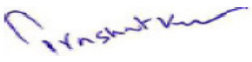
Procurement Technical Specification of Electrical Panels for MRS1

Approved	26.12.2019	V. SYLAJA	
Reviewed	26.12.2019	PRASHANT KUMAR	
Prepared	26.12.2019	V.SARANYA	
	Date	Name	Signature

REVISION DETAILS

REV. NO.	CLAUSE NO.	PAGE	CHANGES	DATE
0			FIRST ISSUE	26.11.2019
1	7.1.3	17	• Point no. 20 added • Drawings of EDB DMC, TC, & MC car – BOM updated & revised.	26.12.2019

TABLE OF CONTENTS

1. Introduction

1.1. General

This document, Procurement Technical Specification (PTS) describes the complete technical requirement of Electrical Panels to be supplied for cars under the 'MRS1' contract (hereafter MRS1). The Electrical Panels shall comply in all respects with MRS1 Employer's Requirements General Specification (ERGS) and Employer's Requirements Technical Specification (ERTS).

BEML shall carry out all required works and activities as Supplier for MRS1 contract while the subcontractor shall be responsible for all works required in this PTS with regard to Design, supply, testing and commissioning of Electrical Panels and shall be responsible for supporting the BEML activities as subcontractor for MRS1 contract.

The scope of work covers design, development, testing, manufacture, supply, commissioning and integrated testing of the Electrical Panels. The scope also covers supply of spares, special tools, testing and diagnostic equipment, jigs and fixtures for maintenance, repair and overhaul of Electrical Panels.

The scope of work shall include 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 tender specifications as specified in ERTS 1.1.3 (i) to (ix) and ERTS 1.1.7.

As per ERTS 1.1.8 & ERTS 1.4, during initial phase of the project, all trains (including prototype train) shall be tested and commissioned for GoA2 modes of automation. Upgradation of all trains to GoA3/GoA4 modes shall be done subsequently (refer Note No. 6. of 'Attachment to Appendix FB-1' to 'Form of Bid'). The interface testing may have to be done separately for line 2 & 7 of Mumbai Metro.

The Electrical Panels shall be suitable for Unattended train operation conforming to Grade of Automation-GOA4 as specified in IEC62290-1:2006 or latest, including the training of operating and maintenance staff of the BEML/DMRC, for line 2 and 7 of the Mumbai Mass Rapid Transit System.

The rake formation shall be as follows:

***DMC – TC – MC –**	- 3 car unit formation
DMC – TC – MC – MC – TC – DMC	- 6 car train formation

For increase in quantity (if required)

– TC – MC –	- 2 car unit formation
DMC – TC – MC– TC – MC – MC – TC – DMC	- 8 car train formation

● DMC: Driving Motor Car, MC: Motor Car, TC: Trailer Car

* : Front Automatic Coupler(FAC)

– : Semi-Permanent Coupler (SPC)

Each DMC shall be provided with Automatic couplers without electric head, at the front end of

the train. The other end of DMC and either ends of TC & MC shall be equipped with semi-permanent couplers.

The design of Electrical Panels shall be suitable for 8 car formation in future. The design details and performance parameters of Electrical Panels for 8 car train shall be submitted by the subcontractor during design stage itself and got approved from the Engineer.

1.2. Climatic and Environmental Condition(ERTS clause 3.10)

The MRS1 cars shall operate reliably and safely under Mumbai climatic and Environmental conditions as per ERTS 3.10 shown in the following Table. Accordingly the Electrical Panels shall be designed to operate with satisfactory performance under the following climatic and environmental conditions,

Description	**Limiting Values**
Maximum ambient temperature (See note 1 below)	36℃
Minimum temperature	14.3℃
Humidity (See note 2 below)	≥95% RH
Rainfall	The annual precipitation is 2,078 mm with 34 % (709 mm) falling in the month of July.
Atmosphere during hot season	Extremely dusty including bird feathers
Maximum wind speed	150 km/hr.
Vibration & Shocks	The sub-systems & their mounting arrangements shall be designed to withstand satisfactorily the vibration and shocks encountered in service as specified in IEC 61373 and IEC 60571.
SO_2 level in atmosphere	80 - 120 mg/m3
Suspended particulate matter in atmosphere (TSPM)	360 - 540 mg/m3
Life	The Metro car is designed for min.35 year of life. Accordingly, the subject items & accessories shall also not deteriorate in their performance for 35 years

Note:

1. The temperature of the metal surfaces of the vehicles when exposed directly to the sun, for long periods of time, may be assumed to rise to 70℃.

2. Any moisture condensation shall not lead to any malfunction or failure.

3. Adequate margin shall specially be built into the design particularly to take care of the higher ambient temperatures, high humidity, dusty and corrosive conditions, etc. prevailing in Mumbai area.

1.3. Vehicle Performance Requirements (ERTS clause 3.22)

The vehicle performance requirements with fully loaded train and tangent track are as per the following table.

Item		All Corridors
Maximum design speed	With inflated secondary suspension	90 kmph
	With deflated secondary suspension	80 kmph
Maximum operational speed	With inflated secondary suspension	80 kmph
	With deflated secondary suspension	70 kmph
Minimum Design Average Acceleration rate for fully loaded (AW3) train on level tangent track shall be as under: 0 kmph to 40 kmph 0 kmph to 60 kmph 0 kmph to 80 kmph		 1.0 m/s2 0.75 m/s2 0.40 m/s2
Minimum Operational Average Acceleration rate for AW2 loaded train on level tangent track shall be as under: 0 kmph to 35 kmph 0 kmph to 60 kmph 0 kmph to 80 kmph		 1.20 m/s2 0.80 m/s2 0.45 m/s2
Average Service braking rate from 80 kmph to standstillfor fully loaded (AW3) train on level tangent track.		1.0 m/s2
Average Service braking rate from 80 kmph to standstillfor AW2 train on level tangent track.		1.1 m/s2
Average Emergency braking rate from 80 kmph to 0 kmph for fully loaded trains on level tangent track		1.3 m/s2
Jerk rate(Maximum)		0.75 m/s3
Annual running distance of one train (for design purpose)		150,000 km

1.4. Signalling System (ERTS clause 3.18)

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.

1.5. Current Collection System (ERTS clause 3.17)

System Particulars	**For all sections and depot**
Supply Voltage System	25kV AC single phase 50Hz
Current Collection	Through Pantograph
Nominal Voltage	25.0 KV AC
Minimum voltage	19.0 kV AC
Maximum voltage	27.5 kV AC
Instantaneous minimum voltage	17.5 kV AC
Occasional maximum voltage	31.0 kV AC
Voltage for guaranteed performance	22.5 kV AC
Variation in frequency	48 to 52 Hertz

1.6. Track structure Parameters (ERTS clause: 3.14)

The MRS1 cars will operate with the track parameters as specified in the following table:

Description	Elevated and At-grade Corridor		Underground Corridor
	Ballasted	Ballast less (DFF)	Ballast less (DFF)
Track Laying Gauge	1435 mm		
Rail Type (Main Line & Depot)	60E1 (UIC 60) 880/HH	60E1 (UIC 60) 1080/HH	60E1 (UIC 60) 1080/HH
Rail Profile	UIC 861-3		
Inclination Of Rail	1 in 20		
Sleeper Spacing (Main line)	600 mm ± 10mm	600 mm ± 10mm	700 mm ± 10mm
Sleeper Spacing (Depot)	650 mm ± 10mm	Not applicable	
Ballast Cushion Depth(Main line)	300mm	Not applicable	
Ballast Cushion Depth (Depot)	250mm	Not applicable	
Standard Rail Length	13m and 18m	18m	
Rail Panel Lengths	Longer than 200m		
Minimum Radius of Curvature	200m-Underground 110m-Elevated 100m-Depot		
Minimum Turn out Radius.- (Main line)	1 in 9 - 300m radius 1 in 7- 190m radius		
Minimum Turn Out Radius Depot	1 in 7 - 190m radius		
Maximum Cant Permissible	110 mm		
Maximum Cant Desirable	110 mm		
Maximum Cant Deficiency Permissible	85mm		
Maximum Cant Deficiency Desirable	85 mm		
Maximum Permissible Cant Gradient	1 in 440		
Maximum Desirable Cant Gradient	1 in 720		
Turn-out Speed : Turnout (1 in 9) R-300	45 km/h	45 km/h	40 km/h
Turn-out Speed : Scissors (1 in 9) R-300	45 km/h	45 km/h	40 km/h
Turn-out Speed : In Depots (1 in 7) R-190	35 km/h	35 km/h	25 km/h
Turn-out Speed : Turnout (1 in 7) R-190	35 km/h	35 km/h	25 km/h
Turn-out Speed : Turnout(1 in 12) R-410	50 km/h	50 km/h	50 km/h
Turn-out Speed : Turnout(1 in 12) R-410	50 km/h	50 km/h	50 km/h

Turn-out Speed : Turnout (1 in 8.5) R-218	30 km/h	30 km/h	30 km/h
Turn-out Speed : Turnout(1 in 8.5) R-218	30 km/h	30 km/h	30 km/h
Maximum Gradient Main Line	4%		
Maximum Gradient Depot Connection	4%		
Minimum vertical curve radius of curvature	1500m		

1.7. Principal Notional Vehicle Dimensions/ Leading Particulars (ERTS Clause 4.3.2)

Description		Dimension
Gauge		1,435 mm
Maximum Length over body(including end-fairings)	DM car	22,010 mm
	T and M cars	22,010 mm
Maximum Length over couplers for all cars		23,000 mm
Maximum Width over Body		3,200 mm
Minimum Passenger Saloon Headroom		2,050 mm
Locked down pantograph height for 25kV AC cars from rail level at Car Centre Line		4,048 mm
Maximum Floor height above rail level of any unloaded vehicle		1,130 mm
Minimum Floor height above rail level of fully loaded vehicle		1,100 mm
Maximum height of coupler above rail level for unloaded vehicle		815 mm
Minimum height of coupler above rail level for fully loaded vehicle		740 mm
Bogie Wheel Base	Maximum	2400 mm
	Minimum	2200 mm
Distance between bogie centres	Maximum	15,100 mm
	Minimum	14,400 mm
Wheel diameters	New	860 mm
	Fully worn	780 mm
Maximum axle load		17 Tonne (including all tolerances as per IEC 1133-1992)

2. Definition and Abbreviations

The following definitions and abbreviations are applicable to the PTS.

2.1. Definitions

- **"Employer"** means Delhi Metro Rail Corporation Limited (DMRC), it's legal successors and assignees
- **"Engineer"** means any person nominated or appointed from time to time by the Employer to act as the Engineer for the purposes of the Contract and notified as such in writing to the Contractor
- "**Engineer's Representative**" means any Assistant of the Employer appointed from time to time by the Employer.
- **"Contract"** means the contract between Subcontractor and BEML in relation to the supply of Electrical Panels for MRS1 project.
- **"BEML"** means the Contractor to procure the Electrical Panels for MRS1 Contract.
- **"Subcontractor"** means the supplier of Electrical Panels to BEML for MRS1 Contract.
- **"Contractor"** means the persons or person appointed by the Employer to undertake the execution of the works for MRS1 project. In order to avoid misunderstanding of the roles of the Contractor in ERTS and ERGS, the term "Contractor" shall be read as "Subcontractor" in ERTS/ERGS for those ERTS/ERGS clauses referred to in this PTS.
- "ERGS" means Employer's Requirements-General Specification of MRS1 contract.
- "ERTS" means Employer's Requirements-Technical Specification of MRS1 contract.
- "PTS" means BEML's Procurement Technical Specification.
- "GTC" means General Terms & Conditions of the tender issued by BEML for procurement of the Electrical Panels for MRS1 contract.

2.2. Abbreviations

GoA	:	Grade of Automation
UTO	:	Unattended Train Operation
EMC	:	Electro-Magnetic Compatibility
ERGS	:	Employer's Requirements General Specifications
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
ISO	:	International Standards Organization
ITP	:	Inspection Test Plan

LRU	:	Line 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
RDSO	:	Research Design and Standards Organisation (Ministry of Railways)
SOD	:	Schedule of Dimension
SPC	:	Semi-Permanent Coupler
TCMS	:	Train Control Management System

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

3. Precedence of Documents

The PTS shall be read in conjunction with the General Terms & Conditions (GTC) of the tender, ERGS and ERTS.

To the extent that any provision of the PTS is inconsistent with any provision of the General Terms & Conditions of the tender (GTC), the provisions of the GTC shall prevail.

To the extent that any provision of GTC is inconsistent with any provisions of the ERGS and ERTS, the provisions of GTC shall prevail.

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	DMRC ERTS
2	DMRC ERGS
3	GTC
4	PTS

4. Standards and Codes (ERGS clause 1.6 & Appendix TA of ERTS)

All equipment 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/DMRC. When a Standard or Code is referred to, it shall be assumed that the revision that is current during the design finalisation 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/DMRC.

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/DMRC.

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 DMRC representative.

5. Requirements of Documentation

All drawings, documents and information by Subcontractor shall be prepared in English and submitted to BEML for approval as per Appendix 4 of ERGS.

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 Electrical Panels in a format readable with AutoCAD 2013 (latest), CATIA V5 on CD-ROM or e-mail as requested by the BEML or DMRC's Representative.

The drawings shall contain minimum three (3) view points (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/DMRC

6. Qualifying Criteria for subcontractor and Vendor approval

6.1. Proven Design (ERTS clause 3.2)

The proposed Electrical Panels by the sub-contractor against this PTS shall satisfy the "Proven Design" clause 3.2.2 of ERTS. 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 Electrical Panels only from such manufacturing units that have supplied the Electrical Panels that fulfill the proven design requirements as above (Refer ERTS clause 3.2.2).

6.2. Qualifying Criteria (ERTS clause 3.2.2)

(i) The subcontractor shall meet the qualification criteria as per ERTS 3.2.2.

(ii) The subcontractor should be an OEM and should have carried out design and manufacturing of sub-assemblies and those sub-assemblies proposed for Electrical Panels 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 Electrical Panels should have been in service during the preceding three years or more in respect of Electrical Panels 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.

The Electrical Panels 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. Accordingly, the number of years in revenue service and operation for the above requirements shall be calculated as on the contracted Key Date No. 3.1 corresponding to Pre-Final Design Completion.

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

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

(v) The subcontractor shall undertake to provide support during Testing & Commissioning, service trials, revenue service and DLP period either by themselves or through sister company or a partner in India. The subcontractor shall submit detailed proposal in this regard.

(vi) The technical support of subcontractor shall be made available through permanent positioning of subcontractor's staff in Depots at Mumbai for meeting DLP obligation as per ERTS 3.2.5.

(vii) The subcontractor shall give an undertaking to supply spares for a minimum period of 10 years from the date of completion of the contract as per ERGS 8.12.

