

ANNEXURE – E1

Signaling and Telecommunication Technology

Scope: The scope of approval of this document by Ministry of Railway, is giving the in-principle approval of the Signaling and Telecommunication Technology to be used by a Metro Rail, for ensuring the safety of Train Control System. The in-principle approval is given on the basis of submission of safety certificates and performance certificates of vital sub-systems proposed to be used by Metro Railways before execution of work.

Following Documents are required for various sub-systems of signaling & Telecommunication, duly approved by Metro authorities at appropriate stage.

1. Independent Safety Assessor's assessment of vital signaling equipment like CBI, ATP, track detection system etc. (all the items being used for vital functions shall be covered). Regarding ATS, ATO & PSD ISA certification shall be done to required safety level as decided by metro.
2. Submission of the following:
 - (a) Relevant system details as may be necessary to give full particulars of principle of Operations and safety features incorporated for CBI, ATP, ATS, ATO, PSD, Track Vehicle Detection, Telecommunication systems being provided by Metro.
 - (b) ISA certificate and ISA assessment report for the safety certification of proposed vital signaling systems as mentioned in 1 above.
 - (c) User certificate* for safety and operational performance of the proposed version of the equipment in 1 above.
 - (d) Report of EMI/EMC interference/compatibility with rolling stock/traction, as applicable for track Detection, on-board and other related S&T equipment as per EN-50238/EN-50121 or any other equivalent international standards.
 - (e) Typical schematic of earthing/ bonding of signaling & Telecommunication equipment.
3. Verification and validation and certification by the ISA** of adherence to SIL-4 process from design to testing and commissioning stages of signaling system, including application data of vital equipment for the Signaling system. This shall include hazard analysis, its mitigation and acceptance of the same by competent authority for the concerned Metro Railway.

Note:

- i. Documents listed in Sr. No. (1) & (2) shall not be required in case there is an extension to an existing line incorporating no new type of signaling equipment. However, document 2(d) is required in case there is a modification in rolling stock and/or traction system and the EMI/EMC compatibility shall be examined between S&T and new set of rolling stock/traction.
- ii. *The safety and operational performance of same hardware and software version is required. However, in exceptional cases, if the offered equipment has undergone minor hardware/software upgradation to improve functionality/safety of the equipment in recent past, safety and operational performance of the earlier version (prior

to minor modifications) can be considered (in line with Railway Board’s policy for Cross acceptance for new/improved technology product for Railway Signaling).

- iii. ** “Independent Safety Assessors (ISAs): Metro Rail authorities shall select an ISA from the approved panel issued by RDSO/Railway Board for their Metro systems.

4. Detail list of Sub Documents of annexure E1 as per On-Line Portal:

S.No.	Doc. No.	Description	Type
1	E 1.1	Brief description of proposed Signalling system	PDF
2	E 1.2	ISA safety certificate & report of CBI and performance certificate from user	PDF
3	E 1.3	ISA safety certificate & report of ATP and performance certificate from user	PDF
4	E 1.4	ISA safety certificate & report of Track detection system performance certificate from user	PDF
5	E 1.5	ISA safety certificate & report of ATS, ATO & PSD (if provided) performance certificate from user	PDF
6	E 1.6	System details of Interlocking: Type of CBI and other details	PDF
7	E 1.7	System details of ATP	PDF
8	E 1.8	System/sub-system details of Track vehicle detection	PDF
9	E 1.9	System/sub-system details of Train control system	PDF
10	E 1.10	System/sub-system details of ATS & ATO (if provided)	PDF
11	E 1.11	System/sub-system details of PSD System (If provided)	PDF
12	E 1.12	System/sub-system details of Point machine	PDF
13	E 1.13	System/sub-system details of Tele-Communication systems/sub-systems	PDF
14	E 1.14	Report of EMI/EMC interface with rolling stock/traction	PDF
15	E 1.15	Typical schematic of earthing/bonding of signaling equipment	PDF
16	E 1.16	Report of Verification, validation and certification by the ISA of complete Signaling system (at appropriate stage)	PDF
17	E 1.17	Interference report (both out of band and in band interferences) to prove non-susceptibility of frequency band used for CBTC application (at appropriate stage)	PDF
18	E 1.18	Hazard Analysis report (at appropriate stage)	PDF
19	E 1.19	Other reports, if any (at appropriate stage)	PDF
<p>Note for Attachment E1.20 to E1.33:</p> <p>These are optional documents (as a complete set) and need to be submitted ONLY in case Metro is planning to run train without ATP (limited Signaling) during initial stage operations as per Metro Rules as follows:</p> <p>1) Rule 29(3) of Opening of Metro Railways for Public Carriage of Passengers Rules, 2013 and</p> <p>2) Rule 87 of Metro Railway General Rules, 2013</p>			
1	E 1.20	Brief description of proposed Signaling system	PDF
2	E 1.21	ISA safety certificate & report of CBI and performance certificate from user	PDF
3	E 1.22	ISA safety certificate & report of Track detection system and performance certificate from user	PDF
4	E 1.23	System/sub-system details of Signaling	PDF
5	E 1.24	System/sub-system details of CBI	PDF

6	E 1.25	System/sub-system details of Train control system	PDF
7	E 1.26	System/sub-system details of Track vehicle detection	PDF
8	E 1.27	System/sub-system details of Point machine	PDF
9	E 1.28	System/sub-system details of Tele-Communication systems/sub-systems	PDF
10	E 1.29	Report of EMI/EMC interface with rolling stock/traction	PDF
11	E 1.30	Typical schematic of earthing/bonding of signaling equipment	PDF
12	E 1.31	Report of Verification, validation and certification by the ISA of complete Signaling system (at appropriate stage)	PDF
13	E 1.32	Hazard Analysis report (at appropriate stage)	PDF
14	E 1.33	Other reports, if any (at appropriate stage)	PDF

Minimum Technological Requirements for Signalling & Telecommunications Systems

Scope: This annexure lists the summary of minimum requirement for Signalling and Telecommunication technology. The related documents for these systems shall be submitted as per details in Annexure E1.

