97	N.S	Waiting/ P.A.(MD/ Chairman)				

	Doctor Cabin	I	
++	Providing and placing tables for		
	Waiting/PA / Doctor Room of size		
	$1800(W) \times 600(D) \times 750(H) \&$ Side		
	$T_{able:1000W} \times 450D \times 750H$		
	Proving shutter Pack Storage with		
	aswing shutter back Storage with		
	laminated finish of size: 1800 w x		
	450D x /50Hmm, worktop: worktop		
	shall be made out of 25mm thick E-		
	l/good grade (Environmental		
	Friendly) particle board cover with		
	laminate and all the edges of worktop		
	shall be provided with machine		
	pressed 1.5-2 mm thick ABS edge		
	banding glued with hot melt EVA		
	glue. E1/good grade laminate with		
	zero urea formaldehyde emissions		
	(<or= 100="" 8mg="" board-<="" dry="" g="" oven="" td=""><td></td><td></td></or=>		
	perforated method) for better in-house		
	air quality. This should comply with		
	(EN 120-1992).		
	The wiring tray is made of steel sheet		
	thickness 1.2mm. Epoxy powder		
	coated spray color, baked at		
	temperature 200 C°.Raceways contain		
	the horizontal cable channel that fitted		
	with a modesty panel tidily and		
	effectively. The understructure is		
	made of 2mm thick Steel square pipe		
	dimension 50 X 50 mm with Epoxy		
	powder coated spray paint, baked at		
	temperature 200 C° coated of 70-80		
	micron thickness Powder coating		
	should be scratch resistance (cross		
	hatch test 6x6 grid method) The		
	wooden access flan (400x150mm) is		
	made from 16mm thick F-1/good		
	grade (Environmental Friendly		
	particle board cover with laminate		
	with 0.45 mm thick ΔRS Edge		
	handing The modesty panel (wherever		
	required) is made of 16mm thick E		
	1/good grade (Environmental		
	Friendly) particle board cover with		
	1mm thick laminate with 2mm thick		
	ADS and Drockets used are 2.2		
	ADS and Brackets used are 3.2 mm		
	Powder Coaled Steel of 80-90		
	microns.		

	 Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. El/good grade laminate with zero urea formaldehyde emissions (<or=8mg (en="" 1.5mm-2mm="" 10="" 100="" 120-1992).="" abs="" air="" all="" and="" anti-shock="" approved="" architect.="" as="" banding.="" be="" better="" bifma="" board-perforated="" brand="" by="" certified="" closing="" comply="" dry="" edge="" exposed="" finally="" fitted="" for="" g="" gold="" hardware="" hardwares="" hinges.="" in-house="" li="" make="" method)="" of="" oven="" per="" product="" quality="" quality.="" rated="" reputed="" sample="" scsglobal="" secured="" shall="" should="" soft="" storages="" the="" thick="" this="" warranty.<="" with="" worktop="" years=""> Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty. </or=8mg>	Each	8.00	53,491.00	4,27,928.00
98 N.S	Helping Desk				
	Providing and placing tables for Helping Desk of size 1500(W) x 600(D) x 750(H),Worktop :Worktop shall be made out of 25mm thick E- 1/good Grade Pre-Laminated particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick ABS	Each	2.00	23,812.00	47,624.00

		lipping glued with hot melt EVA glue.		
		This should comply with (EN 120-		
		1992) The understructure is made of		
		Steel square pipe dimension 38 X		
		38mm Thickness 2mm Enovy		
		powder coated spray paint baked at		
		powder coaled spray paint, baked at		
		temperature 200 C ^e coated of 70-80		
		micron thickness. Powder coating		
		should be scratch resistance (cross		
		hatch test 6x6 grid method).		
		The modesty panel(wherever		
		required) is made of 16 mm thick		
		Particle Board (E-1/good grade),		
		Coated of Laminated ABS edge-		
		banding with 2mm and Brackets used		
		are 3.2 mm Powder Coated Steel of		
		80-90 microns. Complete as per the		
		direction of Architect.		
		Product should be BIFMA gold rated		
		SCSglobal certified for in-house air		
		quality and with 10 years warranty		
		quality and with 10 years warranty.		
00	NC	C.f. F. MD/Chaimman /Dimester		
99	N.5	Sola For MD/Chairman/Director		
		Providing & placing sofa for Other		
		Cabin . wooden structure of sofa to be		
		fabricated using good quality		
		hardwood duly seasoned and applying		
		5 11 5 8		
		anti-termite paint of approved brand		
		anti-termite paint of approved brand & manufacture to ensure stability of		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S>		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam 100mm thick Back		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick_Sides (inside) - 32 Kg/cum		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outride) & back (back side) - 32		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick.		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm. All SS work		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm. All SS work should be in grade 304. Base of sofa		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm. All SS work should be in grade 304. Base of sofa should be infilled with suitable wood		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm. All SS work should be in grade 304. Base of sofa should be infilled with suitable wood sections so as to give proper support		
		anti-termite paint of approved brand & manufacture to ensure stability of the frame, On the wooden base frame of the sofa to be provided with M>S> helical spring, sides & back with jute strips, with polyfill covered with jute & finished with thick marking cloth before doing fine finished with leatherite have basic cost not less than 1000/- Pet Mt. Seat - 30-32Kg/cum density PU Foam, 100mm thick, Back - 32Kg/cum density PU foam, 60mm thick, Sides (inside) - 32 Kg/cum density PU Foam, 45 mm thick Sides (outside) & back (back side) - 32 Kgcum density PU foam, 25mm thick. Seat shall rest on SS square frame of size 25mm x 25mm supported be legs made of 25mm x 25mm square SS section of height 225mm. All SS work should be in grade 304. Base of sofa should be infilled with suitable wood sections so as to give proper support to the seat. Height of the base of sofa		

	1	Finished width of arm shall be 100mm	l			
		after upholstery work. Sofa to be fully				
		unbolstered using approved fabric				
		(stitch) of A grade of desired shade				
		duly embossed including providing &				
		fixing of all other related materials				
		including bardwares etc. complete as				
		directed by the Architect				
		Product should be RIEMA gold rated				
		SCS global cortified for in house air				
		quality and with 10 years warranty				
00.1		a soster sofe overall dimension				
99.1		3 sealer sola overall dimension -	Fach	15.00	71 020 00	10 65 595 00
00.2		2 soster sofe overall dimension	Each	13.00	/1,039.00	10,05,585.00
77. 4		1/80mm W x 750mm D x 670mm H	Fach	4.00	41 677 00	1 66 708 00
00.3		1 seater sofa overall dimension	Lacii	4.00	41,077.00	1,00,708.00
JJ. J		800mm W x 750mm D x 670mm H	Fach	28.00	22 900 00	6 41 200 00
99.4		Providing and fixing tables of size -	Lacii	20.00	22,700.00	0,41,200.00
<i>)</i>),, 4		600mm x 600mm 400mm h for				
		whose top is made of Particle board				
		wood Grade E-1/good(Environmental				
		Friendly) thickness 25mm cover with				
		Melamine. Edge banding (PVC)				
		2mm.E1/good grade laminate with				
		zero urea formaldehyde emissions				
		(<or= 100="" 8mg="" board-<="" dry="" g="" oven="" th=""><th></th><th></th><th></th><th></th></or=>				
		perforated method) for better in-house				
		quality. This should comply with (EN				
		120-1992). The understructure is made				
		of SS.	Each	34.00	14,944.00	5,08,096.00
99.5		Providing and fixing tables of size -				i
		1200mm x 600mm x 400mmh for				
		whose top is made of Particle board				
		/BB E-1/good(Environmental				
		Friendly), thickness 25mm cover with				
		Veneer finish, Edge banding (ABS)				
		2mm.E1/good grade Veneer with zero				
		urea formaldehyde emissions (<or=< th=""><th></th><th></th><th></th><th></th></or=<>				
		8mg/100 g oven dry board-perforated				
		method) for better in-house quality.				
		This should comply with (EN 120-				
		1992).The understructure is made of				
		SS.	Each	19.00	24,212.00	4,60,028.00
100	NS	Sofa For Other Cabing				
100	11.0					

1 1				I	1
	Providing & placing sofa for Other				
	Cabin . wooden structure of sofa to be				
	fabricated using good quality				
	hardwood duly seasoned and applying				
	anti-termite paint of approved brand				
	& manufacture to ensure stability of				
	the frame, On the wooden base frame				
	of the sofa to be provided with M>S>				
	helical spring, sides & back with jute				
	strips, with polyfill covered with jute				
	& finished with thick marking cloth				
	before doing fine finished with				
	leatherite have basic cost not less than				
	1000/- Pet Mt. Seat - 30-32Kg/cum				
	density PU Foam, 100mm thick, Back				
	- 32Kg/cum density PU foam, 60mm				
	thick, Sides (inside) - 32 Kg/cum				
	density PU Foam, 45 mm thick Sides				
	(outside) & back (back side) - 32				
	Kgcum density PU foam, 25mm thick.				
	Seat shall rest on SS square frame of				
	size 25mm x 25mm supported be legs				
	made of 25mm x 25mm square SS				
	section of height 225mm.				
	All SS work should be in grade 304.				
	Base of sofa should be infilled with				
	suitable wood sections so as to give				
	proper support to the seat. Height of				
	the base of sofa shall be 200-				
	250mm(approx.). Finished width of				
	arm shall be 100mm after upholstery				
	work. Sofa to be fully upholstered				
	using approved fabric (stitch) of A				
	grade of desired shade duly embossed				
	including providing & fixing of all				
	other related materials including				
	hardwares etc. complete as directed by				
	the Architect				
	Product should be BIFMA gold rated				
	SCSglobal certified for in-house air				
	quality and with 10 years warranty.				
100.1	3 seater sofa overall dimension -				
	1930mm W x 750mm D x 670mm H	Each	44.00	58,601.00	25,78,444.00
100.2	2 seater sofa overall dimension -			,	, 0,
	1480mm W x 750mm D x 670mm H	Each	5.00	32.616.00	1.63.080.00
100.3	1 seater sofa overall dimension -		2.00	,010.00	1,00,000,00
10000	800mm W x 750mm D x 670mm H	Each	88.00	21,684.00	19.08.192.00
100.4	Providing and fixing tables of size -		20.00		
TIVUT	$600 \text{mm} \times 600 \text{mm} = 400 \text{mm} \text{ h for}$				
	whose top is made of Particle board				
	wood Grade E-1/good(Environmental				
	Friendly), thickness 25mm cover with				
	Melamine. Edge banding (PVC)	Each	117.00	11.129.00	13.02.093.00
	Melanine, Euge Sanding (1 v C)	Luch	117.00	11,127.00	15,02,095.00

		2mm.E1/good grade laminate with				
		zero urea formaldehyde emissions				
		(<or= 100="" 8mg="" board-<="" dry="" g="" oven="" th=""><th></th><th></th><th></th><th></th></or=>				
		perforated method) for better in-house				
		quality. This should comply with (EN				
		120-1992). The understructure is made				
		of SS.				
101	N.S	Sofa For Open Area & Lounge				
		Providing & placing sofa for Lounge				
		& open area . wooden structure of				
		sofa to be fabricated using good				
		quality hardwood duly seasoned and				
		applying anti-termite paint of				
		approved brand & manufacture to				
		ensure stability of the frame, On the				
		wooden base frame of the sofa to be				
		provided with M>S> helical spring,				
		sides & back with jute strips, with				
		polyfill covered with jute & finished				
		with thick marking cloth before doing				
		fine finished with leatherite have basic				
		cost not less than 1000/- Pet Mt. Seat -				
		30-32Kg/cum density PU Foam,				
		100mm thick, Back - 32Kg/cum				
		density PU foam, 60mm thick, Sides				
		(inside) - 32 Kg/cum density PU				
		Foam, 45 mm thick Sides (outside) &				
		back (back side) - 32 Kgcum density				
		PU foam, 25mm thick. Seat shall rest				
		on SS square frame of size 25mm x				
		25mm supported be legs made of				
		25mm x 25mm square SS section of				
		height 225mm. All SS work should be				
		in grade 304. Base of sofa should be				
		infilled with suitable wood sections so				
		as to give proper support to the seat.				
		Height of the base of sofa shall be				
		200-250mm(approx.).				
		Finished width of arm shall be 100mm				
		atter upholstery work. Sofa to be fully				
		upholstered using approved fabric				
		(stitch) of A grade of desired shade				
		auly embossed including providing &				
		tixing of all other related materials				
		including hardwares etc. complete as				
		directed by the Architect ,				
		Product should be BIFMA gold rated				
		SCS global certified for in-house air				
101 1		quality and with 10 years warranty.				
101.1		5 sealer sola overall dimension -	Feeb	20.00	50 094 00	17 00 520 00
101.3		203011111 W X 60011111 D X / 8011111 H	Each	20.00	39,984.00	17,99,520.00
101.2		2 sealer sola overall dimension -	Each	30.00		
		1580mm W x 860mm D x 780mm H			42,989.00	12,89,670.00
-------	-----	--	-------	-------	-----------	--------------
101.3		1 seater sofa overall dimension -				
		820mm W x 860mm D x 780mm H	Each	27.00	21,334.00	5,76,018.00
101.4		Providing and fixing tables of size -				
		600mm x 600mm 400mm h for				
		whose top is made of Fatticle board wood Grade $E_1/good(Environmental)$				
		Friendly) thickness 25mm cover with				
		Melamine. Edge banding (PVC)				
		2mm.E1/good grade laminate with				
		zero urea formaldehyde emissions				
		(<or= 100="" 8mg="" board-<="" dry="" g="" oven="" td=""><td></td><td></td><td></td><td></td></or=>				
		perforated method) for better in-house				
		quality. This should comply with (EN				
		120-1992). The understructure is made	E. d.	(2.00	11 200 00	7.06.056.00
101 5		OI SS.	Each	62.00	11,388.00	/,06,056.00
101.5		1200mm x 600mm x 400mmh for				
		whose top is made of Particle				
		board/BB, thickness 25mm cover				
		with Veneer finish, Edge banding				
		(ABS) 2mm.E1/good grade Veneer				
		with zero urea formaldehyde				
		emissions (<or= 100="" 8mg="" dry<="" g="" oven="" td=""><td></td><td></td><td></td><td></td></or=>				
		board-perforated method) for better				
		m-nouse quanty. This should comply with $(EN = 120, 1992)$ The				
		understructure is made of SS	Each	41.00	16 146 00	6 61 986 00
			Durin		10,110100	0,01,20000
102	N.S	Medium laminated Height Storage				
		Providing and fixing Medium height				
		storages H. Body of storages made out				
		25 mm thick Particle/B Board (E-				
		with 2 mm PVC edge banding				
		E1/good grade laminate to be used				
		which provide no urea formaldehyde				
		emission and formaldehyde should be				
		phenol base with emission of not more				
		than ($<$ or= 8mg/100 g oven dry board-				
		perforated method) for better in-house				
		quality. This should comply with (EN				
		Storages should be made out of metal				
		or 16 mm thick Particle Board (E-				
		1/good Grade).melamine finishes with				
		2 mm. PVC edge-banding fitted with				
		extruded aluminum handle, as per				
	1	requirement. Storages should be				
		provided with adjustable levelers.				
		provided with adjustable levelers. Door Lock should be of three-way				
		provided with adjustable levelers. Door Lock should be of three-way lock mechanism, the hinged doors can				

		provided with Hinge-damping				
		mechanism to enable soft closing of				
		doors. Droduct should be DIEMA cold reted				
		SCS clobal certified for in-house air				
		quality and with 10 years warranty.				
102.1		1500mm W x 450mm D x 1200mm				
			Each	120.00	27,213.00	32,65,560.00
102.2		900mm W x 450mm D x 1200mm				
			Each	10.00	16,126.00	1,61,260.00
102.3		1200mm W x 450mm D x 1200mm				
			Each	40.00	20,748.00	8,29,920.00
102.4		1350mm W x 450mm D x 1200mm	F 1	2 00	24.045.00	40,000,00
			Each	2.00	24,045.00	48,090.00
102	NC	Commentant				
105	<u>п.э</u>	Supplying and fixing in position				
		Compactor Single Static Bay Push				
		Pull Type of following specifications:				
		Overall Dimensions of SS1 - Single				
		Static 1 Bay Push Pull Type (U/C +				
		Fittings) shall be 915mm(W) x				
		460mm(D) x 2080mm (H) (Height				
		with undercarriage and rails in mm:				
		1980+65+35=2080). The Construction				
		shall be Welded Construction sheet				
		thickness is 0.8 mm for sides & top				
		Finish shall be Epoxy polyester				
		powder coated thickness of 40				
		microns . Shelf construction shall be				
		made from CRCA steel 0.8 mm thick				
		IS :513 .Uniformly distributed load				
		capacity of 80 Kg . Undercarriage				
		shall have construction in welded				
		frame made of HR sheet 3.15 mm				
		thick conforming to IS : 10/48.				
		powder coat of approved color &				
		shade with a dry film thickness of				
		minimum 40 microns . The				
		movements of the system shall be				
		Push pull configuration (TYPE-				
		P1/TYPE-P2) : Movement of units				
		achieved by pushing or pulling				
		chrome plated 'C' Handle fitted onto				
		1.0 mm thick plate (mounted on each				
		rigidly fixed at suitable beight on				
		body side				
		Each movable undercarriage has 4				
		nos. of antifriction ball bearings for				
		rolling onto channels & 4 no. of	Nos	100.00	15,300.00	15,30,000.00

		antifriction ball bearings for guiding		
		between channels & 'J' section .		
		Fittings shall be centralized locking		
		arrangement through locking stiffener		
		mounted onto back of single last unit		
		so that it gets locked on channels		
		when all the units are brought		
		together		
		The Decess here the lock is of make for		
		The Recess handle lock is of make &		
		placed at suitable height. This		
		arrangement occupies a space of 90.0		
		mm. When the last unit is twin		
		movable, hinged doors are provided		
		for the end bodies, so in this case		
		locking stiffener is mounted onto		
		drive unit cover ; and with tile fascia		
		option, it will be mounted in the		
		recess of vertical trim . Each Drive		
		Type units shall have Locking Knob		
		near the drive wheel for manual		
		locking of individual units when a		
		person is using those units. Knob		
		shall be rotated to unlock position		
		when units are to be moved End		
		stoppers shall be provided to prevent		
		derailment Door locking shall be		
		having hinged doors of recessed die		
		ast handle cum lock giving 3 way		
		locking through a lover & shooting		
		holto. Cuido chonnolo chall hous 'I'		
		bolts . Guide channels shall have J		
		section 2 mm thick HR & 25 mm		
		Square bright bar . Easteners shall be		
		galvanized/blackodized/Zn plated		
		The label holder shall be made from 2		
		mm thick clear transparent acrylic		
		sheet. Also total no. of loading levels		
		per understructure shall be 5 for SS1.		
104	N.S	Café Tables		
		Providing and fixing tables for whose		
		top is made of Particle board wood		
		Grade E-1/good(Environmental		
		Friendly), thickness 25mm cover with		
		laminate, Edge banding (PVC)		
		2mm.E1/good grade laminate with		
		zero urea formaldehyde emissions		
		(<or= 100="" 8mg="" board-<="" dry="" g="" oven="" th=""><th></th><th></th></or=>		
		perforated method) for better in-house		
		quality. This should comply with (EN		
		120-1992).The understructure is made		
		of Steel square pipe dimension 38 X		
		38mm. Thickness 2.5mm. Epoxy		
		38mm. Thickness 2.5mm. Epoxy		

1		powder coated spray paint, baked at				
		temperature 200 C° coated of 70-80				
		micron thickness				
		Product should be BIFMA gold rated				
		SCSglobal certified for in-house air				
		quality and with 10 years warranty				
104.1		quality and with 10 years warranty.				
104.1		SQUARE TABLE, SIZE - 950IMIM A	F 1	20.00	14.950.00	5 64 642 00
		950MM X /50MM H	Each	38.00	14,859.00	5,64,642.00
104.2		SQUARE TABLE, SIZE - 1200MM				
		X 750MM X 750MM H	Each	8.00	16,064.00	1,28,512.00
105	N.S	Café Chair				
		Providing and placing in position Cafe				
		Chair. The seat and back are made up				
		injection molded high impact strength				
		polypropylene polymer (PP)				
		compound with indoor grade UV				
		Resistance. The Powder coated weled				
		tubular frame is made from				
		M.S.E.R.W tub. Leveler are made of				
		high impact strength polypropylene				
		polymer compound with indoor grad				
		IV Resistance and pressed fitted with				
		tubular frame Overall size: 420W y				
		500D v $820Hmm$				
		Draduat should be DIEMA cold rated				
		Product should be BIFWIA gold rated				
		SCSglobal certified for in-house air		1 60 00	4 (07 00	
		quality and with 10 years warranty.	Each	168.00	4,607.00	7,73,976.00
106	NS	Library Table				
200	1110	Providing and placing Library table of				
		size $1350(W) \times 900(D) \times 750(H)$				
		Workton: Workton shall be made out				
		of 25mm thick E 1/good grade				
		(Environmental Eriendly) norticle				
		(Environmental Thendry) particle				
		odana of workton shall be mavided				
		edges of worktop shall be provided				
		with machine pressed 1.5-2 mm thick				
		ABS edge banding glued with not				
		melt EVA glue. El/good grade				
		laminate with zero urea formaldehyde				
		emissions (<or= 100="" 8mg="" dry<="" g="" oven="" th=""><th></th><th></th><th></th><th></th></or=>				
		board-perforated method) for better				
		in-house air quality. This should				
		comply with (EN 120-1992).The				
		understructure is made of 2mm thick				
		Steel square pipe dimension 50 X 50				
		mm with Epoxy powder coated spray				
	1					
1		paint, baked at temperature 200 C°				
		coated of 70-80 micron thickness.				
		coated of 70-80 micron thickness. Powder coating should be scratch				
		coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross batch test 6x6 grid	Each	4 00	14 893 00	59 572 00

		method). Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.				
107	NS	Library Chair				
		Providing & supplying Library chair. Chair Seat made up of insert moulded polyurethane foam upholstered with foam laminated mesh fabric, insert moulded foam assembled over a load bearing plastic seat cover, back made up of two piece injection moulded frame, inner frame upholstered with mesh fabric and mounted on the main assembly, back adjustable lumbar support for achieving comfortable seating posture, seat size 52.5 cm width (approx.), 54.0 cm depth (approx.), sub assembly back size 48.5 cm max. width, 62.0 cm height.(approx.), effective back height from Seat 57.0 cm. (approx.), polyurethane foam for seat moulded with density 65±4 kg/m3, sled base leg frame welded assembly made of MS ERW round tube having outer dia 24mm (approx.) and thickness 2mm. including powder coating, based shoes on frame etc. all complete as per manufacturers specification. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.	Each	30.00	14,338.00	4,30,140.00
108	N.S	Library Book Storage(Double				
		Library book storage Back to Back Cantilever shelving Module Back to Back Cantilever shelving Module Welded Frame Upright with base shelf and adjustable shelves. Canopy brackets fixed to welded frame upright. Module having one base shelf and 5 adjustable shelves with				

		clear height between each shelf to be 330 mm.				
		- Welded Frame Upright (900x2190)				
		to be made of 2 mm thick fully				
		welded superior quality MS powder				
		coated rolled form section or standard				
		closed section with slots at pitch of 25				
		mm. Frame having intermediate the				
		Base shelf Shelf Tray to be made of				
		1 mm thick superior quality MS				
		CRCA powder coated sheet with				
		bottom stiffener made of 1 mm thick				
		MS CRCA powder coated sheet				
		skirting to be made of 1 mm thick				
		superior quality MS CRCA power				
		coated sheet end bracket to be made				
		out of 1.6 mm thick MS CRCA				
		powder coated sheet. Base support is				
		made out of 1.6 mm thick MS CRCA				
		powder coated sheet.				
		- Adjustable Shelf Shelf Tray to be				
		made of 1 mm thick superior quality				
		MS CRCA powder coated sheet with				
		MS CPCA power costed sheet and				
		bracket is made out of 1.6 mm thick				
		MS CRCA powder coated sheet				
		Each shelf to have an index plate in				
		polycarbonate.				
		- Canopy bracket made up of 1.6 mm				
		thick MS CRCA powder coated sheet,				
		fixed to welded frame upright.				
		Metal finish : All metal components				
		are colour with powder coating not				
		more than 60 micron.				
		- Wooden cladding of 25 mm thick				
		Pre-laminated MDF .(foll same as				
		Product should be RIEMA cold rated				
		SCS slobal certified for in-house air				
		quality and with 10 years warranty				
108.1	N.S	750 (W) X 1000 (D) X 2190 (H)				
			Each	76.00	30,513.00	23,18,988.00
108.2	N.S	900 (W) X 1000 (D) X 2190 (H)				
			Each	12.00	37,692.00	4,52,304.00
100	NG					
109	IN.S	LIDRARY BOOK Storage Non Sharing (Single Sided)				
1	1	(Single Sluce)				

		Library book Single Sided storage			
		Back to Back Cantilever shelving			
		Module			
		Back to Back Cantilever shelving			
		Modulo			
		Would France Unicht with here			
		welded Frame Upright with base			
		shelf and adjustable shelves. Canopy			
		brackets fixed to welded frame			
		upright. Module having one base			
		shelf and 5 adjustable shelves with			
		clear height between each shelf to be			
		330 mm.			
		- Welded Frame Upright (900x2190)			
		to be made of 2 mm thick fully			
		welded superior quality MS powder			
		costed rolled form section or standard			
		closed section with slots at nitch of 25			
		mm From hoving internet lists if			
		mm. Frame naving intermediate tie			
		member for extra strength.			
		- Base shelf Shelf Tray to be made of			
		1 mm thick superior quality MS			
		CRCA powder coated sheet with			
		bottom stiffener made of 1 mm thick			
		MS CRCA powder coated sheet			
		skirting to be made of 1 mm thick			
		superior quality MS CRCA power			
		coated sheet end bracket to be made			
		out of 1.6 mm thick MS CRCA			
		nowder costed sheet Base support is			
		mode out of 1 6 mm thick MS CDCA			
		made out of 1.6 min thick MIS CRCA			
		powder coated sheet.			
		- Adjustable Shelf Shelf Tray to be			
		made of 1 mm thick superior quality			
		MS CRCA powder coated sheet with			
		bottom stiffener made of 1 mm thick			
		MS CRCA power coated sheet end			
		bracket is made out of 1.6 mm thick			
		MS CRCA powder coated sheet.			
		Each shelf to have an index plate in			
		polycarbonate			
		- Canopy bracket made up of 1.6 mm			
		- Canopy bracket made up of 1.0 IIIII thick MS CDCA powder costed sheet			
		fined to welded from a weight			
		Inxed to werded frame upright.			
		ivietai finisn : All metal components			
		are colour with powder coating not			
		more than 60 micron.			
		- Wooden cladding of 25 mm thick			
		Pre-laminated MDF .(foil same as			
		classroom table top)			
		Product should be BIFMA gold rated			
		SCSglobal certified for in-house air			
		quality and with 10 years warranty			
100 1	NS	$750 (W) \times 500 (D) \times 2190 (H)$	Fach	4 00	
107.1	11.0	$100(11) \times 100(D) \times 2170(11)$	Lacii	т. 00	

					26,880.00	1,07,520.00
109.2	N.S	900 (W) X 500 (D) X 2190 (H)	Each	7.00	31.627.00	2.21.389.00
110	N.S	Digital Librarian				, ,
		Providing and placing of Digital Lib Workstations of Size : 1500W x 600D x 1200-1250 (H). Cubical Workstations with rectangular worktop- Size of Main table - 1500MM X 600MM X 750MM H. Worktop shall be made out of 25mm thick E-1/good Grade Pre-Laminated particle board. All the open edges of work surface shall be provided with machine pressed 2 mm thick ABS lipping glued with hot melt EVA glue. The work surface shall be provided with circular cut out of Dia.65mm as per the requirement, for passing of wires. These cut outs shall be provided with ABS covers. Work surfaces are fitted to the panels by work surface brackets, wooden legs & wooden modesty. Brackets are made of 2.0mm thick CRCA grade D steel as per IS : 513. Brackets are slide in between end trim and vertical extrusions. Panel: Frame			- -	
		 work shan consist of main spine and return spine of aluminium extruded section of minimum thickness of 1.2 mm. The thickness of main & return Panel is 60-70 mm. The panel will be hollow inside to accommodate wiring for electrical/data and outer frame of panel should be made of extruded aluminium, cladding with 3mm thick MDF both sides of the panel to create the hollow for the wire management. 				
		On the MDF 0.5-0.6 mm fabric / Steel CR 0.5.06 mm EPC/ EPF Foam 3-4 mm for pin up as an option based on the requirement and as per approved by Architect. For the glass panel different aluminium profile (Top and bottom of the frame) with 60-70 mm thick which should accommodate the glass of thickness 4-6 mm.Finishes of panel: Above the top fabric pinup & Glass writable board with raceway in main spine (return table) & fabric pinup (Main table) & balance fabric finish for aisle side & return panel, below the top should be metal with				

		MDF tile with one raceway at skirting level and etc. whichever required. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.				
		Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.	Each	3.00	59,808.46	1,79,425.4
111	N.S	Librarian Table Providing and placing Librarian table of Size: 1800(W) x 750(D) x 750(H) & back storage of size 1800W x450D x750H Worktop: Worktop shall be made out of 25mm thick E- 1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 100="" 8mg="" board-<br="" dry="" g="" oven="">perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200</or=>				

C°.Raceways contain the horizontal			
cable channel that fitted with a			
modesty panel tidily and effectively			
modesty panel hany and encetively.			
The understructure is made of 2mm			
thick Steel square pipe dimension 50			
X 50 mm with Epoxy powder coated			
spray paint baked at temperature 200			
Spray paint, baked at temperature 200 C° costed of 70.80 micron thickness			
C coaled of 70-80 fillefold the constant			
rowuer coaling should be scratch			
resistance (cross hatch test 6x6 grid			
method). The wooden access flap			
(400x150mm) is made from 16mm			
thick E-1/good grade (Environmental			
Friendly particle board cover with			
laminate with 0.45mm thick ABS			
Edge banding. The modesty			
panel(wherever required) is made of			
16mm thick E-1/good grade			
(Environmental Friendly) particle			
board cover with 1mm thick laminate			
with 2mm thick ABS and Brackate			
with 211111 thick ADS and Diackets			
used are 5.2 mill Powder Coaled Sleer			
 of 80-90 microns.			
Back Storage : The storages should be			
made out of particle board of 25mm			
thick top and doors, sides and shelves			
should be made out of 16-19mm thick			
particle board in approved finished.			
E-1/good grade particle board finished			
with 2mm ABS edge banding.			
E1/good grade laminate with zero			
urea formaldehyde emissions (<or=< td=""><td></td><td></td><td></td></or=<>			
8 mg/100 g oven dry board-perforated			
method) for better in-house air			
quality This should comply with (EN			
120 1002) The averaged adds of			
120-1992). The exposed edge of			
worktop shall be secured with 1.5mm-			
2mm thick ABS edge banding.			
Storages should be fitted with soft			
closing hardwares and anti-shock			
hinges. All hardware shall be of			
reputed make/brands per sample			
finally approved by the Architect.			
Product should be BIFMA gold rated			
SCSglobal certified for in-house air			
quality and with 10 years warranty			
quality and with 10 years warranty.	I I	I	

		Drawer Unit : 3 drawer Metal pedestal of overall dimensions internal and external dimensions 380-430 mm (W) x 430-480 mm (D) x 600-620 mm (H). Drawer body should be made of CRCA of thickness 0.7-0.8 mm duly powder coated with 70-80 micron. Each pedestal should be provided with pencil tray of 40-45 mm(H) x 110-120 mm (D) x 300-310 mm (W). Each pedestal should have 5 Nos castor fitted to it where in one castor will be fitted to lower most drawer to provide extra stability. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 ware warranty.	Each	1.00	58 860 00	58 860 00
110	NC	with 10 years warranty.	Each	1.00	28,800.00	58,860.00
	11.3	Providing and fixing for Librarian Cabin table of size 1650(W) x 750(D) x 750(H) & Side Table:1000W x 450D X750H & Free standing Swing shutter with laminated finish of size: 1650W 450D 750Hmm ,Worktop shall be made out of 25mm thick E- 1/good grade (Environmental Friendly) particle board cover with laminate and all the edges of worktop shall be provided with machine pressed 1.5-2 mm thick ABS edge banding glued with hot melt EVA glue. E1/good grade laminate with zero urea formaldehyde emissions (<or= 100="" 8mg="" board-<br="" dry="" g="" oven="">perforated method) for better in-house air quality. This should comply with (EN 120-1992).The wiring tray is made of steel sheet thickness 1.2mm. Epoxy powder coated spray color, baked at temperature 200 C°.Raceways contain the horizontal cable channel that fitted with a modesty panel tidily and effectively.</or=>				
		thick Steel square pipe dimension 50 X 50 mm with Epoxy powder coated spray paint, baked at temperature 200 C° coated of 70-80 micron thickness. Powder coating should be scratch resistance (cross hatch test 6x6 grid method).The wooden access flap (400x150mm) is made from 16mm				

	thick E-1/good grade (Environmental				
	Friendly particle board cover with				
	laminate with 0.45mm thick ABS				
	Edge banding The modesty				
	Luge ballung. The modesty				
	panel(wherever required) is made of				
	16mm thick E-1/good grade				
	(Environmental Friendly) particle				
	board cover with 1mm thick laminate				
	with 2mm thick ABS and Brackets				
	used are 3.2 mm Powder Coated Steel				
	of 80-90 microns.				
	Back Storage · The storages should be				
	made out of particle board of 25mm				
	thick top and doors sides and shelves				
	should be made out of 16 10mm thick				
	should be made out of 10-19mm thick				
	particle board in approved finished.				
	E-1/good grade particle board finished				
	with 2mm ABS edge banding.				
	E1/good grade laminate with zero				
	urea formaldehyde emissions (<or=< td=""><td></td><td></td><td></td><td></td></or=<>				
	8mg/100 g oven dry board-perforated				
	method) for better in-house air				
	quality. This should comply with (EN				
	120-1992) The exposed edge of				
	workton shall be secured with 1 5mm-				
	2mm thick ABS edge				
	Lining Storegas should be fitted with				
	banding. Storages should be fitted with				
	soft closing nardwares and antishock				
	hinges. All hardware shall be of				
	reputed make/brand as per sample				
	finally approved by the Architect.				
	Product should be BIFMA gold rated				
	SCSglobal certified for inhouse air				
	quality and with 10 years warranty.				
	Drawer Unit : 3 drawer Metal				
	pedestal of overall dimensions internal				
	and external dimensions 380-430 mm				
	(W) x $430-480$ mm (D) x 600.620				
	(Π) A $\mp 30^{-} \mp 60^{-} \Pi \Pi (D)$ A $000^{-} 020^{-}$				
	min (Π). Drawer body should be				
	made of URCA of thickness 0.7-0.8				
	mm duly powder coated with 70-80				
	micron. Each pedestal should be				
	provided with pencil tray of 40-45				
	mm(H) x 110-120 mm (D) x 300-310				
	mm (W).				
	Each pedestal should have 5 Nos				
	castor fitted to it where in one castor				
	will be fitted to lower most drawer to				
	provide extra stability Product should				
	ba RIEMA gold rotad SCS-label				
	be DIFIVIA gold rated SUSGIODAL				
	certified for in-nouse air quality and	г ·	1.00		
	with 10 years warranty.	Each	1.00	72,077.00	72,077.00
					1

	I			1	I	1
113		Ante Room For MD/ Chairman &				
		Director Cabin				
	N.S	Single Bed				
		Providing and fixing of Single Bed of				
		Size 950(W)X2050(L)X750(H) with				
		Head board and foot board. Head				
		Board & Foot Board made up of 18				
		mm thick MDF/BB with 0.4 mm				
		membrane foil . Head board size:				
		900x600 mm and foot board of size:				
		990x300 mm Support structure of Bed				
		thick and 40x40x12mm thick duly				
		thick and 40x40x1.2mm thick duly				
		powder coaled infough seven lank				
		Panel: The side panels are made up				
		of 18mm thick MDE /Roard with both				
		side decorative laminate. All exposed				
		edges are sealed with 2mm thick PVC				
		edge Banding/5MM solid wood Bed				
		Base: - The Bed Base shall be made				
		up of 12mm thick MDF/B Board with				
		both side White laminate.				
		All Exposed edges of MDF/BB to be				
		sealed with 2mm thick PVC edge				
		band and 0.8mm thick PVC edge-				
		band to be applied on Non-exposed				
		edges with the help of hot-melt glue				
		through fit edge-banding machines.				
		The Edge-banding of exposed area to				
		be done in the way that there should				
		not be any sharp edge or corner left				
		after processing. All the exposed				
		edges should have buffing radius of				
		1.5 to 2mm without affecting aesthetic				
		value of the panel. Mattress-				
		Providing quilted mattress 4" with				
		coir, Thickness of 100mm, density 80				
		GM/dcm3, pilled toam quilting (one				
		dongity 18 CM/d are 2 DU f				
		thiskness 5 mm Estric 25 CSM rely				
		cotton metorial				
		Droduct should be RIEMA gold roted				
		SCS global certified for in-house air				
		quality and with 10 years warranty	Fach	7.00	29 491 00	2 06 437 00
		quanty and with 10 years warranty.	Lacii	7.00	27,471.00	2,00,757.00
114	N.S	Lounge Chair				

		Lounge Chair, Providing & placing Lounge chair. Chair seat & back made up of insert moulded Polyurethane Foam upholstered with foam laminated mesh fabric, insert moulded foam assembled over a load bearing ply seat cover, fixed and seats. Base: wooden structure of chair with pvc glides, On the wooden leg of the chair to be provided with M.S. brackets, Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.	Each	7.00	22,113.00	1,54,791.00
115	N.S	Reception Table				
		Custom made Reception Table. Providing and fixing of Reception Table and – Providing and fixing reception counter cladded with 122mm thick solid surface. This include reception counter . The shape desired to be achieved through 19mm Marine Mdf BB carcess, cladded with italian marble, stainless steel and 12mm thick Acrylic Sold Surfaces sheets thermoformed by using dyes and molds and pasted and seamlessly finished over. MS pipe framework to be used for strengthening the structure. The item includes cost of 12mm Acrylic Solid Surfaces. 19mm Marine Mdf/BB & MS square pipe, hardware, drawer units, shutter doors with laminated mica or veneers, locking mechanism, foot rest etc. as per architect's drawing and finished as per guidelines of site in charge.				
		4000W X900D X900H	Each	1.00	5,04,899.00	5,04,899.00
		CORPORATE BUILDING				8,38,67.827.39
		· -				, , ,
		SUBHEAD10:ADMINISTRATIVEBUILDINGFURNITUREFurniture should be BIFMA goldrated SCS global certified for in-houseair quality and with 10 YEARS				
		air quality and with 10 YEARS REPLACEMENT WARRANTY.				

			 •	
116	N.S	Staff Table		
		Providing and placing Staff table of		
		Size : 1500(W) x 750(D) x 750(H) &		
		back storage of size 1500W x450D		
		x750H Worktop: Worktop shall be		
		made out of 25mm thick E-1/good		
		grade (Environmental Friendly)		
		particle board cover with laminate and		
		all the edges of worktop shall be		
		provided with machine pressed 1.5-2		
		mm thick ABS edge banding glued		
		with hot melt EVA glue. E1/good		
		grade laminate with zero urea		
		formaldehyde emissions (<or=< th=""><th></th><th></th></or=<>		
		$8m\sigma/100$ g oven dry board-perforated		
		method) for better in-house air		
		quality This should comply with (EN		
		120-1992) The wiring tray is made of		
		steel sheet thickness 1.2mm Enovy		
		nowder coated spray color baked at		
		temperature 200 C° Raceways contain		
		the horizontal cable channel that fitted		
		with a modesty papel tidily and		
		effectively		
		The understructure is made of 2mm		
		thick Steel square pipe dimension 50		
		V 50 mm with Enoxy powder costed		
		A 50 min with Epoxy powder coaled		
		spray paint, baked at temperature 200 C° agosted of 70.80 migron thickness		
		C coaled of 70-80 Inicion unckness.		
		Powder coating should be scratch		
		resistance (cross natch test oxo grid		
		method). The wooden access flap		
		(400x150mm) is made from 16mm		
		thick E-1/good grade (Environmental		
		Friendly particle board cover with		
		laminate with 0.45mm thick ABS		
		Edge banding. The modesty		
		panel(wherever required) is made of		
		16mm thick E-l/good grade		
		(Environmental Friendly) particle		
		board cover with 1mm thick laminate		
		with 2mm thick ABS and Brackets		
		used are 3.2 mm Powder Coated Steel		
		ot 80-90 microns.		

		Back Storage : The storages should be made out of particle board of 25mm thick top and doors, sides and shelves should be made out of 16-19mm thick particle board in approved finished. E-1/good grade particle board finished with 2mm ABS edge banding. E1/good grade laminate with zero urea formaldehyde emissions (<or= 8mg/100 g oven dry board-perforated method) for better in-house air</or= 				
		120-1992). The exposed edge of worktop shall be secured with 1 5mm-				
		2mm thick ABS edge banding.				
		closing hardwares and anti-shock				
		reputed make/brand as per sample				
		Product should be BIFMA gold rated				
		SCSglobal certified for in-house air quality and with 10 years warranty.				
		Drawer Unit : 3 drawer Metal				
		pedestal of overall dimensions internal				
		and external dimensions $380-430 \text{ mm}$ (W) x 430 480 mm (D) x 600 620				
		$(W) \times 430-480$ mm (D) $\times 000-020$ mm (H) Drawer body should be				
		made of CRCA of thickness 0.7-0.8				
		mm duly powder coated with 70-80				
		micron. Each pedestal should be				
		provided with pencil tray of 40-45				
		$mm(H) \ge 110-120 mm (D) \ge 300-310 mm (W)$				
		Each pedestal should have 5 Nos				
		castor fitted to it where in one castor				
		will be fitted to lower most drawer to				
		provide extra stability. Product should				
		be BIFMA gold rated SCSglobal				
		with 10 years warranty	Each	3 00	54 245 00	1 62 735 00
			_~~	2.00	,5.00	1,02,700,000
117	N.S	Lecture Hall Chair				
		Providing and fixing in position				
		Auditorium Chairs With Writable				
		515mm (W) x 720mm (D) x 980mm				
		(H). Seat Height from floor should be				
		of 440mm as per Ergonomic				
		standards. The chairs should have				
		ionowing description : The dimensions				
		and seat and Backrest should be made				
		515mm (W) x 720mm (D) x 980mm (H). Seat Height from floor should be of 440mm as per Ergonomic standards. The chairs should have following description :The dimensions after push back shall be 515mm wide and seat and Backrest should be made				

should be with buffering mechanism to enable soft closing of seat when it is folded and all hole on seat shelf should be noise absorbing. Armrest of chairs should be of fixed type made out of wood and should be provided with option of folding table to be used as writing pad. Legs of chairs should be made with cold rolled cold annealed steel duly powder coated with 80-100 micron thickness to provide smooth and clean surface.Seat should be foldable to enable comfortable seating, maintenance and to provide space utilization to walk around. Seat and Back should be wrapped with Titch make O-Fabric of desire colour as per Architect with zero formaldehyde glue. Product should be BIFMA gold rated SCSglobal certified for in-house air crudity and with 10 traces ware ware to be should be are and sufface and to provide space 216.00 13.265.00 28.86	₹ <i>10.00</i>
118N.SPodium ,Providing and fixing podium, Podium of overall size 600mm x600mm x1200mm H made of 18mm pre-laminated MDF board. The top is made up of 25mm thick Pre=laminated MDF Board. The Podium also has a shelf below the top made up of 18mm Pre Laminated MD Board to keep papers etc. All exposed edges are sealed with 2mm thick PVC edge banding and unexposed edges sealed and unexposed edges sealed and unexposed edges sealed and unexposed edges sealed mother to matchines. Product should be BIFMA gold rated SCSglobal certified for in-house air quality and with 10 years warranty.Each2.0012,972.0025	944.00
119 N.S Reception Table	

119.1		Custom made Reception Table. Providing and fixing of Reception Table and – Providing and fixing reception counter cladded with 122mm thick solid surface. This include reception counter . The shape desired to be achieved through 19mm Marine Mdf carcess, cladded with italian marble, stainless steel and 12mm thick Acrylic Sold Surfaces sheets thermoformed by using dyes and molds and pasted and seamlessly finished over. MS pipe framework to be used for strengthening the structure. The item includes cost of 12mm Acrylic Solid Surfaces. 19mm Marine Mdf & MS square pipe, hardware, drawer units, shutter doors with laminated mica or veneers, locking mechanism, foot rest etc. as per architect's drawing and finished as per guidelines of site in charge. 3300W x900D x900H				
11/11			Each	1.00	2,34,623.00	2,34,623.00
		ADMINISTRATIVE BUILDING				33 10 1/2 00
		SUBHEAD 11: FURNITURE FOR HOSTEL BUILDING AND CAFETARIA INCLUDING BEDS				
		AND CHAIKS ETC. ALL FURNITURE TO HAVE A 5 YEAR REPLACEMENT				
120	NS	WAKKANTY. Study Toble				
		Providing and fixing of Study Table :- 18mm MDF for table with 0.18mm PVC vacuum laminating for surface of table top & shelf thickness is 15mm , Top & shelf fixed on MS powder coated SQ pipe. Load bearing capacity (table top):35 Kg. Construction: Knock down fitting Color: Granite black Dimensions (L)1350 x 550 x (H) 1050/750mm . Product should be BIFMA certified for in-house air				
		quality and with 5 years warranty.	Each	162.00	11,161.00	18,08,082.00

121	N.S	Study Chair				
		Providing and placing of Study				
		Chair:-The seat and back shall be				
		made up of 1.2 ±0.1cm. thick hot-				
		pressed plywood and upholstered				
		with fabric upholstery covers and				
		moulded Polyurethane foam. The				
		back foam shall be designed with				
		contoured lumbar support for extra				
		comfort. The seat shall be extra thick				
		foam on front edge to give comfort to				
		popliteal area. The dimensions of back				
		shall be $47.5 \text{ cm}(W) \ge 58.0 \text{ cm}(H)$ and				
		of seat shall be 47.0 cm (W) x 48.0				
		cm (D). The HR polyurethane foam				
		shall be moulded with density= 45 ± 2				
		kg/m3 and hardness load 16 ± 2 kgf				
		as. per IS:7888 for 25% compression.				
		The one-piece armrests shall be				
		injection moulded from black Co.				
		polymer Polypropylene. The				
		mechanism shall be designed with				
		360° revolving type, Upright-position				
		locking, Tilt tension adjustment,				
		Seat/back tilting ratio of 1:3. The				
		pneumatic height adjustment shall has				
		an adjustment stroke of 12.0 ±0.3cm.				
		The bellow shall be 3 piece telescopic				
		type and injection moulded in black				
		Polypropylene. The pedestal shall be				
		injection moulded in black 33% glass-				
		filled Nylon-66 and fitted with 5 nos.				
		twin wheel castors. The pedestal shall				
		be 66.3 ± 0.5 cm. pitch-center dia.				
		$(76.3 \pm 1.0 \text{ cm} \text{ with castors})$. The twin				
		wheel castors shall be injection				
		moulded in Black Nylon. Overall				
		Dimensions of Chair shall be Seat				
		$\begin{array}{c} \text{reight} - \text{imin } 42.5 \text{ to max } 54.5 \text{cm}, \\ \text{Height} & \text{min } 85.5 \text{ to max } 97.5 \text{cm}, \\ \end{array}$				
		Width & Donth of Chair of max 9/.5cm,				
		from nodestal Width 76.2 are and				
		Donth 76.3 cm				
		Depui-70.3 cill. Droduct should be DIEMA corriginal				
		for in house air quality and with 5				
		vears warranty	Fach	162.00	8 352 00	13 53 024 00
		years warranty.	Laun	102.00	6,332.00	15,55,024.00
122	NC	Woodon Wordrobo				
122	1N.S	wooden wardrode				

		Providing and fixing of build-in Almira on site 450 -600mm deep with 18 mm thick moisture resistant ply board on all four sides with swing shutters, finished with 2mm thick edge binding tape. Back ply to be 6mm thk . Almira to be finished with 1mm thk selected gloss/matt finish laminate on the outside and white laminate on the inside(as approved from the Architect), with shelves and drawers fixed with telescopic channel, lock and embedded handle, hanging rod and looking mirror 5mm thick as per drawing and other necessary hardware (preferred make : haffle, ozone, kich or doorset) Details to be taken asper dwgs attached. Product should be BIFMA certified for in-house air quality and with 5 years warranty.	SQMT	513.00	10,860.00	55,71,180.00
123	NS	Single Bed With Box				
		Providing and fixing of Single Bed of Size 950(W)X2050(L)X750(H) with Head Board and foot board. Head Board & Foot Board made up of 18 mm thick MDF with 0.4 mm membrane foil . Head board size: 900x600 mm and foot board of size: 990x300 mm Support structure of Bed made up of M.S. Pipe 75x25x1mm thick and 40x40x1.2mm thick duly powder coated through seven tank process of Powder Coating. Side Panel: - The side panels are made up of 18mm thick MDF Board with both side decorative laminate. All exposed edges are sealed with 2mm thick PVC edge Banding. Bed Base: - The Bed Base shall be made up of 12mm thick MDF Board with both side White				

		laminate. All Exposed edges of MDF to be sealed with 2mm thick PVC edge band and 0.8mm thick PVC edge-band to be applied on Non- exposed edges with the help of hot- melt glue through fit edge-banding machines.				
		The Edge-banding of exposed area to be done in the way that there should not be any sharp edge or corner left after processing. All the exposed edges should have buffing radius of 1.5 to 2mm without affecting aesthetic value of the panel. Product should be BIFMA certified for in-house air quality and with 5 years warranty.	Each	162.00	14,470.00	23.44.140.00
			2001	102.00	1.,	20,11,110000
124	N.S	Bed Side Table				
		with Overall Size : Depth - 450.0 mm, Width -440.0 mm, Height - 510.0 mm Material : Body and drawer panels of Bed side table are made of 18 mm thick Prelaminated MDF Board. All the exposed edges are edge banded with 0.8 mm thick PVC edge banding. Side panels are made of 18 mm thick Prelaminated MDF board with imported H.D.F. foil wrapped decorative trim fixed on to it. Hardware : The high quality hardware used like Roller slides, Hinges , minifix, dowels is of make Hettich. Product should be BIFMA certified for in-house air quality and with 5 years warranty.	Each	162.00	4,852.00	7,86,024.00
125	N.S	Mattress				
		Providing and placing Mattress- Providing quilted mattress 4" with coir, Thickness of 100mm, density 80 GM/dcm3, pilled foam quilting (one side) 14 mm thickness, pilled foam density 18 GM/d cm3, PU foam thickness 5 mm, Fabric 85 GSM poly cotton material.	Each	162.00	6,105.00	9,89,010.00
126	N.S	T.V. Unit				

127	N.S	Providing and placing, Customized TV unit as per the site requirement . Maximum size - 1200x350 x900Hmm, TV unit made of with 18 mm thick moisture resistant ply board on all four sides. Product should be BIFMA certified for in-house air quality and with 5 years warranty. Café Table Providing and placing in position Cafe table. Top made of 40 to 50 mm thick Block Board with Laminated covering on all sides . Edge Banding/Matching solid wood lipping. The understructure for tables up to one meter length /dia shall be made out of stainless steel tubes in 304 grade. The size of the stainless steel 304 grade shall be 38x38 square tube having minimum thickness of 3 mm. The understructure shall be star shaped base with four legs and four arm support for top with a central pole support of 38x38 mm stainless steel tube minimum 3 mm thick with additional vertical supports of minimum 25x25 mm stainless steel tubes having minimum thickness of 2 mm. There should be extra four vertical supports for four legs of base joining the legs and the arms by this vertical support. Table having any side more than 1 mtr shall have end to end support structure with 38x38 mm	Each	81.00	11,854.00	9,60,174.00
		side more than 1 mtr shall have end to end support structure with 38x38 mm stainless steel tube minimum 3mm thick. The structure so designed shall be made to ensure proper stability. The tables shall be in house custom made at site.				
	a	RECTA, SIZE - 2100MM X	Fach	16.00	27 200 00	4 35 200 00
	b	SQUARE, SIZE - 1000MM X 1000MM X 740MM H	Fach	10.00	23 375 00	93 500 00
	с	RECTA, SIZE - 900MM X 750MM X	Each	2.00	25,575.00	71 400 00
	d	RECTA, SIZE - 2400MM X		2.00	33,700.00	/1,400.00
	e	DIA, SIZE - 1500MM DIA X	Each	2.00	30,600.00	61,200.00
	f	DIA, SIZE - 900MM DIA X 740MM	Each	3.00	21,250.00	1,48,750.00
-						

		Н			34,000.00	1,02,000.00
128	N.S	Café Chair				
		Providing and placing in position Cafe Chair. The seat and back are made up injection molded high impact strength polypropylene polymer compound with indoor grade UV Resistance. The Powder coatedweled tubular frame is made from 22mm x 0.12 mm x15mm x 0.12mm M.S.E.R.W tub The Shoes are made of high impact strength polypropylene polymer compound with indoor grad UV Resistance and pressed fitted with tubular frame. SIZE : (W)x525mm (D)x 558mm(H)845 (seat H) 450mm Seat Size 525mm(W)x432 mm(D) Back Size 516 mm(W)x405mm (H). Product should be BIFMA certified for in-house air quality and with 5				
		years warranty.	Each	120.00	2,945.00	3,53,400.00
129	N.S	Office Table				
		Providing and fixing ,MAIN TABLE of size 2100W x 750D x 750H MM with top made of with top made of 25mm thick Pre-laminated MDF board and balancing laminate on unexposed face. The Gable end is made up of 25mm thick. pre- laminated MDF board. The understructure is made of 18mm thick prelaminated MDF board with all exposed edges sealed with 2mm PVC edge banding tape and all unexposed edges sealed with 0.6mm edge banding tape pressed at 2000 C with hot melt glue on special machines. Table has a provision for wire manager caps at top. Side Unit Of size 1000L X 450D X 750H MM : The Side top is made up of 25mm thick. Prelaminated MDF Board & under structure is made up of 18mm thick. pre-laminated MDF board. all exposed edges sealed with 2mm PVC edge banding tape and all unexposed edges sealed with 0.6mm edge banding tape and all unexposed edges sealed with 0.6mm edge banding tape pressed at 2000 C with hot melt glue on special.				