6.3. Vendor approval (ERTS clause 3.2.5)

Vendor approval from DMRC is mandatory for all sub-system suppliers. Accordingly the request for Vendor approval with all relevant references and details as per Vendor approval format (Refer Annexure-1) shall be submitted along with the technical offer, Company profile, Product range and the organization structure. The acceptance of the technical offer is subject to approval of the Vendor by DMRC–based on the vendor approval details submitted by the subcontractor.

Vendor approval needs to be taken for the Firms participating in the tender. Firms who have supplied similar panels for Metro projects in India can be considered subject to Notice of No objection from DMRC/Engineer.

6.4. Indigenization (ERGS Clause 1.1.8)

The subcontractor shall make efforts to source maximum number of equipment and materials from India, as specified in the Table 1.C recommended items for indigenization of ERGS 1.1.8, Electrical Panels to be indigenized to meet the required performance requirements and quality standards and facilitate ease in maintenance and easy availability

of spares.

7. Scope of Supply and Work

7.1. Hardware

7.1.1 General

Subcontractor shall design and select the components of each panel in accordance with the drawings provided by BEML. Subcontractor shall provide all components of Electrical Panels **(EDB Panel for DMC Car, EDB Panel for TC Car, EDB Panel for MC car)** to BEML in pre-wired condition. The Subcontractor shall provide all the Electric Boards/Panels but not limited to as per the scope of supply given in the Cl. No.7.1.2 & 7.1.3 of this PTS.

If the components are used incorrectly, the subcontractor shall, at his own expense, take whatever action is deemed necessary, such as, rectification, readjustment or design changes to the satisfaction of the BEML and MRS1. The subcontractor shall consider TS 14, for design of each board and purchase of Electronic components.

The specification, quantity and location etc., of components such as Relays, Contactors, MCB, TB's etc., provided in the BOM of the drawings will undergo some change during review of Proto train & design document by DMRC. The subcontractor shall absorb those design changes without any additional cost to BEML.

Subcontractor shall consider ERGS & ERTS of MRS1 project during design of the electrical boards. The Subcontractor shall provide, as a minimum, the following:

7.1.2 Scope of Supply for Electrical Panels

The list of Electrical Boards/Panels to be supplied by sub-contractor for MRS1 is as per **Table-I** below:

Sl. No.	DRAWING NUMBER	EQUIPMENT	QTY/CAR		
			DMC	TC	MC
1	525-21095	EDB PANEL (DMC CAR)	1 No.	-	-
2	525-21096	EDB PANEL (TC CAR)	-	1 No.	-
3	525-21097	EDB PANEL (MC CAR)	-	-	1 No.

7.1.3 Guideline Components of Electrical Panels

The components used for similar type car are described below. After detailed circuit diagram, Electrical Panels and the components may require to be changed accordingly. But the components, described below, can be guideline components to design Electrical Panel for MRS1 contract.

1) Common components

Following components were used in common.

- Name Plate
- Cable Bar
- Cables
- Handle
- Mounting Support
- Painting
- Earth Pad

- Fixing Hole Pad
- Accessories

2) Electrical Boards

Sl. No.	COMPONENTS
1	MCBs
2	AUXILIARY SWITCH
3	RELAYS
4	CONTACTORS
5	TIMER RELAY & SOCKETS
6	INDICATORS
7	CONNECTORS
8	ELECTRICAL OUTLET
9	TERMINAL BLOCKS
10	FUSE
11	RESISTOR
12	ANY OTHER COMPONENTS REQUIRED

The components described above are just guideline components to select the components for MRS1 contract.

The subcontractor shall provide all components related to the Electrical Panels, but not limited to, the following.

1. All components to meet the performance requirements of the Electrical Panels

2. Complete tools, Hardware, Facilities, Jigs, Fixture diagnostic etc. for whole Electrical Panels shall be in line with contractual & Engineers Requirement.

3. Enclosures & Mounting arrangements has to be provided by the subcontractor for the all the equipments supplied by subcontractor.

4. Cables between equipments:
    i. Subcontractor shall supply the cable harness 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.

    ii. 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.

5. All mating connectors, Pins, Hood, Gland etc., for car body side wiring shall be supplied by the subcontractor.

6. The connector, terminal blocks, relays, indicators, contactors, MCB’s and other items shall be from OEM as per BEML drawings.

7. Mating connectors for vehicle side with all pins even if pin is not used, back shells and accessories shall be supplied by the subcontractor.

8. Non-screwed and self locking type connectors for complete system shall be ensured.
9. Cable Assembly instruction documents for Ethernet cables and any special cables etc.,
10. Earth pad / stud and fasteners for fastening (preferably which suits to M6 and 6 sq. mm. cable)
11. Name plates or Name Labels
12. Rubber (packing or gasket) for the water-tightness when the subsystem or components are installed shall be supplied by the subcontractor.
13. The subcontractor shall provide one full set of connector and its contacts as mounted on the equipments for each car-type (DM, T & M cars) to carry out vehicle level voltage withstand test at BEML factory.
14. 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.
15. The subcontractor shall position the DLP & commissioning spares at MRS1 depot. The sub contractor shall submit along with the tender, the list of DLP & commissioning spares for approval of MRS1.
16. The ratings and Make of MCBs, Relays and Contactors to be submitted for approval of BEML / MRS1 for operation with dust proof box based on the de-rating factors of temperature and proximity.
17. The cables required for manufacture of the above Electrical boards will be supplied by BEML to the subcontractor.
18. All cable accessories shall conform to EN45545, HL3 standard.
19. Painting specification & process wherever applicable shall be as per the approved Painting Specification provided by BEML.
20. The Gold pin contacts to be provided for all shield cables (core + shield).

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

7.1.4 Warranty

The subcontractor shall be responsible for any defect or failure of equipments provided in the cars, due to defective design, material or workmanship during warranty period.

The warranty period of special tools, test and diagnostic equipment, maintenance and unit exchange spares shall be as per GS of MRS1 from the date of acceptance by MRS1/MMRDA.

The repair and/or replacement of failed components and equipment and installation of repaired/replaced components/equipment shall be taken by the subcontractor on his own charge at the Site (BEML' works/ MRS1 depots).

The subcontractor shall bear GST, custom duty, freight charges and all other expenses involved in collection of defective components and equipment from the Site, and transportation to the manufacturer's works in India or abroad and its return to Site after repairs.

Further, should any design modification be required to any components or equipment as a consequence of failure analysis, the period of 18 months shall recommence from the date when the modified part is commissioned into service and modification shall be carried out free of charge.

The subcontractor shall carry out all replacement and repairs under the warranty promptly and satisfactorily on notification of the defect by BEML so that no car is out of revenue service for more than 48 hours.

Also Refer General Terms and Conditions (GTC) of the tender.

7.1.5. Deliverables (as per ERTS 12.13)

The Contract deliverables (tools/equipment/software etc.) required to be supplied by the Contractor are listed below:

S.No.	Clause No.	Tools/Equipment/Software	Quantity
1	12.4.9 (ii) of ERTS	Relay testing kit as per clause 12.4.9(ii)	2 nos in each depot
2	12.4.9 (iii) of ERTS	Tools for extension of relay base as per clause 12.4.9(iii)	2 nos for each type of relay in each depot
3	12.4.9 (iv) of ERTS	Dummy relay (test switch)	1 no for each type of relay in each depot

Note:

1. The above mentioned list of deliverables is non exhaustive and only meant for the Convenience for the Contractor and the Engineer.

2. The cost of these deliverables is deemed to be included in the quoted price of contract.

7.1.6. Equipment side connectors for Di-electric test

Subcontractor shall supply one full set of connector and its contacts as mounted on the equipments for each car-type (DM, T & M cars) to carry out vehicle level voltage withstand test at BEML factory. Detailed list shall be decided and finalised before first supplies.

