Procurement Technical Specification of Fire Detection System (FDS) for Chennai Metro ARE02A Contract

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1. Introduction

1.1. General

This document, Procurement Technical Specification (PTS) describes the complete technical requirement of **Fire Detection System** to be supplied for cars under the **ARE02A** contract for **Chennai Metro Rail Corporation Limited**.

The CMRL Metro Phase 2 Project will be approximately 118.9 km long, operating within three corridors i.e.,

- Corridor 3 from Madhavaram to Sipcot of 45.8 Km,
- Corridor 4 from Lighthouse to Poonamalle of 26.1 Km,
- Corridor 5 from Madhavaram to Sholinganallur of 47 Km

And their inter-corridor operations in the Chennai Metro Rail Phase 2 Project. The route will be approximately 76.3 km elevated and 42.6 km underground.

The Fire Detection System shall comply in all respects with ARE02A Employer's Requirements Technical Specification (ERTS-RS), (ERTS) – Depot Machinery & Plant (DM&P) &(ERTS) – Comprehensive Maintenance Contract (CMC) of Rolling Stock and Depot Machinery & Plant.

BEML shall carry out all required works and activities as Supplier for ARE02A contract while the subcontractor shall be responsible for all works required in this PTS with regard to Design, supply, testing & commissioning of **Fire Detection System** and shall be responsible for supporting the BEML activities as subcontractor for ARE02A contract.

The specified work includes the Design, Manufacture, Supply, Testing & Commissioning, Training of Personnel and Comprehensive Maintenance Contract for fifteen (15) years of standard gauge metro Rolling Stock (Electrical Multiple Units) and Depot Machinery & Plant (DM&P).

Subcontractor is responsible for providing material & support for comprehensive maintenance of Fire detection system during DLMP period, for the same subcontractor shall supply the required spares, special tools, testing and diagnostic equipment, jigs and fixtures for maintenance, repair and overhaul of Fire Detection System.

The scope of work includes all items of work which may be required to meet the performance requirements, trouble free and efficient operation of trains and meeting the best international practices even if not specifically mentioned in the specifications. ERTS 1.3.8 (i) to (viii).

The rake formation shall be as follows:

DMC + TC + DMC - 3 car train formation

Operation of Trainsets that are formed of 6-cars shall be achievable through two (2) possible

configuration options:

i) The future provision of a single Consist trainset comprised of the following rake configuration *DMC + TC + MC + MC + TC + DMC* (67% traction power)

ii) Multi-Consist trainset comprising of two (2) coupled 3-car consists having configuration *DMC +TC + DMC* *DMC + TC + DMC* (67% traction power)

DMC denotes 'Driving Motor Car', TC denotes 'Trailer car' (with pantographs), MC denotes Motor Car

***** : Fully Automatic Coupler (With electrical head)

+ : Semi-Permanent Coupler (SPC)

The rake shall consist of a 3-Car Trainset (also able to operate in a 6-car formation comprising of two (2) coupled consists) during initial revenue operation. The possibility of conversion to a single consist six-car rake at a later date shall also be achievable within the chosen design concept.

Underground stations will be equipped with Full Platform Screen Doors (PSD) and elevated stations with half-height Platform Screen Doors (PSD). Each station will be provided with Smart Card / NCMC / QR / Bio-Metric / any latest better Automatic Fare Collection system with vending machines. The system will operate under a "proof of payment" regime.

The Complete network will be electrified at 25 kV AC 1ϕ, 50 Hz with auto tensioned Overhead Flexible catenary & contact wire system and overhead rigid catenary system. This overhead catenary system shall be available in elevated, underground, and at-grade system.

This specification establishes requirements for the design, development, manufacture, supply, testing, delivery, commissioning and integrated testing of fully furnished modern passenger cars with microprocessor controlled 3ϕ AC asynchronous motor or latest better motor technology with variable voltage and variable frequency (VVVF) drive Control and suitable for UTO conforming to GoA4 as specified in IEC 62290 (1, 2 & 3):2014 or latest, including the training of personnel authorized by CMRL. The trains shall be able to operate in GoA4 immediately after commissioning and from the initial stage of passenger operations.

The at-grade, underground and elevated sections as well as the track at Madhavaram and Semmancheri Depots will all have ballast-less track. Whereas the track sections at Poonamalle Depot will have Ballasted track type. The cars shall be designed to meet the performance requirement given in ERTS clause 2.14 of this specification. The track gauge is 1435 mm.

Unattended Train Operation (UTO) shall be the predominant mode of train operation. In case if CMRL does not engage UTO for any reason, at any stage of passenger operation or non-passenger operation, the Train Operator will deploy staff to drive the train under ATO or Manual Mode (under ATP).

The cars required for the various Lines shall be delivered and commissioned by the Contractor at one or more of Designated Depot(s) as allocated by CMRL. The Designated Depot(s) are defined in Part 2 – Section VI C: ERTS – CMC of RS CMC Requirements Chapter 1.1.

1.2. OPERATIONS

1.2.1 CMRL plans to operate 365 days a year, from approximately 4.00 Hrs to 00.00 Hrs Monday through Sunday during the complete fleet operation conditions.

1.2.2 Rakes will operate in revenue service in as 3 car trainsets initially and shall be increased to 6 car trainsets later in case of increased passenger patronage. Under normal operating conditions, trains may be coupled and uncoupled during maintenance and in rescue modes.

1.2.3 Based on operational requirement, rakes may have to be operated in GoA2 mode with driver / in GoA3 mode with attendant / in GoA4 (UTO). However, the Phase 2 project is planned with operations in GoA4 (UTO) from the initial passenger service inauguration itself.

1.2.4 The maximum allowable operating speed of the vehicles shall be 80 kmph. The maximum design speed of the train shall be 90 kmph. Minimum headway shall be 90 seconds to satisfy normal peak ridership.

1.2.5 During the complete fleet operation conditions of this project, the trains may travel an average of 1,50,000 km per year.
Operating Schedule Speed : The minimum average Round-trip Operating Schedule Speed shall be 32 kmph.
Declared Schedule Speed (DSSP) : The Contractor shall propose DSSP values (in Kmph) for each load condition during the design stage. DSSP values for load conditions up to AW3 shall be greater than or equal to 32 kmph and shall meet the requirements defined in ERTS Clause 2.14.1.

1.2.6 The rakes shall include ventilation and air conditioning systems, rake's front & rear end evacuation emergency detrainment doors. The vehicles shall also include on-board CCTV cameras and external CCTV cameras for security and emergency doorways monitoring, etc.

1.2.7 The operating modes are defined as follows:
a) Normal Mode: The train shall achieve the required Operating Schedule Speed whilst driving under normal Tractive / Braking Effort characteristics with a minimum 8% of coasting and keep to timetable factoring the defined dwell times (excluding turnaround time at terminal stations). Brake blending shall utilise regenerative braking to the most extent possible. Normal mode will be used when trains are running on time and the timetable can be maintained.
b) All-out Mode: Shall be the same as normal mode except that there shall be no coasting in order to exceed the Operating Schedule Speed. All-out mode will be used to make up time when trains are running late. When the train is in UTO / ATO mode, the train will get appropriate commands from Signalling system.

1.3. SUSTAINABILITY

1.3.1 The Contractor shall apply the highest standards for application of sustainability (with proven design) in the design and construction of the trains to effect overall life-cycle cost savings and environmental benefits. Life-cycle analysis shall be conducted and used for rationalizing all sustainability inputs. Sustainability consideration will provide heavy emphasis on delivering energy

efficiency of system and subsystems, energy conservation and regenerative braking, potential and kinetic energy conservation systems and light weightiness to effect reduced traction power energy consumption.

1.4. Carbon Credits

1.4.1 The Contractor shall assist CMRL in obtaining Carbon Credits by providing necessary documentation to support the amount of power / energy saved by utilizing regenerative braking and other energy efficiency features used in train.

1.5. Signaling System (Section VI A: ERTS – RS –Appendix C - 2)

Train control system	CBTC based on board Continuous Automatic Train Control system (CATC) consisting of i) Automatic Train Protection ii) Automatic Train Operation (ATO) iii) Automatic Train Super-vision (ATS) iv)Attended/Unattended train operation (GoA2/GoA3/GoA4)
Train control mode	i) Automatic mode ii) Coded Manual modes iii) Restricted Manual mode iv) Run on Sight mode v) Cut-out mode vi) UTO vii) Standby
Conditions in stations	All stations shall have Platform Screen Doors (PSD's). These doors shall not be of full height and shall have provision to allow free flow of air for platform ventilation.

1.6. Current Collection System (ERTS clause 10)

System Particulars	**For all sections and depot**
Supply Voltage System	25kV AC single phase 50Hz
Current Collection	Two (2) pantographs located on the T-car
Nominal Voltage	25.0 KV AC
Normal variation in voltage	19.0 – 27.5 kV AC
Occasional maximum voltage (Cut off)	30 kV AC

Occasional minimum voltage	17.5 kV AC
Cut off voltage	16 kV AC
Voltage for guaranteed performance	22.5 kV AC
Frequency variation	47 to 52 Hertz

1.7. Flood Proofing

The Traction Equipment mounted on the under-frame shall be designed to permit propulsion of the train at 10 km/h through water up to a depth of 75 mm above rail level as per ERTS 2.11.3 (with maximum allowable wheel and rail wear). Traction equipment shall be made splash proof in accordance with International Standards.

2. Definition and Abbreviations

The following definitions and abbreviations are applicable to the PTS.

2.1. Definitions

The following definitions and abbreviations are applicable to the PTS.

“CMRL” means the Employer for the Mass Rapid Transport System (MRTS) for Chennai

“BEML” means the Contractor to procure the Fire Detection System for CMRL phase-2 contract.

“Subcontractor” means the supplier of Fire Detection System to BEML for CMRL phase-2 Project.

“ERTS-RS” means Employer’s Requirements Technical Specifications – Rolling Stock of CMRL phase-2 contract for CMRL Metro Project

“ERTS-DM&P” means Employer’s Requirements Technical Specifications – Depot Machinery & Plant of CMRL phase-2 contract for CMRL Metro Project

“ERTS-CMC & DP&M” means Employer’s Requirements Technical Specifications – Comprehensive Maintenance Contract of Rolling Stock and Depot Machinery & Plant of CMRL phase-2 contract for CMRL Metro Project

“PTS” means BEML’s Procurement Technical Specification.

"GTC" General Terms & Conditions of BEML for the procurement of the Fire Detection system

"Engineer / Project Manager / CMRL’s Representative " means any person nominated or appointed from time to time by the employer to act as the Engineer / Project Manager for the purpose of the contract and notified as such in writing to the contractor.

"Engineer's / Project Manager's Representative" means any assistant of the Engineer / Project Manager appointed from time to time by the Engineer.

2.2. Abbreviations

ATC	:	Automatic Train Control
CMRL	:	Chennai Metro Rail Limited
CBTC	:	Communications Based Train Control
DLMP	:	Defect Liability Maintenance Period
GoA	:	Grade of Automation
UTO	:	Unattended Train Operation
EMC	:	Electro-Magnetic Compatibility
EMI	:	Electro-Magnetic Interference
ERTS	:	Employer's Requirements Technical Specifications
FAC	:	Front Automatic Coupler
FMEA	:	Failure Mode Effects Analysis
FMECA	:	Failure Mode Effects and Criticality Analysis
FRACAS	:	Failure Reporting and Corrective Action system
FAI	:	First Article Inspection
FDR	:	Final Design
ISO	:	International Standards Organization
ITP	:	Inspection Test Plan
LRU	:	Least Replaceable Unit
MRTS	:	Mass Rapid Transit system
MDBF	:	Mean Distance Between Failures
MDBCF	:	Mean Distance Between Component Failures
MTTR	:	Mean Time To Repair
NCR	:	Non-Conformance Report
PHA	:	Preliminary Hazard Analysis
PTS	:	Procurement Technical Specification
PDR	:	Preliminary Design Review
PFDR	:	Pre-Final Design Review
RDSO	:	Research Design and Standards Organization (Ministry of Railways)
SOD	:	Schedule of Dimensions
SPC	:	Semi-Permanent Coupler
TCMS	:	Train Control Management System
TBD	:	To Be Determined

For further abbreviations, please refer to APPENDIX-A of ERTS

3. Precedence of Documents

The PTS shall be read in conjunction with General Terms and Conditions (GTC) of tender and ERTS-RS and ERTS-CMC & DP&M.

In the event of any conflict between requirements of particular parts of this PTS, the Subcontractor shall seek clarification from BEML.

Order of precedence	Document Title
1	CMRL Phase-2 ERTS-RS and ERTS-CMC & DP&M
2	PTS
3	GTC

The PTS shall in no way relieve the subcontractor from any requirements specified in the ERTS.

The complete requirements are those found in the above documents. It shall be the subcontractor's responsibility to ensure that equipment, documentation, and services furnished against this PTS are in full compliance with all the above documents.

Also, in the event of any conflict among the requirements of particular parts of the PTS and ERTS, the subcontractor shall seek clarification with BEML prior to making a contract, the subcontractor shall comply with BEML's Interpretation for any discrepancies.

4. Standards and Codes (Appendix B of ERTS)

The Contractor shall design, manufacture, and test the rolling stock using the "INTERNATIONAL STANDARDS" listed in Appendix B. Any deviation from these standards must first be approved by CMRL.

Acceptable design standards for this contact are International Standards (UIC), IEC standards, European Standards (EN), British Standards (BS), Japanese Standards (JIS), French Standards, American Standards and Bureau of Indian Standards (BIS). Any other standards the Contractor wishes to substitute must first be confirmed and approved by CMRL. All the standards used shall be latest issued revisions.

Note: Any other equivalent standards mentioned in Appendix B or additional standards as proposed by the Contractor may be followed subject to approval of CMRL. All the standards used shall be latest issued revisions.

All equipment and software supplied shall be in accordance with the requirements of the standards and codes specified in the ERTS. The subcontractor may propose an alternative equivalent international standard during the design stage. The acceptance of alternative standard will

however be subject to review by BEML/CMRL. When a Standard or Code is referred to, it shall be assumed that the revision that is current during the design finalization shall be applicable, unless otherwise stated.

Where no standard is identifiable, the subcontractor shall make a proposal, based on the best international practice, which shall be subject to review by BEML/CMRL.

During the preliminary design phase, the subcontractor shall submit a consolidated list of all the standards that he intends to use for the design, manufacturing and testing and other phases of the contract, for review of BEML/CMRL.

During the pre-final design phase, the subcontractor shall supply one original copy each of the standards and codes in form of searchable pdf format to BEML and CMRL representative.

5. Requirements of Documentation

All drawings, documents and information by Subcontractor shall be prepared in English and submitted to BEML for approval.

Except for drawings, all documents and information to be submitted shall be of Microsoft Office format on CD-ROM or e-mail.

The Subcontractor shall provide BEML with the drawings of component of Fire Detection System in a format readable with AutoCAD 2015 (latest), CATIA V5 on CD-ROM or e-mail as requested by the BEML or CMRL's Representative.

The drawings shall contain minimum three (3) viewpoints (for example, front view, top view and left view) for three (3) dimensional modeling. The Subcontractor shall provide STEP file or CATIA file to BEML/CMRL.

6. System Requirements

6.1. General requirements

This chapter establishes the performance, environmental, and design criteria for the Trainset. Included are dimensional, environmental, weight, ride quality, performance, acoustical, and electrical noise requirements, etc.

This rake as constructed, manufactured, assembled, and delivered shall fully conform to all provisions of those requirements unless otherwise specified in these provisions and shall be furnished with components, materials, equipment, and systems that comply fully with those requirements.

The rake shall consist of a 3-Car Trainset (also able to operate in a 6-car formation comprising of two (2) coupled consists) during initial revenue operation. The possibility of conversion to a single consist six-car rake at a later date shall also be achievable within the chosen design concept.
The rake shall be a high-floor design, with level boarding from platforms. Wheelchair and mobility-impaired boarding shall not require the use of bridging or lifting devices. The horizontal gap between the passenger door thresholds and platform edge and vertical gap between the passenger door thresholds and platform edge details are mentioned in SOD (Clause 2.7.1). In no cases (including the worst operating conditions) shall the top surface of the horizontal threshold of the car be lower than the top edge of the platform.

Trainsets shall be operated bi-directionally and shall have equal performance in either direction. The details of the emergency operator desk details explained in ERTS-RS chapter 5.
Prototype Train Program: Following the successful completion of all design review activities the BEML will begin production of a Prototype Train, which consist of the manufacture of two Diving Motor Cars and one Trailer Car, which will make up a 3-Car trainset. Upon delivery, these three cars shall then constitute the Prototype Train. The Prototype Train shall be considered a "proof of design" first article after being exercised in test and simulated revenue service, and the adequacy of all aspects of the design and manufacturing activities have been substantiated. The Prototype Train program shall be conducted in three phases:

(i) Phase 1 – The first 3-car trainset shall precede all other cars in production and shall be considered the prototype train. Components and cars shall be tested according to the requirements in ERTS-RS chapter 17, as applicable. Components and cars shall also be offered for first article inspection as specified in ERTS-RS chapter 17 at the sub-contractor facility or the BEML facility. All adjustments and/or changes required shall be completed prior to shipment to CMRL's facility.

(ii) Phase 2 - Upon arrival at CMRL, the Prototype cars shall be on-site qualification tested for required functional characteristics as per ERTS-RS Chapter-RS 17.

(iii) Phase 3 - When the on-site delivery testing requirements have been satisfied, the three Prototype cars shall be united to form a Prototype Train. The Prototype Train shall then undergo operational testing as required in ERTS-RS Chapter 17 followed by proof of

performance testing as a 3-Car rake. This shall include all specified system interface testing on CMRL's property.

Any adjustments / changes found necessary during the Prototype Train program are properly documented and incorporated into the following production cars configuration at no additional charge, unless approved by the BEML/CMRL. It is intended that except where otherwise approved or required by BEML/CMRL, the Prototype Cars' manufacturing quality level after the completion of all required modifications shall be the standard for all following cars.

Automatic coupler with mechanical, pneumatic, and electrical head shall be provided at the front end of each DMC cab. For the 3-Car rake configuration, semi-permanent couplers shall be provided between the DMC and the Trailer Car. Both automatic and semi-permanent couplers shall comply the requirements specified in ERTS-RS Chapter 04. Semi-permanent mechanical, pneumatic and jumper cables shall be used between the DMC and TC for the 3-Car consist configuration shown below.
3-Car rake: *DMC + TC + DMC* (67% Traction power)

Operation of Trainsets that are formed of 6-cars shall be achievable through two (2) possible configuration options:

(i) The future provision of a single Consist trainset comprised of the following rake configuration *DMC + TC + MC + MC + TC + DMC* (67% traction power)
(ii) Multi-Consist trainset comprising of two (2) coupled 3-car consists having configuration *DMC + TC + DMC* *DMC + TC + DMC* (67% traction power)

Notes:
• The symbol * denotes a fully automatic coupler (with electrical head)
• The symbol + denotes a semi-permanent coupler.
• DMC denotes Driving Motor Car
• TC denotes Trailer car (with pantographs)
• MC denotes Motor Car
Cars shall be equipped to operate normally as a single rake. Trainsets shall be equipped for emergency towing operation without any manual intervention for coupling or any purpose.

The rake shall be designed and manufactured to operate successfully within the environments of CMRL's dedicated right-of-way.

The cars shall include a Public Address System, Interior and Exterior Passenger Information Displays, Cab-to-Cab Communications, Passenger Emergency Intercoms, Diagnostic Monitoring System, Event Recorder, Video Surveillance and CCTV, as described in ERTS-RS Chapter 13.

Environmental conditions for the equipment on board the cars shall conform to EN 50125-1.

Electronic equipment shall be designed, constructed and tested in accordance with EN 50155.

When fully mated, the connectors for internal use (i.e., fitted within car body) shall achieve a seal rated to atleast IP 53 in accordance with IEC 60529 if the sealing is not provided by the cabinet in

similar. Connectors fitted externally to the car body shall achieve a seal rated to atleast IP 65.

It shall be demonstrated that all electronic equipment shall be immune to surge and transients typically expected in the Rolling Stock environment in accordance with EN 50155.

The main electrical protection of the Traction Power Supply to each car shall comply with the requirements of IEC 60077. The inductors used shall comply with the requirements of IEC 60310 (2004) or latest.

The Rolling stock and all its sub-systems functions has to meet all the criteria defined in ERTS-RS Chapter 14.

The sub contractor shall identify and implement any design and/or interface Works required to ensure the ARE02a Rolling Stock fleet achieves the following objectives for interoperability:-

a) The fleet shall serve all three (3) corridors of the CMRL Phase-2 network.
b) Be capable of running in mixed traffic operational diagrams; alongside up to two (2) additional fleet variants of passenger Rolling Stock as well as maintenance vehicles.
c) Have limited cross-compatibility with other passenger Rolling Stock fleets (ARE03a/ARE04) to the extent that is defined by the technical requirements elsewhere in this Contract (E.g. emergency train rescue requirements).
d) Complies with any other interoperability requirements identified during the course of coordinated interface Works with other Designated Contractors (as defined in ERTS-RS Appendix-C) or as may be required to ensure the safe operation of the railway.
The Sub contractor shall comply with all the Statutory requirements and guidelines related with Research Designs and Standards Organization (RDSO), Ministry of Railways (MoR), Commissioner of Metro Railway Safety (CMRS), Ministry of Housing and Urban Affairs (MoHUA) or any other bodies related to the sanction and operation of metro rolling stock.

All electrical and electronic components shall comply with the EMC and EMI requirements of EN 50121 (all parts), IEEE 16, EN 55011 and IEC 61000 standards or other equivalent international standards. The requirements of EMC EMI requirements referred in ERTS-RS clause 10.19 & ERTS-RS clause 2.18 of the rolling stock shall be met.

Fire properties of the materials used shall comply with EN 45545 part 1 to part 7 latest editions (Category 4-A, Hazard level HL3) as a minimum or better international standard applicable for similar Metro applications. Requirements of ERTS-RS clause 2.26 shall be met. Material requirements of all sub systems of train shall be compliant with the requirements of ERTS-RS Chapter 19.

Multi-Consist Configuration

a) The functionality of all Train subsystems shall be fully available when Trainsets are operated in a 6-car multi-consist configuration.
b) Hardware & Software of all subsystems (including but not limited to Traction system, APS system, PAPIS & CCTV system, TCMS system, Pneumatic & Brake system, Saloon Door system, VAC system, Trainlines, Signaling system, Telecommunication system, PSD system, etc) shall be automatically reconfigure as required whenever a coupling or decoupling command is initiated by

OCC or the Train Operator.
c) The sub contractor shall submit the design proposal for multi-consist configuration during Preliminary design stage. All technical requirements shall be addressed during Pre-final design stage and tested at the CMRL site to the full satisfaction and approval of BEML/CMRL.

6.2. Design life

The equipment boxes shall be designed for a service life of 35 years minimum in the Chennai environment (as defined in the specification), based on an average annual operating distance of 150,000 km per rake without requiring structural repair or replacement for any reason other than collision damage, vandalism, natural disasters, or misuse.

All other equipment shall be designed for a minimum service life of 18 years subject to routine maintenance, overhaul, or replacement. Major subassemblies and/or LRU's requiring overhaul or replacement to meet the requirements of this Chapter shall be identified at Preliminary Design Review (PDR), Pre-Final Design Review (PFDR) and Final Design Review (FDR).

Unless agreed otherwise by BEML/CMRL, the rakes shall utilize subassemblies that minimize the life-cycle costs of the car. If requested by BEML/CMRL, the sub contractor shall submit a cost-benefit analysis for review.

6.3. Service-proven design

The equipment's shall conform to EN 12663:2000 or any other standard as applicable to Cars of an urban rail transport system Category P-III. Car, system and subsystem designs shall be service proven. BEML/CMRL will evaluate the applicability of "service proven" according to the risk associated with each particular design. In general, "service proven" shall mean the system, subsystem, equipment or components, etc. which shall comply with requirement's specified in Part 1 - Section III : Evaluation and Qualification Criteria of the contract document.

To establish a design's service-proven history, the sub contractor shall submit as part of the proposal specific details of the application history. The sub contractor is free to propose design improvements; provided the service proven design basis is substantially unchanged. Proposed changes to the design or method of manufacture must be supported by reasonable justifications such as resolution of obsolescence, meeting specific BEML/CMRL technical requirements or for the improvement of product reliability. Submitted change proposals must specify the reason for the proposed changes and be supported by evidence to demonstrate the risk of adversely effecting operation and performance is mitigated. For such service proven designs, the sub contractor shall produce for BEML/CMRL review and approval test documents from the other systems/projects for which the sub contractor is providing the proven design application.
Evidence documenting service proven design shall be furnished as part of the proposal for the traction converter inverter system, traction motors, drive gear units and couplings, auxiliary converter inverter system and battery charger, TCMS and event recorder, high voltage equipment's.

BEML/CMRL may waive some requirements for detailed design review and design conformance

testing when service-proven equipment is provided. In general, the decision to waive design and test requirements will be based on BEML/CMRL understanding of the historical success of the equipment applications.

6.4. Designs for refurbishment

The passenger rake shall be designed to simplify future overhaul and refurbishment, including repair and replacement of all systems and their constituent parts. Removal and replacement of system equipment shall be possible without causing damage to other systems or to the car body.

It shall be possible to easily separate and move a car for the purposes of repair, overhaul, or refurbishment, with electrical connections having quick-disconnect connectors. Pneumatic connections between the cars shall use flexible hoses and quick disconnects.

Interior panels and equipment shall be of a modular design suitable for future refurbishment.

6.5. Aesthetic appearance

The rake's exterior design shall present a smooth, sleek, and attractive appearance. A purely functional layout is not sufficient. Body side bi-parting doors shall be compliant with ERTS-RS Chapter 6.

To the greatest extent possible, consistent with regulatory requirements, safety, satisfactory performance and maintainability, equipment shall be hidden from sight.

Cover panels shall be readily removable and/or hinged for maintenance access. Hinged panels shall be provided with a means for locking in the open position. Equipment cases shall consist of a dust and damp protecting enclosure manufactured with sealing rating of IP 65 in accordance with EN 60529.

The interior design and layout of the rake shall provide an attractive appearance. The interior design shall enable the rake to be easily maintained in a clean state. The exterior and interior of the cars must be designed and equipped to aesthetically accommodate and display public advertisements, as a means for the CMRL to derive revenue for offsetting operating cost.

6.6. Car general characteristics

Passenger Capacity

(i) The following data and assumptions shall be used by the sub contractor for all normal and degraded performance requirements and calculations. For a 3-Car metro rake composition, minimum seating and standing capacity shall comply with EN 15663 and below requirements:

(ii) For a Driving Motor Car, there shall be a 1 Wheelchair provision and minimum of 44 seats longitudinally arranged along each side of the interior of the car. Seat shall be standard type bench seats with no individual/single seat mouldings. The typical width of the passenger seat spacing

shall be 450mm and the depth, including leg room (as per EN 15663), shall be 670 mm. The remaining floor space shall maximize standing room for passengers for each of the loading conditions described in ERTS-RS clause 2.12.2.

(iii) For trailer cars, there shall be a minimum of 50 seats longitudinally arranged along each side of the car. Seat shall be standard type bench seats with no individual/single seat mouldings. The proposed width, height, depth, and leg room (as per EN 15663) of the seats shall be optimised to ensure maximum standing room for passengers for each of the loading conditions described in ERTS-RS Chapter The proposed design shall be subjected to CMRL approval.

	DM car	T car	M car
Seats	44	50	50
Wheelchair	1	-	-
Standees (AW3 condition)	210	210	210
Standees (AW4 condition)	280	280	280
Total capacity (3-car) AW4 condition	(44+1+280) + (50+280) + (44+1+280) = 980		
Total capacity (6-car) AW4 condition	(44+1+280) + (50+280) + (50+280) + (50+280) + (50+280) + (44+1+280) = 1970		

The general dimensions of the rake are indicated in Table 5-1. Tolerances for these dimensions shall be approved by CMRL.

Table 5-1: Car Dimensions

Dimension	**Values**
Length of DMC / TC / MC over coupler faces	22,600 mm
Height of car, overall	Compatible with the dynamic gauge specified in Appendix D. (4048 mm with pantograph in lockdown position)
Width of car, overall	2900 mm

Wheel dimensions: New wheel diameter Wheel wear limit	 860 mm 80 mm (on diameter)
Height of car floor above top of rail at door threshold	1,130 mm (maximum) 1,100 mm (minimum)
Spacing between bogie centerlines	14,850 ± 250 mm
Dynamic outline	Rake shall not exceed the dimensions shown in ERTS-RS Appendix D

Seats shall be arranged longitudinally to maximize the number of standing Seats shall be provided for handicapped persons as described in ERTS-RS clause 3.8.

Vertical and horizontal handrails shall be provided at the doorways on either side way. The layout and design shall be submitted for CMRL's approval. Details of stanchions and Handrails requirements are in clause 3.6.3.

The Contractor shall submit a seating conceptual layout with the technical proposal that offers the best trade-off between passenger seating capacity, standing and circulation space

6.7. Clearance requirement

The Kinematic Envelope of the Car shall be in accordance with Schedule of Dimensions in ERTS-RS Appendix D. The Contractor's calculations of the static and kinematic envelope of the vehicle shall be calculated in accordance with UIC 505 and/or equivalent International Standard. The vehicle and attached equipment shall be designed to operate within the Kinematic Envelope shown in ERTS-RS Appendix D, under all worst conditions of speed, passenger load, sway, roll, side play, wear, including wheel and rail wear and failures other than structural failures on level tangent track. The method and details of the calculations shall be submitted for the approval of CMRL as a separate design submission.

The clearance envelope is limited through stations by the station platform. The Contractor shall assess the reduced car clearance envelope present through stations. Interference with station platform due to lateral and vertical displacements and all conditions of passenger load, sway, roll, side play, wear of wheel, and rail and a single point failure shall be included in the assessment.

The sub contractor shall submit for approval design configuration drawings showing the static and kinematic clearance envelope for the cars, indicating compliance with ERTS-RS clause 2.7 and 2.8.

The sub contractor shall perform tests as specified in ERTS-RS Chapter 17 to demonstrate compliance with the static and kinematic clearance requirements.
The sub contractor shall ensure that the cars conform to the latest version of Schedule of

Dimension (SOD) without any addition cost to CMRL.

6.8. Wayside characteristics

The Rolling Stock shall fulfil the conditions as per UIC 512 for smooth operation.

The provisions on the following pages provide the basic track and wayside limitations under which the rake shall operate in revenue passenger service. The Contractor shall be responsible for submission of any additional data for design clearance and certification by the Commissioner for Metro Railway Safety (CMRS). All interface data interchange is described in ERTS-RS Appendix C, Interfaces.

Station Platforms in All underground stations will be air conditioned. The station platform edges will be equipped with Platform Screen Doors. The major dimensions of the station platform edge are given in SOD.

Track (Design Values) The cars shall be designed to negotiate all track conditions found on the CMRL system. The design geometry of the track is as defined in the ERTS-RS Appendix D (Schedule of Dimensions) and ERTS Appendix D (Alignments and Profiles).

Track Maintenance

The tolerances within which the main track will be maintained is provided in the Schedule of Dimensions in ERTS-RS Appendix D.
Table 5-2 contains information on the track design values.
Table 5-3 provides information on the track structure parameter.
Table 5-4 provides information on the track tolerances and
Table 5-5 provides information on the platform interfaces.

Table 5-2: Track Design Values

Dimension	**Maximum**	**Minimum**
Track gauge	1,435 mm (nominal)	
Horizontal curve radius: Mainline Under Ground Sections Elevated and Surface Sections Depot and Sidings at Stations	 ----- ----- -----	 200 m (minimum) 120 m (minimum) 100 m (minimum)
Dimension	Maximum	Minimum
Minimum radius of vertical curve	1,500 m	

Cant deficiency	100 mm	-----
Cant	125 mm	-----
Cant gradient	-----	1 in 440
Gradient At station At turnout Other sections in Mainline Depot	0.25 % (1 in 400) 2.5 %(1 in 40) 4 % (1 in 25) Including compensation level Level	 ----- -----
Rate of grade change	-----	1 in 440
Rail type: CWR	60E 1 Profile as per IRS T 12 – 2009 (With Latest Amendments/ Correction Slips) canted at 1 in 20	
Platform curve	1,000 m	

Track characteristics

a) The track structure parameters for At-grade, Elevated and underground sections are set out in Table 5-3.