		The side unit is combination of 2 drawer + 1 filling & one openable shutter with proper locking arrangement. Back Unit Of size 2100L X 450D X 750H MM : The Side top is made up of 25mm thick. Prelaminated MDF Board & under structure is made up of 18mm thick. pre-laminated MDF board. all exposed edges sealed with 2mm PVC edge banding tape and all unexposed edges sealed with 0.6mm edge banding tape pressed at 2000 C with hot melt glue on special. The side unit is combination of 2 drawer + 1 filling & one openable shutter with proper locking arrangement All Hardware (Handles, Slides ,Hinges) Hettich Make. Product should be BIFMA certified for in-house air quality and with 5 years warranty.	Each	1.00	23,462.00	23,462.00
130	NS	High chair For Office				
		Providing and placing of Chair for Office Table- seat made up of insert moulded Polyurethane Foam upholstered with foam laminated mesh fabric(Stitch Make), insert moulded foam assembled over a load bearing plastic seat cover, back is made up of two piece injection moulded frame, inner frame upholstered with mesh fabric and mounted on the main assembly, back adjustable lumbar support for achieving comfortable seating posture. Armrests should be adjustable with 120-160 mm adjustability with PU padded. Base: Black nylon base with nylon castors. Chair should be of 360 degree swivel Posture Control with multi pointer locking and synchro tilt mechanism and hydraulic gas lift gas lift to allows 90-100 mm. of height adjustment. Seat size 440 - 550 mm depth, Seat width of 530-550 mm Seat Height of 430-530mm with hydraulic height adjustability of 90-100mm.				

		Sub assembly back size 550 - 620 mm height. Chair Back should be connected to four directional adjustable lumbar support for achieving comfortable seating posture. Effective back height form Seat - 570mm, polyurethane foam for seat having density 65-70 kg/m3. Pedestal made of nylon base fitted with 5 nos. twin wheel castors (castor wheel dia. 60-70 cm), base pedestal dia 60-70 mm and pitch center dia. 700-720mm with castors, twin wheel castors injection moulded in Nylon etc. all complete as per manufacturers specification, approved sample and direction of Architect. Product should be BIFMA certified for in-house air quality and with 5 years warranty.				
			Each	2.00	10,928.00	21,856.00
131	N.S	Visitor chair For Office				
		Providing and placing Low back revolving chairs for Office. Chair seat made up of insert moulded Polyurethane Foam upholstered with foam laminated mesh fabric, insert moulded foam assembled over a load bearing plastic seat cover, back is made up of two piece injection moulded frame, inner frame upholstered with mesh fabric and mounted on the main assembly, back adjustable lumbar support for achieving comfortable seating posture. Armrests should be adjustable with 120-160 mm adjustability with PU padded. Base: Black nylon base with 5 nos. nylon castors. Chair should be of 360 degree swivel Posture Control with multi pointer				
		Posture Control with multi pointer locking and synchro tilt mechanism and hydraulic gas lift gas lift to allows 90-100 mm. of height adjustment. Seat size 440 - 550 mm depth, Seat width of 530-550 mm Seat Height of 420-510mm with hydraulic height adjustability of 90-100mm. Sub assembly back size 550 - 620 mm height. Effective back height from Seat - 570mm, polyurethane foam for seat having density 65-70 kg/m3.	Each	5.00	9,813.00	49,065.00

		Providing and placing of Single Seater Sofa :The seat should be made of PU foam with Density 32 ± 2 kg/cu.mtr having an additional top layer of J PU foam with Density $28 \pm$ 2 kg/cu. Seat should be upholstered with fabric or leatherette. 2) BACK FOAM: The back should be made of PU foam with Density 28 ± 2 kg/cu. mtr with two additional top layer of super soft foam of density 23 ± 2 kg/cu.	Each	2.00	15 894 00	31 788 00
133	N.S	Single Seater				
132	N.S	castors injection moulded in Nylon etc. all complete as per manufacturers specification, approved sample and direction of Architect Product should be BIFMA certified for in-house air quality and with 5 years warranty. 3 Seater Sofa Providing and placing of three Seater Sofa : The seat should be made of PU foam with Density 32 ± 2 kg/cu.mtr having an additional top layer of J PU foam with Density 28 ± 2 kg/cu. Seat should be upholstered with fabric or leatherette. 2) BACK FOAM: The back should be made of PU foam with Density 28 ± 2 kg/cu. mtr with two additional top layer of super soft foam of density 23 ± 2 kg/cu. mtr, upholstered with fabric or leatherette. Understructure should be made up of 1.2 ± 0.1 cm. thick hot pressed plywood. Spring assembly should be mounted in understructure for support and additional cushioning purpose .t should be a welded assembly made in Stainless steel (grade SS 202) tube & plate. Product should be BIFMA certified for in-house air quality and with 5 years warranty.	Each	3.00	35,193.00	1,05,579.00
		Pedestal made of nylon base fitted with 5 nos. twin wheel castors (castor wheel dia. 60-70 cm), base pedestal dia 60-70 mm and pitch center dia.				

		mtr, upholstered with fabric or leatherette. Understructure should be made up of 1.2±0.1 cm. thick hot pressed plywood. Spring assembly should be mounted in understructure for support and additional cushioning purpose .t should be a welded assembly made in Stainless steel (grade SS 202) tube & plate. Product should be BIFMA certified for in-house air quality and with 5 years warranty.				
134	N.S	Centre Table				
		Providing and placing of center table (1200W x600D 450H) with top made 25mm thk. Pre-Laminated MDF Board and understructure with a shelf is made of 18mm thick prelaminated MDF board with all exposed edges sealed with 2mm PVC edge banding tape and unexposed edges sealed with 0.6mm PVC edge banding tape pressed at 2000 C with hot melt glue on special machines. Product should be BIFMA certified for in-house air quality and with 5 years warranty	Fach	2 00	6 755 00	13 510 00
		yours warrancy.	Euch	2.00	0,700.00	10,010.00
135	N.S	Side Table				
		Providing and placing of side table (450mmW x 450mmD x 450mmH) with top made 25mm thk. Pre- Laminated MDF Board and understructure with a shelf is made of 18mm thick prelaminated MDF board with all exposed edges sealed with 2mm PVC edge banding tape and unexposed edges sealed with 0.6mm PVC edge banding tape pressed at 2000 C with hot melt glue on special machines. Product should be BIFMA certified for in-house air quality and with 5 years warranty.	Each	2.00	5,951.00	11,902.00
		HOTAL FURNITURE FOR HOSTEL BUILDING AND CAFETARIA INCLUDING BEDS AND CHAIRS ETC.				1,53,34,246.00
		SUBHEAD 12: Chairs for VVIP seatings, senior officers, visitors,				

		conference rooms, junior visitors				
		and staff				
		ALL CHAIRS TO HAVE AN ON				
		SITE REPLACEMENT				
		WARRANTY FOR A PERIOD OF				
		12 YEARS FOR EACH AND				
		EVERY COMPONENT AND				
		CHAIR FOR 24X7X 365 USAGE				
		OF CHAIR				
136		Chairs for VVIP Seating				
	а	Executive Task Chair with Seat Ht				
		range 17"-22" with adjustable seat				
		depth ranging 15"-18" inches with				
		overall back height 45". The tilt				
		mechanism should be 2 fiberglass leaf				
		springs, a gear-driven tension				
		adjustment, and stamped-steel				
		nousing. A 2-piece ABS cover shall				
		chall have a naminal 18% of hadr				
		shall have a nominal 18° of body				
		limitar located at left roor corner				
		halow the sect late users limit the				
		amount of recline in 3 incremental				
		adjustments: upright 42% 77% and				
		full recline. The back & seat should				
		have a pixelated engineering with				
		textile cover should consist of a 3D				
		knit fabric ton layer of breathable				
		100% virgin polyester bonded to an				
		underlying 100% polyester clear				
		monofilament spacer construction that				
		allows for a visual transfer of color				
		through the chair back Chairs should				
		have 10.4"-by-4.5" arm pads of self-				
		skinning urethane foam molded in				
		place to a glass-filled nylon insert.				
		Arm pads should be flexible with a				
		lightly textured surface. Base should				
		be 5-star base with casters, should be				
		die-cast aluminum, with a textured or				
		smooth-coat powder-coat epoxy				
		finish. The chair should swivel 360°.				
		Chairs should be furnished with				
		interchangeable casters. Chair should				
		be Greenguard certified. Should have				
		a weight bearing capacity of 300				
		pounds or under. Warranty: The chair				
		should carry a 12year 3 shift warranty.				
		Chair should meet or exceed (ANSI/				
		BIFMA) performance requirements				
		per ANSI X5.1-2002.	Nos	15.00	77,711.00	11,65,665.00
	b	Visitor Chairs as stated above		30.00		

				47,514.00	14,25,420.00
125					
137	Task Chair with sizes Height : 15.7"				
	20.4" Depth: 15.0" Width: 18.9"				
	Seat and Back. The seat and back				
	surfaces should be constructed from a				
	single sheet of mesh material Lyris				
	the should be constructed from				
	Hytrel [®] monofilaments in the				
	horizontal direction and polyester				
	fibers in the vertical direction. Arms :				
	Chairs shall have 9"-by-2.5" arm pads				
	with a lightly textured surface. The				
	arm pad should be made from				
	thermoplastic elastomer material and				
	should be attached to the loop arm				
	through an over molding process. Tilt				
	the tilt mechanism should be Silver				
	Alloy aluminum yoke, front link, and				
	a glass filled hyfor fear filk. The tilt should contain Kinematic Spine that				
	should fley as body weight applied				
	Base: 5-star bases with casters should				
	be a corrosion resistant Silver Allov				
	aluminum, with a bead blasted				
	textured surface. The chair should				
	swivel 360° and should be furnished				
	with interchangeable casters. Chair				
	should be certified ANSI/ BIFMA as				
	per ANSI X5.1- 2002. Chair should				
	support weight of 300 pounds or				
	under.	Nos	164.00	37,543.00	61,57,052.00
138	JGM/ AGM Chairs/ Board Room				

Task Chair that should have sizes of: Overall Height: 37 ³ ⁄ ₄ ", Seat Depth :16-18" (adjustable) Overall Width : 26.75". Seat :The contoured seat should be constructed of molded polypropylene insert with molded polyurethane foam. The foam should have a nominal ¹ ⁄ ₂ "- 1 ¹ ⁄ ₂ " thickness and have waterfall edges. Back : the suspension back should be constructed of thermoplastic urethane (TPU), stretched and fastened onto a structural frame (Arc Span) on the bottom and fastened at the top by a Y- Tower made of an injection molded glass-filled nylon. Lumbar Pad :the lumbar pad should be constructed of unfilled nylon and should attach to and slides up and down on an acetal lumbar bow. Arms : Each arm should have an arm support stem of glass- filled nylon with self-skinning polyurethane arm pads. Arms should be height adjustable. Tilt : the tilt mechanism should be made of 2 fiberglass leaf springs, a lead-screw- driven tension adjustment, and a stamped steel housing. The tilt mechanism should also be in a 4- piece, snap-together polypropylene cover. The tilt tension adjustment should have 18 full revolution turns. Base :the chair base should house a unitized pneumatic cylinder seat height adjustment mechanism contained in 2 steel tubes, the inner tube should slide and rotate in a bushing within an outer tube. Warranty:12 years 3 shift warranty. Chair should be certified with BIFMA/CMD-1-2002. The should have a weight bearing capacity of 350 pounds or under.	Nos	590.00	29,914.00	1,76,49,260.00

139	ED Chairs				
	Task chair ht size seat height 16-				
	20.5" seat depth 16.25" and seat width				
	19.25". The tilt mechanism should be				
	2 fiberglass leaf springs, a gear-driven				
	tension adjustment, and a cast				
	aluminum housing. A 3-piece,				
	polycarbonate ABS blend cover shall				
	snap together to enclose the tilt				
	mechanism. The back-to seat tilt ratio				
	shall be 2° to 1° when the chair is				
	reclined from a neutral angle. The				
	molded back should be a durable				
	polypropylene attached to a loop-				
	shaped support spine made from				
	glass-filled Nylon 6. It should support				
	and distribute the user's weight evenly				
	over the entire back of the chair and				
	shall retain its original shape when the				
	chair is unoccupied. The seat should				
	be a durable, breathable AireWeave				
	material stretched within a carrier ring				
	and fitted into an outer frame. The				
	AireWeave material should be a				
	woven blend and a solution-dyed				
	polyester yarn. It should support and				
	distribute the user's weight evenly				
	over the seat of the chair and shall				
	retain its original shape when the chair				
	is unoccupied. Adjustable Lumbar pad				
	should be a molded polypropylene				
	thermoplastic secured to a bow-				
	shaped attachment. The bow-shaped				
	attachment (a.k.a. lumbar bow) shall				
	be molded-in nylon. The pad should				
	be approximately .130° thick. The				
	handles of the lumbar support should				
	be made from glass filled hylon				
	(GFPA). The chair base should be 5				
	star with casters should house a				
	unitized single-stage pneumatic seat				
	acentariand in 2 steel tubes, on innon				
	tube shall slide and notate in a hushing				
	tube shall shde and rotate in a bushing				
	within an outer tube. The outer tube				
	shall be coaled black and shall have a				
	the base and an unner and that shall				
	the base, and an upper end that shall				
	Chair should be tested and more than				
	Chair should be tested and warranted				
	for use by persons 350 pounds and				
	under. Warranty: the chair should	N	70.00	47 514 00	22.25.000.00
	carry a 12 year 3 shift warranty. The	INOS	70.00	47,514.00	33,25,980.00

		chair should meet the California Technical Bulletin 117-2013 fire safety standard and ANSI/BIFMA X5.1-2017.				
140	NS	DGM/ Manager/ Astt. Manager Chair Providing HIGH back revolving chairs, Chair seat made up of insert moulded Polyurethane Foam upholstered with foam laminated mesh fabric, insert moulded foam assembled over a load bearing plastic seat cover, back is made up of two piece injection moulded frame, inner frame upholstered with mesh fabric and mounted on the main assembly, back adjustable lumbar support for achieving comfortable seating posture, seat size 44.5 - 52.5 cm depth (approx.), 46.4 - 51.0 cm width (approx.), sub assembly back size 55.5 cm- 62 cm height. (approx.), effective back height from Seat - 57 cm (approx.), polyurethane foam for seat having density 65±4 kg/m3, armrest top injection moulded in polyurethane and mounted on the injection moulded height adjustable type armrest, armrest height adjustable up to 4.5 cm (approx) in 3 steps & width movement adjustable, 360 degree revolving type. mechanism, single point control for seat and back adjustment, front pivot for tilt, tilt adjustment for back in 3position locking with antishock feature, pneumatic height adjustment of 8.5 cm spine bracket made of aluminum die cast piece connecting to				
		back with mechanism, pedestal made of die cast alunimium fitted with 5 nos. twin wheel castors (castor wheel dia. 6.0 cm approx.), base pedestal dia 65.0cm (approx.) and pitch center dia. 71.0 cm with castors, twin wheel castors injection moulded in Nylon etc. all complete as per manufacturers specification, approved sample and direction of Engineer in Charge	Nos	240.00	10.043.00	47 86 320 00

141	NS	Other Chairs & Workstation Chairs Providing and placing medium Back chairs . Chair seat made up of insert				
		moulded Polyurethane Foam				
		upholstered with foam laminated				
		mesh fabric, insert moulded foam				
		assembled over a load bearing plastic				
		seat cover, back is made up of two				
		piece injection moulded frame, inner				
		frame upholstered with mesh fabric				
		and mounted on the main assembly,				
		back adjustable lumbar support for				
		achieving connortable seating posture,				
		seat size $44.5 - 52.5$ cm depth (approx) $46.4 - 51.0$ cm width				
		(approx), 40.4 - 51.0 cm which (approx) sub assembly back size 55.5				
		(approx.), sub-assembly back size 55.5 cm_{-} 62 cm height (approx) effective				
		hack height from Seat - 57 cm				
		(approx) polyurethane foam for seat				
		having density 65+4 kg/m3, armrest				
		top injection moulded in				
		polyurethane and mounted on the				
		injection moulded height adjustable				
		type armrest, armrest height				
		adjustable up to 4.5 cm (approx) in 3				
		steps, 360 degree revolving type.				
		mechanism, single point control for				
		seat and back adjustment, front pivot				
		for tilt, tilt adjustment for back in				
		3position locking with antishock				
		feature, pneumatic height adjustment				
		of 8.5 cm spine bracket made of				
		aluminum die cast piece connecting to				
		back with mechanism, pedestal made				
		of die cast alunimium fitted with 5				
		nos. twin wheel castors (castor wheel				
		dia. 6.0 cm approx.), base pedestal dia				
		65.0cm (approx.) and pitch center dia.				
		71.0 cm with castors, twin wheel				
		castors injection moulded in Nylon				
		etc. all complete as per manufacturers				
		specification, approved sample and	ŊŢ	724.00	1405700	1 00 00 0 00 00
	-	direction of Engineer-in-Charge	NOS	/24.00	14,957.00	1,08,28,868.00
		IUIAL CHAIRS FOR VVIP				
		SEATINGS, SENIOR OFFICER'S				
		CHAIR, VISITOR CHAIR,				1 53 38 565 00
		AND HINIOD VISITOD CHAID				4,33,30,303.00
		AND STAFF CHAIR				
	1	TOTAL FOR INTERIOR WORKS				
		(NON-SCHEDULE ITEMS) – "A"				43,46,91,967.40

В		PLUMBING WORKS				
		SUBHEAD 13: SANITARY INSTALLATIONS				
142	N.S	Providing and fixing sink mixer with swivel spout including cutting and making good the wall complete as per required.	Each	22.00	3,524.00	77,528.00
143	N.S	Providing and fixing toilet tissue paper dispenser wall mount -Medium Traffic paper type C fold/ M fold capacity as per requirement .	Each	40.00	2,218.00	88,720.00
144	N.S	Providing and fixing Electrical storage water heaters of adequate capacity fixing on wall with dash fastener complete as per manufacturers specifications. Horizontal/vertical outlets fixed to floor with all accessories.				
144.1		5 Liters water mounted heater (Toilet)	Each	36.00	6,800.00	2,44,800.00
145	N.S	Supplying, Installation, Testing and Commissioning C.P. Pillar cock with aerator including cutting and making good the wall wherever required.	Each	90.00	2,550.00	2,29,500.00
146	N.S	Supplying, Installation, Testing and Commissioning of twin flush concealed cistern with knob and frame and fittings, nuts, bolts and gasket etc. complete including cutting and making good the wall wherever required.	Each	78.00	5,100.00	3,97,800.00
147	N.S	Supplying, Installation, Testing and Commissioning urinal partition of size 90x320x720 mm deep. including cutting and making good the wall wherever required.	Each	76.00	3,570.00	2,71,320.00
148	N.S	Providing and fixing white vitreous china with battery based infrared sensor operated urinal of approx. size 610 x 390 x 370 mm having pre & post flushing with water (250 ml & 500 ml consumption), having water inlet from back side, including fixing to wall with suitable brackets all as per manufacturers specification and direction of Architect/Engg/DECCI	Each	86.00	18,310.00	15.74 660 00

	I		I	I	1 1	
149	N.S	Providing and fixing, testing and commissioning of (Health faucet) with 1mtr. Long easy flex tube in chrome finish & with hook etc. complete.	Each	88.00	1,937.00	1,70,456.00
150	N.S	Providing and making arrangement for shut-off the water supply line in to the tank comprising motorized valve, liquid level controller to control cut-in and cut-out of motorized valve when the water is low and high in Overhead water tank complete with necessary electrical works, probs etc.				
150.1	N.S	40mm dia	Each	1.00	18,159.00	18,159.00
150.2	N.S	65mm dia	Each	1.00	37,561.00	37,561.00
151	N.S	Supplying automatic 'NO-Touch ' SS electric hand-driers complete with all accessories & fittings.	Each	42.00	12,659.00	5,31,678.00
152	N.S	Providing and fixing white vitreous china extended wall mounting automatic water closet of size 700 x 410 x 535 mm 305 mm WD	Each	7 00	1 00 980 00	7 06 860 00
		Soft Close Seat Cover Complete intelligent EWC set with remote control, Automatic opening and closing seat cover with				.,,
		three cleansing modes to cover all requirements of hands-free hygiene & comfort and six water temperature & five water volume adjustments for				
		comfort of use Water pressure and heating protection devices for safety of use Auto flucking when user welks away				
		TOTAL OF SANITARY INSTALLATIONS				43,49,042.00
		SUBHEAD 14: SOIL, WASTE, RAIN WATER PIPES				
		Note: Rates quoted for this subhead are inclusive of cutting hole in RCC slabs/beams by diamond core cutting machine and making good the same as per satisfaction of Project Manager/Site-in-charge for which nothing extra will be paid. Agency				

		shall be provide suitable size sleeves for fixing of pipes & fixtures.				
153	N.S	Providing and fixing Poly propylene Trap with minimum 50mm water seal with rubber seal on inlet to push fit hopper for indirect waste connections.				
153.1	N.S	a) 110 mm inlet & 110 mm outlet.	Each	132.00	1,967.00	2,59,644.00
154	N.S	Providing and fixing stainless steel grating (without hole type) approved make and quality grade 304 on top of floor trap. The rate includes the cost of all ancillary works and material as required to complete the works.				
154.1	N.S	80mm size	Each	58.00	389.00	22,562.00
154.2	N.S	127mm Size	Each	132.00	554.00	73,128.00
155		Providing and fixing sound insulated Polypropylene piping system with 3 layer pipe, push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 22 dBA, with all necessary fittings, supports, fitted with factory fitted lip ring (Inside toilets & kitchens). Nothing extra will be paid for supports.				
155.1	N.S	40 mm outer dia	Meter	153.00	573.00	87,669.00
155.2	N.S	75mm outer dia	Meter	98.50	887.00	87,369.50
155.3	N.S	110 mm outer dia	Meter	759.50	1,382.00	10,49,629.00
156	N.S	Providing and fixing PP clean out plug for cleaning.				
156.1		For 110 OD Pipe	Each	59.00	324.00	19,116.00
157		Providing and fixing Upvc CLEANOUT PLUG for cleaning.				
157.1	N.S	For 110 OD Pipe	Each	2.00	114.00	228.00
157.2	N.S	For 160 OD Pipe	Each	2.00	318.00	636.00
	1					
158	12.41	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion i) Single socketed pipes				
-------	--------------	--	-------	--------	----------	--------------
158.1	N.S	160mm diameter	Meter	85.00	1,408.00	1,19,680.00
159	12.42	Providing and fixing on wall face unplasticised - PVC moulded fittings/accessories for unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion.				
159.1	12.42.1	Coupler				
159.2	N.S	160mm	Each	17.00	308.00	5,236.00
		TOTAL for SOIL, WASTE, RAIN WATER PIPES				17,24,897.50
		SUBHEAD 15: WATER SUPPLY INTERNAL				
160	18.7	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Architect. Internal work Exposed on wall				
160.1	N.S	65 mm nominal outer dia Pipes	Meter	105.00	1,960.00	2,05,800.00
160.2	N.S	80mm nominal outer dia pipes	Meter	24.00	2,547.00	61,128.00
161	DSR (E&M)	Supplying, laying/ fixing, testing and commissioning of following nominal sizes of hot water piping inside the building (with necessary clamps, vibration isolators and fittings but excluding valves, strainers, gauges etc.) duly insulated with following closed cell elastometric nitrile rubber of minimum 45 Kg / cu m density,				

161.1	N.S	 thermal conductivity 0.037 W/MK or better at 20 deg mean temperature class 'O' insulation applied by suitable adhesive complete including repairing of damage to building etc. as per specifications and as required complete in all respect. 20 mm dia(19 mm thick insulation) 	Meter	65.00	125.00	8,125.00
162	18.10	Providing and fixing G.I. pipes complete with G.I. fittings and clamps, i/c cutting and making good the walls etc.				
162.1	N.S	65mm dia nominal bore	Matar	42.00	816.00	24 272 00
		TOTAL for WATER SUPPLY	Wieter	42.00	810.00	34,272.00
		INTERNAL				3,09,325.00
		TOTAL FOR PLUMBING WORKS (NON-SCHEDULE ITEMS) – "B"				63,83,264.50
С		SUBHEAD 16: SIGNAGES				
		Suspended-Aluminium Modular Signage using Aluminium Alloy 6063 extrusion with Anodizing (The thickness of the anodization is typically 30 microns. The integrity of the anodize coating is tested to meet the international specifications ISO 2143-1981.) With lifetime Warranty in normal working condition. Clear Cover : Clear UV protected 1mm thick Poly carbonate Sheet with Non Glare/Glossy Finish. Plastic End Cap : High Quality ABS End Caps with Screws which can be fastened into the extrusion. Graphics : Photo paper Insert Hanging cable and Fastening Element to be made of SS 304 Size : 150MM X 200MM				
				153	1,607.00	2,45,871.00

1	ĺ	1		I	
164	NS	Door Mounting			
104	11.5	Aluminium Modular Signage using			
		Aluminium Alloy 6063 extrusion with			
		Anodizing (The thickness of the			
		anodization is typically 30 microns			
		The integrity of the anodize coating is			
		tested to meet the international			
		specifications ISO 2143-1981.) With			
		lifetime Warranty in normal working			
		condition. Clear Cover : Clear UV			
		protected 1mm thick Poly carbonate			
		Sheet with Non Glare/Glossy Finish.			
		Plastic End Cap : High Quality ABS			
		End Caps with Screws which can be			
		fastened into the extrusion.			
		Graphics : Photo paper Insert			
		Size : 150MM X 200MM			
			457	1,224.00	5,59,368.00
165	N.S	Suspended			
		Suspended-Aluminium Modular			
		Signage using Aluminium Alloy			
		thickness of the anodization is			
		typically 30 microns. The integrity of			
		the anodize coating is tested to meet			
		the international specifications ISO			
		2143-1981) With lifetime Warranty			
		in normal working condition			
		Clear Cover : Clear UV protected			
		1mm thick Poly carbonate Sheet with			
		Non Glare/Glossy Finish.			
		Plastic End Cap : High Quality ABS			
		End Caps with Screws which can be			
		fastened into the extrusion.			
		Graphics : Photo paper Insert			
		Hanging cable and Fastening Element			
		to be made of SS 304			
		Size : 210MM X 150MM	16	1 0 1 2 0 0	20 502 00
			10	1,912.00	30,392.00
166	N.S	Directional Signs			
		Suspended-Aluminium Modular			
		Signage using Aluminium Alloy			
		6063 extrusion with Anodizing (The			
		thickness of the anodization is			
		typically 30 microns. The integrity of			
		the anodize coating is tested to meet			
		the international specifications ISO			
		2143-1981.) With lifetime Warranty			
		in normal working condition.			
		Clear Cover : Clear UV protected			

		1mm thick Poly carbonate Sheet with Non Glare/Glossy Finish. Plastic End Cap : High Quality ABS End Caps with Screws which can be fastened into the extrusion. Graphics : Photo paper Insert Hanging cable and Fastening Element to be made of SS 304 Size : 900MM X 300MM	 		
			28	1,377.00	38,556.00
167	N.S	Floor DirectorySuspended-AluminiumModularSignage usingAluminium Alloy6063 extrusion with Anodizing (Thethickness of the anodization istypically 30 microns. The integrity ofthe anodize coating is tested to meetthe international specifications ISO2143-1981.)With lifetime Warrantyin normal working condition.Clear Cover : Clear UV protectedImm thick Poly carbonate Sheet withNon Glare/Glossy Finish.Plastic End Cap : High Quality ABSEnd Caps with Screws which can befastened into the extrusion.Graphics : Photo paper InsertHanging cable and Fastening Element			
		Size : 600MM X 1020MM	27	6,426.00	1,73,502.00
168	N.S	5MM thick Acrylics letter cut letters (Colour as per Architect) Size : 4" X 4"	 18	24,480.00	4,40,640.00
169	N.S	Photo luminescent rigid plastic, 2 mm thickness, Printed on High Quality gloss paint with UV resistance, 5 years warranty, Material Used - Non Radioactive, non-phosphorous, non toxic and lead free Time after removing the light source (in minutes) : 60 minutes, Luminescent intensity			
		Size : 4.5" X 4"	 18	6,732.00	1,21,176.00

1	i.				1 1	
170	NC	Eine Enit			+	
170	N.5	Fire Exit				
		Photo luminescent rigid plastic, 2 mm				
		thickness, Printed on High Quality				
		gloss paint with UV resistance, 5				
		years warranty, Material Used - Non				
		Radioactive, non-phosphorous, non				
		toxic and lead free Time after				
		removing the light source (in minutes)				
		: 60 minutes, Luminescent intensity				
		Size : 16" X 6"				
				20	2,754.00	55,080.00
171	NG					
1/1	N.S	Fire Evacuation Plan				
		Supply of imported cast Sandwiched				
		Transparent Acrylic boards				
		(4mm+4mm) with 10mm dia 2 inch				
		length SS studs fixed on 4 sides -				
		Content printed on 3M Clear with 3M				
		Photo luminescent Film as installed				
		between two Acrylics				
		Size : 23.5" X 33"				
-				20	3,519.00	70,380.00
		TOTAL OF SIGNAGES WORK				
		(C)				17,35,165.00
D		SUBHEAD 17: KITCHEN EQUIPMENT (ALL STAINLESS STEEL)				
-						
		Service Area				
		Service Area				
172	NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan				
172	NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650				
172	NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650	No.	2	78,650,00	1.57.300.00
172	NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650	No.	2	78,650.00	1,57,300.00
172	NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650	No.	2	78,650.00	1,57,300.00
172	NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan	No.	2	78,650.00	1,57,300.00
172	NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan	No.	2	78,650.00	42,350.00
172 173 174	NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard	No.	2	78,650.00	1,57,300.00 42,350.00
172 173 174	NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long	No.	2	4,235.00	1,57,300.00
172 173 174	NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long	No. No.	2 10 2	78,650.00 4,235.00 22,990.00	1,57,300.00 42,350.00 45,980.00
172 173 174	NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long	No. No.	2 10 2	78,650.00 4,235.00 22,990.00	1,57,300.00 42,350.00 45,980.00
172 173 174 175	NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN	No. No.	2 10 2	78,650.00 4,235.00 22,990.00	1,57,300.00 42,350.00 45,980.00
172 173 174 175	NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan	No. No.	2 10 2	78,650.00 4,235.00 22,990.00	1,57,300.00 42,350.00 45,980.00
172 173 174 175	NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan Size : 800x650	No. No.	2 10 2	78,650.00 4,235.00 22,990.00	1,57,300.00 42,350.00 45,980.00
172 173 174 175	NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan Size : 800x650	No. No.	2 10 2 2	78,650.00 4,235.00 22,990.00 50,820.00	1,57,300.00 42,350.00 45,980.00 1,01,640.00
172 173 174 175	NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan Size : 800x650	No. No. No.	2 10 2 2	78,650.00 4,235.00 22,990.00 50,820.00	1,57,300.00 42,350.00 45,980.00 1,01,640.00
172 173 174 175 176	NS NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan Size : 800x650 1/1 GN Pan	No. No. No.	2 10 2 2	78,650.00 4,235.00 22,990.00 50,820.00	1,57,300.00 42,350.00 45,980.00 1,01,640.00
172 173 174 175 176	NS NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan Size : 800x650 1/1 GN Pan	No. No. No. No.	2 10 2 2 2 4	78,650.00 4,235.00 22,990.00 50,820.00 4,235.00	1,57,300.00 42,350.00 45,980.00 1,01,640.00 16,940.00
172 173 174 175 176	NS NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan Size : 800x650 1/1 GN Pan	No. No. No. No.	2 10 2 2 2 4	78,650.00 4,235.00 22,990.00 50,820.00 4,235.00	1,57,300.00 42,350.00 45,980.00 1,01,640.00 16,940.00
172 173 174 175 176 177	NS NS NS NS NS NS	Service Area Hot Bain Marie for 5nos .1/1 GN Pan Size : 1800x650 1/1 GN Pan Sneeze Guard Size : 1800mm Long Ice Cold Bain Marie for 2nos. 1/1 GN Pan Size : 800x650 1/1 GN Pan Size : 800x650	No. No. No. No.	2 10 2 2 2 4	78,650.00 4,235.00 22,990.00 50,820.00 4,235.00	1,57,300.00 42,350.00 45,980.00 1,01,640.00 16,940.00

	<u> </u>				15,730.00	31,460.00
178	NS	Microwave Oven> 30L	Nos.	2	27,830.00	55,660.00
170	NIS	Exhaust Hood				
1/9		Size : 2300x700				
		5120 . 2500x700	No.	1	93,170.00	93,170.00
		Receiving Area				
180	NS	Work Table with Sink				
		Size : 1500x650x850+150				
			No.	1	42,350.00	42,350.00
181	NS	Platform Trolley				
		Size : 900x600x1000				
			No.	2	21,780.00	43,560.00
182	NS	Bussing Trolley				
102		Size · 900x600x1000				
		5120 . 900000001000	No.	1	26,620.00	26,620.00
102	NG	Store				
183	NS	SS Pallet				
		Size : 1200x600x150	No.	2	15,730.00	31,460.00
						· · · · · · · · · · · · · · · · · · ·
		Prep. Area				
184	NS	Work Table with Sink				
		Size : 2000x650x850+150				
			No.	1	52,030.00	52,030.00
185	NS	Garbage Bin				
		Size: Syntex	No	1	10,285.00	10,285.00
186	NS	3 Door U/c Ref.				
		Size: 1800x700x850+150	No.	1	1,16,160.00	1,16,160.00
		Kitchen				
187	NS	Combi Oven with Stand				
		Size : Rational				
			No.	1	8,47,000.00	8,47,000.00
		Pick up Area				
188	NS	Pick up Counter with 20HS				
		Size : 1500x600x850+450+300	No	2	72 600 00	1 45 200 00
			110.	۷	12,000.00	1,43,200.00
	1					

		Dish Wash Area				
189	NS	Dirty Dish landing Table with Garbage Chute				
		Size: 1800x750x850 + 150	No.	1	43,560.00	43,560.00
190	NS	U/c Ref. with 2OHS				
		Size: 1500x600x850+450+300	No.	2	72,600.00	1,45,200.00
191	NS	Garbage Bin				
		Size : Syntex	No.	2	10,285.00	20,570.00
192	NS	Two Sink Unit				
		Size : 1200x750x850+150	No.	1	52,030.00	52,030.00
193	NS	Pre-Rinse Spray Unit				
170		Size : T&S	No.	1	26,620.00	26,620.00
194	NS	Grease Trap Size : 600x450x325	No.	1	66,550.00	66,550.00
						,
195	NS	Dish Washer-Hood Type				
		Size : Winterhalter-P50	No.	1	3,26,700.00	3,26,700.00
196	NS	Vapour Hood				
		Size : 900x900	No.	1	43,560.00	43,560.00
197	NS	Clean Dish Landing Table				
		Size : 1100x750x850+150	No.	1	27,830.00	27,830.00
198	NS	SS Wall Mounted Glass Rack Shelf			+	
170	110	Size : 900x540				
			No.	1	10,890.00	10,890.00
199	NS	Water Softener for Dish Washer	No.	1	1,33,100.00	1,33,100.00
200	NS	Clean Dish Storage Rack				
		Size : 900x450x1800	No.	2	27,225.00	54,450.00
201	NS	Pot Wash haudi to be a part of Civil Work and To be Paid as per Measurement of Actual Work Done				
		To be paid in their respective heads in		1		

		Civil Works				
		Hoods				
202	NS	Exhaust Hood				
		Size : 4500x900	No.	1	1,81,500.00	1,81,500.00
203	NS	Exhaust Hood				
		Size : 6550x900	No.	1	2,64,990.00	2,64,990.00
204	NC	Extra Air Curtain with Sansar				
	IND	Size : 1500mm long	No.	1	39,930.00	39,930.00
205	NS	Insect-O-Cutor				
		Size : Wall Mounted	No.	6	10,285.00	61,710.00
206	NS	Flushing Hose Unit	Na	1	78 (50.00	78,650,00
			INO.	1	/8,050.00	78,650.00
		TOTALOFKITCHENEQUIPMENTS (D)				34,30,955.00
		TOTAL FOR INTERIOR & FURNISHING WORKS (NON- SCHEDULE ITEMS) (A + B+ C + D)				44,62,41,351.90
		TOTAL FOR INTERIOR & FURNISHING WORKS "SCHEDULE-I" [(SCHEDULE (i) + NON SCHEDULE ITEMS(ii)] –				52,75,39,723.42

Explanatory Notes for BOQ:

i) The quantities shown in above Schedules are approximate and are as a guide to give the tenderer(s) an idea of quantum of work involved. The DFCCIL reserves the right to increase/ decrease and/or delete or include any of the quantities given above as per site conditions.

		BILL OF QUANTITIES OF ELECTR	ICAL W	ORKS	-	
BO Q Item No.	DSR 2018 Item No.	Item Description	Unit	Qty	Rate	Amount
II	110	SCHEDULE-II				
Α		ELECTRICAL WORKS				
(i)		SCHEDULE DSR ITEMS				
		SUBHEAD 1 : INTERNAL WIRING				
S. No.	CPW D- 2018/	Description				
	MK					
1.0		SUB-HEAD : INTERNAL WIRING				
		Note :				
		Rates of only ISI marked steel. conduit. FRLS PVC				
		insulated copper conductor single core cables,				
		moulded plate type switches in passivated box and				
		FRLS PVC insulated earth wire have been taken in				
		the following items unless otherwise specified and as ner specification				
1.1	1.3	Wiring for Light point / Fan point / Exhaust Fan point / Call Bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed steel. conduit , with modular switch ,modular plate ,suitable GI box and earthing the point with 1.5 sq.mm FR PVC insulated copper conductor single core cable etc. as required.				
a	1.3.3	Group - C	Point	2997	1,063.55	3,187,459.35
1.2	1.54	Wiring for group controlled (looped) light point/fan point/exhaust fan point/ call bell point (without independent switch etc.) with 1.5 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed steel conduit and earthing the point with 1.5 sq. mm FRLS PVC insulated copper conductor single core cable etc. as required.				
a	1.5 4 .	Group C	Point	3124	620.03	1,936,986.22
1.3	5	Wiring for circuit/ submain wiring along with earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed steel conduit as required.				
a	1.7.1	2 X 1.5 sq.mm +1 X 1.5 sq.mm earth wire	Metre	8500	182.44	1,550,740.00

b	1.7.2	$2 \times 2.5 \text{ sg. mm} + 1 \times 2.5 \text{ sg. mm}$ earth wire	Metre	26000	200.92	5,223,920.00
c	1.7.3	2 X 4 sq.mm +1 X 4 sq.mm earth wire	Metre	180	230.48	41,486.40
d	1.7.4	2×6 sq. mm + 1 $\times 6$ sq. mm earth wire	Metre	1400	311.97	436,753.80
e	1.7.7	4 X 2.5 sq.mm +2 X 2.5 sq.mm earth wire	Metre	2000	297.18	594,364.62
f	1.7.9	4 X 6sq.mm +2X 6 sq.mm earth wire	Metre	1280	464.16	594,124.80
g	1.7.1	4×10 sq.mm +2X 6 sq.mm earth wire	Metre	95	587.34	55,797.54
0	0					,
h	1.7.1 1	4 X16 sq.mm +2X 6 sq.mm earth wire	Metre	875	829.89	726,150.25
1.4		Supplying and drawing following sizes of FRLS PVC insulated copper conductor, single core cable in the existing surface/recessed steel conduit/Raceway as required.				
а	1.17. 12	3 x 2.5 sq. mm	Metre	26000	65.83	1,711,580.00
1.5	1.5	Wiring for light / power plug point with 2 x 4 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed steel conduit along with 1 No. 4 sq.mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	Metre	28600	231.95	6,633,770.00
1.6	1.6	Wiring for light / power plug point with 4 x 4 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed steel conduit along with 2 No. 4 sq.mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	Metre	947	343.72	325,501.36
1.7	1.31	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 3 pin 5/6 A modular socket outlet and 5/6 A modular switch, connections etc. as required.	each	1702	351.60	598,424.90
1.8	1.32	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess ,including providing and fixing 6 pin 15 / 16 & 5 / 6 amps modular socket outlet and 15 / 16 amps modular switch, connection, etc.as required.	each	947	434.07	411,061.92
1.9	1.24. 4+1.2 7.1=9 7.31+ 212.9 8=31 0.29	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess ,including providing and fixing 3 pin 5 / 6 amps modular socket outlet without modular switch,connection,painting etc.as required.	each	123	310.29	38,165.67
1.10	1.24. 3+1.2 7.1=1 15.47 +212. 98=3 28.45	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess ,including providing and fixing 15 / 16 amps modular switch,connection,painting etc.as required.	each	36	328.45	11,824.20
1.11	1.56	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 2 nos. 3 pin 5/6 A modular socket outlet and 2 nos. 5/6 A modular switch,	each	1049	510.14	535,136.86

838 | Page

		connections etc. as required. (For light plugs to be used				
		in non residential buildings). UPS & IV SOCKET				
1.12	1.20	Supplying and fixing of following sizes of steel conduit				
		along, with accessories in surface/recess including				
		painting in case of surface conduit, or cutting the wall and making good the same in case of recorded conduit				
		as required				
a	1.20.	25 mm	Metre	13825	144.37	1,995,875.02
	2					· · ·
b	1.20. 3	32 mm	Metre	60	178.32	10,699.14
с	1.20.	40 mm	Metre	60	256.16	15,369.36
d	1.20.	50 mm	Metre	60	322.53	19,351.74
1 1 2	5	Construction of finite 20 A 240 M CDN Indext informer	1.	6	1 000 26	C 400 14
1.13	2.18	Supplying and fixing 30 A, 240 V, SPN industrial type socket outlet, with 2 pole and earth, metal enclosed plug	each	6	1,080.36	6,482.14
		top along with 30 A "C" curve, SP, MCB, in sheet steel				
		enclosure, on surface or in recess, with chained metal				
		cover for the socket out let and complete with				
		connections, testing and commissioning etc. as required.				
1.14	2.20	Supplying and fixing 30 A, 415 V, TPN Industrial type	each	10	2,672.51	26,725.08
		socket outlet, with 4 pole and earth, metal enclosed plug				
		top along with 30 A "C" curve, IPMCB, in sheet steel enclosure on surface or in recess with chained metal				
		cover for the socket out let and complete with				
		connections, testing and commissioning etc. as				
		required.				
		TOTAL OF INTERNAL WIRING				26 687 750 00
						20,007,750.00
2.0		SUB-HEAD : ERRECTION OF FANS & LIGHT				
21	4012/	FIATURES Supplying and fixing Circular C I Box for ceiling fan	each	265	48.40	12 826 00
2.1	2016/	internal dia 140 mm, 73 mm height, toppled of 1.5mm	cuen	205	-010	12,020.00
	CIVI	thick MS sheet as required.				
	L					
2.2	1.25	Supplying and fixing two module stepped type	each	265	299.74	79,430.04
		switch box including connections but excluding				
		modular plate etc. as required.				
2.3	1.41	Installation, testing and commissioning of prewired	each	5501	147.00	808,671.75
		fluorescent fitting/compact fluorescent fitting of all				
		types complete with all accessories and tube etc.				
		directly on ceiling/wall including connections with 3x1.5 sq mm EPLS PVC insulated conner conductor				
		single core cable and earthing as required.				
2.4	1.42	Installation, testing and commissioning of prewired	each	620	313.97	194,663.26
		fluorescent fitting /compact fluorescent fitting of all				
		types, complete with all accessories and tube etc.				

		including supplying and fixing ball and socket arrangement, 2 nos down rods of 20mm dia x1.6mm thick steel conduit up to 30cm length, painting and wiring the down rod and connections with 3x1.5 sq.mm FRLS PVC insulated copper conductor, single core cable and earthing etc as required .				
2.5	1.45	Installation, testing and commissioning of ceiling fans/bracket fan of all sizes including wiring the down rod .of standard length (up to 30 cm) with 3x1.5 sq.mm FR PVC insulated copper conductor single core cable including providing and fixing phenolic laminated sheet cover on the fan box etc. as required.	each	265	177.55	47,051.88
2.6	1.50. 1+1.5 1	Installation of exhaust up to 450mm sweep & in the existing opening, including making the hole to suit the size of the above fan, making good the damage, connection, testing, commissioning etc. as required including fixing of louvers/shutters complete	each	169	465.01	78,587.37
		TOTAL OF ERRECTION OF FANS & LIGHT FIXTURES				1,221,230.00
2.0						
3.0	56	SUB-HEAD : EARTHING	Sot	6	10 241 2	62 0/9 11
5.1	5.0	3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 metre long etc. with charcoal/ coke and salt as required.	361	0	10,341.3	02,046.11
3.2	5.15* 2=18 1*2= 362	Providing and laying G.I. tape 50 mm X 6 mm from earth electrode directly in ground as required	Metre	280	362.00	101,360.00
3.3	5.15	Providing and fixing 25 mm X 5 mm G.I. strip on surface or in recess for connections etc. as required.	Metre	1130	181.00	204,530.00
3.4	5.14	Providing and fixing 25 mm X 5 mm copper. strip on surface or in recess for connections etc. as required.	Metre	120	884.35	106,122.00
3.5	5.16	Providing and fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.	Metre	300	50.03	15,007.80
		TOTAL OF EARTHING				489,068.00
4.0		SUB HEAD . LICHTNING DEOTECTION				
4.0		SUD-HEAD . LIGHTMING FROTECTION				
4.1	6.2	Providing and fixing of lightning conductor finial, made of 25 mm dia 300 mm long, G.I. tube, having single prong at top, with 85 mm dia 6 mm thick G.I. base plate including holes etc. complete as required.	each	26	393.04	10,218.92
4.2	6.7	Providing and fixing G.I. tape 20 mm X 3 mm thick on parapet or surface of wall for lightning conductor complete as required.(For horizontal run)	RM	2600	91.37	237,561.48
4.3	6.8	Providing and fixing G.I. tape 20 mm X 3 mm thick on parapet or surface of wall for lightning conductor	RM	1390	143.14	198,958.90

		complete as required.(For vertical run)				
4.4	6.12	Providing and fixing testing joint, made of 20 mm X 3 mm thick G.I. strip, 125 mm long, with 4 nos. of G.I. bolts, nuts, chuck nuts and spring washers etc. complete as required	each	70	89.75	6,282.50
4.5	6.14	Providing and laying G.I. tape 32 mm X 6 mm from earth electrode directly in ground as required.	RM	1500	154.00	231,000.00
		TOTAL OF LIGHTNING PROTECTION				684,022.00
						,
5.0		SUB-HEAD : DISTRIBUTION BOARD				
5.1	2.3	Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 V, on surface/ recess complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator				
a	2.3.1	6 way, Double door	each	82	1,455.97	119,389.46
b	2.3.2	8 way, Double door	each	3	1,543.08	4,629.24
	2.7	pole and neutral, sheet steel for 415 volts on surface/recess complete with loose wire box, terminal connector for all incoming and outgoing circuits, duly prewired with suitable size FRLS PVC insulated copper conductor upto terminal blocks, tinned copper busbar,neutral link, earth bar, din bar, detachable gland plate, interconnections, powder painted including earthing etc. as required. (But without MCB / RCCB / Isolator)				
a	2.4.1	4 way (4 + 12), Double door, horizontal type	each	21	2,690.13	56,492.65
b	2.4.2	6 way (4 + 18), Double door	each	28	3,238.35	90,673.91
5.3	2.4.3	Supplying and fixing 5 amps. to 32 amps. rating, 240/415 V,10 KA, C' series, Miniature circuit breaker (MCB) suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.	each	29	4,033.98	110,963.40
a	2.10. 1	Single pole	each	3006	174.87	525,656.21
b	2.10. 3	Double pole	each	20	487.31	9,746.25
5.4	2.11	Supplying & fixing single pole, blanking plate in the existing MCB DB complete etc. as required.	each	6	7.21	43.26
5.5	2.2	Providing and fixing following rating and breaking capacity and pole MCCB with thermomagnetic release and terminal spreaders in existing cubicle panel board including drilling holes in cubicle panel, making connections, etc. as required.				