7.1.7. The sub contractor shall be fully responsible for integrated testing and commissioning including Commissioning Type tests and Commissioning Routine tests of the Electrical Panels at BEML works (Factory test) and at MRS1 site (Depot & Main line tests) for 6-car and 8-car train formation.

7.1.8. The sub contractor shall be responsible to maintain the DLP and commissioning spares at MRS1 site. The list of DLP and commissioning spares shall be furnished by the sub

contractor for review and approval by BEML/ DMRC.

7.1.9. The sub contractor shall provide all the documents for MRS1 project and shall also provide any other documents required by DMRC as per ERGS 2, ERGS 5, ERGS 6, ERGS 7, ERGS 8, ERGS 9, ERGS 12, Appendix- 4, 6, 7 & 9 of ERGS and ERTS 13.

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

b) *Description of Electrical Panels with drawings.*

c) *Quality assurance plan (QAP)*

d) *Type test procedure for Electrical Panels*

e) *Routine test procedure for Electrical Panels*

f) *Inspection and test plan (ITP)*

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

h) *Testing and commissioning plan*

i) *Interface plan*

j) *Type test and Routine test reports*

k) *Operation and maintenance manual*

l) *Spare parts catalogue*

m) *Special tools & Testing equipment*

n) Any other documents requested by BEML/DMRC.

7.1.10. The sub contractor shall provide valid type test certificates/documents and routine test certificates/documents for the Electrical Panels.

7.1.11. The supplier shall maintain the Electrical Panels and supply of spares for at least 10 years from the date of completion of the contract as per ERGS 8.12.

7.1.12. The supplier shall provide the spares of Electrical Panels as per Annexure-2 according to Cost center G.

7.1.13. The sub contractor shall provide training in operation and maintenance to BEML and DMRC staff.

7.1.14. Only 110V D.C. (+25%, -30%) would be made available on train for control power supply of Electrical Panels system. The Electrical Panels shall continue to operate correctly with the 110 V DC car battery voltage supply as per ERTS 12.1.1 and 12.3.2.

7.2. Software

NA

7.3. Interface

7.3.1 Mechanical Interface

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 Electrical Panels, 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 Electrical Panels 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.

• Cooling & clearance for ventilation

• Interface with interior facilities & train body

• Anti-vibration material such as rubber

7.3.2 Electrical Interface

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

The following is a brief of requirements for Electrical Interface

• Power requirements.

• Technical specification.

• Rated current, voltage characteristic and consumption.

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

• Connector/terminal arrangement

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

7.4. Design Information

7.4.1. The Subcontractor shall provide all necessary documents, drawings and software for BEML according to the time schedule defined by BEML. The Subcontractor shall provide the technical requirements and design information as a minimum as per Table TF 1.2 of Appendix-TF of ERTS.

Chapter 12		
S. No.	**Description**	**ERTS Clause Reference**
1.	List of control equipment and manufacturers	12.4.1
2.	List of indicators including function, control & display	12.6.2

The above list is not exhaustive. Detailed design submission list will be finalized during design stage. Further, if any additional documents demanded by end Employer /statutory authority same shall be submitted by the subcontractor.

7.4.2. The drawings and documents shall be submitted to BEML including preliminary, pre-final, and final design submissions, the final contract document, and all other submission both in the paper copies and electronic format.

7.4.3. The Subcontractor shall require the interface information, which possibly affects performance, fitting and form, from BEML.

7.4.4. General

The Subcontractor shall provide, but not be limited to, the following general information in accordance with the schedule approved by BEML before contract award.

To satisfy BEML that the Subcontractor have the ability to supply the Electrical Panels in accordance with the requirement of PTS, before contract award the Subcontractor shall provide BEML for review and approval the following information.

(a) Vendor approval documents

(b) Project Management Plan

1) Data Submission Plan
2) Design Submission Plan
3) 1st Production Plan
4) Type Test & FAI Plan
5) Mass Production after Testing and Delivery Plan
6) Training Plan
7) O&M Manual Plan
8) As Built-In Drawing Plan

(c) Preliminary Inspection and Test Plan (hereinafter, ITP)

(d) Preliminary Quality Assurance Plan (hereinafter, QAP)

(e) Preliminary Technical system/product/function description (including Lay-Out

drawing)

(f) Subcontractor's Option Suggestion about PTS requirements

(g) Clause by Clause commentary for PTS

7.4.5. 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/ DMRC.

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 including DMRC approval	2 weeks
2	Pre final design completion including DMRC-approval	2 months
3	Final design completion including DMRC approval	4 months

The design details for the above 3 stages shall comply with the requirements of clause 5.7 of ERGS.

Design calculation, Design reports, Design drawings and deliverables, as per the requirements specified in Chapter-5 of ERGS, but not limit to, the following design deliverables to BEML according to the time schedule defined by BEML.

Design Stage	Document/Deliverables	Submission date required (from LOI / contract award)
Evaluation Stage	Refer to Submittals Checklist as per Annexure-3	Within 2 weeks after receiving PTS.
PDR	Project Management Plan (PMP): The Subcontractor shall resubmit, if there is any amendment of PMP, in time for acceptance of BEML. - Illustrated project schedules, Chart, tables - List of Submission Data, - Configuration Management Plan	Within 2 weeks Shall update / submit whenever any change happens.
	Schedule Plan for - Design Deliverables/Drawing submission - Design, Validation, Test & Inspection and Manufacturing	Within 2 weeks. Shall update/ submit whenever any change happens.
	Compliance certification to all required Standards of Electrical Panels	Within 2 weeks
	General description	Within 2 weeks
	Concept design Drawings (Dimensional Installation Drawings: CATIA V5 file)	
PFDR	Technical Description (incl. at least following information) - The detailed submission schedule of each item shall be submitted for approval according to required design stage.	Required to keep updating to the latest design.
	- Compliance certificate to Standard applied for design, test & manufacturing	Within 1 month
	- Detailed Tech. Spec. & data of Electrical Panels	Within 1 month
	- Estimated/Measured weight of all Electrical Panels	Within 1 month
	- Material List/Spec. & Certification for Fire safety	Within 1 month

Design Stage	Document/Deliverables	Submission date required (from LOI / contract award)
	- Surface Finish & Painting Specification (Painting to ERTS 14.19.)	Within 1 month
PFDR	Preliminary Design Drawings (Dimensional Assembly Drawing: CATIA V5 file)	Within 2 months
	Water-Tightness Method	Within 2 months
	Caution Instruction for Electrical Panels Installation	Within 2 months
	Replacement Instruction & Demonstration of Electrical Panels	Within 2 months
	Life expectancy of major parts and LRUs	Within 2 months
	Consumables List for Electrical Panels	Within 2 months
	Preliminary Plan/schedule for Testing & Inspection	Within 2 months
	O&M Manual, IPC submission List	Within 2 months
	Preliminary list of spares, special tools and test equipment	Within 2 months
	List of equipment identification labels	Within 2 months
	Type Test Procedure (incl. record sheet) & Report	Within 2 months
	Routine Test Procedure (incl. record sheet) & Report	Within 2 months
	FAI Procedure & Report	Within 2 months
	Combined Test procedure (incl. record sheet) & Report	Within 2 months
	Type/Routine Test Procedure (incl. record sheet) & Report in Completed car	Within 2 months
	Commissioning Type Test Procedure & Report	Within 2 months
FDR	Final Design Drawings (Dimensional Sub-assembly drawings: CATIA V5 file)	Within 4 months
	The manufacturing details of all Electrical Panels	Within 4 months
	Installation Instruction of all Electrical Panels	Within 4 months
	Cleaning, storage and handling instruction of Electrical Panels	Within 4 months

Design Stage	Document/Deliverables	Submission date required (from LOI / contract award)
	Maintenance & Inspection Instructions (Video Manual)	Within 4 months
	Detailed Test & Inspection Plan/Schedule	Within 4 months
	Updated list of LRUs	Within 4 months
	Final List of Special Tools, Spare Parts, Test Equipment	Within 4 months
	Draft & Final O/M manuals	Within 4 months
	Draft & Final IPC (Illustrated Parts Catalogue)	Within 6 months
	Training Manuals & Materials	Within 6 months
	Details of equipment identification labels	
	All relevant Operation & Maintenance Information and Training Manual for Special Tools and Test Equipment	Within 6 months
	As-built drawings & List	Within 6 months

7.5. Testing

The Subcontractor shall carry out, as a minimum, the followings for Electrical Panels.
The Subcontractor shall perform, as a minimum, the following tests for Electrical Board (EDB-DMC, EDB-TC, EDB-MC).