Table No 5-3: Track Structure Parameters

Description	**Elevated and At-grade sections**	**Underground sections**
Track Laying Gauge	1435 mm ± 2 mm	
Rail Type		
Main Line	60E 1 Head hardened as per IRS T 12 – 2009 With All Amendments / Correction Slips. (1080 deleted as per latest draft no more 1080)	
Depot	60E 1 (880 Grade) as per IRS T 12 – 2009 With All latest Amendments / Correction Slips.	
Rail Profile	60 E1 Profile	
Inclination Of Rail	1 / 20	
Rail Seat spacing, Main line	Nominal 650 mm ± 5 mm	

Sleeper Spacing, depot	650 mm ± 5 mm; Inspection Lines 1000 mm	
Ballast Cushion		
Depot	Ballast less Track in Madhavaram Depot Ballasted Track in Poonamalle Depot	
Rail Panel Lengths	Continuous welded rails	
Minimum Radius of Curvature	Depot – 100 m Main line (At grade and elevated) – 120 m	200 m
Minimum Turn Out Radius. Main Line	140m	
Minimum Turn Out Depot	Madhavaram Depot: 1 in 7 R140 Poonamalle Depot: 1 in 7 R140,	
Minimum Turn Out Main line	1 in 7 R 140	
Maximum Cant Permissible in curves	125 mm	
Maximum Cant Deficiency Permissible	100 mm	
Maximum Permissible Cant Gradient	1 in 440	
Turn-out Speed : Turnout (Main line)	1 in 9 R 300 = 45 kmph; 1 in 9 R 190 = 35 kmph 1 in 7 R 190 = 35 kmph; 1 in 7 R 140 = 25 kmph	
Maximum Gradient (Main Line)	4 % Including Grade Compensation.	
Minimum vertical curve radius crest	1500 m	
Maximum track axle load (AW4)	16 tons	
Widening of track Gauge on curves	Up to 9 mm	
Structural gauge and passing clearance in straight line, in curves, in open air grade, in tunnel	As per SOD of CMRL Refer to Appendix D of the ERTS-RS document for typical Sections	
Tunnel Profile	As per SOD of CMRL Drawings showing section of cut and cover and bored tunnel in the Underground sections and details of various equipment's/cables etc located therein are mentioned in are enclosed in ERTS-RS Appendix D	

Line profile	The drawings showing the line profiles of all corridors are enclosed in ERTS-RS Appendix D of this document:

b) The Track tolerances for At-grade, Elevated and Underground sections are set out in Table 5-4. Final track tolerances will be confirmed by CMRL during the preliminary design of the vehicle.

Table 5-4Track Tolerances

Description	**Ballasted**	**Ballast-less (DFF)**
Laying Tolerance of Vertical Alignment measured by 10m chord (Designed level)	± 4 mm	± 4 mm
Alignment (Laying) (Base 10m)	± 5mm	(±4 mm for 20 m chord as per CMRL maintenance manual)
Cross Level Laying Tolerance (Designed)	± 3mm	±2 mm
Twist (Other than transition curve)	1 mm / 250 mm	Target value not to exceed 3 mm over 3 m; isolated locations up to 5 mm over 3 m; Threshold value for speed restrictions 10 mm over 3 m.
Cross Level Difference (Maintenance)	15 mm	10 mm
Gauge measured at a point 14mm below crown of rail (laying) (with respect to 1435 mm)	±6 mm	Target value ±6 mm Threshold value for speed restrictions +20 mm / - 10 mm
Unevenness (Maintenance) – 3, m chord	3 m chord: 15 mm	Target value not to exceed 6 mm; isolated locations up to 10 mm; Threshold value for speed restrictions 15mm.
Alignment (Maintenance) (Base 7.5m)	15 mm	Target value not to exceed 5 mm; isolated locations up to 10 mm; Threshold value for speed restrictions 15mm.
Gauge variation maintenance (sleeper to sleeper)	±6 mm	(±6 mm as per CMRL maintenance manual)

Gauge (Maintenance) – Tangent track (with respect to 1435 mm)	- 10mm to + 20 mm	Target value ±6 mm Threshold value for speed restrictions +20 mm / - 10 mm
Gauge (Maintenance) - >500m radius (with respect to 1435 mm)	+20 mm / - 10 mm over widened gauge	+20 mm / - 10 mm over widened gauge
Gauge (Maintenance) - <500m radius (with respect to 1435 mm)	+20 mm / - 10 mm	+20 mm / - 10 mm over widened gauge
Gauge Face Wear	8mm	8mm

c) Platform interfaces are set out in Table 5-5

Table 5-5: Platform interfaces

Particulars		**Measurements**
Length		136 m (6 coaches)
Width: Island type		8.0 to 12.0 m
Width: Side type		4.0 to 6.0 m
Particulars		**Measurements**
Height above Top of Rail level	Ballasted Track	1090 mm ± 5 mm
	Ballast-less Track	1080 mm ± 5 mm
Distance between track centre and platform edge		In underground: 1510 mm – 1515 mm In Elevated and At grade: 1515 mm – 1520 mm
Minimum horizontal curvature at platform		1000 m
Structural gauge and passing clearance in platform		Refer to Appendix D of this document

6.9. Train's inter-operability requirements

Metro passenger trains of this contract shall be designed for operation in all corridors of CMRL

Phase 2 network.

All the requirements of Interface suggested in ERTS-RS Appendix C shall be taken care during the design of the Rolling stock.

Trains shall be able to be maintainable & stabled in all the depots of CMRL Phase 2 network. Hence all the related interface with various depot machines and track systems suggested in ERTS-RS Appendix C – Section 6, Section 10, Section 11 shall be achieved.

Trains shall be compatible with combined operation with other type of trains in CMRL Phase 2 network. Hence all the related interface with other Rolling stock systems suggested in ERTS-RS Appendix C & Section 14 shall be achieved.

All the requirements of interface suggested in ERTS-RS Appendix C shall be taken care during the design of rolling stock.

6.10. Climatic and Environmental Condition (ERTS clause 2.11)

The ARE02A cars shall operate reliably and safely under Chennai climatic and Environmental conditions as per ERTS 2.11 shown in the following Table. Accordingly, the Fire Detection System shall be designed to operate with satisfactory performance under the following climatic and environmental conditions:

Condition	**Maximum**	**Minimum**
Climate	Tropical Wet, Dry, and humid	
Ambient temperature	45°C	16 °C
Rainfall	1,333 mm average annual. (Very heavy / continuous with heavy lightning discharges).	
Relative humidity	100 % saturation during rainy season which may be as long as 3 ~ 4 months. Other times, 82 % humidity.	
Atmosphere during hot season	Extremely dusty	
Maximum wind speed	130 kmph	
SO2 level in atmosphere	5 ~ 40 micro g / m3	
NOx level in atmosphere	10 ~ 40 micro g / m3	
Respiratory Suspended Particles Matter in atmosphere (RSPM)	45 ~ 100 micro g / m3	
Total Suspended Particles Matter in atmosphere (TSPM)	150 ~ 320 micro g / m3	
Altitude	Sea Level	
Conditions in stations	All underground stations will be A/C. Above ground stations will have A/C for certain designated rooms only.	

Note:

1. The rakes shall be continuously exposed to highly corrosive, salty atmosphere along with industrial pollutants. With maximum allowable wheel and rail wear, the rake must be able to operate successfully under the above conditions with no entry of moisture or other contaminants into any compartment, component, or device that could cause equipment on the rake to malfunction or be damaged; that could increase maintenance requirements; or that could cause premature wear or failure. The Water used in Chennai for washing is likely to have a high level of dissolved matter which may aid corrosion.

2. The temperature of stationary rake exposed to sun for long periods may go as high as 70°C. The equipment shall not be adversely affected in any way due to exposure to such high temperatures.

3. Smoke/ heat detectors should be sturdy and suitable to be used in rail cars. Detectors shall not malfunction in train operation, equipment shall be designed to take care of such thermal shocks. These shall be suitable for the external environment of Chennai.

7. Qualifying Criteria for subcontractor and Vendor approval

7.1. Proven Design (ERTS clause 2.4)

The proposed Fire Detection System by the sub-contractor against this PTS shall satisfy the "Proven Design" clause 2.4 of ERTS. Service proven shall mean the system, subsystem, equipment or components, etc. which shall comply with requirement's specified in Part 1 - Section III : Evaluation and Qualification Criteria of the contract document. The proposed system shall have been in use and have established its satisfactory performance and reliability on at least three mass rapid transit systems in revenue service over a period of three years or more (in each MRTS) either outside the country of origin in three different countries or in an MRTS in India.

The subcontractor shall manufacture and supply the Fire Detection System only from such manufacturing units that have supplied the Fire Detection System that fulfill the proven design requirements as above (Refer ERTS clause 2.4).

7.2. Design life as per ERTS 2.3

The car body structure, bogie structure, seat frames, and equipment boxes shall be designed for a service life of 35 years minimum in the Chennai environment (as defined in the specification), based on an average annual operating distance of 150,000 km per rake without requiring structural repair or replacement for any reason other than collision damage, vandalism, natural disasters, or misuse.

All other equipment shall be designed for a minimum service life of 18 years subject to routine maintenance, overhaul, or replacement. Major subassemblies and/or LRU's requiring overhaul or replacement to meet the requirements of this Chapter shall be identified at Preliminary Design Review (PDR), Pre-Final Design Review (PFDR) and Final Design Review (FDR).

Unless agreed otherwise by CMRL, the rakes shall utilize subassemblies that minimize the lifecycle costs of the car. If requested by CMRL, the Contractor shall submit a cost-benefit analysis for review.

7.3. Qualifying Criteria

(i) The subcontractor shall meet the qualification criteria as per Part 1, Section III, ERTS 2.5

(ii) The subcontractor should be an OEM and should have carried out design and manufacturing of sub-assemblies and those sub-assemblies proposed for Fire Detection System shall be state-of-art & of proven design and shall have been in use and have established their satisfactory performance and reliability on at least three mass rapid transit systems in revenue service over a period of three years or more (in each MRTS) either outside the country of origin in three different countries or in an MRTS in India. Sub-systems/components used in existing rolling stock of an MRTS in India do not get automatically qualified for use unless specifically approved by the Engineer for this project. Proposed Fire Detection System should have been in service during the preceding three

years or more in respect of Fire Detection System in similar metro system. To this effect, the subcontractor shall submit purchase order copies and satisfactory performance certificates from the customers / Metro Corporations along with the technical offer. Where similar sub-systems of a different rating are already proven in service as per the above criteria then the design shall be based on such sub-systems.

If required by the Project Manager, Contractor shall provide certificate of satisfactory performance for a period of three years or more from the Metro operators. Where similar sub-systems of a different rating are already proven in service as per the above criteria then the design shall be based on such sub-systems.

The Fire Detection System shall be procured from the approved vendors and sourced from only such manufacturing units that have supplied the sub-systems that fulfill the proven design requirements as above. The contract envisages commencement of manufacturing only after completion of pre-final design.

In case the subcontractor proposes to use sub-system(s) that do not fulfill the above said criteria then the subcontractor shall furnish sufficient information to prove the basic soundness and reliability of the offered sub-system(s) for review of the Engineer. The Engineer's decision on subcontractor's proposal shall be final and binding.

(iii) The subcontractor shall clearly indicate in the reference list regarding supply experience of executed projects having SIL2 architecture.

(iv) The subcontractor shall clearly indicate in the reference list regarding supply experience of executed projects having GoA4/UTO mode.

(iv) The subcontractor shall have established International Quality systems and certification like ISO 9001/ISO 14001/IRIS. The subcontractor shall submit supporting documents in this regard.

(v) The subcontractor shall submit Inspection & Test Plan / Quality Manual followed.

7.4. Vendor approval (ERTS clause 16.12)

Vendor approval from CMRL is mandatory for all sub-system suppliers. Accordingly, the request for Vendor approval with all relevant references and details as per Vendor approval format shall be submitted along with the technical offer along with Company profile, Product range and the organization structure. The acceptance of the technical offer is subject to approval of the Vendor by CMRL based on the vendor approval details submitted by the subcontractor.

8. Scope of Supply and Work

8.1. Hardware

The Subcontractor shall be responsible for the design, manufacture, supply, installation support**,** testing, commissioning and integrated testing of the Fire Detection System. The subcontractor shall provide all components related to the Fire Detection System, but not limited to, the following.

1. All components to meet the performance requirements of the Fire Detection System
2. Complete tools, Software, Hardware, Facilities, Jigs, Fixture diagnostic etc. for whole Fire Detection System shall be in line with contractual & Engineers Requirement.
3. Dust and Water-tightness and at least IP 65 or higher shall be ensured for all type of exterior equipment & enclosure/cubicles etc.
4. Enclosures & Mounting arrangements has to be provided by the subcontractor for the all the equipment's supplied by subcontractor.
5. Cables between equipment's:
    i. Subcontractor shall supply if any special cable required other than the following cables between the FDS system equipment's with the heat shrink tube, protective jacket, numbering tube, bundle name-tag, strain relief bushings, ferrules for terminal block and in case of lead cable, the brackets for fixing cable and fasteners must be supplied by the subcontractor.
        a. BEML will provide below cables only for car-side wiring;
        (i) Power cables (1.5 sq mm) for 110 V DC input power supply
        (ii) Fire-resistance Ethernet cable (CAT 5/5e).
        (iii) Fire-resistance 2-core shielded cable (2x1.00 Sq mm)."
    ii. Specification of Special cables proposed by the subcontractor shall be submitted with the tender. (Cables from sources approved by CMRL only will be used.).
    iii. Cable Number/Tagging must be under transparent heat shrinkable tube and should have a life of 35 years. Same is also applicable for Name Plate or Name labels.
6. Mating connectors for vehicle side with all pins even if pin is not used, back shells and accessories.
7. Non-screwed and self-locking type connectors for complete system shall be ensured.
8. Unused connector shall be covered with protective cover plug (or dummy cap) to prevent dust form accommodating on the contacts.
9. Name plates or Name Labels
10. Rubber (packing or gasket) for the water-tightness when the subsystem or components are installed on the exterior of vehicle.
11. One full set of connectors and its contacts as mounted on the equipment's for each car-type

(DM, T & DM cars) to carry out vehicle level voltage withstand test at BEML factory.

All information and contact details of the sub-suppliers shall be provided to contact the sub-suppliers after expiry of warranty.

8.1.1. Fire Detection System

The subcontractor shall provide, as a minimum, but not limited to, the following:

Item	Quantity			Spec.
	DMC	TC	DMC	
(1) Smoke/Heat Detectors (Multi-sensor)	06 to 08 nos. (Minimum)	06 to 08 nos. (Minimum)	06 to 08 nos. (Minimum)	ERTS 2.26.5.2
(2) Linear Heat Detectors (LHD) in all technical cabinet areas (cabinet/ enclosures / cubicles)	06 location	04 location	06 Location	ERTS 2.26.5.2 (a)
(3) Heat Detectors in fire prone equipment	02 nos.	02 nos.	02 nos.	ERTS 2.26.5.2 (a)
(4) LHD/HD for Under frame enclosures except propulsion equipment's.	01	07	01	ERTS 2.26.5.2 (a)
(5) Central Fire Detection & control unit (FDCU) (Central unit)	01	--	01	ERTS 2.26.5.2
(6) Fire Detection & control unit for Detectors (Local unit)	01	01	01	ERTS 2.26.5.2
(7) Alarm hooter / Beacons	01	--	01	ERTS 2.26.5.2 (d)
(8) Necessary diagnostic tools (software, hardware, etc.)	As required			ERTS 2.26.5
(9) Necessary hardware and software for FDS	As required			ERTS 3.14.4
(10) Mating connectors for all equipment's (male / female connectors along with male / female crimp contacts, etc.).	As required			
(11) Any other scope items required as per ERTS	As required			

Table 1: Scope of Supply - On-board equipment

Item	Q'ty	Spec.
(1) Training	As per CMRL ARE02A Contract	
(2) Printed Circuit Boards (PCB) Details	As per ARE02A Contract	ERTS 19.55
(3) Microprocessor Details	As per ARE02A Contract	ERTS 19.57
(4) Deliverables for CMRL ARE02A project	As per ARE02A Contract	
(5) SIL2 Certification and certificate submission for Fire Detection system	As per ARE02A Contract	
(6) Various required Software (complete package including Operation & Maintenance (O&M) Manuals, source code)	As per ARE02A Contract	ERTS 19 & ERTS 20

Table 2: Scope of Supply / Scope of Work - Project Deliverables, Training & Manuals)

Sl. No.	EQUIPMENT	Quantity		
		DMC	TC	DMC
1	Spares, Special tools & Consumables for maintenance during Comprehensive Maintenance period	As per ARE02A Contract		

Table 3: Scope of Supply / Scope of Work- Comprehensive Maintenance Period

Sl. No.	EQUIPMENT	DMC	TC	DMC
1	First Article Inspection (FAI), Equipment type test, documentation for design documents	As defined in PTS		
2	Vehicle level Testing & Commissioning for static. dynamic type & routine tests at factory, nominated depots & mainline	For 3 Trainsets		
3	Equipment's required for Type test / routine test at BEML factory / depot / Mainline.	Necessary equipment's need to be arran ged by APS subcontractor.		

Table 4: Scope of Supply / Scope of Work - NRC, Type test and Testing & Commissioning activites at respective depots

NOTE:

(i) Final quantity & type of detectors for applicable enclosures will be finalized during design stage with CMRL approval.

(ii) The above type and quantity (Table 1) of equipment can be modified by the proposal of

Subcontractor as per the design offered

(iii) The number of smoke/heat detectors (multi sensor) & heat detector (HD) and their exact location may vary and shall be finalized during design stage.

(iv) The length of LHD cable and the exact location may vary and shall be finalized during the design stage. The length of LHD cable shall be selected in order to meet the design requirement.

(v) Any addition electrical components needed to meet FDS design requirement shall be supplied and are in scope of FDS supplier.

(vi) Final decision on use of LHD / Heat detector in Underframe Electrical enclosures will be taken during design stage.

(i) Any design changes of equipment arise during proto-train review, shall be reflected to mass production of the equipment.

(ii) Alarm hooter / Beacons shall be provided in train at a suitable location as well as in and RSC consoles of OCC, BCC & DCCs. The Contractor shall provide necessary diagnostic tools (software, hardware, etc.) in order to identify failures immediately. The details shall display the actual location of the incident.

8.2. Deliverables

The subcontractor shall submit BEML all necessary documents and deliverables such as the detailed drawings, specification, calculations, back-up data, plan, procedure, reports, co-ordination & interface information which possibly affects performance, fitting for approval to the schedule accepted by BEML

i. Preliminary Design Review (PDR)

The Preliminary Design Review (PDR) shall include as following, but not limited to:

a) Technical description of Fire detection System

ii. Pre-Final Design Review (PFDR)

The Pre-Final Design Review (PFDR) shall include as following, but not be limited to:

a) Technical description of Fire detection System
b) Drawings of all aggregates of Fire Detection System.
c) Electrical Specification of Fire detection System
d) Electrical schematic of Fire detection System
e) TCMS interface specification of Fire detection System

iii. Final Design Review (FDR).

The Final Design Review (FDR) shall include as following, but not be limited to:

a) Test plan
b) Equipment level type & routine test procedure
c) Equipment level type & routine test report.
d) Vehicle performance test procedure

8.3. Technical Requirement of Fire Detection System

The system requirements & general requirements for Fire Detection System shall meet, but not be limited to, the following sections in ERTS-RS

- ERTS Section – VI A Chapter 1: System Description
- ERTS Section – VI A Chapter 2 System Requirements
- ERTS Section – VI A Chapter 3 Vehicle Body
- ERTS Section – VI A Chapter 5 Emergency Operator's Desk
- ERTS Section – VI A Chapter 7 Ventilation and Air-Conditioning
- ERTS Section – VI A Chapter 9 Auxiliary Supply Electrical Equipment
- ERTS Section – VI A Chapter 10 HV and Propulsion System
- ERTS Section – VI A Chapter 14 Train Control Management System
- ERTS Section – VI A Chapter 15 System Support
- ERTS Section – VI A Chapter 18 Systems Assurance
- ERTS Section – VI A Chapter 19 Materials and Workmanship
- ERTS Section – VI A Chapter 20 Software Management Requirements
- ERTS Section – VI Appendix A Abbreviations
- ERTS Section – VI Appendix B International Standards
- ERTS Section – VI Appendix C Interfaces
- ERTS Section – VI Appendix D Guidelines and Drawings
- ERTS Section – VI Appendix G Documentation and CAD Drawing Requirements
- ERTS Section – VI Appendix H Deliverables List
- ERTS Section – VI Appendix I Train Withdrawal Scenarios For 3-Car Trains

Subcontractor shall submit the clause-by-clause compliance for the above chapters of ERTS

8.3.1. System requirements:

The proposed Fire Detection System shall meet the requirement of following clauses of ERTS but not limited to:

ERTS 2.26.5: Smoke & Heat detection system

2.26.5.1 The fire detection system shall be able to detect any fire originating inside the cars, and also detect smoke coming inside cars emanating from outside including emergency driver desk and all electrical cabinets. The focus is on protection of passengers and staff in rolling stock. The objective shall be to detect incipient fires in an early stage to warn Train Operator / OCC. A fire event shall be detected early during the development phase; the affected area shall be located exactly by identifying which sensor(s) is actuated and further system's actions shall be activated without any delay. The fire / smoke detection system shall meet ARGE (German standard), or any other acceptable international fire standards, requirements. The correct functioning of the fire detection system shall be demonstrated by tests. Ventilation shall be provided depending on whether the fire / smoke has been detected inside or outside of the passenger saloon area.

ERTS 2.26.5.2: System Design Requirements shall consider the following aspects in the design but not limited to:

a) Proven methodology in metro railways application shall be used for the fire detection system shall consist of dual smoke and heat detectors (multi-sensors) or individual heat & smoke detector in passenger area (6 to 8 nos./sets per car may be provided), Linear Heat Detectors (LHD) in all technical cabinet areas (cabinet/ enclosures / cubicles), Heat Detectors in fire prone equipment, integrated with Fire Detection & Control Unit (FDCU). The FDCU shall interface with TCMS in a redundant manner. The interface of the system shall be suitably ensured with the overall system integration and GoA4 requirements.

b) All events (alarms, faults etc.) shall be recorded in TCMS and shall be retrievable for analyzing any issue.

c) The system shall provide a dynamic two detector dependency (smoke and/or heat) in the passenger areas along with provision of drift compensation in order to decrease the risk of false, or unwanted alarm.

d) Alarm hooter / Beacons shall be provided in train at a suitable location as well as in and RSC consoles of OCC, BCC & DCCs. The Contractor shall provide necessary diagnostic tools (software, hardware, etc.) in order to identify failures immediately. The details shall display the actual location of the incident.

e) Complete system should be SIL2 compliant. Any change in SIL level shall be subject to the hazard analysis and acceptance or otherwise of the same by the CMRL whose decision shall be final and binding. The system shall be designed

and tested for polluted environmental condition of Chennai. Any failure / maloperation on account of environmental conditions is not acceptable.

f) Quick detection; EN54 shall be complied for validation.

g) Positioning and number of detectors shall consider size and design of passenger saloon, VAC design and other operational aspects like door opening at stations etc. ARGE guidelines for fire detection in rolling stock application or similar shall be used for real scale smoke test to certify the layout of smoke detection system.

h) Robust design to avoid false alarm.

i) Complying to GoA4 requirements

j) The relevant requirements in EN45545, EN 50533, EN50126 & EN50128 shall be complied.

ERTS 2.26.5.3: Fire Detectors (Smoke & Heat Detectors) for passenger area:

Minimum 6~8 nos. of Smoke & Heat detectors (multi-sensors) or 6~8 pairs of individual heat & smoke detectors shall be installed in passenger area of each car. The sensitivity and response of smoke / heat detectors shall fulfil the requirements of ARGE guidelines. The actuating temperature of heat detector shall be settable according to the international norms and standards.

ERTS 2.26.5.4: Linear Heat Detectors (LHD) for Enclosures / Cubicles:

A linear heat detector, suitable for Rolling Stock applications shall be provided in all Enclosures / cubicles for review and approval by CMRL. The linear heat detector is to be actuated in case of any fire / overheating in the electrical cabinets.
LHD system shall also be provided in Underframe and Roof Enclosures / cabinets as mentioned in different chapters of this document. However, final decision on use of LHD / Heat detector in Underframe Electrical enclosures will be taken during design stage.

ERTS 2.26.5.5:

Provision for bypassing any faulty / malfunctioning detector is required and the proposal shall be made during PFDR stage for review and approval by CMRL.

ERTS 2.26.5.6

The number of smoke / heat detectors, LHD and their exact location may vary and shall be finalized during design stage.

ERTS 2.26.5.7

Functioning Controlling, Monitoring, Reset of smoke and heat detection system shall be integrated with the TCMS and the same shall be available from OCC / BCC / DCC.

ERTS 2.26.5.8

Provision shall be available to avoid false alarm and bypass the fire detection control unit though TCMS / OCC in UTO / Non UTO modes of Operations.

ERTS – DM&P 1.4 : INSTALLATION, INSPECTION, TESTING & COMMISSIONING

The aim of these tests is to prove functionality and positioning of smoke and heat detectors in passenger areas and heat detectors/LHD in electric cabinets (enclosures/cubicles). The tests shall conform to the requirements of the ARGE Guideline (Part-1 for "Fire detection in Rolling Stock" and Part-3 for "System functionality fire detection & fire fighting in Rolling Stock") or any other applicable international standard.

Type tests shall be conducted for the following:
(i) Dual Smoke and Heat detectors (multi-sensors),
(ii) Heat Detectors,
(iii) Linear Heat Detectors (LHD).

ERTS 7.4.8.7:

In case of false alarm of smoke detection, Provision shall be available to bypass the smoke detectors though TCMS, RSC consoles of OCC, BCC & DCCs.

ERTS 7.4.8.8:

Location of the smoke detectors and the logic and operation of smoke signal activation shall be designed in such a way that possibility of false alarm is avoided. Full details of the system proposed shall be given by the Contractor during design stage.

ERTS 7.7.19 (f):

Heat detectors / temperature sensors shall be used and integrated to TCMS / Fire Detection Control Unit for real time monitoring of all connections of the VAC cables

ERTS 9.4.10:

Smoke detectors / Heat detectors / LHD / other better heat detection systems shall be provided inside the Auxiliary Converter Inverter boxes, battery charger and in battery control box. The status shall be linked to TCMS and communicated to RSC consoles of OCC, BCC & DCCs as

Audio and Visual Alarms. Smoke and Heat detection system referred in ERTS clause 2.26 shall be complied.

8.3.2. Fire Detection for Propulsion Equipment's:

For below ERTS clauses Fire/smoke detectors (Heat Detectors/LHD) are installed in propulsion equipments (Main Transformer, SIV, Battery charger, Converter/ Inverter, Traction Motor (TM), etc) by propulsion contractor and these detectors shall link with Fire Detection & control unit (FDCU) for monitoring the status.

The subcontractor shall interface suitably with propulsion contractor for above requirement.

ERTS 10.8.9 (g): Heat detectors / LHD on low voltage / high voltage terminal boxes linked to TCMS / fire detection & control unit (refer clause 2.26) so that their status is monitored. The above information shall be logged in TCMS and shall be transmitted to RSC consoles of OCC, BCC & DCC.

ERTS 10.12.9 : Redundant Temperature / Heat sensor / LHD location shall be in proximity of IGBTs and shall be linked to TCMS / Fire Detection & Control Unit (refer clause 2.26) so that their status is monitored.

ERTS 10.13.27 : Each traction motor shall be provided with redundant thermistor for determination of temperature of stator winding. It should be possible to replace the thermistors in the depot without lifting the car. Traction motor terminal boxes shall be provided with heat-detectors / LHD linked to TCMS / fire detection & control unit (refer clause 2.26) so that their status is monitored.

8.3.3. TCMS communication Interface

ERTS 14.3.1: TCMS shall schedule, initiate and control data acquisition, processing and analysis by interfacing with Fire Detection System.

ERTS 14.7.4.1: Fault Detection
Degraded performance condition monitoring shall be provided as an integral part of TCMS wherein on-board CPU shall process the inputs from on-board subsystems and be able to determine car level, unit level or train level faults based upon the defined fault parameters/ detection logic.

Data Communication Link & Network Communication technology shall have the below features (ERTS 14.2.1)

a) The network communication technology to be adopted for all TCMS data communication links and subsystem communication interfaces shall be based on Ethernet (100 Base TX or better) or latest better service-proven network technology.

b) EMI Immune
Train networks shall be proven train data communication links that are immune to EMI / EMC and harmonics generated by traction equipment or generated from external environment of train. Suitable physical bus interfaces, to ensure error-free and high-speed data transmission shall be provided.

ERTS 14.2.3 Ethernet Consist Network (ECN)

Ethernet Consist Network with dual-homing ladder-type topology or Ring Network type or latest better technology (compliant with IEC 61375-3-4) shall be adopted.

ERTS 14.2.4 Dual-Homing End Devices (ED)

All the End Devices shall support dual-homing type or any latest technology type of Ethernet connections to ECN via physically independent ports to increase system reliability and availability.
All digital and analogue Input / Output interfacing with TCMS (directly or via an interface unit) shall also be fully redundant. In any case, the Contractor shall maintain full system availability, in case of single point failure of any TCMS component or communication link, and the vehicle operation shall not be affected.

ERTS 14.3.3 Communication Protocol Details

The software and communication protocols used throughout the TCMS and the interfaces to subsystems shall be compliant to a common standard or standards. The Contractor shall submit details of the communication protocols used in their design clearly indicating how the requirements of monitoring and control are complied with. The Contractor shall also define the dual-homing compliant communication protocols for all EDs. Further details along with any hardware / software tools required shall be submitted during design stage.

Detailed requirement of protocol is defined in annexure-3 of PTS.

TCMS will interface with two FDUs in each DM car via Ethernet Network as shown in the below figure 1.

- FDU in DM car1 is connected to CN1 and another FDU in DM car6 is connected to CN2.

- FDUs communicate with each other using the FDU Network to be provided and / or determined by the FDU supplier.

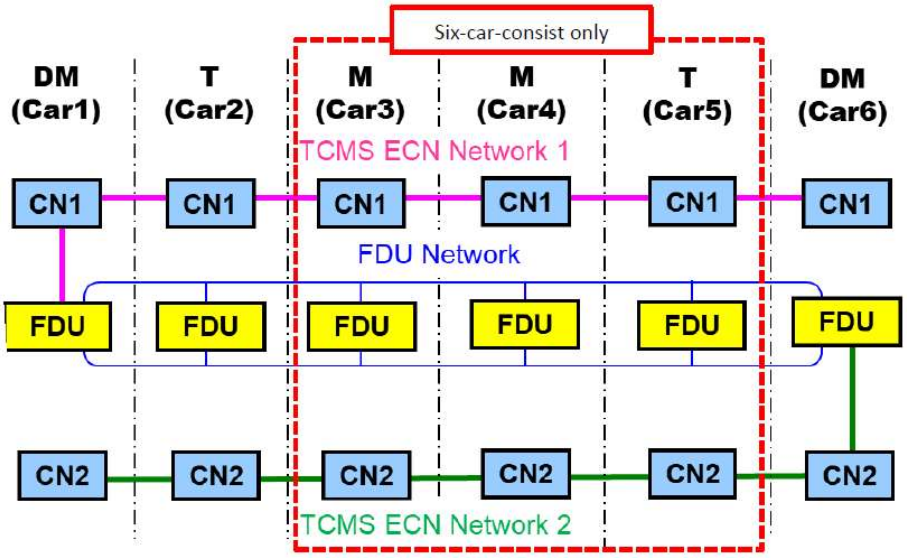

Figure 1: Network Interfaced System Configuration

Table 3: System Interface Detailed Information

S. No.	Contents	Description
1	System Name	Fire Detection Unit System
2	Numbers of Device connected with TCMS	2 units (1 unit per each DM-Car)
3	Transmission Protocol	Ethernet
4	Transmission Speed	100Mbps Ethernet based 100BASE-TX (IEC 61375-3-4:2014)

Safety Data Transmission:

FDS system shall have capability to have facility of data transmission between TCMS using safety data communication as per requirement defined in safety data Transmission protocol specification (Annexure-3 of PTS). Version of safety data transmission protocol shall be discussed during the design stage.