а	2.2.1	800 A, 50 KA,TPN MCCB	each	2	29,684.7 7	59,369.53
b	2.2.1	100 A,30KA,FPMCCB	each	8	6,468.00	51,744.00
		TOTAL OF DISTRIBUTION BOARD				1,034,730.00
6.0		SUB-HEAD : L.T CABLES				
6.1		Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 1.1 KV grade of following size direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc. as required				
а	7.1.3	Above 95 sq. mm and upto 185 sq. mm	Metre	10	308.93	3,089.30
b	7.1.2	Above 35 sq. mm and upto 95 sq. mm	Metre	76	296.36	22,523.36
с	7.1.1	Upto 35 sq. mm	Metre	431	283.50	122,186.66
6.2	7.5	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 1.1 KV grade of following size in the existing RCC / HUME / METAL pipe as required				
а	7.5.1	Upto 35 sq. mm	Metre	3950	27.18	107,361.00
b	7.5.2	Above 35 sq. mm and upto 95 sq. mm	Metre	681	41.46	28,234.26
с	7.5.3	Above 95 sq. mm and upto 185 sq. mm	Metre	189	56.13	10,607.77
0.3	9.1	supplying and making end termination of following sizes with brass compression gland including providing and crimping solderless plugs/ferrules of sizes PVC insulated PVC sheathed aluminum conductor armoured cable 1.1 KV grade.				
a	9.1.3 6	4 X 50 sq. mm (35mm)	Set	2	291.15	582.29
b	9.1.3 4	4 X 25 sq. mm (28mm)	Set	10	218.81	2,188.11
с	9.1.3 3	4 X 16 sq. mm (28mm)	Set	100	218.81	21,881.00
d	9.1.3 2	4 X 10 sq. mm (25mm)	Set	54	192.10	10,373.18
e	9.1.2	2 X 10 sq. mm /4x6mm (19mm)/4x6sqmm	Set	2	173.51	347.02
f	9.1.2	2 X 10 sq. mm /4x6mm (19mm)/2x6sqmm	Set	12	173.51	2,082.14
6.4	4.6	Supplying and installing following size of perforated Hot Dipped Galvanized Iron cable tray (Galvanization thickness not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required				
a	4.6.1 0	450 mm width X 62.5 mm depth X 2.0 mm thickness	Metre	820	1,262.91	1,035,584.31
		TOTAL OF LT CAPLES				1 367 040 00
		IUIAL OF L.I CABLES				1,307,040.00

1	1			l	l	1
7.0		FACADE LIGHTING				
7.1	DSR Façad e	Supply, Installation, Testing and Commissioning of LED RGBW Floodlight Luminaire for Facade lighting with die cast aluminium housing, with powder coating of following wattage. Luminaire shall be capable of producing dynamic color changing light with 16 million colors by DMX/Ethernet based control. The beam angle of the fixture shall be 30 deg as per the requirement. The luminaire shall have high optical efficiency, anti aging and anti UV PMMA/PC lenses. Luminaire shall be complete with driver and capable of operating at line voltage without any separate power supply from 120 to 270 V AC, 50 Hz, power factor > 0.9. High power LED's shall be SMD type and fixture shall have system efficacy at System level (Not Chip Level) >=40 LPW, Life of fixture (Including Driver): 50K Hrs. @ L70 Lumen maintenance at 35 °C Ambient Temperature. CRI \geq 70, PF >0.90 & THD<20%, minimum Internal Surge Protection 3KV, 10 kV external surge protector, must be having IP66 & IK \geq 06 Impact rating & Approbation-CE along with IEC Classification Class I, RoHS. Cables Connectors for DMX through wiring. Fixture shall be suitable to operate at ambient temperature range of -10°C to +50°C. The offered				
		Specifications mentioned in the tender.				
a	1.4	140 W	Nos.	9	65,775.0 0	591,975.00
7.2	DSR Façad e	Supply, Installation, Testing and Commissioning of LED RGBW Linear Wall Washer luminaire for Facade lighting with aluminium extruded housing with die cast aluminium end caps, with powder coating of following wattage. Luminaire shall be capable of producing dynamic color changing light with 16 million colors by DMX/Ethernet based control. The fixture to be with adjustabil tilting angle ± 95 deg with beam angle of the fitting 15X45 deg/25X40 deg asymmetric as per the requirement. The luminaire shall have high optical efficiency, anti aging and anti UV PMMA/PC lenses with Clear tempered glass. Luminaire shall be complete with driver and capable of operating at line voltage without any separate power supply from 120 to 270 V AC, 50 Hz, power factor > 0.9. High power LED's shall be SMD type and fixture shall have system efficacy at System level (Not Chip Level) >=40 LPW, Life of				

		fixture (Including Driver): 50K Hrs. @ L70 Lumen maintenance at 35 °C Ambient Temperature. CRI \geq 70, PF >0.90 & THD<20%, minimum Internal Surge Protection 3KV, 10 kV external surge protector, must be having IP66 & IK \geq 06 Impact rating & Approbation- CE along with IEC Classification Class I, RoHS. Cables Connectors in fixture to be of IP67 for Male/Female connectors for DMX through wiring. Fixture shall be suitable to operate at ambient temperature range of -10°C to +50°C. The offered fixture shall conform to the LED Wall Washer Specifications mentioned in the tender.				
a	2.4	40 W, 4 Feet	Nos.	780	34,240.0 0 20,280.0	26,707,200.00
0	2.5		INUS.	50	20,280.0	1,155,080.00
		TOTAL OF FAÇADE LIGHTING				28,434,855.00
8.0		SUB-HEAD : SERVICES: TELEPHONE/TV/DATA				
8.1	1.18. 3	Supplying, drawing, of 0.5sqm (4 pair) FR PVC insulated copper conductor, unarmored telephone cable in existing surface/ recessed steel /PVC conduit as required	Metre	300	25.19	7,555.78
8.2	1.19	Supplying and drawing co-axial TV cable RG-6 grade, 0.7 mm solid copper conductor PE insulated, shielded with fine tinned copper braid and protected with PVC sheath in the existing surface/ recessed steel/ PVC conduit as required.	Metre	3680	29.28	107,734.87
8.3	1.53	Supplying and drawing of UTP 4 pair CAT 6 LAN Cable in the existing surface/ recessed steel/ PVC conduit as required	Metre	73705	42.81	3,155,405.39
8.4		Supplying and fixing following modular switch/ socket on the existing modular plate & switch box including connections but excluding modular plate etc. as required.				
a	1.24. 6 + 1.27. 1	2 Pair telephone cord outlet (RJ-11)	each	932	317.42	295,838.24
b	1.24. 7 + 1.27. 1	TV antenna socket outlet	each	113	317.42	35,868.46

8.5		Supplying and fixing of following sizes of steel conduit along, with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required.				
а	1.20. 2	25 mm	Metre	39755	144.37	5,739,310.09
b	1.20. 3	32 mm	Metre	250	178.32	44,579.75
с	1.20. 4	40 mm	Metre	250	256.16	64,039.00
d	1.20. 5	50 mm	Metre	1550	322.54	499,939.56
		TOTAL OF SERVICES: TELEPHONE/TV/DATA				9,950,271.00
		TOTAL OF ELECTRICAL (SCHEDULED ITEM)- "A"				69,868,966.00
В	DSR Wet	FIRE FIGHTING WORK				
	Riser					
1		SUB HEAD-A (PIPING & VALVES)				
1.1	DSR	Providing, laying, testing & commissioning of 'C'				
	Wet	class heavy duty MS pipe conforming to IS 3589/IS				
	Riser	1239 including Welding, fittings like elbows, tees,				
		flanges, tapers, nuts bolts, gaskets etc. and fixing the				
		pipe on the wall/ceiling with suitable clamp/support				
		frame and painting with two or more coats of synthetic				
	71	25 mm dia	RM	3106	413.00	1 282 778 00
	7.1	32 mm dia	RM	141	462.10	65 156 10
	7.2	40 mm dia	RM	806	570.80	460 064 80
	7.4	50 mm dia.	RM	678	690.05	467.853.90
	7.5	65 mm dia.	RM	551	880.30	485,045.30
	7.6	80 mm dia.	RM	231	983.80	227,257.80
	7.7	100mm dia	RM	413	1314.35	542,826.55
	7.8	150mm dia	RM	818	1809.75	1,480,375.50
1.2		Supplying, fixing, testing and commissioning of				
		butterfly valve of PN 1.6 rating with bronze/gunmetal				
		seat duly ISI marked complete with nuts, bolts,				
		sizes as required :				
	11.6	150 mm dia	Nos	10	7627 35	76 273 50
	11.0		1105	10	1021.33	10,213.30
1.3	13	Supplying and fixing orifice plate made out of 6				
		mm thick stainless steel (Grade 304) with orifice of				
		required size to be fitted between flange & landing				
		valve of external and internal hydrants to reduce	Each	36	1131.95	40,750.20

1		pressure at the outlet to the level of 3.5 kg/cm^2				
		complete as required.				
1.4		Drawiding installation tasting and commissioning of				
1.4		non-return valve of following sizes confirming to				
		IS: 5312 complete with rubber gasket, GI bolts,				
		nuts, washers etc as required :				
	14.7	150 mm dia			15411.6	
			Nos	4	5	61,646.60
1.5		Providing, installation, testing and commissioning of				
		stainless steel Y-strainer fabricated out of 1.6 mm				
		dia holes with stainless steel flange.				
	15.3	150mm dia		1	9345.90	9,345.90
16		Supplying installation testing & commissioning				
1.0		of sprinkler flexible pipe (UL Listed) of stainless				
		steel complete with 15 NPT on reducer thread				
		with maximum working pressure of 1/5 PSI test pressure of 875 PSI (Burst) with branch line (Inlet)				
		25mm NPT male thread to sprinkler head (Outlet)				
		15mm NPT female thread with reducer, nipple, 2				
		side brackets, center bracket, stockbar of following sizes complete as required				
a	25.1	700mm	Set	1785	1175.80	2,098,215.10
b	25.2	1000mm	Set	1785	1350.30	2,409,610.35
19	NS	Providing and fixing gunmetal single acting air release				
1.9	10.0.	valve with screwed inlet 25 mm dia.	Nos	4	989.00	3,956.00
1.10		Providing & fixing flow switch in following sizes				
	23.2	M.S. pipe including connection etc as required.	Fach	9	7776.40	69 987 60
	23.2	TOTAL SUB HEAD-A (PIPING & VALVES)	Lacii	,	7770.40	9,781,143.20
2.0		SUB HEAD-B (FIRE HYDRANT ACCESSORIES)				
2.1		valve with instantaneous Gunmetal/Stainless Steel				
		coupling of 63 mm dia with cast iron wheel ISI marked				
		conforming to IS 5290 (Type -A) with				
		required :				
	9.1	Single headed stainless steel	Nos	27	6570.80	177,411.60
2.2		Supplying and fixing 63 mm dia, 15 m long RRL hose				
		pipe with 63 mm dia male and female couplings duly bound with GI wire rivets etc. conforming to				
		IS 636 (type-A) as required :				
	16.1	Gun metal	~			
	16.2	Stainless Steel (Grade 304)	Set	54	3887.75	209,938.50

2.3	17	Supplying and fixing first-aid Hose Reel with MS				
		construction spray painted in post office red,				
		conforming to 1S 884 complete with the following				
		20 mm nominal internal dia water hose				
		thermoplastic (Textile reinforced) type -2 as per IS:				
		12585				
		20 mm nominal internal dia gun metal globe valve				
		& nozzle.				
		Drum and brackets for fixing the equipmets on wall.				
		Connections from riser with 25 mm dia stop gun metal value $%$ M S. Dips and scalat				
		30 m	Nos	27	7376.60	100 168 20
		50 m	1105	<i>∠1</i>	1310.00	179,100.20
2.4		Supplying & fixing 63 mm dia gun metal short branch	<u> </u>			
		pipe with 20 mm nominal internal diameter size nozzle				
		conforming to IS 903 suitable for instantaneous				
		connection to interconnect hose pipe coupling as				
	10.0	required:				
	18.2	Stainless Steel (Grade 304)	Nos	27	1445.00	39,015.00
		TOTAL SUB HEAD-B (FIRE HYDRANT ACCESSORIES)				625 522 20
		ACCESSORIES)				025,555.50
3.0		SUB HEAD-C (SPRINKLERS ACCESSORIES)				
3.1		Providing, fixing, testing & commissioning of 15mm				
		dia quartzoid bulb type sprinklers of rating 68				
		degree centigrade with required accessories :				
a	21.1	Pendent Sprinkler	Nos	1954	424.40	829,277.60
b	21.2	Upright Sprinkler	Nos	1650	424.40	700,260.00
c	21.3	Horizontal side wall sprinkler	Nos	27	507.65	13,706.55
3.2	29	Providing, installation, testing & commissioning				
		of adjustable rosette plate for 15mm dia in white finish	Fach	1054	181 50	354 651 00
		TOTAL SUB HEAD-C (SPRINKLERS	Lati	1934	101.30	554,051.00
		ACCESSORIES)				1,897.895.15
		TOTAL FOR FIRE FIGHTING SYSTEM-"B"				12,304,571.65
						· ·
		TOTAL OF ELECTRICAL WORK (SCHEDULED				8,21,73,538.00
		$\mathbf{ITEM}) - (\mathbf{i}) \ (\mathbf{A} + \mathbf{B})$				

Explanatory Notes for BOQ:

- (i) All DSR items contain intem nos. and, if any discrepancy is found in nomenclature, then scheduled nomenclature of CPWD DSR 2016/2018/2019 will prevail.
- (ii) The rates of all CPWD DSR Items are already exclusive of GST. However, the rates of all items of DSR 2018 & 2019 are evaluated excluding GST component on DAR basis.
- (iii) The quantity mentioned in the Schedules is approximate and the DFCCIL reserves the right to increase / decrease the same as per site requirement.

3,740.00
3,740.00
3,740.00
3,740.00
3,740.00
3,740.00
3,740.00
3,740.00
3,740.00
9,291.00
-

	2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
С	SITC of recessed LED downlighter, made of pressure die cast aluminum housing including flange with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=110 lumens/watt and a minimum system lumen output of 1200 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	1,307	1,317.00	1,721,319.00
D	SITC of recessed LED downlighter with Zig bee/ Bluetooth enabled dimmable control gear, made of pressure die cast aluminum housing including flange with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100lumens/watt and a minimum system lumen output of 2000 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for	Nos.	1,338	4,569.00	6,113,322.00

	Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
E	SITC of surface mounted LED downlighter, made of pressure die cast aluminum housing including flange with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt and a minimum system lumen output of 1200 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347- 1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	276	1,411.00	389,436.00
F	SITC of LED bulkhead with integral electronic control gear, made of pressure die cast aluminum housing with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=110 lumens/watt and a minimum system lumen output of 1100 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP66, IK>=08, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted	Nos.	62	1,202.00	74,524.00

	from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
G	SITC of recessed LED downlighter with DALI dual channel/ Bluetooth enabled tuneable & dimmable control gear, made of pressure die cast aluminum housing including flange with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt and a minimum system lumen output of 1200 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 3000-6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61547 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	72	5,436.00	391,392.00
Н	SITC of recessed 3-4W LED step light with integral electronic control gear, made of pressure die cast aluminum housing with high efficiency PC/PMMA diffuser for homogeneous light distribution. Luminaire	Nos.	104	5,384.00	559,936.00
	should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 3000K, CRI >80, PF >0.90, THD<10%, IP65, IK>=08, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV.				

I	SITC of recess mounted LED luminaire (2X2) with Zig bee/ Bluetooth enabled dimmable control gear, made of extrusion Aluminium having powder coating with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) $>=120$ lumens/watt and a minimum system lumen output of 3600 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 - 2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	319	7,108.00	2,267,452.00
J	SITC of dimmable recessed LED downlighter with 78±6 mm cut out, made of pressure die cast aluminum housing including flange with high efficiency lens on LED. The downlighter can also be supplied with PC/PMMA diffuser depending upon the suitability. Fixture should have minimum efficacy at System level (Not Chip Level) >=70 lumens/watt and a minimum system lumen output of 770 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >90, PF >0.90, THD<10%, R9>20, 50°-60 deg beam angle, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL	Nos.	819	2,822.00	2,311,218.00

	approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
K	SITC of surface/suspended high efficiency LED channel, 60 mm width, 1200 mm length with Zig bee/ Bluetooth enabled dimmable control gear, made of extrusion/anodised aluminium with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt and a minimum system lumen output of 2200 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	119	8,990.00	1,069,810.00
L	SITC of Mirrior mounted 2 Ft LED Batten, fixture to be made of extrusion/anodised aluminium housing with high efficiency polycarbonate diffuser, LED Used shall be SMD type and fixture should have minimum efficacy at System level >=100 lumens/watt with Minimum system Lumens 1000, Life of fixture: 25000 burning Hrs. @ L70 Lumen maintenance, CCT of 5700/6500K (SDCM<=3) , CRI >80, PF >0.90, Operating working temp range - 0°C < Ta < 45°C & Voltage Range of 140 - 270 VAC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	211	418.00	88,198.00

M	SITC of deep recessed LED downlighter, made of pressure die cast aluminum housing including flange with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt and a minimum system lumen output of 2000 lumens with beam angle of 36/40 Deg. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5000/5700K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the	Nos.	29	3,188.00	92,452.00
N	fixture and Driver should have BIS approval. SITC of recess mounted energy efficient LED channel, width 60 mm, 1200 mm length with Zig bee/ Bluetooth enabled dimmable control gear, made of extruded/anodised aluminium with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt and a minimum system lumen output of 2200 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm, LM79 and	Nos.	217	10,506.0	2,279,802.00

	LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
0	SITC of recess mounted energy efficient LED downlighter with Zig bee/ Bluetooth enabled dimmable control gear, made of pressure die cast aluminium housing including flange with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt and a minimum system lumen output of 2000 lumens with beam angle of 36/40 Deg. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval	Nos.	112	5,749.00	643,888.00
P	SITC of recess mounted energy efficient LED downlighter with Zig bee/ Bluetooth enabled tuneable & dimmable control gear, made of pressure die cast aluminium housing including flange with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=75 lumens/watt and a minimum system lumen output of 900 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 3000-6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.0KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -	Nos.	38	4,495.00	170,810.00

	2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
Q	SITC of surface mounted/suspended energy efficient LED round luminaire with Zig bee/ Bluetooth enabled tuneable & dimmable control gear, made of extruded/anodised aluminium with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=75 lumens/watt and a minimum system lumen output of 2200 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 3000-6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.0KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	40	20,959.0 0	838,360.00

R	SITC of recessed energy efficient LED luminaire (2X2) with DALI dual channel/ Bluetooth enabled tuneable & dimmable control gear, made of extruded/anodised aluminium with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt and a minimum system lumen output of 3600 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 3000-6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the firsture and Driver should have PIS accredited	Nos.	24	2,404.00	57,696.00
S	SITC of wall/surface mounted energy efficient LED batten made of extruded/anodised aluminium with high efficiency PC/PMMA diffuser for homogeneous light distribution. Fixture should have minimum efficacy at System level (Not Chip Level) >=120 lumens/watt and a minimum system lumen output of 2000 lumens. Luminaire should have 70% of luminous flux after 50,000 operating hours (L70), CCT of 5700/6500K (SDCM<4), CRI >80, PF >0.90, THD<10%, R9>20, IP20, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C and an operating Voltage Range of 140 - 270V. Internal Surge Protection 2.5KV. The luminaire shall be integrated with daylight harvesting and PIR compatible sensor. The fixture design should comply with EMC / EMI compliance with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 - 2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. The internal wiring to be done with LSZH wires. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by	Nos.	214	2,598.00	555,972.00

	firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
T	SITC LED Highbay luminaire with a housing of High Pressure Die casted Aluminium and cover of high transmittence tempered glass/PC to ensure protection. The luminaire should have a color consistency SDCM < 5, CRI > 80 and CCT of 5700/6500K. The luminaire shall be compliant with IP65 classification and impact protection of IK08 to ensure durability. Luminaire shall be designed to emit at least 24000 nominal lumens at a system efficacy of atleast 110 lumen/watt. The lumainaire shall have both Narrow beam and Wide beam options available to provide flexbility in applications with new designed optic module to reduce glare UGR<25. The luminaire shall be designed so as to ensure lumen depreciation of up to 30% over 50k burning hours @ design ambient temp 45 deg C. The electronic driver used shall have a power factor >0.95 and THD <10% with a minimum inbuilt surge protection of 4kV and suitable for an operation voltage range of 140-270V AC. The fixture should comply with the parameters as per IS10322. The LED driver should comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347- 1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have PIS	Nos.	48	16,726.0 0	802,848.00
U	 SITC of recessed LED Downlighter, made up of pressure die cast aluminum housing including flange with high efficiency polycarbonate diffuser/PMMA, fixture should have minimum efficacy at System level >=110 lumens/watt with Minimum system Lumens 2000, Life of fixture : 50000 burning Hrs. @ L70 Lumen maintenance, CCT of 5700/6500K (SDCM<=3), CRI Ra >=80, PF >0.95, UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C & operating Voltage Range of 140-270 V AC. Minimum Internal Surge Protection 2.5KV. The fixture design should be with flicker free operations ripple <5%, comply to IEC61000-3-2 ed.3.2, 2009 for Harmonics, IEC61347 -2 -13, 2006 in Conjunction with IEC61347-1 ed.2.0, 2007 for Electrical Safety, IEC62384 ed.1.1, 2011 for performance and IEC61547 ed.2.0, 2009, CISPR-15 for EMI/EMC. Manufacturer 	Nos.	195	1,565.00	305,175.00

	shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.				
V	SITC of recess mounted luminaire (2x2), with a ninimum system lumen output of 3600 lumens and a minimum system efficacy of 120 lm/W. The luminaire should have a color temperature of 5700/6500K (SDCM<4) and CRI>80. Driver of the luminaire shall have THD<10% and PF >0.95. UGR<19, IK>=04, Operating working temp range - 0°C < Ta < 45°C & operating Voltage Range of 140-270 V AC. Minimum Internal Surge Protection 2.5KV. The luminaire housing should be made of powder coated extruded Aluminium with high efficiency opal PS/PMMA diffuser. Manufacturer shall have inhouse lab approved by NABL or Ministry of Science, Govt of India or reports to be verified at NABL approved labs for parameters by firm. LM79 and LM80 reports need to be submitted from a NABL/UL accredited lab to verify above parameters. Both the fixture and Driver should have BIS approval.	Nos.	41	2,404.00	98,564.00
W	Supply, Installation, Testing & Commissioning of Surface mounted LED Downlighter made of pressure die cast aluminium housing including flange, LED Used shall be SMD type and fixture should have minimum efficacy at System level (Not Chip Level) >=100 lumens/watt with Minimum system Lumens 750, Life of LED : 50000 burning Hrs. @ L70 Lumen maintenance, CCT of 4000/5700K (SDCM<4), CRI >80, PF >0.95, Min working temp range - 0°C < Ta < 45°C, an operating Voltage Range of 140 - 270 VAC.Minimum Internal Surge Protection 2.0KV & IP20 protection, Luminaire manufacture shall provide LM79 report from NABL/UL accredited lab & LM80 report issued by LED manufacturer.	Nos.	191	1,150.00	219,650.00
Х	Wall mounted decorative light fixture made up of crome finish metal housing with non yellowing frosted white glass. Suitable for 18W LED Lamp.	Nos.	179	2,796.00	500,484.00
	TOTAL OF LIGHT FIXTURES				22,175,339.00
1.2	LIGHTING CONTROL				
	Various types of lighting fixtures are provided in the				
	various buildings/floors/rooms.				
	Some luminaires are Tunable and Dimmable, some are				
	only Dimmable and rest are plain luminaires.				
	Luminaires with control feature shall provide day light				
	narvesung as well as occupancy sensor. Normal luminaires shall provide occupancy sensor facility if				
	runnianes shan provide occupancy sensor facility, II			I	

	required depending upon the location of luminaires.				
	Sensor may be integrated with luminaire or can be				
	external for group of luminaires. If power supply				
	required for the external sensors, it is covered under this				
	item.				
	Control of the luminaires are desired to be on wireless				
	architecture with communication to LMS as well as				
	BMS.				
	Network devices employed as per requirement need to				
	be wired with luminaires and power supply for these				
	devices to be arranged by the Contractor.				
	Detailed specification and architecture shall be				
	submitted prior to commence the work of lighting.				
	Lighting Management Software (LMS) to be installed				
	to integrate all luminaires employed in buildings. LMS				
	must provide standard data, control and management of				
	luminaires. LMS shall be suitable to provide seemless				
	integration with BMS. LMS shall be preferably stand				
	alone type system installed on multiple PCs, but cloud				
	hosted system can also be employed with free hosting				
	for 5 years.				
	Lighting control shall be able to provide seemless				
	integration with BMS and provide all relevant data				
	control and management facaility to BMS for				
	integration				
	The cost of the lighting control hardware and LMS				
	software shall not vary due to change in quantity of				
	luminaires				
Α	SITC and Training of Lighting Control hardware along	Lot	1	9,751,77	9,751,770.00
	with Lighting Management System (LMS) software.			0.00	
	The system shall work on wireless technology				
	(Bluetooth/Zigbee/Wi-fi). The LMS software shall be				
	installed in a server grade PC/cloud (with 5 years				
	hosting) and must provide full functionality like				
	control, scheduling, reporting, usage charting, energy				
	measurement and other required functionality. The				
	system shall be able to accomplish the switching, day				
	light harvesting as well as occupancy & vacancy based				
	control. The LMS shall provide seemless integration of				
	the system with BMS. The system shall be able to				
	control variety of luminaires as per description below				
	The system shall meet the requirements as per description below.				
	specification and include following control and network				
	devices to accomplish the task				
	Wireless Tunable & Dimmable Controllers for				
	dimming and changing the CCT of the luminaires for				
	about 200 luminaires				
	Wiralass Dimmakle Controllars for dimming of the				
	whereas Diminable Controllers for dimming of the				
	Iuminaires for about 3000 luminaires				
	Controllers with PIK sensor for motion detection for				
1	about 1300 luminaires				

		Sensors for day light harvesting and motion detection				
		for about 3200 luminaires				
		Network devices like Bridges, Gateways, Switches etc				
		to integrate the luminaires with the LMS server				
		Inter wiring of the Bridges/Gateways/any other devices				
		within a building				
В		SITC of Wireless switch for room and scene control.	Nos.	25	9,108.00	227,700.00
		The switch shall be able to on/off, dim and tune the				
		status and temperature & Humidity Separate control				
		shall be available for tuning and dimming. The switch				
		shall have minimum 4 programmable presets for scene				
		control. The switch may be wall/table mounted type.				
С		SITC of Wireless remote to control the luminaires with	Nos.	110	4,554.00	500,940.00
		on/off and dim up/down buttons				
		TOTAL OF LIGHTING CONTROL				10,480,410.00
1.0						
1.3		FANS & EXHAUSIS				
А	NS	Supplying and Fixing of 1200 mm sweep ceiling fan	Nos	265	2 484 00	658 260 00
	110	with 300/600 mm standard down rod and electrical	11001	200	_,	000,200100
		connection as required etc.				
В	NS	Supplying and Fixing of 400mm sweep wall bracket	Nos.	6	2,611.00	15,666.00
		fan, oscillatory type, 3 speed control, heavy duty type				
		as required.				
C	NS	Supply and Fixing of 750 mm sweep air circulator fan,	Nos.	9	12,901.0	116,109.00
		oscillatory type, 3 speed control, heavy duty type as			0	
	NG	required.				
D	NS	Supply and Fixing of heavy duty type exhaust fans of following size sweep with gravity lowers chutters				
		including all accessories/installation materials required				
		metuding an accessories/instantation materials required make				
a		381 mm sweep 1400 rpm	Nos.	6	4,118.00	24,708.00
b		305 mm sweep 900 rpm	Nos.	61	3,433.00	209,413.00
с		230mm sweep 900 rpm	Nos.	92	1,927.00	177,284.00
		TOTAL OF FANS & EXHAUSTS				1,201,440.00
		TOTAL OF SUDDLY OF FANS & LOUT				22 957 100 00
		FIXTURES WITH CONTROL				33,037,189.00

		I				
1.4		FACADE LIGHTING				
		3				
1.4.1	NS	SITC of surface 10W LED Planter Luminaire, made of pressure die cast aluminium alloy housing with corrosion resistant powder coating, PMMA secondary lens with beam angle options in 10 deg, 30 deg & 40 deg, high efficiency encapsulated integrated driver with safety protections, capable of operating at line voltage without any separate power supply from 140 to 270 V. CRI \geq 70, CCT - 5700K/3000K, PF>0.90, IP 66, Life of LED @ L70 - 50,000 hrs, 3 kV internal surge protection including 10 kV external SPD. Luminaire shall be conforming to BIS and shall be complete with all necessary accessories required for proper working of fixture including weather proof connection cables, water proof connectors etc. as required.	Nos.	40	9149	365,960.00
1.4.2	NS	SITC of ground recessed 20W LED Luminaire, 270 mm dia, made of pressure die cast aluminium alloy housing with corrosion resistant powder coating, toughned glass with stainless steel front cover with beam angle options in 15 deg & 30 deg asymmetric. Luminaire shall be complete with high efficiency encapsulated isolated driver with safety protections, which should be maintainable from the base and capable of operating at line voltage without any separate power supply from 140 to 270 VAC,50Hz. CRI \geq 70, CCT - 5700K/3000K, PF>0.90, IP 66, Life of LED @ L70 - 50,000 hrs, 3 kV internal surge protection including 10 kV external SPD. Luminaire shall be conforming to BIS and shall be complete with all necessary accessories required for proper working of fixture including weather proof connection cables, water proof connectors etc. as required.	Nos.	40	23681	947,240.00
1.4.3	NS	SITC of landscape application 10W LED Luminaire (Bollards), made of pressure die cast aluminium alloy and extruded aluminium base with corrosion resistant powder coating, 600 mm, square top of 100 mm X 100 mm, UV stabilized PC/PMMA diffuser, high efficiency encapsulated integrated driver with safety protections, capable of operating at line voltage without any separate power supply from 100 to 270 VAC,50Hz. CRI \geq 70, CCT - 5700K/3000K, PF>0.90, IP 66, Life of LED @ L70 - 50,000 hrs, 3 kV internal surge protection including 10 kV external SPD. Luminaire shall be conforming to BIS and shall be complete with all necessary accessories required for proper working of fixture including weather proof connection cables,waterproofconnectors etc. as required.	Nos.	75	9149	686,175.00

1.4.4	NS	SITC of 3072 Channel Stand alone DMX Controller. (Incl. 6 V Power supply unit), Powerful StandAlone Engine. Upto 2000 Scenes in 20 Zones, Compact DIN Rail mount enclosure, Astronomical Clock Triggers, for Sunset/Sunrise, Time based ON/OFF, Scene/Color change, Dimming etc. I/O ports for 3rd party triggering like sensors, UDP, Serial Ports, dedicated RS232 Input port, Audio inputs etc. On-Board buttons to change scenes. DMX Controller shall be capable of interfacing with standard BMS systems via UDP, RS232, SERIAL COM PORTS etc. Controller shall be capable of receiving triggers for scene changes from BMS systems.	Nos.	1	403650	403,650.00
1.4.5	NS	SITC of 6 Output compact DIN Rail Mount DMX Splitter, Fully isolated Outputs to Split/Boost DMX Input. Terminal Block Connectors for easy solderless termination, Incl. External Power supply with built-in protection for Short circuit / Overload / Over voltage / Over temperature. UL508 & EN50082-2 certified	Nos.	7	80730	565,110.00
1.4.6	NS	Supply, laying, testing and commissioning of Power Cable, 3 core, 2.5 sq. mm Cu flexible	RM	1000	81	81,000.00
1.4.7	NS	DMX Cable, 120 Ohm Impedence, Single Pair Shielded copper cable, Worldwide Standard for DMX applications 2 core 0.75 sq mm Wire	RM	1000	161	161,000.00
1.4.8	NS	Supply, Installation, Testing and commissioning of 20mm PVC conduit.	RM	1500	54	81,000.00
		TOTAL OF FACADE LIGHTING				3.291.135.00
						3,2 ,2,1,100,00
1.5		MAINTENANCE FREE EARTHING				
1.5.1	NS	Supply of Maintenance free Conductive Concrete Earthing electrode - having copper bonded MS rod of Dia 17.2 mm x 3000 mm length x 80 mm Dia. of Earth Enhancing Material, INCLUDING Boring with Installation & commissioning of earthing electrode - Cu Bonded MS rod of Dia 17.2 mm x 3 meter length (3000 mm) x 80 mm and Supply of 10" HDPE earth chamber Heavy Duty cover (One chamber per electrode)	Nos.	70	13584	950,880.00
		TOTAL OF MAINTENANCE FREE EARTHING				950,880.00
2.0		SUB-HEAD : DISTRIBUTION BOARD				
2.1		Supplying and fixing following way prewired triple pole and neutral, sheet steel for 415 volts on surface/recess complete with loose wire box, terminal connector for all incoming and outgoing circuits, duly prewired with suitable size FRLS PVC insulated copper conductor upto terminal blocks, tinned copper busbar,neutral link, earth bar, din bar, detachable gland plate, interconnections, powder painted including earthing etc. as required. (But without MCB / RCCB / Isolator)				

Α	NS	12 way (4 + 36), Double door	each	28	7,519.01	210,532.29
2.2	NS	Supplying and fixing of following ways surface/ recess				
		mounting, vertical type, 415 V, TPN MCB distribution				
		board of sheet steel, dust protected, duly powder				
		painted, inclusive of 200 A tinned copper bus bar,				
		common neutral link, earth bar din bar for mounting				
		MCBs & incomer MCCB (but without MCBs and				
		TDDD is normally used where 2 phase outlets are				
		required)				
а		12 way (4 + 36) Double door	each	8	33 354 9	266 839 55
u		12 way (+ + 50), Double door	caen	0	4	200,057.55
b		6 way (4+18), Double door	each	7	23,759.8	166,318.61
					0	
с		8 way (4+24), Double door	each	10	24,837.5	248,375.66
					7	
	NS	Supplying and fixing following rating, four / two pole,				
		415 / 240 volts, Residual Current Device (RCBO)				
		naving earth leakage, over load and short circuit				
		Boards or in soperate analogura having a sonsitivity				
		current of $30/100$ mA complete with connections				
23		testing and commissioning etc. as required ·				
2.5 a		25 Amp DP RCBO (30 mA)	each	4	2.905.03	11.620.11
b		40/32 Amp DP RCBO (30 mA)	each	81	4,201.15	340,292.79
с		40 Amp 4P RCBO (30 mA)	each	54	4,288.03	231,553.39
d		63 Amp 4P RCBO (30 mA)	each	76	5,076.22	385,792.69
	NS	Providing and fixing following rating and breaking				
		capacity and pole MCCB with thermomagnetic release				
		and terminal spreaders in existing cubicle panel board				
		including drilling holes in cubicle panel, making				
2.4		connections, etc. as required.	1	10	0.021.02	100 201 00
a 1		125 A, 25 KA, 1PN MCCB	each	12	9,031.82	108,381.89
b		160 A, 25 KA, IPN MCCB	each	/	11,603.3 9	81,223.70
	NS	Supplying, fixing, connecting, testing and			,	
		commissioning of following rating, ISI marked (IS				
		8828) 240 / 415 volts, 10 KA, Miniature Circuit				
		Breaker (MCB) of single / double / three / four poles				
		in the existing MCB DB or in existing MS enclosure				
2.5		complete in all respects.		~	1 20 1 15	
a	NS	32/40 Amp. 3P MCB	each	91	1,731.10	157,530.06
b	NS	50/63 Amp. 3P MCB	each	33	1,/31.10	57,126.29
		TOTAL OF DISTRIBUTION ROADD				22 65 587 00
		I UTAL OF DISTRIBUTION BUARD				22,03,307.00
3.0		SUB-HEAD : L.T CABLES				
3.1	NS	Supplying of following 1100 volt grade XLPE				
		insulated PVC sheathed aluminium conductor				
		armoured cables as per specification as required.				
	1	$4 \cos 120 \sin mm$	DM	100	5/9.91	100 212 04
----------	----	---	------	------	---------------	--------------
a b		4 core 120 sq. mm		307	/36.01	109,212.94
C C		4 core 70sq. mm		307	355 /2	1/0 390 51
d		4 core 50sq. mm	RM	55	268.65	14 776 02
e		4 core 25sq. mm	RM	187	166.21	31 081 39
f f		4 core 16sq mm	RM	2638	121.26	319 885 46
α 1		4 core 10sq. mm	RM	1150	106.63	122 619 56
<u> </u>		4 core 6sq. mm	RM	331	84.67	28 026 88
i		2 core 6sq. mm	RM	75	68 78	5 158 80
3.2		Supplying and making end termination of following sizes with brass compression gland including providing and crimping solderless plugs/ferrules of sizes PVC insulated PVC sheathed aluminum conductor armoured cable 1.1 KV grade.				
a	NS	4 X 120 sq. mm (45mm)	Set	6	883.32	5,299.92
b	NS	4 X 95 sq. mm (45mm)	Set	18	868.04	15,624.68
С	NS	4 X 70 sq. mm (38mm	Set	28	591.67	16,566.71
3.3	NS	Supplying of following 1100 volt grade XLPE insulated PVC sheathed Cu. conductor armoured cables as per specification as required.				0.00
а		3 core 2.5sq. mm Cu. Armoured Cable	RM	4000	122.81	491,230.87
b		4 core 6sq. Mm Cu. Armoured Cable	RM	500	288.09	144,044.00
5.4		supprying and making end termination of following sizes with brass compression gland including providing and crimping solderless plugs/ferrules of sizes PVC insulated PVC sheathed coupper conductor armoured cable 1.1 KV grade.				
а	NS	3 core 2.5sq. mm Cu. Armoured Cable	Set	474	466.25	221001.08
b	NS	4 core 6sq. mm Cu. Armoured Cable	Set	24	536.96	12887.16
		TOTAL OF L.T CABLES				18,11,952.00
4.0		SUB-HEAD : SERVICES : TELEPHONE/TV/DATA				
4.1	NS	Providing, fixing, connecting and testing of following pair solderless telephone tag block, with powder coated box (Krone make) of required size box with hinged lockable cover and clamps for dressing of wires etc. as required.(Hensel make)				
а		400Pairs	each	1	39,801.7 0	39,801.70
b		130Pairs	each	2	17,705.0 9	35,410.19
с		10Pairs	each	3	2,556.93	7,670.78
d		600Pairs	each	1	15,243.3	15,243.30
e		100Pairs	each	4	1.739 70	6 958 80
f		60Pairs	each	3	1.739.70	5.219.10
-				5	-,	2,217.10
I		l .			1	

4.2 a b c d	NS	Providing, laying, connecting, testing & commissioning of multi-core telephone Armoured cables of conductor size 0.5 mm. PVC insulated & PVC sheathed with G.I strip armouring,genrallay confg. to ITD specifications S/WS-113C & S/WS-114.Armouring & Outer sheath conforming to IS:554 (part-1) to be laid in existing conduit/pipe/cable tray as required complete in all respects. 10 pair 20 pair 50 pair	Metre Metre Metre Metre	25 35 145 225	167.70 270.40 574.01 1,008.30	4,192.43 9,463.90 83,231.93 226,867.08
4.3	NS	Providing, fixing, connecting, testing and commissioning of zinc passivated box with moulded plate in recess or on surface moulded type with following including all necessary materials etc. as required.				
a		Computer terminal (RJ-45)	each	1123	910.86	1,022,894.38
		TOTAL OF SERVICES · TELEPHONE/TV/DATA				1 456 954 00
		TOTAL OF SERVICES . TELETHONE/TV/DATA				1,430,734.00
5.0		SUB-HEAD : RACE WAYS				
5.1		raceways for distributing cabling in screed floor installations. Raceway should be made up of Pre galvanized sheet with minimum thickness of 1.5 mm consist of body and cover. It should have average of 275GSM zinc coating. Raceway should be supplied with required accessories such as fixing brackets and coupling plates as required. Raceway should be confirmed with the standard EN 50085-2-2 including all accessories complete as required.				
a		50 mm wide x 38 mm deep raceway (1 compartment)	Meter	2536	63.98	162,241.67
b		100 mm wide x 38 mm deep raceway (1 compartment)	Meter Meter	605	988.90	598,285.17
d		225 mm wide x 38 mm deep raceway (1 compartment)	Meter	258	1,298.32	497.866.75
e		300 mm wide x 38 mm deep raceway (3 compartment)	Meter	17	2,349.95	39,949.10
5.2	NS	Supply and fixing of following size of Height adjustable under floor /crossover Junction box with flyover for Raceways for direct access to cables at the intersection of Raceways supplied completely with base and cover plate(lid). Junction box should be made of Pre galvanized sheet consist of body and cover. Height of the junction box should be adjustable from minimum 65mm. Junction box should be supplied with the metal cover for protecting the junction box during constructions at site. It should be confirmed with the standard EN 50085-2-2s including all accessories complete as required:				

а		150 x 150 x 65 mm-90mm	each	743	1 674 65	1 244 265 47
b b		225 x 225 x 65 mm -90mm	each	124	2.291.41	284.134.49
c		300 x 300 x 65 mm-90mm	each	61	3.052.42	186,197,74
d		400 x 400 x 65 mm-90mm	each	54	4.576.54	247.133.28
					.,	211,100120
5.3	NS	Supply and fixing of following size of under floor Vertical access unit (riser) for Raceways from floor tracks to well for connection of floor receives to				
		Distribution boards/ for vertical raceways. Riser box				
		should be made of Pre galvanized sheet consist of body and cover. Piser, her should be supplied with the metal				
		cover for protecting the junction box during				
		constructions at site. It should be confirmed with the				
		standard EN 50085-2-2s including all accessories				
		complete as required:				
а		225 x 200 x 60 mm	each	21	1,509.49	31,699.19
b		300 x 200 x 60 mm	each	18	1,737.37	31,272.69
		TOTAL OF RACE WAYS				3,843,674.00
6.0		SUB HEAD : MAIN L.T. PANEL				
6.1	NS	Design, manufacturing, supplying installation, testing				
		and commissioning and assisting in testing and				
		compartmentalised <i>Ab</i> construction cubicle type, front				
		access dead back 2mm thick steel enclosed free				
		standing dust and vermin proof switchboard with IP42				
		protection with hinged and lockable doors duly powder				
		coated with minimum 70-80 micron thickness				
		complete with incoming & outgoing MCCB's, Copper				
		Busbars, interconnections, tinned copper crimping lugs,				
		bonding to earth, suitable for use at 415 volts, 3 phase 4				
		wire 50 Hertz system, and suitable for a fault level of				
		25 MVA (35 KA) symmetrical at 415 volts as per IEC				
		60439-2				
		Admin building				
		Normal supply incoming (1 no.) equipped with				
		-				
		1 NO. 050 AIIIP, 55KA, 4P MICCB complete with Microprosser based release baying over current short				
		circuit and earth fault protection with extended rotary				
		handle				
		1-CT epoxy cast 600/5A, 15 VA, Class 1				
		Digital Multi Function Meter, 3 Ph, 4W, Class 1 with RS485 port				
		1 set of R/Y/B LED Indicating lamps with control MCB for Incomers				
		Terminal to receive $630 \text{Amp} 2 \text{ Nos} 3.5 \text{ s} 300 \text{ so mm} \Delta 1$				
		-XLPE-cable				
		BUSBAR-				

		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 630 Amp throughout having a				
		maximum current density of 1.6 amp per sq. mm				
		suitable to withstand symmetrical fault level of 25				
		MVA at 415 volts. The neutral bus bar is to be of 50%				
		capacity.				
		OUTGOING UNITS				
	a)	1 No. 100 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle				
	b)	2 No. 125 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit, protection with extended rotary handle				
	c)	6 No. 160 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit, protection with extended rotary handle				
	d)	3 No. 63 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit, protection with extended rotary handle				
	e)	2 No. 40 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit, protection with extended rotary handle	a .		100 50 1	122 524 00
		The panel shall be complete with all interconnections,	Set	1	433,/34.	433,734.00
()	NG	risers, internal wiring, labels etc. complete as required.			00	
6.2	NS	Design, manufacturing, supplying installation, testing				
		and commissioning and assisting in testing and				
		commissioning of the following from operated modular				
		access dead back 2mm thick steel enclosed free				
		standing dust and vermin proof switchboard with IPA2				
		protection with hinged and lockable doors duly powder				
		coated with minimum 70-80 micron thickness				
		complete with incoming & outgoing MCCB's Copper				
		Busbars, interconnections, tinned copper crimping lugs.				
		bonding to earth, suitable for use at 415 volts, 3 phase 4				
		wire 50 Hertz system, and suitable for a fault level of				
		25 MVA (35 KA) symmetrical at 415 volts as per IEC				
		60439-2				
		Floor panels (1st, 2nd , 3rd Floor) Admin				
		Normal supply incoming (1 no.) equipped with				
		_				
		1 No. 160 Amp, 35KA, 4P MCCB complete with				
		Microprosser based release having over current, short				
		circuit and earth fault protection with extended rotary				
		handle				
		1-CT epoxy cast 600/5A, 15 VA, Class 1				
		Digital Multi Function Meter, 3 Ph, 4W, Class 1 with RS485 port				
		1 set of R/Y/B LED Indicating lamps with control MCB for Incomers				
		Terminal to receive 160Amp 1Nox3.5x120 sqmm Al -XLPE-cable				

1	1	RUSBAR-				
		Electrolytic high conductivity Conner three phase and				
		neutral bus bars rated at 160 Amp throughout having a				
		maximum current density of 1.6 amp ner sa mm				
		suitable to withstand symmetrical fault level of 25				
		MVA at 415 volts. The neutral bus bar is to be of 50%				
		capacity.				
		OUTGOING UNITS				
	a)	1 No. 125 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle				
	b)	3 No. 63 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle				
	c)	3 No. 40 Amp, 25KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle				
		The panel shall be complete with all interconnections,	Set	3	185,592.	556,778.25
		risers, internal wiring, labels etc. complete as required.			75	
6.0	210					
6.3	NS	Lift Panel (Admin)				
		Supply & installation, testing and commissioning of				
		1 Nos.125Amp 25 KA 4 P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary nandle. Incomer				
		Shall be complete with following.				
		RS485 port				
		3 Nos. Cast resin current transformers of 125/5 ratio				
		Class 1.0 for metering.				
		Three phase indicating lamps (LED type) with control				
		MCB.				
		BUSBAR				
		Electrolytic high conductivity Aluminium three phase				
		and neutral bus bars rated at 125 Amp having a				
		maximum current density of 1.6 amp per sq.mm				
		suitable to withstand symmetrical fault level of 25				
		MVA at 415 volts. The neutral Busbar is to be of 100%				
		capacity.				
		OUTGOING UNITS				
		6 Nos.40 Amp, 25 KA, TPN MCCB complete with				
		I nermal-magnetic release having overcurrent, short				
		CITCUIT PROTECTION				
		1 NOS. 32 AMP, 10 KA, 1PN MCB complete having				
		The Life nonal shall be several to write all	C - 4	1	150 145	150 145 00
		The Lift panel shall be complete with all	Set	1	152,145.	152,145.00
		complete as required			00	
		complete as required.				
	I					

6.4	NS	UPS PANEL (Admin)				
	110	Design, manufacturing, supplying installation, testing				
		and commissioning and assisting in testing and				
		commissioning of the following front operated modular				
		compartmentalised construction cubicle type, front				
		access, dead back, 2mm thick steel enclosed free				
		standing, dust and vermin proof, switchboard with IP42				
		protection with hinged and lockable doors duly powder				
		coated with minimum 70-80 micron thickness complete				
		with incoming & outgoing MCCB's, Copper Busbars,				
		interconnections, tinned copper crimping lugs, bonding				
		to earth, suitable for use at 415 volts, 3 phase 4 wire 50				
		Hertz system, and suitable for a fault level of 25 MVA				
		(35 KA) symmetrical at 415 volts as per IEC 60439-2.				
а		2 Nos. 315 Amp, 35KA, 4P with MCCB complete with				
		microprocessor based release having overcurrent, short				
		circuit, & earth fault protection with extended rotary				
		handle with 400A 4Pole power contactor				
b		1 set cast resin current transformer of 500/5 ratio class				
		1.0 for metering, 15 VA Burden.				
C 1		I set of three R Y B indicating lamps.				
d		Red / green / amber ON / OFF / Trip indicating lamps				
e		Digital Multi Function Meter, 3 Ph. 4W. Class 1 with				
-		RS485 port				
		BUSBAR				
		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 400 Amp throughout having a				
		maximum current density of 1.6 amp per sq. mm				
		suitable to withstand symmetrical fault level of 25				
		MVA at 415 volts. The neutral Busbar is to be of 50%				
		capacity.				
		OUTGOING				
		10 Nos. 63 Amp, 25KA, 4P MCCB complete with	Set	1	669,921.	669,921.00
		Microprocessor release having overcurrent, short circuit			00	
		protection with extended rotary handle				
6.5	NS	UPS PANEL (COPORATE TOWER)				
		Design, manufacturing, supplying installation, testing				
		and commissioning and assisting in testing and				
		commissioning of the following front operated modular				
		compartmentalised construction cubicle type, front				
		access, dead back, 2mm thick steel enclosed free				
		standing, dust and vermin proof, switchboard with IP42				
		protection with hinged and lockable doors duly powder				
		coated complete with incoming & outgoing MCCB's,				
		Aluminium Busbars, interconnections, tinned copper				
		crimping lugs, bonding to earth, suitable for use at 415				
		volts, 3 phase 4 wire 50 Hertz system, and suitable for a				
		tault level of 25 MVA (35 KA) symmetrical at 415				
		voits as per IEC 60439-2.				

a		2 Nos. 400 Amp, 35KA, 4P with MCCB complete with				
		microprocessor based release having overcurrent, short circuit & earth fault protection with extended rotary				
		handle with 500A 4Pole power contactor				
b		1 set cast resin current transformer of 250/5 ratio class 1.0 for metering, 15 VA Burden.				
с		1 set of three R Y B indicating lamps.				
d		Red / green / amber ON / OFF / Trip indicating lamps 1set				
e		Digital Multi Function Meter, 3 Ph, 4W, Class 1 with RS485 port				
		BUSBAR				
		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 500 Amp throughout having a				
		maximum current density of 1.6 amp per sq. mm				
		suitable to withstand symmetrical fault level of 25				
		MVA at 415 volts. The neutral busbar is to be of 50%				
		capacity.				
		OUTGOING				
		I No. 32Amp, 25KA, DP MCCB complete with				
		circuit protection				
		9 Nos. 63Amp, 25KA, 4P MCCB complete with	Set	1	726069.	726,069.75
		thermal magnetic release having overcurrent, short			75	
		circuit protection				
		GENERAL LAB				
6.6	NS	Design, manufacturing, supplying installation, testing				
		and commissioning and assisting in testing and				
		commissioning of the following front operated modular				
		compartmentalised construction cubicle type, front				
		access, dead back, 2mm thick steel enclosed free				
		standing, dust and vermin proof, switchboard with IP42				
		protection with hinged and lockable doors duly powder				
		coated complete with incoming & outgoing MCCB's,				
		Coppere Busbars, interconnections, tinned copper				
		crimping lugs, bonding to earth, suitable for use at 415				
		fault level of 25 MVA (35 KA) symmetrical at 415				
		volts as per IEC 60439-2				
		Normal supply incoming (1 no.) equipped with				
		1 No. 630 Amp, 35KA, 4P MCCB complete with				
		Microprosser based release having over current, short				
		circuit and earth fault protection with extended rotary				
		handle				
		1-CT epoxy cast 630A/5 15 VA				
		Digital Multi Function Meter, 3 Ph, 4W, Class 1 with				
		RS485 port				
		1 set of R/Y/B LED Indicating lamps with control				
		MCB for Incomers				

	Terminal to receive 630Amp 2Nox3.5x300 sqmm Al				
	VI DE cable				
	-ALI E-cable				
	BUSBAR-				
	Electrolytic high conductivity Copper three phase and				
	neutral bus bars rated at 630 Amp throughout having a				
	maximum current density of 1.6 amp per sq. mm				
	suitable to withstand symmetrical fault level of 35				
	MVA at 415 volts. The neutral bus bar is to be of 50%				
	capacity.				
	OUTCOINC UNITS				
a)	2 No. 100 Amp. 25KA 4P. MCCB complete with				
<i>a)</i>	thermal magnetic release having over current, short circuit, protection				
b	2 No. 200 Amp, 25KA, 4P MCCB complete with				
	thermal magnetic release having over current, short				
	circuit, protection				
c)	3 No. 63 Amp, 25KA, 4P MCCB complete with				
	thermal magnetic release having over current, short circuit, protection				
d)	3 No. 40 Amp, 25KA, 4P MCCB complete with				
	thermal magnetic release having over current, short				
	circuit, protection	<u> </u>	1	200.056	200.056.05
	The panel shall be complete with all interconnections,	Set	1	298,856.	298,856.25
	risers, internar wiring, rabers etc. complete as required.			23	
6.7 NS	Design, manufacturing, supplying installation, testing				
	and commissioning and assisting in testing and				
	compartmentalized construction cubicle type front				
	access dead back 2mm thick steel enclosed free				
	standing dust and vermin proof switchboard with IP42				
	protection with hinged and lockable doors duly powder				
	coated complete with incoming & outgoing MCCB's				
	Copper Busbars. interconnections. tinned copper				
	crimping lugs, bonding to earth, suitable for use at 415				
	volts, 3 phase 4 wire 50 Hertz system, and suitable for a				
	fault level of 25 MVA (35 KA) symmetrical at 415				
	volts.				
	HOSTEL BUILDING				
	INFINITE SUPPLY INCOMING (1 NO.) EQUIPPED WITH				
	1 INO. 050 AIIIP, 55KA, 4P MUCB complete with Microprosser based release basing over overest short				
	circuit and earth fault protection with extended rotary				
	handle				
	1 Set CT's of ratio 630A /5A,class 1.0 accuracy and 15VA burden.				
	Digital Multi Function Meter. 3 Ph. 4W. Class 1 with				
	RS485 port				
	1 set of R/Y/B LED Indicating lamps with control				
	C 1				
	HOSTEL BUILDING Normal supply incoming (1 no.) equipped with 1 No. 630 Amp, 35KA, 4P MCCB complete with Microprosser based release having over current, short circuit and earth fault protection with extended rotary handle 1 Set CT's of ratio 630A /5A,class 1.0 accuracy and				

		Terminal to receive 630Amp 2Nox3.5x300 sqmm Al				
		-XLPE-cable				
		BUSBAR-				
		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 630 Amp throughout having a				
		maximum current density of 1.6 amp per sq. mm				
		suitable to withstand symmetrical fault level of 25				
		MVA at 415 volts. The neutral bus bar is to be of 50%				
		capacity.				
		8 No. 100 Arm 25KA 4D MCCD complete with				
a		8 No. 100 Allip, 25KA, 4P MCCB complete with				
		circuit protection with extended retery handle				
h		1 No. 125 Amp. 25KA 4D. MCCP. complete with				
0		thermal magnetic release having over current short				
		circuit protection with extended rotary handle				
C		8 No 63 Amp 25KA /D MCCB complete with				
		thermal magnetic release having over current short				
		circuit protection with extended rotary handle				
		The panel shall be complete with all interconnections	Set	1	357.057	357 057 75
		risers internal wiring labels etc. complete as required	Bet	1	75	337,037.73
		nisers, mernar wring, rabels etc. complete as required.			15	
6.8	NS	Lift Panel (HOSTEL)				
		Supply & installation, testing and commissioning of				
		1 Nos.100Amp 25 KA 4 P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle. Incomer				
		shall be complete with following.				
		Digital Multi Function Meter, 3 Ph, 4W, Class 1 with				
		RS485 port				
		3 Nos. Cast resin current transformers of 100/5 ratio				
		Class 1.0 for metering.				
		Three phase indicating lamps (LED type) with control				
		MCB.				
		BUSBAR				
		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 100 Amp having a maximum				
		current density of 1.6 amp per sq.mm suitable to				
		withstand symmetrical fault level of 25 MVA at 415				
		volts. The neutral Busbar is to be of 100% capacity.				
		5 Nos 40 Amp 25 KA TDN MCCD complete with				
		Thormal magnetic release having avanuation that				
		circuit protection				
		1 Nos 22 Amp 10 KA TDN MCD complete having				
		controlled of 18 nos 6-20 amps SP MCB				
		The Lift nanel shall be complete with all	Set	1	90 80/1 0	90 804 00
		interconnections risers internal wiring labels etc.	501	1	0,004.0	20,004.00
		complete as required.			U	
L	I	1 comptoto ao toquitodi				

	l					
6.9	NS	COMMON AREA PANEL (COPORATE TOWER)				
		Supply & installation, testing and commissioning of				
		I Nos.250 Amp 25 KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle. Incomer				
		shall be complete with following.				
		Digital Multi Function Meter, 5 Pn, 4W, Class 1 With DS485 port				
		3 Nos Cast rasin current transformers of 250/5 ratio				
		Class 1.0, 15 VA for metering.				
		Three phase indicating lamps (LED type) with control				
		MCB.				
		BUSBAR				
		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 250 Amp having a maximum				
		current density of 1.6 amp per sq.mm suitable to				
		withstand symmetrical fault level of 25 MVA at 415				
		volts. The neutral Busbar is to be of 100% capacity.				
		OUTCOING UNITS				
		1 No 160 Amp 25 KA TPN MCCB complete with				
		Thermal-magnetic release having overcurrent, short				
		circuit protection with extended rotary handle				
		6 Nos.100/40/63 Amp. 25 KA. TPN MCCB complete				
		with Thermal-magnetic release having overcurrent,				
		short circuit protection with extended rotary handle				
		The Lift panel shall be complete with all	Set	1	117972.	117,972.75
		interconnections, risers, internal wiring, labels etc.			75	
		complete as required.				
<i></i>						
6.10	NS	Lift Panel 2 -COPORATE TOWER				
		Supply & installation, testing and commissioning of				
		I No.160 Amp, 25 KA, 4P MCCB complete with				
		thermal magnetic release having over current, short				
		shall be complete with following				
		Digital Multi Eurotion Mater 2 Dh 4W Class 1 with				
		RS485 port				
	<u> </u>	3 Nos. Cast resin current transformers of 160/5 ratio				
		Class 1.0, 15 VA for metering.				
		Three phase indicating lamps (LED type) with control				
		MCB.				
		BUSBAR				
		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 160 Amp having a maximum				
		current density of 1.6 amp per sq.mm suitable to				
		volts. The neutral Bushar is to be of 50% capacity				
		vons. The neutral busbal is to be of 50% capacity.				
						L

1 1		OUTCOINC UNITS	I		i I	
		OUIGUING UNITS				
		6 Nos. 100/40/63 Amp, 25 KA, 1PN MCCB complete				
		with Inermal-magnetic release naving overcurrent,				
		short circuit protection with extended rotary nandle				
		I Nos. 40 Amp, 10 KA, IPN MCB complete having				
		controlled of 27 nos 6-20 amps SP MCB	G (1	100000	100 000 50
		The Lift panel shall be complete with all	Set	1	109882.	109,882.50
		interconnections, risers, internal wiring, labels etc.			50	
	210	complete as required.				
6.11	NS	Lift Panel 1 -COPORATE TOWER				
		Supply & installation, testing and commissioning of				
		1 Nos.100/40 Amp 25 KA 4P MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle. Incomer				
		shall be complete with following.				
		Digital Multi Function Meter, 3 Ph, 4W, Class 1 with				
		K5485 port				
		Class 1 0 15 VA for metering				
		Three phase indicating lamps (LED type) with control				
		MCB				
		MeD.				
		BUSBAR				
		Electrolytic high conductivity Copper three phase and				
		neutral bus bars rated at 100 Amp having a maximum				
		current density of 1.25 amp per sq.mm suitable to				
		withstand symmetrical fault level of 25 MVA at 415				
		volts. The neutral busbar is to be of 100% capacity.				
		OUTGOING UNITS				
		2 Nos 40 Amp, 25 KA, TPN MCCB complete with				
		Thermal-magnetic release having overcurrent, short				
		circuit protection				
		1 Nos. 32 Amp, 10 KA, TPN MCB complete having				
		controlled of 12 nos 6-20 amps SP MCB				
		The Lift panel shall be complete with all	Set	1	67257.7	67,257.75
		interconnections, risers, internal wiring, labels etc.			5	
		complete as required.				
6.12	NS	PRESSURIZATION PANEL AT TERRACE				
		COPORATE TOWER				
		Supply & Installation, testing and commissioning of				
		I No. 200 Amp 25 KA, 4P, MCCB complete with				
		thermal magnetic release having over current, short				
		circuit protection with extended rotary handle. Incomer				
		snall be complete with following.				
		Digital Multi Function Meter, 3 Ph, 4W, Class 1 with RS485 port				
		3 Nos Cast resin current transformers of 200/5 ratio				
		Class 1.0, 15 VA for metering.				
		Three phase indicating lamps (LED type) with control				
		MCB.				