(1) Routine and type tests of equipment and sub-systems.
(2) Complete vehicle Type tests for Electrical Board of the MRS1 project.
(3) Commissioning Type test for Electrical Board of the MRS1 project.

The vendor shall furnish the type test & routine test procedure and valid type test certificates for Electrical Board/Panels.

The detailed requirements are specified in the ERGS 7 & ERTS 15.

7.6. Operation and Maintenance Manuals and Spare Parts Catalogues

The Subcontractor shall provide the Operation/Maintenance Manuals and Spare Parts Catalogues of the Electrical Panels both in the copies and electronic format. The requirement for Operation/Maintenance Manuals and Spare Parts Catalogues shall be provided for Approval of BEML according to the time schedule defined by BEML.

The subcontractor shall provide the following O & M manual:

i. Volume 1 – Technical Manual.
ii. Volume 2 – Operation Manual.
iii. Volume 3 – Maintenance Manual.
iv. Volume 4 – Fault Diagnostics Manual.
v. Volume 5 – Spare Parts Manual.
vi. Volume 6 – Software Manual.
vii. Volume 7 – Special Tools & Test Equipment Manual.

The subcontractor shall provide the Operation/maintenance manuals and spare parts catalogues to BEML for approval of DMRC.

7.7. Investigation & Design Submission

7.7.1 Technical Investigation Document

Subcontractor who wants to be involved in making Electrical Boards for DMRC project shall submit the Technical Investigation Document and estimated costs for each component. At the Technical Investigation Document, all components shall be compared with another company's goods, component by component.

7.7.1.1 Investigation Point

1) Control Relay, Safety Relay, Contactor & Time Relay
- Make: Schneider / Morssmitt,
- Investigation Point:
• Is it suitable for DMRC project (think about IEC standard)?
• Coil Rating, Contact Rating, Power consumption.
• How many contacts can we use?
• Lifetime
• Does it comply with International Standard (IEC, etc.)?
• Does it have reliability (have ISO certification or not)?
• Is it useful under Noise and Vibration?
• On/Off time.
• Size, Fixing method, working condition.
• Can we buy it from India.
• Etc.

2) Indicator
Make: EAO

Investigation Point:
• Is it suitable for DMRC project (think about IEC standard)?
• Rating, Power consumption.
• Shape & Color
• Lifetime
• Does it comply with International Standard (IEC, etc.)?
• Does it have reliability (have ISO certification or not)?
• Is it useful under Noise and Vibration?
• On/Off time.
• Size, Fixing method, Working condition.
• Can we buy it from India.
• Etc.

3) Connector

Make: Harting, Weidmuller,FCI,etc.
Investigation Point:
• Is it suitable for DMRC project (think about IEC standard)?
• Pin & Socket Rating.
• Insulator rating.
• How many Pins & Sockets can we use (3O-6OP)?
• Lifetime
• Distance between Pins/Sockets
• Pin/Socket type(Gold plating or Silver plating)
• Usable cable size for Pin/Socket.
• Does it comply with International Standard (IEC, etc.)?
• Does it have reliability (have ISO certification or not)?
• Is it useful under Noise and Vibration?
• Size, Fixing method, Working condition.
• Can we buy it from India.
• Etc.

4) MCB

Maker: Schneider / Siemens

Investigation Point:
• Is it suitable for DMRC project (think about IEC standard)?
• Rating and Trip time.
• Can we use auxiliary contact?
• Lifetime
• Does it comply with International Standard (IEC, etc.)?
• Does it have reliability (have ISO certification or not)?
• Is it useful under Noise and Vibration?
• On/Off time.
• Size, Fixing method, Working condition.
• Can we buy it from India.
• Etc.

5) Terminal Block

Make: WAGO, Weidmuller, etc.
Investigation Point:
• Is it suitable for DMRC project (think about IEC standard)?
• Rating.
• Lifetime
• Is it ease to add Terminal blocks
• Does it comply with International Standard (IEC, etc.)?
• Does it have reliability (have ISO certification or not)?
• Is it useful under Noise and Vibration?
• Size, Fixing method, Working condition.
• Can we buy it from India.
• Etc.

6) Panel
- Investigation Point: Material, Size, Painting

7) The REST (Resistor, Hinge, Fuse, Outlet, Weight)
- The Subcontractor shall recommend Maker who has ISO certification and a component complied with IEC.

7.8. Spares, Special Tools and Testing Equipment

7.8.1. The Subcontractor shall hand over the Spares, Special tools and testing equipment in accordance with the delivery schedule of BEML. The Subcontractor shall supply the following items of spares (as per Annexure-2, in line with Cost centre G)

(i) Unit Exchange Spares

(ii) Consumable spares for maintenance of all trains during commissioning, service trials and up to completion of Warranty period

(iii) Mandatory spares

(iv) Recommended spares

(v) Overhauling spares

(vi) Special tools, Testing and Diagnostic equipment

(vii) Special Jigs, Fixtures & Gauges required for maintenance, repair and overhaul of various equipment, sub-systems in particular and the complete trains in totality

The detailed requirements are specified in ERGS 8.

7.8.2. Employer at his sole discretion may exercise the option to increase/decrease the quantities (to any extent) of spares indicated under milestones G1, G2, G3,G4, G5 and G6. For increased quantities, payment to the contractor shall be on the basis of actual supplies made and quoted unit rates and no escalation or any other additional sums shall be payable. Any decrease in quantities, if considered by the Employer, shall be intimated by Employer within two years of the commencement date. However increase in quantities may be intimated at any time during the execution of Contract and the delivery period for the enhanced quantities only shall be mutually agreed

The actual requirements (list & qty) as per above MRS1 cost center 'G' contract conditions are subject to DMRC/BEML approval. The subcontractor shall comply with the same

7.9. 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.

The detailed requirements are specified in ERGS 13.

7.10. Training

7.10.1 General:

The subcontractor shall provide the training for Employer's operating staff and maintenance staff according to the requirements specified in ERGS 9.

The detail requirements for training schedule including the number of times will be informed later.

7.10.2 Training Requirements:

The sub-contractor shall provide training to BEML/MRS1 staff at Factory and MRS1 site. The subcontractor shall submit a training proposal to BEML.

Training shall be carried out such locations as will provide the maximum benefit to the trainees. Such locations may be at places of manufacture, assembly or testing or other locations shall be furnished by sub-contractor.

The detailed requirements are specified in ERGS 9.1.