Clock Synchronization (ERTS 14.3.5)

TCMS shall synchronize its clock with the system master clock through STC Contractor interface. All the microprocessor / microcontroller based on-board systems shall synchronize respective clocks with TCMS clock. The event and fault logging of the respective sub-systems of train shall always be in-line with the TCMS clock in all the UTO, Non-UTO and other degraded modes of train operation. Detailed clock synchronisation proposal shall be submitted for CMRL approval.

Fire Detection system shall interface with TCMS in a redundant manner. The interface of the system shall be suitably ensured with overall system integration and GoA4 requirement.

All the major events (alarm, fault etc.) shall be recorded in TCMS and shall be retrievable on maintenance terminal for analyzing any issue.

List of Operator Control Functions (ERTS 14.4.5)
Remote Control features of train available from the OCC, BCC and from the DCC's control via remote operation shall include, but not be limited to, the following (These features shall be available in all UTO and Non-UTO modes of operation).

- Resetting of minor faults in sub-systems.

In addition to Ethernet interface, hard wire communication through potential free relay contact is also required between Fire Detection System & TCMS.
Sufficient nos. of programmable relay (Min. 2 nos.) shall be provided in FDS control unit for TCMS hardwired interface.

The following is a brief of requirement for communication interface

- Control circuit logic shall permit testing and monitoring of the operation.
- Carrying out self-test to ensure the integrity of the equipment **(ERTS 14.4.9)**
- The status and fault information shall be transmitted and recorded to TCMS

ERTS 14.6.2 Subsystem Self-Diagnostic Tests

All the on-board microprocessor/ microcontroller-based subsystems shall also perform self diagnostic tests and report the detailed health status to TCMS, both automatically and on specific request (using DDU) by maintenance personnel.

ERTS 14.6.3 Self-Diagnostic Tests

14.6.3.1 The self-diagnostic tests shall assess and report the health of boards, sensors, memory, watchdog timers, inputs, outputs, bus connectivity, PCB level components status, software, firmware etc. Hardware and software shall be provided for self-diagnostic test of the critical system functions. Detection of a failure shall cause an indication to be displayed on the DDU.

14.6.3.2 The complete scheme of self-diagnostic tests of TCMS and sub systems shall be developed for the purpose of deep dive checking of system's health by maintenance personnel through DDU as well as for UTO when these tests are performed by the TCMS after receiving remote "wake-up" from ATC. Details to be submitted for review of CMRL.

14.6.4 Software / Firmware Versioning
Time stamping of date of software(s) / firmware(s) as well as version of software(s) used in different sub-systems of the train and their compatibility shall be ensured by TCMS. The details of version of software(s) / firmware(s) used in different sub-systems with time of uploading shall be displayed at the TCMS at the time of Power Up (wake-up). The system shall not permit loading of incompatible software(s). Manual override in certain cases can be permitted by CMRL, details to be finalized during design stage.

14.6.5 Feature of self-check and calibration shall be incorporated in the design. Details of the self-diagnostic features shall be submitted during design stage for CMRL review and approval.

DESIGN CONFORMANCE TESTING (ERTS 7.5.4.8.16)
Fire, Smoke & Heat detection verification testing

All the requirements of clause 2.26 regarding fire, smoke and heat detection systems installed in all sub-systems of train shall be verified for conformance.

ERTS Appendix C - Interfaces

2.4.44 RS and STC Contractors shall interface to ensure that at least but not limited to following emergency / Operational conditions should result in the event-based auto popup of CCTV images of a camera or a predefined set of cameras via CCTV network on OCC, BCC, DCC & SCR (within one station vicinity of the train on either ends). The detail implementation shall be finalized during interface with the approval of CMRL. The utilization of bandwidth of CCTV network shall be managed dynamically.

e) Fire/Smoke Detection inside or outside the train.

2.9.2 Remote Control from OCC in ATS work-station: The Signalling and Train Control Contractor and Rolling Stock Contractor shall coordinate to allow the following functions, as a minimum, to be performed remotely from OCC in ATS work-station under UTO mode but not limited to the following functions. CMRL shall request a few other operational requirements during the project execution stage

d) Smoke Alarm Reset

ERTS APPENDIX – I: TRAIN WITHDRAWAL SCENARIOS FOR 3-CAR TRAINS

S. No.	System name	Withdrawal Condition
39	Fire system	≥ 2 in one car fire detector failure - Failure of fire control unit including its backup

8.3.4. General Technical requirement:

8.3.4.1. The proposed architecture for Fire detection system shall be proven as per PTS clause 8. The smoke & heat detectors shall be addressable type independently and no additional component shall be required to make it addressable.

8.3.4.2. The Contractor shall ensure that the system shall not be affected in single point failure. There should not be any detector communication loss at train level during single point failure.

8.3.4.3. Smoke & Heat detector (SHD) will be installed in side coving area of saloon. Subcontractor has to provide the simulation/analysis for SHD layout in each type of car so that it will fulfill the ARGE requirement.

8.3.4.4. Subcontractor shall ensure that the requirements of ARGE Guideline Part 1 and Part 3 are to be fully met in proposed fire detection system.

8.3.4.5. Testing tool/provision for checking sensitivity of detectors (in fitted condition) shall be provided.

8.3.4.6. Proposed Fire Detection System has ensured to perform its function, after fire detection and triggering of the fire control system, which shall happen within few seconds as per applicable international standards.

8.3.4.7. During Neutral section Opening/Closing, Fire Detection System functionality will not be affected/ disturbed.

8.3.4.8. Selection of LHD/Heat detector/Multi-sensor (S&H) at applicable/appropriate location will be finalized during design stage based on taking consideration of feasibility and other constraints with review of Fire consultant/ CMRL.

8.3.4.9. The subcontractor shall fully meet the requirement of ERTS-RS and ERTS-CMC & DP&M for the proposed Fire Detection system for ARE02A contract.

8.3.4.10. The Fire Detection system shall fully meet the requirement of EMI/EMC as per ERTS 10.19

8.3.4.11. The subcontractor shall comply with the RAMS requirements as specified in ERTS 18.

8.3.4.12. Fire Detection system shall have its own data terminal port for fault downloading / software uploading (Including application software/firmware) both at Fire Detection system and TCMS for single point downloading/uploading as per ERTS 14.9 & 14.10.

8.3.4.13. The Fire Detection system shall have provision of single point downloading the data log stored in the internal memory using TCMS interface as per ERTS 14.9.

8.3.4.14. All the software(s) used in train, diagnostics, monitoring or analysis purpose shall be compatible with latest Windows version and upgradable for higher versions of Windows as per ERTS 14.9.6.

8.3.4.15. The sub-contractor shall be fully responsible for integrated testing and commissioning including Commissioning Type tests and Commissioning Routine tests of the Fire Detection system at BEML works (Factory test) and at CMRL site (Depot & Main line tests) for 3-car trainset. Software should be compatible for testing of 3 car set configuration without any problem.

8.3.4.16. The sub-contractor shall provide all the documents for ARE02A project and shall also provide any other documents required by CMRL as per ERTS-RS and ERTS-CMC.

a) Design documents – Preliminary, Pre-final & Final.

b) Description of Fire Protection system with drawings.

c) Quality assurance plan (QAP)

d) Software quality assurance plan (SQAP)

e) Type test procedure for Fire Detection system and aggregates

f) Routine test procedure for Fire Detection system and aggregates

g) Inspection and test plan (ITP)

h) Factory tests, Depot tests and main line test procedures

i) Testing and commissioning plan

j) Interface plan

k) Type test and Routine test reports

l) Operation and maintenance manual

m) Spare parts catalogue

n) Special tools & Testing equipment

o) Any other documents requested by BEML/CMRL.

8.3.4.17. The sub-contractor shall provide valid type test certificates/documents and routine test certificates/documents for the Fire detection system aggregates.

8.3.4.18. The sub-contractor shall provide training in operation and maintenance to BEML and CMRL staff.

8.3.4.19. Only 110V D.C. (+25%, -30%) would be made available on train for control power supply of Fire Detection system. The Fire Detection system shall continue to operate correctly with the 110 V DC car battery voltage supply as per ERTS 9.3.4

8.3.4.20. If the Fire detection system operates on 24V then sub-contractor has to provide the DC-DC converter of sufficient quantity as per the requirement.

8.3.4.21. ERTS 19.51 & 19.52: All relays/MCBs/equipment etc. shall be suitably de-rated for specific temperature including the proximity effect.

8.3.4.22. Component Identification (ERTS-RS 16.11.7)

All assemblies, subassemblies, and components shall have an identification label placed in a location that is easily viewable by maintenance personnel. These labels shall be of metallic type and shall not be deteriorated during the usage. The label shall contain:

a. Equipment/component ID or Name
b. Part number (OEM and the Contractor, where applicable)
c. Serial number (where applicable)

Labels of permanent nature shall be provided on supports of all switches, fuses, contactors, relays and other electrical component for easy identification.

8.3.4.23. All the stainless-steel items / enclosures shall be at least of grade SUS 316

8.3.4.24. Proposed Fire Detection system shall comply to EN45545-6 requirements.

8.3.4.25. ERTS 2.18.11.1 & 19.54**:** All electrical and electronic equipment on board the Rolling Stock shall be immune to any radiated electromagnetic energy produced by other pieces of Rolling Stock equipment and external sources as required by EN 50121-3.

Dry heat test: The dry heat test shall be conducted for class T3 and temperature shall be considered 80°C against 70oC specified in IEC/EN. An extra performance check at 95°C shall also be carried out for 10 minutes over temperature value. LCD / LED display units may be tested at 70°C and an extra performance check at 85°C shall also be carried out for 10 minutes over temperature value

8.3.4.26. ERTS 19.54.3**:** Following tests shall also be carried out on control electronics PCBs:

i) Cyclic Humidity tests (IEC 60571)

ii) Dust and sand test & Mould growth tests: The tests shall be done as per IEC60068 & IEC 60721. The dust settlement rate shall be taken as 6gm/m2/day and dust particle size shall not be larger than 100 microns.

8.3.4.27. ERTS 20.6.1 Software requirement:

a) The Contractor and any Subcontractor(s) providing train subsystem which include software scope shall follow the relevant guidelines, principles and processes of ISO 9001, ISO 9000-3, EN 50128 and any other applicable standards throughout the project period. It is clarified, however, that ISO 9001 certification shall form part of validation (which will be applicable at FDR stage).

b) The Contractor shall produce a Software Safety Plan that indicates, according to both the SwSIL and SwDS, which software safety techniques and studies will be implemented to meet the Project's Safety Targets. As per EN 50128, SwSIL1 shall be processed as SwSIL2 and SwSIL3 shall be processed as SwSIL4.

These two plans shall follow the following pattern, this table shows that the Contractor shall put a 'Very High' level of development into a New SwSIL4 software when a 'Fair' level of development will be sufficient for a SwSIL0 software, whatever its SwDS.
SwSIL0 software, whatever its SwDS.

	Proprietary	**Modified**	**New**
SwSIL0	Fair	Fair	Fair
SwSIL2	Medium	Medium	Medium
SwSIL4	High	High	Very High

It is important to highlight that only the higher SwSIL (SwSIL4) justifies a graduation of the development effort according to the SwDS, See below:
i. For SwSIL0 and SwSIL2 software, which has none or an indirect impact on safety, the tasks comprising their V-cycle will require justification. Therefore, it is not economical to distinguish between the various SwDS. In terms of tests for example, these software will all be processed as New software,
ii. For SwSIL4 software, which has a direct impact on safety, the tasks comprising their V-cycle require an important amount of justification. Therefore, it becomes economical to distinguish between the various SwDS. In terms of tests for example, Proprietary software will be re- tested, a Modified software will be tested on its relevant parts only and a New software will be thoroughly

tested.

8.3.5. Others.

In the event of any additional requirement of component/aggregate required for smooth operation of the Fire detection system the same shall be provided by the subcontractor.

The subcontractor shall provide valid type test certificates/documents and routine test certificates for the Fire detection system aggregates.

The subcontractor shall be fully responsible for integrated testing and commissioning of the Fire detection system and **software must support for 3 cars trainsets configuration** at BEML works and at CMRL site.

The subcontractor shall be responsible for interfacing with all other aggregate suppliers for integrating the system.

If the delayed submission of interface documents causes the delay of delivery schedule or cost effect for the project, the responsible party for the delayed submission shall take full responsibility for it.

BEML and the subcontractor will comply with and be responsible for the interface requirement and develop the interface specification on his scope of supply.

The subcontractor shall share complete details of fire detection system with the 3rd party fire consultant nominated by BEML for evaluation & certification of the FDS system.

The subcontractor shall be responsible to maintain the required spares at CMRL site during DLP & DLMP period. The list of spares shall be furnished by the subcontractor for review and approval by BEML/CMRL.

The subcontractor shall provide relevant hardware such as bolts, nuts, washers and other fasteners required for the installation.

The subcontractor shall provide following documents and shall also provide any other documents required by BEML/ CMRL.

a) Description of Fire detection system aggregates with drawings.

b) Quality assurance plan (QAP)

c) Software quality assurance plan (SQAP)

d) Type test procedure for the Fire detection system and aggregates

e) Routine test procedure for Fire detection system and aggregates

f) EMI/EMC test procedure & plan

g) Factory tests, Depot tests and main line test procedures

h) Testing and commissioning plan

i) Type test and Routine test reports

j) Operation and maintenance manual

k) Spare parts catalog

The subcontractor shall provide training in operation and maintenance to BEML and CMRL staff.

All drawings, documents and information by Subcontractor shall be prepared in English and submitted to BEML/CMRL for approval.

8.4. Split of Responsibilities

When subcontractor submits the design submission, BEML will complete the review of the design package at the intermediate and each design levels after which the review comments in writing or on marked-up drawing and specification will be furnished to the subcontractor within 2 weeks. If the design submission is acceptable to BEML, it will be submitted to end user for approval and it will be reviewed by them for 4 weeks. Subcontractor shall re-submit the revised document incorporating end-clients comments issued during first review within 2 weeks, if any. Subcontractor shall supply requested documents / drawings during approval process within 1-2 weeks from each request. Subcontractor must establish the project schedule (including design completion schedule) by considering this review turnaround time.

In the event that the submission is rejected the subcontractor shall improve the design to the acceptable completion level and resubmit it for review within 1-2 weeks. Any adjustment in design activities to recover the lost time due to the resubmission shall be the full responsibility of the subcontractor and shall submit the catch-up plan for no schedule impact.

Upon receipt of the review comments, the subcontractor shall resubmit the updated documents and drawings, if required these documents must be supported through other calculation / drawings document. Each re-submission shall be enclosed with response sheet format of response sheet will be advised by BEML during the design review process. For avoidance of doubt, in any case reply of subcontractor along with revised documents incorporating end-client request shall be submitted not later than 2 weeks.

The subcontractor shall be responsible for meeting the requirement of constructional details, material, and workmanship. All materials and workmanship shall be in every respect in accordance with the proven up-to date best practice.

The subcontractor should take whole responsibility for occurring liquidated damage due to delays with regard to design data submission, production, supply, design error and so on.

8.5. Interface

Fire Detection system has to interfaced mechanically and electrically with different subsystems such as car structure, interior, exterior & cab equipment layout arrangement, interior panels,

Vehicle Control Circuits, communication system, HVAC, TCMS etc., The subcontractor must participate in the interface meeting/workshops in order to discuss and finalize the interface issues to the satisfaction of BEML/Engineer and shall be implemented in the system design.

8.5.1. Mechanical Interface

The location of the mounting points and the design of equipment installation comprising of the Fire Detection system shall be defined by the Subcontractor and approved by BEML in order to avoid the mechanical interference with other equipment for the vehicle.

Subcontractor shall be responsible for confirming the mounting method and providing all materials for mounting the Fire Detection system as specified in the drawings. BEML shall be responsible for defining the technical and the design constraints and the technical requirements. The Subcontractor shall be responsible for the optimum design of the Fire Detection system, the submission of design information (drawings, technical documents and 3-dimensional modeling data) and the execution of test & inspection in a timely manner without any delay. Any changes of Fire Detection system design shall be submitted in a timely manner for approval. The Subcontractor shall have full responsibility to declare and clarify if there is any required information or data from vehicle side and/or running/operating conditions to prevent any design defect under revenue service in the main line.

The Subcontractor shall be responsible for all costs of labor and material, for defect identification and location, and for removal, repair or replacement of defective parts, and for alteration, repairs, tests and adjustments in connection therewith made to fully comply with the requirement in PTS, TS, GS and Contract Specification, All such replaced or repaired shall be guaranteed for the reminder of the warranty period.

The following is a brief of requirements for Mechanical Interface

• Outline dimension.

• Electrical connection position.

• Fastening, point & torque.

• Demands, free space for installation and maintenance of cover.

• Weight and center of gravity.

• Earth position, size and type

• Thickness of flitting frame & Size and distance dimension of fitting hole.

8.5.2. Electrical Interface

The subcontractor shall provide the interface specification between Vehicle equipment, TCMS.

Time to time BEML will facilitate direct face to face meeting between other sub-supplier either at sub-contractors works, BEML works, and another sub-supplier works or at Employer place. Subcontractor is responsible to resolve the interface issues to achieve the ERTS requirement.

The following is a brief of requirements for Electrical Interface

• Power requirements.

• Technical specification.

• Rated current, voltage characteristic and consumption.

• Cable specification (Power, control and grounding).

• Connector (male and female) with pin and socket part no.

• Signal input/output list and interface specification.

• Connector/terminal arrangement

• Cable inlet/outlet diagram. (Size for cable gland of holes)

• Electrical schematics of fire detection system

The following is a brief of the requirements for TCMS.

- Control circuit logic shall permit testing and monitoring of the operation
- Carrying out self-tests to ensure the integrity of equipment
- The status and fault information shall be transmitted and recorded in TCMS.

8.5.3. Interface Responsibilities

The location of mounting points and the design of equipment installation comprising of the Fire Detection system shall be defined by the Subcontractor and approved by BEML in order to avoid the mechanical interference with other equipment for the vehicle. The Subcontractor shall be responsible for the equipment and material to be supplied and recommended installation method and procedures.

BEML shall be responsible for defining the technical requirements and the design constraints.

The Subcontractor shall be responsible for the design of the Fire Detection system and the submission of design information and the performance of testing activities and the supply, installation and commissioning of Fire Detection system and the maintenance and rectification of the Fire Detection system during the defects liability period, etc. The Subcontractor shall be responsible for the hardware interface required by BEML. The Subcontractor shall be responsible of deputing his engineer to BEML for the technical meeting.

The Subcontractor shall be responsible for interface with TCMS and other sub-system and the subcontractor shall meet the communication protocol requirements of the leader of interface design in accordance with the interface document requirements for Fire Detection system.

Interface with TCMS shall be Ethernet based communication system and shall be compliant to a common standard or standards as per ERTS 14.3.3 & 14.2.1.

The sub-contractor shall meet the requirements but not be limited to ERTS Chapter 14 with regard to TCMS interface.

Finalization of ICD for complete system covering all aspects of Engineer's Requirement, Operating principle including OCC/BCC etc. shall be in the scope of work of sub-contractor.

Following 110V/24V DC hardwire SIL2 digital output shall be provided though potential free contacts in redundant manner to train side as minimum for Fire detection system.

(i) "FIRE DETECT" train line to TCMS & HVAC.

(ii) "FAULT ALARM" to TCMS.

(iii) Vital Alarm of "FIRE DETECT" to ATC.

Supplier shall provide parallel interface through dry contact with TCMS for indication of fault in Fire Detection system.

Supplier shall provide provision of bypassing the FDCU unit, individual detector etc. through TCMS.

8.6. Design

The objective of the design submission process is to ensure that the proposed resulting works comply with the specifications, are capable of being produced consistently to exacting quality standards, achieve low life cycle costs and can be operated safely to the satisfaction of the Engineer.

The design submissions include Design Calculations, Design Reports and Design Drawings. All design submissions shall include a 'clause by clause' compliance status to all applicable contract clauses of ERTS.

In the event that a statutory body (e.g. Government of India Ministry of Railways, RDSO, Commissioner of Metro Railway Safety, etc.) requires design information in a particular format, it shall be incumbent upon the subcontractor to provide the same, as directed by BEML/ CMRL.

The subcontractor shall submit all necessary documents viz., documents and drawings describing function description, product description, design calculations, interface requirement description, RAM requirement description, Life cycle calculations, Fire safety, Type & routine test specifications, list and details of spares, related calculations etc.

The Design Phase will be undertaken in three stages:

a) Preliminary Design
b) Pre-final Design and
c) Final Design.

Sl. No	Description of Stage	Submission from subcontractor to BEML (from LOI / contract award)
1	Preliminary design completion(PDR)	2 weeks
2	Pre final design completion(PFDR)	4 weeks

3	Final design completion(FDR)	12 weeks

The design details for the above 3 stages shall comply with the requirements of Section VI A: ERTS – RS – Appendix H but not limit to, the following design deliverables to BEML according to the time schedule defined by BEML.

8.7. Operation and Maintenance Manuals and Spare Parts Catalogues

The Subcontractor shall provide the operation/maintenance/ spare parts manuals and spare part s catalogues for the Fire Detection system aggregates both in the hard copies and electronic for mat (editable copy of word document in BEML provided template) as required in ERTS-RS chapter 15 and appendix G. The subcontractor shall provide the following O & M manual:

a) Volume 1 – Technical Manual
b) Volume 2 – Operation Manual
c) Volume 3 – Maintenance Manual
d) Volume 4 – Fault Diagnostics Manual
e) Volume 5 – Spare Parts Manual
f) Volume 6 – Software Manual
g) Volume 7 – Special Tools & Test Equipment Manual
h) Volume 8 – OEM manuals

The subcontractor shall provide the operation/maintenance manuals and spare parts catalogues to BEML for approval of CMRL according to the time schedule defined by BEML.

Failure to submit the deliverables in time by subcontractor may attract Liquidated damage as defined in GTC.

Submissions
The Supplier shall submit the draft of all manuals to BEML for approval of CMRL/BEML. The final manuals shall be provided after duly incorporating the changes indicated.

8.8. Spares, Special Tools and Testing Equipment:

The subcontractor shall hand over the spares, special tools and testing equipment in accordance with the delivery schedule of BEML. The supplier shall maintain the Fire Detection system aggregates and supply of spares for at least 20 years from the last date of taking over of whole of Works. The sub-contractor shall comply the requirements specified in ERTS Section IV C – Comprehensive maintenance contract (CMC) requirements.

Throughout the CMC period, the sub-contractor shall always maintain sufficient stock of all Spares and Consumables to the full extent necessary to fulfil all the obligations of the CMC scope and in compliance with the inventory requirements defined in ERTS section IV C Clause 1.5.12.

Spares and Consumables (herein referred to only as Spares) shall include but shall not be limited

to the following subcategories, as applicable to both Rolling Stock and Depot Machinery & Plant (including CMV) assets,

a) Unit exchange spares
b) Mandatory spares
c) Recommended spares
d) Consumable spares
e) Special Tools, Jig, Fixtures, Gauges, Testing and Diagnostic Equipment
f) Overhauling Spares
g) Any other items required for maintenance (identified by the sub-contractor / BEML / CMRL / OEM).

One set of special tools, jigs, measuring devices, HMI, etc., to be considered as per OEM recommendations.

This particular clause for spares requirement supersedes the ERTS terms and condition for the CMC.

The list of the above spares, consumables, special tools, special equipment and ordinary tools/equipment shall be as per the agreed design in train configuration and recommendation indicated in the OEM O&M Manuals.

8.8.1 Commissioning and DLP/DNP Spares

The Contractor shall submit to the Engineer for review a list of minimum spare parts that he intends to make available during the installation, erection, commissioning and defect liability periods.

Subcontractor shall submit to BEML for review and approval of BEML/CMRL a list of minimum spare parts that he intends to make available during the installation, commissioning and defect liability period. During DLP warranty period OEM's has to maintain the DLP spares at Chennai Depot.

The Subcontractor shall keep on site, at his own cost throughout the installation, commissioning and defect liability period, stocks of spare parts to enable rapid replacement of any item found to be defective or in any way in non-conformance with the specification.

OEM to give the storage procedure for the spares supplied at Depot. Any modifications carried out during DLP/Warranty period, also to be implemented in spares supplied under this contract.

8.9. Storage, Packing Crating and Marking

The Subcontractor shall be fully responsible for the provision and maintenance of acceptable storage facilities for the Plant and any materials or equipment he intends to use for the carrying out of the Works.

The Subcontractor shall prepare, protect and store in a manner to be accepted by the Engineer, all equipment and materials so as to safeguard them against loss or damage from repeated handling, from climatic influences and from all other hazards arising during shipment or storage

on or off the Site. Secure and covered storage shall be provided for all equipment and materials other than those accepted by the Engineer as suitable for open storage.
For detail information refers to ERTS section VI A chapter 18.5.

8.10. Materials and workmanship

The Subcontractor shall be responsible for meeting the requirement of constructional details, material, workmanship and cables. All materials and workmanship shall be in every respect in accordance with the proven up-to- date best practice.

The requirements for material and workmanship of Fire Detection system aggregates shall meet the requirements as per ERTS section VI A chapter 19.

8.11. Training

The subcontractor shall provide comprehensive training to the CMRL/ BEML Employer's staff (maintenance, operating, training and engineering) in accordance with the training activities and works for the Fire Detection system specified in ERTS Section VIA Chapter 15 shall be approved by BEML.
The subcontractor shall provide according to requirement of BEML and CMRL training schedule, time, method and site etc.

The subcontractor shall provide a training proposal, one original and five copies and electronics copies of the training manual for use by CMRL / BEML for conducting in-house training.

The detailed requirements are specified in ERTS Section VIA Chapter 15.
The Subcontractor shall provide the training materials (presentation, student guide, Instructor's guide) and training activity for the required days to assure that the Employer's staff is thoroughly trained in the operation, maintenance, and overhaul of the equipment supplied under this PTS.

The Subcontractor shall propose the required days for the supplied equipment for Operation and Maintenance staffs. Additionally the Subcontractor shall be quoted on daily basis for the further training course for Employer's staffs.

The subcontractor shall submit CV of instructor and training material of proposed training at least 6 weeks in advance of actual training schedule.

Subcontractor shall dispatch the trainer(s) to the end user works/depot and/or BEML's plant for based on the relevant duration of each training course.

The Subcontractor shall provide the training according to BEML's Training Plan for End user.

The Subcontractor shall provide, but not limited to, training materials (Hard copies & Electronic files), tools and equipment.

In addition to the training material, subcontractor shall provide computer based inter-active tutorial module. These interactive tutorials modules may include animation, videos, flash programs, etc.

Repair service training should provide the explanation and practical experience about the technical competence and operation of the system for the trainees who are responsible for troubleshooting and repairs.
Subcontractor should provide training program about operating and maintaining all the system devices provided. Training should be provided enough so that the corporate personnel may practice and learn how to use the operation, interface with other devices and testers.

The program should also contain the theoretical background and practical experiences for troubleshooting, repairing procedure and preventive maintenance to the trainees, who should be provided with the training about personally operating the systems and using testers/maintenance devices in case failing to troubleshoot.
Sub-contractor shall also submit training evaluation module.

The training material and the entire training program shall be approved by BEML.

Subcontractor shall propose necessary hours for each subject.

If End user or BEML request more training courses, subcontractor should provide them.

All expenses for trainings are to be borne by Subcontractor.

The Technical Documents and Training section, specification requires some very specific guidelines for the development of the technical documentation. These guidelines are but not limited to the following:
This section lists extensive requirements for the development and implementation of the training.

Specifies include;

- General Program Outline
- Instructor Manuals with Lesson Plans
- Participant Manuals
- Supplemental training materials
- Training aids
- Classroom attendance requirements

Specific Objectives for operating and maintenance personnel;

- Proficiency in operation, inspections, maintenance, servicing, troubleshooting and repair of cars to instruct and train other personnel
- Qualify individuals as Qualified Maintenance Person (QMP) or Qualified Person (QP) Daily and periodic inspections
- Understand and effectively use the technical documents developed
- Select, order and stock replacement parts

Course Categories

- Introduction and Familiarization
- Major systems and sub-systems

- Operation and fault isolation
- Fault isolation via TCMS/Hardware switches
- Servicing and maintenance
- Detail maintenance and fault isolation via TCMS/Hardware switches
- Special tools and test equipment

Personnel by function Maintenance

1. Field – daily inspections and running repairs
2. Electrical
3. Non-electrical
4. Shop – periodic inspection and heavy repair

Classroom and hands-on

- Sufficient time in both to do all diagnostics correct malfunction and use special tools

Instructor qualifications

- Fluent in English
- Experienced trainers
- Adult education techniques

Lesson Plans to include:

- Student prerequisites
- Safety, fault isolation and inspections up to 5 year level
- Time frames for each unit
- List of training aids and other training technology
- Set-up time and equipment lists for hands-on
- Safety, protective equipment, hazards
- Instructor preparation
- Student preparation
- Evaluations of students
- Lesson summary
- Student application of material
- Student assignments

Training Aids and Standards (all training aids and lesson plans become the property of End-User)

i. Manuals, catalogs, OEM's
ii. Fire Detection system compatible format (no overhead projections)
iii. Specifics – visual aids
    - Component locations, cutaways, schematics, wiring diagrams
    - Flow direction on hydraulic, pneumatic, air conditioning
    - Maintenance schedules, diagnostic process diagrams, special tolls usage, test equipment application
    - Engineer approval electronic medium for review

iv. Training aids list

- Test equipment considered training aids used to troubleshoot, diagnose, inspect, vehicle operation except meters, meggers, oscilloscopes, laptops)
- Actual mechanically-operable devices without dismantling – non-examples as diagrams, cut-away views.

v. Schematic wiring diagrams sectionalized – single line functional diagrams for each system and component

Classroom Instruction:

- Outlined in classroom and hands-on information
- Qualified instructors
- Field Instruction
- Instructor must be qualified
- All materials available and ready
- Access to cars per authority
- Participants must demonstrate competency

It is subcontractor's responsibility to provide sufficient support and information for obtaining No Objection Advice for Training pertaining to sub-supplier

Aggregates	**On job Training and supervision of Employer's maintenance personnel in the metro train depot of CMRL in India.** **Man Days (RSH5)**
<u>Fire Detection System</u> • Maintenance work instruction for Fire Detection System as per service check (A, B1, B2, B4, B8) based on kilometres/ periodicity, items to be inspected, equipment/ measuring instruments/ gauges, special tools, consumables, jigs and fixtures required for inspection and testing • Method for operation and testing of smoke detector and linear heat detector • Procedure for Cleaning smoke detector and linear heat detector • Procedure for replacement of Fire detection System including smoke detector and Linear heat detector • Software uploading, data downloading in FCU and analysing for troubleshooting • Troubleshooting of Fire detection system along with detailed action to be taken. • Required each card functionality details for analysis and troubleshooting • Condition Based monitoring and Predictive maintenance methodology of Fire Detection System. • Common/General types of Breakdowns and procedure to attend repairs. • Software maintenance and methodology for any modification. • Any other item related to maintenance	24

9. Comprehensive Maintenance during DLMP period:

The details of Scope of Supply (SOS) & Scope of work (SOW) related to Comprehensive Maintenance during DLMP are defined as a minimum at Annexure 1 and as per ERTS-RS and ERTS-CMC & DP&M.

Subcontractor shall provide material & support for comprehensive maintenance of Fire detection system during DLMP period along with required spares, special tools, testing and diagnostic equipment, jigs and fixtures for maintenance, repair and overhaul of Fire Detection system including the preventive and corrective activities performed to avoid failure of detectors due to contamination.

9.1. Comprehensive Maintenance Contract period

On Train maintenance is under BEML scope and OEM is required for special support which needs some technical review and discussion.
However, Test Bench facilities to be provided at Madhavaram depot for Fire Detection system for maintenance activity with Special Tools, Jigs, Fixtures, Gauges, Testing and Diagnostic Equipment, Mechanical & Electrical Measuring and Testing Equipment, and Electric Tools and any other items required for all types of maintenance activities carried out on Rolling Stock for Fire Detection system as per ERTS Part-2: Section VI C, CMC -RS & DMP.