	BUSBAR				
	Electrolytic high conductivity Copper three phase and neutral bus bars rated at 200 Amp having a maximum				
	current density of 1.6 amp per sq.mm suitable to				
	withstand symmetrical fault level of 25 MVA at 415				
	volts. The neutral Busbar is to be of 100% capacity.				
	OUTGOING UNITS				
	9 Nos. 100/63/32/20 Amp, 25 KA, TPN MCCB complete with Thermal-magnetic release having overcurrent, short circuit protection with extended rotary handle				
	The panel shall be complete with all interconnections, risers, internal wiring, labels etc. complete as required.	Set	1	153835. 50	153,835.50
	TOTAL OF MAIN L.T. PANEL				3,734,315.00
7.0	SANDWICH TYPE RISING MAIN				
7.1	SITC of following consists for 1 1 T D'				
7.1 NS	SITC of following capacity Sandwich Type Rising Mains for use on 3 phase 4 wire 415 volts, 50Hz A.C. supply with metal clad enclosure having IP-54 rating after fixing the tap off boxes and all accessories, made of 1.6mm thick steel sheet duly powder coated in convenient sections complete with 4 Nos Coupper bus bars having current density of 130 A/ sq cm at nominal current rating, necessary joints, elbow joints & expansion joints and bends, fire barrier at each floor, provision of tapping at every metre, adopter box and copper flexible for joints, continuous earthing with 2 Nos aluminium strip of suitable size (one on each side) including, G.I. clamping brackets, suspenders, angle iron bracket, steel fasteners, necting to earthing system				
	800 A Isc = 50 kA	D		26805.0	857,760.00
7.2 NS	SITC of following capacity End Feed Unit as per IEC 61439 for the existing Sandwich Type bus trunking/ rising mains for use on 3 phase 4 wire 415 volts, 50Hz A.C. supply, made with 1.6mm thick steel sheet enclosure (IP54) duly powder coated with provision of MCCB/ACB (but without MCCB/ACB) complete with necessary joints including clamping brackets, angle iron bracket, steel fasteners, connecting to earthing system etc. as required	ĸm		0	
	1000 A 50kA SC for 1 sec	Nos	2	57132.0	114,264.00
7.3 NS	SITC of following capacity 4P Tapp Off Unit as per IEC 61439 for the existing Sandwich Type bus trunking/ rising mains for use on 3 phase 4 wire 415 volts, 50Hz A.C. supply, made with 1.6mm thick steel sheet enclosure (IP54) duly powder coated with provision of MCCB/ACB (but without MCCB/ACB)				

7.4 7.5 7.6 7.7	NS NS NS NS	complete with necessary joints including clamping brackets, angle iron bracket, steel fasteners, connecting to earthing system etc. as required 125-250A, 50kA for 1 Sec Plugin Hole Flange End Spring Hanger End Cover	Nos. Nos. Nos. Nos. Nos.	7 32 1 10 1	17345.0 0 2409.00 20428.0 0 1033.00 657.00	121,415.00 77,088.00 20,428.00 10,330.00 657.00
		TOTAL OF SANDWICH TYPE RISING MAIN				1,201,942.00
		TOTAL OF ELECTRICAL (NON-SCHEDULED ITEM) – "A"				5,24,13,628.00
В		LIFTS			I I	
8.0						
8.1		A) LIFT FOR CORPORATE BUILDING				
0.1.1						
8.1.1	N.S.	(A) SCHEDULE OF WORK FOR PASSENGER LIFTS				
		Supplying, Installation, Testing and Commissioning of 20 passenger (1360 Kg), Gearless & Machine Room Less lifts for Office Building having contract speed of 1.5-1.75 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under:				
		CIVIL REQUIREMENTS				
		Clear Inside Shaft (available) - 2550 mm Width x 2450 mm Depth Pit Depth - 1600 mm				
		Minimum Floor to floor height (required) - 2600 mm				
		Travel Height - 36.5 m				
		Headroom Height - 4700 mm				
		Lockable storage room (required) - 250 Sq. feet				
		Stilt area under roof (required) - 200 Sq. feet				
		ELEVATOD SDECIEICATIONS				
		ELEVATOR SPECIFICATIONS Power Supply: TN_S (3L+ $PE+N$)				
		Number of Persons: 20				
		Rated Load: 1360 kg				
		Number of Stops & Openings: 9 Stops & 9 Openings				
		Number of Access sides: 1 on all floors				
		Drive System: Alternating Current Variable Voltage				
	1	Type of controller: Triplex Collective Selective Control		1		
		Speed of travel: 1.5 - 1.75 m/s			+ +	
		Light power supply voltage - 230 V				
	1				1	

		Power supply needed: 400/415 V				
		CAR DESIGN				
		Car Finish - Stainless Steel (Hairline)				
		Car Door Finish - Stainless Steel (Hairline)				
		Landing Door Finish - Stainless Steel (Hairline)				
		Mirror finish SS Handrail				
		Mirror on rear car panel				
		Granite/Marble Flooring				
		Car Operating Panel (COP): Full height, flush mounted				
		Landing Operating Panel (LOP): Individual LOP for				
		each elevator				
		Door Opening Direction - Center Opening 2 panels				
		Aluminium Sill				
		STANDARD FEATURES				
		Automatic Rescue Device (ARD) in case of power				
		failure				
		Alarm button in COP				
		Automatic operation for car fan				
		Adjustable door opening time				
		Emergency Light				
		Full load by pass				
		Infra Red screen for car door				
		Intercom				
		Motor overheat protection				
		Attendant control				
		Fireman control				
		Fireman emergency return				
		Floor Annunciator				
		Visual and acoustic confirmation of call				
		Position indicator				
		Overload detection				
			Each	3.00		8,420,340.00
					2,806,78	- , - ,
		Call acceptance (visual)			0.00	
8.1.2	N.S.	(B) SCHEDULE OF WORK FOR GOODS LIFT				
		Supplying, Installation, Testing and Commissioning of				
		Goods Lift (1500 Kg), Gearless & Machine Room				
		Less/Machine Room lifts for Office Building having				
		contract speed of 1.0 Mps with compatibility for				
		seemless integration with BMS as per enclosed				
		technical specifications and details given as under:				
		Speed : 1.0-1.5 MPS				
		Floors : Ground + 1st to 8th Floors+Terrace (10				
		Floors).				
		Travel: 40 Meters (approx.)				
		Stops and Opening: 10 Stops & 10 Opening				
		Controller: Gearless drive with VVVF(Variable	Т			
		Voltage Variable Frequency) Closed loop				
-			-			

		Automatic Rescue Device complete with dry maintenance free batteries as required				
		Operation: Microprocessor based single automatic				
		nucleopiecessoi based single automatic				
		attendent				
		Bower 415 V 2 Dhose 50 Hz 4 wines system				
		Turne of Deere				
		Com Well finish in Stainless Steel Maannach finish				
		with 6 mm Aluminium Composite Danal 0.8 thick				
		stainless steel Cladding.				
		Landing doors : Landing door finish in Stainless Steel				
		SS hand rail not less than 600 mm long at 900 mm				
		above floor level to be fixed adjacent to control panel in				
		the lift car.				
		Voice announcement system in the car to announce the	No	1.00		2 894 492 00
		position of the elevator in the hoist way as the car	1.0.	1.00	2.894.49	2,001,102.000
		passes or stops at a floor served by the elevator.			2.00	
		TOTAL FOR LIFTS IN CORPORATE BUILDING				11.314.832.00
8.2	N.S.	B) LIFTS FOR HOSTEL BLOCK				
		Supplying, Installation, Testing and Commissioning of				
		6 passenger (408 Kg). Gearless & Machine Room Less				
		lifts for Hostel Building having contract speed of 1.0-				
		1.5 Mps with compatibility for seemless integration				
		with BMS as per enclosed technical specifications and				
		details given as under:				
		CIVIL REQUIREMENTS				
		Shaft Walls - Concrete				
		Clear Inside Shaft (available) - 1650 mm Width x 1575				
		mm Depth				
		Pit Depth - 1600 mm				
		Minimum Floor to floor height (required) - 2600 mm				
		Travel Height - 25 m (APPROX.)				
		Headroom Height - 4700 mm				
		Lockable storage room (required) - 250 Sq. feet				
		Stilt area under roof (required) - 200 Sq. feet				
		ELEVATOR SPECIFICATIONS				
		Power Supply: TN-S (3L+PE+N)				
		Number of Persons: 6				
	1	Rated Load: 408 kg				1
	1	Number of Stops & Openings: 6 Stops & 6 Openings			1	1
		Number of Access sides: 1 on all floors				
		Drive System: Alternating Current Variable Voltage				†
		Variable Frequency (ACVVVF)				
		Type of controller: Full Collective Control				+
	<u> </u>	Speed of travel: 1.0 - 1.5 m/s				1
	1	Light power supply voltage - 230 V				
		Power supply voltage - 250 v				
L	1	10001 Supply notation. T00/T15 V				1

		CAR DESIGN				
		Car Finish - Stainless Steel (Hairline)				
		Car Door Finish - Stainless Steel (Hairline)				
		Landing Door Finish - Stainless Steel (Hairline)				
		Mirror finish SS Handrail				
		Mirror on rear car panel				
		Granite/Marble Flooring				
		Car Operating Panel (COP): Full height, flush mounted				
		Landing Operating Panel (LOP): Individual LOP for				
		each elevator				
		Door Opening Direction - Center Opening 2 panels				
		Aluminium Sill				
		STANDARD FEATURES				
		Automatic Rescue Device (ARD) in case of power				
		failure				
		Alarm button in COP				
		Automatic operation for car fan				
		Adjustable door opening time				
		Emergency Light				
		Full load by pass				
		Infra Red screen for car door				
		Intercom				
		Motor overheat protection				
		Attendant control				
		Fireman control				
		Fireman emergency return				
		Floor Annunciator				
		Visual and acoustic confirmation of call				
		Position indicator				
		Overload detection				
			Fach	2.00		2 277 000 00
			Lach	2.00	1 138 50	2,277,000.00
		Call acceptance (visual)			0.00	
					0.00	
		TOTAL FOR LIFTS IN HOSTEL BLOCK				2 277 000 00
						2,211,000.00
83	NS	C) LIFTS FOR ADMINISTRATIVE BLOCK				
831	11.0.	Supplying Testing and commissioning of 16 passenger				
0.5.1		(Gearless & Machine Room Less) lifts for office				
		Building (1360 Kg) Lifts having contract speed of 1				
		Mps serving different Floor in lift shaft with				
		compatibility for seemless integration with BMS as per				
		detailing specifications enclosed and as under:				
		CIVIL REQUIREMENTS			1	
		Shaft Walls - Concrete				
		Clear Inside Shaft (available) - 3050 mm Width x 1950				
		mm Depth				
		Pit Depth - 1600 mm				
I					1	1

			1	
Minimum Floor to floor height (required) - 2600 mm				
Travel Height - 25 m (APPROX.)				
Headroom Height - 4700 mm				
Lockable storage room (required) - 250 Sq. feet				
Stilt area under roof (required) - 200 Sq. feet				
ELEVATOR SPECIFICATIONS				
Power Supply: TN-S (3L+PE+N)				
Number of Persons: 16				
Rated Load: 1088 kg				
Number of Stops & Openings: 4 Stops & 4 Openings				
Number of Access sides: 1 on all floors				
Drive System: Alternating Current Variable Voltage				
Variable Frequency (ACVVVF)				
Type of controller: Duplex Collective Selective Control				
Speed of travel: 1.0 - 1.5 m/s				
Light power supply voltage - 230 V				
Power supply needed: 400/415 V				
CAR DESIGN				
Car Finish - Stainless Steel (Hairline)				
Car Door Finish - Stainless Steel (Hairline)				
Landing Door Finish Stainless Steel (Hairline)				
Mimor finish SS Use droil				
 Mimor on noon con nonal				
Millior on rear car panel				
Granite/Marble Flooring				
Car Operating Panel (COP): Full height, flush mounted				
Landing Operating Panel (LOP): Individual LOP for				
each elevator				
Door Opening Direction - Center Opening 2 panels				
Aluminium Sill				
STANDARD FEATURES				
Automatic Rescue Device (ARD) in case of power				
failure				
Alarm button in COP				
 Automatic operation for car fan				
Adjustable door opening time				
Emergency Light				
Full load by pass				
Infra Red screen for car door				
Intercom				
Motor overheat protection				
Attendant control				
Fireman control				
Fireman emergency return				
Floor Annunciator				
Visual and acoustic confirmation of call				
Position indicator				
Overload detection				
Call acceptance (visual)	Each	2.00		3,859,322.00

8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT 1.00 8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT Supplying, Installation, Testing and Commissioning of Goods Lift (1000 Kg), Gearless & Machine Room Less/Machine Room lifts for Admin Building having contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: Speed : 1.0-1.5 MPS Floors : Ground + 1st to 4th Floor (5 Floors). Travel : 20 Meters (approx.) Stops and Opening : 5 Stops & 5 Opening Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required Quertation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>							
8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT 1.00 8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT 1.00 8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT 1.00 8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT 1.00 8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT 1.00 8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT 1.01 8.3.2 N.S. (Goods Lift (1000 Kg), Gearless & Machine Room Less/Machine Room lifts for Admin Building having contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: 1.01 Supps and Opening : 5 Stops & 5 Opening 1.01 1.01 Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop 1.01 1.01 Automatic Rescue Device complete with dry maintenance free batteries as required 1.01 1.01 Operation: Microprocessor based single automatic push buttor) / duplex collective selective with / without attendant. 1.02 1.01 Power - 415 V, 3 Phase, 50 Hz, 4 wires system 1.02 1.02 1.02 Type of Doors 1.02 1.02 1.02 1.05 Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick strainless steel Cladding. 1.00 1.00 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>1,929,66</td> <td></td>						1,929,66	
8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT Supplying, Installation, Testing and Commissioning of Goods Lift (1000 Kg), Gearless & Machine Room Less/Machine Room Itis for Admin Building having contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: Speed: 1.0-1.5 MPS Floors: Ground + lst to 4th Floor (5 Floors). Travel: 2.0 Meters (approx.) Stops and Opening: 5 Stops & 5 Opening Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Power + 415 V, 3 Phase, 50 Hz, 4 wires system						1.00	
8.3.2 N.S. (B) SCHEDULE OF WORK FOR GOOD LIFT Supplying, Installation, Testing and Commissioning of Goods Lift (1000 Kg), Gearless & Machine Room Less/Machine Room lifts for Admin Building having contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: Speed: 1.0-1.5 MPS							
Supplying, Installation, Testing and Commissioning of Goods Lift (1000 Kg), Gearless & Machine Room Less/Machine Room lifts for Admin Building having contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: Speed : 1.0-1.5 MPS	8.3.2	N.S.	(B) SCHEDULE OF WORK FOR GOOD LIFT				
Goods Lift (1000 Kg), Gearless & Machine Room Less/Machine Room lifts for Admin Building having contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: Speed: 1.0-1.5 MPS Floors: Ground + 1st to 4th Floor (5 Floors). Travel : 20 Meters (approx.) Stops and Opening : 5 Stops & 5 Opening Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system Type of Doors Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Landing doors : Landing door finish in Stainless Steel Moorrock with thickness : 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. 0.00 </td <td></td> <td></td> <td>Supplying, Installation, Testing and Commissioning of</td> <td></td> <td></td> <td></td> <td></td>			Supplying, Installation, Testing and Commissioning of				
Less/Machine Room lifts for Admin Building having contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: Speed : 1.0-1.5 MPS Floors : Ground + 1st to 4th Floor (5 Floors). Travel : 20 Meters (approx.) Stops and Opening : 5 Stops & 5 Opening Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system Type of Doors Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm S band rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. O00 TOTAL FOR LIFTS IN ADMINISTRATIVE 5,618,822.00 BLOCK TOTAL OF LIFTS (NON-SCHEDULED ITEM): Yes Yes 			Goods Lift (1000 Kg), Gearless & Machine Room				
contract speed of 1.0 Mps with compatibility for seemless integration with BMS as per enclosed technical specifications and details given as under: Speed : 1.0-1.5 MPS Floors : Ground + 1st to 4th Floor (5 Floors). Travel : 20 Meters (approx.) Stops and Opening : 5 Stops & 5 Opening Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system Type of Doors Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Image: Single automatic stainless Steel Moonrock with thickness: 1.2mm Shand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. No. 1.00 1,759,500.00 1,92,10,			Less/Machine Room lifts for Admin Building having				
seemless integration with BMS as per enclosed technical specifications and details given as under:			contract speed of 1.0 Mps with compatibility for				
Image: secifications and details given as under: Image: secifications and details given as under: Image: secifications and details given as under: Image: secifications and details given as under: Image: secifications and betails given as under: Image: secifications and betails given as under: Image: secifications and Depaing : S Stops & S Opening Image: secifications and Depaing : S Stops & S Opening Image: secification image: secification is secification as a complete with dry maintenance free batteries as required Image: secification image: secification as a complete with dry maintenance free batteries as required Image: secification image:			seemless integration with BMS as per enclosed				
Speed : 1.0-1.5 MPS Floors : Ground + Lst to 4th Floor (5 Floors). Travel : 20 Meters (approx.) Stops and Opening : 5 tops and Opening : Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required 0 Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system 1 Type of Doors 0 Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. 1.00 Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. 1.00 TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK 5,618,822.00 BLOCK 1.92,10,654.00			technical specifications and details given as under:				
Floors : Ground + 1st to 4th Floor (5 Floors). Image: Travel : 20 Meters (approx.) Stops and Opening : 5 Stops & 5 Opening Image: Travel : 20 Meters (approx.) Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Image: Travel : 20 Meters are required Automatic Rescue Device complete with dry maintenance free batteries as required Image: Travel : 20 Meters are required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Image: Travel : 20 Meters are required Power - 415 V, 3 Phase, 50 Hz, 4 wires system Image: Travel : 20 Meters are required Type of Doors Image: Travel : 20 Meters are required Monrock with finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Image: Travel : 20 Meters are required Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. No. 1.00 1,759,500.00 Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. 1.00 1,759,500.00 1,759,500.00 0.00 1,759,500.00 1,92,10,654.00 1,92,10,654.00 1,92,10,654.00 1,92,10,654.00 1,92,10,654.00 1,92,10,654.00			Speed : 1.0-1.5 MPS				
Travel : 20 Meters (approx.) Image: Stops and Opening : 5 Stops & 5 Opening Stops and Opening : 5 Stops & 5 Opening Image: Stops and Opening : 5 Stops & 5 Opening Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Image: Stops and Opening : 5 Stops & 5 Opening Automatic Rescue Device complete with dry maintenance free batteries as required Image: Stops and Opening : 5 Stops & 5 Opening Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Image: Stops & 5 Opening = 1 Stops & 5 Opening & 5 Opening & 5 Opening & 5			Floors : Ground + 1st to 4th Floor (5 Floors).				
Stops and Opening : 5 Stops & 5 Opening			Travel : 20 Meters (approx.)				
Controller: Gearless drive with VVVF(Variable Voltage Variable Frequency) Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Image: Control of			Stops and Opening : 5 Stops & 5 Opening				
Voltage Variable Frequency Closed loop Automatic Rescue Device complete with dry maintenance free batteries as required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system Type of Doors Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Alumininum Composite Panel 0.8 thick stainless steel Cladding. Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B". TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B". "B"			Controller: Gearless drive with VVVF(Variable				
Automatic Rescue Device complete with dry maintenance free batteries as required Image: Value of the position of the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. Image: Value of the position of the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. TOTAL FOR LIFTS (NON-SCHEDULED ITEM)- "B" Image: Value of the position of the lift car. TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B" Image: Value of the position of the lift car. TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B" Image: Value of the position of the lift car. TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B" Image: Value of the position of the lift car.			Voltage Variable Frequency) Closed loop				
maintenance free batteries as required Imaintenance free batteries as required Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system Imaintenance free batteries as required Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. No. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK 5,618,822.00 TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B" 1,92,10,654.00 "B'' Image: State			Automatic Rescue Device complete with dry				
Operation: Microprocessor based single automatic push button / duplex collective selective with / without attendant.			maintenance free batteries as required				
Operation. Microprocessor based single automatic push button / duplex collective selective with / without attendant. Image: Collective selective with / without attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system Image: Collective selective with / without attendant. Type of Doors Image: Collective selective with / without attendant. Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Image: Collective selective selective selective stainless steel Cladding. Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm Image: Collective selective selective stainless steel cladding. SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Image: Collective selective stainless at a floor served by the elevator. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. Image: Collective stainless state floor served by the elevator. TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK State Stat			Oneration: Microprocessor based single automatic				
attendant. Power - 415 V, 3 Phase, 50 Hz, 4 wires system			push button / dupley collective selective with / without				
Power - 415 V, 3 Phase, 50 Hz, 4 wires system			attendant				
Type of Doors			Bower 415 V 2 Phase 50 Hz 4 wires system				
Image: Car: Wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Image: Car: Wall finish in Stainless Steel Noonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Image: Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm Image: Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Image: Landing door finish in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. 1.00 1.759,500 Image: Car			Fower - 413 V, 5 Phase, 30 HZ, 4 whes system				
Car: wall finish in Stainless Steel Moonrock finish with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding. Image: Care of the stainless steel Cladding. Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. No. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK 5,618,822.00 TOTAL OF LIFTS (NON-SCHEDULED ITEM)- 1,92,10,654.00 "B" Image: Content of the state of the s			Type of Doors				
with 6 mm Aluminium Composite Panel 0.8 thick stainless steel Cladding.			Car: Wall finish in Stainless Steel Moonrock finish				
Statiness steer Cladding. Image: Cladding. Image: Cladding. Landing doors : Landing door finish in Stainless Steel Moonrock with thickness: 1.2mm Image: Cladding. SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Image: Cladding. Image: Cladding. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. Image: No. 1.00 1,759,500 TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK Image: No. Image: No. Image: No. Image: No. TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B" Image: No. Image: No. Image: No. Image: No. C UPS Image: No. Image: No. Image: No. Image: No.			with 6 mm Aluminium Composite Panel 0.8 thick				
Landing doors : Landing door mitsh in Stainless Steel Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. 1.00 Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. 1.00 TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK TOTAL OF LIFTS (NON-SCHEDULED ITEM)- 1,92,10,654.00 "B" Image: state sta			staniess steel Cladding.				
Moonrock with thickness: 1.2mm SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Image: Control panel in the lift car. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. 1.00 1,759,500.00 TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK TOTAL OF LIFTS (NON-SCHEDULED ITEM)- Image: Control panel in the car control panel in the car control panel in the lift car. Image: Control panel in the car control panel in the car control panel in the car control panel in the lift car. Image: Control panel in the car control			Landing doors: Landing door finish in Stainless Steel				
SS hand rail not less than 600 mm long at 900 mm above floor level to be fixed adjacent to control panel in the lift car. Image: Control panel in the lift car. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. 1.00 1,759,500.00 TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK TOTAL FOR LIFTS IN ADMINISTRATIVE 5,618,822.00 TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B" Image: Control panel in the lift car. Image: Control panel in the lift car.			Moonrock with thickness: 1.2mm				
above floor level to be fixed adjacent to control panel in the lift car. image: control panel in the lift car. Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. No. 1.00 1,759,500.00 TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK TOTAL FOR LIFTS (NON-SCHEDULED ITEM)- "B" Image: control panel in 1,759,500.00 Image: control panel in 1,759,500.00 TOTAL OF LIFTS (NON-SCHEDULED ITEM)- "B" Image: control panel in 1,92,10,654.00 Image: control panel in 1,92,10,654.00			SS hand rall not less than 600 mm long at 900 mm				
the lift car. interview interview </td <td></td> <td></td> <td>above floor level to be fixed adjacent to control panel in</td> <td></td> <td></td> <td></td> <td></td>			above floor level to be fixed adjacent to control panel in				
Voice announcement system in the car to announce the position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. 1.00 1,759,50 Image: Description of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. 0.00 1,759,50 Image: Description of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. 0.00 1,759,50 Image: Description of the elevator in the hoist way as the elevator. Image: Description of the elevator. 1,759,50 Image: Description of the elevator in the hoist way as the elevator. Image: Description of the elevator. 1,759,50 Image: Description of the elevator in the hoist way as the elevator. Image: Description of the elevator. 1,759,50 Image: Description of the elevator in the hoist way as the elevator. Image: Description of the elevator. 1,759,50 Image: Description of the elevator in the hoist way as the elevator. Image: Description of the elevator. 1,759,50 Image: Description of the elevator. Image: Description of the elevator. 1,759,50 1,92,10,654.00 Image: Description of the elevator. Image: Description of the elevator. Image: Description of the elevator. Image:			the lift car.	N	1.00		1 750 500 00
position of the elevator in the hoist way as the car passes or stops at a floor served by the elevator. 1,759,50 TOTAL FOR LIFTS IN ADMINISTRATIVE BLOCK 5,618,822.00 TOTAL OF LIFTS (NON-SCHEDULED ITEM)- 1,92,10,654.00 "B" 1			Voice announcement system in the car to announce the	No.	1.00	1 750 50	1,759,500.00
passes or stops at a floor served by the elevator. 0.00 Image: Constraint of the served by the elevator. 0.00 Image: Constraint of the served by the elevator. 0.00 Image: Constraint of the served by the elevator. 0.00 Image: Constraint of the served by the elevator. 0.00 Image: Constraint of the served by the elevator. 0.00			position of the elevator in the hoist way as the car			1,759,50	
TOTAL FOR LIFTS IN ADMINISTRATIVE 5,618,822.00 BLOCK 5,618,822.00 TOTAL OF LIFTS (NON-SCHEDULED ITEM)- 1,92,10,654.00 "B" 1			passes or stops at a floor served by the elevator.			0.00	
TOTAL FOR LIFTS IN ADMINISTRATIVE 5,618,822.00 BLOCK 1,92,10,654.00 "B" 1,92,10,654.00							
BLOCK Image: Second secon			TOTAL FOR LIFTS IN ADMINISTRATIVE				5,618,822.00
TOTAL OF LIFTS (NON-SCHEDULED ITEM)- 1,92,10,654.00			BLOCK				
TOTAL OF LIFTS (NON-SCHEDULED ITEM)- 1,92,10,654.00 "B"							
"B" Image: Constraint of the second sec			TOTAL OF LIFTS (NON-SCHEDULED ITEM)-				1,92,10,654.00
			"R "				
	<i>c</i> :						
	C		UPS				
9.0	9.0						
9.1 Supply, Installation, testing and commissioning of	9.1		Supply, Installation, testing and commissioning of				
following sizes of Three Phase Modular True Online			following sizes of Three Phase Modular True Online				
NS UPS in N+1 parallel redundant configuration		NS	UPS in N+1 parallel redundant configuration				
confirming to IEC EN 62010 (All parts) compatible for		115	confirming to IEC EN 62010 (All parts) compatible for				
seemless integration to BMS with following			seemless integration to BMS with following				
specifications complete:			specifications complete:				
Fully rated IGBT rectifier, charger and inverter			Fully rated IGBT rectifier, charger and inverter				
integrated in each UPS module			,				
			integrated in each UPS module				

		Each power module shall be having Decentralized				
		Parallel Architecture				
		3 phase input voltage (380-415V) and frequency 50 Hz				
		including phase sequence corrector				
		One extra UPS module to be provided beyond the rated				
		capacity of the UPS				
		UPS cabinet must have spare space for future UPS				
		module				
		Fully rated hot scalable/swapable with power module				
		UPS shall be capable of adding or removing UPS				
		module as well as static bypass without going to bypass				
		mode				
		UPS full load efficiency shall not be less than 95%				
		Sealed maintenance free 12V batteries shall be provided				
		to provide minimum 30 minutes backup at full load.				
		Input Power Factor : >0.95				
		Output Power Factor : Unity				
		Input Distortiopn THDi : \leq 5% at 100%				
		Overall Efficiency : Upto 95%				
		Hot Sync paralleling : Inbuilt				
		In built ABM : Inbuilt				
		Communication Ports : USB, RS232, SNMP, Ethernet				
		Satnadard : IEC/EN 62040				
		IP Rating : IP20				
а		160 KVA UPS	Nos.	1		2.753.100.00
			11001	-	2.753.10	2,700,100,000
					0.00	
b		120 KVA UPS	Nos.	1		2,390,850.00
					2,390,85	
					0.00	
9.2		True Online, Double Conversion, Dual Source 10 KVA				
		UPS System with new energy efficient IGBT Rectifier				
		& IGBT Invertor along with Battery Circuit Breaker				
	NS	(BCB), Battery Rack, Exide/Quanta Batteries,				
	145	Interlinks & DC-DC Cable with complete				
		accessories with below mentioned key features along				
		with Accessories for 30 min backup on 10 KVA				
		load				
		Fully rated IGBT rectifier, charger and inverter				
		integrated in UPS				
		3 phase input voltage (380-415V) and frequency 50 Hz				
		including phase sequence corrector				
		UPS full load efficiency shall not be less than 95%				
		Sealed maintenance free 12V batteries shall be provided				
		to provide minimum 30 minutes backup at full load.				
		Input Power Factor : >0.95				
		Output Power Factor : Unity				
		Input THD1 : < 5%				
		AC-AC Efficiency : Upto 94%				
		Hot Sync paralleling : Inbuilt				
1		In built ABM : Inbuilt				

		SNMP : Inbuilt	Nos.	1	320,850. 00	320,850.00
		Total for UPS (NON-SCHEDULED ITEMS)-"C"				5,464,800.00
D		EIDE FICHTING WODKS				
U		FIRE FIGHTING WORKS				
1		SUB HEAD-A (PIPING & VALVES)				
1.1	N.S.	Providing and fixing brass ball valve (full bore type) with plastic coated lever and screwed female ends tested to 20 Kg/ cm2 of approved quality as specified.				
а		25 mm dia.	Nos	27	713.00	19 251 00
b		50 mm dia.	1105	21	/15.00	17,201.00
1.2	NC	Droviding & fiving 25mm dia III listed symmetry	Nos	27	1,601.00	43,227.00
1.2	IN. S .	inspector test and drain valve with integral sight glass connected to drain line complete in all respects.	Nos	27	237.00	6,399.00
1.3	N.S.	Providing and fixing gunmetal single acting air release				
		valve with screwed inlet 25 mm dia	Nos	4	970.00	3,880.00
1.4	N.S.	Providing and fixing dial type pressure gauge with isolation cock and copper pipe at hydrant station.				
		Dial diameter 100 mm calibration 0-15 kg/ sq.cm.	Nos	9	924.00	8,316.00
1.5	N.S.	Providing and fixing blank flanges as per table 'E' with asbestos gasket, nut, bolts, washers complete				
		150 mm dia.	Nos	9	643.00	5,787.00
		TOTAL SUB HEAD-A (PIPING & VALVES)				86.860.00
2.0	N.S.	SUB HEAD-B (FIRE HYDRANT ACCESSORIES) Providing and fixing door with frame for all internal fire hydrants fabricated from 20x20x3 mm and 40x20x3 mm aluminium hollow box sections mounted with 3 no. of 100 mm Aluminium butt hinge on Aluminium angle frame of 45x45x5 mm size with hold fasts fixed to wall with P.C.C. (1:2:4) blocks 100x100x100 mm including 2 nos allen key lock for locking along with padlock arrangement & fully glazed with 4 mm thick float glass approved by local Fire Authority, powder coated fire red finish with " fire hose' written on front suitable to house 15 mm long two length of canvas hose with couplings, one no of branch pipe, one fire mans axe and two numbers of portable extinguishers, first aid fire hose and supports for hoses,				
		branch pipes, Axe and hose reel. Size 2100x 900 mm	Nos	27	7,498.00	202,446.00

		complete as per approved design including necessary fixing arrangement for hoses & axe and branch pipe.)				
		TOTAL SUB HEAD-B (FIRE HYDRANT ACCESSORIES)				202,446.00
3.0		SUB HEAD-D (FIRE EXTINGUISHERS & MISC. ITEMS)				
3.1	N.S.	Providing and fixing Carbon-di-oxide fire extinguishers consisting of welded M.S cylindrical body, squeeze lever discharge valve fitted with internal discharge tube, 30cms long high pressure discharge hose, discharge nozzle, suspension bracket, confirming to IS : 15683 finished externally with red enamel paint and fixed to wall with brackets with rawl plug/dash fasteners complete with internal charge. Capacity 4.5 kg. ISI Marked.(Contractor should submit test certificate form manufacturer along with serial number of every autinguichers supplied.)	Nos	21	° 625 00	267 275 00
3.2	N.S.	Providing and fixing Powder type (ISI marked) fire extinguishers consisting of welded M.S. cylindrical body squeeze lever discharge valve 30 cm long high pressure discharge hose, discharge nozzle suspension bracket ISI marked finished externally with red enamel paint and fixed to wall with brackets complete with internal charger.	1105		8,023.00	207,373.00
		Capacity 4kg.(IS:15683)	Nos	27	1 917 00	51 759 00
3.3	N.S.	Providing and fixing of self illuminated / auto glow "EXIT" signs printed on photoluminescent sheet containing self illuminated base chemical, of appropriate size not less than 400 x 150 mm, suspended from ceiling or fixed to the walls with accessories as required and as directed at site.	Nos	54	1,917.00	103,518.00
		& MISC. ITEMS)				422,652.00
		TOTAL FOR FIRE FIGHTING SYSTEM				711,958.00
		TOTAL OF ELECTRICAL WORKS (NON- SCHEDULED ITEM) – (ii) (A+B+C+D)				7,78,01,040.00
		TOTAL OF ELECTRICAL WORKS (SCHEDULED+NON-SCHEDULED ITEM) – (i) +(ii)				15,99,74,578.00

		BILL OF QUANTITIES OF HVAC &	& BMS V	VORK		
Sr. No.	DSR- 2018/201 9	Description of item	Unit	Total Qty.	Unit Rate	Total Amount
TTT						
111		SCHEDULE-III HVAC WORKS				
(i)		SCHEDULE ITEMS				
(1)						
1.0		AIR DISTRIBUTION SYSTEM				
1.1		Site Fabricated Duct – GI Sheet Metal duct				
		Supplying, installation, balancing and commissioning of fabricated at site GSS sheet metal rectangular/round ducting complete with neoprene rubber gasket, elbows, splitter dampers, supports, flexible hangers with isolators, flexible connections, nut bolts, fastner, and vanes, volume control dampers etc as per approved drawings and specifications of following sheet thickness complete as required.				
А	D.S.R 16.12.2.1	0.63mm (24 gauge) GSS	Sqm	2850	826	2,354,100.00
b	D.S.R 16.12.2.2	0.8 mm (22 gauge) GSS	Sqm	1200	985	1,182,000.00
с	D.S.R 16.12.2.3	1.0mm (20 gauge) GSS	Sqm	70	1,278	89,460.00
d	D.S.R 16.12.2.4	1.25mm (18 gauge) GSS	Sqm	70	1,444	101,080.00
1.2		Factory Fabricated Duct – GI duct				
		Supply,Installation,balancing and commissioning of factory fabricated GSS sheet metal rectangular/round ducting complete with neoprene rubber gaskets, elbows, splitter,vanes, hangers, supports etc. in accordance with the approved drawings and specifications of following sheet thickness complete as required.	2			
A	16.12.1.1	0.63mm (24 gauge) GSS	Sqm	3000	862	2,586,000.00
D	10.12.1.2	$\begin{array}{c} \text{U.0 IIIII} (22 \text{ gauge}) \text{GSS} \\ 1.0 \text{mm} (20 \text{ gauge}) \text{GSS} \end{array}$	Sqm	1500	1,011	1,310,300.00
с Л	16.12.1.3	1.0 mm (20 gauge) GSS	Sam	30	1,110	44,040.00
u	10.12.1.7	1.201111 (10 Judge) 000	Squi	50	1,770	,100.00
1.3		Supplying, installing, testing and balancing of aluminium supply/return air grills of various sizes. Each grill shall be with fixed horizontal front bar at Zero/15 Deg deflection through the collar and register.				
А	D.S.R 16.15	Supply air grills with VCD.	Sqm	33	7,435	245,355.00

I		I	1	1	I	
b	D.S.R	Exh (Botum oir grill without VCD	Sqm	23	4,829	111,067.00
с	16.17	Supplying, fixing, testing and commissioning of supply air diffusers of powder coated aluminium with alluminium volume control dampers with anti smudge ring and removable core.	Sqm	40	9,964	398,560.00
d	16.18	Supplying, fixing, testing and commissioning of return air diffusers of powder coated aluminium without alluminium volume control dampers with anti smudge ring and removable core.	Sqm	40	6,628	265,120.00
1.4		MOTORIZED FIRE AND SMOKE DAMPERS				
a	D.S.R 16.20.1	Supply, Installation, Testing and commissioning of motorized combination fire and smoke damper (spring return type) of approved make of atleast 120 minute fire rating and as per the specifications as detailed earlier in the relevant sections. The fire damper shall be complete with electronic temperature sensor and electrically operated actuator . The fire dampers shall be located in the supply/return air ducts, at all fire rated crossovers (shafts/walls etc.) The control panel will be such located that the reset can be easily done These combination smoke and fire dampers shall be interlocked with the building management system for fire detection / HVAC and shall trip/close in the event of fire / smoke in the respective zone . Bare Fire Dampers with 400 mm sleeve Control panel actuator, including	SqM	14	8,666	116,991.00
b	16.20.2	Electrical, spring type actuator, remote indication of the fire damper position.	No	28	8,081	226,268.00
		TOTAL OF AIR DISTRIBUTION SYSTEM				9,281,241
2.0		INSULATION WOKKS				
		Supply and installation of cross linked closed cell Oxide Acetate (Thermo Isolate) Foam Thermal insulation on ducts having density of 30 ± 3 Kg/ M ³ , having K value 0.029 W/m ° K at 0°C Deg temp and temp range of -70°C to +100°C and fire rating Class O as per BS 476 Part 6 from CBRI,Roorkee and CFC/HCFC free as per US EPA 5021 A(2014). • Smoke & Toxicity index of material shall be passed as per IMO MSC 307 (88) 2010 Anexx 1 Pt 2 and as per the approved specifications of following thickness.				
I A	D.S.R	19 mm	Sqm	3140	611	1.918.540.00

	16.23.1					
		TOTAL OF INSULATION WORKS				1,918,540
3.0		ASSOCIATED ELECTRICAL WORKS				
5.0		ASSOCIATED ELECTRICAL WORKS				
3.1		Supply, installation, testing & 888solators888888ng of cable termination of above cables with copper lugs & flameproof brass compression glands on both the ends with 888solators888 compound etc. complete as required.				
А	DSR- 9.1.1	2Cx04 Sqmm	Set	6	174	1,044.00
b	DSR- 9.1.7	3Cx04 Sqmm	Set	26	185	4,810.00
c	DSR- 9.1.7	3Cx06 Sqmm	Set	16	194	3,104.00
d	DSR- 9.1.8	3Cx16 Sqmm	Set	40	192	7,680.00
e	DSR- 9.1.32	4Cx06 Sqmm	Set	108	192	20,736.00
f	DSR- 9.1.32	4Cx04 Sqmm	Set	12	192	2,304.00
3.2		Supplying and installing following size of perforated G.I. cable trays, G.I. bends with perforation not more than 17.5%, joined with connectors, suspended from the ceiling with suitable suspenders including G.I. bolts & nuts, painting of suspenders etc. complete as required.				
А	DSR- 4.6.1	100 mm. Width x 50mm. Depth x 1.6mm. Thickness.	Rmt	85	525	44,625.00
b	DSR- 4.6.2	150 mm. Width x 50mm. Depth x 1.6mm. Thickness.	Rmt	90	565	50,850.00
c	DSR- 4.6.3	225 mm. Width x 50mm. Depth x 1.6mm. Thickness.	Rmt	100	711	71,100.00
d	DSR- 4.6.4	300 mm. Width x 50mm. Depth x 1.6mm. Thickness.	Rmt	70	767	53,690.00
3.3		Providing and fixing following size of G.I. strip / G.I. wire on surface or in recess for loop earthing alongwith the existing surface/ recessed conduit/ submain wiring / on cable tray/ on surface including G.I. clamps etc. complete as required.(For Equipment and Panels)				
а	DSR-5.9	6 SWG G.I. wire	Rmt	380	114	43,320.00
		TOTAL OF ELECTRICAL WORKS				3,03,263

4.0	1		l	1	1
4.0					
		AIR COOLED VRF UNITS			
4.1	DCD				
4.1	DSR-				
	2019,Item				
	-01	OUTDOOR UNITS (HEAT PUMP TYPE)			
		Supplying, installing, testing and			
		commissioning of aircooled variable			
		refrigerant volume / Flow modular type			
		airconditioning system with R410a			
		refrigerant. The PCB Chamber of outdoor unit			
		should be refrigerant cooled suitable for			
		$415\pm10\%$ 3 Phase, 50 cycles. The unit shall			
		consist of indoor and out door units with			
		individual controller as per detail given in			
		specifications and having following items :			
		Modular type outdoor units equipped with			
		highly efficient 100% inverter type hermitically			
		sealed scroll compressors, minimum two			
		comprossors for and above 14 HP modules,			
		with special precoated heat exchanger, low			
		noise condenser fan housed in compact housing			
		duly powder coated and manufacturer of			
		compressor and outdoor unit should be same.			
		The Unit should have automatic refrigerant			
		charge function. The static pressure of the			
		outdoor unit shall be more than 78 Pa to			
		avoid hot air recirculation. The unit shall be			
		able to operate upto to 49°C in cooling			
		mode. The unit shall also have feature to			
		automatically modulate the evaporative			
		temperature between 6 deg C to 11 deg C with			
		respect to load for better comfort and			
		energy efficiency etc complete as reqd. The			
		units should have free phase technology for			
		continued operation. The unit shall deliver the			
		rated capacity at AHRI Conditions and work			
		even at 50°C ambient temperature without			
		tripping.			
		The Minimum ISEER Should be as mentioned			
		below:- Up to 10 HP 30 Btu/hr/w			
		12 HP to 14 HP 25 Btu/hr/w			
		16 HP & Above 21 Btu/hr/W			
		Cost of R 410 A Gas should be inclusive			
		The outdoor unit should include all loading,			
		unloading, transportation, power cabling/wiring			
		from near the indoor and outdoor units			
		respectively.			