7.10.3 Training Manual

The subcontractor shall provide one original and five colored copies and electronic copies of the training manual for use by the Employer for conducting in-house training. The Manuals shall cov er all requirements specified in ERGS 9.

After completion of the training, training aids and materials used shall become the property of B EML to enable and further training to take place.

7.11. Engineering Support

Subcontractor shall depute the engineer(s) for the following;

1) The Subcontractor shall depute the technical experts for design review meetings and for technical discussions to sort out design / technical issues whenever required. Following are tentative meetings duration which might be required during design approval.
   - CDR meeting: 2～3 days
   - PDR meeting: 2～3 days
   - PFDR meeting: 5～6 days, two times

- FDR meeting: 8～10 days, two times

- Other interface meeting, if necessary with TCMS, Signaling and Telecom

2) Installation guide for first train: Depending on manufacturing schedule

3) Testing

- Equipment Type / Routine test (at subcontractor's place)

- Factory Acceptance (Complete car) test: Full support depending on the test schedule

- On-Site (Depot at Mumbai & Mainline) Test: Full support depending on the test schedule

- Subcontractor shall provide additional days to resolve faults and defects of Electrical Panels.

4) The Subcontractor shall depute the design engineer(s) / technical experts for design review meetings and for technical discussions to sort out design / technical issues as per above requirements. All costs related to the meetings shall be borne by the Subcontractor.

8. General Requirements

8.1. Weight

The weight of each component of Electrical Panels shall be verified and controlled by the subcontractor in accordance with the requirements defined by BEML.

The Subcontractor shall comply with all weight reductions judged as necessary by BEML. 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 subcontractor shall furnish the weight of the Electrical boards.

8.2. Fastener Requirements

a) 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.

8.3. 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 14.17.

8.4. Project Management

Along with the technical offer, the subcontractor shall submit a Project Management Plan which shall provide a clear over-view of the Contractor's organization, the management system and methods to be used for completion of the works. The organization resources for the design, procurement, manufacture, installation, testing & commissioning and setting to work shall be clearly defined.

The Project Management Plan shall provide the following information.

- A diagram showing the organizational structure for the management of the Contract with locations, names and position titles of staff and their line and staff relationship. The diagram shall include associate organisation and sub-suppliers and show clearly the individuals and lines of responsibility linking the various groups. 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.
- To fulfill the subcontractor’s obligations during the Testing and Commissioning and the Defect Liability Period, the subcontractor shall nominate experienced maintenance engineers and organise deployment before undertaking testing and commissioning in depots at Mumbai. 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.

8.5. Fire Safety

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 Electrical Panels with details of material, applied mass, fire safety compliance (Flammability, smoke, toxicity) and fire load calculations, during the preliminary design phase.

All materials/items used in Electrical Panels shall conform to Fire Safety requirements of EN 45545 Part 1 to 7(Category 4-A, 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 Engineer as per ERTS 2.5.8 & 2.19.

1. Flammable materials shall be well contained with At least IP 65 protection as per ERTS 2.19.1 (iii)

2. ERTS 12.5.2: The insulation of all wires and cables including those used within equipment / subsystem shall be halogen-free flame- retardant and formulated to minimise generation of smoke, noxious emissions and corrosive fumes, in the case of overheating or fire in compliance with EN 45545 (Category 4-A, Hazard level HL3) latest edition. All Cables shall comply NF F 63-808 (for low voltages), and NF F 63-826 (for high voltages) or other international standards like EN 50264(Part 1 to 3) and EN 50306(Part 1 to 4) as approved by the Engineer.

8.5.1. 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.

8.5.2. 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

8.6. EMC Requirement

NA

8.7. Spares, Special Tools and Testing Equipment

8.7.1. The Sub-Contractor shall supply the following items of spares (as per Annexure-2, in-line with Cost centre G):

1. Unit Exchange Spares;
2. Consumable spares
3. Mandatory spares;
4. Recommended spares;
5. Overhauling spares;

6. Special tools, Testing and Diagnostic equipment;
7. Special Jigs, Fixtures & Gauges required for maintenance, repair and overhaul of various equipment, sub-systems in particular and the complete trains in totality;

8.7.2. Unit exchange Spares

The subcontractor shall supply Unit exchange spares for maintenance of all trains as per GS 8.2

8.7.3. Consumable Spares

The Subcontractor shall supply consumable spares for maintenance of all trains during commissioning, service trails and up to completion of warranty period as per GS 8.3.

The consumable spares shall include lubricants, oils, grease, sealants, filter media, gaskets and any other items, whose declared life is less than one year.

Recommended list shall be furnished by the Subcontractor as part of design submission.

8.7.4. Mandatory spares

The subcontractor shall supply mandatory spares as per GS 8.4

8.7.5. Recommended spares

The subcontractor shall supply recommended spares as per GS 8.5. Subcontractor shall provide list of recommended spares which are not covered under consumables and mandatory spares but are expected to be required during two years after expiry of warranty period.

8.7.6. Overhauling spares

The subcontractor shall supply overhauling spares as per GS 8.6. Subcontractor shall supply the overhauling kits for five (5) metro trains. Overhauling kits for all those equipments, systems, sub-systems of trains that will need overhauling during intermediate overhaul of the train will be included in these kits.

8.7.7. Special Tools, Testing and Diagnostic equipments

The subcontractor shall supply Special tools, testing & equipments as per GS 8.7.

Subcontractor shall provide a recommended list and supply one (1) set of fixed and two (2) sets of portable and hand held special tools, testing and Diagnostic equipments for preventive and breakdown maintenance, overhauling and diagnostics of various equipment provided in the cars.

Recommended list shall be furnished by the Subcontractor as part of design submission.

8.7.8. Special Jigs, Fixtures and Gauges

The subcontractor shall supply special Jigs, Fixtures and gauges as per GS 8.8.

Subcontractor shall provide a recommended list and supply, as minimum, one (1) set of fixed Special Jigs, Fixtures and Test Benches and two (2) sets of hand held and portable tooling, measuring and diagnostic equipment and Gauges separately for preventive and breakdown maintenance, overhauling and diagnostics of various equipments provided in the cars.

Recommended list shall be furnished by the Subcontractor as part of design submission.

8.7.9. Commissioning and DLP Spares

The subcontractor shall supply commissioning and DLP spares as per ERGS 8.11.

Subcontractor shall submit to BEML for review and approval of BEML/DMRC a list of minimum spare parts that he intends to make available during the installation, commissioning and defect liability period.

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.

8.8. Quality

8.8.1 General

All works for product shall be executed and controlled by a quality management system, which can assure the quality of the product. And it is essential that the supplier of electronic components shall be certified as a minimum, ISO 9001/2 according to the TS 14.12.4. The requirement for quality described in this document was issued on the basis of GS & TS and ISO 9000 quality system requirements.

And the subcontractor shall follow and perform both this document and the contractual requirements.

If there are conflicts and/or different level of requirements between this quality requirement and contracts from DMRC, the contracts from DMRC shall have the priority over this document.

8.8.2 Quality System Requirements

Subcontractor shall maintain and perform appropriate quality system for the quality assurance of product in the step of following matters.

-Design
-Development & Testing
-Production
-Installation
-Servicing

The Quality Assurance System shall be applied without prejudice to, or without in any way

limiting, any quality assurance system that the subcontractor already maintains.

8.8.3 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.

8.8.4 Quality Assurance Plan

The Subcontractor shall develop and submit to BEML QC team for review and approval a Quality Assurance Plan (QAP) based on ISO 9001 and GS 2.5. 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.

