

**PROCEDURE ORDER FOR CROSS ACCEPTANCE/APPROVAL OF SOFTWARE EMBEDDED ELECTRONICS SYSTEMS AND NEW/IMPORTED TECHNOLOGY PRODUCTS FOR RAILWAY SIGNALLING FOR DFCCIL**

**I. Preface**

- (a) These guidelines are meant for evaluating software embedded electronic systems and new/imported technology products for Railway signaling, which are already in use on a passenger carrying service anywhere in the world at speed more than 100KMPH, for adoption on DFCCIL using the concept of cross acceptance/cross approval. The procedure outlined in relevant CENELEC or any other equivalent standards to define and verify the safety requirements form the basis of these guidelines.
- (b) These guidelines are applicable for evaluation of equipment against valid Contract Agreement with DFCCIL. These guidelines are to be applied as per requirement of respective Contract Agreement.
- (c) These guidelines do not absolve the Contractor of his overall responsibility towards the relevant contract(s) in any manner whatsoever.

**II. Object:**

The object of these guidelines is to outline the process, activities, responsibilities and documentation necessary to carry out the Cross Acceptance / Cross Approval exercise by DFCCIL.

**III. Responsibility of Safety Assurance:**

- (a) Safety clearance shall be given adopting the guidelines pertaining to Cross Acceptance/Cross Approval for adoption on DFC. This will include the System Hardware & Software Platform, Application software for implementing Safety Functions, Communication Interfaces, Input/Output modules, Power Supply (vital) Systems & other related equipment.
- (b) This approval for a particular product/system will be requested by the manufacturer of the system, through the Contractor. The manufacturer will be responsible for submission & authenticity of the documentation. The documentation should be as per procedure laid down.

**IV. Applications:**

These guidelines shall be applied for evaluation & acceptance of all Software Embedded Electronic Safety Systems and New/Imported Technology Products for Railway Signalling for provision on DFC.

The Electronic systems/products are as under:

- (i) Electronic interlocking, Digital Axle Counters and Train Protection and Warning System
- (ii) STEP items to be supplied on account of STEP loan conditions

**V. Procedure:**

1. DFCCIL shall appoint an ISA for safety assessment of the equipment.
2. Contractor of the project shall ensure that manufacturer extends complete cooperation to DFCCIL/ISA/PMC.
3. Manufacturer shall depute his technical personnel for technical clarifications when required by DFCCIL/ISA/PMC.
4. The manufacturer/firm shall submit a Safety Plan to DFCCIL/ISA/PMC for evaluation of the system/equipment for Cross Acceptance/Approval. All documents shall be prepared in English language, checked & verified & marked appropriately indicating their version number, no. of alterations, etc.
5.
  - (a) Safety plan shall be prepared and submitted. This will include:-
    - (i) System description, which includes the system architecture /configuration, system design & safety principle adopted for hardware & software.
    - (ii) Safety Integrity Level of the system
    - (iii) Safety case
  - (b) Manufacturer shall check and verify that the system being offered meets the requirement of safety integrity laid down in the specifications.
  - (c) Safety Case is documentary evidence that the safety system is conforming to and complies with the laid down safety requirements for it. Safety Case will have to be prepared in accordance with relevant CENELEC or equivalent standards & submitted to DFCCIL/ISA/PMC as the case may be for assessment. Safety case shall consist of the following documents:
    - (i) Details of approval given by an authority responsible for clearing safety system for use on a passenger carrying service at speed of more than 100 KMPH anywhere in the world.
    - (ii) Standards to which the equipment have been developed and proposed to be supplied, i.e., CENELEC standard or any other equivalent standard adopted by that passenger-carrying Railway.
    - (iii) Details of agencies, which have done software/hardware validations.
    - (iv) Criteria adopted and assumption made.
    - (v) Documentation of these approvals, including trials, tests & measurements and simulation carried out.
    - (vi) Restrictions, precautions, conditions or limitations imposed while giving clearance and thereafter action taken by the manufacturer.
    - (vii) Calculations of Hazard rate or rate of unsafe side failure.
    - (viii) Details/documents related to installation, functional operation, maintenance & modifications. Part list, wiring diagram, cable requirement, and list of tools and measuring equipments along with specification shall be given.
    - (ix) Performance feedback duly authenticated and certified by various user Railways.