		Outdoor Units-Heat Pump, Fully Gas Charged, Aluminum fins within the ODU (condensing) unit shall be coated with polysiloxane based coating , vibration isolators with suitable foundation etc .				
		The Vendor should considere the deration on				
		ODU selection as per Greater Noida Ambient				
		conditions				
a		10 HP Outdoor unit	No.	1	143,928	143,928.33
b		16 HP Outdoor unit	No.	2	230,285	460,570.67
с		18 HP Outdoor unit	No.	1	259,071	259,071.00
d		20 HP Outdoor unit	No.	7	287,857	2,014,996.67
e		26 HP Outdoor unit	No.	2	374,214	748,427.33
f		30 HP Outdoor unit	No.	1	431,785	431,785.00
g	DSR-	32 HP Outdoor unit	No.	1	460,571	460,570.67
h	2019,Item	34 HP Outdoor unit	No.	2	489,356	978,712.67
i	-01	36 HP Outdoor unit	No.	4	518,142	2,072,568.00
j		38 HP Outdoor unit	No.	2	546,928	1,093,855.33
k		40 HP Outdoor unit	No.	2	575,713	1,151,426.67
1		42 HP Outdoor unit	No.	1	604,499	604,499.00
m		44 HP Outdoor unit	No.	2	633,285	1,266,569.33
n		48 HP Outdoor unit	No.	1	690,856	690,856.00
0		60 HP Outdoor unit	No.	4	863,570	3,454,280.00
		Note: Rates have been taken Rs 14392.8 per HP as per CPWD DSR-2019				
4.2	DSR-					
	2019,Item					
	-02	INDOOR UNITS				
4.2.1		Supply, installation, testing and commissioning				
		of following minimum capacity 4-way flow				
		VRV/VRF Cassette Type Indoor ceiling				
		mounted unit equipped with synthetic washable				
		dynamically halanced blower multicroad				
		motor coil soction with DY Coppor coil				
		electronic expansion valve outer cabinet drain				
		nump grill necessary supports vibration				
		isolation cord less remote control etc suitable				
		for operation on single phase $230V \pm 10\%$				
		50Hz AC supply, complete as required.				
		Aluminum fins within the IDU (evaporator				
		unit) shall be coated with polysiloxane based				
		coating, The unit shall have automatic force				
		shut down provision in case of fire on receiving				
		signal from BMS System. The cooling capacity				
		of Indoor Unit will be at Air inlet conditions of				
		27 Degree C DB and 19 Degree C WB				
		temperature.				
		4-Way Cassette Unit				
a.	2.1	440-450 CFM/0.8 TR	NOS.	60	24,008	1,440,480.00
b.	2.2	440-450 CFM/1.0 TR	NOS.	31	25,547	791,957.00

			1 1 1 0 0			1 0 4 4 0 0 0 0 0
с.	2.3	500 CFM/1.2-1.3 TR	NOS.	76	25,855	1,964,980.00
d	2.4	565 CFM/1.6 TR	NOS.	14	26,483	370,762.00
e	2.5	635 CFM/2.0 TR	NOS.	1	27,006	27,006.00
f	2.8	1165 CFM/3.18 TR	NOS.	4	28,748	114,992.00
g	2.10	1218 CFM/4.0 TR	NOS.	2	29,795	59,590.00
1.2.2						
4.2.2		Supply, installation, testing and commissioning				
		of following minimum capacity VRV/VRF				
		High wall Type Indoor unit equipped with				
		with low poice for/ dynamically belanced				
		blower multispaed motor coil section with DX				
		Copper coil electronic expansion value outer				
		cabinet cord less remote control drain pan				
		necessary accessories etc suitable for				
		operation on single phase $230V \pm 10\%$ 50Hz				
		AC supply, complete as required. Aluminum				
		fins within the IDU (evaporator unit) shall be				
		coated with polysiloxane based coating. The				
		unit shall have automatic force shut down				
		provision in case of fire on receiving signal				
		from BMS System. The cooling capacity of				
		Indoor Unit will be at Air inlet conditions of 27				
		Degree C DB and 19 Degree C WB				
		temperature.				
		Wall Mounted				
						1
a.	3.3	300-330 CFM/1.0-1.02 TR	NOS.	1	17,273	17,273.00
a. b.	3.3 3.7	Wan Mounted 300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wan Mounted 300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b. 4.2.3	3.3 3.7	Wan Mounted 300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b. 4.2.3	3.3 3.7	Wait Mounted 300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRE ceiling mounted	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wait Mounted 300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable, type, indoor unit equipped with	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wan Mounted 300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter fan section	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wain Mounted 300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wan Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wan Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wan Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as	NOS. NOS.	1 8	17,273 19,377	<u>17,273.00</u> 155,016.00
a. b.	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891 solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have	NOS. NOS.	1 8	17,273 19,377	<u>17,273.00</u> 155,016.00
a. b.	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of 	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The cooling capacity of Indoor Unit will be at Air	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b.	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The cooling capacity of Indoor Unit will be at Air inlet conditions of 27 Degree C DB and 19 Degree C WP temperature	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b. 4.2.3	3.3 3.7	300-330 CFM/1.0-1.02 TR 475-500 CFM/1.98-2.01 TR Supply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The cooling capacity of Indoor Unit will be at Air inlet conditions of 27 Degree C DB and 19 Degree C WB temperature.	NOS. NOS.	1 8	17,273 19,377	17,273.00 155,016.00
a. b. 4.2.3	3.3 3.7	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The cooling capacity of Indoor Unit will be at Air inlet conditions of 27 Degree C DB and 19 Degree C WB temperature.Ceiling Mounted HSP Ductable Unit565-635 CFM / 15-160 TP	NOS. NOS.	1 8	17,273 19,377 30,915	17,273.00 155,016.00
a. b. 4.2.3	3.3 3.7 4.9	Wait Mounted300-330 CFM/1.0-1.02 TR475-500 CFM/1.98-2.01 TRSupply, installation, testing and commissioning of following minimum capacity and External static pressure VRV/VRF ceiling mounted ductable type indoor unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration 891solators, drain pan, other necessary supports etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The cooling capacity of Indoor Unit will be at Air inlet conditions of 27 Degree C DB and 19 Degree C WB temperature.Ceiling Mounted HSP Ductable Unit 565-635 CFM / 1.5-1.60 TR	NOS. NOS.	1 8 	17,273 19,377 30,915 34,110	<u>17,273.00</u> <u>155,016.00</u> <u>30,915.00</u> 228 822 00

f	4.17	1975-2047 CFM / 5.45-5.50 TR	No.	2	75,200	150,400.00
g	4.19	2542-2825 CFM /7.95- 8.0 TR	No.	13	78,554	1,021,202.00
		Coiling Mounted MSD Dustable Unit				
h	4.7	450-500 CFM / 1.25-1.30 TR	No.	92	30,118	2,770,856.00
		TOTAL OF VRV SYSTEM				26,705,927
5.0	DSR-					
5.0	2019	REFRIGERANT PIPING				
	Item-05	Supply, Installation, testing and commissioning including vaccumiazation and Nitrogen testing of following nominal sizes of soft/hard drawn copper refrigerant piping for VRV/VRF system, complete with fittings, with suitable adjustable ring type hanger supports, jointing/brazing including accessories, insulated with XPLE Class-O tubular insulation/Class-O closed cell elasto metric nitrile rubber tubular sleeves sections of specified thickness with polysiloxane based coating running in cable tray as given below for Suction and Liquid lines, all accessories as per specifications etc. as required:				
а	5.1	6.4 mm dia (OD) (Soft drawn) with tube thickness 1.2 mm with 13 mm thick insulation	RM	1025	214.82	220,190.50
b	5.2	9.5 mm dia (OD) (Soft drawn) with tube thickness 1.2 mm with 13 mm thick insulation	RM	590	290.22	171,229.80
С	5.3	12.7 mm dia (OD) (Soft drawn) with tube thickness 1.2 mm with 13 mm thick insulation	RM	1350	408.60	551,610.00
d	5.4	15.86 mm dia (OD) (Soft drawn) with tube thickness 1.2 mm with 13 mm thick insulation	RM	685	515.56	353,158.60
e	5.5	19 mm dia (OD) (Hrad drawn) with tube thickness 1.2 mm with 13 mm thick insulation	RM	980	619.90	607,502.00
f	5.6	22.2 mm dia (OD) (Hard drawn) with tube thickness 1.2 mm with 19 mm thick insulation	RM	580	758.44	439,895.20
g	5.8	28.58 mm dia (OD) (Hard drawn) with tube thickness 1.2 mm with 19 mm thick insulation	RM	400	971.50	388,600.00
h	5.10	34.9 mm dia (OD) (Hard drawn) with tube thickness 1.62 mm with 19 mm thick insulation	RM	410	1,078.47	442,172.70
i	5.12	41.27 mm dia (OD) (Hard drawn) with tube thickness 1.62 mm with 19 mm thick insulation	RM	340	1,147.74	390,231.60
		TOTAL OF REFRIGERANT PIPING				3,564,596
	TOTAL	OF HVAC WORKS (SCHEDULE ITEMS)				4,17,73.561.00

(1) All DSR items contain intem nos. and, if an CPWD DSR 2016/2018/2019 will prevail.

- (ii) The rates of all CPWD DSR Items are already exclusive of GST. However, the rates of all items of DSR 2018 & 2019 are evaluated excluding GST component on DAR basis.
- (iii) The Quantity mentioned in the Schedules is approximate and the DFCCIL reserves the right to increase / discrease the same as per site requirement.

	DCD					
Sr.	DSK- 2018/201		Unit	Total	Unit	Total Amount
No.	9	Description of item	Cint	Qty.	Rate	1 otur 1 mount
III	-	SCHEDULE-III				
		HVAC WORKS				
(ii)		NON-SCHEDULE ITEMS				
()						
6.0		AIR DISTRIBUTION SYSTEM				
		Supply, Fabrication, Installation and testing of				
		Insulated Al. Flexible ducts in accordance with				
6.1	NS	the approved shop floor drawings and				
		specifications and shall also confirm to the BIS				
		specifications.				
a		150 mm Dia.	Rmt	80	744	59,520.00
b		100 mm Dia.	Rmt	400	664	265,600.00
6.2	NS	Supplying, installing, testing and balancing of				
		aluminium supply/return air grills of various				
		sizes. Each grill shall be with fixed horizontal				
		front bar at Zero/15 Deg deflection through the				
		collar and register.				
a		Cont. 150mm wide S/R air Grille	Rmt	750	787	590,250.00
b			Sam	2	4.237	8.474.00
		Al. Constructed collar damper for supply collar	~ 1	_		
с		Jet Diffusers (315mm Dia.)	Nos.	15	7,310	109,650.00
d		AI Volume control dampers for ducts	Sqm.	19	6,288	119,472.00
e		Aluminium return/exhaust air Valve	Sam.	44	6.199	272,756.00
		circular/squirell diffuser without damper.	~ .1		~,	
6.3	NS	FRESH/EXH. AIR LOUVERS:				
		Supply, Installation, Testing and				
		Commissioning of extruded aluminium louvres				
		with frame bird screeen, mounting arrangement				
		etc. as per specifications and drawings.	0	0	5 152	41.004.00
a		Fresh Air/Exhaust Louvers	Sqm	8	5,153	41,224.00
<u> </u>						
6.4	NS	MOTORIZED FIRE AND SMOKE				
1		DAMPERS	1			

		Supply, Installation, Testing and commissioning				
		of motorized combination fire and smoke				
		damper (spring return type) of approved make				
		of atlaast 120 minute fire rating and as nor the				
		of atteast 120 minute file fatting and as per the				
		specifications as detailed earlier in the relevant				
		sections. The fire damper shall be complete with				
		electronic temperature sensor and electrically				
		operated actuator .The fire dampers shall be				
		located in the supply/return air ducts, at all fire				
		rated crossovers (shafts/walls etc.) The control				
		panel will be such located that the reset can be				
		easily done These combination smoke and fire				
		dampers shall be interlocked with the building				
		management system for fire detection / HVAC				
		and shall trip/close in the event of fire / smoke				
		in the respective zone				
а		Interconnecting wiring for the fire alarm system				
a		with the AHI and the smoke dampers	Lot	2	53,125	106,250.00
h		Sealing the openings around the sloove of the				
U		fire dempers with approved fire scalent as per				
		the dampers with approved fire seatant, as per	Lot	2	53,125	106,250.00
		the recommendations of the manufacturer and				
		specifications.				
						16 70 446 00
		TOTAL OF AIR DISTRIBUTION SYSTEM				10,79,440.00
7.0		INSULATION WODES				10,79,440.00
7.0		INSULATION WORKS				10,77,440.00
7.0	NS	INSULATION WORKS				10,79,440.00
7.0	NS	INSULATION WORKS THERMAL INSULATION:				10,77,440.00
7.0	NS	INSULATION WORKS THERMAL INSULATION: Supply and installation of cross linked closed with Original Asstation (Therman Judicia) Form				10,77,440.00
7.0	NS	TOTAL OF AIR DISTRIBUTION SYSTEM INSULATION WORKS THERMAL INSULATION: Supply and installation of cross linked closed cell Oxide Acetate (Thermo Isolate) Foam Thermo Isolate) Foam				10,77,440.00
7.0	NS	TOTAL OF AIR DISTRIBUTION SYSTEM INSULATION WORKS THERMAL INSULATION: Supply and installation of cross linked closed cell Oxide Acetate (Thermo Isolate) Foam Thermal insulation on ducts having density Of Colspan="2">Colspan="2"Colspan="2">Colspan="2"Colspan="2">Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2" Colspan="2" Colspan="2" <td></td> <td></td> <td></td> <td>10,77,440.00</td>				10,77,440.00
7.0 7.1	NS	TOTAL OF AIR DISTRIBUTION SYSTEM INSULATION WORKS THERMAL INSULATION: Supply and installation of cross linked closed cell Oxide Acetate (Thermo Isolate) Foam Thermal insulation on ducts having density Of 30 ±3 Kg/ M³ ,having K value 0.029 W/m ° K				
7.0	NS	INTURE OF AIR DISTRIBUTION SYSTEM INSULATION WORKS THERMAL INSULATION: Supply and installation of cross linked closed cell Oxide Acetate (Thermo Isolate) Foam Thermal insulation on ducts having density Of 30 ±3 Kg/ M³ ,having K value 0.029 W/m ° K at 0°C Deg temp and temp range of -70°C to				
7.0	NS	INTIGENTION OF AIR DISTRIBUTION SYSTEM INSULATION WORKS THERMAL INSULATION: Supply and installation of cross linked closed cell Oxide Acetate (Thermo Isolate) Foam Thermal insulation on ducts having density Of 30 ±3 Kg/ M³ ,having K value 0.029 W/m ° K at 0°C Deg temp and temp range of -70°C to +100°C and fire rating Class O as per BS 476				
7.0	NS	INTIAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION: Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ±3 Kg/ M³ ,having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFC				
7.0	NS	INTURE OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION: Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ±3 Kg/ M³ ,having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014).				
7.0	NS	IDIAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION: Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density 0f30 ± 3 Kg/ M³ ,having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke & Toxicity index of material shall be passed as per				
7.0	NS	IDIAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION: Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ± 3 Kg/ M³, having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and as				
7.0	NS	IDIAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION: Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ± 3 Kg/ M³, having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.				
7.0 7.1	NS	IDIAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION: Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ± 3 Kg/ M³ ,having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with				
7.0 7.1	NS	IOTAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION:Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density 0f30 ± 3 Kg/ M³ ,having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbond	Sqm	350	903	316,050.00
7.0 7.1	NS	IDIAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION: Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density 0f30 ± 3 Kg/ M³ ,having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbondinsulation (for exposed duct)	Sqm	350	903	316,050.00
7.0 7.1 a	NS	IOTAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION:Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density 0f $30 \pm 3 \text{ Kg/ M}^3$, having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbondinsulation(for exposed duct)13mm thick insulation oxide acetate	Sqm	350	903	316,050.00
7.0 7.1 a b	NS	IOTAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION:Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ±3 Kg/ M³, having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbondinsulation(for exposed duct)13mm thick insulation oxide acetate foam	Sqm	350	903	316,050.00
7.0 7.1 a b	NS	IOTAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION:Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ±3 Kg/ M³, having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbondinsulation(for exposed duct)13mm thick insulation oxide acetate foamlaminated with aluminium foil supply air ductOmm thick insulation oxide acetate foam	Sqm	350	903 468	316,050.00
7.0 7.1 a b c	NS	IOTAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION:Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density Of30 ±3 Kg/ M³ ,having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbondinsulation(for exposed duct)13mm thick insulation oxide acetate foamlaminated with aluminium foil supply air duct9mm thick insulation oxide acetate foam	Sqm Sqm	350 400 4700	903 468 335	316,050.00 1,574,500.00
7.0 7.1 a b c	NS	IOTAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION:Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density 0f $30 \pm 3 \text{ Kg}/\text{ M}^3$, having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbondinsulation(for exposed duct)13mm thick insulation oxide acetate foamlaminated with aluminium foil supply air ductACOUSTICACOUSTICACOUSTICACOUSTIC	Sqm Sqm	350 400 4700	903 468 335	316,050.00 1,574,500.00
7.0 7.1 a b c 7.2	NS	IOTAL OF AIR DISTRIBUTION SYSTEMINSULATION WORKSTHERMAL INSULATION:Supply and installation of cross linked closedcell Oxide Acetate (Thermo Isolate) FoamThermal insulation on ducts having density 0f $30 \pm 3 \text{ Kg}/\text{ M}^3$, having K value 0.029 W/m ° Kat 0°C Deg temp and temp range of -70°C to+100°C and fire rating Class O as per BS 476Part 6 from CBRI,Roorkee and CFC/HCFCfree as per US EPA 5021 A(2014). • Smoke &Toxicity index of material shall be passed as perIMO MSC 307 (88) 2010 Anexx 1 Pt 2 and asper the approved specifications.32 mm thick insulation oxide acetate foam with2 layesr coat 7 mile cloth insulation or starbondinsulation(for exposed duct)13mm thick insulation oxide acetate foamlaminated with aluminium foil supply air duct ACOUSTIC LINING IN THE	Sqm Sqm Sqm	350 400 4700	903 468 335	316,050.00 1,574,500.00

a	Supply and installation of cross linked open cell Oxide Acetate (Acco Isolate) Foam Acoustic insulation on ducts having density of 30 to 60 Kg/ M ³ , having K value 0.029 W/m ° K at 0°C Deg temp and temp range of -70°C to +100°C and fire rating Class O as per BS 476 Part 6 from CBRI,Roorkee and CFC/HCFC free as per US EPA 5021 A(2014). • Smoke & Toxicity index of material shall be passed as per IMO MSC 307 (88) 2010 Anexx 1 Pt 2 and as per the approved specifications. 15mm thick Oxice Acetate Acco Isolate				
b	Acoustic open cell insulation on one side for Duct acoustic insulation 25mm thick Oxice Acetate Acco Isolate	Sqm	1745	823	1,436,135.00
	Acoustic open cell insulation on one side for AHU Room acoustic insulation	Sqm	400	1,068	427,200.00
	TOTAL OF INSULATION WORKS				3,941,085
8.0	ASSOCIATED ELECTRICAL WORKS				
	The rates for the distribution boards from the Breakers and instruments shall also include the following :				
A	Wiring for light / Fan points with 1.5 sq. mm PVC insulated copper conductor 1100 Volt grade stranded flexible FRLS wires of approved make in 1.6 mm thick 25 mm dia MS conduit including cost of providing & fixing saddles, hangers, supports, cutting chases and filling chases for recessed conduiting, and including the cost of providing and fixing a 6 amp 240 Volt Modular Plate type switches of approved quality, colour, make and design with moulded cover plate in zinc chromate passivated MS box and including the cost of running 1.5 sq. mm PVC insulated copper earth wire for loop earthing etc. complete TPN ACB's / MCCB's shall mean 3 pole				
	ACB's / MCCB's with adequate size of neutral link.				
C	All MCB's shall be of minimum 10 KA breaking capacity and MCCB 's shall be not lessthan 25KA				
D	The breaking capacity of MCCB's are mentioned panel wise. All MCCBs shall be ICS rated. All MCCB's shall be with microprocessor release for above 100A and as per BOQ. All MCCBs shall be with extended rotary handle.				
E	All MCB's used for protection of resistive and lightly inductive load shall be type "B" characteristic and inductive (motor) load				

		shall be of type "C" characteristic.			
Б		Panal construction shall be 4h type. Degree of			
Г		protection for following type of distribution			
		panel enclosure shall be as per IS:13947-1993.			
		i. IP 42 for indoor panels.			
		ii. IP 55 for ODU panel.			
G		All MCCB's shall be provided with			
		operating mechanism for door interlock.			
Н		All hinged door shall be earthed through 2.5 sq			
		mm tinned braided copper wire.			
Ι		Providing cable clamps / supports within			
		distribution boards cable alley.			
J		Current density of Copper shall be 1.6 sq mm			
		for 1.0 Amps for rated current of bus bars. All			
K					<u> </u>
IX.		Model current capacity location and frame size			
		of switchgear shall be written inside of the			
		panel doors with paint / permanent marker as			
		approved shop drawings / site requirment.			
L		All meters shall be digital type and all starter			
		shall be as per Type-2 Coordination chart. All			
		MCBs shall be used			
М		Current Transfomer shall be resin cast			
N		All Panel Shall be BMS Compatible			
8.1	NS	AHU/Fan Panel			
		Design, fabrication, assembling, wiring, supply,			
		installation, testing and commissioning of			
		following LT panels fabricated out of 14 guage			
		creater steel in cubical formation with			
		channel T iron flats. All steel material used in			
		the construction of panels shall be powder			
		coated. A solid busbar shall be provided at the			
		bottom of the panel with two connecting eyes			
		for termination. The boards shall be suitable for			
		415 volts, 50 Hz, 3 phase , 4 wire supply			
		system. All the hardware used in the fabrication			
		of the panel shall be galvanized with zinc			
		compartmentalized to accommodate one feeder			
		in each compartment. A vertical cable allev of			
		suitable width shall be provided to serve on or			
		two vertical feeder sections. Also the opening			
		between the busbar chamber and the feeder			
		section shall be shrouded with bakelite / hylam			
		sheet with min.3 mm thickness.			

	Panel as described above and in drawings.	No.	1	46,827	46,827.00
	Taket as described above and in drawings.	110.	1	40,027	40,027.00
b	HVAC Fan Panel AMCC-02 (Smoke &				
	Pressurization Fan Panel)				
	Incoming				
	Incoming				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for $O/C + S/C$ Away + Alerm context and				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and				
	Incoming1 No. 80 A TP, 25 kA MCCB with TM releasefor O/C + S/C, Aux + Alarm contact andextended rotary handle				
	Incoming1 No. 80 A TP, 25 kA MCCB with TM releasefor O/C + S/C, Aux + Alarm contact andextended rotary handlePhase indicating lights with control MCB.				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Pug Page				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves.				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6 10 A. TP MPCP (with DOL starter)				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter)				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter)				
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter)				
	Incoming1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handlePhase indicating lights with control MCB.Breaker ON/OFF/TRIP indicating lights.Bus Bars100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves.Outgoings3 no. 6-10 A, TP MPCB (with DOL starter)1 no. 9-14 A, TP MPCB (with DOL starter)Panel as described above and in drawings.	No.	1	71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings.	No.	1	71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings.	No.	1	71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings.	No.	1	71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings. HVAC Kitchen Fan Panel HMCC-01 1 no. 20 amp FP MCB with Aux + Alarm	No.	1	71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings. HVAC Kitchen Fan Panel HMCC-01 1 no. 20 amp FP MCB with Aux + Alarm Contact	No.	1	71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings. HVAC Kitchen Fan Panel HMCC-01 1 no. 20 amp FP MCB with Aux + Alarm Contact	No.		71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings. HVAC Kitchen Fan Panel HMCC-01 1 no. 20 amp FP MCB with Aux + Alarm Contact Phase indicating lights with control MCB.	No.		71,753	71,753.00
	Incoming 1 No. 80 A TP, 25 kA MCCB with TM release for O/C + S/C, Aux + Alarm contact and extended rotary handle Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights. Bus Bars 100 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves. Outgoings 3 no. 6-10 A, TP MPCB (with DOL starter) 1 no. 9-14 A, TP MPCB (with DOL starter) Panel as described above and in drawings. HVAC Kitchen Fan Panel HMCC-01 1 no. 20 amp FP MCB with Aux + Alarm Contact Phase indicating lights with control MCB. Breaker ON/OFF/TRIP indicating lights.	No.		71,753	71,753.00

	1 no. 2.5-4 A, TP MPCB (with DOL starter)				
	1 no. 4-6.3 A, TP MPCB (with DOL starter)				
	Panel as described above and in drawings.	No.	1	37,631	37,631.00
d	HVAC Fan Panel HMCC-02 (Pressurization				
	Fan Panel)				
	1 no. 50 amp FP MCB with Aux + Alarm				
	Dhase in dissting lights with control MCD				
	Phase indicating lights with control MCB.				
	Outgoings				
	2 no. 6-10 A, TP MPCB (with DOL starter)				
	Panel as described above and in drawings.	No.	1	39,688	39,688.00
e	HVAC Fan Panel GLMCC-02, 2 Nos.				
	(Smoke Fan Panel)				
	1 no. 20-25 A, TP MPCB (with Star delta starter				
)				
	Phase indicating lights with control MCB.				
	Breaker ON/OFF/TRIP indicating lights.				
	Panel as described above and in drawings.	No.	2	25,168	50,336.00
f	HVAC AHU/Fan Panel MCC-01 (4 Nos.)				
	1 no. 13-18 A. TP MPCB (without VSD, VSD)				
	With AHU Plug Fan))				
	Phase indicating lights with control MCB.				
	Breaker ON/OFF/TRIP indicating lights.				
	Panel as described above and in drawings.	No.	4	19,844	79,376.00
g	HVAC AHU/Fan Panel MCC-02 (2 Nos.)				
	1 no. 9-14 A, TP MPCB (without VSD, VSD				
	With AHU Plug Fan))				
	Phase indicating lights with control MCB.				
	Breaker ON/OFF/TRIP indicating lights.				
	Panel as described above and in drawings.	No.	2	17,303	34,606.00
h	HVAC AHII/Fan Panal MCC-03				
11	1 no 6.10 A TD MDCD (without VCD VCD			+ +	
	With Δ HI Plug Fan)				
	Phase indicating lights with control MCP			+	
	Breaker ON/OFE/TRID indicating lights			+ +	
	Panel as described above and in drawings	No	1	17.061	17.061.00
		110.	1	17,001	17,001.00
i	HVAC AHU/Fan Panel MCC-04				
	Incoming			↓	
	1 no. 50 amp FP MCB with Aux + Alarm				
	Contact			ļ	
	Phase indicating lights with control MCB.			ļ	
	Breaker ON/OFF/TRIP indicating lights.			ļ	
	80 amp TPN Copper Bus Bar with heat				
	shrinkable insulation colored sleeves.				

	Outgoings				
	2 nos. 4-6.3 A,TP MPCB (with DOL starter)				
	2 nos 9-14 A TP MPCB (with DOI starter)				
	Panel as described above and in drawings	No	1	73 689	73 689 00
	Tallet as described above and in drawings.	110.	1	73,007	75,007.00
j	HVAC AHU/Fan Panel MCC-05				
	Incoming				
	1 No. 80 A TP, 25 kA MCCB with TM release for $O/C + S/C$, Aux + Alarm contact and				
	extended rotary handle				
	Phase indicating lights with control MCB.				
	Breaker ON/OFF/TRIP indicating lights.				
	125 amp TPN Copper Bus Bar with heat				
	shrinkable insulation colored sleeves.				
	Uutgoings				
	starter)				
	1 nos.25-40 A,TP MPCB (with VSD Space Provision)				
	1 nos. 6 A, MCB				
	Panel as described above and in drawings.	No.	1	99,704	99,704.00
k	HVAC AHU/Fan Panel MCC-06				
K	Incoming				
	1 No. 100 A TP, 25 kA MCCB with TM release				
	for $O/C + S/C$, Aux + Alarm contact and				
	extended rotary handle				
	Phase indicating lights with control MCB.				
	Breaker ON/OFF/TRIP indicating lights.				
	125 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves.				
	<u>Outgoings</u>				
	1 nos. 20-25 A,TP MPCB (with Star Delta starter)				
	1 nos.25-40 A,TP MPCB (with VSD Space Provision)				
	1 nos. 6 A, MCB			1	
	Panel as described above and in drawings.	No.	1	83,732	83,732.00
1	HVAC AHU/Fan Panel MCC-07				
	Incoming				
	1 No. 63 A TP, 25 kA MCCB with TM release				
	for $O/C + S/C$, Aux + Alarm contact and				
	extended rotary handle			<u> </u>	
	Prostor ON/OEE/TDID indicating 11 shts			+	
	Bue Bare			+	
	100 amp TPN Copper Rus Bar with boat			+ +	
	shrinkable insulation colored sleeves.				

I	Outgoing		l	1		
	2 nos 6 10 A TR MPCP (with DOL starter)					
	2 lios. 0-10 A, IF MIFCB (with DOL starter)					
	1 nos. 9-14 A, TP MPCB (with DOL starter)					
	Panel as described above and in drawings.	No.	1	64,372	64,372.00	
m	HVAC AHU/Fan Panel MCC-08					
	Incoming					
	1 No. 100 A TP, 25 kA MCCB with TM release for $O/C + S/C$, Aux + Alarm contact and extended rotary handle					
	Phase indicating lights with control MCB.					
	Breaker ON/OFF/TRIP indicating lights. 125 amp TPN Copper Bus Bar with heat shrinkable insulation colored sleeves.					
	Outgoings					
	3 nos. 6-10 A, TP MPCB (with DOL starter)					
	2 nos. 20-25 A,TP MPCB (with Star Delta starter)					
	Panel as described above and in drawings.	No.	1	112,288	112,288.00	
n	HVAC AHU/Fan Panel MCC-09					
	Incoming					
	1 No. 100 A TP, 25 kA MCCB with TM release for $O/C + S/C$, Aux + Alarm contact and extended rotary handle					
	Phase indicating lights with control MCB.					
	Breaker ON/OFF/TRIP indicating lights. 125 amp TPN Copper Bus Bar with heat					
	shrinkable insulation colored sleeves.					
	Outgoings					
	2 nos. 25-40 A,TP MPCB (with Star Delta starter)					
	Panel as described above and in drawings.	No.	1	105,633	105,633.00	
8.2	NS	METER BOARD / SUB PANEL'S				
-----	----	---	------	---	---------	------------
		Supplying, Installation, Testing and				
		Commissioning of dust, damp and vermin proof				
		free floor standing / wall mounted factory built				
		sheet steel enclosed modular construction				
		extendable panel, suitable for operation on 415				
		+ 10% volts, 50 Hz AC 3 phase 4 wire system				
		tabricated out of suitable sized square tubular				
		section and covered with 2.0mm thick CRCA				
		sheet, minged doors of 2mm thick CRCA sheet,				
		interconnection with solid conner conductor				
		wires / aluminium strips neutral links earth bus				
		etc necessary metering protections &				
		indications and mounted with the following as				
		per drawing and technical specifications				
		attached etc. complete as required. MFM with				
		Ethernet port, equivalent to Schneider				
		PowerLogic PM5000 series on each outgoing				
		circuit for each ODU module to be provided				
		(Total ODU modules are 33 Nos.)				
a		ODU's Panel-AMCC-01				
		Same as above item but outdoor Panel with				
		tollowing accessories.				
		INCOMING:				
		1 No. 400 amps, 25 kA, 415V TPN MCCB				
		with overcurrent and short circuit protection,				
		button etc				
		Coloured (Red Vellow Blue) phase indicating				
		lamp - 1 set				
		CT operated MFM of accuracy class 1.0 with		-		
		RS 485 port				
		BUSBAR:				
		500 Amp. TPN, 35 kA Cu. Bus Bar				
		OUTGOINGS:				
		80A, TPN RCCB with 100mA - 11Nos. (Incl.				
		1No. Spare)				
		40A, TPN RCCB with 100mA- 2Nos. (Incl.				
		21NO. Spare)				
		wirwi with Ethernet port, equivalent to Schneider Powerl ogic DM5000 corrige on each				
		outgoing circuit				
		ODI Panel Described as $above/\Delta s$ per	No			
		Manufacturer ODU Configuration.	110.	1	180,774	180,774.00
		<u> </u>				
b		ODU's Panel-HMCC-01				
		Same as above item but outdoor Panel with				
		following accessories.				
		INCOMING:				

	1 No. 250 amps, 25 kA, 415V TPN MCCB with overcurrent and short circuit protection, extended rotary handle, all indication, push				
	Coloured (Red, Yellow, Blue) phase indicating				
	lamp - 1 set CT operated MFM of accuracy class 1.0 with RS 485 port				
	BUSBAR:				
	500 Amp. TPN, 55 KA Cu. Bus Bar				
	OUTGOINGS:				
	80A,TPN RCCB with 100mA - 7Nos. (Incl. 1No. Spare)				
	40A, TPN RCCB with 100mA - 2Nos. (Incl. 2No. Spare)				
	MFM with Ethernet port, equivalent to Schneider PowerLogic PM5000 series on each outgoing circuit				
	ODU Panel Described as above/As per Manufacturer ODU Configuration.	No.	1	124,509	124,509.00
C	ODU's Panel-01-Terrace				
	Same as above item but outdoor Panel with following accessories.				
	INCOMING:				
	1 No. 800 amps, 25 kA, 415V TPN MCCB with overcurrent and short circuit protection, extended rotary handle, all indication, push button etc.				
	Coloured (Red, Yellow, Blue) phase indicating lamp - 1 set				
	CT operated MFM of accuracy class 1.0 with RS 485 port				
	1000 Amp. TPN, 35 kA Cu. Bus Bar				
	OUTGOINGS:				
	80A, TPN RCCB with 100mA - 20 Nos. (Incl. 1No. Spare)				
	40A, TPN RCCB with 100mA - 05 Nos. (Incl. 1No. Spare)				
	MFM with Ethernet port, equivalent to Schneider PowerLogic PM5000 series on each outgoing circuit				
	ODU Panel Described as above/As per Manufacturer ODU Configuration.	No.	1	303,468	303,468.00
d	ODU's Panel 02 Terrage				
u	ODU S Fallet-02- Terrace				

		Same as above item but outdoor Panel with				
		following accessories.				
		INCOMING:				
		1 No. 800 amps, 25 kA, 415V TPN MCCB				
		with overcurrent and short circuit protection,				
		extended rotary handle, all indication, push				
		button etc.				
		Coloured (Red, Yellow, Blue) phase indicating				
		lamp - 1 set				
		CT operated MFM of accuracy class 1.0 with				
		RS 485 port				
		BUSBAR:				
		1000 Amp. TPN, 35 kA Cu. Bus Bar				
		OUTGOINGS:				
		80A, TPN RCCB with 100mA - 20 Nos. (Incl.				
		INo. Spare)				
		40A, TPN RCCB with 100mA - 03 Nos. (Incl.				
		INo. Spare)				
		MFM with Ethernet port, equivalent to				
		Schneider PowerLogic PM5000 series on each				
		OUTGOING CITCUIT	N			
		ODU Panel Described as above/As per	No.	1	290,521	290,521.00
		Manufacturer ODO Configuration.				
8.3	NS	CABLING (POWER)				
		Power Cabling and Earthing:				
		Supply, installation, testing & commissioning of				
		Cu conductor cables PVC sheathed, armoured				
		cables of 1.1 KV grade with termination glands				
		and GI earthing, identification tags, clamps and				
		saddles etc.				
a		2Cx04 Sqmm	Rmt	50	159	7,950.00
b		3Cx04 Sqmm	Rmt	280	139	38,920.00
с		3Cx06 Sqmm	Rmt	195	170	33,150.00
d		3Cx16 Sqmm	Rmt	450	278	125,100.00
e		4Cx06 Sqmm	Rmt	1170	258	301,860.00
f		4Cx04 Sqmm	Rmt	120	246	29,520.00

8.4	NS	Control Cabling				
		Supply, installation, testing & commisioning of Copper conductor , PVC insulated, PVC sheathed armoured cable of 1.1 KV grade (Which is Interconnecting wiring for the fire alarm system with the AHU and the smoke dampers & Touch screen controller).	DM	000	205	202.050.00
a		8C x 1.5 Sqmm	RM	990	205	202,950.00
		TOTAL OF ASSCIOATED ELECTRICAL WORKS				2,555,418
9.0		VRF SYSTEM				
9.1	NS	INDOOR UNITS				
		4-Way Compact Cassette Unit				
		of following minimum capacity 4-way flow VRV/VRF Compact Cassette Type Indoor ceiling mounted unit equipped with synthetic washable media pre-filter, fan section with low noise fan/ dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve outer cabinet, drain pump, grill, necessary supports, vibration isolation, cord less remote control etc. , suitable for operation on single phase 230V +/- 10% 50Hz AC supply, complete as required. Aluminum fins within the IDU (evaporator unit) shall be coated with polysiloxane based coating, The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The cooling capacity of Indoor Unit will be at Air inlet conditions of 27 Degree C DB and 19 Degree C WB temperature.				
a		315-320 CFM/0.63-0.80 TR	NOS.	51	30,855	1,573,605.00

		Caller - Marrieta d HCD Darreta bla Haite				
0.1.2		Celling Mounted HSP Ductable Unit				
9.1.2		Supply, installation, testing and commissioning				
		High Well Type Indoor unit equipped with				
		synthetic washable media pre filter fan section				
		with low noise fan/ dynamically balanced				
		blower multispeed motor coil section with DX				
		Copper coil electronic expansion valve outer				
		cabinet, cord less remote control, drain pan,				
		necessary accessories, etc., suitable for				
		operation on single phase 230V +/- 10% 50Hz				
		AC supply, complete as required. Aluminum				
		fins within the IDU (evaporator unit) shall be				
		coated with polysiloxane based coating, The				
		unit shall have automatic force shut down				
		provision in case of fire on receiving signal				
		from BMS System. The cooling capacity of				
		Indoor Unit will be at Air inlet conditions of 27				
		Degree C DB and 19 Degree C WB				
		temperature.				
0		1270-1624 CEM /4 55 /4 75 TP	No	Λ	63 520	254 120 00
a b		2047 2205 CEM / 6 25 6 5 TD	No.	4	75 006	1 367 028 00
0		2047-2295 CFM7 0.55-0.5 TK	INO.	10	75,990	1,307,928.00
913		Floor Mounted Horizontal Air Handling				
7.1.5		Units With Exh. Blower and Enthalny				
		Recovery Wheel (FM AHU)				
		Supply. Installation Testing and Commissioning				
		of floor mounted AHU's. The AHU's shall be				
		double skin type made of 0.80 mm thick GI				
		sheet with 43 ± 2 mm Thick for outdoor				
		application PUF insulation. The Drain Pan for				
		ÂHU's shall be of SS. They shall be suitable for				
		indoor/outdoor installation. The AHU's selected				
		shall be supplied with Forward / Backward				
		direct driven/belt driven supply air Blower Fans				
		and exh. air blower with Ethalpy Recovery				
		Wheel (Min. Efficiency of HRW is 75%)				
		(ERW/HRW) suitable to deliver the undergiven				
		CFM and Static. The AHU's shall have DX				
		Cooling coil, complete with mixing chamber				
		and electrical push buttnos on starting panel for				
		operating the AHU. AHU Include VI Pads.				
		All AHI shall include Sunnly/Return/Fresh Air				
		Damper & Thermal Break Profile and with				
		three phase motor suitable for VSD drive and				
		BMS Compitable Aluminum fins within the				
1	1	Divis comprision, numinium mis wrumin the			1	
		IDU (evaporator unit) shall be coated with				
		IDU (evaporator unit) shall be coated with polysiloxane based coating				

a	Double skin floor mounted Horizontal 8-Row Depth DX Cooling Coil (2Nos. Coil) with Supply Fan 8750 CFM with pre, fine filter (MERV-13), S.P. is 80 mm & Exhaust fan 6400 CFM with Pre Filter, S.P. 55 mm, Heat Recovery Wheel (Enthalpy Wheel) AHU Coil is 32.0 TR, mixing box with Plug fan with VSD & motor.	No.	1	781,660	781,660.00
b	Double skin floor mounted Horizontal 8-Row Depth DX Cooling Coil (1 Coil) with Supply Fan 16000 CFM with pre, fine filter (MERV- 13), S.P. is 80 mm & Exhaust fan 14000 CFM with Pre Filter, S.P. 55 mm, Heat Recovery Wheel (Enthalpy Wheel) AHU Coil is 50.0 TR, with mixing box,with Plug fan with VSD& motor & Weather Proof Canopy.	No.	1	1,753,59 3	1,753,593.00
с	Double skin floor mounted Horizontal 8-Row Depth DX Cooling Coil (1 Coil) with Supply Fan 16000 CFM with pre, fine filter, S.P. is 80 mm & Exhaust fan 10000 CFM with Pre Filter, S.P. 55 mm, Heat Recovery Wheel (Enthalpy Wheel) AHU Coil is 50.0 TR, with mixing box,with Plug fan with VSD& motor & Weather Proof Canopy.	No.	1	1,661,02 8	1,661,028.00
0.1					
9.1.4	Floor Mounted Horizontal Air Handling Units (FM AHU)				
9.1.4	Floor Mounted Horizontal Air Handling Units (FM AHU) Supply, Installation Testing and Commissioning of floor mounted AHU's. The AHU's shall be double skin type made of 0.80 mm thick GI sheet with 23±2mm for indoor application PUF insulation. The Drain Pan for AHU's shall be of SS. They shall be suitable for indoor/outdoor installation. The AHU's selected shall be supplied with Backward direct driven Blower Fans suitable to deliver the undergiven CFM and Static. The AHU's shall be DX-Type Cooling Coil and have electrical push buttnos on starting panel for operating the AHU.				
9.1.4	Floor Mounted Horizontal Air Handling Units (FM AHU)Supply, Installation Testing and Commissioning of floor mounted AHU's. The AHU's shall be double skin type made of 0.80 mm thick GI sheet with 23±2mm for indoor application PUF insulation. The Drain Pan for AHU's shall be of SS. They shall be suitable for indoor/outdoor installation. The AHU's selected shall be supplied with Backward direct driven Blower Fans suitable to deliver the undergiven CFM and Static. The AHU's shall be DX-Type Cooling Coil and have electrical push buttnos on starting panel for operating the AHU.9500 CFM, 16.0 TR, Floor Mounted (Horizontal/Vertical) 6- Row Deep DX cooling coil , 80 mm Static Pressure, with Pre & Fine Filter (MERV-13),thermal Break Profile and with Plug fan with VSD & motor	No.	1	273,581	273,581.00

c		10000 CFM, 16.5 TR,Floor Mounted (Horizontal/Vertical) 6- Row Deep DX cooling coil, 80 mm Static Pressure, with Pre & Fine Filter (MERV-13),thermal Break Profile and with Plug fan with VSD & motor	No.	2	287,980	575,960.00
d		4000 CFM, 7.0 TR,Floor Mounted (Horizontal/Vertical) 6- Row Deep DX cooling coil, 80 mm Static Pressure, with Pre & Fine Filter (MERV-13),thermal Break Profile and with Plug fan with VSD & motor	No.	1	118,278	118,278.00
e		12000 CFM, 20.0 TR,Floor Mounted (Horizontal/Vertical) 6- Row Deep DX cooling coil, 80 mm Static Pressure, with Pre & Fine Filter (MERV-13),thermal Break Profile and with Plug fan with VSD & moter	No.	1	345,576	345,576.00
0.2	NS	Aggessories				
a	115	SITC of Expansion Kit Required for the above AHU to make the system complete	Nos	18	30,855	555,390.00
b		SITC of Control Kit Required for the above AHU to make the system complete	Nos	18	25,713	462,834.00
93	NS	REMOTE CONTROL LERS				
a	110	Supply, installation, tesing and commissioning of High quality Remote controllers (Corded) for operation of AHU's.	Nos	10	4,114	41,140.00
b		Supply, installation, tesing and commissioning of High quality Remote controllers (Cordless) for operation of High wall /Cassette/ Ceiling Concealed indoor units.	Nos	30	3,600	108,000.00
9.4	NS	Touch screen controller for indoor units controller - VRV				
a		Supply, installation, testing and commissioning of touch screen controller for control of minimum 320 nos. indoor units in terms of ON/Off Status, temp. Status, Fan Speed, ODU On/Off Status etc. with all accessories and controls.	Nos	1	149,133	149,133.00
b		Supply, installation, testing and commissioning of touch screen controller (Which is controlled 100 nos. indoor units in terms of ON/Off Status, temp. Status, Fan Speed, ODU On/Off Status etc.) with all accessories and controls.	Nos	2	92,565	185,130.00

	I	1	1	1	1 1	1
95	NS	REFNETS / V-IOINTS				
2.5		Supply, installation, tesing and commissioning of Imported fittings Y-joints insulated, distributer and headers for all Indoor units at both the ends floors layout as per layout drawings.All interconnecting joints, Y Joints with polysiloxane based coating	Nos	406	3,600	1,461,600.00
9.6	NS	TRANSMISSION & CONTROL WIRING				
9.0	113	Supply, installation, testing, termination and commissioning of control cum transimission wiring (should be shielded cable in PVC Pipe) of 2C x 1.5 Sqmm Cu between indoor unit and out door unit and indoor units and its remote controller.				
а		2C x 1.5 Sqmm Cu Cable or as specified by OEM	RM	4400	232	1,020,800.00
b		Perforated GI Tray with hangers & supports for copper piping (250 mm wide)	RM	1150	349	401,350.00
97	NS	Refrigerant-410a				
a		Supply , charging & Leackage testing of refrigerant -410a in additional copper piping circuit.	Kgs.	370	1,029	380,730.00
0.0	NC					
9.8	INS	Air Purifier (UVGI) for AHU/Ductable Units				
9.9.1		Supply, installation, testing and commissioning of Modular UV Emitters with modules rated 1000 & 2000 CFM which interconnect with earch other. The UV system shall be factory fabricated and plug & play type with possibility of interchangeability. The UV system shall be designed to provide UV dosage of 1500 micro W/cm2. The UV lamp net wattage density shall be greater than 0.8 inch per watt of UV-C produced. The UV lamp shall be single/double ended, pin type Quartz lamp with current of 425 mA each producing UV-C @ 253.7 nm wavelength. Bacteria test or Bio Test to be done before and after installation. Refer technical specififcations for more details and complinace.				
•		Linte O CTD Desciption in the second		1.00	14.000	0.000.000
A D		Upio 2.6 TR Ductable Indoors		169	14,020	2,369,380
D C		Above 2.0 TK Ductable Indoors		1	23,300 <u>48</u> 020	1,444,000
<u>D</u>		8000 CFM AHU		2	92,040	184 080
E		8750 CFM to 10000 CFM AHU	Nos.	4	116.600	466.400
F		12000 CFM AHU		1	135.160	135,160
					,	

		1				
8.9	NS	DRAIN PIPING				
		Providing & fixing rigid PVC piping complete with fittings, supports as per specifications and pre insulated with 6mm thick closed cell elastomeric nitrile rubber tubular insulation				
Δ		25 mm dia	RM	1680	216	362 880 00
R		32 mm dia	RM	500	210	128 500.00
C		40 mm dia	RM	380	309	117 420 00
D		50 mm dia	RM	210	386	81.060.00
D			ICIVI	210	500	01,000.00
9 10	NS	CANVASS CONNECTION				
A	110	Supply Installation Testing and commissioning				
		of doble layer canvas connection with fire	Nos.	201	2,057	413,457.00
		TOTAL OF VRF SYSTEM				20,040,621.00
10.0		Ventilation System				
		Ventilation Equipments:				
10.1	NS	Propeller fan				
		Supply, installation, testing and commissioning of Propeller fan of the following capacity of approved make and specification. Fan shall be supplied with aluminum gravity louver & bird screen.				
А		150 mm dia propeller fan, with single phase motor	Nos.	86	3,445	296,270.00
В		300 mm dia propeller fan, with single phase motor	Nos.	10	3,754	37,540.00
С		450 mm dia propeller fan , with single phase motor	Nos.	14	5,143	72,002.00
10.2	NS	Inline for				
10.2		Supply, installation, testing and commissioning of AMCA Certified circular type Inline fan of the following capacity of approved make and				
		specification. (Cost to be inclusive of Speed Regulator) Fan shall be supplied with aluminum gravity louver & bird screen.				
a		100-400 CFM, 5-7mm SP WG with Single phase motor with three speed	Nos.	4	7,457	29,828.00
b		500-750 CFM, 12-15mm SP WG with Single phase motor with three speed	Nos.	3	15,942	47,826.00
10.3	NS	Tube Axial Flow fans				
		SITC of Long case Tube axial flow fans, as per specifications and approved makes suitable for three phase operation at 960/1450 RPM				

		respectively Normal/Smoke case.				I
10.3. 1		AMCA Certified Long case tube axial flow fans complete with all accessories, suitable for wall mounted /Floor Mounted/ ceiling suspended installation. The fan shall be supplied				
		with suitable 3PH/4P motor at 1450 RPM, and shall be selected for 25 mm static pressure (WG), For 2hrs fire rated (H Class motor insulation) All fan with fire retardent Canvas				
		connection, bird screen and Gravity dampers .(For Smoke Extract fan) Fans capacity as per below mentioned as:(As per Vent. Fan Schedule)				
9		18000 CEM smoke extract	Nos	1	128 563	128 563 00
h		31000 CFM smoke extract	Nos	2	226 270	452 540 00
c		40000 CFM smoke extract	Nos	2	287 980	575 960 00
•			1105.		201,200	272,900100
10.3.		AMCA Certified Long case tube axial flow fans complete with all accessories suitable for				
2		wall mounted /Floor Mounted/ ceiling				
		suspended installation. The fan shall be supplied				
		with suitable 3PH/4P motor at 1450 RPM, and				
		shall be selected for 40 mm static pressure				
		(WG), (F Class motor insulation) All fan with				
		fire retardent Canvas connection, bird screen and				
		Gravity dampers .(For Smoke make up air or				
		pressurization fan) Fans capacity as per below				
		mentioned as:(As per Vent. Fan Schedule)				
а		6000 CFM (for Liftwell pressurization)	Nos.	4	53,996	215,984.00
b		8000 CFM (for Liftwell pressurization)	Nos.	1	61,710	61,710.00
с		9500 CFM (For Liftwell Pressurization)	Nos.	4	66,853	267,412.00
d		23500 CFM (For Lift lobby Pressurization)	Nos.	1	164,560	164,560.00
e		7000 CFM (For Lift well Pressurization)	Nos.	1	53,996	53,996.00
f		12500 CFM (For Stairwell Pressurization)	Nos.	1	87,423	87,423.00
g		24500 CFM (For Stairwell Pressurization)	Nos.	1	174,845	174,845.00
10.4	NS	Evaporative air cooler(Air Washer)				
		Supply, Install, test and commission double skin Evaporative air washer as per				
		specifications, suitable for the following capacity given below at 90% efficiency of evaporative medium. The fan shall be of DIDW centrifugal construction. Packaged Type				
a		1800-2000 CFM, 40 mm (WG) static pressure,Floor/ ceiling mounted (For Kitchen Vent.), Cost to be inclusive of unit isolator	Nos.	1	56,568	56,568.00
b		5500 CFM, 40 mm (WG) static pressure,Floor/ ceiling mounted (For Kitchen Vent.), Cost to be inclusive of unit isolator	Nos.	1	92,565	92,565.00

NS	Air Scrubber (DRY Type)				
	DIDW FAN : CSSD/Laundry/Kitchen Exhaust				
	Supply, installation, testing and commissioning of DIDW Backward curved horizontal floor mounted fan unit comprising of accurately cut scroll & side plates, heavy gauge with all welded construction, sheet steel fabricated impeller, drive with blower pulley, motor pulley, V-belts, squirrel cage motor complete as per specification (fan-motor efficiency exceeding ASHRAE 90.1-2007 Criteria). (The bidder shall submit fan performance curves for all fans)				
	3000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator	No.	1	61,710	61,710.00
	6000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator	No.	1	101,307	101,307.00
	DRV SCRURRED , Kitchon Exhaust				
	Supply, Installation, Testing and Commissioning of Dry Scrubber comprising of extract air intake section, electrostatic precipitation technology, dry type air cleaner to remove odour, smoke and fumes from exhaust air.				
	Electrostatic section shall be made of 16 gauge galvanised sheet, high bake epoxy powder coated, washable type aluminium mesh filters, stainless steel spiked ionizers to create high voltage DC field, Stainless Steel 316 collector plates which should be alternatively charged positive and negative with large collecting area with 14" deep cell, to work as magnet for charged smoke and oil particles. Average efficiency of 95% and more in single pass as per DOP test method. Electrostatic Precipitator should be able to charge particles from 0.01 micron to 10 microns through solid state power supply. The system should be fitted with interlock switch for safety. The system should allow connection to a fan section to achieve 500 FPM velocity across the air cleaner.				
	3000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator	No.	1	92,565	92,565.00
	6000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator	No.	1	185,130	185,130.00
NS	AIR CURTAIN				
	Supply, installation testing and commissioning of AIR CURTAIN of following size as per approved make .(At ground entrance)				
	NS	NS Air Scrubber (DRY Type) DIDW FAN : CSSD/Laundry/Kitchen Exhaust Supply, installation, testing and commissioning of DIDW Backward curved horizontal floor mounted fan unit comprising of accurately cut scroll & side plates, heavy gauge with all welded construction, sheet steel fabricated impeller, drive with blower pulley, motor pulley, V-belts, squirrel cage motor complete as per specification (fan-motor efficiency exceeding ASHRAE 90.1-2007 Criteria). (The bidder shall submit fan performance curves for all fans). 3000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator 6000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator DRY SCRUBBER : Kitchen Exhaust Supply, Installation, Testing and Commissioning of Dry Scrubber comprising of extract air intake section, electrostatic precipitation technology, dry type air cleaner to remove odour, smoke and fumes from exhaust air. Electrostatic section shall be made of 16 gauge galvanised sheet, high bake epoxy powder coated, washable type aluminium mesh filters, stainless steel spiked ionizers to create high voltage DC field, Stainless Steel 316 collector plates which should be alternatively charged positive and negative with large collecting area with 14" deep cell, to work as magnet for charged smoke and oil particles. Average efficiency of 95% and more in single pass as per DOP test method. Electrostatic Precipitator should be able to charge particles from 0.01 micron to 10 microns through solid state power supply. The system should be fitted with interlock switch for safety. The system should allow connection to a fan section to achieve 500 FPM velocity across the air cleaner. 30000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost	NS Air Scrubber (DRY Type) DIDW FAN : CSSD/Laundry/Kitchen Exhaust Supply, installation, testing and commissioning of DIDW Backward curved horizontal floor mounted fan unit comprising of accurately cut scroll & side plates, heavy gauge with all welded construction, sheet steel fabricated impeller, drive with blower pulley, motor pulley, V-belts, squirrel cage motor complete as per specification (fan-motor efficiency exceeding ASHRAE 90.1-2007 Criteria). (The bidder shall submit fan performance curves for all fans). No. 3000 CFM / 75 mm WG SP (For Kitchen Vent.)_Cost to be inclusive of unit isolator No. 6000 CFM / 75 mm WG SP (For Kitchen Vent.)_Cost to be inclusive of unit isolator No. DRY SCRUBBER : Kitchen Exhaust Supply, Installation, Testing and Commissioning of Dry Scrubber comprising of extract air intake section, electrostatic precipitation technology, dry type air cleaner to remove odour, smoke and fumes from exhaust air. Electrostatic section shall be made of 16 gauge galvanised sheet,high bake epoxy powder coated, washable type aluminium mesh filters, stainless steel spiked ionizers to create high voltage DC field, Stainless Steel 316 collector plates which should be alternatively charged positive and negative with large collecting area with 14' deep cell, to work as magnet for charged smoke and oil particles. Average efficiency of 95% and more in single pass as per DOP test method. Electrostatic Precipitator should be able to charge particles from 0.01 micron to 10 microns through solid state power supply. The system should be fitted with interlock switch for safety. The system should allow connection to a fin section to achieve 500 FPM velocity acrosst the air cleaner. No. <	NS Air Scrubber (DRY Type) DDW FAN : CSSD/Laundry/Kitchen Exhaust Supply, installation, testing and commissioning of DIDW Backward curved horizontal floor mounted fan unit comprising of accurately cut scroll & side plates, heavy gauge with all welded construction, sheet steel fabricated impeller, drive with blower pulley, motor pulley, V-belts, squirrel cage motor complete as per specification (fan-motor efficiency exceeding ASHRAE 90.1-2007 Criteria). (The bidder shall submit fan performance curves for all fans). 3000 CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator No. Mood CFM / 75 mm WG SP (For Kitchen Vent.),Cost to be inclusive of unit isolator No. DRY SCRUBBER : Kitchen Exhaust Supply, Installation, Testing and Commissioning of Dry Scrubber comprising of extract air intake section, electrostatic precipitation technology, dry type air cleaner to remove odour, smoke and fumes from exhaust air. Electrostatic section shall be made of 16 gauge galvanised sheet, high bake epoxy powder coated, washable type aluminium mesh filters, stainless steel spiked ionizers to create high voltage DC field, Stainless Steel 316 collector plates which should be alternatively charged positive and negative with large collecting area with 14" deep cell, to work as magnet for charged spokke and oil particles. Average efficiency of 95% and more in single pass as per DOP test method. Electrostatic Precipitator should be able to charge particles from 0.01 micron to 10 microns through solid state power supply. The system should be fitted with interlock switch for safety. The system should allow connection to a fan section to achieve 500 FPM velocity across the air cleaner. <td< td=""><td>NS Air Scrubber (DRY Type) </td></td<>	NS Air Scrubber (DRY Type)

a	1800 mm long (High flow type)	Nos.	1	24,684	24,684.00
С	2100 mm long (High flow type)	Nos.	2	29,312	58,624.50
					2 220 (12
	TOTAL OF VENTILATION SYSTEM				3,339,013
11	SERVER ROOM PAC WORKS				
11.1	DX UNIT For Server Room				
a	Floor Mounted, Bottom discharge Single Circuit Air Cooled Varaible Capacity compressor (From 20% to 100%), DX type Precision Air conditioners of cooling capacity 7.2 TR and with R-410a/407C Refrigerant Gas and infloor EC fan. Return Temp 20 Deg C & 50+/-5% RH, at 44Deg C ambient. Each machine should be able to deliver 4500-5000CFM or more.Cooling coil should be designed in such a way so that face				
	velocity does not exceed 2.5 m/s. The Indoor unit shall comprise of Variable capacity Digital Scroll Compressor Infloor				
	Evaporator Fan complete with Backward curved type with EC motor, Blue fin Evaporator DX Cooling Coil , Microprocessor controllers, Thermostatic Expansion valves, Driers, G4 Filter, Suction and Discharge piping, Internal power and Control wiring, Crankcase heaters, Infrared Humidifiers, Heaters, HP/LP Cutouts, Power and Control contacotrs and Other Electrical accessories.				
	The Outdoor Condenser unit(Coated with corrosion resistant) shall comprise of Condenser fans & motor, Condenser cooling coil (Copper coil with aluminium fins),Fan Speed Controller (Variex), Isolater switch.				
	The unit shall be suitable for operation on 415 Volts, 50 Hz, 3 Phase, 4 Wire AC supply. Each unit should be having individual display panel, which shall display date, time, actual & set values, operating conditions, signal faults, collective faults, limiting values and PAC wellness alarm / service alarm to reduce the down time and unit memory shall hold the 400 most recent events with ID number, time and date stamp for each event.				
	Supply of Unit, as per above specification. Each unit footprint should not exceed 850mm (W) x 850 mm (D) x 1950 mm (H). (4 Working +2 Standby)	Nos	6	555,581	3,333,486.00
	The Break-up of Pricing is as under:				