1. It may be noted that the given criteria are based upon systems already adopted by the existing Indian Metros. However, in case Metro Authorities are adopting a new technology, then the same shall be advised and concurrence of RDSO should be obtained in-principle.

I. Signaling systems

SN	Description	Minimum requirement
1.	Type of Signaling	Cab Signaling, CATC (ATP, ATO, ATS). ATP and ATS are essential, ATO is optional.
2.	Back up Signaling	Line side (CLS) at entry and exit at all interlocked stations.
3.	Interlocking	EI with built-in block working facilities
4.	Train control system	CATC (ATP, ATS and optionally ATO)
5.	Type of Train detection system(s)	Coded Audio Frequency Track Circuits (AFTC) or Axle Counters
6.	Point machine	
	i) For Main Line	i) Non-Trailable high thrust, high performance point machine
	ii) For Depot	ii) Trailable high thrust, high performance point machine
7.	Redundancy in cab equipment for ATP (Cab Sig.)	1+1(hot standby)

II. Telecommunication systems

SN	Description	Minimum requirement
1.	Tele communication	Integrated system with OFC, Train Radio, CCTV, Centralized clocks, PA system, with the additional provision that Train Display Boards at stations should also be integrated in the system. Regarding Train Radio system, it should be fully digital and duplex system, the standards may be chosen based on techno-economic considerations.
2.	Positive Train Identification	Provided with interface between ATS and Train Radio

III. Platform Screen Door (PSD) System:

SN	Grade of Automation (GoA)*	Minimum requirement of PSD
1.	GoA-1(Non automated train operation – NTO)	Optional
2.	GoA-2 (Semi automated train operation – STO)	Optional
3.	GoA-3 (Driverless Train Operation - DTO)	Shall be provided

4.	GoA-4 (Unattended Train Operation- UTO)	Shall be provided
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*Grades of Automation are defined in IEC-62267

2. Detail list of Sub Documents of annexure E2 as per On-Line Portal:

S.No.	Doc.No.	Description	Type
1.	E 2.1	Summary as per attached proforma-1 (For complete signaling system)	PDF
2.	E 2.2	Summary as per attached proforma-2 (For limited signaling system) - optional)	PDF

These shall be submitted as per following proforma:

PROFORMA-1 (For complete signaling system)

Signaling systems			
S.No.	Description	Minimum requirement	Proposed system/sub-system
1.	Type of Signalling	Cab Signalling, CATC (ATP, ATO, ATS). ATP and ATS are essential, ATO is optional.	to be filled by Metro
2.	Back up Signalling	Line side (CLS) at entry and exit at all interlocked stations.	to be filled by Metro
3.	Interlocking	EI with built-in block working facilities	to be filled by Metro
4.	Train control system	CATC (ATP, ATS and optionally-ATO)	to be filled by Metro
5.	Type of Train detection system(s)	Coded Audio Frequency Track Circuits (AFTC) or Axle Counters	to be filled by Metro
6.	Point Machine		
	For Main Line	i) Non-Trailable high thrust, high performance point machine	to be filled by Metro
	For Depot	ii) Trailable high thrust, high performance point machine	to be filled by Metro
7.	Redundancy in cab equipment for ATP (Cab Sig.)	1+1(hot standby)	to be filled by Metro
Telecommunication systems			
S.No.	Description	Minimum requirement	Proposed requirement / sub-systems
1.	Telecommunication	Integrated system with OFC, Train Radio, CCTV, Centralized clocks, PA system, with the additional provision that Train Display Boards at stations should also be integrated in the system. Regarding Train Radio system,	to be filled by Metro

		it should be fully digital and duplex system, the standards may be chosen based on techno-economic considerations.	
2.	Positive Train Identification	Provided with interface between ATS and Train Radio	to be filled by Metro
It may be noted that the given criteria is based upon systems already adopted by the existing Indian Metros. However, in case Metro Authorities are adopting a new technology, then the same shall be advised and in principle concurrence of Ministry of Railways should be obtained.			

PROFORMA- 2 (For limited signalling system) - optional

Note for Proforma-2:

This is optional document and need to be submitted ONLY in case Metro is planning to run train without ATP (limited Signalling) during initial stage operations as per Metro Rules as follows:

- 1) Rule 29(3) of Opening of Metro Railways for Public Carriage of Passengers Rules, 2013 and
- 2) Rule 87 of Metro Railway General Rules, 2013

Signalling System			
S.No.	Description	Proposed system/sub-system	
1	Type of Signalling	To be filled by Metro	
2	Interlocking	To be filled by Metro	
3	Train control system	To be filled by Metro	
4	Type of Track Circuits	To be filled by Metro	
5	Point Machine		
	I) For Main Line	To be filled by Metro	
	ii) For Depot	To be filled by Metro	
Telecommunication systems			
S.No.	Description	Proposed System / sub-system	
1	telecommunication	To be filled by Metro	

-----End of Annexure E2-----

Legend: The major changes are highlighted in RED ink. The copy of existing Metro Manual whose revision is proposed above is also enclosed for reference.

The revised document may kindly be forwarded to competent authority for approval or modification as found suitable.

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