9.2. Spares required during Comprehensive Maintenance Contract (CMC) period

List of Mandatory Spares required during CMC period to be supplied by the sub-contractor as per **Annexure-A**
During CMC period, list of mandatory spares to be positioned at the depot in scheduled manner and delivery schedule will be discussed and finalized during techno commercial discussion and the Mandatory spares to be placed at the depot after completion of DLP/DNP period as per **Annexure-A**

9.3. Warranty

1. Refer ERTS chapter 16 & related clauses of the tender, Notice Invitation Tender (NIT) and General Terms and Conditions (GTC).

2. Sub-contractor shall ensure minimum spare parts that he intends to make available during the installation, erection, commissioning and warranty period.
3. The sub-contractor shall keep on site, throughout the installation, erection, commissioning and warranty period, stocks of spare parts, to enable rapid replacement of any item found to be defective or in any way in nonconformance with the specification.

10. General Requirements

10.1. Weight

The subcontractor shall specify the following equipment weight.

Items	***Weight***
Fire Detection System	
(1) Fire Detection Control Unit (FDCU)	
(2) Heat & Smoke Detector Unit	
(3) Linear Heat Detector(LHD)	
(4) Alarm sounders / Beacons	
(5) Other items	

The weight of each component of Fire Detection System aggregates shall be verified and controlled by the subcontractor in accordance with the requirements specified in ERTS section VI A 2.12.

The Subcontractor shall comply with all weight reductions judged. Any unit exceeding the permissible weight shall be rejected. Overweight tolerance is not permitted.

The subcontractor shall submit the list which describes the exact weights of all equipment. The subcontractor shall maintain and publish a weight control document. The weight control document shall list the weight and center of gravity of all components with tolerances.

The actual measured weights shall not deviate by +/-4% of the estimated weights. Over weight tolerance is not permitted. Any unit exceeding the permissible weight shall be rejected. The weight of each component shall be verified and written in the weight control list as well as on each equipment drawing

10.2. Electrical Requirement

a) Load current for minimum switching of each switch, relay and contactor to sub-system should be over 10mA.
b) Scope of mating connector assy.
   - Mating connector such as plug or receptacle including accessories (pin / socket / clamp / back shell) should be supplied for train side connectors.
   - All the part number of connector assy. should be listed in the bill of material
   - Connector pin or socket crimp size should match with train side cable conductor size. And electrical capacity should be considered and selected under responsibility of sub-system supplier.

- Unless otherwise mentioned, each control line and communication/signal line of train side is 1.5 sq. mm. cable conductor size. However, power cable will depend on system's load capacity.
- Contact material of connector shall be gold-plated.

c) Scope of wire/cable.
- Any other special cable for connection of Fire Detection system than regular cables supplied by car builder shall be supplied by subcontractor.
- If the subcontractor supplies its product as a "harness system", the same has to be informed and supplied drawings need to clearly indicate it.
- The cable markers provided shall be fire retardant heat shrinkable type. The cable markers shall be protected against fading by providing Fire retardant heat shrinkable clear sleeve.

d) Surge Suppressor

e) All relays, contactors and magnet valves such as inductive loads should have suppressor to be protected by arc. The kind of suppressor can be used with varistor, diode or others.

f) Subsystem should have an obligation to inform the rating/inrush current and time constant to train side regarding each load when requested.

g) Circuit breaker installed on train side is for circuit wiring. If system needs a sensitive circuit protection such as fuse or others, it is restricted to install into their own system.

h) All the workmanship guides to ensure the subcontractor's system functionality associated with shielding method, connector crimping, protection methods against electrical interference should be supplied to car builder in order to get a proper application when requested.

i) Except for electronic equipment, all cable termination shall be of the crimped type in accordance with BS 4579: Part 1: 1988, Compression joints in copper conductors, or other service proven type. Soldered connections will not be accepted.

j) Variable resistors shall be avoided wherever possible.

k) The requirement of Microprocessors and Software-based Equipment shall be met as per ERTS 19.57.

l) The requirement of PCB and connectors shall be met as per ERTS 19.55.

m) All electrical circuits shall be fully insulated from the superstructure on both the positive and negative sides and the super-structure shall not be used as any portion of an earth return circuit as per ERTS 19.51.

n) The subcontractor shall meet the requirements of ERTS Chapter 19: Material and Workmanship although other requirements are not described here in PTS.

10.3. Fastener Requirements

c) Normally screw threads smaller than M5 size shall not be used. Screw and bolt heads shall be of hexagonal form on all M5 and larger screws. Screws smaller than M10 shall be of high tensile material.

10.4. Label Requirements

a) All items shall be labeled in English with the maker's name and type and form of the piece or item, discrete serial number and rating data and the date of manufacture of the particular

piece of equipment. It is desirable that the labels used for different equipment / subsystems / systems on the train are of standard pattern.

b) The labels shall be clearly stamped, cast or engraved and securely attached to the equipment. Where appropriate equipment shall be labeled with warnings of high temperature and electric shock risk. Wiring labels shall be multilingual (regional language(s) and English and/or Hindi) as per ERTS 16.11.7.

10.5. Product breakdown structure

The sub-contractor shall provide a list of technical breakdowns of their sub-systems into components (Least Replaceable Units or LRU's). This breakdown stops at the lowest to a level where a failure can be associated with a remove action of maintenance. More detail explanation shall be given in the RAMS Guideline to be provided by BEML.

Breakdown of the material used in each component include:

- Identity
- Equipment name
- Quantity in vehicle
- Supplier part number
- Part Price (for LCC calculation)
- Quantity recommended for spare part

10.6. Project Management

The subcontractor shall assist BEML to smoothly carry out Project management, Co-ordination with designated and other contractors, Design submission, Software management and control, etc according to the requirements specified in ERTS section VI A chapter 16.
The subcontractor shall comply with the detailed requirements to be specified later by BEML/ CMRL if any.

The Project Management Plan shall provide the following information.

- An organization chart which clearly identifies all staff expected to be allocated to the Works; indicating reporting lines to the Key Staff or any additional departmental managers proposed. It shall also identify the persons designated as contacts with BEML.

- The names, qualifications, positions and current resumes of key executive, supervisory and engineering staff to be employed full-time for the works.

- A narrative describing the sequence, nature and inter-relationship of the main Contract activities including timing for exchange of information.

- Procedure for documentation control.

- The subcontractor shall nominate a suitably qualified and experienced English-speaking engineer from his staff to be Project Manager. The proposed Project Manager shall have total experience of minimum 15 years and shall have been the Project Head in at least one Rolling Stock Project in last 10 years. The proposed project Manager shall be the employee of the subcontractor. The CV of the Project manager shall be submitted along with the technical offer.

- To fulfill the subcontractor's obligations during the Testing and Commissioning and the Defect Liability Period, the subcontractor shall nominate experienced maintenance engineers and organize deployment before undertaking testing and commissioning in depots at Chennai. Separate maintenance engineer shall be positioned in each depot.

- The subcontractor shall submit relevant CVs of the Design Manager, Production Manager, Quality Manager, Interface Manager and Maintenance Engineer in addition to the Project manager in the technical offer.

10.7. RAMS requirements

The sub-contractor shall comply every aspect with the requirements of RAMS (Reliability, Availability, Maintainability and Safety) as per ERTS-RS and EN50126. During warranty period (standard purchase warranty), the values of the RAMS target shall be calculated from the records of all faults and service failures. In the event that the target is not achieved, the supplier shall, at his own expense, take whatever action necessary to meet the target specified. Also, the sub-contractor shall provide all information related to the RAMS requirements. The sub-contractor shall comply with, but not limited to, the following requirements.

10.7.1. RAMS Deliverables

The sub-contractor shall submit the following RAMS Deliverables as a minimum as per the enclosed format during PFDR and FDR.

1) FMECA (Failure Mode, Effects and Criticality Analysis)
2) List of LRU
3) RAM Analysis (MDBCF, MDBCSF & MTTR)
4) Maintenance Schedule (Corrective Maintenance, Preventive Maintenance, Overhauling Maintenance)
5) Reliability Block Diagram (RBD)
6) Hazard Analysis
    a. Subsystem Hazard Analysis (SSHA)
    b. Interface Hazard Analysis (IHA)
    c. Operating Hazard Analysis (OHA)
7) Fault Tree Analysis
8) Safety Analysis
9) Life Cycle Cost (Corrective Maintenance, Preventive Maintenance, Overhauling Maintenance)

Sub-contractor shall submit the above RAMS deliverables in the format shared by BEML as

a minimum requirement.

10.7.2. Reliability Analysis

The reliability data shall be based on actual operating information for the equipment.

In addition, the subcontractor shall submit a list of typical train withdrawal scenarios as per ERTS Appendix I for review and acceptance by the BEML. The list shall include all anticipated failure scenarios, which can affect safety, punctuality and passenger comfort. Also, a list of typical train withdrawal scenarios should be based on the reliability analysis.

The reliability block diagrams and prediction of reliability performance shall be submitted to BEML for acceptance.

The reliability block diagrams shall include all elements essential to the successful performance of the system and the interrelationships and interface of these elements.

The subcontractor shall submit reliability prediction to demonstrate by quantitative methods above the achievement of the specified levels of reliability for the scope of supply.

10.7.3. Reliability Target

The MDBCF and MDBSF per 3 car train-set of the Fire Detection System shall meet the following table, considering 150,000 train-km of annual running mileage.

The Reliability performance shall be assessed by the following measure:

$$\text{MDBCF} = \frac{\sum \text{Traveled kilometer per train-set}}{\sum \text{Number of relevant Failures}}$$

Mean Distance Between Component Failure (MDBCF): The MDBCF of a system is the ratio of the total operating distance accumulated by the total population of identical items in the available fleet of the system to the total number of relevant Failures occurring within the population identical items.

System / Equipment	MDBCF target (Equip-km)	Failure Rate (1/MDBCF)
FDS	5,000,000	2.00E-07

Please note the above mentioned MDBCF targets shall be followed as a minimum. It is the responsibility of sub-contractor to submit the MDBCF of their equipment's for review of BEML/CMRL.

10.7.4. Availability Requirements

The trains supplied shall achieve minimum average availability of 95.0% for fleet of trains for the assessment durations. Penalties for not meeting Availability targets shall be imposed on the sub-contractor as per ERTS-RS & ERTS-CMC.

10.7.3.1 Definitions

Commercial / Revenue Hours of Operation: This defines the period when trains are expected to run according to a timetable to convey passengers. It is expected that this shall ordinarily be between 04:00 hrs - 00:00 hrs However, CMRL may at its sole discretion apply minor changes to the start / end times to allow for flexibility in the timetable.

Non-Revenue Hours: Defines the period when trains are not required to convey passengers and is expected to be between 00:00 hrs - 04:00 hrs.

Morning Peak Hours: Defines the anticipated morning rush hours, during which shorter headways will be planned. It shall ordinarily be between 08:00 hrs - 11:00 hrs on Weekdays.

Evening Peak Hours: Defines the anticipated evening rush hours, during which shorter headways will be planned. It shall ordinarily be between 17:00 hrs - 20:00 hrs on Weekdays.

Peak Hours: Shall be taken to mean either Morning Peak Hours, Evening Peak Hours or the combination of both as the case may be. CMRL may at its sole discretion apply minor changes to the nominal Peak Hours to respond to changes in passenger demand.

Availability shall be assessed by the following measure:

$$\%\text{Availability} = \left(1 - \left(\frac{DT(SC) + DT(OPM) + DT(CM)}{\text{Total Time}}\right)\right) \times 100$$

Total Time Where:

(i) Total Time is the time in hours during the assessment period multiplied by the total number of trains of the fleet.

(ii) DT (SC), or Down Time due to service checks, is the total down time in hours due to service checks summed over all the trains during the assessment period.

(iii) DT(OPM), or Down Time due to Other Preventive Maintenance, is the total down time in hours due to Preventive Maintenance other than service checks, summed over all sessions carried out on all trains during the assessment period.

(iv) DT (CM), or Down Time due to Corrective Maintenance, is the total down time in hours due to corrective maintenance or retrofit modifications in trains, summed over all sessions carried out on the trains in revenue operation during the assessment period. Any unreasonable delay in handing over the train for repairs for reasons not attributable to the Contractor shall be excluded. Time spent on train integrity inspections after train reformations arising from corrective maintenance work shall be included.

(v) DT(CM) shall be counted starting from the moment when the defective train is handed over to the Contractor and shall end when the train is restored to service condition.

(vi) The down times DT (SC), DT (OPM) and DT (CM) shall also cover the full content of the maintenance work concerned, including safety precautions, inspections, servicing, replacement of equipment, defect detection and rectification, testing and restoration to service condition.

10.7.3.2 Availability Targets

The sub contractor shall ensure that Trains are offered and made available for operation at the respective Depot as per the Train Operation Plan and in accordance with the procedures agreed upon during execution phase. The entire process pertaining to monitoring of Train Operation Plans shall be administered through DCC / PPIO. Detailed procedures for placement and withdrawal of the Trains, daily availability monitoring of trains and anything necessary to apply the above-mentioned requirements shall be finalized and agreed during the execution phase.

CMRL shall prepare the monthly Train Operation Plan (TOP) indicating the scheduled placement and withdrawal timings of Trains from the train handover point and inform the same at least 7 (seven) days before start of each month.

In some emergency / festive scenarios, TOP can be changed subject to condition that it will be informed at least 24 hours in advance and for not more than 15 days in a calendar year.

At the time of major maintenance such as major overhaul of trains, the availability targets as applicable will be revised by CMRL, decision of CMRL shall be final and binding.

The fleet of trains supplied shall achieve a minimum average availability target of 95.0% overall for the assessment durations mentioned in ERTS section VI C clause 3.3.3.

10.7.3.3 Availability demonstration during CMC period

The availability of trains shall generally be more than 95% during CMC period.

The average availability of the trains shall be assessed during CMC period under the Contract. The total down times for all trains shall be collected by the CMRL on monthly basis, and the average availability during the preceding three (3) months (assessed quarterly of respective year) shall be worked out from the above-mentioned formula in ERTS section VI C clause 3.3.1.
The assessment period for the availability calculation shall be scheduled from the actual date of start of CMC Works and assessed separately for each quarter of respective year for the entire duration of CMC period. The sub contractor shall submit monthly reports and the calculation of availability demonstration as below,

ADQ = (AD1 + AD2 + AD3) / 3

Where ADQ is the average availability demonstration of the monthly score AD1, AD2, AD3.

If the availability target mentioned in ERTS section VI C clause 3.3.2 (e) is not achieved for any assessment period duration, availability penalty/damages is applicable as per ERTS section VI C clause 3.3.4 of this chapter.

10.7.3.4 Availability damage

Trainsets shall be considered as 'Available' provided they are offered for revenue service at least 30 minutes prior to the scheduled departure time as per the Train Operation Plan.

As far as reasonably practicable, no trainset shall be inducted on mainline with a defect, the Contractor may however, prepare and submit the list based on previous experience for CMRL review and acceptance.

Penalty / Damages on not meeting Availability targets: Penalties for not meeting Availability targets shall be imposed on the sub contractor through a reduction of the certified payment for Price Center RS-CMC. Availability performance shall be calculated on a Monthly basis. The assessment period against the targets defined in below Table shall be on a quarterly basis throughout the entire CMC period.

SL No.	Availability target	Penalty / Damages
1	> 95%	No penalty shall be imposed during the respective quarter when this target is met.
2	> 93% to ≤ 95%	0.5% Penalty on the respective quarter Price Center RS-CMC apportioned amount.
3	> 90% to ≤ 93%	1% Penalty on the respective quarter Price Center RS-CMC apportioned amount.
4	≤ 90%	2% Penalty on the respective quarter Price Center RS-CMC apportioned amount. If availability ADQ is ≤ 90% consecutively for 3 (three) times, the CMC Works is liable for termination as per the provisions of GCC.

10.7.5. Penalty on service failure

- Penalties on account of service failures: If train is withdrawn from service as per withdrawal scenario present in ERTS Appendices I of Section VI A Part 2 then penalty shall be imposed on sub contractor as per below table.
- Trainset available with delay: A Trainset shall be considered as available with delay if such Trainset is offered with a delay such that it affects its scheduled departure time as per the Train Operation Plan. Availability damages in such cases shall be as per the Number of trip(s) delayed / cancelled as defined and penalty shall be imposed on sub contractor as per below table. CMRL shall return the trains as per TOP ordinarily.
- Non-Available Trainset: A trainset can be classified as non-available if the sub contractor is already accruing penalties outlined in SL No. 3 of below table or is

attending to a fault/defect (service failure/relevant failure) in the train(s) that are attributable to the sub contractor.

- The subcontractor shall comply to ERTS-CMC 3.3 for availability of Trainset for commercial services.
- Detailed list of different conditions and corresponding penalty / damages which shall be levied on the Contractor are outlined below.:

Sl. No.	Conditions	Penalty / Damages per incident (Figures in INR)
1.	Passenger De-boarding & Train withdraw in midsection due to train immobilization	20,00,000
2.	Passenger De-boarding & Train withdrawn at station due to train immobilization	15,00,000
3.	Passenger De-boarding at any Station, but train not immobilized	1,00,000
4.	Train withdrawn at terminal Station during Peak Hour	20,000
5.	Train withdrawn at terminal Station during Non- Peak Hour	10,000
6.	>2 minutes ≤5 minutes (Trip Delay)	10,000 per trip delay
7.	>5 minutes	20,000 per trip delay
8.	Trip Cancellation	75,000 per trip cancellation

Table 3-5: RS Service Affecting Failure

Note:

1. Penalty / Damage figures shall prevail for the entire CMC Period.
2. Where a failure arising on a single trainset causes scenarios 1 – 5 to occur on multiple Trainsets; only one penalty shall be imposed on the Contractor derived by the scenario attracting the highest penalty amount.
3. Delays shall be calculated according to the time deviation from Timetable recorded at the destination station (one-way trip). CMRL judgement shall be final and binding on the RS Contractor.
4. In case of partial trip cancellation, penalty corresponding to 8 of table 3-5 shall be applicable on pro-rata basis.
5. The damages mentioned above are calculated on a per train incident basis and shall be recovered by deduction from the certified payment amount for Price Center RSCMC.
6. Escalation of 5% compounded annually shall be applicable for the figures mentioned under Penalty / Damages from the Commencement date of the Contract.

10.7.6. RS Penalties on Service Failures

Penalties on account of service failures: If train is withdrawn from service as per withdrawal scenario present in Appendices I of Section VI A Part 2 then penalty shall be imposed as per Table 3-5.

Trainset available with delay: A Trainset shall be considered as available with delay if such Trainset is offered with a delay such that it affects its scheduled departure time as per the Train Operation Plan. Availability damages in such cases shall be as per the Number of trip(s) delayed / cancelled as defined in Table-3-5. CMRL shall return the trains as per TOP ordinarily.

Non-Available Trainset: A trainset can be classified as non-available if the Contractor is already accruing penalties outlined in SL No. 3 of Table-3-5 or is attending to a fault/defect (service failure/relevant failure) in the train(s) that are attributable to the RS Contractor.

10.7.7. Maintainability Requirements

10.7.7.1. Maintenance Interval

Session	Interval (Minimum)	Manpower and downtime requirements (Maximum)	
		Downtime	Expected staff
A Service Check	15 days or 6,250km	2.5 hours	8 persons per train
B1 Service Check	45 days or 18,750km	10 hours	8 persons per train
B4 Service Check	180 days or 75,000km	20.5 hours	8 persons per train
B8 Service Check	360 days or 150,000 km	47.5 hours	8 persons per train
C1 Intermediate Overhaul1	Minimum 4 years+ or 600,000km+	5.5 days	4 persons per car
C2 Periodic Overhaul1	Minimum 8 years+ or 1200,000 km+	11.5 days	4 persons per car
C3 Intermediate Overhaul2	Minimum 12 years+ or 1800,000km+		
C4 Periodic Overhaul2	Minimum 16 years+ or 2400,000 km+		
C5 Mid-life refurbishment	Minimum 18 years+ or 2700,000km+		
Corrective Maintenance operations that do not require car lifting	-	4 hours	-
Corrective Maintenance operations that require car lifting, excluding time required for shunting	-	6 hours	-

Preventive Maintenance Interval should be compliance with the interval specified in the above table.

10.7.7.2. Maintainability Targets

In addition, the Sub Contractor will demonstrate that a car Mean Time to Restore (MTTR) that does not exceed 1.5 hours, with a maximum maintenance repair time of 3 hours, is achievable for

at least 95% of all failures using the diagnostic tools and procedures provided by the Sub Contractor.

10.7.7.3. Master Maintenance schedule

a) The maintenance schedules shall be provided stating the parts needing attention at the basic service period and for major overhauls.
b) The sub-contractor shall submit work instructions/manuals for all scheduled maintenance activities, fault finding, and corrective maintenance of all faults likely to be found during maintenance and servicing.
c) The master maintenance schedule should be incorporated in maintenance manual and sub-contractor shall provide the relevant chapter reference no in maintenance manual against each maintenance task in master maintenance schedule.

10.7.8. Life Cycle Costs

The sub-contractor shall provide equipment that has minimum total Life Cycle Cost. The sub-contractor shall submit all information for Life Cycle Cost calculation in accordance with RAMS Guideline to be provided by BEML. The Life Cycle Cost which contains preventive and corrective maintenance activities shall be in compliance with the Maintenance Manuals prepared by the Contractor.

The subcontractor shall comply the requirements as per the ERTS-RS 2.27 and submit the Life Cycle Cost calculation document (as per format shared) in the technical offer for Scope of equipment.

The sub-contractor shall develop a life cycle cost plan in accordance with IEC 60300-3-3 with an aim to minimize the overall life cycle cost whilst meeting the safety, quality and reliability requirement of this particular specification. The LCC shall include the capital cost, cost of operation (including energy consumption), maintenance (both material and labor), depreciation, refurbishment, inflation etc. Per unit energy consumption cost may be considered as INR 8.50.

The subcontractor shall declare the useful life (years) / life class of the electronic equipment as per EN 50155 for Life Cycle Cost (LCC) evaluation.

Items/equipment having an OEM rated design-life that will lapse during the course of the Defect Liability and Maintenance Period (DLMP) shall be replaced by the sub-contractor (on or before expiry) as part of the obligations of the comprehensive maintenance scope.

List of such items shall be submitted as part of Spares in the technical offer for DLMP and shall be updated based on the final design.

10.7.9. Reliability and Maintainability Demonstrations

During Defects Liability Period, the values of the R&M target shall be calculated from the records of all faults and service failures. In the event that the R&M target is not achieved, the sub-contractor shall, at his own expense, take whatever action to meet the R&M target specified.

The sub-contractor shall support an active A/S for high availability. The A/S procedure of BEML is same as figure1. Therefore, the sub-contractor should be complied with BEML's procedure. If some failure needed the sub-contractor 's support, the sub-contractor should dispatch engineer as soon as possible. Also, if the sub-contractor needs some training for BEML's maintenance engineer, the sub-contractor shall perform it.

The sub-contractor shall provide sufficient spare part for high availability. The sub-contractor shall submit a spare part list and recommended quantity at the maintenance depots at Chennai.

The sub-contractor also has to comply the ERTS section VI A clause 18.6.

The subcontractor shall assist BEML to complete a final report to enable the Employer's Representative to assess acceptability of the vehicle and its components for reliability, maintainability and system safety. The detailed requirements are specified in ERTS section VI A clause 18.5, 18.6, 18.7 and section VI C chapter 3.

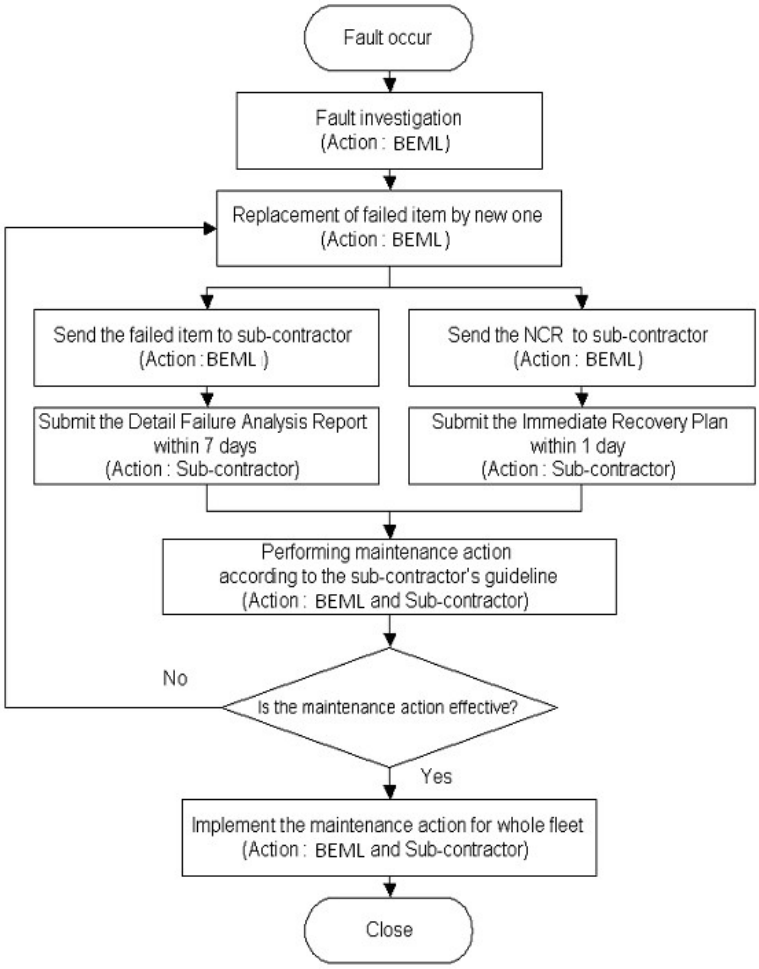

Figure 1. Maintenance Procedure of BEML

10.7.10. Safety Requirements (ERTS 18.5)

The subcontractor shall submit safety assurance plan for Fire Detection system. This shall cover design, manufacture, testing, commissioning of the system. This shall also indicate features minimizing the magnitude and seriousness of events or malfunctions, which could result in injury to passengers and damage to the equipment but cannot be completely eliminated.

To meet the safety requirement, the Subcontractor shall submit the following documentations as a minimum.

1) System Safety assurance plan as per ERTS section VI A chapter 18.
2) Hazard Analysis including preliminary hazard analysis, sub-system Hazard Analysis, operating and support hazard Analysis and interface hazard analysis as per clause 18.5 of ERTS.
3) FMECA (Failure Mode, Effects and Criticality Analysis) (ERTS 18.5.4.4)
4) Fault Tree Analysis (FTA) for Safety Critical Events

The subcontractor shall fully compliance with the RAMS (Reliability, Availability, Maintainability

and Safety) requirements given in the ERTS Chapter 18.

10.7.11. Software

Subcontractor should comply to all the software requirements mentioned in ERTS VIA chapter 20.

Also, subcontractor shall provide BEML with all information for the completion of software assurance plan and also comply with the software assurance plan defined according to the requirements specified in ERTS-RS Chapter 20.

Software shall be written in a structured manner and fully documented during all stages of its design and development, with at least two levels of documentation above source code level.

All software to be developed or modified shall follow the standardization requirements of EN 50128 (Railway Applications: Software of Railway Control and Protection Systems).

Independent review, verification and testing, using real and synthetic data shall be performed at the software module and system level. The subcontractor shall specify the software interface testing with the sub-systems along with the Pre-requisites of the testing and the site proposed for testing.
Sufficient software documentation shall be provided to BEML and CMRL a full understanding of the software function and operation.

The subcontractor shall provide all tools, equipment, manuals and training necessary for CMRL to maintain and re-configure all software provided under the contract.

After loading, and the satisfactory functioning of the software, the subcontractor shall supply two back-up copies of the software, including any new versions and adopted.

All test software, with the exclusion of built-in test software, shall be produced in accordance with a quality system controlled under the requirements of ISO 90003.

The detailed submissions to be made to CMRL project and shall be approved by CMRL/BEML.

As per ERTS 20.7, Below mentioned plans and details shall be submitted by sub-contractor (for all Sub-systems) as part of document submission:

i. Detailed Work Schedule
ii. Product Breakdown Structure
iii. Software Documentation Submission Schedule
iv. Review Programme
v. Traceability Matrix
vi. Software Development Plans
vii. Software Specifications
viii. Software Verification Plan

ix. Software Verification Report
x. Software Validation Plan
xi. Software Test Specifications
xii. Software Test Reports
xiii. Software Validation Report
xiv. Safety Cases
xv. Supporting Documentation
xvi. Software Quality Assurance Plan

10.7.12. Software Update:

Additional software updates due to CMRL's requirements shall be made free of charge during warranty period. The sub-contractor shall support (free of charge) and update all software pertaining to Fire detection System and any other required software until the system becomes stable and the Employer satisfies with the system. It includes both subcontractors' error and the Employer's any reasonable requests.

The subcontractor shall provide necessary support to resolve all pending or new interface related issues arising during the operation of the trains till completion of DLMP period.

10.7.13. Noise and vibration Performance test:

The sub-contractor shall perform the Withstanding Vibration and Shock test of Fire Detection System in accordance with the requirements specified in ERTS section VI A 17.5.4.8.12 and 2.17. The test results shall be submitted for approval and shall submit the type test in the form of 1/3 octave sound pressure level for the noise prediction Analysis.
Parts
The noise specification applies to all speeds up to design speed (90kmph) in both rotation (clockwise and counter clockwise) with no load and Tare load (AW0) conditions. Resonance test shall be performed prior to any other tests to find peak values in noise and vibration by sweeping rotation speed

If Subcontractor could not meet the above noise levels indicated then the subcontractor shall provide noise mufflers/ silencer/ dual speed blower to reduce the noise emission to bare minimum, the same may be discussed & finalized during design stage.

10.7.14. Fire Performances

Materials used in the construction of components shall be selected to reduce to the maximum extent practical the heat load, rate of heat release, propensity to ignite, rate of flame spread, smoke emission and toxicity of combustion gases as per ERTS-RS clause 2.26.

The subcontractor shall furnish the relevant data, fire load calculations (as per formats shared), certifications etc., of the items considered in fire load calculations separately for above & below the floor level as per ERTS-RS 2.26. For complete requirements of Fire Performance refer to ERTS-RS 2.26. The maximum heat release rate per car shall be restricted to low levels.

Fire load calculation for all non-metallic materials have to be calculated with heat release rate data tested in accordance with EN 45545 (Part 1 to 7), Category 4- A, Hazard level HL3. The calculations shall be included in the Fire safety plan submitted as the source of heat value.

The design and the materials used in the equipments shall conform to fire safety requirements of EN45545 Part 1 to 7 (Category 4-A, Hazard level HL3) latest editions or better international standards for similar metro operations, subject to the acceptance of BEML/CMRL.

The sub contractor shall submit a plan to BEML/CMRL for review which shall describe the process that will be used to systematically identify and eliminate fire hazards, to avoid the use of combustible materials whenever practical and to reduce to the extent practical the energy content and heat release rates of the combustible material that are used.

Material used in the equipments shall meet the Flammability, Smoke Emission and Toxicity requirements of the chosen Specification and shall comply to latest standard.

In case of occurrence of fire in the train, the details shall be sent as an audio-visual alarm to the TCMS and RSC consoles of OCC, BCC & DCCs. The details shall display the actual location of the incident

10.7.15. Fire Protection Performance

The subcontractor shall submit a Fire-safety Plan providing the list of Non-metallic material items, wires & cables that are proposed to be used in the Fire Detection System with details of material, applied mass, fire safety compliance (Flammability, smoke, toxicity) and fire load calculations, during the preliminary design phase.

The materials used shall conform to Fire Safety requirements of EN 45545 Part 1 to 7(Hazard level HL3) latest editions as a minimum or better international standards applicable for similar Metro for underground operations with front evacuation, subject to the acceptance of the Project Manager as per ERTS section VI A 2.26 3.14

10.7.16. Fire Load Calculation

The maximum heat release rate per car shall be restricted to low levels.

Fire load calculation for all non-metallic materials have to be calculated with heat release rate data tested in accordance with EN 45545 HL3. The calculations shall be included in the Fire safety plan submitted as the source of heat value.

10.7.17. Fire Performance Deliverables

The fire performance deliverables shall be provided in accordance with following table.