1 1		1		1	
	Basic Unit Price of Each Unit				
	Items included are:	T 1 1			
	Digital Scroll Compressor	ed			
	Infloor EC Backward curved Fan	Includ ed			
	Evaporator Cooling Coil	Includ			
	Air cooled condenser	Includ			
	Fan Speed Controller (Variex),	Includ			
	Microprocessor (ICOM)	Includ			
	Heater	ed Includ			
	IR Humidifier	ed Includ			
	Power Panel & starter for all drives	ed Includ			
	Filter	ed Includ			
	Card for BMS/Web	ed Includ			
	Water leak detector sensor	ed Includ			
		ed			
	Team Mode feature for PAC units controller for synchronising the Multiple No. of units to work as single system for all above units.	Includ ed			
	Load sharing mode feature	Includ ed			
	Cascading Effect	Includ ed			
	Sequencing of above Units	Includ ed			
b	DX UNIT For Server Room SITC of Air Gas purification as per standard and requirement of server room. Model BPU 500TV2	Nos	2	132,281	264,562.00
11.2	Lowside accessories and Installation & Commissioning:				
i	Installation & commissioning of Precision AC units comprising of:				
	Lifting, shifting & positioning of units to site without use of crane				
	Pressure testing,vacummizing and Commissioning of the system.	Nos.	6	31,748	190,488.00

I	I	1	1	1 1	
ii	Interconnecting epoxy coated Copper piping between indoor & outdoor unit.@ 25 RMT Copper piping will be duly insulated with in the AC space.				
а	Hot gas line	Rmt	210	921	193,410.00
b	Liquid line	Rmt	210	709	148,890.00
iii	Interconnecting copper cabling between indoor & outdoor unit (3 Core x 2.5 Sqmm) on suitable GI tray	Rmt	220	291	64,020.00
iv	Incoming Copper Cabling from Incoming Isolator to CRAC Unit@ 25 mtr per machine	Rmt	150	312	46,800.00
V	Condensate drain piping with 40NB GI- B class pipes.	Rmt	30	381	11,430.00
vi	Humidifier water piping with 25NB GI-B class pipes.	Rmt	20	307	6,140.00
vii	IDU & ODU Stand	Nos.	12	2,117	25,404.00
viii	Refrigerant R-410a/407c	Kgs.	50	1,111	55,550.00
ix	EXTENDED PIPING KIT in case piping length increases more then 30 mtr/ckt.	Nos.	6	37,039	222,234.00
X	Installation, Testing and commissioning of extended piping kit complete with supply of check valves, solenoid valves, "U" trap, additional oil charge cabling etc. as required	Lot	2	26,456	52,912.00
xi	Incase of single/multiple circuits the measure will be considered one Kit per unit. Hence supplier should quote rate accordingly.	Lot		37,039	0.00
xii	AIR DISTRIBUTION	Lot	1	3,175	3,175.00
	Supply, Installation, testing and Balancing of double louvered supply air grilles in accordance with the approved shop drawings along with VCD				
xiii	Supply and installation of Air Powder coated extruded aluminium grilles with dampers of approved colour & shade. Size 600 x 600 mm	Nos.	32	2,117	67,744.00
XV	INSULATION Supply and Application of 13mm thick UV laminated Cross Linked Polyethylene for floor of Server Room as per drawings.	Sqm.	60	556	33,360.00
	TOTAL CARRIED TO SUMMARY (Server PAC Works)				4,719,605

12		BUILDING MANAGEMENT SYSTEM				
12.1	NS	CENTRAL CONTROL STATION				
a		SITC of BMS Computer System: 17 Processor or Equivalet Server PC, Intel(R) Xeon(R) Processor, 2.93GHz, 4MB Cache with 8 GB RAM, 1 TB HDD, 10/100 Mbps Ethernet card, USB connection & internal modem, Web server software, DVD-ROM Drive (with RAM), 100/1000 Mbps NIC for Network connection and anti virus software as per Tender Specifications. Accessories included Wireless Optical Mouse & Key Pad, with the above BMS System configuration. MS Windows 10 Enterprise or latest Licensed software compatible with the BMS platform etc. complete as required. Makes (Dell/HP/Lenovo)	Nos	1	149,541	149,541.00
b		46" Ultra Narrow Bezel Video Wall, 3.5 mm combined Bezel full array LED Backlighting, 700 nits brightness along with Display Panel and controller, In combination of 2x2 Sets, Including all cables, wall mounting.	Nos.	1	1,915,20 0	1,915,200.00
с		Laserjet A4 color printer	Nos.	1	35,004	35,004.00
12.2	NS	APPLICATION SOFTWARE				
A		SITC of the following window based graphical software for IBMS system with 1 No. Client for Operator workstation. The Software shall have 3D & HD vector dynamic graphics with Autocad import of plan with Zoom In & Zoom Out facility, Native 64 Bit System, Multi- Monitor Support-(Max 4 Nos), Multi-language support, BTL, UL, EN Certified System, BACnet Profile B-AWS (Advanced workstation) as per the BTL Listing, dot net platform, Certified OPC DA Server by OPC Foundation, Web-Based Server software shall permit use of Standard Web-Browsers such as Microsoft Internet Explorer, Netscape Navigator, etc. The Software shall comply to international standards and strive to deliver products that meet security standards such as ISA/IEC 62443, UL2900, ISO/IEC 27001, ISO/IEC62443 and OWASP. Cybersecurity audit trail, 4-eye principle, Seamless integration of certificates within customer IT infrastructure, Microsoft's active directory-based authentication, Use of network infrastructure that supports physical network or VLAN segmentation, Placing the web server in a "demilitarized zone" (DMZ), End-	Nos.	1	1,815,94	1,815,944.00

	_					
b		to-end encryption, from client to server, End- to-end encryption between servers, Certificate- based data exchange, Encrypted backups. The software shall have the capability to integrate with Lighting and other services as per technical specification. The software license shall have 5000 points. Client License for Engineer workstation SITC of High-quality CAPACTIVE touch 7.0" panels for technical on-site operation of plants as well as room operation. The Touch Panel shall have integrated web server and a BACnet/ IP web interface to connect a HTML5 browser	Nos. Nos.	<u>1</u> 2	88,105 72,326	88,105.00 144,652.00
		to a device on the network. Generic operation and monitoring of plant functions (alarms, schedulers, calendars, set point changes, display of actual values, etc.)				
d		Design, Supply, installation, testing and commissioning of Automation Station and related Field devices for STP Plant with a capacity of STP-400 KLD. The controller shall have a capcity of 600 IO points with integration port. It should store trend logs and event buffer for a typical duration of upto 30 days, DDC controller shall have a resident real time clock with a battery backup DDC must support trending & scheduling at controller level . All trend data must be created and saved to the automation station to achieve gap-free trend documentation during communication failure for Modular DDC analog IO Modules should local override facility with LCD display (LO/ID to ISO 16 484-2) & relay modules should have override as per ISO 16 484-2 . The controller shall be housed in a vandal proof lockable & secure MS cabinets along with all necessary switchgear protections as required. The same shall included the following.	Nos.	1	714,446	714,446.00
e		3 Phase starter Panel with VFD drive for 11 KW with category C1 Filter as per EN61800-3 and inbuilt choke with all communcation protocol required for integartion	Nos.	1	128,509	128,509.00
f		Electro-magnetic flow meter at the sewage inlet and outlet of membrane suction pump of suitable size	Nos.	2	183,436	366,872.00
g		PN16 Motorised Buterfly Valve with On/Off Actuator DN Size 150 mm	Nos.	2	139,909	279,818.00
h		pH Meter at membrane suction pump outlet for measurement of pH	Nos.	1	94,309	94,309.00
i		Differential pressure Switch Water	Nos.	4	8,601	34,404.00
j		Water Flow Switch	Nos.	2	9,535	19,070.00
k		Level Transmitter	Nos.	1	52,233	52,233.00

12.3	NS	INTEGRATORS				
		SITC of True IP Based BTL & UL Listed for third party integration. The controller shall have 2- port Ethernet switch and WLAN interface. It should have BTL label (BACnet communications passed the BTL test) and consisting of Dual microprocessor with Storage capacity of 1 GByte RAM. It should support Real Time clock upto 7 Days. It should Support of the major communication protocols: BACnet,/IP, BACnet MS/TP, Modbus IP and Modbus RTU upto 500 points. Integartor shall be of same make only. (Make:- Honeywell Comfort Point/ Siemens/ ALC)				
а		For VRF System on Bacnet/IP - 6000 Points	Nos.	1	1,550,87	1,550,871.00
b		For Fire ALARM System on Bacnet/IP - 1500 Points	Nos.	1	449,851	449,851.00
С		For HT/LT/Transformer on Bacnet/IP or Modbus RS485 - 500 Points	Nos.	1	141,848	141,848.00
d		For AHU/TFA VFDs on Modbus/RS485 - 120 Points	Nos.	1	141,848	141,848.00
e		For DG Sets on Modbus RS485 - 60 Points	Nos.	1	141,848	141,848.00
f		For Multifunctional energy meters Modbus/RS485 - 300 Points	Nos.	1	141,848	141,848.00
g		For PAC Units on Modbus/RS485 - 60 Points	Nos.	1	141,848	141,848.00
h		For Lifts on Modbus/Rs485 - 54 Points	Nos.	1	141,848	141,848.00
i		For UPS on Modbus/RS485 - 45 Points	Nos.	1	141,848	141,848.00
j		For Solar Panel on Modbus/TCIP - 50 Points	Nos.	1	41,187	41,187.00

[1
12.4	NS	DDC CONTROLLERS				
		SITC of Standalone BTL & UL listed BACNet I/P field DDC controller having universal input/ output ports. Controller shall have 2 10/100 ethernet port & can communicate in Star, Daisy chain, RSTP topology & offer path redundancy for communication. DDC controller shall be DHCP enabled to ensure VPN network . All DDC Controllers shall be provided with hinged doors with locking facility. Apart from the controllers, the enclosers shall house the terminal blocks, load relays and associated equipment. The internal wiring in the enclosure shall be factory wired. The packaging shall be such that complete installation of the field equipment and field wiring can be done prior to the installation of the electronics. The controller shall be independent in operation and the failure of any other device / controller or the operator workstations, shall not cause any disruption to the function of the rest of the system. The DDC controllers shall have the facility to implement user modifiable time schedules as daily, weekly, monthly annual temporary schedules. The DDC Controllers Shall have integration facility with				
		at least 2 ports of integration. The above shall be housed in vandal proof, lockable & secure MS Cabinets to be supplied along with all necessary switchgear protections as required. Number of controllers shall have spare capacity of 15% for future expansion.				
а		Controller for Common indication	Nos.	2	144,015	288,030.00
b		Controller for AHU system (1 AHU per DDC)	Nos.	9	109,513	985,617.00
c		Controller for TFA (1 TFA per DDC)	Nos.	3	109,513	328,539.00
d		Controller for Air Washer Units	Nos.	1	109,513	109,513.00
e		Controller for Ventilation Fans (4 Fans in 1 DDC)	Nos.	2	109,513	219,026.00
f		Controller for Pressurisation Fans (4 Fans in 1 DDC)	Nos.	4	109,513	438,052.00
g		Controller for DG Sets	Nos.	1	126,763	126,763.00
h		Controller for Lifts	Nos.	2	126,763	253,526.00
i		Controller Lighting System (Max 8 in 1 DDC per floor)	Nos.	5	122,970	614,850.00
j		Controller for Fire Fighting system	Nos.	1	109,513	109,513.00
k		Controller for Tanks	Nos.	2	109,513	219,026.00
1		Controller for Plumbing System	Nos.	1	109,513	109,513.00

12.5	NS	FIELD INSTRUMENTS				
		Supplying, installing, testing and				
		commissioning of the following sensors /				
		transducers / transmitters. The DDC shall				
		support sensor with DC 020 mA or 420 mA,				
		DC 0 10 V, LGNi 1000, 2x LG-Ni1000, Pt				
		1000, NTC 10k, NTC 100k, 1000 Ohm. (Make:				
		Honeywell/ Siemens/ ALC)		_		
а		Combined Ambient air temperature + humidity,	Nos	6	43,479	260,874.00
		CO2 sensors with Display.				1 12 000 0
b		Combined PM2.5, PM10 Sensor with Display	Nos	6	23,833	142,998.00
с		Differential pressure switch Air	Nos	32	4,676	149,632.00
d		Temperature sensor	Nos	12	2,548	30,576.00
e		Space type CO2 sensor	Nos	12	18,647	223,764.00
f		CO Sensor	Nos	5	9.525	47.625.0
g		Flameproof Level Switch	Nos	4	16.093	64.372.0
b h		Voltage Transducer	Nos	4	12,809	51,236,00
i		Current Relay	Nos	19	3 530	67,070,00
i		Water pressure sensor	Nos	2	17 351	34 702 0
J k		Bi Level Switch	Nos	3	11 088	35,964,0
<u>к</u> 1		Occupancy Sensor	Nos	40	3 381	135 240 00
1			1105.	40	5,501	155,240.00
12.6	NS	Cable, Conduit and Cable Trav				
12.0	110	Supply Installation Testing & Commissioning				
		of the following cables conduit and cable tray				
		as per the specifications:				
		as per the specifications.				
		2 Core 1 5 Samm Annealed Tinned Copper	RM	2800	138	386 400 00
9		Twisted pair Shielded armoured cable for	i di i	2000	150	200,100.00
a		signal and power as per specifications				
		A Core 1.5 Samm Anneolod Tinned Conner	DM	1500	204	206.000.00
1.		4 Core 1.5 Squim Annealed Timled Copper, Twisted pair Shielded armoured cable for	KIVI	1500	204	500,000.00
D		signal and power as per specifications				
		signal and power as per specifications	D 14	10.00	10	00.000.00
с		Cat-6 unarmoured cable with required jacks and	RM	1860	48	89,280.00
d		HUI DIP GALVANISED GALVANISED				
		PERFORATED TYPE CABLE TRAY		200	7.40	222.000.00
		150X50X1.6MM	RM	300	/43	222,900.00
e		GI Flexible 25 mm	RM	800	86	68,800.00
127		NETWORK SWITCHES	Nec	5	11 075	200 275 0
12.7			I INOS	5	41,0/0	209,373.00
12.7		of Laver 2 unmanaged switch with 16/24 ports	1105.			
12.7		of Layer 2 unmanaged switch with 16/24 ports	1105.			
12.7		of Layer 2 unmanaged switch with 16/24 ports (RJ-45) port rack mountable, SMPS power supply. The switch to switch distance shall not	100			
12.7		of Layer 2 unmanaged switch with 16/24 ports (RJ-45) port rack mountable, SMPS power supply. The switch to switch distance shall not	11051			
12.7		of Layer 2 unmanaged switch with 16/24 ports (RJ-45) port rack mountable, SMPS power supply. The switch to switch distance shall not exceed beyond 80 meters				
12.7		of Layer 2 unmanaged switch with 16/24 ports (RJ-45) port rack mountable, SMPS power supply. The switch to switch distance shall not exceed beyond 80 meters				15 201 728 00

13	AMC Wor	ks				
13.1		Comprehensive AMC for seven (7) years of complete VRF based HVAC system of capacity 1100 HP including BMS as per scope mentioned in technical specification after completion of 18 months DLP.				
		DLP Period	HP	1100	FREE	
a		1st Year	HP	1100	3,060	33,66,000.00
b		2nd Year	HP	1100	3,213	35,34,300.00
с		3rd Year	HP	1100	3,374	37,11,400.00
d		4th Year	HP	1100	3,542	38,96,200.00
e		5th Year	HP	1100	3,719	40,90,900.00
f		6th Year	HP	1100	3,905	42,95,500.00
g		7th Year	HP	1100	4,100	45,10,000.00
		TOTAL CARRIED TO SUMMARY (AMC Works)				2,74,04,300.00
		SCHEDULE ITEMS)				7,88,81,816.00
						12.06.55.255.0
		IUIAL OF HVAC & BMS WOKKS (SCHEDILE + NON SCHEDILE TTEMS)				12,06,55,577.0
						v
<u> </u>						
<u> </u>		I	1			

Note: The rates mentioned above are excluding GST

Explanatory Notes for BOQ:

i) The quantities shown in above Schedules are approximate and are as a guide to give the tenderer(s) an idea of quantum of work involved. The DFCCIL reserves the right to increase/ decrease and/or delete or include any of the quantities given above as per site conditions.

IV		SCHEDIII E-IV				
11		LOW VOLTAGE WORKS				
(ii)		NON-SCHEDULE ITEMS				
(11)						
		SUBHEAD 1 : FIRE ALARM/PA SYSTEM				
1	NS	Supply, Installation, Testing and Commissioning of addressable fire alarm control panel, expandable upto 20 loops. Controller shall be 5.7 inch color touch screen display, inbuilt networking port (both RS485&Ethernet), Serial port for printer with 10000 history event. The Panel shall be modular, decentralized, with redundancy in CPU and Power Supply with full functionality, Bidder not having redundancy shall supply 2 panels to comply. The panel shall be capable of providing BACnet/MODbus protocol for integration with BMS system. The number of loops should be calculated to accommodate all detector and devices with 20% spare. Seamless integration with Public Address System. Panel shall have battery backup of 24 hour in standby				
		and 30 minute in alarm condition. The Panel shall be VDS-EN 54/UL-FM approved.				
1.1		12 Loops Panel	Nos.	1.00	8,42,531.00	8,42,531.00
1.2		2 Loops Panel	Nos.	1.00	3,02,737.00	3,02,737.00
1.3		1 Loops Panel	Nos.	2.00	2,66,971.00	5,33,942.00
2	NS	Supply, Installation, Testing and Commissioning Active Repeater Panel. Controller shall be 640 character/6 inch color touch screen display, inbuilt networking port(both RS485&Ethernet),Serial port for printer. The Repeater Panel shall allow users to acknowledge, reset, silence, program, view history eventsetc. (All functions similar to main panel)The user interface of the repeater panel shall be same as the Main Controller. The Panel shall be VDS/EN 54 approved/UL- FM approved.	Nos.	3.00	1,38,740.00	4,16,220.00
3	NS	Supply, Installation, Testing and Commissioning of intelligent addressable Multicriteria detector (Smoke + thermal). Detector should have inbuilt isolators as per NFPA 72 style 7 wiring requirements and have an option of soft addressing. Detector should monitor Electromagnetic interference and report to the panel - current and average	Nos.	747.00	2,823.00	21,08,781.00

		values. The detector shall have tri color LED, Green for Normal, Amber /yellow for trouble and Red for alarm. Shall have pre- programmed sensitivity parameter sets Sensitive,Standard,Robust. Shall be Polarity Insensitive. It Shall be EN54/ VDs/ UL certification.(Detectors without Inbuilt Isolators may be considered with an additional Isolator Module per detector)				
4	NS	Supply, Installation, Testing and Commissioning of intelligent addressable Smoke detector. Detector should have inbuilt isolators as per NFPA 72 style 7 wiring requirements and have an option of both soft & hard addressing. Detector should monitor Electromagnetic interference and report to the panel - current and average values. The detector shall have tri color LED, Green for Normal, Amber /yellow for trouble and Red for alarm Shall be Polarity Insensitive. It Shall be EN54/ VDs/ UL certification.(Detectors without Inbuilt Isolators may be considered with an additional Isolator Module per detector)	Nos.	582.00	2,734.00	15,91,188.00
5	NS	Supply, Installation, Testing and Commissioning of intelligent addressable Heat detector. Detector should have inbuilt isolators as per NFPA 72 style 7 wiring requirements and have an option of both soft & hard addressing. Detector should monitor Electromagnetic interference and report to the panel - current and average values. Provides seven (7) field-selectable settings in the $135^{\circ} - 174^{\circ}F$ ($57.2^{\circ} - 78.9^{\circ}F$) temperature range and can be configured to provide a low- temperature warning signal at $40^{\circ}F$ ($4.4^{\circ}C$). Tri color LED, Green for Normal, Amber /yellow for trouble and Red for alarm. Shall be Polarity Insensitive. It Shall be EN54/ VDs/ UL certification.(Detectors without Inbuilt Isolators may be considered with an additional Isolator Module per detector)	Nos.	66.00	2,705.00	1,78,530.00
6	NS	Supply, Installation, Testing and Commissioning of Addressable Control Relay Module with inbuilt isolators as per NFPA 72 style 7 wiring requirements & with flexible network. Shall have multi-color light-emitting diode (LED) which indicates system status Green, Amber and Red. It Shall be Polarity Insensitive. It Shall be EN54/ Vds	Nos.	16.00	4,533.00	72,528.00

		Certification/UL.				
7	NS	Supply, Installation, Testing and Commissioning of Addressable Module with one input & one output contacts, with inbuilt isolators, monitoring of a line with EOL resistor ,Potential free contact monitoring. It Shall have multi-color light-emitting diode (LED) which indicates system status Green, Amber and Red. Shall be Polarity Insensitive. Shall be EN54 / Vds/UL Certification.	Nos.	27.00	4,533.00	1,22,391.00
8	NS	Supply, Installation, Testing & Commissioning of Response Indicator with matching screws complete with GI Junction box, Cable lugs at cable end and ferruling. Response indicator shall be of same make as main Panel.	Nos.	752.00	1,779.00	13,37,808.00
9	NS	Supply, Installation, Testing and Commissioning of addressable Manual Pull Station. Shock and Vibration Resistant, Pull Down Lever Remains Down Until Reset with inbuilt isolators as per NFPA 72 style 7 wiring requirements, with flexible network structures & necessary fixing arrangements with key complete as required. Shall be EN 54 / Vds/UL Certification. It Shall be Polarity Insensitive .	Nos.	47.00	4,052.00	1,90,444.00
10	NS	Supply, Installation, Testing and Commissioning of sounder as per NFPA 72 style 7 wiring requirements & with 20 different tone variants selection options & adjustable sound pressure by 5 levels, the sound pressure 92 dB(A), should be programmed from the panel. Shall be EN54 / Vds/UL Certification.	Nos.	47.00	7,556.00	3,55,132.00
11	NS	Supply, Installation, Testing and Commissioning of UL listed red strobe with field selectable 15/30/75/110 candelas. Shall be EN54 / Vds/UL Certification.	Nos.	47.00	7,232.00	3,39,904.00
12	NS	Supply, Installation, Testing and Commissioning of Addressable Duct detector with Housing of same make, Shall have inbuilt isolators as per NFPA 72 style 7 wiring requirements, should be programmed from the panel. Shall be EN54 / Vds/UL Certification.	Nos.	14.00	11,888.00	1,66,432.00
13	NS	Supply, Installation, Testing and Commissioning of Beam Detector with range of 10 - 100 mtr, with addressable interface module with inbuilt isolators as per NFPA 72	Nos.	5.00	46,064.00	2,30,320.00

		style 7 wiring requirements, should be programmed from the panel. Shall be EN54 / Vds/UL Certification.				
14	NS	Supply, Installation, Testing & Commissioning of LPCB certified 2 C x 1.5 sq.mm Fire Survival Armoured cable, clamped directly on wall/Ceiling /structural member with the use of GI clamps/saddle etc. Cable shall be 600/1000V rated, twisted with Class-2 annealed stranded copper conductor having special cross-linkable Low Smoke Zero Halogen Ceramified Silicon insulation as per BS EN 50363, galvanized steel wire armour and Low Smoke Zero Halogen inner & outer sheath. Should comply to EN 61034-2 & EN 60754-1. Should meet fire performance circuit integrity test as per BS EN 50200 & BS 6387 CWZ (950 Deg. C for 180 mins). Outer sheath will be in Red colour	Mtrs	20800	127.00	26,41,600.00
15	NS	SITC of EN-54 Certified IP based EVAC PA controller capable of adding 12 zones in the system and expandable upto 150 zones with 14x 4 Audio matrix with full DSP functionality. 8 audio inputs, 4 audio outputs, 4 channel output matrix. Shall support amplifier redundancy, 12 speaker line outputs. 8000 fault, warning and event conditions log. Built in message manager for 100 emergency/business calls up to 85 minutes. 18 control inputs and 19 control outputs. Impedance measurement and Pilot Tone supervision for speaker line monitoring. The controllers shall be able to exchange audio signals over the network without the need of a running PC/server, software dependent solutions shall not be accepted. Multiple controllers can be networked over IP using Dante audio up to 16 digital audio input signals and 16 digital audio output channels with low latency. Audio flows Up to 16 \times 16 simultaneous audio streams@48kHz.Frequency response (ref. 1 kHz) 20 Hz to 20 kHz (-0.5 dB), Signal-to- noise ratio (A-weighted): Line in to line out: 106 dB typical, THD+N < 0.05%, Sample rate 48 kHz, DSP processing resolution 24-bit linear A/D and D/A conversion, 48-bit processing.	Nos	1	2,02,605.00	2,02,605.00

16	NS	SITC of EN54 Certified EVAC Router for adding 24 zones in the system, 2-in-6 matrix. 20 Control Inputs, 26 Control Outputs. Shall support amplifier redundancy. Impedance measurement and Pilot Tone supervision for speaker line monitoring.	Nos	2	1,59,677.00	3,19,354.00
17	NS	SITC of EN-54 certified 2x 500W Class D, high efficiency amplifier. 70/100V loudspeaker output voltages, 4 automatic selectable audio inputs , local input for audio source. THD \leq 1%. Frequency response, ref. 1 kHz, rated load, -3 dB : 50 Hz to 25 kHz. Signal-to-noise ratio (A-weighted) > 104 dB . Audio input level limiter, RMS output power limiter, high temperature, DC, short circuit, mains under voltage protection, DC supply under voltage protection, inrush current limiter, ground fault	Nos	3	2,03,971.00	6,11,913.00
18	NS	SITC of EN-54 certified Call Station for 15 zone selection keys for Zone selection, source selection, level control, emergency on/off, message on/off, failure acknowledge/reset, Switching output trigger on/off or 0 to 10V, select scheduled events, scheduled event on/off. Multilanguage LC display(122×32) pixel ,Five menu/function keys, gooseneck microphone with supervised electret microphone, pop shield and permanent monitoring, integrated loudspeaker for system sounds. The call station should have the provision to be configured as a numeric keypad.	Nos	3	88,118.00	2,64,354.00
19	NS	 SITC of 6W wall mount speaker with excellent speech & music reproduction Max Power: 9W,Rated Power: 6Watts, Power Tapping: 6/3/1.5W Effective frequency range(-10 dB) : 180 Hz to 20KHz SPL at Sound pressure level at 6 W / 1 W (4 kHz, 1 m)100 dB / 92 dB (SPL) Opening Angle 1 KHz / 4 KHz (-6 dB): horizontal 165° / 95°, vertical 158° / 73° Dimensions (H x W x D) 243 x 151 x 141/119 mm Safety acc. to EN60065 	Nos	25	5,946.00	1,48,650.00
20	NS	SITC of 6W ceiling mount EN 54 certified speaker with suitable fire dome having the following specification: - Max Power: 9W,Rated Power: 6Watts, Power Tapping: 6/3/1.5W - Effective frequency range(-10 dB) :90 Hz to	Nos	286	3,789.00	10,83,654.00

		20KHz - SPL at rated power (1Khz at 1 m) 98 dB - Opening Angle 1 KHz / 4 KHz (-6 dB): 180/50 - Diameter 216 mm (8.5 in) Maximum depth 90 mm (3.54 in)				
		Cables & Aggessories				
21	NS	Supply, Installation of CD/DVD Player	Nos	1	6,241.00	6,241.00
22	NS	Supply, Installation of Volume control units 12,36,100W	Nos	1	5,943.00	5,943.00
23	NS	Supply, Installation of 19 "Equipment Rack, 32U Made of MS for housing of all above equipment, front lockable glass door, Fan tray fro Colling, Caster wheel base, Main Panel with Spike Buster, Individual FUSE power supply unit, including all internal wiring/ interconnection as required	Nos	2	5,201.00	10,402.00
24	NS	Supply, Installation of Brackets for Mounting Speakers	Nos	311	743.00	2,31,073.00
25	NS	SITC of workstation i-7 PC with 8 GB RAM and 1 TB HDD, 10/100 Mbps Ethernet card, USB connection and internal modem, Microsoft(R) Windows(R) 10 OS Professional Enterprise or latest, Web Server Software, DVD-ROM Drive (with RAM), 100/1000 Mbps NIC for Network connection and antivirus software with 24" colour graphics monitor as per Tender Specifications. (Accessories included Wireless Optical Mouse and Key Pad.)	Nos	1	1,08,172.00	1,08,172.00
		TOTAL for FIRE ALARM/PA			-	1,44,22,849.00
		SUBHEAD 2 : ACCESS CONTROL SYSTEM/PANIC BAR				
26	NS	Supply, Installation, Testing & Commissioning of 2 - reader - 2 door Intelligent I.P Controller with TWO READERS, FOUR RELAY OUTPUTS AND FOUR SUPERVISED INPUTS TO THE CONTROLLER, Microprocessor: 32 Bit, Memory: 30000 User and 20000 Logs, Card Holder Capacity : 30,000 Min, Event Buffer : 20,000 Min, Inputs : 4 Supervised, dual-resistor, 2 state end-of-line inputs, Hi-impedance, active low 5 VDC 8	Nos.	1	66,892.00	66,892.00

		supervised expandable inputs, Outputs : 4 fully programmable 5 A, N.O. and N.C. relay				
26.1	NS	Supply, Installation, Testing & Commissioning of On Board 4 Reader Expander	Nos.	1	24.516.00	24.516.00
26.2	NS	Supply, Installation, Testing & Commissioning of On Board 2 Reader Expander	Nos.	1	14.111.00	14.111.00
26.3	NS	Supply, Installation, Testing & Commissioning of 16 relay board	Nos.	1	22.939.00	22.939.00
26.4	NS	Supply, Installation, Testing & Commissioning of 16 input board	Nos.	1	22.939.00	22.939.00
26.5	NS	Supply, Installation, Testing & Commissioning of 16 input board, 8 output board	Nos.	1	1,09,864.00	1,09,864.00
26.6	NS	Supply, Installation, Testing & Commissioning of housing for above	Nos.	1	14.489.00	14.489.00
26.7	NS	Supply, Installation, Testing & Commissioning of Biometric reader	Nos.	47	38.848.00	18.25.856.00
26.8	NS	SITC of Bluetooth smart card readers as per specifications suitable for mounting on metal surface/metal frames or wooden frames wall or as required based on site conditions including	Nos.	59	10,081.00	5,94,779.00
26.9	NS	SITC of electromagnetic locks/ electric lockset	Nos	27	4 075 00	1 10 025 00
26.10	NS	SITC of electromagnetic locks/ electric lockset double leaf with LED as per specifications	Nos	23	6,569.00	1,51,087.00
26.11	NS	SITC of push to exit buttons	Nos	67	2,084.00	1,39,628.00
26.12	NS	SITC of smart cards as per specifications	Nos	800	131.00	1,04,800.00
26.13	NS	SITC of emergency door open break glass unit as per specifications	Nos	59	1,062.00	62,658.00
26.14	NS	SITC of Magnetic Door Contact	Nos	118	352.00	41,536.00
26.15	NS	SITC of Buzzer	Nos	86	539.00	46,354.00
26.16	NS	SITC of walk through door frame metal detectors as per specifications	Nos	2	1,33,481.00	2,66,962.00
26.17	NS	SITC of panic bar with electric latch retraction.	Nos	27	16,195.00	4,37,265.00
26.18	NS	Supply, installation of hand held metal detector	Nos	3	4,345.00	13,035.00
26.19	NS	SITC of workstation i-7 PC with 8 GB RAM and 1 TB HDD, 10/100 Mbps Ethernet card, USB connection and internal modem, Microsoft(R) Windows(R) 10 OS Professional	Nos	2	1,08,172.00	2,16,344.00
		Enterprise or latest, Web Server Software, DVD-ROM Drive (with RAM), 100/1000 Mbps NIC for Network connection and antivirus software with 24" colour graphics monitor as per Tender Specifications.				

		(Accessories included Wireless Optical Mouse and Key Pad.)				
26.20	NS	SITC of Access Control Software, Software shall be based on a standard Client-Server architecture, The server connects to the database the clients draw the information from the server: Clients connect to the server using a LAN remote communication :The server runs as a Windows service by default.	Nos	2	29,071.00	58,142.00
26.21	NS	Supply, laying, termination, testing and commissioning of 8 core 1.5 sq.mm shielded cable for reader	RM	2880	141.00	4,06,080.00
26.22	NS	Supply, laying, termination, testing and commissioning of 2 core 1.5 sq.mm power cable.	RM	2920	47.00	1,37,240.00
26.23	NS	Supply, laying, termination, testing and commissioning of 4 core 1.5 sq.mm cable for EM Lock, EDR & Push Button.	RM	184	77.00	14,168.00
26.24	NS	Supply, laying, termination, testing and commissioning of 4 core 1.5 sq.mm communication cable from controller to controller.	RM	920	77.00	70,840.00
26.25	NS	Supply,Installation,Testingandcommissioning of 25mm PVC conduit.TOTAL OF ACCESS CONTROL	RM	3840	41.00	1,57,440.00 51,29,989.00
		SUBHEAD 3 : BOLLARDS AND BARRIERS				
27	N.S	Supply, Installation, Testing & Commissioning of K-4 crash rated automatic hydraulic bollard with independent drive unit (Set of 5 Units), Cylinder stroke - 1000mm min, Cylinder diameter - 355 mm min, Cylinder material - Steel S355JR EN10210 (16 mm thickness), Rise time about 6 sec/standard version, 1.5 sec/EFO version, Descent time of about 2 sec, maximum expressed force - 5000 N, Impact resistance - 150 KL, Break-in resistance -656 KJ (in compliance with standard ASTM F2656-07 - M30), Load class C25 (25t), Junction bos IP 66, Standard refracting strip height - 55mm, Operating temperature - (-)15				

		accessories and as per technical specification				
		Remote & Reciver				
		Traffic light with pole, 3.5M				
27.1		Loop detector	Nos	1		
27.1			1105	1	37.04.889.00	37.04.889.00
28	NS	SITC of Automatic Hydraulic Crash rated				07,01,007100
20	115	Boom Barrier K4 Crash Certified successfully				
		stimulated impact tested to ASTM-2626				
		capable of stopping a 72.800 Kg truck				
		travelling at 48 kmph within one meter. 100%				
		duty cycle. IP67 with continuous ventilation				
		and manual hand pump for emergency				
		operations, 4 meter length with required				
		accessories as per technical specifications				
		Photocell				
		Remote & Receiver				
		Push Button	Nos	2		
28.1			1105	-	7.07.294.00	14.14.588.00
2011					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1,1,1,000,000
		TOTAL for BOLLARDS AND BARRIERS			-	
						51.19.477.00
						, ,
		SUDUEADA. CCTV SVSTEM				
		SUDREAD 4: CCI V SISIENI				
1		SUBHEAD 4: CCTV STSTEM				
29	NS	SITC Dome camera 2 MP -IP network IR	Nos.	158		
29	NS	SUBHEAD 4: CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBHEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple	Nos.	158	24,406.00	38,56,148.00
29	NS	SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBHEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBHEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance,	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBHEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67,	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG,	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : -35°C to 60° C. Certifications:	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : –35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 \times 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : -35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af)	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 \times 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : –35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af)	Nos.	158	24,406.00	38,56,148.00
29	NS	SUBILEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : –35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af) SITC Bullet Camera 2 MP - IP Network IR	Nos.	25	24,406.00	38,56,148.00
29	NS	SUBILEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : -35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af) SITC Bullet Camera 2 MP - IP Network IR Bullet Camera, 1/2.8" CMOS, 2 MP @ 25fps	Nos.	25	24,406.00	6,31,350.00
29	NS	SUBILEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : –35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af) SITC Bullet Camera 2 MP - IP Network IR Bullet Camera, 1/2.8" CMOS, 2 MP @ 25fps or better,ANR, triple stream, Min. Illumination	Nos.	25	24,406.00	6,31,350.00
29	NS	SUBILEAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : –35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af) SITC Bullet Camera 2 MP - IP Network IR Bullet Camera, 1/2.8" CMOS, 2 MP @ 25fps or better,ANR, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True	Nos.	25	24,406.00	6,31,350.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 \times 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : -35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af) SITC Bullet Camera 2 MP - IP Network IR Bullet Camera, 1/2.8" CMOS, 2 MP @ 25fps or better,ANR, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 \times 1080, triple	Nos.	25	24,406.00	38,56,148.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : –35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af) SITC Bullet Camera 2 MP - IP Network IR Bullet Camera, 1/2.8" CMOS, 2 MP @ 25fps or better,ANR, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 × 1080, triple stream, 2.8–12 mm motorized focus & zoom	Nos.	25	24,406.00	38,56,148.00 6,31,350.00
29	NS	SUBILIAD 4 : CCTV STSTEM SITC Dome camera 2 MP -IP network IR Dome Camera, 1/2.8" CMOS, 2 MP @ 25fps or better, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 \times 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, ROI,HLC, 3DNR, Privacy Mask, 3 IR LEDs Smart IR with upto 30m IR distance, Corridor Mode, 128GB SD card support, IP67, IK10, PoE, H.265 High Profile and MJPEG, PoE Class 3 and 12V DC, Having Operating temp range : -35°C to 60° C. Certifications: ONVIF Profile,UL,FCC,CE,IK10,IP67,DC 12V±25%, PoE (IEEE 802.3af) SITC Bullet Camera 2 MP - IP Network IR Bullet Camera, 1/2.8" CMOS, 2 MP @ 25fps or better,ANR, triple stream, Min. Illumination required 0.001 lux @ F1.4 (color), 120dB True WDR, Min. Pixels 1920 \times 1080, triple stream, 2.8–12 mm motorized focus & zoom lens, BLC, HLC, 3DNR, Privacy Mask, 4 IR	Nos.	25	24,406.00	38,56,148.00 6,31,350.00

		LEDs Smart IR with upto 50m IR distance, 128GB SD card support, Corridor Mode, 1 RJ45 10M/100M Base-TX Ethernet, PoE, H.264 High Profile and MJPEG,Alarm I/Audio I/O PoE Class 3 and 12V DC, Having Operating temp range : -35°C to 60° C.DC 12V±25%, PoE (IEEE 802.3af) Power consumption: Max 9W, Certifications: ONVIF Profile S & Profile G compliant, UL,FCC,CE,IK10,IP67				
31	NS	SITC 32-ch NVR,Two-way Audio Input:1-ch, RCA, Network: 320Mbps/ 320Mbps, 1-ch, RCA, 128, IPV4, IPV6, SNMP,P2P, UPnP, NTP, DHCP, PPPoE, HTTP, SMTP, TCP/IP, RTSP, HDMI1/VGA: 1920x1080p /60Hz, 1920x1080p /50Hz, 1600x1200 /60Hz, 1920x1080p /50Hz, 1280x720 /60Hz, 1024x768 /60Hz, HDMI2:4K (3840x2160) /60Hz, 4K (3840x2160) /30Hz, 1920x1080p /60Hz, 1920x1080p /50Hz, 1600x1200 /60Hz, 1920x1080p /50Hz, 1600x1200 /60Hz, 1024x768 /60Hz, 1-ch, BNC, Recording Resolution- upto 12 Mp, Audio Output :1-ch, RCA, Synchronous Playback: 16-ch, Corridor Mode Screen:3/4/5/7/9/10/12/16/32, Decoding: Ultra 265, H.265, H.264, Live view/ Playback:Upto 12 Mp, Capability: 3 x 12MP@25, 4 x 4K@30, 8 x 4MP@30, 16 x 1080P@30, 32 x 960P@25, 36 x 720P@30, 64 x D1, Hard Disk: 8 SATA interfaces, up to 10TB for each HDD, 1 eSATA interface, Complete with N+1 redundancy for auto failover, Smart: Face detection, Intrusion detection, Cross line detection, Audio detection, Defocus detection, Scene change detection, Auto tracking, Face search, Behavior search, People counting, Disk Array: RAID 0, 1, 5, 6, 10, External Interface: 2 RJ45 10M/100M/1000M self-adaptive Ethernet Interfaces, 1 x RS232, 1 x RS485, Front panel: 2 x USB2.0,Rear panel: 1 x USB3.0, Alarm In/out: 16/4 ch, General: 100~ 240 VAC, Power Consumption: \leq 20 W(without HDD), -10°C ~ + 55°C (+14°F ~ +131°F), Humidity \leq 90% RH(non- condensing), 442mm ×425mm× 86mm (17.4" × 16.7"× 3.4"), \leq 5.13 Kg (11.31 lb), CE, FCC,UL	Nos.	9	1,32,883.00	11,95,947.00
20	NIC	SITC DTZ Comoro 2 MD ID Natural 1/2.9"	Noc	0		
52	1NO	CMOS, ICR, 1920x1080:30fps, H.264/MJPEG Or better, Triple streams, AC24V/DC24V,	1105.	7	95,982.00	8,63,838.00

33	NS	IP67 Micro SD card slot, Alarm in/out 1/1, Audio, -40-65°C, IP66, 30x optical zoom(4.5 ~ 135mm), IR range: up to 150m, IR anti- reflection window , 120dB WDR, IP66, 30X optical zoom, HLC, Smart functions, EIS , CE,FCC,UL,Defog,Privacy mask, Up to 16 patrols, up to 32 presets per patrol, PAN Range - 360° (endless) 0.1° /s ~ 240°/s ,Tilt Range15° ~ 90° (auto reverse) $0.1^{\circ} \sim 160^{\circ}$ /s ,ANR	Nos	18		
55	110		105.	10	26,842.00	4,83,156.00
34	NS	SITC of 55"LED Display	Nos.	10	98,259.00	9,82,590.00
35	NS	SITC of workstation i-7 PC with 8 GB RAM and 1 TB HDD, 10/100 Mbps Ethernet card, USB connection and internal modem, Microsoft(R) Windows(R) 10 OS Professional Enterprise or latest, Web Server Software, DVD-ROM Drive (with RAM), 100/1000 Mbps NIC for Network connection and antivirus software with 24" colour graphics monitor as per Tender Specifications. (Accessories included Wireless Optical Mouse and Key Pad.)	Nos.	2	1,08,172.00	2,16,344.00
		TOTAL for CCTV				
						82,29,373.00
		NETWORKING COMPONENTS				
		SUBHEAD 5 : PASSIVE NETWORKING COMPONENTS				
36	NS	Supply & Installation of Unshielded Twisted Pair LSZH CAT6A (as per EIA/TIA Standards) Cable Box of 305 Metre with star filler, in the installed MS raceways/ conduits.	Mtr.	159390	58.00	92,44,620.00
37	NS	Supply & Installation of 24 Port Patch panels CAT6A (1U with rear wire manager) 45°silver- plated IDCs (insulation displacement connection) for secure, reliable gas-tight connections	Nos	128	12,503.00	16,00,384.00
38	NS	Face Plate				
38.1		Supply of Face Plate 3" x 3" (dual with shutters)	Nos	1	142.00	142.00
38.2		Supply of Face Plate 3" x 3" (single with shutters)	Nos	1	138.00	138.00

39	NS	Supply & installation of CAT6A RJ45 I/O with a separator to eliminate crosstalk, on concealed wall mounted boxes, impacting of I/O's (CAT6 RJ45 I/O) & installation /impacting of surface mount boxes (includes labelling) Terminates 8 conductors at the same time reducing installation time 45° silver-plated IDCs provide secure, reliable gas-tight connections	Nos	1830	522.00	9,55,260.00
40	NS	Supply of Patch cords (2m) CAT6A (with molded boots) Over-molded boot at each end provide strain relief and maintains minimum bend radius of the cable. Assembled with RJ45 50µ" gold plated contacts according to IEC 603.7/class A.	Nos	1840	648.00	11,92,320.00
41	NS	Supply of Patch cords (1m) CAT6A (with molded boots)	Nos.	2312	580.00	13,40,960.00
42	NS	Supply & Installation/ Laying of Fiber Cable Multimode (06 core OM4) outdoor in Meters (Armoured) 50/125 µm – OM4 (supporting upto 300m) Tight buffered	Mtr.	8000	172.00	13,76,000.00
43	NS	Supply & Installation of 12 Port LIU (fiber optic interconnecting unit) Rack Mount 19" housing with front modules/ Couplers with blank adapter panel & Fully loaded with 24 Pigtails, Splice tray & Cable Management accessories	Nos.	30	20,413.00	6,12,390.00
44	NS	Supply & Installation of 48 Port LIU (fiber optic interconnecting unit) Rack Mount 19" housing with front modules/ Couplers with blank adapter panel & Fully loaded with 48 Pigtails, Splice tray & Cable Management accessories	Nos.	10	58,606.00	5,86,060.00
45	NS	Supply of Duplex Fiber optic patch cords Multimode (LC to SC) 3m - OM4 50/125 Factor SFP Connector SC - Standard Connector ("Shove & Click") SC stands for Subscriber Connector- a general purpose push/pull style connector developed by NTT	Nos.	140	2,219.00	3,10,660.00
		TOTAL FOR PASSIVE NETWORKING				1,72,18,934.00
		SUBHEAD 6 : NETWORK RACKS				
46	NS	Supply & Installaltion of Closed Network Rack 36U- with Side panel, Perforated Doors,	Nos.	5	45,266.00	2,26,330.00
46	NS	SUBHEAD 6 : NETWORK RACKS Supply & Installaltion of Closed Network Rack 36U- with Side panel, Perforated Doors, Dimensions should be minimum of 800mm	Nos.	5	45,266.00	2,26,330

		(W) x 800mm (D), All mounting /				
		cable management accessories & Castors)				
		Not exceeding 2200mm in height (For Server				
		room - Servers, Voice & IP Surveillance)				
		2 Nos. of 1U power distribution box, with 10 x				
		IEC - C13 sockets & with 32Amp MCB-				
		terminating on a IP56 power sockets - Vertical				
		in each rack				
		1 No. Horizontal PDU with 5/15Amp				
		Universal Sockets with 32Amp MCB				
		Grounding / Bonding kit 42U in each rack				
		Mounting Hardware (Pack of 10) x 10				
		Cantilever tray & Keyboard Tray				
		Stationary Shelf - full depth (2Nos.)				
47	NS	Supply & Installation of 9U (W 600mm / D	Nos	5	+ +	
7	115	600mm) Close rack 19" Floor mount ·	1105.	5	37 027 00	1 85 135 00
		AC Distribution Box + H/W (5 Points of 5/15			57,027.00	1,05,155.00
		AMP sockets - (Horizontal)				
		19" 111 Cable Manager PVC with duct fingers				
		v 5				
		Fan housing unit 4 Fan POSN				
		Fair flousing unit 4 Fair FOSIN				
		Castor Set Normal/Brake				
		Castor Set Normal/ Drake				
		Dar, Earthing 90 Mounting Handware (Deals of 10) = 5				
		Mounting Hardware (Pack of 10) x 5				
19	NC	Supply & Instalation of 15U (W 600mm / D	Noc	12		
40	IND	Supply & Instalation of 150 (W boomin / D	INUS.	15	0.062.00	1 17 810 00
		Eront Door \$12C_10" / 15U			9,003.00	1,17,019.00
		AC Distribution Dox + 11/W (5 Doints of 5/15				
		AC Distribution $B0x + H/W$ (5 Points of $3/15$				
		AMP Sockets - (Horizontal)				
		19 10 Cable Manager PVC with duct lingers				
		X J				
		Fan housing unit 4 Fan POSN				
		Fans 90 CFM 230 VAC				
		Mounting Hardware (Pack of 10) x 5				
10			NT	7		
49	NS	Supply & Installation of 2/U (W 600mm / D	Nos.	/	20.076.00	2 72 922 00
		650mm) Close rack 19 [°] Floor mount :			38,976.00	2,72,832.00
		Front Door S12C 19" / 24U				
		Rear Door S12C 19" / 24U				
		Side Panels S12C 24U / 800mmD				
		AC Mains Channel (10 Points of 5/15 AMP				
		sockets - (Vertical)				
		AC Distribution Box + H/W (5 Points of 5/15				
		AMP sockets - (Horizontal)			_ _	
		19" 1U Cable Manager PVC with duct fingers				
		x 5				
		Fan housing unit 4 Fan POSN				
		Fans 90 CFM 230 VAC				
	1	L Castor Set Normal/ Brake				