Name, Designation, Phone & FAX Nos. and address of the official certifying the performance feedback should be clearly available. This will include Mean Time Between Failures (MTBF) and Mean Time Between Wrong Side Failures (MTBWSF) and Mean Time To Repair (MTTR) figures as per format given in Annexure 'A'.

- (x) Software & related instructions to configure the system initially as well as later due to changes in yard layout.
  - (xi) Complete history of development of the equipment shall be given. Modifications carried out in the system, if any, during last five years shall be listed. Date of each modification with brief reasons for undertaking modification and whether modification has got approval of original validation/approving agency. Version No. allotted after each modification shall be mentioned.
  - (xii) Type test (if required), Routine tests (which must be carried out on each equipment by the manufacturer) and acceptance tests (which are to be carried out on the equipment in the firm's premises before delivery) formats with test procedures and its significance for safety/reliability assessment of equipment. Sample routine test report/type test report/ factory acceptance test reports shall be submitted
  - (xiii) Details of climatic/EMI (Electro Magnetic Interference)/EMC (Electro Magnetic Compatibility) tests undergone by the equipment. Test reports of an accredited test laboratory (third party) shall be submitted. (The equipment shall also be subjected to environmental tests as per specification if not already done by some other reputed agency to the specified severity).
  - (xiv) Clause wise compliance statement to the specification and
  - (xv) statement whether system is suitable for DFC application or will require modifications. Updated history of application has to be submitted in the format as per Annexure 'B' for use in passenger carrying service at speeds of more than 100 kmph.
6. The Safety Integrity Requirement/Level for all vital applications for LC gates, station & Block Signaling & Interlocking systems / equipment / Track Circuits to be used on DFC, shall be SIL-4. In case, any system is required to have a SIL other than Safety Integrity Level-4 (SIL-4), DFCCIL approval shall be obtained before evaluating the system for Cross Acceptance.
7. The evaluation for Cross Acceptance shall normally be in compliance to the relevant specifications.
8. Provenness criteria of equipment usage of same Type/Make & Model/Version shall be as under: -

Sl. No.	Category of Equipment/System	Minimum no. of Equipment	Equipment Hours in use
1.	Digital Axle Counter	50	4,32,000
2.	TPWS (i) On Board Equipment (ii) Track Equipment Balise	25 100	2,16,000 8,64,000
3.	Electronic Interlocking	25	2,16,000
4.	Other items	100	8,64,000

**Note 1:** For all the above items : At least 20% of the equipment/system, with a minimum of 10, should be in continuous operation for a minimum period of 720 days.

**Note 2:** If the offered equipment has undergone minor hardware/software upgradation to improve functionality/safety of the equipment in recent past, then the equipment utilisation of the earlier version (prior to minor modifications) can be considered for the provenness. This decision of considering the earlier version for provenness shall be taken by DFCCIL. However, in such cases, a minimum of 10 (Ten) upgraded equipments should be in continuous operation for a minimum period of 180 days. Field trial of the equipment shall be conducted as detailed at Annexure C.

**Note 3 :** STEP items to be supplied, as part of tied Japanese loan, if not deployed for commercial service anywhere, shall be subjected to type test and field trial as detailed at Annexure 'C'.