Sl. No.	Deliverables	Remarks	Submission Schedule
1	Fire safety plan	As per EN45545 HL3	Preliminary Design stage
2	Fire safety Test Reports of the items including heat release rate for standard items common with other projects of the subcontractor	As per EN45545 HL3	Pre-Final Design stage
3	Fire safety Test Reports of the items including heat release rate for all other items	As per EN45545 HL3	Final Design stage

10.8. EMC Requirement

10.8.1. General Requirements

The Sub-contractor must ensure that all intra-system EMI are taken care of through proper design and other special measures. The Sub-contractor shall ensure that all train equipment is designed and constructed in accordance with the latest issues or version of internationally recognized EMC standards, including but not limited to CISPR, EN50082, EN50121-3-1, EN 50121-3-2, EN50155, IEC60571-1, IEC61000 or equivalents, to ensure proper functioning as per ERTS 2.2.29.

10.8.2. Electro-Magnetic Compatibility performances (EMI & EMC)

The Subcontractor who provides electronic/electrical equipment to BEML for CMRL project shall make and submit EMC control plan. The EMC control plan, at least, must include the following information.

The Subcontractor shall ensure that his equipment is designed and constructed in accordance with the EMC control plan.

Items	BEML	Subcontractor	Remarks
1. Train Level	√	√	Including the interface management with all designated contractors
2. Equipment Level			

2.1. BEML Supply	√		
2.2. Subcontractor Supply		√	

BEML and Subcontractor shall conform to EMI/EMC specification specified in ERTS and the requirement of Interfacing and the interface documents.

Subcontractor shall be responsible for the requirement of EMI/EMC for the equipment in Subcontractor Scope of Supply and shall follow the BEML/ CMRL guidelines, ERTS for procedures, plans & test criteria.

Subcontractor will provide detailed EMI/EMC plan for their equipment in accordance with ERTS to BEML/ CMRL.

Subcontractor shall conform to the EMI/EMC requirement for their equipment and shall achieve the EMI/EMC performance by conducting type tests as per the standards/criteria defined in ERTS and submit the type test reports to BEML/ CMRL.

BEML/ Subcontractor are responsible to carry out EMI/EMC test on the 3-car train at BEML's factory / depot & mainline. In the event of EMC test not conforming to the agreed test criteria due to issue in Subcontractor equipment, Subcontractor shall immediately take remedial action in order to achieve the agreed EMC test criteria.

Subcontractor shall provide recommendation/advice regarding to minimize EMC/EMI effect for laydown cables which are connected to their equipment. (i.e., data cable, temperature sensor to card connection cable).

10.8.3. EMC Control Plan

The subcontractor shall submit an EMC Control Plan for the BEML's review and acceptance and it shall include an EMC analysis report including various measures to reduce conducted, induced and radiated emissions to acceptable levels as specified by the relevant international standards. The plan shall specify measures to increase immunity of the subsystems in scope of supply. All train borne equipment on the vehicle shall be designed and constructed to fulfill the requirements of EN 50121-3-2 and any standards where applicable.

10.8.4. EMC Laboratory Tests

Emission and Immunity tests for all individual equipment's on vehicles shall be performed under normal operating condition according to EN 50121-3-2 and the test specification and the test report shall be provided to BEML for review and acceptance.

Train Level EMC test as per EN 50121-3-1 and ERTS will be performed by car-builder (or) nominated testing agency. In case of any EMI/EMC issue on the sub-contractor's aggregates, the mitigation measures shall be designed and implemented by sub-contractor at no additional cost & no schedule impact to BEML.

10.9. Maintenance Requirement

During the design stage, the subcontractor shall submit downtime and manpower requirements for the maintenance inspections, service checks and Overhaul considered necessary for maintaining the trains under normal operational conditions. The service check and Overhaul sessions shall include all routine and heavy maintenance activities including inspections, minor / major overhauls and half-life overhaul. And if the equipment has half-life overhaul, the interval of the equipment shall be defined by Sub-Contractor. The subcontractor shall perform the maintainability demonstration, as applicable to his equipment, at his own expense.

Maintenance schedule, and items to be attended in a schedule, should be clearly defined by subcontractor for all components of the FDS. The schedules frequency should be synchronized with the train maintenance schedule program. Consumable spares, and arrangements for cleaning the filters etc. should be provided.

10.10. Quality Assurance Program

This section describes quality assurance program required to assure the quality of products supplied from the Subcontractor to BEML. The Subcontractor shall assure the quality of product and maintain quality system to achieve high quality of the product. Also, sub-contractor should comply to the requirements mentioned in ERTS VIA chapter 18.8 & 18.9.

10.10.1. Quality Assurance Plan

The Contractor shall develop and submit Quality Assurance (QA) Program Plan. The QA plans shall include a company policy statement, which defines the authority and role of QA within the Contractor or subcontractor's organization, particularly with regard to schedules and cost. The plan shall be formatted in accordance with ISO 9001, which shall be used as the guiding document for all QA activities. Subcontractor QA plans shall be approved by the Contractor and submitted to CMRL during Pre Final Design stage.

Submission of QAP shall not be later than 30(thirty) days after purchase order by BEML.
The subcontractor shall have the following

a) Organization chart
b) Certification of Personnel
c) Evidence of Compliance
d) Certificates of compliance
e) Calibration of measurement equipment and tools

The subcontractor shall comply with the detailed Quality Assurance Plan provided by BEML.

10.10.2. Quality Assurance activities

The Supplier shall address, as a minimum, the following activities and shall provide a means of self-correcting any shortcomings in his Quality Assurance Plan (QAP) as per ERTS section VI A clause 18.8.

10.10.3. Quality Audit

The Subcontractor shall permit Quality Audit by BEML and/or the Employer of BEML(CMRL). The scope of the audit will be only the field related with the implementation of this project and the Subcontractor's QAP. If any Nonconformity is detected while the audit, Corrective Action request will be issued to the Subcontractor. For the Corrective Action Request, the Subcontractor shall prepare and submit appropriate action plan within 10 (ten) days, perform the action plan and reply the result to BEML QC team.

10.10.4. Organization

The organization of the Supplier's Quality Assurance (QA) Program shall have sufficient, well-defined responsibility and organization. It shall report directly to the General Manager of the Supplier's facility or the Supplier's Project Manager. The QA/QC personnel shall have complete freedom to identify and evaluate problems; to recommend solutions; to verify implementation of solutions; and to control further processing, delivery, or installation of a Non-conforming or deficient item until proper and documented disposition has been obtained.
The QA/QC organization shall be arranged to promote a control function that operates in an independent, objective manner unbiased by schedule, cost, and authority limitations imposed by personnel other than the Suppliers high level management starting with the General Manager or equivalent.

10.10.5. Manufacturing Inspection

Inspection shall occur at appropriate points in the manufacturing sequence to ensure quality consideration for compliance with drawings, test specifications, process specifications and quality standards. BEML may designate inspection hold (or witness) points into the Supplier's Inspection and Test Plan (ITP) upon review of the Supplier's efforts. Inspection/test shall be 100% (one hundred percent) unless there is a specified sampling plan in the specification of BEML. Non-conforming materials shall be identified as discrepant, and shall be segregated and reviewed for disposition.

10.10.6. Production Conformance Testing

The Supplier's QA/QC personnel shall perform all Production Conformance inspections/tests and verify proper configuration of the equipment inspected/tested. If any item does not satisfy all performance or design criteria, the item shall be re-inspected retested until the inspections/tests are passed with the necessary adjustments or repairs documented and certified by a witness.

10.10.7. Receiving Inspection

The Supplier's receiving inspection activities shall provide for the inspection of all incoming materials. These inspection measures shall used to preclude the use of incorrect or discrepant materials and to ensure that only correct and accepted items are used and installed. All material certifications and test reports used as the basis for acceptance by the Supplier shall be preserved. Inspection measures shall identify any item at any stage of production to an applicable drawing, specification or other pertinent technical document. Permanent physical identification shall be used to the maximum extent possible.

10.10.8. Shipping Inspection

The Supplier's Quality Assurance Program shall provide and enforce procedures for the proper inspection of all products to assure completion and conformance as required by the Contract prior to shipment. All shipments shall be prepared as require precluding damage during shipment. The inspections and preparation for shipment shall be verified by the Supplier's QA/QC personnel.

10.10.9. Ensure Inspection with Latest Revisions/ Changes

The Supplier shall ensure that inspection and tests are based on the latest approved revision or change to drawings and specifications. The Supplier shall ensure that obsolete drawings and change requirements are promptly removed from all points of issue and use. Means of recording the effective points of changes shall be employed.

10.10.10. Identification of Items using tags etc.

The Supplier shall maintain a system for identifying the progressive inspection status of materials, components, sub-assemblies and assemblies as to their acceptance, rejection or non-inspection. The system shall provide for ensuring that required inspections and tests are performed and that the status of items with regard to inspections and test performance is known throughout manufacturing, installation and testing. Nonconforming items shall be identified by physical segregation and status indicators such as tags, serialization, markings, stamps and inspection records. The identification system shall ensure that only items that have passed the required inspection and tests are used or installed.

10.10.11. Handling

The Supplier's Quality Assurance Program shall provide for adequate surveillance work and inspection instructions for the handling, storing, preserving, packaging, marking and shipping to protect the quality of products.

10.10.12. Non-conformance Control

The Supplier shall establish and maintain an effective and positive system for controlling nonconforming material and workmanship, including procedures for its identification, segregation and disposition.
The supplier shall assure that nonconforming materials are not used. To assure prompt Correction,

Corrective action Compensation and any necessary actions for any nonconformity caused by the Supplier or Supplier's suppliers, the Supplier shall establish nonconformity control procedure and includes it in the QAP.

All nonconforming issues shall be positively identified to prevent unauthorized use, shipment or intermingling with conforming material.
Corrective action and related information shall be documented and made available to BEML upon request. Corrective action shall extend to the performance of all sub- suppliers and include as a minimum:

a) Immediate response, prompt action and prevention of recurrence for nonconformity.
b) Analysis of data and examination of discrepant products to determine extent and causes with corrective action implemented in an expeditious manner prior the next shipment, order or inspection.
c) Submission of detail documents (specifications, drawings, repair procedure, analyzed data, test/inspection data, measures, action plan and etc) required to resolve nonconformity detected.
d) Introduction of required improvements and corrections, initial review of the adequacy of such measures, and monitoring of the effectiveness of corrective action taken.
e) Analysis of trends in processes or performance of work to prevent nonconforming products.

10.10.13. Inspection and Test Plan (ITP)

ITP shall be submitted to BEML QC team for review and approval as following no later than 30 days after purchase order by BEML. Subcontractor shall comply with ERTS 17.

A) The ITP includes all the major inspection and test activities planned prior and during the design, procurement and installation phases.

B) Witness/Hold point of Inspection/Test

After review of the ITP received from the Subcontractor, BEML will designate witness/hold point (if required) of BEML and/or the Employer of BEML and notify them to the Subcontractor.

C) Inspection/Test Notification of Witness/Hold point

After receiving of ITP, BEML will inform Notification schedule and procedure to the Subcontractor according to the Main Contract between BEML and the Employer of BEML.

11. Testing

11.1. General

1) The Subcontractor shall be responsible for undertaking and passing all necessary testing activities for Fire detection system.
2) The subcontractor has the responsibilities to dispatch their engineers(s) at their own cost to perform the tests viz., equipment type test, FAI, vehicle level performance type test and static & dynamic commissioning type test until successful completion.
3) The Subcontractor shall develop, organize and implement the test that verify the Fire Detection system to meet all functional, safety, systems reliability and performance requirements.
4) The tests and commissioning are conducted according to Guideline for the performance test of railroad/ Standard for the performance test of urban railway, Guideline for the manufacturing inspection of railroad and ERTS.
5) BEML and/or End user have the right to witness any of these tests and inspections at any stage of the test & inspection process.
6) All test & inspection specifications and reports including all repair activities and check-lists shall be submitted to and approved by BEML and end-user.
7) The Subcontractor shall ensure that the equipment is compliant to all requirements prior to inviting for testing and FAI. The pre-test result prior to official testing/FAI shall be submitted with the invitation letter to request Employer's witness.
8) If any inspections or tests indicate that specific hardware, software, or documentation does not meet the specified requirements, the appropriate items shall be repaired, replaced, upgraded, or added by the Subcontractor with its own cost, as necessary to correct the noted deficiencies. After correction of a deficiency, all tests necessary to verify the effectiveness of the corrective action shall be repeated.
9) Prior to the start of testing, BEML and End user shall have all approved test plans and procedures for the test and all relevant prerequisite testing shall have been completed by subcontractor.
10) Type test of sub-supplier equipment and train level will be responsibility of sub-supplier; sub-supplier shall depute their engineers to conduct the vehicle level type test at BEML’s Factory and Depot at Chennai/Mainline for testing as per schedule prepared by BEML’s project management team. Sub-supplier shall continuously update themselves about the type test schedule of Factory and Site as it may happen that first schedule could not be followed due to rise of unexpected hindrance.
11) Sub-supplier shall arrange all necessary tools & instruments for relevant field test.
12) If there is a problem during testing & commissioning and thus BEML request dispatching engineer to solve the problem, the subcontractor should dispatch engineer within 24 hours.
13) The test requirements shall meet, but not be limited to, the following sections in the ERTS-RS:
    (a) ERTS Chapter 9 : Auxiliary Electrical Equipment
    (b) ERTS Chapter 17 Test Program
    (c) ERTS Appendix B International Standards

14) Combination with TCMS, Signaling and Train Radio:
Subcontractor has to attend the combination test with engineer and proper equipment based on the detailed test schedule and location.
15) Before the type commissioning test, complete car at the vehicle level, the subcontractor shall meet the TCMS combination test between TCMS and their equipment. One or several equipment's including connector, power cables etc should be delivered to TCMS supplier's test place before the testing period by subcontractor. Subcontractor's engineer shall attend the combination test for technical support for example software changes or equipment installation in accordance with TCMS supplier's requirement.

11.1.1. Inspection Hold Points

The subcontractor shall propose a set of inspection hold points in the Inspection, Testing and Commissioning Plan in accordance with the requirements specified in ERTS 18.9 & ERTS 1.4.

11.2. First Article Inspection

All the materials, fittings, equipment, manufacturing processes, and assembly workmanship shall be subject to inspection by BEML and CMRL, wherever carried out in accordance with the requirements specified in ERTS 18.9.7.

The supplier shall offer the first set of Fire Detection system aggregates for First Article Inspection (FAI) by BEML and CMRL. After clearance from BEML, mass production shall be taken up.

11.3. Test Procedure

Each Test procedure shall include all information necessary to ensure the successful, accurate and safe performance of the described test as stipulated in ERTS chapter 17. At a minimum, each test procedure shall include:

1) Relevant specification applicable to each of the tests.
2) Type, routine and special tests to be carried out.
3) Description of the tests, scheduled dates, and locations of the tests.
4) Test parameters to be measured.
5) Constraints to be applied during the test.
6) Defined pass/fail criteria
7) Facilities, equipment, and test and measurement tools.
8) Test procedures shall be amended, as required by the subcontractor the throughout the duration of the Contract, to reflect changes in system design or the identification of additional testing requirements.
9) Scope and objectives for each test
10) Prerequisites for test to be conducted
11) Organization/entity and person(s) conducting the test
12) Safety Precautions

13) Identification of the specification section(s) that are verified by the test
14) Scope of test (what is being tested and how many)
15) Test equipment required (by model number, make) and latest calibration information
16) Other personnel required
17) Any special conditions required, including condition of the equipment under test
18) Reference drawings, schematics, or documents
19) Clearly understood step-by-step instructions for performing the test, test equipment set-up
20) Clear pass/fail criteria, including applicable tolerances, nonconformance correction, retest provisions
21) Data sheets to record test results, including confirmation of test equipment certification
22) Raw data correlation procedures
23) Sample test report format

Test procedure shall be submitted to BEML for review and acceptance during PFDR and FDR and at least ninety (90) days in advance of the notification of the actual testing. All procedures must be approved prior to notifying the test witness request.

11.4. Test Reports

1) All test reports of the component, system, factory and field acceptance test for Fire Detection system shall be prepared by the Subcontractor and they shall be submitted to BEML. The Test reports shall include, but not be limited to, the followings:
   (a) The reference to the corresponding Test Procedure
   (b) The date of the test was executed
   (c) Description of any test conditions, input data, or tester actions
   (d) Details of test instruments used (Make, Model) along with calibration certificate.
   (e) The test results for each test including a Passed / Failed indication
   (f) Identification of the Subcontractor's test engineer
   (g) Action and the result of the action for comments by End user's representative
   (h) Copies of any deficiency reports generated as a result of the execution of the correction.
   (i) Configuration data that fully describes the hardware and software that was tested, including software version and identifiers for every software module.
2) Written reports of all tests performed shall be submitted within Fourteen (14) days of test performance to BEML for acceptance.
3) Records of all inspection and testing shall be kept completely by the Subcontractor and available to End user during the performance of this Subcontract and for a minimum of ten (10) years after expiration of the warranty period.

11.5. Sequence of Tests

1. Routine and type test of equipment and sub-systems in accordance with relevant standard and specifications in Contractor/Sub-contractor's factories.
2. Factory and Site Tests of complete cars in accordance with IEC 61133.
3. Testing and Commissioning of cars/trains in Depot at Chennai in accordance with IEC 61133.
4. Integration Tests in conjunction with all Designated Contractors.
5. Service Trials

11.6. Routine and type tests of equipment and sub-systems

The Fire Detection System shall comply with the requirements of ERTS 17

11.6.1. Equipment level Type & Routine Test, Fire Detection system

This test is required to verify that the Fire Detection system operate in accordance with the Approved Design Data.
Type test of each component shall be performed by the Subcontractor under BEML and CMRL participation in accordance with the requirements specified in ERTS 17.

Subcontractor has responsibility for the type & routine test of the component. During test the criteria shall be observed and recorded in a log book and necessary alterations and adjustments carried out.

The subcontractor shall perform, as a minimum, the following test in accordance with the requirements specified in ERTS 2.26.5, 19.54 & 17.

No.	Division	Type	Routine	Standard
1	Visual inspection	◎	◎	-
2	Dimensional check	◎	◎	-
3	Withstand voltage test	◎	◎	IEC 60571
4	Insulation resistance test	◎	◎	IEC 60571
5	Operating test	◎	◎	-
6	Voltage variation test	◎	◎	IEC 60571
7	Low temperature test	◎	-	IEC 60068 2-1
8	High temperature test	◎	-	IEC 60068 2-2
9	Temperature cycle test	◎	-	IEC 60068 2-14
10	Electrostatic discharge immunity test	◎	-	IEC 61000 4-2

11	Radiated, radio-frequency, electromagnetic field immunity test	◎	-	IEC 61000 4-3
12	Electrical fast transient/burst immunity test	◎	-	IEC 61000 4-4
13	Surge immunity test	◎	-	IEC 61000 4-5
14	Immunity to conducted disturbances, induced by radio-frequency fields	◎	-	IEC 61000 4-6
15	EMI radiation test	◎	-	EN 55011
16	EMI conductivity test	◎	-	EN 55011
17	Shock test	◎	-	IEC 61373 1-B
18	Vibration test	◎	-	IEC 61373 1-B
19	IP Grade test	◎	-	IEC 60529
20	Dry heat test	◎	-	The dry heat test shall be conducted for class T3 and temperature shall be considered up to 85°C as specified in IEC/EN standard. As per ERTS clause 19.54.3 (i)
21	Salt Mist Test	◎	-	IEC 60571 ST3
22	Cyclic Humidity Test	◎	-	
23	Dust and Sand Test & Mould Growth Test	◎	-	IEC 60721 & IEC 60068
24	Function test	◎	-	As per Test procedure/ Specification
25	Combination (integration) test	◎	-	System itself and interface with TCMS, HVAC, PAPIS & Vehicle Controls.
26	Any other tests required by CMRL	◎	-	Approved Test standard/Specification according to Employer's requests.

※ Dimensional Inspection: This inspection shall be done with the specimen picked by a lot of products. If the result is not proper, all quantities of the lot product shall be inspected to the approved drawing.

※ Type tests for certain equipment may be waived if these were carried out earlier on equipment of identical design, witnessed by a reputed organization, and the service performance of such equipment was found to be reliable. The sub-contractor shall submit a proposal in this regard to BEML for review. The waiver of Type Test is entirely at the discretion of the BEML's Engineer and CMRL. Change of manufacturing place may require re-type test. Incase waiver of certain type test is accepted by BEML's Engineer or CMRL, sub-supplier must carry out type test in accordance with approved test plan.

※ Above lists are indicative and sub-supplier shall be responsible to carry out any additional test required by client within the scope of ERTS.

※ All the electronic devices with PBA (PCB Assembling) shall be subjected to Environmental Aging test (Temperature cycling test) according to burn-in test procedure as per the following.
- First article: 20 cycles (1 cycle: 25℃,1h ---- - 40℃,0.5h ---- 85℃, 0.5h)
- Mass production: 2 cycles (1 cycle: - 40℃,0.5h ---- 85℃, 0.5h)
  * Temperature rising/falling speed: 5 ~ 10℃/ min

11.7. Factory & Depot tests of completed cars

11.7.1. Type Test, Completed car, unit and Train Tests

- The individual cars, complete units and trains (**software must be compatible for testing of 3-car/6-car train set configuration**) shall be type tested by Subcontractor for Fire detection system aggregates in accordance with IEC 61133, ARGE Guideline and ERTS – DM&P 1.4.

- The aim of these tests is to prove functionality and positioning of smoke and heat detectors in passenger areas and heat detectors/LHD in electric cabinets (enclosures/cubicles). The tests shall conform to the requirements of the ARGE Guideline (Part-1 for "Fire detection in Rolling Stock" and Part-3 for "System functionality fire detection & fire fighting in Rolling Stock") or any other applicable international standard.

  Type tests shall be conducted for the following:

  (i) Dual Smoke and Heat detectors (multi-sensors),

  (ii) Heat Detectors,

  (iii) Linear Heat Detectors (LHD).

The Subcontractor, Design Engineer, shall also participate in this testing to ensure that Fire detection system aggregates meet the performance requirements specified at the contract and do not introduce any adverse effects into the train.

11.7.2. Routine Test, Completed car, unit and Train Tests

The individual cars, units, complete trains (**software must be compatible for testing of 3-car /6-car train set configuration**) shall be routine tested by Subcontractor for Fire detection system aggregates in accordance with approved routine test specification in line with IEC 61133, ARGE Guideline and in accordance with ERTS-RS.

Subcontractor shall provide the source details along with Type/Make, specifications for test instruments required for Vehicle Type, Routine Test for Fire detection system.
Subcontractor shall provide training for BEML Engineers for carrying out Type/routine test with detailed documentation for instrumentation setup, configuration settings of test equipment's , analysis/reading of data., support. The Subcontractor shall be responsible for correcting any interfacing defects.

11.8. Integration Test

The Scope of work (SOW) related to Comprehensive Static, Dynamic & Interface Tests (Type & Routine Tests) and supply of Testing Tools & Equipment refer to Section 8 & 11 of this PTS.

Integration test shall be carried out according to ERTS-RS at designated depot and mainline. The subcontractor shall submit all necessary information, test procedures and check sheets for the integration test for approval of CMRL/BEML.

The subcontractor shall also perform all those tests that are considered to be in the scope and was performed in the past indian projects or as advised by BEML/ CMRL engineer.

11.9. Service Trials

BEML will perform the service trial for CMRL Metro Phase 2 Project corridor and the sub-contractor shall supply the sufficient information and assistance if necessary, according to ERTS-RS.

The subcontractor shall submit all information for the service trials to BEML. If needed, the concerned engineer from subcontractor shall participate in the service trial.

11.10. Others

The delivery format of all deliverables (design submission, maintenance manuals, training manuals and etc) shall be approved by BEML/ CMRL.

Any discrepancy in specifications can be clarified after the discussion between BEML and the subcontractor.

12. Defect Notification Period (DNP) / Defect Liability Period (DLP) / Warranty

1. Refer General Conditions & ERTS and related clauses of the tender.
2. Sub-contractor shall ensure minimum spare parts that he intends to make available during the installation, erection, commissioning and DNP/DLP/Warranty period.
3. The sub-contractor shall keep on site, throughout the installation, erection, commissioning and warranty period, stocks of spare parts, to enable rapid replacement of any item found to be defective or in any way in non-conformance with the specification.
4. During DLP warranty period, DLP spares to be positioned and maintained by OEM at the Chennai depot.

13. Submittals – Technical offer:

The Subcontractor shall provide as a minimum, the following along with the technical offer. The submittals check-list as per Annexure-6 of this PTS shall also be submitted.

(i) Complete Technical offer for Fire Detection system along with Technical description, specification drawings, weight and power consumption details.

(ii) Clause wise compliance against

a) PTS - Doc no. GR/TD7053
b) CMRL ERTS (Refer “Compliance Matrix_ARE02A _Section VI A_ERTS-RS”)
c) CMRL Project Wide Interface Document (Rollingstock Interface)
d) PTS Annexure-3
in the following format

Clause No	Response (Complied/ Noted/ Not Complied)	Remarks

- Complied: “Complied” shall be indicated by the supplier where the supplier is able to comply with the clause.
- Noted: Where a clause merely provides information.
- “Complied with comments” will be considered as fully complied for the clause with no additional commercial impact.
- Offers with Non-compliance and deviations to any of the ERTS & PTS clauses with regard to Fire Detection system, are liable for rejection.

(iii) Supply details with references for same / similar design to support the qualification criteria as per section 7 of this document.

(iv) The list of spares as detailed at clause 8.8 of this PTS along with LCC.

(v) SIL2 Certificate of previous executed project having similar architecture.

(vi) Duly filled vendor approval format (Annexure-5)

(Vii) Duly filled submittals check list (Annexure-6)

14. Attachment

Annexure-1: ERTS CMRL phase-2 ARE02A

Annexure-2: Compliance Matrix_ARE02A _Section VI A_ERTS-RS

Annexure-3: Interface document between TCMS and FDS

Annexure-4: RAMS formats

Annexure-5: Vendor Approval/Notice for No objection (NNO) Format

Annexure-6: Submittals check list

Annexure-7: Format for LCC

Annexure-A: List of Mandatory Spares to be positioned at Depot during CMC Period

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BEML LIMITED

(A Govt. of India Mini Ratna Company under Ministry of Defence)
BANGALORE COMPLEX, POST BOX: 7501, NEW THIPPASANDRA POST,
BANGALORE-560075

NOTICE INVITING TENDER

BID INVITATION NO:6300039524 **Dt:19.05.2025**

Subject: Design, Manufacture, Supply, Testing & Commissioning, Training & Manuals of Fire Detection System including CMC Spares, Tools and service activities required for 210 cars of Chennai Metro Rail Project-Phase II (ARE02A).

Quotation/offer are invited from Original Equipment Manufacturer (OEM) or authorized representatives of OEMs of **Fire Detection System** for Metro Rolling stock having experience in Design, Manufacture, Supply, Testing & Commissioning of Fire Detection System in accordance with the enclosed terms and conditions within the tender closing date.

Quotations should be submitted online (E-mode) in BEML SRM portal in Two-Bid system as below:

1) **Technical Bid**
2) **Commercial Bid**

Note: Commercial bids of only technically acceptable firms will be opened and considered for further evaluation by BEML.

Please note that bidder should be having a **valid Class-III Digital Signature Certificate** issued by authorized Certifying Authority to submit bid in our SRM e-Procurement system. Interested bidders can contact BEML through e-mail: admin.srm@beml.co.in to obtain the username & password for submitting the quotations In case of any queries, you may contact BEML SRM Team on phone no. **080-22963269**

Note: - The tender consists of 62 Nos. of pages including this page.

2. TABLE OF CONTENTS

3. General Instructions to Bidders:

1. The Bidders are advised to carefully go through, read and understand this tender document completely including terms and conditions, Annexures and Appendices etc. before submitting bids

   a. This NIT is not transferable under any circumstances.
   b. All entries in the bids, formats which would be part of bids shall be in English either typed or written legibly. Erasing, over-writings and use of correction fluids are not permitted. All cancellations and insertions should be duly signed / attested by bidder concerned.
   c. All the corresponding documents shall be attached along with the quotation/offer
   d. The bidder shall **sign each and every page of tender document** before submitting the tender. No corrections/revisions will be entertained after opening the bids.
   e. Late and/or incomplete tender shall not be considered.
   f. Canvassing in any manner including unsolicited letters and request for post tender corrections shall render offers of such parties liable for rejection.
   g. Bidder shall ensure that all the information & documents submitted by them are true & correct.
   h. In case, it comes to the knowledge of BEML that the bidder has submitted false information before awarding of contract then the offer would be rejected.
   i. In the event, it comes to the knowledge of BEML that the successful bidder has submitted false information, subsequent to the award of contract, the contract shall be cancelled/short closed by the company and shall invoke Risk purchase clause with liabilities on such bidder for the entire contract quantity. The PBG shall also be encashed as a result of consequence of breach of contract at the discretion of BEML.

2. Abbreviations used in this NIT

NIT- Notice Inviting Tender	BEML -BEML Limited
TS-Train set	CMRL -Chennai Metro Rail Limited
PTS- Procurement Technical Specification	ERTS - Employer's requirements General Specification
PO-Purchase order	DLP -Defect Liability Period
GTC- General Terms and Conditions	DNP – Defect Notification Period
CMC – Comprehensive Maintenance Contract	PBG – Performance Bank Guarantee
SRM - Government e-Marketing	SRM- Supplier Relationship Management

3. In case any person/persons, Company, firm, Associations having any litigation, arbitration cases between themselves and BEML Ltd, pending before any court of law/ Arbitrator shall not be eligible to participate in this tender.

4. Non-compliance with any of the tender conditions, incomplete offers, conditional and ambiguous offers are not acceptable and liable for rejection.

5. The bidder shall fill in all the required particulars in the blank space provided for the purpose in the tender document.

6. All the documents shall be uploaded in SRM Portal.

7. Fax/email quotations are not acceptable.

8. BEML reserves the right to accept or reject all tenders or any tender in part or full without assigning any reasons thereto, which is final & binding on the Bidder

4. DETAILS OF THE TENDER

This "Notice Inviting Tender" hereinafter referred to as the 'NIT' is designated as the tender for **Design, Manufacture, Supply, Testing & Commissioning, Training & Manuals of Fire Detection system including CMC Spares & Tools, Deliverables and service activities required for 210 cars of Chennai Metro Rail Project-Phase II (ARE02A).**

1) The tender consists of two parts as indicated below:

Sl. No.	Nature of Bid	Mode of Submission	Details
1	**Technical Bid**	**SRM Portal**	**Technical Bid (Without Price Details) shall be uploaded and submitted in the SRM Portal, wherein** only technical Bid /technical information in SRM Portal shall be uploaded
2	**Commercial Bid**	**SRM Portal**	Price details to be duly filled in specified field on SRM Portal. Evaluation is based on the total bid value of all the items & services.

1. Equipment with DNP/DLP

Table-1.1 List of items for Fire detection System:

Sl No	Part No	Description	UoM	Qty/ T.Set	Qty for 210 Cars (70 T.Sets)
1	5242100005	KIT OF FIRE DETECTION SYSTEM	SET	1	70

Scope shall also cover the following:

i. Testing & Commissioning activities for Fire detection system for one Train for each of three corridors 3, 4 & 5

Corridor 3 from Madhavaram to Sipcot

Corridor 4 from Lighthouse to Poonamalle

Corridor 5 from Madhavaram to Sholinganallur

ii. Spares and consumables including Service for Defect Notification period (DNP)/ Defect Liability Period (DLP) as per ERTS requirements. Detailed BOM for DNP/DLP Spares and Consumables for warranty period to be provided by the bidder.