		Bar, Earthing 36U				
		Mounting Hardware (Pack of 10) x 5				
50	NS	Supply & Installaltion of Closed Network Rack 42U- with Side panel, Perforated Doors,	Nos.	8	2,859.00	22,872.00
		Dimensions should be minimum of 800mm				
		(W) x 1000mm (D), All mounting /				
		cable management accessories & Castors)				
		Not exceeding 2200mm in height (For Server				
		room - Servers, Voice & IP Surveillance)				
		2 Nos. of 1U power distribution box, with 10 x				
		IEC - C13 sockets & with 32Amp MCB-				
		terminating on a IP56 power sockets - Vertical				
		in each rack				
		1 No. Horizontal PDU with 5/15Amp				
		Universal Sockets with 32Amp MCB				
		Grounding / Bonding kit 42U in each rack				
		Mounting Hardware (Pack of 10) x 10				
		Cantilever tray & Keyboard Tray				
		Stationary Shelf - full depth (2Nos.)				
		TOTAL FOR NETWORK RACKS				8,24,988.00
		SUBIEAD 7 - ACTIVE NETWORKING				
		SUBHEAD / : ACTIVE NETWORKING				
		COMPONENTS				
51		Chassis Based Core Switch Min 10 Slot	Nos	1		
51		Chassis with dual management and fabric	1405.	1	37 62 000 00	37 62 000 00
		modules with dual power supplied and fully			37,02,000.00	57,02,000.00
		featured software with advanced IP routing SW				
		IPv4/IPv6. Should include 48 wire rate RJ-45				
		10/100/1000M Base-T ports enhanced network				
		interface card which supports advance L2, L3,				
		and ACL policies. Should also include 10				
		Gigabit network interface card offering 48				
		1/10G wire rate unpopulated SFP+ ports which				
		supports advance L2, L3, and ACL policies.				
52	NS	Supply of Distribution switch - 1RU 10GE L3	Nos.	2		
		with 48 10G SFP+ and 6 40G QSFP+ ports.			9,06,983.99	18,13,967.99
		QSFP+ ports operate as 40GE or 4x10GE.				
		with advance 1.2 features from Day 1 as				
		mentioned in the specifications Should come				
		with 40 Gigabit direct attached conner cable 1m				
		OSFP+.Distribution switch should be in HA				
		mode with dual uplinks, creating network				
		Agrregation with Edge switches.				
53	NS	Core switch - 1RU 10GE L3 with 48 10G	Nos.	2		
		SFP+ and 6 40G QSFP+ ports. QSFP+ ports			9,06,984.00	18,13,968.00
		operate as 40GE or 4x10GE. Should includes				
		RPS and country specific cords with advance				
		L3 teatures from Day I as mentioned in the				

54	NS	specifications. Should come with 40 Gigabit direct attached copper cable 1m, QSFP+. Core switch should be in HA mode with dual uplinks, creating network Aggregation with Edge switches. Edge switch: 48 RJ-45 PoE 10/100/1G BaseT, 2 fixed SFP+ (1/10G)+ 4 fixed SFP+ (1G/10G) uplink/stacking ports. 1RU size, 920W AC power supply. Includes country specific power cord, guides, 19" rack mount hardware and 10 Gigabit direct attached cable (DAC, uplink/stacking) 1m, SFP+	Nos.	34	1,81,260.00	61,62,840.00
55	NS	Supply of Edge switch: 24 RJ-45 10/100/1000 Base-T PoE+ ports, four of them provide 60 W, four fixed SFP+ (1G/10G) ports, USB, EMP, and two VFL/stacking ports. Includes a built-in co-processor for Enhanced network services. The bundle includes one 600-W AC PoE power supply. Includes country specific power cord, guides, 19" rack mount hardware and 10 Gigabit direct attached cable (DAC, uplink/stacking) 1m, SFP+	Nos.	17	1,40,220.00	23,83,740.00
56	NS	Edge Switch: 48 RJ-45 10/100/1G BaseT, 2 fixed SFP+ (1/10G)+ 4 fixed SFP+ (1G/10G) uplink/stacking ports. 1RU size, internal AC power supply. Includes a country specific power cord, guides, 19" rack mount hardware and 10 Gigabit direct attached cable (DAC, uplink/stacking) 1m, SFP+	Nos.	17	1,47,600.00	25,09,200.00
57	NS	Supply of Edge Switch: 24 RJ-45 10/100/1000 Base-T ports, four fixed SFP+ (1G/10G) ports,USB, and two VFL/stacking ports. The bundle includes one AC power supply. Includes a country specific power cord, guides, 19" rack mount hardware and 10 Gigabit direct attached cable (DAC, uplink/stacking) 1m, SFP+	Nos.	2	1,47,600.00	2,95,200.00
58	NS	Supply, Installation, Testing & Commissioning of Modules 10GBASE-SX SFP, MMF 220 & 550 meters, LC connector, Industrial Temp/ GPON SPF	Nos.	140	16,416.00	22,98,240.00
59	NS	Supply , Installation , Testing and commissioning of Wireless Controller with 200 AP licenses in HA mode	Nos.	2	5,99,040.00	11,98,080.00
60	NS	Dual radio 2x2, 4x4 802.11a/b/g/n/ac MU- MIMO AP, integrated antenna, 1x GbE, 1x	Nos.	235	27,000.00	63,45,000.00

		USB opt BLE), 1x 48V DC power interface, 1x Consolo with mounting Kit				
61	NS	Network Management System for managing both wired and wireless devices with upto 500 device license	Nos.	2	5,90,400.00	11,80,800.00
62	NC	Supply Installation Testing & Commissioning	Nec	2		
62	NS	Supply, Installation, Testing & Commissioning of Internet Web Security solution with minimum of 1000 users from day one with 3 years of subscription / support and flexibility to scale up to 10000 users, having 99.9% uptime with each level redundancy, single pane of glass for reporting and includes following featues as per detailed specification: a) Web Security b) Full SSL Inspection c) Next Generation Firewall d) Sandboxing e) Bandwidth Control f) Cloud Applications Visibility g) Mobility 6 x 10GE SFP+ slots, 34 x GE RJ45 ports (including 32 x ports, 2 x management/HA ports), SPU NP6 and CP9 hardware accelerated, 480GB SSD onboard storage, dual AC power supplies Unified (UTM) Protection (24x7 FortiCare plus Application Control, IPS, AV, Web Filtering and Antispam, Sandbox Cloud) Centralized log & analysis appliance - 2 x GE RJ45, 4TB storage, up to 100GB/Day of logs. The item includes 24x7 Maintenance Contract	Nos.	2	75,99,200.00	1,51,98,400.00
		TOTAL FOR ACTIVE NETWORKING				4,49,61,435.99
						, , ,
		SUBHEAD 8: Voice Solution				
(2)	NC					
03	INS	IPPBX for Corporate Building IP Communication Servers – 02 Nos. (On redundant mode with hot standby) as per the specifications in the RFP. Should include Rack Mountable Gateways with duplicated controls	Set	1	6822106	68,22,106.00
		IP Users: 868 Nos. with soft phone for all users				
		PRI: 04 Nos. DID- 10 nos				
		Desk phone Based Operator Console with 14 Key DSS: 02 Nos.				
		PC Based Operator Consoles with Busy lamp Field, Multi-Media Keyboard & associated IP Phones: 02 No. Inclusive of PC with latest configurations				
						-
		records with associated PC of latest configuration: 01 No.				
------	----	---	------	-----	-------------	-------------------------------
		DISA & Integrated Multi-Level Automated Attendant				
		28 Party Meet-Me Conferencing Bridges-01 Nos.				
		28 Party Blast Dial Conference Bridge-01 No.				
		Unlimited 3 Party Conference				
63.1		Basic IP Phones	Nos	800	5 000 00	40.00.000.00
63.2		IP Phones type 1	Neg	60	15 490 00	0.28.800.00
63.3		IP Phones type 2	INOS	00	15,480.00	9,28,800.00
		TOTAL FOR Voice Solution	Nos	8	24,110.00	1,92,880.00 1,19,43,786.00
		TOTAL for NETWORKING (SUBHEAD 5 TO 8)			-	7,49,49,143.99,
		MISCELLENEOUS ITEMS				
		SUBHEAD 9 : FIRE RATED DOOR				
64	NS	Server Room - supply and fixing of 2 hour fire rated Metal door for server room only,	Nos	1	59,506.00	59,506.00
		TOTAL FOR FIRE RATED DOOR				59,506.00
		SUBHEAD 10 : VESDA				
65	NS	SERVER ROOM (approximate area - 11.3x 10)				
65.1		Supply installation, testing & Commissioning of Early warning smoke detection system control Panel with Display, Single Zone, Power supply (To be supplied by the Panel Manufacturer) & all required accessories. The panel should have the capability to be integrated to the Intelligent Fire Alarm System.	Nos	1	2,63,330.00	2,63,330.00
65.2		Supply, installation, testing & Commissioning of Aspiration sampling nozzles / Sampling tubes/Hooter complete with required stickers & necessaries elbows & joints	Set	1	36,508.00	36,508.00
		TOTAL FOR VESDA				2,99,838.00
66	NS	SUBHEAD 11 : Kodent Kepellent SERVER ROOM (approximate area - 11.3x 10)				
66.1		Supply, Installation, testing & Commissioning of Master Console Capable of connecting to 12	Nos	1	21,622.00	21,622.00

	satellites complete as required and as per specifications.				
66.2	Supply Installation, testing & Commissioning of Satellite units complete as required and as per specifications.	Nos	5	1,506.00	7,530.00
66.3	Supply, installation, testing & Commissioning of Wire Bundles (2C x 1.5 sqmm armoured cable.	Mtrs	40	134.00	5,360.00
	TOTAL FOR RODENT REPELLENT				34,512.00
	SUBHEAD 12 : Water Leak Detection				
67	Supply, Installation, testing & Commissioning of Water leak Detection Panel/Hooter/Sensing cable	Lot	1	23,824.00	23,824.00
68	Supply, installation, testing & Commissioning of Wire Bundles (2C x 1.5 sqmm armoured cable.	Mtrs	40	134.00	5,360.00
	TOTAL for Water Leak Detection				29,184.00
	SUBLEAD 12 - CAS SUDDESSION				
	SUBIEAD 15 : GAS SUFF RESSION				
69	Supply, Installation, Tetsing & Commissioning of Clean Agent Storage Cylinder, high pressure seamless carbon steel cylinder, Test Pressure 334/ 250 Bar, working pressure 200/150 Bar and dia. 356/232 mm, 110Ltrs.	Nos.	2	168354	336708
70	Supply, Installation, Testing & Commissioning of Valve Assembly (Brass), safety burst disc and a safety cap. Inlet & amp; outlet port for actuation hose connection for operation during multi cylinder system to operate the inline master and slave cylinders.	Nos.	2	148130	296260
71	Supply, Installation,Testing & Commissioning of Pressure Gauge cum Switch for monitoring the cylinder pressure.	Nos.	2	22978	45956
72	Supply, Installation, Testing & Commissioning of HFC 227ea Gas (1,1,1,2,3,3,3 Hepta fluro propane), Zero ODP, Stored Pressure 25BAR.	Kgs	104	6607	687128
73	Supply, Installation, Testing & Commissioning of Electric Control Head (Solenoid actuator) used for releasing the GAS, Electrically operated, Voltage range 24VDC, Ambiente Temperature 55 Deg. C, Protection class IP65. Mounted over the cylinder valve.	Nos.	1	113401	113401

I					
74	Supply, Installation, Testing & Commissioning of Manual (Mechanically Operated) Control Head (Brass) to operate the system pulling the mechanical lever with help of S.S. wire & amp; Manual Pull station. Mounted over the Solenoid actuator	Nos.	1	16836	16836
75	Supply, Installation,Testing & Commissioning of Manual Activation Mechanical box	Nos.	1	11754	11754
76	Supply, Installation,Testing & Commissioning of Pneumatic Actuator.	Nos.	2	26154	52308
77	Supply, Installation,Testing & Commissioning of Discharge Nozzles are designed to provide the proper flow rate and distribution of FM- 200 to total flood a hazard area : 180 deg. / 360 deg.	Nos.	6	9731	58386
78	Supply, Installation,Testing & Commissioning of Master Cylinder Adapter Kit	Nos.	1	26154	26154
79	Supply, Installation, Testing & Commissioning of Manifold Check Valve installed at the discharge manifold to allow removal of any FM-200 cylinder from the manifold while still retaining a closed system.	Nos.	3	52413	157239
80	Supply, Installation,Testing & Commissioning of Discharge Pressure Switch	Nos.	1	21759	21759
81	Supply, Installation, Testing & Commissioning of Flexible discharge Hose	Nos.	1	34465	34465
82	Supply, Installation,Testing & Commissioning of Flexible Actuation Hose	Nos	1	8206	8206
83	Supply, Installation,Testing & Commissioning of M.S. Container strap	Nos.	2	1621	3242
84	Supply, Installation, Testing & Commissioning of Brass Elbow	Nos.	1	1621	1621
85	Supply, Installation, Testing & Commissioning of Gas Release Panel with battery & battery charger	Nos.	1	45001	45001
86	Supply, Installation,Testing & Commissioning of Manual Release Switch	Nos.	1	2298	2298
87	Supply, Installation, Testing & Commissioning	Nos.	1	2298	2298

		of Manual Abort Switch				
88		Supply, Installation, Testing & Commissioning of Warning Sign Board.	Nos.	1	1684	1684
89		Supply, Installation, Testing & Commissioning of Detectors	Nos.	10	2298	22980
90		Supply, Installation, Testing & Commissioning of 1.5sqmm 2 Core Cable	Mtr.	60	218	13080
91		Supply, Installation, Testing & Commissioning of Piping, fittings & supports, etc.Pipe (S) : M.S. Seamless To ASTM A-106, SCH. 40	Lot	1	67024	67024
92		Supply, Installation,Testing & Commissioning of Manifold fabricated from seamless pipe Pipe (S) : M.S. Seamless To ASTM A-106, SCH. 80	Nos.	1	15142	15142
		TOTAL for GAS SUPPRESSION				2040930
		TOTAL for MISC. (SUBHEAD 9 TO 13)				24,63,970.00
		AUDIO VISUAL SYSTEM				
		SUBHEAD 14 : WEB CONFERENCING & LECTURE HALL EQUIPMENT				
69	NS	CAMERA				
69.1		SITC of super-low-light 2M pixel sensor for clear and natural imaging in low-light conditions Resolution: (16:9) 1920 x 1080, 1600 x 900, 1280 x 720, 960 x 540, 848 x 480, 800 x 448, 640 x 360, 424 x 240, 320 x 180; (4:3) 800 x 600, 640 x 480, 480 x 360, 320 x 240 at 60, 30, 15fps SmartFrame for automatic FOV adjustment to fit all participants True WDR up to 120dB: Superb backlight compensation technology for optimizing light balance in high-contrast conditions Zoom: 18X total zoom (12X optical zoom) Wide field of view (DFOV): 82° Lens focal length: 3.9 mm (wide) ~ 47.3 mm (tele) Lens F#: 1.8 (wide) ~ 2.8 (tele) Mirror, Flip, AE, white balance: aut o, manual override via PTZApp Minimum focus distance: 1.5 m Standard tripod screw holes and Kensington	NO.	8	14,000.00	1,12,000.00

		slot Motorized Pan & Tilt Movement Pan: ±170° Tilt: +90° (up) -30° (down) 10 camera presets (through remote control) Fast and quiet pan & tilt movement Video Format YUV, MJPEG, H.264 Network video compression format: H.264 Network protocols: RTSP, RTMP Audio Format				
		AAC-LC Network protocol: RTSP, RTMP LAN				
		10/100/1000 1005				
70	NS	SPEAKER PHONE				
70.1		SITC of Full duplex microphone array with echo cancellation Advanced noise suppression Dual-microphone array	NOS.	8	27,600.00	2,20,800.00
		3.5 mm phone-in jack				
		Speaker: 6W Adjustable to 90dB SPL at 0.5 m				
		Microphone frequency response: 120Hz-				
		16kHz				
		Microphone sensitivity: -34 ± 2 dBV @1KHz, 94dBSPI				
		Microphone distortion: < 1% from 150Hz				
		Microphone support range: Diameter 6M				
		Touch controls for volume down/up, mute,				
		phone input, call, and hang-up				
		Bridge phone-in and USB into one call Security: Kensington slot				
71		WEB CAM WITH IN BUILT				
		MICROPHONE				
		Camera				
71.1		SITC of Web Cam with sensor: 1/2.5"Sony Exmor 4K CMOS sensor Frame rate: 4K 30fps; 1080p , 720p , 960x540, 848x480 800x448 640x480 640x360	nos.	2	38,200.00	76,400.00
		424x240, 320x240, 320x180 at up to 60fps				
		120° Wide field of view				
		Lens iris, focus, zoom: fixed				
		AE, white balance: auto, manual override by				
		Minimum working distance: 80cm				
		Back light compensation and 2D noise				
		reduction technology for optimizing light				
		balance in different conditions				
		Standard tripod screw holes				
		Zoom, Pan, and 111 Movement			1	

	Zoom: up to 4X leveraging 4K sensor (not				
	available in 4K or 60fps)				
	Pan and tilt: when zoomed in leveraging 4K				
	sansor				
	Microphone				
	1 uni directional microphones				
	1 uni-directional microphones				
	Frequency response: 100~12K Hz				
	Sensitivity: -3/dB				
	LECTURE ROOM				
72	DIGITAL LECTURE	nos.	2		
				2,26,000.00	4,52,000.00
	INTERACTIVE DIGITAL PODIUM made of				
	COLD ROLLED STEEL (PAINT				
	COATED) with 21.5" finger touch monitor.				
	Touch Button Source Switching & Control and				
	Power Built-in 2x2 HDMI Switching Matrix				
	Supports Deskton/Lanton $(AK/2K)$ Supports 2				
	Channel Audio Input & 2 Channel Mic Input 1				
	Audio Output Droigstor Switch Or Off				
	Audio Output Projector Switch Oil/Oil.				
	Supports Projector Power Switch Delay while				
	Switching Off Projector Built-in Infrared				
	Learning Function. I independent				
	programmable RS232 Control Interface and 1				
	infrared control interface. One built-in electric				
	screen power control, one 220V power socket.				
	Supports connection of IC Card Reader				
	System. 21.5" TFT LCD Monitor. 16:9 Aspect				
	Ratio. 1920 x 1080 (Resolution). 200				
	Brightness: cd/m2. Contrast Ratio:1000:1.				
	Colour: 16.7million Surface Treatment:				
	Tempered Glass AG Touch Solution: Finger				
	Touch & wireless pen Digital Resolution:				
	2000 ppi Prossura Laval: 2048 Laval Dan				
	Z000+ ppi Hessure Level. 2048 Level. Ten				
	Cartification: Dalls CCC Microphane (50)				
	Certification: ROHS, CCC, Microphone (50+				
	cm long), Double soft metal pole mic				
	Frequency response: 100 HZ to 15 KHZ,				
	Cardoid Directed Output Impedence: 600				
	OHMs, Sensitivity: -36 db Voice Assistance:				
	20-50 cm, Power: DC 12V/1A, Four channel				
	80HMs Stereo, 120W x 4, Durable Speakers				
	Set. 30W x 2. Volume and Level Controls.				
	Switch for Mono/Stereo. RCA/EP Inputs. A3				
	Visualizer. 8MP/1080P @ 30FPS.				
	HDMI/VGA Output. 11 LED Lights				
	Autofocus, Supports Direct Interactivity Live				
	Video Recording PC Less Operation Supports				
	Un to 32GR SD Card ID Domoto Built in				
	Mia				
L			I	L	1

73	NS	PROJECTOR	nos.	2		
					1,08,000.00	2,16,000.00
		Projection Technology-3LCD Technology				
		LCD: 0.76 inch with C2 Fine				
		Video Output:				
		4K enhancement				
		Lightsource:				
		Laser				
		Brightness				
		Colour Light Output :				
		7,000 Lumen- 4,900 Lumen (economy) in				
		accordance with IDMS15.4				
		$7000\mathrm{lm}$				
		White Light Output:				
		7 000 Lumen - 4 900 Lumen (economy) in				
		accordance with ISO 21118:2012				
		Connectivity				
		USB 2.0 Type B (Service Only), RS-232C.				
		Wired Network, Wireless Network (2x), VGA				
		in, VGA out, DVI in, HDMI in, BNC in,				
		HDBaseT, Stereo mini jack audio out, Stereo				
		mini jack audio in (3x), HDMI (HDCP 2.2),				
		Wireless LAN IEEE 802.11b/g/n (WiFi 4)				
		(optional)				
		Contrast Ratio:				
		Contrast Ratio:				
		Over 2,500,000 : 1				
		Projection Lens				
		Focal Length:				
		24 mm - 38.2 mm				
		\mathbf{F} -number:				
		1.7 - 2.5				
		Motorized - Vertical $+ 67 \%$ horizontal $+ 30 \%$				
		Screen Size:				
		50 inches - 1 000 inches				
		Zoom:				
		Motorized, Factor: 1 - 1.6				
		Screen Size (Projected Distance):				
		Zoom : Wide:				
		1.5 m - 31.6 m (50 inch screen)				
		Zoom : Tele:				
		2.5 m - 50.4 m (50 inch screen)				
74	NS	MOTORISED SCREEN	nos	2		
/ 4	110	HOIORIGED BOREEN	1103.	2	55,000.00	1,10,000.00
		Sizes: 200" diagonal				
		• Installation Options: Floating Wall Mount /				
		Ceiling Mount / Suspended Mount,				
		Control Options: IR / RF / RS485 + Dry				
		Contact Control / 3-12 Voltage Trigger Control				

	 / Central Control Tension Adjustment Mechanism Colour: White Aluminum Casing TOTAL for WEB CONFERENCING & LECTURE HALL EQUIPMENT SUBHEAD 15 : DISPLAYS 				11,87,200.00
75 NS	Supply, Installation, Testing and Commissioning of 4K LED Display which shall have Screen Size of 42 inches or more. It shall have an aspect ratio of 16:9, 4:3 or better. It shall have native resolution of 3840X2160 or more. It shall have brightness of 400cd/m2 or more. It shall be with static contrast ratio of 1200:1 or more. It shall have viewing angle of 178X178 or more. It shall have yiewing angle of 178X178 or more. It shall have 3 or more HDMI 2.0 Input, 1 or more USB Port or better. It shall have optical Audio Out. It shall have Speaker output of 10W+10W or better. It shall have RS-232 control port. It shall have RJ-45 port. It shall support Time Scheduler, RJP Mode, One Channel Map and Embedded Content Manager. It shall support Functions like USB Cloning, IR Out, Multi IR Cloning. It shall have CI Slot interface. It shall have RF Port, Debug Port and Optical Audio Out Port. It shall have Web browser, soft app, Wi-Fi (ac), Bluetooth audio playback. It shall have a Dynamic CR of Ten Lakh to One or better. It shall have min/max Energy Conservation of Sixty Eight/Thirty Three or better. It shall have a typical Power consumption of 93 Watts or less. It shall be supplied with Remote controller, Power cord as included accessories. It shall be supplied with 5 meters HDMI Type A to Type A which shall support resolutions of up to 3820x2160@60 Hz or better. It shall have Gold Plated Contacts for Signal Integrity. It shall have an insulation resistance of 100 ohms or better. It shall have a Dielectric Strength of 500V/minute or better. It shall be HDMI 2.0 or better. It shall have a Dielectric Strength of 500V/minute or better. It shall be HDMI 2.0 or better. It shall have up to 1536 KHz or better Audio Sample Frequency for highest audio fidelity. It shall be highly resistant with RF and EMI interference. It shall work without the use of External Power Supplies. 400 or +/- 50 nits. OEM MAF required.	Nos.	2	38,560.00	77,120.00

76	NS	Supply, Installation, Testing and commissioning of LED display which shall	Nos.	8	61,300.00	4,90,400.00
		have Screen Size of 55 inches or more. It shall				
		have an aspect ratio of 16:9, 4:3 or better. It				
		shall have native resolution of 3840X2160 or				
		more. It shall have brightness of 500cd/m2 or				
		more. It shall be with static contrast ratio of				
		1300:1 or more. It shall have viewing angle of				
		178X178 or more. It shall have 3 or more				
		HDMI 2.0 Input, 1 or more USB Port or better.				
		It shall have optical Audio Out. It shall have				
		Speaker output of 10W+10W or better. It shall				
		have RS-232 control port. It shall have RJ-45				
		port. It shall support Time Scheduler, RJP				
		Mode, One Channel Map and Embedded				
		Content Manager. It shall support Functions				
		like USB Cloning, IR Out, Multi IR Cloning. It				
		shall have CI Slot interface. It shall have RF				
		Port, Debug Port and Optical Audio Out Port.				
		It shall have Web browser, soft app, Wi-Fi (
		ac), Bluetooth audio playback. It shall support				
		mobile connection overlay. It shall have a				
		Dynamic CR of Ten Lakh to One or better. It				
		shall have min/max Energy Conservation of				
		Eighty Eight/Thirty Five or better. It shall have				
		a typical Power consumption of 125 Watts or				
		less. It shall be supplied with Remote				
		controller, Power cord as included accessories.				
		It shall be supplied with 10 meters HDMI				
		Active Optical Cable Type A to Type A which				
		shall support data rate of up to 18.2 Gbps. It				
		shall support resolutions of up to				
		3820x2160@60 Hz or better. It shall have a				
		Power Consumption of 250mV or better. It				
		shall support lossless signal transmission up to				
		100 meters or better. It shall be HDMI 2.0 or				
		better. It shall support HDCP 2.2 or better. It				
		shall have an outer cable diameter of 4mm or				
		less. It shall be highly resistant with RF and				
		EMI interference. It shall work without the use				
		of External Power Supplies. 400 or +/- 50 nits				
		. OEM MAF required.				

77	NS	Supply, Installation, Testing and	Nos.	6	1 22 800 00	7 36 800 00
		shall have Screen Size of 65 inches or more. It			1,22,800.00	7,30,800.00
		shall have an aspect ratio of 16:0 4:3 or better				
		It shall have native resolution of 3840X2160 or				
		more. It shall have brightness of 350cd/m2 or				
		more. It shall be with static contrast ratio of				
		1300:1 or more. It shall have viewing angle of				
		178X178 or more. It shall have 3 or more				
		HDML 2.0 Input 1 or more USB Port or better				
		It shall have ontical Audio Out. It shall have				
		Speaker output of $10W\pm10W$ or better. It shall				
		have RS-232 control port. It shall have RI-45				
		nort It shall support Time Scheduler RIP				
		Mode One Channel Map and Embedded				
		Content Manager It shall support Functions				
		like USB Cloning, IR Out, Multi IR Cloning, It				
		shall have CI Slot interface. It shall have RF				
		Port, Debug Port and Optical Audio Out Port.				
		It shall have Web browser, soft app, Wi-Fi (
		ac), Bluetooth audio playback. It shall support				
		mobile connection overlay. It shall have a				
		Dynamic CR of Ten Lakh to One or better. It				
		shall have a typical Power consumption of 179				
		Watts or less. It shall be supplied with Remote				
		controller, Power cord as included accessories.				
		It shall be supplied with 10 meters HDMI				
		Active Optical Cable Type A to Type A which				
		shall support data rate of up to 18.2 Gbps. It				
		shall support resolutions of up to				
		3820x2160@60 Hz or better. It shall have a				
		Power Consumption of 250mV or better. It				
		shall support lossless signal transmission up to				
		100 meters or better. It shall be HDMI 2.0 or				
		better. It shall support HDCP 2.2 or better. It				
		shall have an outer cable diameter of 4mm or				
		less. It shall be highly resistant with RF and				
		EMI interference. It shall work without the use				
		of External Power Supplies 400 or +/- 50 nits.				
		OEM MAF Required.				

78 NS	Supply, Installation, Testing and Commissioning of 4K LED Display which shall have Screen Size of 75 inches or more. It shall have an aspect ratio of 16:9, 4:3 or better. It shall have native resolution of 3840X2160 or more. It shall have brightness of 350cd/m2 or more. It shall have brightness of 350cd/m2 or more. It shall be with static contrast ratio of 1300:1 or more. It shall have viewing angle of 178X178 or more. It shall have 3 or more HDMI 2.0 Input, 1 or more USB Port or better. It shall have optical Audio Out. It shall have Speaker output of 10W+10W or better. It shall have RS-232 control port. It shall have RJ-45 port. It shall have response time of 9ms or better. It shall support Time Scheduler, RJP Mode, One Channel Map and Embedded Content Manager. It shall support Functions like USB Cloning, IR Out, Multi IR Cloning. It shall have CI Slot interface. It shall have RF Port, Debug Port and Optical Audio Out Port. It shall have Web browser, soft app, Wi-Fi (ac), Bluetooth audio playback. It shall support mobile connection overlay. It shall have a Dynamic CR of Ten Lakh to One or better. It shall have min/max Energy Conservation of Sixty Eight/Thirty Three or better. It shall have a typical Power consumption of 179 Watts or less. It shall be supplied with Remote controller, Power cord as included accessories. It shall be supplied with 10 meters HDMI Active Optical Cable Type A to Type A which shall support data rate of up to 18.2 Gbps. It shall support lossless signal transmission up to 100 meters or better. It shall have a Power Consumption of 250mV or better. It shall support lossless signal transmission up to 100 meters or better. It shall be HDMI 2.0 or better. It shall support HDCP 2.2 or better. It shall have an outer cable diameter of 4mm or	Nos.	1	1,76,250.00	1,76,250.00
	100 meters or better. It shall be HDMI 2.0 or better. It shall support HDCP 2.2 or better. It shall have an outer cable diameter of 4mm or less. It shall be highly resistant with RF and EMI interference. It shall work without the use of External Power Supplies 400 or +/- 50 nits. OEM MAF required.				

79	NS	Supply, Installation, Testing and commissioning of LED display which shall have Screen Size of 98 inches or more. It shall have IPS Panel Technology or better. It shall have iPS Panel Technology or better. It shall have an aspect ratio of 16:9. It shall have native resolution of 3840X2160 or more. It shall have brightness of 350cd/m2 or more. It shall have brightness of 1300:1 or more. It shall have viewing angle of 178X178 or more. It shall have 3 HDMI Input, 1 or more Display Port, 1 or More DVI-D, Audio input Port or better. It shall have at least 1 Video output in the form of HDMI or DVI-D or Display Port. It shall have at least 1 Audio Output Port as well as external speaker out. It shall have RS-232 input as well as output port. It shall have RS-45 port and IR receiver. It shall support Portrait and Landscape Orientation. It shall have 14.9mm or lesser even bezel. It shall have a typical Power consumption of 318 Watts or less. It shall have 24*7 usage capability. It shall be IEC / EN / UL Sixty Thousand Nine Hundred Fifty happen one certified for safety. It shall have real time monitoring and control and multi screen mode upto 4 screens along with PIP with both main screen and sub screen at the same time. It shall be supplied with Remote controller, Power cord, IR/Light sensor receiver, CD (Manual), RS232C as an included accessory. It shall be FCC Class A certified, it shall be CE and KC certified for EMC. It shall be supplied with 10 meters HDMI Active Optical Cable Type A to Type A which shall support lossless signal transmission up to 100 meters or better. It shall have a static bend radius of 40mm or better. It shall have a static bend radius of 40mm or better. It shall have a static bend radius of 40mm or better. It shall have a static bend radius of 40mm or better. It shall have a nouter cable diameter of 4mm or less. It shall be highly resistant with RF and EMI i	Nos.	1	7,72,200.00	7,72,200.00
		TOTAL for DISPLAYS				22,52,770.00

1	1	I	1	I	1 1	
		SUBHEAD 16 · AUDIO				
80	NS	Supply, Installation, testing and commissioning of 2-way wall mount loudspeaker, 100V tapping : 40watt-20watt-10watt, LF driver : 5", HF driver : 1", IP rating : 40, Max SPL : 104dB, dispersion (HXV) : 110° X 110°, frequency response : 70 Hz - 18 kHz, frequency range : 55 Hz - 20 kHz, Crossover Frequency : 2.5 kHz etc complete required as per specifications	Nos.	12	16,051.00	1,92,612.00
81	NS	Supply, Installation, testing and commissioning of digital channel power amplifier,4 x 50watt @ 8 Ω Stereo, Technology : class-D, built in conventionally cooling, Protection : DC Short circuit; Over heating; Over load; Signal limiting, switching mode power supply, input Sensitivity (1W/1m) : 0 dB (1V RMS), Crosstalk (@ 1 kHz) : > 70 dB, THD+N (@ 1 kHz) : < 0.1%, Signal / Noise : > 90 dB, Energy star rated, Inputs Sensitivity : 0 dB (1V RMS), Input Impedance : 12 k Ω balanced, etc complete required as per specifications.	Nos.	1	82200	82,200.00
82	NS	Supply, Installation, testing and commissioning of 2-way wall mount loudspeaker, 100V tapping : 50watt-50watt-12.5watt, MF / LF Woofer : 6" or more, Dome tweeter : 1" or omre, Max SPL : 106dB, dispersion (HXV) : 120° X 120°, frequency response : 70 Hz - 18 kHz, frequency range : 55 Hz - 20 kHz, low impedance RMS power : 50watt @ 16ohm etc complete required as per specifications	Nos.	6	22936	1,37,616.00
83	NS	Supply, Installation, testing and commissioning of Professional Media Player with CD Player, MP3 Player and AM/FM RDS Tuner in single rack with front panel LCD screen display with CD Slot, USB Slot & SD/MMC card Slot. Individual output of CD MP3 Player & FM Tuner; Unbalanced outputs etc complete required as per specifications	Nos.	5	66,540.00	3,32,700.00
84	NS	Supply, Installation, testing and commissioning of 2-way wall mount loudspeaker, 100V tapping : 24watt-12watt-6watt, LF driver : 4", HF driver : 1", Max SPL : 100dB, dispersion (H X V): 130° X 130°, frequency response : 100 Hz - 20 kHz, frequency range : 65 Hz - 20 kHz, low impedance power : 35watt @ 8 Ω etc complete required as per specifications	Nos.	8	14026	1,12,208.00
85	NS	Supply, Installation, testing and commissioning of dual channel power amplifier, 2 X 240watt @ 100V, Technology : class-D, built in temperature controlled fan, Protection : DC Short circuit; Over heating; Over load; Signal	Nos.	4	128912	5,15,648.00

86	NS	limiting, switching mode power supply, buil in Advanced protection circuit, High-pass filter switch, THD+N (@ 1 kHz) : < 0.3%, Frequency Response : 50 Hz - 22 kHz, Crosstalk (@ 1 kHz) : < 80 dB, Input Impedance : 10 k Ω balanced etc complete required as per specifications Supply, Installation, testing and commissioning	Nos.	16	25480	
		of Commercial Self-powered Soundbar Power Output @ 60W built in Class D amplifier; 2 X LF Driver 2.25" & 2 X HF Driver 1.5"; Built in Presets for application; IR Remote Control; Built in Bluetooth; Input port: RCA, HDMI, SPDIF (optical and coaxial); Mounting Bracket included etc complete required as per specifications				4,07,680.00
87	NS	Supply, Installation, testing and commissioning of single power amplifier, RMS power : 240watt @ 100V & 40hm both, THD+N : < 1%, Signal / Noise : > 90 dB, Inputs Sensitivity : -12, Input Impedance : 10 k Ω balanced, Technology : class-A/B, built in Dual speed controlled FAN, Protection : DC Short circuit; Over heating; Over load; Signal limiting etc complete required as per specifications	Nos.	1	105422	1,05,422.00
88	NS	Supply, Installation, testing and commissioning of Compact Powered Bass Reflex Cabinet 1 X 8" Ferrite with 2.4" Voice Coil, Max Power Output 200W @ 8 Ohms; Class D Topology; Built-in Loudspeaker Presets; Frequency Range 45Hz - 350Hz; Senstivity 83 dB & Max SPL 108 dB; Amp output : 2 X 150W @ 4 Ohms or 2 X 75W @ 8 Ohms ; Aluminium Housing with ABS etc complete required as per specifications	Nos.	2	176702	3,53,404.00
89	NS	Supply, Installation, testing and commissioning of 2-way wall speaker, LF : 8", HF : 1", frequency crossover : 2.4 kHz, frequency range : 50 Hz - 20 kHz, 70watt @ 16 Ω , frequency response : 60 Hz - 17 kHz, 100V power tap : 60watt - 30watt, dispersion (H X V) : 110° X 110° etc complete required as per specifications	Nos.	9	35490	3,19,410.00
90	NS	Supply, Installation, testing and commissioning of 2-way 5 1/4" ceiling speaker with thin grill, frequency crossover : 2.5 kHz, frequency range : 45 Hz - 20 kHz, 30watt @ 8 Ω , frequency response : 60 Hz - 18 kHz, 100V power tap : 24watt-12watt, Conical dispersion : 145°, speaker type : coaxial, Sensitivity (1W/1m) : 87dB etc complete required as per specifications	Nos.	4	14166	56,664.00

91	NS	Supply, Installation, Tetsing & Commissoning of Digital Audio Conference Control Unit for conference system controls Miniumum 300 discussion units, can be use power supply no central units interconnectivity, Redundant closed loop cabling, built in USB Audio Recorder . An Ethernet Port shall be provided for network connection and control units, Integrated / external PC with 22 inch Full HD LED monitor, pre-installed control software for Microphone management, synoptic and Audio Recording, per channel / microphone recording should be software feature, capable to monitor and mange all the conference units, Graphical user menu in 13 languages, Electronically balanced XLR In and Ouput, Total harmonic distortion : < 0,01%, Signal- to-noise ratio : > 80 dB, per channel /	Nos.	5	4,84,380.00	24,21,900.00
		in software etc complete required as per specifications and compatible with related microphone with all accessories				
92	NS	Supply, Installation, Tetsing & Commissoning of Table Top Digital Chairman Unit with Supercardiod / Array technology Microphone and built in DSP limiter or better, Dual / Twin Loudspeaker for better sound reinforcement, Microphone on/off button with lighting indication, Priority switch for temporary muting delegates, RJ-45/CAT5/CAT6 daisy chain connectivity, total harmonic distortion : 003%, Gooseneck length should not more than 16inch etc complete as per specification and include all required componets / accessories for microphone smooth connectivity and workability.	Nos.	6	80,865.00	4,85,190.00
93	NS	Supply, Installation, Tetsing & Commissoning of Table Top Digital Delegate Unit with Supercardiod / Array technology Microphone and built in DSP limiter or better, Dual / Twin Loudspeaker for better sound reinforcement, Microphone on/off button with lighting indication, RJ-45/CAT5/CAT6 daisy chain connectivity, total harmonic distortion : 003%, Gooseneck length should not more than 16inch etc complete as per specification and include all required componets / accessories for microphone smooth connectivity and workability.	Nos.	78	74,385.00	58,02,030.00
94	NS	SITC of Additional power swithing device for Chairman Unit and Delegate Units	Nos.	3	55,000.00	1,65,000.00
95	NS	SITC of Server Software, Participant Database , Identification at seat License for above	Nos.	2	2,00,000.00	4,00,000.00

		cobferencing system				
96	NS	SITC of Powering Cables for above Conferencing System	Lot	3	2,00,000.00	6,00,000.00
97	NS	SITC of PC for conferencing software	Nos.	3	1,00,000.00	3,00,000.00
98	NS	Supply, Installation, testing and commissioning of wireless handheld / lapel / headworn microphone charging dock station from the same make, simultaneously charger 2 microphone, lighting indication etc complete required as per specifications	Nos.	22	22,815.00	5,01,930.00
99	NS	Supply, Installation, testing and commissioning of wireless digital Handheld Microphone with 18 or more channel, RF output 100mW or more, super cardiod pickup pattern, Frequency range : 1880 to 1930 MHz, Connectivity : RJ- 45, Battery backup : 10 or more hr etc and complete as required.	Nos.	15	1,39,000.00	20,85,000.00
100	NS	SITC of Wireless Lapel Mic-Supply of Wireless Lapel Mic with Cardiod polar pattern for transmitter , Receiver & Transmitter frequency response 100Hz-18kHz or better, Receiver RF sensitivity < 1.0 μ V,Receiver Image rejection>55dB,Receiver Dyanmic range >95dB and receiver having 32 channels possible, Receiver S/N ratio >100dB A, distortion <1 %, Transmitter sensitivity - 5.6 mV/PA, modulation:+/-40kHz.	Nos.	5	1,48,000.00	7,40,000.00
101	NS	 SITC of Wireless Presenter The Wireless presentation device allows users with laptops or mobile to connect and present. The Wireless Presenter should have 1 HDMI or 1 Mini DP/VGA output, and 1 HDMI input The Wireless Presenter should present minimum 1 users' laptops or handheld devices The Wireless Presenter Should be able to share uninterrupted HD video with minimum 30 fps The Wireless Presenter should have feature to put random or defined passcode to validate user authentication 1 x USB 2.0, 1 x RJ45 GB Ethernet. It should have RS232 and IR port for control and support CEC 	Nos.	4	1,95,000.00	7,80,000.00

102	NS	SITC of 4 Channels video Recording/Mixing/ Switching and Streaming up to 3 destinations simultaneously. Able to record full motion video with flexible scaling and switching up to 16 videos*(4HDMI and 12 IP camera). 4HDMI inputs and 4 no. 3.5mm Audio inputs and IP camera,NDI HX camera,RTSP source (H.264@1080P 60/30 fps). Video comperession H.264/AVC 4:2:0 8bit colour,Bit rate 200kbps to 10mbps. Scaled resolution 720p,1080p. Recording file type H.264and AAC in an MP4 container,JPEG. Built in digital audio de-embedded from HDMI. Streaming Protocal Pull:RTSP, Push:RTMP /RTMPS ,TCP,UDP,HTTP,HDCP Client SITC of Full HD 1080p Broadcast PTZ Camea with min 20X Optical Zoom, min 100 Presets, 60 Frames per Second, Ethernet Out, HDMI Out, 3G SDI Out, Audio In Mic/line, RS232/422/Ethernet Controls, -170° ~ +170° Panning angle, -30° ~ +90° Tilting angle, should support PoE+.	Nos	2	2,60,000.00	5,20,000.00
103	NS	Supply, Installation, testing and commissioning of ceiling microphone tile, standard size : 2ft X 2ft, built in indication : 27 or more, lighting indication : 3 corner or more, area of coverage : 50sqmtr, redundant dante connectivity, built in Dante, should not be propreitary connectivity (Required on Open Platform), Max SPL : 104 dB, Dynamic range : 93 dB(A), UL62368 certification (Including UL2043 testing and compliance) etc complete required as per specifications	Nos.	6	4,95,646.00	29,73,876.00
104	NS	Supply, Installation, testing and commissioning of digital signal processor, 6 Input with AEC, 6 output, Dante connectivity, USB connectivity, Connectors : RJ45 with PoE capability (Cat 5/6), RJ45 with Dante connectivity, DC Jack, 40-bit floating point, Sampling rate : 48kHz, Dual-core processing etc complete required as per specification	Nos.	13	277709	36,10,217.00
		Total for Audio			-	2,40,00,707.00
		SUDIEAD 17 . United Commission				
		Video Conferencing				
105	NS	HD Video communication desktop system, 23" 16:9 screen with multi touch capacitive touch screen, in-built high quality audio system, whiteboard and annotation feature, bandwidth upto 3 Mbps point to point, video standards H.263, H.264	Nos.	11	3,36,000.00	36,96,000.00

		(With Three Year OEM Warranty)				
		AI powered video conferencing system,				
		integrated system with in-built microphone and				
		speakers and 4K ultra HD camera, automatic				
		noise suppression, wireless content sharing.				
		includes touch panel for easy operation.				
		bandwidth upto 6 Mbps point to point.				
		H.460.19 fire wall traversal, video standard				
		H.264, 4 Way embedded multi site				
106	NS	Supply, installation, Testing and	Nos.	6		
		commissioning of VC System with automatic		-	4.53.600.00	27.21.600.00
		group framing and touch panel and multiparty			.,,	_,,_,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
		s/w				
		5, **				
		(With Three Year OEM Warranty)				
107	NS	Supply, installation, Testing and	Nos.	7		
		commissioning of VC System with automatic			7,92,120.00	55,44,840.00
		voice tracking and touch panel along with two				
		additional table top mics and multiparty s/w				
		The second se				
		(With Three Year OEM Warranty)				
108	NS	Video Conferencing system comprising of	Nos.	2		
		codec and quad camera bar with integrated			11,59,200.00	23,18,400.00
		speakers and microphones, camera technology			, ,	, ,
		with speaker tracking and auto framing				
		capability, includes touch panel for easy				
		operation, bandwidth upto 6 Mbps point to				
		point, video standard H.265, 2 x HDMI				
		outputs. Audio automatic Noise control and				
		automatic gain control, option to connect three				
		microphones, speaker tracking with 6 element				
		microphone array, 4 way embedded multisite.				
		(With Three Year OEM Warranty)				
109	NS	Ultra High Definition Video Conferencing	Nos.	2		
		system, dual PTZ camera, rack mountable			8,19,000.00	16,38,000.00
		codec, wireless content sharing, touch panel for			· ·	
		control, embedded multi site upto 5				
		participants, 6 simultaneous video inputs. upto				
		16 Mbps multi site bandwidth, option to				
		connect upto 8 microphones. H.265 video				
		standard, 3 x HDMI outputs, Audio AGC &				
		ANR, Speaker tracking thru quad camera, dual				
		stream.				
		(With Three Year OEM Warranty)				
		• • • • • • • • • • • • • • • • • • •				
		Total for Unified Communication / Video				
		Conferencing				1,59,18,840.00

1						
		SUBHEAD 18 : Audio Visual Management				
		System				
110	NS	8x1 4KDCI 4:4:4 Multiform at presentation switcher and control system (either built-in or additional hardware) from the same OEM. It should have 4 x HDMI input, 4XVGA + 4XAUD IN and 1 x HDMI Scaled out. It should have Audio Embedder & De-embedder with 1 x Audio out to be fed to Audio system. It should have (inbuilt or additional) control system having 1 GB RAM, 4GB Storage, 1 RS232 Ports, 1 IR Ports. It should be able to execute multiple programs and control AV equipment, accessories, Lighting, HVAC etc. from Touchscreens and keypads. It should also offer BACnet/IP for interfacing with BMS. It should have ethernet control for all the slave	Nos	12	2,99,460.00	35,93,520.00
111	NG	AV devices.	ŊŢ	2		
	NS	 4x1 ultra high-definition 4K/80 digital AV switcher Fully operable using onboard controls, a Web browser, or a control system Simplified setup through the front panel OLED display or Web browser Four HDMI® inputs and one HDMI output DVI and DisplayPort Multimode compatible [2] Auto-switching mode for hands-off operation Comprehensive built-in EDID configuration tools Enables display device control via CEC Handles Dolby® TrueHD, DTS-HD®, and uncompressed 7.1 linear PCM audio High-speed Ethernet LAN connection Compact, low-profile surface mount design Universal 100-240V external power pack included 	INOS	5	70,808.00	2,12,424.00

112	NS	AV over IP Encoders-Full HD over IP Extension , Supports point-to-point, point-to- multipoint and multipoint-to-multipoint configurations , Up to 120m over a single Cat.5e/6 cable in point-to-point connection, with 1x looping HDMI output for daisy chaining, TCP/IP protocol compliant with selectable streaming bit rate up to 15Mbps per stream, H.264 compression encoding that support resolution up to 1080p@60hz, HDCP Compliant, IR Remote control, with LED display to show the Group ID. Fully operating just out of the box without the need of PC connection ,Integrated web server for configuration, PC tool control and Telnet control (Net Manager and third party remote control compatible, Supports audio format , Wide-band IR pass through to control the source (38kHz to 56kHz), 2 way UART/RS- 232 (Up to 115200) pass-through, with remote control function to select 8 group Baud rate options , Dual power input: 802.3af compliant POE & DC 5V (No need of external power supply when encoders and decoders are connected to a POE Switch Inputs : 1x HDMI, 1x H.264 Streaming, 1x RS-232, 1x IR , Resolution 1080p@24/25/29.97/30/50/59.94/60Hz, 576p, 576i@50Hz, 720p@50/59.94/60Hz, 576p, 576i@50Hz, 480p, 480i@59.94/60Hz Vesa 640×480,800×600,1024×768,1280×768, 1280×960,1280×720,1360×768,1400×1050 , Features : Downscaling, HDCP Support, RS- 232/IR Extension, PoE, Control Options :Web, Telnet, IR	Nos	27	1,76,005.00	47,52,135.00
113	NS	HDMI + CONTROL Extender Pair from the same OEM. TX should have 1 x HDMI IN and 1 x Twisted pair OUT. RX should have 1 x Twisted Pair IN and 1 x HDMI OUT. Should support Resolution of up to 4K DCI 4:4:4 and Distance at least 70m using same OEM Cable. Same pair should extend IR and RS232 using dedicated input and output port at TX and RX . + 8 channel power switch, supports 240 volt 50/60 Hz lighting and Motor loads for Shades / Projection screens / Lifts and Lighting control from the same OEM as Control systems.	Nos	2	1,08,192.00	2,16,384.00

114	NS	AV over IP Decoders-Supply of full HD over IP Extension, Supports point-to-point, point- to-multipoint and multipoint-to-multipoint configurations, Up to 120m over a single Cat.5e/6 cable in point-to-point connection, with 1x looping HDMI output for daisy chaining, TCP/IP protocol compliant with selectable streaming bit rate up to 15Mbps per stream, H.264 compression encoding that support resolution up to 1080p@60Hz, HDCP Compliant, IR Remote control, with LED display to show the Group ID. Fully operating just out of the box without the need of PC connection, Integrated web server for configuration, PC tool control and Telnet control (EclerNet Manager and third party remote control, compatible), Supports LPCM audio format, Wide-band IR pass through to control the source (38kHz to 56kHz), 2 way UART/RS-232 (Up to 115200) pass-through, with remote control function to select 8 group Baud rate options, Dual power input: 802.3af compliant POE & DC 5V (No need of external power supply when encoders and decoders are connected to a POE Switch). Inputs 1x H.264 Streaming, 1x RS-232, 2x IR , Outputs 1x HDMI, 1x RS-232, 1x IR , Features : Downscaling, HDCP Support, PoE, Control Options Web Telnet IR	Nos	17	1,52,184.00	25,87,128.00
115	NS	Control Processor- Supply of SD RAM 512 MB, Flash 4 GB, 10/100 Mbps, auto- switching, auto-negotiating, auto-discovery, full/half duplex, industry-standard TCP/IP stack, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH File Transfer Protocol), FIPS 140- 2 compliant encryption, IEEE 802.1X, SNMP, BACnet/IP [1], IPv4 or IPv6, Active Directory authentication, IIS v.6.0 Web Server, SMTP e- mail client Supports USB mass storage class devices via rear panel USB 2.0 host ports, supports computer console via front panel USB 2.0 device port RS-232/422/485 For 2-way device control and monitoring, all ports support RS-232 up to 115.2k baud with software handshaking, one port also supports RS-422 or RS-485 and hardware handshaking IR/Serial Supports 1-way device control via infrared up to 1.2 MHz or serial TTL/RS-232 (0-5 Volts) up to 115.2k baud, RELAY OUTPUT 1 – 8,I/O 1 – 8,IR - SERIAL OUTPUT 1 – 8	Nos	2	1,85,665.00	3,71,330.00

116	NS	5 Inch Touch panel with Table mount kit and POE power supply. It should be from the same OEM and should support custom graphics programming. It should have auto-brightness control, in-built microphone, speakers and camera. Should support SIP intercom feature, streaming H.264 videos, web browsing, multitouch. Resolution - 960x540, Brightness - 400 nits or higher. 2 GB RAM and 4GB storage.	Nos	14	1,38,949.00	19,45,286.00
117	NS	Supply, installation, Testing and commissioning of IR Probe	Nos	10	5.835.00	58,350.00
		Total for audio Video Management			-	1,37,36,557.00
110	NS	SUBHEAD 19 : Accessories	Nos	45		
110	115	Commissioning of Face Plates which shall have HDMI, USB and RJ-45 Connectivity. It shall be supplied along with double side female connectors for easy installation complete in all respect.	nos.	43	1,680.00	75,600.00
119	NS	Supply, Installation, Testing and Commissioning of High Quality 2 Core shielded audio cable. The cable shall have proper insulation for all cores and shield.	Nos.	175	168.00	29,400.00
120	NS	Supply, Installation, Testing and Commissioning of High Quality 4 Core Control Cable. The cable shall have proper insulation for all cores and shield.	Nos.	325	168.00	54,600.00
121	NS	Supply, Installation, Testing and Commissioning of 2 Core Speaker Cable which shall be 16 AWG or better.	Nos.	700	336.00	2,35,200.00
122	NS	Supply, Installation, Testing and Commissioning of 12U Rack which shall be supplied with 1 nos 6 port 6A power strips which shall be rack mountable. It shall be supplied with cooling fan for proper ventilation. It shall be supplied with mounting screws and mounting plates as included accessories.	Nos.	16	29,400.00	4,70,400.00
123	NS	Supply, Installation, Testing and Commissioning of 24U Rack which shall be supplied with 2 nos 6 port 6A power strips which shall be rack mountable. It shall be supplied with cooling fan for proper ventilation. It shall be supplied with mounting screws and mounting plates as included accessories.	Nos.	4	46,200.00	1,84,800.00

124	NS	Supply, Installation, Testing and Commissioning of 3 meters HDMI Type A to Type A which shall support data rate of up to 18 Gbps. It shall support resolutions of up to 3820x2160@60 Hz or better. It shall have Gold Plated Contacts for Signal Integrity. It shall have a dynamic bend radius of 90mm or better. It shall have an insulation resistance of 100 ohms or better. It shall have a Dielectric Strength of 500V/minute or better. It shall be HDMI 2.0 or better. It shall have up to 1536 KHz or better Audio Sample Frequency for highest audio fidelity. It shall be highly resistant with RF and EMI interference. It shall work without the use of External Power Supplies.	Nos.	75	2,520.00	1,89,000.00
125	NS	Supply, Installation, Testing and Commissioning of 3.5m Stereo male to male Audio Patch Cord. It shall have 3.5mm Male Connectors.	Nos.	75	1,008.00	75,600.00
		Total for Accessories				
						13,14,600.00
126	NS	SUBHEAD 20 · Training and Adaptation				
	115	Manpower for Training and Adaptation (Cost per person per month)	Nos	1	63,000.00	63,000.00
		Total for Training and Adaptation				63,000.00
		Total for AUDIO VISUAL SYSTEM (SUBHEAD 14 TO 20)				5,84,73,674.00
		TOTAL FOR LOW VOLTAGE WORKS (NON-SCHEDULE ITEMS)				16,87,88,476.00
		TOTAL FOR INTERIOR + ELECTRICAL + HVAC + LOW VOLTAGE (I+II+III+IV) (without GST)				97,69,58,153.00

Explanatory Notes for BOQ:

i) The quantities shown in above Schedules are approximate and are as a guide to give the tenderer(s) an idea of quantum of work involved. The DFCCIL reserves the right to increase/ decrease and/or delete or include any of the quantities given above as per site conditions.