8.8.5 Quality Assurance activities

The Subcontractor 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 GS 2.6.

a) Procurement
b) Manufacturing Inspection
c) Production Conformance Testing
d) Receiving Inspection
e) Shipping Inspection
f) Ensure inspection with latest Revision/Changes.
g) Identification of items using tags etc.,
h) Handling (storing, preserving, packaging, marking and shipping).
i) Non-conformance Control.

8.8.6 Quality Audit

The Subcontractor shall permit Quality Audit by BEML and/or the Employer of BEML. 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.

8.8.7 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 15.

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.

8.9. System Assurance (SA)

8.9.1 Safety Assurance Plan

The subcontractor shall meet the Safety Assurance Programme Plan compliant with the requirements specified in TS 2.4.

8.9.2 System Safety Assurance

NA

8.9.3 Hazard Analysis

The subcontractor shall provide the hazard analysis, Fault tree analysis and Failure Modes Effects and Criticality Analysis (FMECA) of the Electrical board and assist the contractor to perform the interface hazard analysis compliant with the requirements specified in TS 2.5.

8.9.4 Reliability: General

The subcontractor shall comply with the Reliability and maintainability requirements prepared by BEML in accordance with the requirements specified in TS 2.7, TS 2.8, TS 2.10 & TS 2.12.

8.9.5 Quantitative Reliability

The subcontractor shall comply with Quantitative reliability levels for the train and equipment specified by BEML in accordance with the requirements specified in TS 2.7 and TS 2.8

8.9.6 Maintainability

The subcontractor shall comply with the Maintainability requirements specified in TS 2.12

8.9.7 Reliability and Maintainability Demonstrations

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 TS 2.9, TS 2.11 & TS 2.13.

8.9.8 Maintenance

The subcontractor shall comply with the Maintenance requirements specified in TS 2.14.

8.10. Materials & Workmanship

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 requirements for material and workmanship of Electrical Panels shall meet, but not be limited to, TS 14.

9. Testing

9.1. General

1) The Subcontractor shall be responsible for undertaking and passing all necessary testing activities for Electrical Panels.
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 Electrical Panels 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 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 Mumbai/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 and ERGS:

(a) ERTS Chapter 14 : Electrical and Control Equipment

(b) ERTS Chapter 15 Inspection, Tests and Trials

(c) ERTS Appendix TA International Standards

(d) ERGS Chapter 7 Testing and Commissioning

9.1.1. General

The subcontractor shall provide BEML with all information for the completion of Inspection, Testing and Commissioning Plan and also comply with the plan defined according to the requirements specified in ERGS 7 and ERTS 15.

The type tests for the Electrical Panels at both the component level and complete train level, for line-2 & line-7, shall be re-performed by the Subcontractor under BEML and DMRC participation, if DMRC wants to witness the tests even though the tests were accepted by BEML.

All such tests shall be carried out at the subcontractor's cost, wherever performed, in the presence of and to the satisfaction of BEML and DMRC, who reserves the right to witness any or all of the tests.

All defects and shortfalls in the subcontractor's system, discovered during all tests / in service, shall be rectified and re-tested to the satisfaction of BEML and DMRC. The subcontractor shall provide full instrumentation to conduct all tests and carry out modifications as required.

All test procedures, reports including all maintenance activities and check lists shall be submitted and approved by BEML and DMRC within the defined period. The results of all tests

shall be submitted to BEML and DMRC, who will record his conclusions as to whether or not the equipment being tested has passed satisfactorily.

The subcontractor shall produce a test report, in three copies, and in an approved format, within a defined period following the test, for acceptance by BEML and DMRC.
The detailed requirements are specified in ERGS 7 and ERTS 15.

Following items shall be complied

1. All test equipment shall carry an appropriate and valid calibration label.
2. The subcontractor shall sign all reports of Tests
3. The subcontractor shall present a comprehensive Testing and Commissioning Program.
4. Test procedures shall be amended, as required by the subcontractor throughout the duration of the Contract, to reflect changes in system design or the identification of additional testing requirements.
5. All costs including labor, supervision of testing, provision of specialized equipment and materials, and the cost of hiring Consultants and the services of other specialized personnel or independent assessors etc shall be borne by the subcontractor. The subcontractor shall also bear any expenses incurred due to re-testing caused by defects or failure of equipment or any other account to meet the requirements of the contract.

The detailed requirements are specified in ERGS 7.

9.1.2. 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 ERGS 7.

9.2. First Article Inspection

All the materials, fittings, equipment, manufacturing processes, and assembly workmanship shall be subject to inspection by BEML and DMRC, wherever carried out in accordance with the requirements specified in ERTS 15.1.

The supplier shall offer the first set of Electrical Panels for First Article Inspection (FAI) by BEML and DMRC. After clearance from BEML, mass production shall be taken up.

9.3. 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 TS 15.4.1. 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.

9.4. Test Reports

1) All test reports of the component, system, factory and field acceptance test for Electrical Panels 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.

9.5. 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 Mumbai in accordance with IEC 61133.

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

The Electrical Panels shall comply with the requirements of ERTS 15.

9.6.1. Type Test, Electrical Panels

This test is required to verify that the Electrical Panels operate in accordance with the Approved Design Data.

Type test of each component shall be performed by the Subcontractor under BEML and DMRC participation in accordance with the requirements specified in ERTS 15.1.2.

Subcontractor has responsibility for the type 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 13.10, 14.12 & 15.

S.No.	Test Items	Type Test	Routine Test	Requirement

1	Visual & dimensional inspection (incl. weight and power consumption measurement)	✓	✓	Approved, Test standard/specification. Any optical distortion or any visual defect is not allowed.
2	Electrical Test. (Dielectric Test & Insulation Resistance Test).	✓	✓	IEC 60077
3	Bell Test.	-	✓	
4	Vibration & shock Test.	✓	✓	IEC 61373
5	Dust Proof Test.	✓	-	IEC 60529
6	Water Proof Test	✓	-	IEC 60529
7	Dry Heat Test.	✓	-	IEC 60068

The subcontractor shall submit the valid type test report of Electrical Panels.

※ Dimensional Inspection: This inspection shall be done with the specimen picked by a lot of product. 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 DMRC. Change of manufacturing place may require re-type test. Incase waiver of certain type test is accepted by BEML's Engineer or DMRC, 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, ERGS.

9.6.2. Routine Test, Electrical Panels

This test is required to verify that the Electrical Panels have been built in such a way that it satisfies the requirements of the Approved Design Data as verified by the Type Test.

During test, the criteria shall be observed and recorded in a logbook and necessary alterations and adjustments carried out.

Records from Routine test shall be held by the Subcontractor and made available timely for BEML and DMRC's inspection. Copies of the approved routine test results shall be submitted together with the associated logbook. Additional copies of records of all tests/inspections result

shall also be held at the Subcontractor work to be made available to BEML and DMRC on demand.

This test basically includes function test, visual inspection and dimensional inspection but not be limited.

The subcontractor shall perform, as a minimum, the following test and submit the routine test report to BEML:

(1) Operation Tests
(2) Visual Inspection
(3) Dimensional Inspection
(4) Bell test
(5) Dielectric and Insulation Resistance test
(6) Earth continuity test
(7) Operation test

9.6.3. Fire Performance Test

The sub-contractor shall perform the fire performance tests of Electrical Panels in accordance with the requirements specified in ERTS 2.19 and 15.26

9.6.4. Shock and vibration test

The sub-contractor shall perform the Withstanding Vibration and Shock test of Electrical Panels aggregates in accordance with the requirements specified in international standard ERTS 2.18.7, 12.4.4 and IEC61373.

The test results shall be submitted for approval.