Table-1.2: Non-Recurring Cost (NRC)

Sl No	Description	UoM	Qty/ Project
1	Design and Submission of design Documents for Fire Detection System.	AU	1

Table-1.3 FAI Reports and Type Test & Report

Sl No	Description	UoM	Qty/ Project
1	FAI Reports and Type Test & Report for Fire Detection System	AU	1

Table-1.4 Deliverables:

Sl No	Part no	Description	UoM	Qty/ Project
1	----	Deliverables as per ERTS Clause 2.26.5.2 for Fire Detection System	AU	1
2	----	Sil Certifications and certificate submission as per ERTS Clause 2.26.5.2 for Fire Detection System	AU	1
3	----	Printed Circuit Boards (PCB) details asper ERTS 19.55 for Fire Detection System	AU	1
4	---	Microprocessor Details as per ERTS 19.57 for Fire Detection System	AU	1

2. Comprehensive Maintenance Contract (CMC)

Table 2.1: Spares & Tools required for CMC period

Sl No	Part No	Description	UoM	Qty/ Project
1	5242100029	Spares as per Annexure-A for Fire Detection System	SET	1
2	5242100030	Tools and Test bench for Fire Detection System	SET	1

Scope of Spares shall be as per Annexure -A and the bidder has to submit the details of Tools & Test Bench in line with Annexure-IV i.e, " Scope of CMC" of NIT

3. Training & Manuals

Table 3.1: Training

Sl No	Description	UoM	Qty/ Project
1	Training on O&M to the CMRL/BEML on Fire Detection system	AU	1

Table 3.2: Manuals

Sl No	Description	UoM	Qty/ Project
1	Training Manual, System/ Technical Manuals, Software Manuals, Operation Manuals, Maintenance Manuals, Fault Diagnostic & Trouble shooting Manuals & Spares Part Catalogue for Fire Detection System	AU	1

Required Delivery Schedule: For Fire Detection System

Sl No	Part No / Description	Total Qty (Trainsets)	Schedule	No of Train Sets (3 Cars/TS)
1	Equipment with DNP/DLP	70 TS (210 cars)	Apr'26	1
			Jul'26	3
			Nov'26	3
			Feb'27	4
			May'27	4
			Jul'27	3
			Aug'27	3
			Sep'27	4
			OCT'27	3
			Nov'27	4
			Dec'27	3
			Jan'28	3
			Feb'28	3
			Mar'28	3
			Apr'28	3
			May'28	4
			Jun'28	4
			Jul'28	3
			Aug'28	4
			Sep'28	4
			Oct'28	4
3	Design and Submission of design Documents for Fire Detection System.	PDR: Jul-25 PFDR: Mar-26 FDR: Jun-26		
4	FAI Reports and Type Test & Report for Fire Detection System	Jun.26		
5	Deliverables as per ERTS Clause 2.26.5.2 for Fire Detection System	Apr.26		
	Sil Certifications and certificate submission as per ERTS Clause 2.26.5.2 for Fire Detection System	Mar-26		
	Printed Circuit Boards (PCB) details asper ERTS 19.55 for Fire Detection System	Mar-26		
	Microprocessor Details as per ERTS 19.57 for Fire Detection System			
6	Spares as per Annexure-A for Fire Detection System	To be supplied as per BEML requirement		
7	Tools and Test bench for Fire Detection System	Dec.'26		
8	Training	Jan.'28		
9	Manuals	Jan.'28		

Note: a) Delivery schedule proposed above is tentative. However, it can be mutually discussed and agreed in line with key dates of CMRL contract.

b) CMC shall start after completion of DLP/DNP activity for 70th Trainset and shall end 15 years after the start of CMC .

c) 1 Trainset comprises of 2 DM car and 1 T car

5. SUBMISSIONS OF TECHNICAL BID

Technical Bid submission Conditions	**TECHNICAL BID (Without Price Details) shall be uploaded and submitted in the SRM Portal, wherein** only technical Bid /technical information in SRM Portal shall be uploaded as indicated below: a. Bidders should upload duly filled, signed & stamped Integrity Pact with two witnesses **[Appendix – A]**. b. Clause by Clause compliance for the BEML Procurement Technical Specification (PTS): Doc no: PTS Doc No GR/TD/7053 (Latest rev). **[Appendix – B]** Bidders to refer "**PTS**" **(Annexure-I)** enclosed along with this tender document. Bidders should upload the following documents duly filled, signature & stamped under technical bid. Formats as per PTS also to be submitted. c. Bidder to upload enclosures related to technical & other information deemed appropriate in respect of this tender on the letter head of the company, if any. Photographs / Drawings if any, may be uploaded. d. Bidders to refer "**GENERAL TERMS AND CONDITIONS (GTC)"** (**Annexure-II)** enclosed along with this tender document and upload clause by clause compliance of GTC duly filled, signature & stamped along with the supporting documents as specified therein. **[Appendix – C]** *e.* Bidders to refer "**SCOPE OF CMC"** (**Annexure-IV)** enclosed along with this tender document *f.* Bidders to commit that they will support BEML for requirement of any additional equipment, spares, service required at the later stage ie after 1st year of taking over and up to completion of CMC period. *(***Appendix- D)** g. Bidders to upload duly filled, signature & stamped confidentiality agreement in plain paper **[Appendix – E]** h. Bidders to upload duly filled, signature & stamped Compliance to Land border sharing Clause – **[Appendix – F]** i. Bidders to upload duly filled, signature & stamped Compliance to purchase preference under public procurement policy – **[Appendix – G]** j. Bidders to upload duly filled, signature & stamped Compliance to Contact Details of Supplier/ Bidder – **[Appendix – H]** k. Bidders to upload duly filled, signature & stamped Compliance to Delivery Schedule – **[Appendix – I]** l. Based on **Annexure- V (JICA)],** bidder to upload duly filled, signed& stamped Compliance to Japanese content Stipulation i.e **[Annexure-V(a)] & [Annexure-VI]** BEML at its sole discretion reserves the right to seek the Soft/ Hard copies of the documents which are already been uploaded in SRM, through Courier / post pertaining to technical bid of this tender enquiry at a later date, if required. In such cases, only the documents uploaded in SRM Portal in original has to be couriered at the request of BEML. Any irrelevant documents furnished through courier will not be considered. **NOTE**: Please note Commercial Bid /Price details should not be indicated in TECHNICAL BID, else bid will not be considered for further evaluation.

6. SUBMISSIONS OF COMMERCIAL BID

The price bid to be submitted through SRM Portal. The following details are to be entered in the SRM Portal.

Table-1. Equipment with DNP/DLP						
Sl. No	Kit Part no	Description	UoM	Total Quantity for 210 Cars (70 T. Sets)	Unit Rate in INR	Total Quantity for 210 Cars (70 T. Sets)
1	5242100005	KIT OF FIRE DETECTION SYSTEM	Set	140	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
2		Design and Submission of design Documents for Fire Detection System.	Set	70	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
3		FAI Reports and Type Test & Report for Fire Detection System	AU	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
4		Deliverables as per ERTS Clause 2.26.5.2 for Fire Detection System	AU	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
5		Sil Certifications and certificate submission as per ERTS Clause 2.26.5.2 for Fire Detection System	Set	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
6		Printed Circuit Boards (PCB) details asper ERTS 19.55 for Fire Detection System	AU	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
7		Microprocessor Details as per ERTS 19.57 for Fire Detection System	AU	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
					Sub-total (Table 1)	
The prices are firm and fixed prices and PVC is not applicable.						

TABLE 2 Comprehensive Maintenance Contract (CMC)						
Sl. No	Part No	Description	UoM	Quantity /Project	Unit Rate in INR	Total Price in INR
1	5242100029	Spares as per Annexure-A for Fire Detection System	Set	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
2	5242100030	Tools and Test bench for Fire Detection System	Set	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
					Sub total (Table 2)	
The prices are firm and fixed prices and PVC is not applicable.						

TABLE-3 Training & Manuals					
Sl. No	Description	UoM	Qty/Project	Unit Rate in INR	Total Price in INR
1	Training on O&M to the CMRL/BEML on Fire Detection system	AU	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
2	Training Manual, System/ Technical Manuals, Software Manuals, Operation Manuals, Maintenance Manuals, Fault Diagnostic & Trouble shooting Manuals & Spares Part Catalogue for Fire Detection System	AU	1	**Price to be uploaded in commercial bid only**	**Price to be uploaded in commercial bid only**
				Sub total (Table 3)	
The prices are firm and fixed prices and PVC is not applicable.					

Note:

1. Bidder has to quote for all the items in SRM Portal
2. Commercial evaluation will be arrived based on grand total of all the tendered items (i.e. Equipment with DNP/DLP, Comprehensive Maintenance Contract (CMC), Training & Manuals). (i.e. Table-1+Table 2 +Table 3)
3. The commercial bids of the technically acceptable vendors only will be opened for further commercial evaluation.

4. . Acceptable Currencies as per CMRL Contract:

   a) **INDIAN RUPEE (INR)**
   b) **EURO (EUR)**
   c) **JAPANESE YEN (JPY)**

5. For the purpose of arriving the landed cost in INR, the exchange rates for EUR/JPY prevailing as on date of tender opening. (Date of Technical bid opening in case of two bid tender)
6. In case of Foreign bidders, for the purpose of arriving the landed Cost in INR, Freight charges of 4.5% shall be loaded during price evaluation.
7. Reverse auction will be conducted at the sole discretion of BEML among technically qualified Bidders and L1 status will be arrived based on total landed bid value. (i.e. Table-1+Table 2 +Table 3).

8. Reverse Auction will be conducted at the discretion of BEML

[ANNEXURE – II]

GENERAL TERMS & CONDITIONS (GTC) FOR PROCUREMENT OF MATERIALS:

1. GLOSSARY, DEFINITIONS & INTERPRETATIONS

1.

a) The Purchaser means "(include company name and address)" (A Government of India
Undertaking) incorporated under the Companies Act having its registered office at "BEML Soudha, No 23/1, 4th main, S.R. Nagar, Bengaluru – 560027" and shall be deemed to include its successors and assignee.

b) Supplier' means a person having been included in a contract as a Contractor and also means a firm or company with whom the order for supply/execution of work is placed and shall be deemed to include the supplier's successors, (approved by BEML Ltd.,) representatives, heirs, executors and administrators. The supplier may also be referred to as the supplier, Contractor or vendor.

c) Parties to the Contract' shall mean the Supplier and the Purchaser as named in the main body of the Purchase Order.

d) Tender' means and includes quotation, invitation to tender and all other documents like drawings, specifications, quality plan, etc that form part of the tender document.

e) Acceptance of Tender' Means the letter of memorandum communicating supplier, the acceptance of the Tender and includes advance acceptance of this tender.

f) Purchase Orders (PO) / Contract' means and includes the invitation to tender, instruction to Tenderers, acceptance of tender, Letter of intent / letter of award, the general terms and conditions of Purchase Order / contract, special conditions of Purchase Order /contract, particulars, descriptions, specifications, schedule of prices, quantities, quality plan, drawings enclosed and other condition specified in the acceptance of tenders and includes the repeat order which has been accepted or acted upon by / for the supplier for the supply of stores and includes an order for performance of service and includes amendments, if any, that may take place subsequent to the discussions, negotiations, mutual agreement if any.

g) Stores / Materials / Services' means the goods or services as described in Procurement Technical Specification (P.T.S.) and in the Purchase Order which the supplier has agreed to supply under the Purchase Order.

h) Specification means technical specifications of the Equipment / Material as set forth in Procurement technical specification (PTS) / technical drawings, which is part of tender. Employer(CMRL) Requirement Technical specification (ERTS) & Employer (CMRL) General Condition of contract(GCC) and Employer Particular condition of Contract (PCC)

i) End-Customer / End-user means: Chennai Metro Rail Limited (CMRL).

j) Words in singular include the plural & vice-versa.

k) Words imparting the masculine gender shall be taken to include the feminine gender and words imparting persons shall include any firm, company or associations or body of individuals whether incorporated or not.

l) The heading of these conditions shall not affect the interpretations or construction thereof
of the contract.

m) C.F.R /F.O.B / F.D.D / DAP. is to be interpreted in accordance with the provisions of INCOTERMS 2020, unless otherwise specified in this Tender Document / Purchase order.

2. **SUBMISSION OF THE TENDER:**
Tender is in TWO-BID system (Technical & Commercial Bid)

Bids should be submitted online mode only as follows:

a) Submission of Technical bid (without price):

i. The Bidder should upload all the requisite technical documents along with respective supporting documents and other information deemed appropriate in respect of the Tender.

ii. **The price details/commercial bid details should not be given in the Technical bid**. If any of the bidder have given any price/commercial details in the Technical bid, their offer is liable for rejection and will not be considered for further evaluation**.**

iii. Technical Bid will be opened on date and time of bid opening and the commercial Bids of those bidders whose technical bids are qualified (accepted) only will be opened for commercial evaluation.

b) Submission of Commercial bid:

i. The Commercial Bids of those bidders whose technical bids are qualified (accepted) only will be opened for commercial evaluation.

ii. Price details in specified field on SRM Portal to be submitted.

iii. Bidder to quote for all the items /Services.

c) General:

i. If dealers are submitting the bids in place of OEM, Dealer should submit Authorization letter from OEM.

ii. BEML reserves right to reject the tender due to unsatisfactory past performance in the
execution of a contract at any of BEML projects / units.

iii. Bidders participating in the tender should declare in their offer that whether they have
been black-listed / kept on hold for a specified period / given Business holiday for a specified period by any Public sector undertaking or Government departments. The reasons for such action with details and the current status of such hold shall be furnished to BEML.

iv. In case any person/persons, Company, firm, Associations having any litigations, arbitration cases between themselves and BEML Ltd, pending before the Court / Arbitrator or initiated litigations/arbitrations in connection with any contract / tender issued by BEML Ltd and any contractor has defaulted against the BEML's orders, they are not eligible to participate in this tender.

v. BEML may decide to scrap the tender/refloat the tender without assigning any reasons thereof before LOI/PO is committed. BEML reserves the right to accept, split, divide, negotiate, cancel or reject any tender or reject all tenders at any time prior to the award of the contract without incurring any liability to the affected tenderers or any obligation to inform affected tenderer, the grounds of such action.

vi. BEML reserves the right to verify, in its sole discretion, any information given by the bidders independently through any third-party agencies. During this process, if it is found that any of the information given by the bidder is false / misleading, offers of such bidders would be out rightly rejected.

vii. BEML also reserves the right to independently assess the capability and capacity of the bidder for execution of the order/contract. BEML's decision on any matter regarding short listing of bidders shall be final.

viii. The Tender / Notice Inviting Tender is not an offer or a contract.

ix. Bidders will not be compensated or reimbursed for the costs incurred in preparing Proposals. Proposals shall become BEML property.

x. BEML's decision is final for Evaluation of the offers which is also based on Employer's (CMRL) requirement and conditions of contract for ARE02A Project.

3. **SUPPLIERS SHARING LAND BORDER WITH INDIA**:
Land border sharing Declaration in line with Department of Expenditure's(DOE) Public Procurement Division order vide F. No. 6/18/2019-PPD dated 23.07.2020 & 24.07.2020 as amended from time to time and its subsequent Orders/Notifications issued by concerned Nodal Ministry for specific Goods/Products, shall be applicable for bidders / suppliers sharing land border with India. Bidders to upload signed & sealed compliance as per appendix attached as part of Technical Bid.

4. **PREFERENCE TO MAKE IN INDIA SUBJECT TO JAPANESE CONTENT STIPULATION AT CLAUSE 44 OF GTC:**

Purchase Preferences as per MII (Make In India Policy) and MSE Purchase Preference as Per Public Procurement Policy is Applicable in-line with revised public procurement (preference to make in india), order 2017 dated 04th June, 2020 as amended from time to time and its subsequent Orders/Notifications issued by concerned Nodal Ministry for specific Goods/Products, shall be applicable for bidders / suppliers under Purchase preferences. Bidders shall upload necessary supporting documents and to upload signed & sealed as per appendix attached as part of Technical Bid.

5. **DELIVERY TERMS:**

a) In case of foreign Supplier: F.O.B (Free on Board) to nearest port basis. The intimation for shipment should be provided 21 days prior to the delivery schedule to our nominated freight forwarder and the consignment to be handed over to our freight forwarder before the cut-off date for sailing.

b) In case of Domestic Supplier: F.O.R (Free on Road) /F.D.D. (Free Door Delivery), BEML, Bangalore Complex.

c) For CMC - Supply of Spares & Tools: F.O.R- Designated CMRL depots, Chennai

6. **PAYMENT:**

SUPPLIES (Equipment)

a) **APPLICABLE TO FOREIGN BIDDERS:**

i. TT payment -100% 60 days from the date of receipt of material at BEML stores subject to inspection clearance.

ii. All bank charges incurred in India shall be borne by BEML and all bank charges outside India shall be borne by the supplier.

b) APPLICABLE TO THE DOMESTIC BIDDERS

i. Terms of payment are 100% in 60 days from the date of receipt of material at BEML stores subject to inspection clearance & for MSEs in 45 days from the date of receipt of material subject to inspection clearance as per MSME act.

Bidders to indicate the category of their firm under Micro/Small/Medium industries with necessary documentary proof of evidence for purpose of evaluation and our data up dation.

I. **NON-RECURRING (NRC) AND SERVICE ACTIVITIES**:

i. **NRC:** 100% payable on 60th day after completion of NRC activities subject to acceptance by BEML R&D and for MSEs 45 days after completion of NRC activities subject to acceptance by BEML R&D

ii. **FAI Reports and Type Test & Report:** 100% payable on 60th day after completion of FAI activities and submission of FAI reports and type test reports subject to acceptance by BEML R&D and for MSEs 45 days after completion of FAI activities and submission of FAI reports and type test reports subject to acceptance by BEML R&D

iii. **Services :**100% payable on 60th day after completion of service activities subject to acceptance by BEML R&D /Depot T&C/End Customer and for MSEs 45 days after completion of service activities subject to acceptance by BEML R&D /Depot T&C/End Customer

Micro and Small enterprises (MSE) registered under UDYAM registration are eligible for the 45 days payment on submission copy of MSE certificate issued by UDYAM.

iv. TDS (Tax deducted at source) will be applicable for service purchase orders including Foreign Services and will be deducted as per law of land. SAC (Service Account code) shall be indicated by the bidder for the services that are proposed be carried out.

II. PAYMENT FOR SPARES SUPPLY DURING CMC PERIOD AS PER MUTUALLY AGREED SCHEDULE:

100% on 60th day from the date of receipt of material as per "Scope of CMC" in Annexure-IV at BEML stores /Chennai Depot subject to inspection clearance and based on mutually agreed delivery schedule between BEML in line with LCC of the system

Note: For Bidders not agreeing with above terms I,II&III, their prices will be suitably loaded with applicable cash credit interest while evaluation of bids.

The payment is further subject to the following:

a) The Invoice shall be compliant with GST laws.

b) GST liability is to be discharged and ensure filing of outward supply details on GSTN portal within timeline prescribed.

c) Any debit note/supplementary invoice if any, is to be raised within September month following the respective financial year of filing of annual return by BEML, which ever is earlier.

d) Any loss of tax credit due to the reason attributable to supplier shall be recovered from supplier along with applicable interest and penalty.

e) Bidders to indicate the GST and other levies applicable. GST shall be paid only after confirmation of payment of GST by vendors on GST Website.

f) Relevant TDS / TCS as applicable shall be deducted as per prevailing Income Tax / GST / GOI notifications

g) The supplier should submit the following documents for each supply:

Tax Invoice; GSTR-1 return filed with authorities with the relevant abstract

GSTR-3B return or any other form of return prescribed by the authorities.

Copy of Challans regarding deposit of GST

Certificate of Chartered Accountant

7. **PRICE BID VALIDITY:**

The Bid should be valid for 180 days from the date of tender opening. BEML's acceptance of the tender at the quoted / negotiated rates will be binding on the tenderer during the tenure of contract.

8. **FIRM PRICE FOR SUPPLY, NON-RECURRING SCOPE AND DELIVERABLES:**
The prices remain firm for the entire supplies of the purchase order and no escalation shall be entertained under any circumstances. The prices are to be firm & no increase in finalized price will be entertained after awarding contract during the period of Contract for any reasons whatsoever.

9. **INSPECTION:**
The Supplier guarantees that the delivery is of good quality and free from all defects and in the case of services rendered that they are performed by skilled personnel and that new materials are used.

The Supplier guarantees that the delivery corresponds exactly with the provisions of the agreement, the reasonable expectations of BEML regarding the characteristics, quality and reliability of delivery.

The Supplier guarantees that the delivery is suitable for the purpose for which it is intended by its very nature or which is evident from the specifications listed and from the order.

The Supplier guarantees that the delivery complies with legal requirements applicable in India and other (international) Government regulations, as applicable.

The supplier guarantees that the delivery complies with the customary norms and standards in the relevant branch of trade or industry. The supplier shall be responsible for compliance with applicable technical, safety, quality, environmental requirements and other regulations in relation to his product, packaging, and raw and ancillary materials.

10. **WARRANTY:**

a) The supplied goods/stores to the purchaser under the contract shall be of the highest grade, free of all the defects & faults in material and of the best quality, manufacture and workmanship and consistent with the established and generally accepted standards for materials of the type ordered and in full conformity with the contract specification, drawing or sample, if any and shall, if operable, operate properly throughout warranty period.

Any defect/fault & non-conformance to standards & descriptions as aforesaid, found during warranty period shall be rectified /repaired/replaced free of cost & at supplier's risk to the complete satisfaction of BEML / End user, within reasonable time at the ultimate destination.

i. Warranty for Design, Manufacture, Supply, Testing and Commissioning, NRC, Deliverables and Service activities for 210 cars:

The said goods/stores shall be warrantied /guaranteed for a period of 24 months from the date of taking over of last trainset by CMRL.

ii. Warranty towards Spares & Tools for Comprehensive Maintenance Contract period:

The said goods/stores shall be warrantied /guaranteed for a period of 24 months from the date of supply of goods at BEML stores/Designated Depots

b) **Defect Liability Period (DLP) / Defect Notification period (DNP):** Defect Liability Period (DLP) / Defect Notification period (DNP): Defect Liability / Notification period shall start after taking over of first train set by customer and shall end two years after taking over certificate date of 70th train set.

For detailed scope of DLP/DNP, Bidders to refer PTS : GT/TD/7053 latest revision attached along with the tender.

If the Works or sections are not available for usage by end user (CMRL) for more than 48 hrs, then a penalty shall be paid by the supplier as applicable in same lines as per CMRL contract where the non-usage is due to vendor supply.

As per CMRL contract, "the cumulative amount shall be deducted by the Employer from the subsequent bills submitted by Contractor.

- Rolling Stock: Rs. 25,000 per day/ train

A penalty of Rs. 2 lakhs for each case shall be levied for the failure or malfunction in the Works or sections during passenger operation which interrupt metro operations in the specific corridor for more than 10 mins"

c) Extension of DLP:

i. Train/System/Sub-system level extension of DLP will be applicable in the case where reliability targets defined as per ERTS 18.6 are not met.

ii. In case of any retrofits/modifications done by the suppliers in any specific system/sub-system/function/component/software shall be subjected to 24 months warranty from the date of completion of retrofit/modification in that train spares. This specific 24-month warranty is irrespective of the train DLP/warranty

iii. There shall be no delay in start of CMC period of car, However, If the DLP / DNP extension arose on account of non-fulfilment of the Reliability Demonstration targets for subject aggregate for which the tendering is done (as defined in ERTS-RS clause 18.6), then payments against Rolling stock CMC shall be reduced by 65% by CMRL on payment to BEML. The same will be reduced in payment to the supplier on back-to-back basis.

d) **Comprehensive Maintenance Contract (CMC):**

CMC shall start after completion of DLP/DNP activity for 70th Trainset and shall end 15 years after the start of CMC

Note: In case of optional cars, CMC shall start after completion of DLP/DNP activity for 80th Trainset and shall end 15 years after the start of CMC

e) **Guarantee / Warranty replacement:**

Guarantee / Warranty replacement shall be dispatched on "DDP / F.O.R – BEML Stores / designated destination" basis for replaceable items during warranty period.

f) The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the BEML may have against the supplier, whether in tort or otherwise.

If any defect or damage is one requiring immediate attention from safety / environmental view point / operational viewpoint, then BEML has the authority to proceed with rectification in any manner suitable and deduct such sums from the suppliers Bill or purchase order whichever is active.

11. **PERFORMANCE SECURITY / PERFORMANCE BANK GUARANTEE (PBG):**

Firm shall submit the following 2 Performance Bank Guarantees:

I. FOR SUPPLY OF EQUIPMENTS, NON-RECURRING SCOPE, FAI, DELIVERABLES AND SERVICE ACTIVITIES

a) Supplier should submit Performance Bank Guarantee for amount equivalent to 10% of the Contract value for supply of equipment, Non-recurring scope, FAI, Deliverables and service activities which will be valid till issue of taking over certificate for last trainset by end customer (CMRL). The bank guarantee has to be submitted within 60 days from the date release of Purchase order from BEML but not later than 30 days before commencement of supplies pertaining to first delivery schedule indicated in the purchase order

b) In case BEML is constrained to extend the Performance Bank Guarantee to its customer (CMRL), due to the failure of aggregates attributable to the supplies made by the supplier or non-fulfilment of NRC and other activities as applicable, then the costs involved to BEML for such PBG extensions shall be borne by the supplier.

c) Performance Bank Guarantee shall be returned back only after completion of issue of taking over certificate for last trainset by end customer (CMRL) and if there is no defect /failure/negligence/complaints and /or any claims notified to BEML on part of supplier in fulfilling the supplies and activities

d) If the minor outstanding works as incorporated in the taking over certificate are not attended by the Supplier within the specified time frame, full amount of Performance Security due to the Supplier shall not be released

II. BANK GUARANTEE TOWARDS SPARES & TOOLS FOR COMPREHENSIVE MAINTENANCE CONTRACT PERIOD:

a) Supplier should submit Performance Bank Guarantee for amount equivalent to 10% of the Contract value for supply of spares & Tools for comprehensive maintenance contract period valid for entire Warranty period for CMC. The bank guarantee has to be submitted within 60 days from the date release of Purchase order from BEML but not later than 30 days before commencement of supplies pertaining Spares & tools indicated in the purchase order

b) In case BEML is constrained to extend the Performance Bank Guarantee due to the failure of aggregates attributable to the supplies made by the supplier, then the costs involved to BEML for such Performance Bank guarantee/security extensions to its customer (CMRL) shall be borne by the supplier.

c) General terms of PBG:

a) In case of foreign bank guarantees, the BGs from foreign banks, authorized /recognized by RBI to issue a Bank Guarantee, in their own letter head will be accepted. In the case of PBG/s submitted from Indian Bank, the PBG shall be furnished by Scheduled Commercial Banks authorized by RBI to issue a Bank Guarantee.

Format for PBG is attached for reference.

PBG shall be returned back only after completion of necessary Warranty /CMC Period and if there is no defect /failure/negligence/complaints and /or any claims notified to BEML on part of supplier in fulfilling the supplies and activities.

b) In the absence of performance bank guarantee to be submitted by the supplier as per contract terms, BEML will not open Letter of Credit (LC) in the cases of LC in favor of supplier pertaining to the shipment / stores to be supplied as per first delivery

schedule indicated in the purchase order. Any delay in submission of performance bank guarantee by the supplier, the subsequent delay in opening in Letter of Credit by BEML and supplies to be effected by the supplier are to the account of the supplier, which attracts liquidated damage charges as per contract terms.

c) No claim shall lie against BEML Ltd., in respect of interest on cash deposits or Govt. Securities depreciation thereof.

d) BEML shall be entitled to and it shall be lawful on its part to encash the Bank Guarantee in whole or in part in the event of any default, failure or neglect on the part of the supplier in the fulfilment or performance in all respect of the Purchase Order.

e) The Bank Guarantee shall be established through **Structured Financial Messaging System (SFMS)** mode from a Scheduled Commercial Bank authorized by RBI in India as defined by RBI.

f) A separate copy of the BG has to be sent by the issuing bank to the Purchaser's bank through SFMS. The details of Purchaser's bank are as under:

STATE BANK OF INDIA
Overseas Branch, No.65,
St. Marks Road,
Bangalore – 560001
IFSC Code: SBIN0006861

g) Following codes are to be used by issuing bank for the purpose of Confirmation and amendment in Bank Guarantees:

Code	Purpose
MT760	Confirmation of Bank Guarantee
MT767	Amendment in Bank Guarantee

h) Bank Guarantee issued on the SFMS platform with any other code other than mentioned above for the purpose shall not be acceptable to the Purchaser.

The Bank Guarantee validity shall be extended as required till the completion of all contractual and warranty obligations in Full.

i) Bank Guarantee to be submitted in electronic form through NeSL platform as required by BEML

12. RIGHT TO VARY QUANTITIES &-QUANTITY OPTION CLAUSE:

a) BEML reserves the right to increase or decrease the quantity specified in the schedule of requirements without any change in the unit price or other terms and conditions within the agreed delivery schedule

b) BEML may at its discretion may advice the supplier in writing about the increase of the total quantity up to 10 complete train sets requirement of 3 cars each i.e. 30 cars. and upto additional 50% qty of spares and tools within CMC period.

c) Supplier shall be required to supply increased ordered quantities at the contracted terms & conditions and determined prices (Excluding design cost, Type test cost, FAI test cost, Training & Manuals cost and Testing & commissioning cost) and no additional amount on account of quantity variation or escalation or any other account whatsoever payable to the supplier

d) In case of increase in quantity beyond the original bid quantity, the delivery schedule for the increased quantities shall be mutually decided at the time of exercise of quantity variation by the Purchaser

e) **CMC obligation for variation quantity**: The CMC obligation as applicable for the base order (70 trainsets of 3 car configuration) quantity shall be applicable for the respective optional trainsets also. The pricing for CMC for the optional trainsets shall be derived accordingly.

13. **LIQUIDATED DAMAGES CLAUSE:**

The time and the date of delivery of the stores stipulated in the PO shall be deemed to be the essence of the Purchase order and delivery must be completed not later than the dates specified therein. The supplier shall strictly adhere to the delivery schedule indicated in the PO. Any supplies made ahead of this schedule are liable for rejection at the discretion of BEML. Should the supplier fail to deliver the stores or any consignment thereon within the period prescribed for such delivery, BEML shall be entitled:

"To accept the delayed supply and to recover from the supplier Liquidated Damage charges at the rate of **0.1%** of total value of the amounts apportioned to the affected delivery schedule for each calendar day of delay for **first 28 days** and **0.2%** of the total value of the amounts apportioned to the affected delivery schedule for each calendar day of delays from **29th day** to the maximum of **10%** of the affected schedule of the purchase order."

The penalty / LD will be charged on the value of the affected delivery schedule excluding statutory levies, freight and insurance wherever not included in the price.

14. **RISK PURCHASE CLAUSE:**

The time and the date of delivery of the stores stipulated in the PO shall be deemed to be the essence of PO and delivery must be completed not later than the date specified therein. Shall the supplier fail to deliver the stores/services or any consignment thereof within the period prescribed for such delivery, BEML shall be entitled at their option either;

a. To purchase elsewhere, without notice to the supplier on the account and at the risk and cost of the supplier the stores not delivered or other of a similar description (where stores exactly complying with the description and readily procurable) without cancelling the PO in respect of consignment not due for delivery

or

b. To cancel the purchase order.

In the event of action being taken under clause (a) or (b) above, the supplier shall be liable for any loss, which BEML may sustain on that account but the supplier shall not be entitled to any gain or purchases made against default. As soon as it is apparent that the scheduled dates cannot be adhered to, an application shall be sent by the supplier to BEML, well before the expiry of the delivery period specified in the purchase order. Without prejudice to the foregoing rights, if such failure to deliver in proper time as aforesaid shall have arisen from any cause which BEML may admit as a reasonable ground for an extension of the time (and their decision

shall be final) they may allow such additional time as they may consider justified by circumstances of the case.

Delivery required to be made in lots shall be made in lots only and any extra deliveries involved either on account of repeated rejections or variance in supply of lots shall be liable for service charges of 5% of the purchase order value for each extra delivery.

15. **SECRECY AND CONFIDENTIALITY:**

a) All the information, know-how, technical data, specification and drawing models or specimens furnished by BEML for the purpose of or in connection with the manufacture and supply of the stores hereby tendered constitute the property of BEML and the supplier shall keep them in strict confidence and he/ she shall not divulge the same to anyone else except under the authority and for the purpose of BEML. All such documents, data, drawing, models and specimens are the property of BEML and shall be returned when done with or when demanded by BEML.

b) The supplier shall not supply the material ordered by BEML to anyone else other than BEML and shall not disclose any initiations, development or adaptations thereof to anyone.

c) BEML shall be entitled to prevent a breach of the above and claim damages in case of breach. In case of non-performance in this PO, BEML will have to take procurement action at your risks and cost apart from levy of liquidated damages.

d) Confidentiality agreement to be executed as per Appendix E.

16. **AUTHORITY OF PERSONS SIGNING DOCUMENT:**

A person signing the tender or any other document in respect of the tender shall be deemed to have power to do so on behalf of the Supplier.