9. The manufacturer shall have adequate skilled and trained manpower with good expertise in relevant fields of manufacturing, installation, training, maintenance support etc. Details of these personnel with name, educational qualification, training undergone & experience shall be furnished at the time of approval.
10. Manufacturer seeking approval shall guarantee for supply of spares during life of the equipment & extend maintenance support.
11. The firm shall provide all necessary test facilities to DFCCIL representative in their premises in India and abroad as prescribed by their principals at the time of approval.
12. DFCCIL/ISA/PMC shall assess the safety case & prepare the assessment report clearly recommending whether the system/equipment is permitted for:-
  - a. Type test and trials
  - b. Field trials
  - c. Use on DFC
13. The type tests and field trials, as required, shall be conducted as per Annexure "C". After DFCCIL/ISA/PMC is satisfied with the documents submitted by the firm; results of the type test and field trial, if any; approval for the particular contract shall be given.
14. If any document of safety case is withdrawn or if any problem with the product arises, the supplier shall inform DFCCIL immediately. In such or any similar case DFCCIL may modify/withdraw the approval, as required

**Annexure 'A'****Format for Performance Feedback**

1. Name of System/Equipment :
2. Make :
3. Model/Version No. :
4. User Railway & Section :
5. Maximum Sectional Speed :
6. Arrange number of Trains per day :
7. Application of System/Equipment :
8. Problems faced and solutions evolved :
9. Failure data may be submitted as per format given below :

Location	No. of System / Eqpt.	Date of commissioning	Total hours in use	No. of safe side failures	No. of unsafe failures	MTBF	MTBWSF	MTTR
<b>Total</b>								

**Annexure'B'**

Format for history of Application

SI NO	Hardware version No.	Software version No.	Model No.	User Rly.	Station/ Section	No. of Eqpts. In use	In use from date

**Type test for signalling items**

In case DFCCIL is fully satisfied with the consolidated report of the assessment, approval shall be given for type testing of prototype sample.

1. The type testing of prototype sample shall be undertaken to the satisfaction of DFCCIL.
2. Type tests shall be carried out on specific items to ensure that they perform their intended functions when subjected to all permutations and combinations of external environment and other factors.
3. The following tests shall constitute type tests :
  - (i) Visual inspection tests
  - (ii) Insulation resistance tests
  - (iii) Card level functional and fail safety tests
  - (iv) System level functional and fail safety tests
  - (v) Computerized testing
  - (vi) EMI/EMC tests
  - (vii) Environmental / Climatic Tests
  - (viii) System Diagnostic Tests
  - (ix) System Software Test
  - (x) Any other test deemed necessary
4. Manufacturer shall submit a comprehensive type test plan including procedure, type test format and expected results. The type test plan shall be finalized in consultation with DFCCIL / ISA / PMC.
5. Type tests shall be carried out at manufacturer's premises. Necessary testing equipments and competent man power shall be made available by the manufacturer.
6. Type test shall be carried out by DFCCIL representative / ISA.
7. Tests which cannot be carried out in house may be referred to independent test house of repute.
8. EMC / EMI tests may not be required if previous independent witness tests have been successfully carried out and reported by document.

**Field trials for signalling items**

1. The field trials shall be conducted to the satisfaction of the DFCCIL.
2. The field trials shall be held on Indian Railways / DFC as decided by DFCCIL. DFCCIL shall coordinate with IR for this purpose.

3. The Contractor / Manufacturer shall make all arrangements for conducting field trials. This shall include; but not limited to; supply, installation, commissioning and monitoring of the equipment.
4. The trials shall be monitored in the following manner –

S N	Name of Division / Railway / Section	Name of station	Model and version no.	Date of installation	No. of failures*	Remarks

\* Analysis of cause of failures to be attached.

#### Duration of field trial

SN	Item / Equipment	Initial trial	
		Number of equipments	Duration
1.	EI	01	180 days in parallel and/or standalone mode or a combination thereof as decided by DFCCIL
2.	DAC	01	180 days in parallel and/or standalone mode or a combination thereof as decided by DFCCIL
3.	TPWS	One (01) set of on Board equipment and ten (10) sets of track side system shall be installed and detailed trials shall be conducted for 180 days for compliance to specifications and performance monitoring.	

#### NOTE:

1. The number of equipments and duration can be suitably revised, as required, by DFCCIL.
2. DFCCIL shall decide if field trials and type test can proceed simultaneously or not.