SAMPLE A G R E E M E N T CONTRACT AGREEMENT

(To be executed on non-judicial stamp paper of appropriate value)

THIS AGREEMENT ("Agreement") is made at Noida on the ____ day of _____

BETWEEN

Dedicated Freight Corridor Corporation of India Limited (a Govt. of India Enterprise under Ministry of Railways) and a company incorporated under the provisions of the Companies Act, 1956 having it's registered office at 5th Floor, Supereme Court Metro Station Complex, New Delhi, India – 110001, represented through it's Chief General Manager (*hereinafter refered to as "DFCCIL" which expression shall, unless repugnant to the context, be deemed to include its successors and assigns and called 'the Employer'*) as one part and _______ a company / corporation / JV incorporated under the laws of ------having its principal place of business at ------ (*hereinafter called "the Contractor"*) as other part.

NOW THIS INDENTURE WITNESSETH that in consideration to the payments to be made by the DFCCIL, the Contractors will duly perform the said works in the said schedule set forth and shall execute the same with great promptness, care and accuracy in a workman like manner to the satisfaction of the DFCCIL and will complete the same in accordance with the said specifications and said drawings and said conditions of contract on or before the ______ day of ______ 20___ and will maintain the said works for a period of ______Calendar months from the certified date of their completion and will observe, fulfill and keep all the conditions therein mentioned (which shall be deemed and taken to be part of this contract, as if the same have been fully set forth herein), AND the DFCCIL, both hereby agree that if the Contractor shall duly perform the said works in the manner aforesaid and observe and keep the said terms and conditions, the DFCCIL will pay or cause to be paid to the Contractor for the said works on the final completion thereof the amount due in respect thereof at the rates specified in the Schedule hereto annexed.

For and on behalf of the Contractor	For and on behalf of the Employer
Signature of the authorized official	Signature of the authorized official
Name of the official	Name of the official
Stamp/seal of the Contractor	Stamp/Seal of the Employer

SIGNED. SEALED AND DELIVERED

By the said	By the said
Name	
	Name
on behalf of the Contractor in the of:	on behalf of the Employer in the presence presence of:
Witness Name Address	Witness Name Address
Enclosures: -	
1. Annexure 'A' - Tender Papers No.	
2. Annexure 'B' - Letter of Acceptance of Tender No	Dated
along with Summary of Prices	
3. Other enclosures -	

FORM No. 6

Format of Bank Guarantee for Performance Security

Bank Guarantee no.....

Dated.....

To,

Chief Project Manager, Dedicated Freight Corridor Corporation of India Ltd/Noida Unit D-89, 1st Floor, Sector-2, Noida-20 1301

Reference:-Contract No....., awarded on

This deed of Guarantee made this day of ______between _______(name of Bank) having registered office at _______ and branch office at _______(hereinafter referred to as "Bank") of the one part and Dedicated Freight Corridor Corporation of India Limited (hereinafter called the Employer) of the other Part.

Whereas the contractor is bound by the said Contract to submit to the Employer an irrevocable performance security guarantee bond for a total amount of Rs..... (*Rs. In Words*) only.

Now, we the undersigned (*Name of Bank officials*), of the bank being fully authorized to sign and to incur obligations for and on behalf of the Bank hereby declare that the said Bank will guarantee the Employer the full amount of Rs..... (*Rs. In Words*) as stated above.

962 | Page

We..... (*indicate the name of Bank*), further undertake to pay to the Employer any money so demanded notwithstanding any dispute or dispute raised by the contractor in any suit or proceeding pending before any court or Tribunal relating to liability under this present being absolute and unequivocal.

The payment so made by us (*name of Bank*) under this bond shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such payment.

We..... (*indicate the name of Bank*), to further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said agreement have been full paid and its claims satisfied or discharged by (*Designation & Address of Contract signing authority*) on behalf of Employer certify that the terms and conditions of the said agreement have been fully and properly carried out by the said contractor and accordingly discharges this guarantee.

Notwithstanding anything to the contrary contained herein the liability of the bank under this guarantee will remain in force and effect until such time as this guarantee is discharged in writing by the employer or until (*date of validity/extended validity*) whichever is earlier and no claim shall be valid under the guarantee unless notice in writing thereof is given by the Employer within validity/extended validity period of guarantee from the date aforesaid.

We..... (*indicate the name of Bank*), to further agree with the Employer that the Employer shall have the fullest liberty without our consent and without effecting in any manner out of obligation hereunder to vary any of the terms and conditions of the said contract from time to time or to postpone for any time or from time to time any to power exercisable by the Employer against the said contractor and to forbear or enforce any of the terms and conditions of the said agreement and we shall not be relieved from our liabilities by reason of such variation, or extension being granted to the said contractor for any bearance act or omission on the part of the Employer or any indulgence by the Employer to the said contractor or by any such matter or thing whatsoever which under the law relating to sureties for the said reservation would relieve us from the liability.

The Guarantee hereinbefore contained shall not be affected by any change in the constitution of Bank or of the Contractor.

The expressions "the Employer", "the Bank" and "the Contractor" hereinbefore used shall include their respective successors and assigns.

We..... (*Name of the bank*) lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinbefore:

- i) Our liability under this Bank Guarantee shall not exceed and restricted to Rs.....(Rs. in words).
- ii) This Bank Guarantee shall be valid up to, unless extended on demand by Employer.
- iii) The Bank is liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only if Employer serve a written claim or demand on or before.....

IN WITNESS WHEREOF we of the Bank have signed and stamped this guarantee on this day of being herewith duly authorized.

Bank seal

Signature of Bank Authorize Official with seal

Name.....

Designation:

Address:

Witness:

1. Name:

Designation:

Address:

2. Name:

Designation:

Address:

SAMPLE

STANDING INDEMNITY BOND FOR "ON ACCOUNT" PAYMENTS

(To be executed on non-judicial stamp paper of appropriate value)

We, M/s _______for and on behalf of the Managing Director/ DFCCIL acting in the premises through the Chief Project Manager / DFCCIL/Noida or his successor (hereinafter referred to as "The Employer") all materials for which "On Account" payments have been made to us against the Contract for (________) on the section _______DFCCIL also referred to as Group/s _______vide letter of Acceptance of Tender _______and material handed over to us by the employer for the purpose of execution of the said contract, until such time the materials are duly erected or otherwise handed over to him.

We shall be entirely responsible for the safe custody and protection of the said materials against all risk till they are duly delivered as erected equipment to the employer or as he may direct otherwise and shall indemnify the employer against any loss/damage or deterioration whatsoever in respect of the said material while in our possession and against disposal of surplus materials. The said materials shall at all times be open to inspection by any officer authorized by the Chief Project Manager /DFCCIL/Noida in charge of Dedicated Freight Corridor Corporation of India Limited (*Whose address will be intimated in due course*).

Should any loss, damage or deterioration of materials occur or surplus material disposed off and refund becomes due, the Employer shall be entitled to recover from us the 85% of supply portion (*as applicable*) and also compensation for such loss or damage if any long with the amount to be refunded without prejudice to any other remedies available to him by deduction from any sum due or any sum which at any time hereafter becomes due to us under the said or any other Contract.

Dated this day ____ of ____

for and on behalf of

M/s _____(Contractor) Signature of witness

Name of witness in Block letter.

Address.

INDEMNITY BOND

(To be executed on non-judicial stamp paper of appropriate value)

This deed of Indemnity Bond is made at NOIDA, on thisday of, we,......through its Authorized Signatory(hereinafter called 'Contractor)AND M/s DFCCIL, D-89, Sector-2, Noida, District Gautam Budh Nagar, U.P., (Hereinafter called 'Client').

We, indemnify and save harmless the Railway/DFCCIL from and against all actions, suit proceedings losses, costs, damages, charges, claims and demands of every nature and description brought or recovered against the Railways/DFCCIL by reason of any act or omission of------(Contractor), his agents or employees, in the execution of the works or in his guarding of the same. All sums payable by way of compensation under any of these conditons shall be considered as reasonable compensation to be applied to the actual loss or damage sustained, and whether or not any damage shall have been sustained.

IN WITNESS WHEREOF the Contractor has executed this Bond of Indemnity at Noida, on this...... of

For and Behalf of Signature of Witness-1 Name of Witness-1 (in Block Letter) Address-1

for and Behalf of Signature of Witness-1 Name of Witness-1 (in Block Letter) Address-1

Authorized Signatory

Authorized Signatory

FORM No. 8

ECS / NEFT / RTGS

MANDATE FORM

Date :-

To, Chief General Manager/Noida DFCCIL, New Delhi. Sub : ECS / NEFT / RTGS payments

We refer to the ECS / NEFT / RTGS set up by DFCCIL for remittance of our payments using RBI's NEFT / RTGS scheme, our payments may be made through the above scheme to our under noted account.

Name of Bank	
Name of City	
Bank Code No	
Name of Bank Branch	
Branch Code No	
Address of Bank Branch	
Telephone Number of Bank Branch	
Fax No of Bank Branch	
Name of customer / Tenderer as per account	
Account Number of Tenderer appearing on cheque book	
Type of Account (S. B. / Current / Cash credit)	
IFSC code for NEFT	
IFSC code for RTGS	
9-Digit-code number of the bank and branch appearing on the	
MICR cheque issued by the bank.	
Details of Cancelled Cheque leaf	
Telephone no of tenderer	
Cell Phone Number of the tenderer to whom details with	
regard to the status of bill submitted to Accounts Office i.e	
Co6 & Co7 & Cheque Purchase Orders particulars can be	
intimated through SMS	
Tenderer's E - mail ID	

Confirmed by Bank signature of tenderer With stamp and address

Enclose a copy of crossed cheque.

FORM No. 9

DRAFT MEMORANDUM OF UNDERSTANDING (MOU) For

JOINT VENTURE PARTICIPATION BETWEEN

(To be executed on non-judicial stamp paper of appropriate value)

M/s having its registered office at (hereinafter referred to as) acting as the Lead Partner of the first part,

and

and

The expressions of and shall wherever the context admits, mean and include their respective legal representatives, successors-in-interest and assigns and shall collectively be referred to as "the Parties" and individually as "the Party"

WHEREAS:

Dedicated Freight Corridor Corporation of India Limited (DFCCIL) [hereinafter referred to as "Client"] has invited bids for ... "[Insert name of work]"

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

- 1. The following documents shall be deemed to form and be read and construed as an integral part of this MOU.
 - (i) Notice for Bid, and
 - (ii) Bidding document
 - (iii) Any Addendum/Corrigendum issued by Dedicated Freight Corridor Corporation of India Limited
 - (iv) The bid submitted on our behalf jointly by the Lead Partner.
- 2. The 'Parties' have studied the documents and have agreed to participate in submitting a `bid' jointly.
- 3. M/sshall be the lead member of the JV for all intents and purpose and shall represent the Joint Venture in its dealing with the Client. For the purpose of submission of bid proposals, the parties agree to nominate as the leader duly authorized to sign and submit all documents and subsequent clarifications, if any, to the Client. However M/s shall not submit any such proposals, clarifications or commitments before securing the written clearance of the other partner which shall be expeditiously given by M/s......to M/s......

4. The `Parties' have resolved that the distribution of responsibilities and their proportionate share in the Joint Venture is as under:

(a) Lead Partner;

(i)

(ii)

(iii)

(b) Joint Venture Partner

(i)

(ii)

(iii)

[Similar details to be given for each partner]

5. JOINT AND SEVERAL RESPONSIBILITY

The Parties undertake that they shall be jointly and severally liable to the Client in the discharge of all the obligations and liabilities as per the contract with the Client and for the performance of contract awarded to their JV.

6. ASSIGNMENT AND THIRD PARTIES

The parties shall co-operate throughout the entire period of this MOU on the basis of exclusivity and neither of the Parties shall make arrangement or enter into agreement either directly or indirectly with any other party or group of parties on matters relating to the Project except with prior written consent of the other party.

7. EXECUTIVE AUTHORITY

The said Joint Venture through its authorized representative shall receive instructions, payments from the Client. The management structure for the project shall be prepared by mutual consultations to enable completion of project to quality requirements within permitted cost and time.

8. BID SECURITIES

Till the award of the work, JV firm/Lead Partner of JV firm shall furnish Bid Security to the Client on behalf of the joint venture which shall be legally binding on all the members of the Joint Venture.

9. BID SUBMISSION

Each Party shall bear its own cost and expenses for preparation and submission of the bid and all costs until conclusion of a contract with the Client for the Project. Common expenses shall be shared by all the parties in the ratio of their actual participation.

10. INDEMNITY

Each party hereto agrees to indemnify the other party against its respective parts in case of breach/default of the respective party of the contract works of any liabilities sustained by the Joint Venture.

11. For the execution of the respective portions of works, the parties shall make their own arrangements to bring the required finance, plants and equipment, materials, manpower and other resources.

12. DOCUMENTS & CONFIDENTIALITY

Each Party shall maintain in confidence and not use for any purpose related to the Project all commercial and technical information received or generated in the course of preparation and submission of the bid.

13. ARBITRATION

Any dispute, controversy or claim arising out of or relating to this agreement shall be settled in the first instance amicably between the parties. If an amicable settlement cannot be reached as above, it will be settled by arbitration in accordance with the Indian Arbitration and Conciliation Act 1996 or any amendments thereof. The venue of the arbitration shall be Delhi.

14. VALIDITY

This Agreement shall remain in force till the occurrence of the earliest to occur of the following, unless by mutual consent, the Parties agree in writing to extend the validity for a further period.

- a. The bid submitted by the Joint Venture is declared unsuccessful, or
- b. Cancellation/ shelving of the Project by the client for any reasons prior to award of work
- c. Execution of detailed JV agreement by the parties, setting out detailed terms after award of work by the Client.
- **15**. This MOU is drawn in number of copies with equal legal strength and status. One copy is held by M/s and the other by M/s..... &M/s and a copy submitted with the proposal.
- **16**. This MOU shall be construed under the laws of India.

17. NOTICES

Notices shall be given in writing by fax confirmed by registered mail or commercial courier to the following fax numbers and addresses:

Lead Partner

Other Partner(s)

.....

.....

(Name & Address)

(Name & Address)

IN WITNESS WHEREOF THE PARTIES, have executed this MOU the day, month and year first before written.

M/s	M/s
(Seal)	(Seal)

Witness

1.....(Name & Address)

2..... (Name & Address)

Notes: (1) In case of existing joint venture, the certified copy of JV Agreement may be furnished.

DRAFT FORMAT OF JOINT VENTURE AGREEMENT

To be executed on non-judicial stamp paper of appropriate value in accordance with relevant Stamp Act and to be registered with appropriate authority under Registration Act.

The JV agreement shall be structured generally as per contents list given below:

A. CONDITIONS AND TERMS OF JV AGREEMENT

- 1. Definitions and Interpretation
- 2. Joint Venture Include Equity of members, transferability of shareholding of equity of a partner leaving during the subsistence of the contract.
- 3. Proposal Submission
- 4. Performance To indicate scope of responsibility of each member
- 5. Language and Law
- 6. Exclusively
- 7. Executive Authority
- 8. Documents
- 9. Personnel
- 10. Assignment and Third Parties
- 11.Severability
- 12.Member in Default
- 13. Duration of the Agreement
- 14 Liability and sharing of risks
- 15.Insurance
- 16. Sharing of Promotion and Project Costs, Profits, Losses and Remuneration
- 17. Financial Administration and Accounting
- 18. Guarantees and Bonds
- 19. Arbitration
- 20.Notices
- 21.Sole Agreement and Variation

B. SCHEDULES

- 1. Project and Agreement Particulars
- 2. Financial Administration Services
- 3. Allocation of the obligations
- 4. Financial Policy and Remuneration

PRO-FORMA LETTER OF PARTICIPATION FROM EACH PARTNER OF JOINT VENTURE (JV)

(To be executed on non-judicial stamp paper of appropriate value in accordance with relevant Stamp Act and to be registered with appropriate authority under Registration Act.)

No....

Dated

From:

To, The Chief General Manager/Noida Unit, **Dedicated Freight Corridor Corporation of India Limited** D-89, 1st Floor, Sector-2 Noida- 201301.

Gentlemen,

Re: Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida.

Ref: Your notice for Invitation for Tender No. CGM/DFCCIL/NOIDA UNIT/INTERIOR & **FURNISHING** WORK/DFCCIL C. O. BUILDING /SEC-145 NOIDA/2020/01.

We wish to confirm that our company/firm has formed a Joint Venture with(i)..... & ii) for the purposes associated with IFB referred to above.

(Members who are not the lead partner of the JV should add the following paragraph) *.

2. 'The JV is led by ... whom we hereby authorise to act on our behalf for the purposes of submission of Bid for and authorise to incur liabilities and receive instructions for and on behalf of any and all the partners or constituents of the Joint Venture.'

OR

(Member(s) being the lead member of the group should add the following paragraph) *

- 2. 'In this group we act as leader and, for the purposes of applying for Bid, represent the Joint Venture:
- 3. In the event of our JV being awarded the contract, we agree to be jointly with i) & ii) (names of other members of our JV) and severally liable to the Dedicated Freight Corridor

Corporation of India Limited, its successors and assigns for all obligations, duties and responsibilities arising from or imposed by the contract subsequently entered into between Dedicated Freight Corridor Corporation of India Limited and our JV.

4. ***I/We, further agree that entire execution of the contract shall be carried out exclusively through the lead partner.**

Yours faithfully, (Signature)

(Name of Signatory)

(Capacity of Signatory)

Company Seal

* Delete as applicable

Note: In case of existing joint venture, the certified copy of JV Agreement may be furnished.

FORMAT FOR POWER OF ATTORNEY FOR AUTHORISED SIGNATORY OF JOINT VENTURE (JV) PARTNERS

POWER OF ATTORNEY*

(To be executed on non-judicial stamp paper of the appropriate value in accordance with relevant stamp Act. The stamp paper to be in the name of the company who is issuing the power of Attorney)

Know all men by these presents, we ... do hereby constitute, appoint and authorise Mr/Ms. who is presently employed with us and holding the position ofas our attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to our bid for the work of...... Including signing and submission of all documents and providing information / responses to Dedicated Freight Corridor Corporation of India Limited, representing us in all matters, dealing with Dedicated Freight Corridor Corporation of India Limited in all matters in connection with our bid for the said project.

We hereby agree to ratify all acts, deeds and things lawfully done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us.

Dated this the day of

(Signature of authorised Signatory)

Signature of Lead Partner

Signature of JV Partner(s)

.....

•••••

(Signature and Name in Block letters of Signatory)

Seal of Company

Witness

Witness 1: Name:

Address: Occupation:

Witness 2: Name:

Address: Occupation:

*Notes:

i) To be executed by all the partners jointly, in case of a Joint Venture.

FORMAT FOR POWER OF ATTORNEY TO LEAD PARTNER OF JOINT VENTURE (JV)

(To be executed on non-judicial stamp paper of the appropriate value in accordance with relevant stamp Act. The stamp paper to be in the name of the company who is issuing the power of Attorney)

POWER OF ATTORNEY*

Whereas Dedicated Freight Corridor Corporation of India Limited has invited Bids for the work of "Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida."

Whereas, the members of the Joint Venture comprising of M/s. ..., M/s. ..., M/s. ..., and M/s. ... are interested in submission of bid for the work of "Complete Interior & Furnishing works such as Flooring, Wall & ceiling finishes, Partitioning, Wood work, False Ceiling, Plumbing, Electrical & other anciliary works for under construction DFCCIL C. O. Building complex at Sec-145, Noida." in accordance with the terms and conditions contained in the bidding documents.

Whereas, it is necessary for the members of the Joint Venture to designate one of them as the Lead Partner, with all necessary power and authority to do, for and on behalf of the Joint Venture, all acts, deeds and things as may be necessary in connection with the Joint Venture's bid for the project, as may be necessary in connection the Joint Venture's bid for the project.

NOW THIS POWER OF ATTORNEY WITNESSETH THAT:

We, M/s., hereby designate M/s. ..., being one of the partners of the Joint Venture, as the lead partner of the Joint Venture, to do on behalf of the Joint Venture, all or any of the acts, deeds or things necessary or incidental to the Joint Venture's bid for the contract, including submission of bid, participating in conferences, responding to queries, submission of information/ documents and generally to represent the Joint Venture in all its dealings with the Railway / DFCCIL or any other Government Agency or any person, in connection with the Bid/contract for the said work until culmination of the process of bidding till the contract agreement if successful, is entered into with the Dedicated Freight Corridor Corporation of India Limited and thereafter till the expiry of the contract agreement.

*To be executed by all the members of the JV except the lead member. The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law

and the charter documents of the executant(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure.

We hereby agree to ratify all acts, deeds and things lawfully done by lead member, our said attorney, pursuant to this power of attorney and that all acts deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us/ Joint Venture.

Dated this the Day of

(Signature)

(Name in Block letters of Executants) Seal of Company

Witness 1	
Name:	
Address:	
Occupation:	
Witness 2	
Name:	
Address:	
Occupation:	

Referece Para 17(b)

Registered Acknowledgement Due

PROFORMA FOR TIME EXTENSION

No	Dated:	
Sub:	(i)	(name of work).
	(ii) Acceptance letter no.	
	(iii) Understanding/Agreement no.	
Ref:	extension to the data received)	(Quote specific application of Contractor for
e	extension to the date received)	

Dear Sir,

- 1. The stipulated date for completion of the work mentioned above is ______. From the progress made so far and the present rate of progress, it is unlikely that the work will be completed by the above date (or 'However, the work was not completed on this date').
- **3.** Please note that an amount equal to the liquidated damages for delay in the completion of the work after the expiry of _______(give here the stipulated date for completion with/without any penalty fixed earlier)will be recovered from you as mentioned in Clause, 17-B of the Standard General Conditions of Contract for the extended period, notwithstanding the grant of this extension. You may proceed with the work accordingly.
- 4. The above extension of the completion date will also be subject to the further condition that no increase in rates on any account will be payable to you.
- 5. Please intimate within a week of the receipt of this letter your acceptance of the extension of the conditions stated above.
- 6. Please note that in the event of your declining to accept the extension on the above said conditions or in the event of your failure after accepting or acting upto this extension to complete the work by ______ (here mention the extended date), further action will be taken in terms of Clause 62 of the Standard General Conditions of Contract.

Yours faithfully For and on behalf of the Employer Name of the Official:-Stamp/Seal of the Employer

Referece Para 60(2)

CERTIFICATE OF FITNESS

1.	(a) Serial Number
	(b) Date
2.	Name of person examined
3.	Father's Name: son/daughter of
	Residing at
4.	Sex
5.	Residence:
6	
0. 7	
1.	Identification marks
8.	Date of birth, if available, and/or certified age
	I certify that I have personally examined (name) who is desirous of being employed in a
	factory or on a work requiring manual labour and that his/her age as nearly as can be ascertained from
	my examination, is years.
	I certify that he/she is fit for employment in a factory or on a work requiring manual labour as an
	adult/child.
9.	Reasons for:
	(a) refusal to grant certificate, or
	(b) revoking the Certificate
	(-)
	Signature or Left Hand
	Thumh Impression of the person Evamined
	r numb impression of the person Examined
	Thumb Impression of the person Examined

Signature of Certifying Surgeon

Note: In case of physical disability, the exact details of the cause of the physical disability should be clearly stated.

Referece Para 62(1)

Registered Acknowledgement Due

PROFORMA OF 7 DAYS NOTICE FOR WORKS AS A WHOLE/IN PARTS

(DETAILS OF PART OF WORK TO BE MENTIONED)

DFCCIL (Without Prejudice)

M/s _____

Dear Sir,

To

Contract Agreement No.

In connection with _____

- 1. In spite of repeated instructions to you by the subordinate offices as well as by this office in various letters of even no. ______, dated _____; you have failed to start work/show adequate progress and/or submit detailed programme for completing the work.
- 2. Your attention is invited to this office/Chief Engineer's office letter no. _____, dated ______ in reference to your representation, dated ______.
- 3. As you have failed to abide by the instructions issued to commence the work/to show adequate progress of work you are hereby given 7 days' notice in accordance with Clause 62 of Standard General Conditions of Contract to commence works / to make good the progress, failing which further action as provided in Clause 62 of the Standard General Conditions of Contract viz. to terminate your Contract and complete the balance work without your participation will be taken.

Kindly acknowledge receipt.

Yours faithfully

For and on behalf of the Employer Name of the Official:-Stamp/Seal of the Employer

Reference Para 62(1)

Registered Acknowledgement Due

PROFORMA OF 48 HRS. NOTICE FOR WHOLE WORK _____DFCCIL

То	(Without Prejudice)
M/s	
Dear Sir,	
Contract Agreement No.	
In connection with	

- 1. Seven days' notice under Clause 62 of Standard General Conditions of Contract was given to you under this office letter of even no., dated _____; but you have taken no action to commence the work/show adequate progress of the work.
- 2. You are hereby given 48 hours' notice in terms of Clause 62 of Standard General Conditions of Contract to commence works / to make good the progress of works, failing which and on expiry of this period your above contract will stand rescinded and the work under this contract will be carried out independently without your participation and your Security Deposit shall be forfeited and Performance Guarantee shall also be encashed and consequences which may please be noted.

Kindly acknowledge receipt.

Yours faithfully

and on behalf of the Employer Name of the Official: -Stamp/Seal of the Employer

FORM No. 17 A

Reference Para 62.(1)

Registered Acknowledgement Due

PROFORMA OF 48 HRS. NOTICE FOR PART OF THE WORK.....

(DETAILS OF PART OF WORK TO BE MENTIONED)

DFCCIL (Without Prejudice)

To
M/s_____
Dear Sir,
Contract Agreement No._____

In connection with_____

1. Seven days' notice under Clause 62 of Standard General Conditions of Contract was given to you under this office letter of even no., dated; but you have taken no action to commence the work/show adequate progress of the part of work...... (details of part to be mentioned).

2. You are hereby given 48 hours' notice in terms of Clause 62 of Standard General Conditions of Contract to commence works / to make good the progress of works, failing which and on expiry of this period your above part of work..... (Details of part to be mentioned) in contract will be rescinded and the work will be carried out independently without your participation.

3. Your full Performance Guarantee for the contract shall be forfeited and you shall not be issued any completion certificate for the contract. However, no additional Performance Guarantee shall be required for balance of work being executed through the part terminated contract.

4. The contract value of part terminated contract shall stands reduced to______

Kindly acknowledge receipt.

Yours faithfully For and on behalf of the Employer Name of the Official: -Stamp/Seal of the Employer

Reference Para 62.(1)

Registered Acknowledgement Due

PROFORMA OF TERMINATION NOTICE

DFCCIL (Without Prejudice)

No		Dated	
Го	M/s		
Dear	Sir,		
	Contract Agreement No.		
	In connection with		

Forty-eight hours (48 hrs.) notice was given to you under this office letter of even no., dated ______; but you have taken no action to commence the work/show adequate progress of the work.

Since the period of 48 hours' notice has already expired, the above contract stands rescinded in terms of Clause 62 of Standard General Conditions of Contract and the balance work under this contract will be carried out independently without your participation. Your participation as well as participation of every member/partner in any manner as an individual or a partnership firm/JV is hereby debarred from participation in the tender for executing the balance work and your Security Deposit shall be forfeited and Performance Guarantee shall also be encashed.

Kindly acknowledge receipt.

Yours faithfully

For and on behalf of the Employer Name of the Official: -Stamp/Seal of the Employer

FORM No. 18A

Reference Para 62(1) Registered Acknowledgement Due

Dated

PROFORMA OF TERMINATION NOTICE FOR PART OF THE WORK...... (DETAILS OF PART OF WORK TO BE MENTIONED)

DFCCIL
(Without Prejudice)

No._____

То

M/s _____

Dear Sir,

Contract Agreement No._____

In connection with_____

1. Forty-eight hours (48 hrs.) notice was given to you under this office letter of even no., dated______; but you have taken no action to commence the work/show adequate progress of the part of work...... (details of part to be mentioned).

2. Your above part of work in contract (details of part to be mentioned) stands rescinded in terms of Clause 62 of Standard General Conditions of Contract and the same will be carried out independently without your participation. Your participation as well as participation of every member/partner in any manner as an individual or a partnership firm/JV is hereby debarred from participation in the tender for executing the balance work

3. Your full Performance Guarantee for the contract shall be forfeited and you shall not be issued any completion certificate for the contract. However, no additional Performance Guarantee shall be required for balance of work being executed through the part terminated contract.

Yours faithfully

For and on behalf of the Employer Name of the Official: -Stamp/Seal of the Employer

PRE-CONTRACT INTIGRITY PACT

GENERAL:

This pre-bid contract Agreement (hereinafter called the Integrity Pact) is made on ______ day of the month of ______ 2020, between, on one hand, the DFCCIL acting through Shri ______ Designation of the officer, (hereinafter called the CLIENT, which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the First Part and M/s ______

represented by Shri ______ Chief Executive Officer (herein after called the "BIDDER/SELLER" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS, the CLIENT proposes to procure (*Name of the Stores/Equipment/Item, Name of the Consultancy Service, Name of Works Contract, Name of Services*) and the [A] is willing to offer/has offered for stores or works.

WHEREAS, the [A] is a private company/public company/Government undertaking/partnership/registered export agency, constituted in accordance with the relevant law in the matter and the CLIENT is a PSU performing its functions on behalf of the President of India.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to: -

Enabling the CLIENT to obtain the desired said (*Name of the Stores/Equipment/Item, Name of the Consultancy Service, Name of Works Contract, Name of Services*) at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling BIDDERs to abstain from bribing or indulging in any corrupt practice in order to secure [B] by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the CLIENT will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this integrity pact and agree as follows:

Commitments of the CLIENT:

1.0 The CLIENT undertakes that no official of the CLIENT, connected directly or indirectly with the [B], will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the [A] either for themselves or for any person, organization or third party related to the [B], in exchange for an advantage in the bidding process, bid evaluation, contracting or

implementation process related to the [B].

- 1.1 The CLIENT will, during the pre-contract stage, treat all BIDDERs alike, and will provide to all BIDDERs the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular [A] in comparison to other BIDDERs.
- 1.2 All the officials of the CLIENT will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.
- **2.0** In case any such preceding misconduct on the part of such officials(s) in reported by the [A] to the CLIENT with full and verifiable facts and the same is prima facie found to be correct by the CLIENT, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the CLIENT and such a person shall be debarred from further dealings related to the [B] process. In such a case while an enquiry is being conducted by the CLIENT the proceedings under the [B] would not be stalled.

3.0 Commitments of BIDDERS:

The [A] commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any precontract or post-contract stage in order to secure the [B] contract or in furtherance to secure it and in particular committee itself to the following: -

- 3.1 The [A] will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the CLIENT, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the [B] in exchange for any advantage in the bidding, evaluation, contracting and implementation of the [B].
- 3.2 The [A] further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the CLIENT or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the [B] or any other [B] with the Government for showing or forbearing to show favour or disfavour to any person in relation to the [B] or any other [B] with the Government.
- 3.3* [A] shall disclose the name and address of agents and representatives and Indian [A] shall disclose their foreign principals or associates.
- 3.4* [A] shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid/contract.
- 3.5 The [A] further confirms and declares to the CLIENT that the [A] is the original manufacturer/integrator/authorized government sponsored export entity of the

defence stores and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the CLIENT or any of its functionaries, whether officially or unofficially to the award of the [B] to the [A] nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation:

- 3.6 The [A] either while presenting the bid or during pre-contract negotiations or before signing the [B] shall disclose any payments he has made, is committed to or intends to make to officials of the CLIENT or their family members, agents, brokers or any other intermediaries in connection with the [B] and the details of services agreed upon for such payments.
- 3.7 The [A] will not collude with other parties interested in the [B] to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the [B].
- 3.8 The [A] will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- 3.9 The [A] shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the CLIENT as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The [A] also undertakes to exercise due and adequate care lest any such information is divulged.
- 3.10 The [A] commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.
- 3.11 The [A] shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.
- 3.12 If the [A] or any employee of the [A] or any person acting on behalf of the [A], either directly or indirectly, is a relative of any of the officers of the CLIENT, or alternatively, if any relative of an officer of the CLIENT has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the [A] at the time of filling of tender.

The term 'relative' for this purpose would be as defined in Section 6 of the Companies Act 1956.

3.13 The [A] shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the CLIENT.

4.0 **Previous Transaction:**

4.1 The [A] declares that no previous transgression occurred in the last three years immediately before signing of this integrity pact, with any other company in any

country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify BIDDER'S exclusion from the tender process.

4.2 The [A] agrees that if it makes incorrect statement on this subject, [A] can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

5.0 Earnest Money (Security Deposit):

- 5.1 While submitting commercial bid, the [A] shall deposit an amount ______ (*to be specified in RFP*) as Earnest Money/Security Deposit, with the CLIENT through any of the following instruments:
 - (i) Bank Draft or a Pay order in favour of _____
 - (ii) A confirmed guarantee by an Indian Nationalized Bank, promising payment of the guaranteed sum to the CLIENT on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the CLIENT shall be treated as conclusive proof or payment.
 - (iii) Any other mode or through any other instrument (to be specified in the *BID*).
- 5.2 The Earnest Money/Security Deposit shall be valid upto a period of five years or the contractual obligations to the complete satisfaction of both the BIDDER and the CLIENT, including warranty period, whichever is later.
- 5.3 In case of the successful [A] a clause would also be incorporated in the Article pertaining to Performance Guarantee in the [B] that the provisions of Sanctions for Violation shall be applicable for forfeiture of Performance Bond in case of a decision by the CLIENT to forfeit the same without assigning any reason for imposing sanction for violation of this pact.
- 5.4 No interest shall be payable by the CLIENT to the [A] on Earnest Money/Security Deposit for the period of its currency.

6.0 Sanctions for violations:

- 6.1 Any breach of the aforesaid provisions by the [A] or any one employed by it or acting on its behalf (whether with or without the knowledge of the [A] shall entitle the CLIENT to take all or any one of the following actions, wherever required: -
 - (i) To immediately call off the pre-contract negotiations without assigning any reason or giving any compensation to the [A]. However, the proceedings with the other BIDDER(s) would continue.

- (ii) The Earnest Money Deposit (*in pre-contract stage*) and/or Security Deposit/performance Bond (*after the [B] is signed*) shall stand forfeited fully and the CLIENT shall not be required to assign any reason therefore.
- (iii) To immediately cancel the [B], if already signed, without giving any compensation to the [A].
- (iv) To recover all sums already paid by the CLIENT, and in case of an Indian [A] with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a [A] from the country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the [A] from the CLIENT in connection with any other [B], such outstanding payment could also be utilized to recover the aforesaid sum and interest.
- (v) To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the [A], in order to recover the payments, already made by the CLIENT, along with interest.
- (vi) To cancel all or any other Contracts with the [A]. The [A] shall be liable to pay compensation for any loss or damage to the CLIENT resulting from such cancellation/rescission and the CLIENT shall be entitled to deduct the amount so payable from the money(s) due to the [A].
- (vii) To debar the [A] from participating in future bidding processes of the Government of India for a minimum period of five years, which may be further extended at the discretion of the CLIENT.
- (viii) To recover all sums paid in violation of this Pact by [A] to any middleman or agent or broker with a view to securing [B] the contract.
- (ix) In cases where irrevocable Letters of Credit have been received in respect of any [B] signed by the CLIENT with the [A], the same shall not be opened.
- (x) Forfeiture of Performance Bond in case of a decision by the CLIENT to forfeit the same without assigning any reason for imposing sanction for violation of this pact.
- 6.2 The CLIENT will entitled to take all or any of the actions mentioned at para 6.1(i) to (x) of this pact also on the Commission by the [A] or any one employed by it or acting on its behalf (whether with or without the knowledge of the [A], of an offence as defined in Chapter IX of the Indian Penal Code, 1860 or Prevention of Corruption Act, 1988 or any other stature enacted for prevention of corruption.
- 6.3 The decision of the CLIENT to the effect that a breach of the provisions of this Pact has been committed by the [A] shall be final and conclusive on the [A]. However, the [A] can approach the independent monitor(s) appointed for the

purposes of this pact.

7.0 Fall Clause:

7.1 The [A] undertakes that it has not supplied / is not supplying similar product/systems or subsystems at a price lower than that offered in the present bid in respect of any other Ministry/Department of the Government of India or PSU and if it is found at any stage that similar product/systems or sub systems was supplied by the [A] to any other Ministry/Department of the Government of India or a PSU at a lower price, then that vary price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the [A] to the CLIENT, if the [B] has already been concluded.

8.0 Independent Monitors:

- 8.1 The CLIENT has appointed independent Monitors (*hereinafter referred to as Monitors*) for this Pact in Consultant with the Central Vigilance Commission (Name and Addresses of the Monitors to be given).
- 8.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this pact.
- 8.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.
- 8.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement, including minutes of meetings.
- 8.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the CLIENT.
- 8.6 The BIDDER(s) accepts that the Monitor has the right to access without restriction to all project documentation of the CLIENT including that provided by the BIDDER. The [A] will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the [A] with confidentiality.
- 8.7 The CLIENT will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.
- 8.8 The Monitor will submit a written report to the MD/DFCCIL within 8 to 10 weeks from the date of reference or intimation to him by the CLIENT/BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

9.0 Facilitation of Investigation:

In case of any allegation of violation of any provisions of this Pact or payment of commission, the CLIENT or its agencies shall be entitled to examine all the documents including the Books of Accounts of the [A] and the [A] shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

10.0 Law and Place of Jurisdiction:

This pact is subject to Indian Law. The Place of performance and jurisdiction is the seat of the CLIENT.

11.0 Other Legal Actions:

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

12.0 Validity:

- 12.1 The validity of this Integrity Pact shall be from date of its signing and extend upto 5 years or the complete execution of the [B] to the satisfaction of both the CLIENT and the [A] including warranty period, whichever is later. In case [A] is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the [B].
- 12.2 Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

5	The parties hereby sign this Integrity Pact aton		
	CLIENT:	BIDDER:	
	Name of the Officer	CHIEF EXECUTIVE OFFICER	
	Designation		
	Deptt./Ministry/PSU		
	Witness:	Witness:	
	1	1	
	2	2	

Note:

- [A] To be replaced by BIDDER/Seller/Consultant/Consultancy firm/Service Provider as the case was may be.
- [B] To be replaced by Contract/Supply Contract/Consultancy Contract/Works Contract as the case was may be.

FINAL SUPPLEMENTARY AGREEMENT

- 8. Articles of agreement made this day_____ in the year ______between DFCCIL, acting through the______ DFCCIL Administration having his office at ______ herein after called the DFCCIL of the one part and ______ of the second part.
- 9. Whereas the party hereto of the second part executed an agreement with the party hereto of the first part being agreement Number_____ dated_____ for the performance______ herein after called the 'Principal Agreement'.
- 10. And whereas it was agreed by and between the parties hereto that the works would be completed by the party hereto of the second part on_____ date last extended and whereas the party hereto of the second part has executed the work to the entire satisfaction of the party hereto of the first part.
- 11. And whereas the party hereto of the first part already made payment to the party hereto of the second part diverse sums from time to time aggregating to ₹ _____ including the Final Bill bearing voucher No._____ dated _____ of value _____ duly adjusted as per price variation clause, if applicable (the receipt of which is hereby acknowledged by the party hereto of the second part in full and final settlement of all his /its claims under the principal agreement.

And whereas the party hereto of the second part have received sum of ₹______ through the Final Bill bearing voucher No______ dated_____ duly adjusted as per price variation clause (PVC), if applicable (the receipt of which is hereby acknowledged by the party thereto of the second part) from the party hereto of the first part in full and final settlement of all his/its disputed claims under principal agreement.

Now, it is hereby agreed by and between the parties in the consideration of sums already paid by the party hereto of the first part to the party hereto of the second part against all outstanding dues and claims for all works done under the aforesaid principal agreement excluding the security deposit, the party hereto of the second part have no further dues of claims against the party hereto of the first part under the said Principal Agreement. It is further agreed by and between the parties that the party hereto of the second part has accepted the said sums mentioned above in full and final satisfaction of all its dues and claims under the said Principal Agreement.

(Applicable in case Final Supplementary Agreement is signed after release of Final Payment)

Or

And whereas the party hereto of the first part already made payment to the party hereto of the second part diverse sums from time to time aggregating to ₹_____ through various On Account Bills (the receipt of which is hereby acknowledged by the party hereto of the second part).

And whereas the party hereto of the second part have received sum of ₹

through various On Account Bills (the receipt of which is hereby acknowledged by the party thereto of the second part) from the party hereto of the first part and party hereto of the second part have accepted final measurements recorded on Page No.... to Page No.... of Measurement Book No.....and corresponding Final Bill duly adjusted as per price variation clause (PVC), if applicable, for full and final settlement of all his/its disputed claims under principal agreement.

Now, it is hereby agreed by and between the parties in the consideration of sums already paid through various On Account Bills and sums to be paid through Final Bill duly adjusted as per price variation clause (PVC), if applicable, based on accepted final measurements including the security deposit by the party hereto of the first part to the party hereto of the second part against all outstanding dues and claims for all works done under the aforesaid principal agreement, the party hereto of the second part have no further dues of claims against the party hereto of the first part under the said Principal Agreement.

(Applicable in case Final Supplementary Agreement is signed before release of Final Payment)

5. It is further agreed and understood by and between the parties that the arbitration clause contained in the said principal agreement shall cease to have any effect and/or shall be deemed to be non-existent for all purposes.

Signature of the Contractor/s

for and on behalf of the DFCCIL Witnesses

ADDRESS: _____

Format of Bank Guarantee for Security Deposit

Bank Guarantee no..... Dated.....

To, Chief Project Manager, Dedicated Freight Corridor Corporation of India Ltd/Noida Unit D-89, 1st Floor, Sector-2, Noida-20 1301

Reference:-Contract No....., awarded on

Whereas the contractor is bound by the said Contract to submit to the Employer an irrevocable performance security guarantee bond for a total amount of Rs..... (*Rs. In Words*) only.

Now, we the undersigned (*Name of Bank officials*), of the bank being fully authorized to sign and to incur obligations for and on behalf of the Bank hereby declare that the said Bank will guarantee the Employer the full amount of Rs...... (*Rs. In Words*) as stated above.

We..... (*indicate the name of Bank*), further undertake to pay to the Employer any money so demanded notwithstanding any dispute or dispute raised by the contractor in any suit or proceeding pending before any court or Tribunal relating to liability under this present being absolute and unequivocal.

The payment so made by us (*name of Bank*) under this bond shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such payment.

We..... (*indicate the name of Bank*), to further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said agreement have been full paid and its claims satisfied or discharged by (*Designation & Address of Contract signing authority*) on behalf of Employer certify that the terms and conditions of the said agreement have been fully and properly carried out by the said contractor and accordingly discharges this guarantee.

Notwithstanding anything to the contrary contained herein the liability of the bank under this guarantee will remain in force and effect until such time as this guarantee is discharged in writing by the employer or until (*date of validity/extended validity*) whichever is earlier and no claim shall be valid under the guarantee unless notice in writing thereof is given by the Employer within validity/extended validity period of guarantee from the date aforesaid.

We...... (indicate the name of Bank), to further agree with the Employer that the Employer shall have the fullest liberty without our consent and without effecting in any manner out of obligation hereunder to vary any of the terms and conditions of the said contract from time to time or to postpone for any time or from time to time any to power exercisable by the Employer against the said contractor and to forbear or enforce any of the terms and conditions of the said agreement and we shall not be relieved from our liabilities by reason of such variation, or extension being granted to the said contractor for any bearance act or omission on the part of the Employer or any indulgence by the Employer to the said contractor or by any such matter or thing whatsoever which under the law relating to sureties for the said reservation would relieve us from the liability.

The Guarantee hereinbefore contained shall not be affected by any change in the constitution of Bank or of the Contractor.

The expressions "the Employer", "the Bank" and "the Contractor" hereinbefore used shall include their respective successors and assigns.

We..... (*Name of the bank*) lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinbefore:

iv) Our liability under this Bank Guarantee shall not exceed and restricted to Rs.....(Rs. in words).

- v) This Bank Guarantee shall be valid up to, unless extended on demand by Employer.
- vi) The Bank is liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only if Employer serve a written claim or demand on or before.....

IN WITNESS WHEREOF we of the Bank have signed and stamped this guarantee on this day of being herewith duly authorized.

Bank seal

Signature of Bank Authorize Official with seal

Name.....

Designation:

Address:

Witness:

3. Name:

Designation:

Address:

4. Name:

Designation:

Address:

$Format for {\it Power of Attorney} for {\it Authorized representative}$

Know all men by these presents, We, [name of organization and address of the registered office] do hereby constitute, nominate, appoint and authorize Mr/Ms [name], son /daughter/ wife of [name], and presently residing at [address], who is presently employed with/retained by us and holding the position of [designation] as our true and lawful attorney (herein after referred to as the "Authorized Representative"), with power to subdelegate to any person, to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our Bid for *[name of assignment]*, to be developed by Dedicated Freight Corridor Corporation of India Ltd. (the "Authority") including but not limited to signing and submission of all applications/bids, proposals and other documents and writings, participating in pre-bid and other conferences and providing information/responses to the Authority, representing us in all matters before the Authority, signing and execution of all contracts and undertakings consequent to acceptance of our bid and generally dealing with the Authority in all matters in connection with or relating to or arising out of our Bid for the said Project and/or upon award thereof to us until the entering into of the Contract with the Authority.

AND, we do hereby agree to ratify and confirm all acts, deeds and things lawfully done or caused to be done by our said Authorized Representative pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Authorized Representative in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us.

IN WITNESS WHEREOF WE, [name of organization], THE ABOVE-NAMED PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS [date in words] DAY OF [month] [year in 'yyyy' format].

For [name and registered address of organization] [Signature]

[Name]

[Designation]

Witnesses:

1. [Signature, name and address of witness]

2. [Signature, name and address of witness]

Accepted

[Signature]

[Name]

[Designation] [Address]

Notes:

- 1. The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executants(s) and when it is so required, the same should be under seal affixed in accordance with the required procedure.
- 2. Wherever required, the Bidder should submit for verification the extract of the charter documents and other documents such as a resolution/power of attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Bidder.

NO DEVIATION CERTIFICATE

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

(Write Name & Address of Officer of DFCCIL inviting the Tender)

Dear Sir,

Sub: No Deviation Certificate.

Ref: 1) NIT/Tender Specification No:,

2) All other pertinent issues till date

We hereby confirm that we have not changed/ modified/materially altered any of the tender documents as downloaded from the website/ issued by DFCCIL and in case of such observance at any stage, it shall be treated as null and void.

We also hereby confirm that we have neither set any Terms and Conditions and nor have we taken any deviation from the Tender conditions together with other references applicable for the above referred NIT/Tender Specification.

We further confirm our unqualified acceptance to all Terms and Conditions, unqualified compliance to Tender Conditions, Integrity Pact etc.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized

representative of the bidder)

GUARANTEE BOND TO BE EXECUTED BY THE CONTRACTOR

FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF

WATER-PROOFING WORKS/ANTI TERMITE TREATMENT

(To be executed on non-judicial stamp paper of the

appropriate value in accordance with relevant stamp Act.)

The agreement made this..... day of (*Two Thousand_____* only)

WHEREAS THIS agreement is supplementary to a contract (*hereinafter called the Contract*) dated and made between the GUARANTOR OF THE ONE PART AND the DFCCIL of the other part whereby the contractor inter alia undertook to render the building and structures in the said contract recited completely water and leak-proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the affect that the said work will remain water and leak proof, for ten years from the date of completion of work.

NOW THE GUARANTOR hereby guarantees that work executed by him will render the structures completely leak proof and the minimum life of such water proofing treatment shall be ten years to be reckoned from the date of completion of work.

The decision of the Engineer/DFCCIL with regard to nature and cause of defect shall be final and binding on Guarantor.

During this period of guarantee, the guarantor shall make good all defects and in case of any defect being found render the building *water proof/anti termite* to the satisfaction of the Engineer/DFCCIL calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the Guarantor's cost and risk. The decision of the Engineer/DFCCIL as to the cost payable by the Guarantor shall be final and binding.

That if the guarantor fails to execute the water proofing/anti termite treatment and fails to control all kinds of leakage and seepage or commits breach there under, then the guarantor will indemnify the principal and his successor against all loss, damage, cost expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and / or cost incurred by the DFCCIL, the decision of the Engineer/DFCCIL will be final and binding on both the parties.

SIGNED, sealed and delivered by OBLIGATOR in the presence of: -

1.....

2.

SIGNED FOR AND BEHALF OF DFCCIL BY in

the presence of: -

1.....

2.....

Form No. 25 Reference Para 64.3 & 64.6

Agreement towards Waiver under Section 12(5) and Section 31A (5) of Arbitration and Conciliation (Amendment) Act

Brief of claim:

- (i) Claim 1- Detailed at Annexure-
- (ii) Claim 2 –
- (iii) Claim 3 –

I/we..... (post of Engineer) with reference to agreement no...... hereby raise disputes as to the construction and operation of this contract, or the respective rights and liabilities, withholding of certificate and demand arbitration in respect of following claims:

I/we.....do/do not agree to waive off applicability of section 12(5) of Arbitration and Conciliation (Amendment) Act.

Signature of Claimant______ Signature of Respondent ______

Agreement under Section 31(5)

I/we...... (Name of claimant) with reference to agreement no...... hereby waive off the applicability of sub section 31-A (2) to 31-A (4) of the Arbitration and Conciliation (Amendment Act. We further agree that the cost of arbitration will be shared by the parties as per Clause 64(6) of GCC.

Signature of Claimant______ Signature of Respondent______

*Strike out whichever not applicable.

Certification by Arbitrators appointed under Clause 63 & 64

of Indian Railways General Conditions of Contract

- 1. Name:
- 2. Contact Details:
- 3. Prior experience (Including Experience with Arbitrations):
- 4. I do not have more than ten on-going Arbitration cases with me.
- 5. I hereby certify that I have retired from Railways/DFCCIL w.e.f. _____ and empanelled as Railway Arbitrator as per 'The Arbitration and Conciliation Act- 1996'.
- 6. I have no any past or present relationship in relation to the subject matter in dispute, whether financial, business, professional or other kind.

Or

I have past or present relationship in relation to the subject matter in dispute, whether financial, business, professional or other kind. The list of such interests is as under:

7. I have no any past or present relationship with or interest in any of the parties whether financial, business, professional or other kind, which is likely to give rise to justifiable doubts as to my independence or impartiality in terms of The Arbitration and Conciliation Act-1996.

Or

I have past or present relationship with or interest in any of the parties whether financial, business, professional or other kind, which is likely to give rise to justifiable doubts as to my independence or impartiality in terms of The Arbitration and Conciliation Act-1996. The details of such relationship or interests are as under:

8. There are no concurrent Circumstances which are likely to affect my ability to devote sufficient time to the arbitration and in particular to finish the entire arbitration within twelve months.

Or

There are Circumstances which are likely to affect my ability to devote sufficient time to the arbitration and in particular to finish the entire arbitration within twelve months. The list of such circumstances is as under:

PART-IV

DRAWINGS

(Drawings have been uploaded separately in the E-Tender portal)

******END of Tender Document******