17. **ACCEPTANCE OF ORDER:**

The supplier shall send Order Acceptance within two weeks from the date of LOI/LOA/Purchase Order or such other period as specified / agreed by the Purchaser. Purchaser reserves the right to revoke the order placed if the order confirmation differs from the original Purchase Order placed and the Purchaser shall only be legally bound after it has agreed explicitly in writing to be in agreement with the deviation. The acceptance of deliveries or supplies by Purchaser as well as payments made in this regard shall not imply acceptance of any deviations. The Purchase Order will be deemed to have been accepted if no communication to the contrary is received within two weeks (or the time limit as specified / agreed by the Purchaser) of receipt of the order.

18. **OTHER CONDITIONS:**

a) Refer BEML Purchase Manual (can be accessed in BEML website www.bemlindia.in) for Important terms and conditions of tender and General Terms & conditions applicable to contracts & purchase orders refer General Terms & Conditions

b) The firm shall take necessary permission for their employees to enter the factory premises and the firm shall arrange ESI & PF coverage to their employees / labourers if any from their end. The firm shall indicate ESI NUMBERS for the labourers hired or employed in advance in order to prepare work permit inside the factory.

c) BEML will not have any kind of binding towards the compensation on case of injury / death to the firms employees while working in BEML premises or other wises.

d) BEML will not have any kind of binding on damages or loss to the tools/instruments etc. brought by the firm for commissioning purpose.

19. **PRICE, INVOICING AND PAYMENT:**

a) The agreed prices are **fixed prices** for the supply, in the currency as specified in the Purchase Order. They shall include packing, forwarding, loading and carriage to the place specified by the Purchaser and are inclusive of all applicable taxes, duties etc. except for those specifically agreed between the supplier and purchaser. The method of invoicing shall be without prejudice to the parties; agreement as to the place of performance. Invoices shall be submitted bearing the Purchase Order number & date, item number / s and supporting documents as called for in the Purchase Order.

As soon as each shipment is made in line with the delivery schedule specified in the purchase order, the supplier shall send **one set of Original documents and three (3) sets of photocopies** each of the following documents to the address indicated below by courier service.

i. Commercial Invoice
ii. Delivery Challan
iii. Packing List
iv. BEML's Inspection clearance document(s), material test certificates and other applicable quality documents pertaining to the supplies.

Postal Address

The Deputy General Manager,
Metro Purchase Department
BEML, Bangalore Complex,
PB No.7501, New Thippasandra post,
Bangalore, Karnataka, India,
Postal Code - 560 075

20. **PROGRESS REPORT:**

The supplier shall regularly inform the progress of work and in such form as may be called for by the Purchaser from time to time. The submission and acceptance of such reports shall not prejudice the rights of the Purchaser in any manner.

21. **QUALITY & WORKMANSHIP:**

The stores supplied shall be of the best quality and Workmanship shall be in strict conformity with all the drawings and specifications furnished with the Purchase Orders and shall answer to the description in all respects. All supplies shall be accompanied by supplier's works inspections / test certificates duly certifying, the Stores are in strict conformity with the drawings / specifications. However, final acceptance will be subject to inspection and approval at BEML works. Once the materials are rejected and communicated to the supplier, no request shall be entertained for re-inspection or acceptance of the stores. However, BEML reserves the right to re-inspect the stores and consider acceptance at its discretion.

22. **QUALITY, CONDITION OF DELIVERY:**

The Supplier shall guarantee that the delivery is of good quality and free from all defects and in the case of services rendered that they are performed by skilled personnel and that new materials are used. The Supplier shall guarantee that the delivery corresponds exactly with the provisions of the agreement, the reasonable expectations of Purchaser regarding the characteristics, quality and reliability of delivery. The Supplier guarantees that the delivery is suitable for the purpose for which it is intended by its very nature or which is evident from the specifications listed and from the order.

The Supplier shall guarantee that the delivery complies with legal requirements applicable in India and other (international) Government regulations, as applicable. The supplier shall guarantee that the delivery complies with the customary norms and standards in the relevant branch of trade or industry. The supplier shall be responsible for compliance with applicable technical, safety, quality, environmental requirements and other regulations in relation to his product, packaging, and raw and ancillary materials.

23. **SUPPLY OF SAMPLE: (if applicable)**

The Contractor shall produce samples of all materials and shall obtain approval before he places bulk order for the material for incorporation in the works. In respect of materials for which samples are not kept or detailed specifications is not given hereinafter, such materials shall comply with the latest relevant Indian Standard Specifications a published up to the date of issue of this tender. The Contractor shall on demand produce original receipts vouchers/invoices in respects of materials supplied by him.

24. **INSPECTION, TESTING & CONSEQUENCE OF REJECTION:**

The goods and stores shall be of approved design and each part /component may be inspected and tested by the Purchaser prior to shipment and shall fully comply with relevant requirements of purchaser.

Purchaser has the right to inspect the delivery. In the event of rejection, Purchaser shall inform the Supplier accordingly and Purchaser shall be entitled to replacement or repair at its discretion or may proceed to terminate or annul the agreement. All this does not affect Purchaser's right to compensation.

In case the goods / stores are rejected at the time of inspection at BEML or the rejections are noticed at the time of further processing the supplier will be informed of these rejections. On receipt of this information the supplier shall immediately arrange to collect the rejected items at his cost and risk and arrange for the replacement of goods within the shortest possible time. Under no circumstances the supplier shall compel the Purchaser to rework the rejected goods.

Wherever the supplier has not collected the rejected items within 60 days from the date of intimation, BEML shall have the right to dispose the goods and all cost related to the cost of material, statutory levies incurred both in procurement and disposal shall be recovered from the supplier from any of the bills that are due. The supplier shall have no claims whatsoever against the Purchaser for such disposal.

Purchaser or his authorized representative shall be entitled at all reasonable times during execution to inspect, examine and test at the Supplier's premises the material and workmanship of all stores to be supplied under the Contract, and if the part of the stores are being manufactured at other premises the Supplier shall obtain Purchaser's or his authorized representative's permission to inspect, examine and test as if the said stores are being manufactured at the Supplier's premises. Such inspection, examination and testing, if made shall not release the Supplier from any obligation under the Contract.

All costs related to inspections and re-inspections shall be borne by the Supplier. The cost of inspection staff / third party specified by the Purchaser shall be borne by Purchaser, unless otherwise specifically agreed. Whether the Contract provides for tests on the premises of the Supplier or any of his Sub-contractor/s, Supplier shall be responsible to provide assistance such as, labour, materials, electricity, fuels, stores, apparatus, instruments as may be required and as may be reasonably demanded to carry out such tests efficiently. Cost of any type test or such other special tests shall be borne by the Purchaser only if specifically agreed.

The supplier shall give the authorized representative of the Purchaser reasonable prior notice in writing of the date on and the place at which any stores will be ready for inspection / testing as provided in the Contract.

25. **RAW MATERIALS ARRANGEMENTS:**

The supplier shall make his own arrangement to procure all raw materials required and BEML shall not be responsible for any assistance in such procurement or whatsoever.

26. **IDENTIFICATION OF ITEMS / PIECES:**

The supplier shall indicate / emboss / engrave, suitable identification marks (Viz. BEML stock number, supplier code number, batch no. etc.,) on each item/piece (or) on all components at convenient non-machinable place as per drawing, wherever applicable.
Also, shall indicate BEML part number, PO No. and date in all delivery documents, invoices and correspondence, wherever applicable.

27. **PACKING AND MARKING:**

a) Packing to be in such a way that it should avoid transit/storage/handling damage.

b) The supplier shall package the deliveries safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by Sea / Air / Rail / Road to its destination suitably protected against loss, damage, corrosion in transit and the effect of tropical salt laden atmosphere. The packages shall be provided with fixtures / hooks and sling marks as may be required for easy and safe handling by mechanical means.

c) The packing, shipping, storage and processing of the delivery must comply with the prevailing legislation and regulations concerning safety, the environment and working conditions. Items packed with raw / solid wood packing material shall be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitary / Fumigation certificate. If

safety information sheets exist for a delivery or the packaging, the Supplier must always supply these sheets direct (at the same time).

d) Supplier shall indicate approximate net weight, gross weight and dimension of the package to enable BEML to determine the mode of dispatch. The packing should with stand the weather conditions during transit. The packing should not damage the contents in the package while transporting and handling. The safety and handling precautions should be clearly marked on the packages. The packing should be easily transportable without any damage. Each consignment should have individual packing list.

e) Marking shall include the following information in sequence on the frame commensurate with the size of package.

To: M/s. BEML Limited, Bangalore Complex,
New Thippasandra,
Bangalore – 560075,
Karnataka State, India.

Purchase order number:
Shipper's mark:
Package number:
Identification number:
Caution marks, if applicable:
Net weight, gross weight and cubic measurement, whichever is appropriate for the shipment.

28. **APPLICABLE LAWS AND JURISDICTION OF COURTS:**

Indian laws both substantive and procedure, for the time being in force including modifications thereto, shall govern Contract. The competent Indian courts of shall have sole jurisdiction over disputes between purchaser and the Supplier.

29. **JURISDICTION**:
Courts of Bangalore alone shall have jurisdiction to decide any issue / dispute arising out of the Arbitration or this Purchase Order in exclusion of all other Courts. However, jurisdiction of any other court may be accepted by mutual discussion and agreement by and between BEML and the Supplier.

30. **ARBITRATION:**
Any disputes and differences that may arise between the parties in connection with this Agreement/Contract shall be settled by the parties amicably by way of mutual discussion / negotiation / conciliations. In case parties fail to settle the dispute amicably, then the dispute or difference shall be referred to India International Arbitration Centre for resolution. The Arbitration Tribunal shall consist of Sole / three Arbitrator /s. The Arbitrator /s shall be appointed and Arbitration proceeding shall be conducted in accordance with the provision of India International Arbitration Centre (Conduct of Arbitration) Regulations, 2023.

During Arbitration, "Supplies under this Purchase Order, if reasonably possible, may continue by mutual agreement during the dispute / Arbitration proceedings"

31. **INTELLECTUAL PROPERTY RIGHTS; LICENSES:**

If any Patent design, trademark or any other intellectual property rights apply to the delivery or accompanying documentation, Purchaser shall be entitled to the legal use thereof free of charge by means of a non-exclusive, worldwide, perpetual license. All intellectual property rights that arise due to the execution of the delivery by the Supplier and by its employees or third parties involved by the Supplier for performance of the agreement belong to Purchaser. The Supplier shall be obligated to do everything necessary to obtain or establish the above-mentioned rights. The Supplier guarantees that the delivery does not infringe on any of the intellectual property rights of third parties. The Supplier shall also be obligated to do everything necessary to obtain or establish the alternate acceptable arrangement pending resolution of any (alleged) claims by third parties.

The Supplier shall defend and indemnify BEML against any claims, costs or expenses incurred by reason of any infringement of alleged infringement of any letters, patent, registered design, trademarks or trade name by the use of sale of the stores / goods /material and against all costs or damages which BEML may undergo in legal action for such infringement or for which the BEML may become liable in any such action.

The supplier shall at all times indemnify BEML and shall take all risk of accidents or damage which causes a failure of the supply. The supplier shall comply with the provisions of 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 Company from and against any claims under the aforesaid Act and the Rules.

32. **BRIBES AND GIFTS:**

Any bribe, commission, gift or advantage given, promised or offered by or on behalf of the supplier or his partner, agent or servant or anyone on his or their behalf to any officer, servant, representative or agent of BEML or any person on his or their behalf in relation to the obtaining or to the execution of or any other contract with BEML shall in addition to any criminal liability which the supplier may incur, subject the supplier to the cancellation of the PO and all other contracts with BEML and also to payment of any loss or damage resulting from any such cancellation to like extent as is provided in case of cancellation under **Clause-15** hereof. Any question or dispute as to the committing of any offence under the present clause shall be settled by BEML in such manner and on such evidence of information as they may think fit and sufficient and their decision shall be final and conclusive.

33. **FORCE MAJEURE CLAUSE:**

Notwithstanding anything contained in the Contract, neither the Supplier nor the Purchaser shall be held responsible for total or partial non-execution of any of the contractual obligations, shall the obligation become unreasonably onerous or impossible due to occurrence of a `Force Majeure' conditions which directly affect the obligations to be performed by the Purchaser or the Supplier. Such events include war, military operations of any nature, blockages, revolutions, insurrections, riots, civil commotions, insurgency,

sabotage, acts of public enemy, fires, explosion, epidemics, quarantine restrictions, floods, earthquake, or acts of God, restrictions by Govt. authorities over which the Supplier or the acts on which the Purchaser has no control.

The party claiming to be affected by Force Majeure shall notify the other party in writing without delay, within two weeks on the intervention and on the cessation of such circumstance. Extension of time sought by the Supplier along with supporting evidence and so granted by the Purchaser for the supply / work affected, if any, shall not be construed as waiver in respect of remaining deliveries. In the case of vendor seeking force majeure then it is discretion of BEML to consider the same based on authenticate document.

Notwithstanding above provisions, Purchaser shall reserve the right to cancel the order/ Contract, wholly or partly, in order to meet the overall delivery schedule and make alternative arrangements including arrangements with third party for completion of deliveries and other schedules. Purchase may takeover partly processed material at a mutually agreed price.

34. **FALL CLAUSE:**

a) The prices charged for the stores supplied under this P.O by the supplier shall in no event exceed the lowest price at which the supplier sells the stores of identical description to any other BEML Office / Division during the pendency of this PO.

b) If at any time, during the said period, the supplier reduces the sale price of such stores or sells such stores to any other BEML Office / Division at a price lower than the price chargeable under this P.O and the price payable under this PO for the stores supplied after the date of coming into force of such reduction shall stand correspondingly reduced.

35. **NON-DISCLOSURE AND INFORMATION OBLIGATIONS:**

The supplier shall provide Purchaser with all information pertaining to the delivery in so far as it could be of importance to Purchaser. The Supplier shall not reveal confidential information to its own employees not involved with the tender / Contract & its execution and delivery or to third parties. The supplier shall not be entitled to use the Purchaser's name in advertisements and other commercial publications without prior written permission from Purchaser.

36. **ASSIGNMENT OF RIGHTS AND OBLIGATIONS; SUBCONTRACTING:**

The supplier is not permitted to sub-contract the delivery or any part thereof to third parties or to assign the rights and obligations resulting from this agreement in whole or in part to third parties without prior written permission from Purchaser. Any permission or approval given by the Purchaser shall, however, not absolve the supplier of the responsibility of his obligations under the contract.

37. DIVISION OF PATRONAGE:

BEML at its discretion reserves to issue order 100% on L1. BEML reserves the right to avail the price offered for full quantity of the tender or part thereof or ignore the offer completely without assigning any reason whatsoever.

38. INTEGRITY PACT:

The bidder / contractor should upload duly signed & stamped **Integrity Pact** (if the tender value is more than or equal to Rs.1.00 crore) as per prescribed format (**APPENDIX- A)** on plain paper as part of technical bid.

The bidder should put their authorized signature in the Integrity pact as a Contractor / bidder with their company seal along with witness's signature, name & address. **The agreement shall be in full as per format enclosed on a plain A4 size paper duly signed & stamped on all pages**.

The Integrity Pact envisages an agreement between the prospective tenderer and the buyer committing the persons/officials of both the parties not to exercise any corrupt influence on any aspect of the contract.

For the successful bidder, the integrity pact will remain valid up to 12 months after the last payment under the contract, and for all other Bidders 6 months after the contract has been awarded.

The Central Vigilance Commission (CVC) has appointed Shri Kasi Vidyasagar & Shri Lt. Gen. Abhay Krishna as Independent External Monitor (IEM) to oversee the implementation of the Integrity Pact.

Address of IEM is as below:-

Shri Kasi Vidyasagar, IAS (Retd.)

House no. 55,

Dream valley gated community,

Manikonda, Hyderabad – 500089.

Mobile no. +91 9771407778

Email : kasividyasagar@gmail.com

Shri Lt. Gen. Abhay Krishna , (Retd.)

4A-902, Gurjinder Vihar,

AWHO Township, Sector CHI-1

Greater Noida, UP - 201310

Mobile no: +91 9871234353

Email: abhayabk@gmail.com

39. GST TERMS & CONDITIONS:

1. The Supplier is required to comply with all the applicable provisions of the GST Laws/Rules/Notifications/Circulars and to furnish required documents/details within the prescribed time limit to enable BEML to claim the benefits of GST Input Tax Credit or any other benefit.

2. The Supplier is required to furnish proper Invoice/Supplementary Invoice/Debit Note/Credit Note in the form and manner prescribed under GST Laws/Rules/Notifications/Circulars containing all the particulars mentioned therein and within the prescribed time limit as per prevailing GST Laws/Rules/Notifications/Circulars. In case of non-compliance by the Supplier, BEML shall not make any payment towards GST against such invoice until it is complied with within the timeline prescribed under GST Laws/Rules/Notifications/Circulars, and also subject to BEML being in a position to avail GST Input Tax Credit as per applicable GST Laws/Rules/Notifications/Circulars.

3. In case of discrepancy in the data uploaded by the Supplier in the GSTN portal or in case of any shortages or rejection in the supply, BEML will notify the Supplier of the same. Supplier has to rectify the data discrepancy in the GSTN portal or issue Credit note (details to be uploaded in GSTN portal) for the shortages or rejections in the supplies, within the prescribed time limit to enable BEML to avail GST Input Tax Credit.

4. In case, the availment of GST Input Tax Credit by BEML is delayed for any reason other than those attributable to BEML, interest at applicable rate as prescribed under GST Laws/Rules/Notifications/Circulars for such delays shall be recovered from the Supplier.

5. In case Supplier delays declaring such invoice in his GST Return and GST Input Tax Credit availed by BEML is denied or reversed subsequently as per GST Laws/Rules/Notifications/Circulars, GST amount paid by BEML towards such reversal as per GST Laws/Rules/Notifications/Circulars shall be recoverable from Supplier along with applicable interest.

   If BEML has not paid/short paid to the Supplier for any invoices within the time limit prescribed under GST Laws/Rules/Notifications/Circulars due to non-compliance of GST Laws/Rules/Notifications/Circulars by Supplier or any other reason attributable to Supplier and leads to any GST Input Tax Credit reversal by BEML, any losses/expenses/cost/penalty, etc., incurred by BEML shall be recoverable from the Supplier.

6. Wherever applicable, BEML will have the right to deduct “Tax Deducted at Source” at the rate prescribed under the GST Laws/Rules/Notifications/Circulars and to remit the same to the Government

7. In case of supplies made under Reverse Charge Mechanism, the Supplier needs to comply with the provisions under the GST Laws/Rules/Notifications/Circulars in terms of supply of Goods/Services and raising of invoice, so as to enable BEML to remit applicable GST to Govt., within the prescribed time limit and avail GST Input Tax Credit on the same. If the Supplier fails to comply with the above and as a result if BEML incurs any losses/expenses/cost/penalty, BEML shall be entitled to recover the same from the Supplier. Further the Supplier has to mention that “the liability of

payment of GST amounting to Rs ……. is on the Recipient of Service" in the invoice raised on BEML.

8. The Supplier is required to comply with the E-Way Bill Provisions under GST Laws/Rules/Notifications/Circulars. If the Supplier fails to comply with the said provisions and as a result if BEML incurs any losses/expenses/cost/penalty, BEML shall be entitled to recover the same from the Supplier.

9. In case of materials/goods issued to Supplier for Job Work, the Job Work Supplier is required to return the goods within the time limit prescribed in the Purchase Order. If the Job Work Supplier fails to return the goods as above, BEML will be entitled to raise a GST Supply Invoice on the Job Worker Supplier with applicable interest as per the provisions of GST Laws/Rules/Notifications/Circulars. In such cases, BEML will be entitled to recover all such GST/interest on GST /losses/expenses/cost/penalty, etc. incurred by BEML along with interest from the Job Work Supplier. Further in such cases where the GST invoice has been raised by BEML, on return of such goods after the prescribed time limit, the Job Work Supplier needs to return the same under GST invoice.

10. The Supplier have the option to give one Bank Guarantee of appropriate value after considering his estimated value of GST involved in invoices raised on BEML instead of Bank Guarantee for each Contract/Invoice. In case of payment through LC, suitable provisions/clause will be inserted while opening LC to ensure compliances of above conditions. However, if at any point of time value of such Bank Guarantee falls short of GST plus interest thereof, Supplier will have to either furnish Bank Guarantee for Differential value or such shortfall value of Bank Guarantee vis-à-vis GST plus interest thereof shall be withheld till Suppliers fulfils its obligations specified under above clauses.

    BEML will be entitled to recover all losses/expenses/cost/penalty, etc. incurred by BEML along with applicable interest from the Supplier due to reasons other than those attributable to BEML.

11. If the Supplier is a Composition/Unregistered Dealer, the Supplier needs to comply with the provisions under the GST Laws/Rules/Notifications/Circulars in terms of supply of Goods/Service and raising of invoice. In case, the Supplier fails to comply with the above and as a result if BEML incurs any losses/expenses/cost/penalty, BEML shall be entitled to recover the same from the Supplier along with applicable interest.

40. **TAX CLAUSE:**

Any tax and/or duty, which may hereafter be imposed outside India, shall be on Supplier's account. **On the other hand, any tax and/or duty, which may hereafter be imposed in India, shall be on BEML's account**. Notwithstanding the foregoing, tax on supervising fee and/or other training fees shall be on Supplier's account, however, it shall be withheld and paid by BEML in India on behalf of Supplier according to provisions of the corporation tax law, the local inhabitant tax law and convention between Republic of India and the respective Suppliers country, for the avoidance of double taxation and the prevention of fiscal evasion with respect to taxes on income.

Where the government of the supplier's country exempts goods in export from any or all of such taxes, levies, duties on imports, the supplier shall charge the purchase price, which are exclusive of and free from such taxes, levies, and duties on imports.

Any downward revision in taxes or duties imposed in supplier's country should be informed and that benefit should be passed on to the BEML.

Any increase in statutory levies during the period wherein supplier has defaulted to effect supplies as per delivery schedule indicated in contract has to be borne by the supplier.

HSN CODE/CHAPTER ID and SAC Code details are to be indicated against each item.

TDS (Tax deducted at source) will be applicable for service purchase orders and will be deducted as per law of land. SAC (Service Account code) shall be indicated for the services /NRC that will be carried out by the supplier.

41. **PROJECT IMPORT REGISTRATION:**

Customs duty on input content imported by domestic bidders to manufacture tendered items.

Chennai Metro Rail Project is eligible for the concessional rate of custom Duty under chapter 98.01 of Custom Tariff Act for Project Import registration mode. In case if an indigenous supplier imports some items from outside India, the firm has to register with customs for availing concessional rate of duty i.e. 7.5% BCD plus cess, through project import registration mode.

To avail the concessional customs duty benefit, Bill of Material (BOM) of such imported material in the prescribed template (containing part number, description, qty, price, source of supply, mode of shipment – Air/Sea, port of arrival etc.,) should be submitted by bidders to BEML within 02 months from finalization of the contract for obtaining PIR sponsoring letter from CMRL. The PIR sponsoring letter should be registered by the bidders with the concerned Customs Authorities at designated Port of Arrival.

The supplier shall submit the following documents for reimbursement of Custom Duty:

i) Bills of Entry

ii) Challan for deposit of Custom Duty

iii) Declaration that the Sub-contractors/Sub-vendors have neither claimed the deemed export benefit nor they will claim the same.

42. **INSURANCE COVERED BY BEML UPTO START OF CMC:**

BEML has insured the Material being procured and the risk Coverage under the MCE policy shall commence from the moment of the first goods/consignments are lifted, mechanically or manually or otherwise, from anywhere in the world for loading onto the transport (all modes included) and remain in force during transit up to BEML's works and designated CMRL depot available till handing over of trainset with 24 months DNP/DLP.

43. **RETENTION MONEY:**

Retention money shall be deducted at the rate of 5% against each Invoice value of PO (excluding CMC) upto cumulative value equal to 5% of the total Material PO value

excluding taxes & duties. Firm to raise Invoice for 100% value indicating that 5% of the Invoice value shall be payable by BEML only after completion of DLP/DNP period of all the trainset.

Upon the request of the Supplier, the purchaser may release the withheld retention money on submission of Bank Guarantee for an equivalent amount in respective currencies from a public sector bank (PSB) of India or Scheduled Commercial Banks in India or any Japanese Bank as listed under Schedule of Commercial Banks by The Reserve Bank of India (RBI).

Retention amount shall be released upon completion of DLP period i.e, a period of 24 months from the date of supply upto taking over of last trainset (70th trainset) by end customer, CMRL

44. JAPANESE CONTENT STIPULATION:

Chennai Metro Rail Project – Phase II (ARE02A) is funded by Japanese ODA Loans and BEML is required to stringently adhere to the Japanese Ratio of 30.069% of accepted contract value for OE Procurement.

Bidders to refer Annexure-V (JICA) of NIT for eligibility criteria and submit details of Japanese components and service of Subject item in the stipulated format as per Annexure V enclosed along with bid.

Bids from eligible sources complying to Annexure-V (JICA) and providing certificate as per Annexure-V (a) and Annexure-VI will only be considered.

45. COMPREHENSIVE ECONOMIC PARTERNSHIP AGREEMENT (CEPA) and DTAA:

Supplier should comply to CEPA agreement wherever applicable and pass on benefits arising out of CEPA agreement.

ANNEXURE – III: KEY DELIVERY DATES (CMRL)

ARE02A KEY DATE DELIVERY SCHEDULE

BANGALORE COMPLEX

PROJECT	Activities	Order Qty on Hand	2026				2027												2028												2029										
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Chennai Metro ARE02A	Delivery of cars @ Chennai	210	3	0	3	3	0	3	3	0	3	3	3	3	12	6	9	9	12	9	12	9	9	9	9	9	9	6	9	9	9	12	9	6							
	Testing & Commissioning of cars													3	3	3	3	3	3	3	6	9	12	9	12	6	6	9	9	9	18	9	9	6	9	9	12	9	6	9	6
														CMC of 15 years will start by Oct-2031 and end by Sep-2046																												
																				Manuals delivery																					
																				Red denote Key Date																					

			2026				2027												2028												2029										
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov

			Note		**CMC:** BEML is required to carry out 15 years Comprehensive Maintenance Contract (CMC) for Rolling Stock which shall commence after the TOC date of 70th Trainset and shall end after 15 years from start **DLP/RS:** Shall start from the date of issuance of Takingover Certificate (TOC) for the 1st trainset and the fleet DNP / DLP ends two years after the TOC date of the 70th TS **DLP/M&P:** Shall start on the TOC date of the respective equipment item and will ends two years after the TOC date of the last equipment Total RS DLP period required spares & manpower support for 1st TS = 51 months, 70th TS = 24 months. **DLP varies from 1st TS to 70th TS**

ANNEXURE-IV: SCOPE OF CMC

1. One Set of Special tools, jigs, measuring devices, HMI, etc. To be considered as per OEM recommendations.
2. Test facility at Madhavaram depot to be considered as per OEM recommendation.
3. CMC period list of mandatory Spares to be positioned at the depot in schedule manner. Delivery schedule to be discussed and finalized during techno commercial discussion. Mandatory spares to be placed at the depot after completion of DLP period as per **Annexure-A**. This particular clause for spares requirement super seeds the ERTS terms and condition for the CMC.
4. Any modifications carried out by OEM During DLP/warranty period, also to be implemented by OEM in spares supplied under this contract.
5. Training for BEML staff to be provided at OEM Factory/ depots for operational & maintenance. This is apart from the training needs to the customer as indicated in the tender line item.
6. On Train Maintenance is Under BEML scope.
7. During DLP warranty period, DLP spares to be positioned and maintained by OEM at the Chennai depot.
8. OEM to give the storage procedure for the spares supplied at the depot.

Annexure-A
(Ref document, PTS of Fire detection system, Doc No.: GR/TD/7053, Latest Revision)

Sl.No	Item	Unit	Mandatory spares Qty	Remarks
1	Smoke/heat detectors (Multi sensors)	Nos	48	Two train set materials(Tentative quantity)
2	Linear heat detectors(LHD)	Mtrs.	160	Two train set materials.
3	Heat detectors' in fire prone equipment	Nos	12	Two train set materials.
4	LHD/HD for under frame enclosures except propulsion system	Nos	24	Two train set materials.
5	Central fire detection & control unit(FDCU) (Central unit)	Nos	2	One train set materials.
6	Fire detection & control unit for detectors (Local unit)	Nos	3	One train set materials.
7	Set of PCBs for fire detection unit (Train set means DMC +TC + DMC cars)	Train Set	2	Two train set Material.
8	Alarm hooter/Beacons	Nos	6	Three train set materials.
9	DC/DC converters	Nos	9	Three train set materials.
10	Ether net switch	Nos	6	Three train set materials.

11	Consist switch	Nos	9	Three train set materials.
12	Linear heat detectors circuit boards	Nos	30	One train set material.
13	Set of minimum all electrical items auxiliaries: Mating connectors along with cable connecting to FDS equipment's (Male/ female connector along with male/female crimp contact), Pins, Terminal blocks, ferrules, etc. which are under vendor's scope. (Train set means DMC +TC + DMC)	Train sets	1	One train set Material.
14	Set of minimum mechanical items auxiliaries: Namely mounting fasteners, Mounting bolts, Washers, rubber items, etc., which are under vendor's scope. (Train set means DMC +TC + DMC cars)	Train sets	1	One train set Material.

Note: BOM & BOM quantity after design freeze is applicable for the above.

APPENDIX- A

(*To be executed on plain paper and applicable for all tenders of value _ Rs. 1 Crore and above)*

INTEGRITY PACT

Between

BEML Limited (BEML) hereinafter referred to as "The Principal"

And

……. hereinafter referred to as "The Bidder/Contractor"

Preamble

The Principal intends to award, under laid down organizational procedures, contract/s for

...……

The Principal values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness / transparency in its relations with its Bidder(s) and / or Contractor(s). In order to achieve these goals, the Principal will appoint an independent External Monitor (IEM), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

(1) The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:

a) No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

b) The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

c) The Principal will exclude from the process all known prejudiced persons.

(2) If the principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act, or it there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section 2 – Commitment of the Bidder(s)/ contractor(s)

(1) The Bidder(s)/ Contractor(s) commit themselves to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

a) The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

b) The Bidder(s)/ Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

c) The Bidder(s)/ Contractor(s) will not commit any offence under the relevant IPC/PC Act; further, the Bidder(s) / Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or documents provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder(s)/ Contractor(s) of foreign origin shall disclose the name and address of the Agents/ Representatives in India, if any. Similarly, the Bidder(s)/ Contractor(s) of Indian Nationality shall furnish the name and address of the foreign Principals, if any. Further, as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines all the payments made to the Indian agent/representative have to be in Indian Rupees only. Copy of the "Guidelines on Indian Agents of Foreign Suppliers" is placed at **Appendix (A-1).**

e) The Bidder(s) / Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

(2) The Bidder(s)/Contactor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/Contractor(s), before award or during execution has committed a transgression through a violation of Section 2, above or any other form such as to put his reliability or creditability in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or act as per the procedure mentioned in the "Guidelines on Banning of business dealings".

Section 4 – Compensation for Damages

(1) If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

(2) If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the contract value or the amount equivalent to Performance Bank Guarantee.

Section 5 – Previous Transgression

(1) The Bidders declares that no previous transgressions occurred in the last three years with any other Company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprises in India that could justify his exclusion from the tender process.

(2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as per the procedure mentioned in "Guidelines on Banning of business dealings".

Section 6 – Equal treatment of all Bidders /Contractors /Sub-contractors

(1) The Bidder(s)/ Contractor(s) undertaker(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.

(2) The Principal will enter into agreement with identical conditions as this one with all Bidders, Contractors and subcontractors.

(3) The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section 7 – Criminal charges against violating Bidder(s) / Contractor(s) / Subcontractor(s)

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or of the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer

Section 8 – Independent External Monitor / Monitors

(1) The Principal appoints competent and credible Independent External Monitor for this Pact.

The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement

(2) The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. It will be obligatory for him to treat the information and documents of the Bidders/Contractors as confidential. He

reports to the CMD, BEML.

(3) The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Contractor. The Contractor 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 is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Subcontractor(s) with confidentiality.

(4) The Principal 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 Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

(5) As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or to take other relevant action. The monitor can in this regard submit non- binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

(6) The Monitor will submit a written report to the CMD, BEML, within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise submit proposals for correcting problematic situations.

(7) If the Monitor has reported to the CMD, BEML, a substantiated suspicion of an offence under relevant IPC/PC Act, and the CMD, BEML has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner.

(8) The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

This pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the contract, and for all other Bidders 6 months after the contract has been awarded. If any claim is made/lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by CMD of BEML

Section 10 – Other provisions

(1) This agreement is subject to Indian Law. Place of performance and jurisdiction is the Corporate Office of the Principal, i.e. Bangalore.

(2) Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

(3) If the Contractor is a partnership or a consortium, this agreement must be signed

by all partners or consortium members.

(4) Should one or several provisions of this agreement turn out to be invalid, the reminder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intensions.

(5) The bidder shall not approach the Courts while representing the matters to IEMs and he/ she will await their decision in the matter.

(6) In case of joint venture, all the partners of the joint venture should sign the Integrity Pact. In case of sub-contracting, the Principal contractor shall take the responsibility of the adoption of IP by the sub-contractor. It is to be ensured that all sub- contractors also sign IP.

(7) In the event of any dispute between the management and the contractor relating to those contracts where Integrity Pact is applicable, in case, both the parties are agreeable, they may try to settle dispute through mediation before the panel of IEMs in a time bound manner. If required, the organization may adopt any mediation rules for this purpose.

In case, the dispute remains unresolved even after mediation by the panel of IEMs, the organization may take further action as per the terms and conditions of the contract.

The fees / expenses on dispute resolution shall be equally shared by both the parties.

(8) In the event of any contradiction between the Integrity Pact and its Annexure, the Clause in the integrity pact will prevail

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(For & On behalf of the Principal)	(For & On behalf of Bidder/Contractor)
(Office Seal)	(Office Seal)
Place----------	Place----------
Date ----------	Date ----------
Witness 1:	***Witness 1:***
(Name & Address)	(*Name & Address*)
----------	----------
----------	----------
Witness 2:	***Witness 2:***
(Name & Address)	(*Name & Address*)
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Appendix A-1

(Applicable Agents / Suppliers to Sign, Seal & Upload / Submit)

GUIDELINES FOR INDIAN AGENTS OF FOREIGN SUPPLIERS

1.0 There shall be compulsory registration of agents for all Global (Open) Tender and Limited Tender. An agent who is not registered with BEML LTD shall apply for registration in the prescribed Application-Form available on *www.bemlindia.in*.

1.1 Registered agents will file an authenticated Photostat copy duly attested by a Notary Public/Original certificate of the principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/remuneration/ salary/ retainer ship being paid by the principal to the agent before the placement of order by BEML LTD.

1.2 Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.

2.0 DISCLOSURE OF PARTICULARS OF AGENTS/ REPRESENTATIVES IN INDIA, IF ANY:

2.1 Tenderers of Foreign nationality shall furnish the following details in their offer:

2.1.1 The name and address of the agents/representatives in India, if any and the extent of authorization and authority given to commit the Principals. In case the agent/representative be a foreign Company, it shall be confirmed whether it is real substantial Company and details of the same shall be furnished.

2.1.2 The amount of commission/remuneration included in the quoted price(s) for such agents/representatives in India.

2.1.3 Confirmation of the Tenderer that the commission/ remuneration if any, payable to his agents/representatives in India, may be paid by BEML LTD in Indian Rupees only.

2.2 Tenderers of Indian Nationality shall furnish the following details in their offers:

2.2.1 The name and address of the foreign principals indicating their nationality as well as their status, i.e, whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents/representatives.

2.2.2 The amount of commission/remuneration included in the price (s) quoted by the Tenderer for himself.

2.2.3 Confirmation of the foreign principals of the Tenderer that the commission/remuneration, if any, reserved for the Tenderer in the quoted price (s), may be paid by BEML LTD in India in equivalent Indian Rupees on satisfactory completion of the Project or supplies of Stores and Spares in case of operation items.

2.3 In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission /remuneration, if any payable to the agents/representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.

2.4 Failure to furnish correct and detailed information as called for in paragraph-2.0 above will render the concerned tender liable to rejection or in the event of a contract materializing, the same liable to termination by BEML LTD. Besides this there would be a penalty of banning business dealings with BEML LTD or damage or payment of a named sum.

Signature
(For & On behalf of Bidder/Contractor)

APPENDIX B

(To be submitted along with technical bid)

COMPLIANCE REPORT FOR PROCUREMENT TECHNICAL SPECIFICATION (PTS)

Compliance to PTS GR/TD/7053, Latest Revision				
PTS Clause No	Description	Complied	Not Complied	Remarks
1. Introduction	1.1. General			
	1.2 Operations			
	1.3. SUSTAINABILITY			
	1.4. Carbon Credits			
	1.5. Signaling System (Section VI A: ERTS – RS –Appendix C - 2)			
	1.6. Current Collection System (ERTS clause 10)			
	1.7. Flood Proofing			
2. Definitions and Abbreviations	2.1 Definitions			
	2.2 Abbreviations			
3. Precedence of Documents				
4. Standards and Codes (Appendix B of ERTS)				
5. Requirements of Documentation				
6. System Requirements	6.1. General requirements			
	6.2. Design life			
	6.3. Service-proven design			
	6.4. Designs for refurbishment			
	6.5. Aesthetic appearance			
	6.6. Car general characteristics			
	6.7. Clearance requirement			
	6.8. Wayside characteristics			
	6.9. Train's inter-operability requirements			
	6.10. Climatic and Environmental Condition (ERTS clause 2.11)			
7. Qualifying Criteria for subcontractor and Vendor approval	7.1. Proven Design (ERTS clause 2.4)			
	7.2. Design life as per ERTS 2.3			
	7.3. Qualifying Criteria			
	7.4. Vendor approval (ERTS clause 16.12)			
8. Scope of Supply and Work				
	8.1. Hardware			
	8.1.1. Fire Detection System			

	8.2. Deliverables			
	8.3. Technical Requirement of Fire Detection System			
	8.3.1. System requirements			
	8.3.2. Fire Detection for Propulsion Equipment's			
	8.3.3. TCMS communication Interface			
	8.3.4. General Technical requirement			
	8.3.5. Others			
	8.4. Split of Responsibilities			
	8.5. Interface			
	8.5.1. Mechanical Interface			
	8.5.2. Electrical Interface			
	8.5.3. Interface Responsibilities			
	8.6. Design			
	8.7. Operation and Maintenance Manuals and Spare Parts Catalogues			
	8.8. Spares, Special Tools and Testing Equipment			
	8.8.1 Commissioning and DLP/DNP Spares			
	8.9. Storage, Packing Crating and Marking			
	8.10. Materials and workmanship			
	8.11. Training			
9. Comprehensive Maintenance during DLMP period				
9.1. Comprehensive Maintenance Contract period				
9.2. Spares required during Comprehensive Maintenance Contract (CMC) peri od ..				
9.3. Warranty				
10. General Requirements				
	10.1. Weight			
	10.2. Electrical Requirement			
	10.3. Fastener Requirements			
	10.4. Label Requirements			
	10.5. Product breakdown structure			
	10.6. Project Management .			
	10.7. RAMS requirements			
	10.8. EMC Requirement			
	10.9. Maintenance Requirement			
	10.10. Quality Assurance Program			
11. Testing				
	11.1. General			
	11.2. First Article Inspection			
	11.3. Test Procedure			
	11.4. Test Reports			
	11.5. Sequence of Tests			

	11.6. Routine and type tests of equipment and sub-systems			
	11.7. Factory & Depot tests of completed cars			
	11.8. Integration Test			
	11.9. Service Trials			
	11.10. Others			
12. Defect Notification Period (DNP) / Defect Liability Period (DLP) / Warranty				
13. Submittals – Technical offer				
14. Attachment				

Authorized signatory with company seal / stamp

APPENDIX – C

COMPLIANCE REPORT OF GENERAL TERMS & CONDITIONS

(To be submitted along with Technical Bid)

Bid Invitation No :

Firm :

Item details :

Sl. No.	Terms / Clause	Complied	Not Complied	Remarks
1.	GLOSSARY, DEFINITIONS & INTERPRETATIONS			
2.	SUBMISSION OF THE TENDER			
3.	SUPPLIERS SHARING LAND BORDER WITH INDIA			
4.	PREFERENCE TO MAKE IN INDIA			
5.	DELIVERY TERMS			
6.	PAYMENT			
7.	PRICE BID VALIDITY			
8.	FIRM PRICE			
9.	INSPECTION			
10.	WARRANTY			
11.	PERFORMANCE BANK GUARANTEE (PBG)			
12.	RIGHT TO VARY QUANTITIES & QUANTITY OPTION CLAUSE			
13.	LIQUIDATED DAMAGES CLAUSE			
14.	RISK PURCHASE CLAUSE			
15.	SECRECY AND CONFIDENTIALITY			
16.	AUTHORITY OF PERSONS SIGNING DOCUMENT			
17.	ACCEPTANCE OF ORDER			
18.	OTHER CONDITIONS			
19.	PRICE, INVOICING AND PAYMENT			
20.	PROGRESS REPORT			

Authorized signatory with company seal / stamp

APPENDIX – C

COMPLIANCE REPORT OF GENERAL TERMS & CONDITIONS

(To be submitted along with Technical Bid)

Bid Invitation No :
Firm :
Item details :

21.	QUALITY & WORKMANSHIP			
22.	QUALITY, CONDITION OF DELIVERY			
23.	SUPPLY OF SAMPLE (If Applicable)			
24.	INSPECTION, TESTING & CONSEQUENCE OF REJECTION			
25.	RAWMATERIALS ARRANGEMENT			
26.	IDENTIFICATION OF ITEMS / PIECES			
27.	PACKING AND MARKING			
28.	APPLICABLE LAWS AND JURISDICTION OF COURTS			
29.	JURISDICTION			
30.	ARBITRATION			
31.	INTELLECTUAL PROPERTY RIGHTS; LICENSES			
32.	BRIBES AND GIFTS			
33.	FORCE MAJEURE CLAUSE			
34.	FALL CLAUSE			
35.	NON-DISCLOSURE AND INFORMATION OBLIGATIONS			
36.	ASSIGNMENT OF RIGHTS AND OBLIGATIONS; SUBCONTRACTING			
37.	DIVISION OF PATRONAGE			
38.	INTEGRITY PACT			
39.	GST TERMS & CONDITIONS			
40.	TAX CLAUSE			
41.	CUSTOMS DUTY ON INPUT CONTENT			
42.	INSURANCE COVERED BY BEML UPTO START OF CMC			
43.	RERENTION MONEY			
44.	JAPANESE CONTENT STIPULATION			
45.	COMPREHENSIVE ECONOMIC PARTERNSHIP AGREEMENT (CEPA) AND DTAA			

Authorized signatory with company seal / stamp

APPENDIX – D

COMMITTEMENT TO SUPPLIES

(To be submitted along with Technical Bid)

This is to certify that we M/s ……. Against SRM tender No. as a Bidder commit that we will support BEML for requirement of any additional Equipment, Spares, Service required at the later stage i.e. from taking over of first trainset and up to completion of CMC by end customer CMRL for all the cars of contract Chennai Metro Rail Project-Phase II (ARE02A).

Authorized signatory with company seal / stamp

APPENDIX- E

CONFIDENTIALITY AGREEMENT
(To be typed on plain paper and submitted along with the technical bid)

This Confidentiality Agreement is made and entered into between M/s BEML, (hereinafter referred to as BEML), a Govt. of India Undertaking under Ministry of Defence, having its Registered Office at BEML Soudha, No.18/1, 4th Main, Sampangirama Nagar, Bangalore – 560 027 and M/s ---------- (hereinafter referred as XXXX) having its Registered Office at…….. . M/s. BEML, has been patronizing XXXX for components / spares listed in Annexure hereto. A need has been felt to revitalize the business relationship for mutual advantage.

1) It is mutually, therefore, agreed that the following shall form part of the terms and conditions for continued business:

- **a)** The supplier shall not divulge to anyone else except under the authority and for the purposed of BEML, all information such as technical data, specifications, drawings, models of specimens furnished / supplied by BEML for the purpose of manufacture or in connection with developmental activities, constitute the property of BEML and the supplier shall keep them in strict confidence. This has been explicitly stated in all the details to the supplier through Purchase Order / Drawings etc., released.
- **b)** The supplier shall not supply the components / spares exclusively manufactured for BEML with the Technical Data / Specifications / assistance furnished by BEML and shall not disclose my initiations, development of adaptations thereof to anyone else except with the written consent of BEML.
- **c)** BEML shall be entitled to prevent breach of the above and to claim damages in case of any breach. It is hereby mutually agreed that for breach of this agreement the Vendor shall pay, without actual proof of damages, a liquidated amount of Rs. 1.00 Crore (Rupees One Crore only).
- **d)** **ARBITRATION:** Any disputes and differences that may arise between the parties in connection with this Agreement/Contract shall be settled by the parties amicably by way of mutual discussion / negotiation / conciliations. In case parties fail to settle the dispute amicably, then the dispute or difference shall be referred to India International Arbitration Centre for resolution. The Arbitration Tribunal shall consist of Sole / three Arbitrator /s. The Arbitrator /s shall be appointed and Arbitration proceeding shall be conducted in accordance with the provision of India International Arbitration Centre (Conduct of Arbitration) Regulations, 2018.

2) BEML shall be entitled to prevent breach of the above and to claim damages in case of any breach.

3) The Signatories hereto declare that they have the sanction and power to execute and deliver this binding agreement.

IN WITNESS WHEREOF, the parties hereto have set their respective hands to this Confidentiality Agreement on …….. written in the presence of Witness.

For BEML

For M/s. XXXX

WITNESS:

1.

2.

APPENDIX -F

Land Border Sharing Declaration

(To be submitted in the bidder's letter head along with technical bid)

In-line with Department of Expenditure's (DoE) Public Procurement Division Order vide ref. F.No.6/18/2019-PPD dated 18.07.2020 & 19.7.2020 and subsequent orders

Tender no. …….

Job: ……..

"I/ we have read the clauses pertaining to Department of Expenditure's (DoE) Public Procurement Division Order (Public procurement no 1, 2 & 3 vide ref. F.No.6/18/2019-PPD dated 18.07.2020 & 19.7.2020) regarding restrictions on procurement from a bidder of a country which shares a land border with India. I/We hereby certify that I/ we the bidder < name of the bidder……> is / are

a) Not from such a country and eligible to be considered for this tender.

OR

b) From such country, has been registered with the competent authority and eligible to be considered for this tender. (Evidence of valid registration by the competent authority shall be attached)

For and behalf of _____ (Name of the bidder)

(Signature, date & seal of authorized representative of the bidder)"

APPENDIX – G

DECLARATION REGARDING MINIMUM LOCAL CONTENT IN LINE WITH REVISED PUBLIC PROCUREMENT (PREFERENCE TO MAKE IN INDIA), ORDER 2017 DATED 04TH JUNE, 2020 AND SUBSEQUENT ORDER(S)

(To be typed and submitted in the Letter Head of the Entity/Firm providing certificate as applicable)

To,
BEML Limited, Bangalore

Dear Sir,

Sub: Declaration reg. minimum local content in line with Public Procurement (Preference to Make in India), Order 2017-Revision, dated 04th June, 2020 and subsequent order(s).

Ref : 1) NIT/Tender Specification No: ……,
2) All other pertinent issues till date

We hereby certify that the items/works/services offered by…… *(specify the name of the organization here)* has a local content of _____ % and this meets the local content requirement for **'Class-I local supplier' / 'Class II local supplier'**** as defined in Public Procurement (Preference to Make in India), Order 2017-Revision dated 04.06.2020 issued by DPIIT and subsequent order(s).

The details of the location(s) at which the local value addition is made are as follows:

1. _____ 2. _____
3. _____ 4. _____

…
…
...

Thanking you,
Yours faithfully,

(Signature, Date & Seal of Authorized Signatory of the Bidder)

****** - *Strike out whichever is not applicable.*

Note:

1. Bidders to note that above format duly filled & signed by authorized signatory, shall be submitted along with the techno-commercial offer.
2. In case the bidder's quoted value is in excess of Rs. 10 crores, the authorized signatory for this declaration shall necessarily be the statutory auditor or cost auditor of the company (in the case of companies) or a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.
3. In the event of false declaration, actions as per the above order necessary action will be taken against bidder.

Authorized signatory with company seal / stamp

APPENDIX –H

CONTACT DETAILS OF THE SUPPLIER

(To be filled and submitted by supplier along with the technical bid)

1) Contact Person details in Marketing Office

(a) Name :
(b) Designation :
(c) Telephone :
(d) Fax :
(e) Mobile :
(f) Email :

2) Head Office :

3) Complete address
including the website :

4) Details of the proposed plant from
where item is to be supplied :

5) Complete address of the Plant
including Website :

6) Contact person details in plant

(a) Name :
(b) Designation :
(c) Telephone :
(d) Fax :
(e) Mobile :
(f) Email :

7) Bank Details: (Will used during L/C Execution)

a) Name of the Bank :
b) Full Address of the Bank :
c) Suppliers Account Number and Type :
b) IBAN No :
e) Swift Code :

APPENDIX – I

(To be submitted along with technical bid)

DELIVERY SCHEDULE

Sl No	Part No / Description	Total Qty (Trainsets)	Schedule	No of Train Sets (3 Cars/TS)
1	Equipment with DNP/DLP	70 TS (210 cars)	Apr'26	1
			Jul'26	3
			Nov'26	3
			Feb'27	4
			May'27	4
			Jul'27	3
			Aug'27	3
			Sep'27	4
			OCT'27	3
			Nov'27	4
			Dec'27	3
			Jan'28	3
			Feb'28	3
			Mar'28	3
			Apr'28	3
			May'28	4
			Jun'28	4
			Jul'28	3
			Aug'28	4
			Sep'28	4
			Oct'28	4
3	Design and Submission of design Documents for Fire Detection System.	PDR: Jul-25 PFDR: Mar-26 FDR: Jun-26		
4	FAI Reports and Type Test & Report for Fire Detection System	Jun.26		
5	Deliverables as per ERTS Clause 2.26.5.2 for Fire Detection System	Apr.26		
	Sil Certifications and certificate submission as per ERTS Clause 2.26.5.2 for Fire Detection System	Mar-26		
	Printed Circuit Boards (PCB) details asper ERTS 19.55 for Fire Detection System	Mar-26		
	Microprocessor Details as per ERTS 19.57 for Fire Detection System			
6	Spares as per Annexure-A for Fire Detection System	To be supplied as per BEML requirement		
7	Tools and Test bench for Fire Detection System	Dec.'26		
8	Training	Jan.'28		
9	Manuals	Jan.'28		

Note: a) Delivery schedule proposed above is tentative. However, it can be mutually discussed and agreed in line with key dates of CMRL contract. b) CMC shall start after completion of DLP/DNP activity for 70th Trainset and shall end 15 years after the start of CMC . c) 1 Trainset comprises of 2 DM car and 1 T car

ANNEXURE- JICA

SECTION V: ELIGIBLE SOURCE COUNTRIES OF JAPANESE ODA LOANS

ELIGIBLE NATIONALITY:

1. The Eligible Nationality of the Supplier(s) for procurement of all goods and services (including consulting services) to be financed out of the proceeds of the Loan shall be the following:
    a) Japan, India & OECD member Countries in the case of the prime Contractor; and
    b) All countries and areas in the case of the sub–contractors(s).

2. With regard to Section V (1) above, in case where the prime Contractor is a joint venture, such joint venture will be eligible provided that the nationality of partners is Japan and/or India and/or OECD member countries.

3. With regard to Section V (1) and (2) above,
    a) For goods and services, except consulting services:
    (i) The prime Contractor or, in the case of a joint venture, the Japanese partners shall be nationals of Japan or juridical persons incorporated and registered in Japan and have their appropriate facilities for producing or providing the goods and services in Japan, and actually conduct their business there (herein after referred to as the "**Japanese Partner**").

    (ii) Not withstanding Section V. (3) (a) (i) above, a juridical person incorporated in a country or area other than Japan that satisfies all of the following conditions can be regarded as the Japanese Partner:
    - It is a subsidiary included in the scope of consolidation and factored into the aggregated accounting figure of a consolidated financial statement of the Japanese Company made in accordance with the Financial Instruments and Exchange Act of Japan and the related ministerial ordinances; and
    - It is registered in the country or area where it was incorporated, has its appropriate facilities for producing or providing goods and services there, and actually conducts its business therein.

    (iii) The prime Contractor or, in the case of a joint venture, the Indian partners shall be nationals of India or juridical persons incorporated and registered in India, and have their appropriate facilities for producing or providing the goods and services in India, and actually conduct their business there; in the case of a juridical person, a majority of the subscribed shares shall be held by nationals of India; and the majority of the full–time directors of the company are national of India(hereinafter referred to a as the "Indian Company").

    (iv) The prime Contractor or, in the case of a joint venture, the OECD member countries partners shall be nationals of OECD member countries (here in after referred to a as the "OECD member countries").

4. Minimum 30.069%oftheContractPrice (Excluding Price Centre 'RS-CMC', Price Centre 'DM&P- CMC' and Taxes & Duties) shall be sourced from Japanese manufacturer/Companies for Goods and Services as it is mandatory requirement under this package.

5. With regard to Section V (4) above, the goods procured form the eligible local manufacturing company(ies) invested by Japanese Companies (here in after referred to as

the "Eligible Local Manufacturing Company(ies)") can be regarded and counted as Japanese origin if such Eligible Local Manufacturing Company(ies) satisy(ies) all of the following conditions:

a) Juridical persons incorporated and registered in India, and which have their appropriate facilities for producing or providing the goods and services in India and actually conduct their business there;
b) Not less than ten percent (10%) of shares are held by a single Japanese Company or juridical person stipulated in Section V.3. (a) (ii); and
c) The proportion of the shares held by the Japanese Company or juridical person stipulated in SectionV.3. (a) (ii) mentioned in(b)above (or the company having the largest share among JapanesecompaniesifmorethanoneJapaneseCompanyorjuridicalpersonstipulatedin Section V.3.(a) (ii) meet the condition stated in(b) above) is the same as or greater than that of the shares held by any company of the third country or area.

6. With regard to Section V (4) above, the goods procured form the eligible development partners' manufacturing company(ies) invested by Japanese companies (herein after referred to as the "Eligible Development Partners' Manufacturing Company(ies)") can be regarded and counted as Japanese origin if such Eligible Development Partners' Manufacturing Company(ies) satisfy(ies) all of the following conditions:
   a) Juridical persons incorporated and registered in a country or area on DAC List of ODA Recipients effective at the time of conclusion of the Loan Agreement and which have their appropriate facilities for producing or providing the goods and services in the country or area and actually conduct their business there;
   b) Not less than one-third of shares are held by a single Japanese Company or juridical person stipulated in Section V. 3. (a) (ii); and
   c) The proportion of the shares held by the Japanese Company or juridical person stipulated in SectionV.3.(a) (ii) mentioned (b) above (or the company having the largest share among Japanese companies if more than one Japanese Company or juridical person stipulated in Section V.3.(a) (ii meet the condition stated in (b) above) is the same as or greater than that of the shares held by any company of a third country or area.

7. With regard to Section V(4) above, the goods procured form the eligible manufacturing company(ies) in developed countries invested by the Japanese Companies (herein after referred to as the "Eligible Developed Countries' Manufacturing Company(ies)") can be regarded and counted as Japanese origin if such Eligible Developed Countries' Manufacturing Company(ies)satisfy(ies) all of the following conditions:
   a) It is a subsidiary in a country or area other than Japan included in the scope of consolidation and factored into the aggregated accounting figure of a consolidated financial statement of the Japanese Company made in accordance with the Financial Instruments and Exchange Act of Japan and the related ministerial ordinances;
   b) It was incorporated and is registered in country or area other than that on the DAC List of ODA Recipients effective at the time of conclusion of the Loan Agreement; and
   c) It has its appropriate facilities for producing or providing goods and services there, and actually conducts its business therein.

8. With regard to Section V. (4) above, if the major components(s) of goods is (are) substantially manufactured by an Eligible Local Manufacturing Company, such components can be regarded and counted as Japanese origin even if the goods are not

procured from Japan. Eligible Local Manufacturing Company(ies). Nor Eligible Developed countries 'Manufacturing Company(ies).

9. With regard to Section V. (4) above, if the major components(s) of goods, which is (are) procured form the Indian Company(ies), is (are) substantially manufactured by a Japanese Company(ies),the goods can be regarded and counted as Japanese origin.

10. With regard to Section V (4) above and in, the goods procured from Indian Company(ies) can be regarded and counted as Japanese origin if such goods satisfy all of the following conditions:
    a) The major component(s) is (are) substantially manufactured by a Japanese Company(ies); and
    b) Japanese Company(ies) substantially manufactures major components and substantially engage with final assembly or the final refinement/processing by the Indian Company(ies) the manners including, but limited to, technical cooperation, commissioning of manufacturing or provision of design.

11. With regard to Section V. (4) above, the services provided by the Japanese Partner(s) can be regarded and counted as Japanese origin.

12. As per Operational rules of the Japan–India Special ODA Loan for Metro and Railway Projects in India, Dated 31st May2018, the prime Contractor shall be either of the followings:
    a) Japanese Company. Specially, the company must satisfy all of the following condition:
       (i) The company is a juridical person in corporate and registered in Japan
       (ii) The company has its appropriate facilities for appropriate facilities for producing or providing goods and services in Japan: and
       (iii) The company actually conducts its business in Japan.

    b) A consolidated subsidiary of a Japanese company in a foreign country. Specifically, the company must satisfy all of the following:
       (i) The company is a subsidiary company whose financial statements are required to be included in a consolidated financial statement of a Japanese company (as a parent company) by the Financial Instruments and Exchange Act of Japan and related ministerial ordinances
       (ii) The company is incorporated and registered in a country where it is located
       (iii) The company has its appropriate facilities for producing or providing goods and services in a country where it is located; and
       (iv) The company actually conducts its business in a country where it is located

    c) An Indian company. Specifically, the company must satisfy all of the following condition:
       (i) The country is a juridical person incorporated and registered in India
       (ii) The company has its appropriate facilities for producing or providing goods and services in India
       (iii) The company actually conducts its business in India: and
       (iv) The majority of the subscribed shares of the company are held by an Indian national(s) and/or juridical person(s)

d) A joint Venture (JV) composed of a Japanese company (ies) and/or Indian company(ies) and/or
OECD member countries.

13. Only for this package, the price of procurement (purchase) from Japanese company shall be deemed as Japanese content. However, only the price of parts of Rolling Stock manufactured by Japanese company (note1) and services (including services and technology (note2)) provided by Japanese company shall be included.

(note 1) The definition of "Japanese Company" will be same as stipulated in Section V12a. and 12 b. above.

(note 2) Services and technology are assumed to include intermediary services by trading company etc and technology licensing by Japanese Company.

ANNEXURE V(a)

CERTIFICATE CONFIRMING TENDER REQUIREMENT FOR JAPANESE GOODS & SERVICES

This is to certify that we, M/s.*[Insert name of the company (Single Entity/JV)]* have carefully examined all the requirements stipulated under the Head ELIGIBLE SOURCE COUNTRIES OF JAPANESE ODA LOANS for meeting requirement of Japanese Goods & Services as required by the tied loan conditions *(excluding Price Centre RS-CMC&DM&P-CMC)*.

We, M/s. *[Insert name of the company (Single Entity/JV)]* have submitted the details including; our Name, Location and Percentage of Japanese Goods & Services Content by value as per the form: Japanese Goods and Services provided.

We acknowledge that any false declaration made by the tenderer regarding Japanese Goods &Services (including payments to be made for value addition) shall be treated as a fraudulent practice and may result in further action being taken against the tenderer or its successor company; including liability of debarring for a period of upto three years for JICA funded Projects.

We also under take to submit a certificate from a statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) to determine and verify calculations of the percentage of Japanese Goods & Services content.

Signature of the Bidder

ANNEXURE VI

FORM JAPANESE GOODS AND SERVICES

Tender No.:	
Name of the Bidder:	
Total Percentage (%) of Japanese Content proposed by the Bidder: [Derived by the sum of qualifying Goods & Services expressed as a % of the Total Contract Price applicable for supply & NRC only].	

No.	**Details of Systems, Subsystems, Parts and/or Services** [bidder should list the item categories it seeks to qualify as Japanese Goods & Services under the terms and conditions of Annexure JICA]	**Annexure Clause No.** [under which qualification is sought]	Name of Japanese Subcontractor, Supplier or Trading Partner.	Evidence to show Compliance to ESC requirements enclosed (Y/N)	Percentage (%) contribution of Japanese Goods and Services
1					
2					
3					
4					
5					

NOTE: The Table value would exclude CMC requirement as well as duties & Taxes

Authorized signatory of bidder with company seal / stamp

Statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies)

PERFORMANCE BANK GUARANTEE

Bank Guarantee No……
Dated …….
Amount …….
Valid upto …….
Claim upto ……

The General Manager (Materials- Management)
BEML
Bangalore Complex
PB No 7501
New Thippasandra
Bangalore 560075

1. This deed of Guarantee made this day of..... (Month& year) between Bank of..... (Hereinafter called the "Bank") of the one part, and BEML LIMITED (Hereinafter called "the Employer") of the other part.

2. Whereas BEML LIMITED has awarded the contract for..... (Name of work as per PO) (Hereinafter called the "Contract") to..... (Name of the Contractor) (Hereinafter called "the Contractor").

3. AND WHEREAS the Contractor is bound by the said Contract to submit to the Employer a Performance Security for a total amount of……...(Amount in figures and words).

4. Now, We the Undersigned……..(Name of the Bank) being fully authorized to sign and to incur obligations for and on behalf of and in the name of.....(Full name of Bank), hereby declare that the said Bank will guarantee the Employer the full amount of Rs. …… (Amount in figures and words) as stated above.

5. NOW THEREFORE, We hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor and we hereby unconditionally, irrevocably and without demur undertake to immediately pay to the Employer upon first written demand and without cavil or argument, any sum or sums within limits of.....(Amount of Guarantee) as aforesaid without reference to the Contractor and without your needing to prove or show grounds or reasons for your demand for the sum specified therein. The Bank shall pay to the Employer any money so demanded notwithstanding any dispute/disputes raised by the Contractor in any suit or proceedings pending before any Court, Tribunal or Arbitrator/s relating thereto and the liability under this Guarantee shall be absolute and unequivocal.

6. This Guarantee is valid till.....(The initial period for which this Guarantee will be valid must be for at least 6-months (six months) longer than the anticipated expiry date of defect liability period / Warranty period as stated in Clause **10** of Annexure IV - Notice Inviting Tenders.

7. At any time during the period in which this Guarantee is still valid, if the Employer agrees to grant a time extension to the Contractor or if the Contractor fails to complete the Works within the time of completion as stated in the Contract, or fails to discharge himself of the liability or damages or debts as stated under Para 5, above, it is understood that the Bank will extend this

Guarantee under the same conditions for the required time on demand by the Employer and at the cost of the Contractor.

8. The Bank agrees that no change, addition, modifications to the terms of the Contract Agreement or to any documents, which have been or may be made between the Employer and the Contractor, will in no way release us from the liability under this Guarantee; and the Bank, hereby, waives any requirement for notice of any such change, addition or modification to the Bank.

9. The Guarantee here in before contained shall not be affected by any change in the Constitution of the Bank or of the Contractor.

10. The neglect or forbearance of the Employer in enforcement of payment of any moneys, the payment whereof is intended to be hereby secured or the giving of time by the Employer for the payment hereof shall in no way relieve the bank of their liability under this deed.

11. The expressions "the Employer", "the Bank" and "the Contractor" hereinbefore used shall include their respective successors and assigns.

12. Notwithstanding anything contained herein:

(a) Our liability under this Bank Guarantee shall not exceed Rs..... (Rs.....)

(b) This Bank Guarantee shall be valid up to.....

(c) We are liable to pay the Guarantee amount or part thereof under this Bank Guarantee only & only if you serve upon us a written claim or demand on or before

In witness whereof l/We of the bank have signed and sealed this Guarantee on the.....day of..... (Month & year) being herewith duly authorized.

For and on behalf of the .....Bank.

Signature of Authorized Bank officials.

Name :.....

Designation : .....

Stamp/Seal of the Bank.....

Signed, sealed and delivered for and on behalf of the Bank by the above named .....in the presence of:

Witness 1.

Signature.....
Name.....
Address.....

Witness 2.

Signature.....
Name.....
Address.....