9.7. Factory tests of complete cars

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

The individual cars, complete units and trains (6-car & 8-car) shall be type tested by Subcontractor for Electrical Panels aggregates in accordance with IEC 61133 and ERTS 15.

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

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

The individual cars, units, complete trains (6-car & 8-car) shall be routine tested by Subcontractor for Electrical Panels aggregates in accordance with IEC 61133 and in accordance with ERTS 15. The Subcontractor shall be responsible for correcting any interfacing defects.

9.8. Testing and Commissioning of cars/trains in Depot

9.8.1. Type Commissioning Tests

The subcontractor shall carry out commissioning **Type Test** on the complete 6-car & 8-car trains in accordance with IEC 61133 & ERTS 15.

9.8.2. Routine Commissioning Tests

The subcontractor shall carry out commissioning **Routine Test** on the complete 6-car & 8-car trains in accordance with IEC 61133 & ERTS 15.

9.9. Integration Test

BEML will perform the integration test with the assistance of sub-contractor according to ERGS 7 and ERTS 15.

The subcontractor shall submit all information for the integration test to BEML. If needed, the concerned engineer from subcontractor shall participate in the test.

9.10. Service Trials

BEML will perform the service trial for MRS1 corridor and the sub-contractor shall supply the sufficient information and assistance if necessary according to ERGS 7 and ERTS 15.

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.

10. Submittals – Technical offer:

The Subcontractor shall provide as a minimum, the following along with the technical offer. The submittals check-list as per Annexure-3 of this PTS shall also be submitted.

- Complete Technical offer for Electrical Panels indicating the make of the components
- Type Test procedure for carrying out the Type test
- Clause wise compliance against

  a) PTS - Doc no. GR/TD/4504
  b) ERTS & ERGS.

  in the following format

- 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, ERGS & PTS clauses with regard to Electrical Panels, are liable for rejection.**
- Supply details with references for same / similar design for the last 3 years for metro projects along with performance certificates from Employer’s (Metro Corporation) to

support the qualification criteria as per section 6 of this document.

- The list of spares as detailed at clause 7.7 of this PTS

11. Attachment

i. ERGS

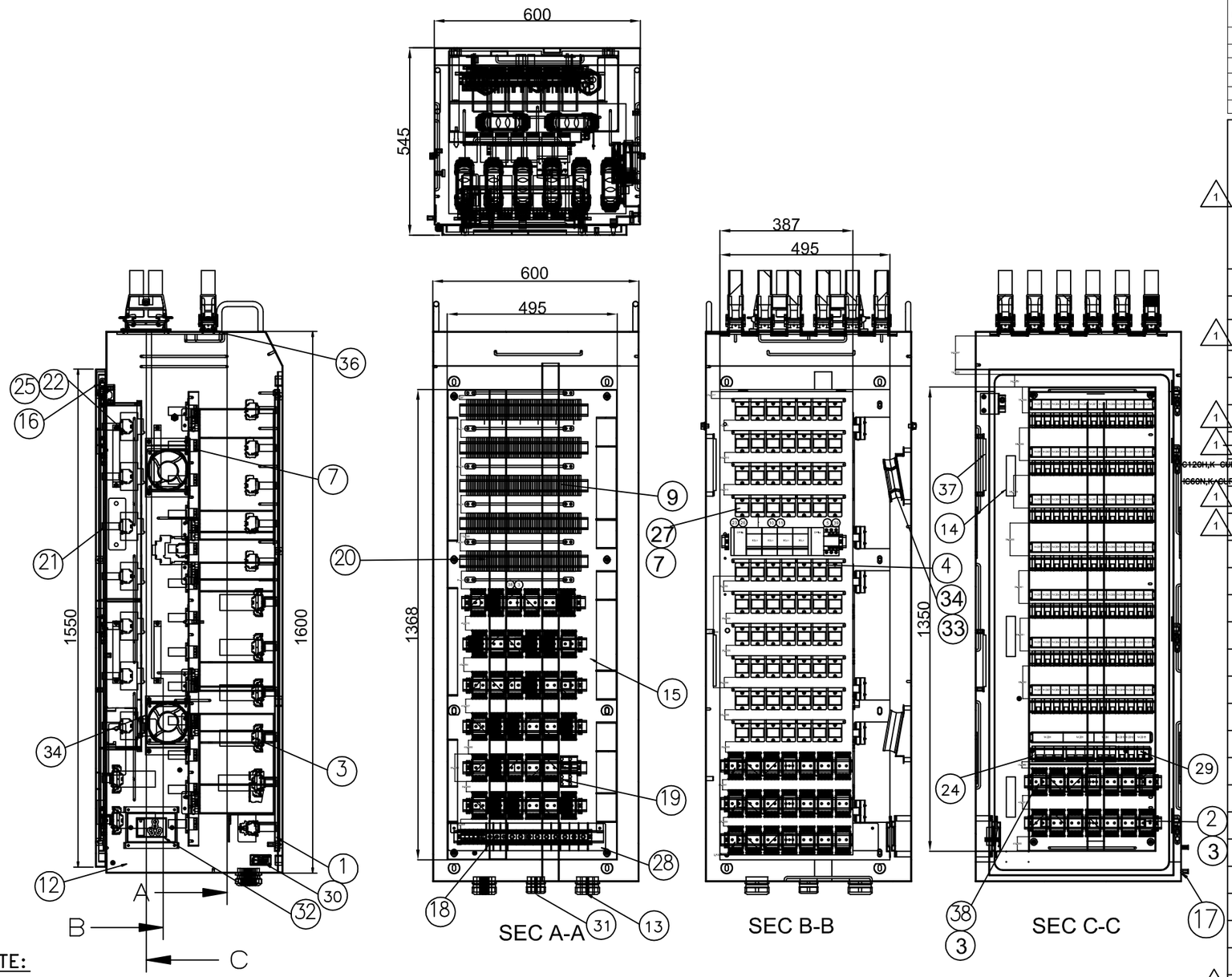
ii. ERTS

iii. EDB Panel Drawings

iv. Annexure-1 : Vendor Approval Format

v. Annexure-2 : List of spares

vi. Annexure-3: Submittals check list



NOTE:

1. PAINTING SPECIFICATION & PROCESS SHALL BE AS PER THE APPROVED PAINTING SPECIFICATION PROVIDED BY BEML.
2. ALL SHARP EDGES TO BE SMOOTHENED AND GROMMETS TO BE PROVIDED AT EDGES IN THE PANEL. ALL THE CABLES ARE TO BE PROPERLY SECURED WITH PROTECTIVE SLEEVES.
3. THE SPECIFICATION, QUANTITY AND LOCATION etc., OF COMPONENTS SUCH AS RELAYS, CONTACTORS, MCB, TB's etc., PROVIDED IN THE BOM OF THE DRAWINGS WILL UNDERGO SOME CHANGE DURING FINAL DESIGN FREEZE / PROTO TRAIN& DESIGN DOCUMENT BY DMRC. THE SUBCONTRACTOR SHALL ABSORB THOSE DESIGN CHANGES WITHOUT ANY ADDITIONAL COST TO BEML.
4. MATING PART OF HARTING CONNECTOR, CODE PINS & HOODS TO BE SUPPLIED BY THE VENDOR.
5. THE CABLE MARKERS PROVIDED SHALL BE FIRE RETARDANT & HEAT SHRINKABLE TYPE.
6. THE CABLE MARKERS SHALL BE PROTECTED AGAINST FADING BY PROVIDING FIRE RETARDANT HEAT SHRINKABLE CLEAR SLEEVES.
7. ALL 1.5SQ.MM, 6SQ.MM & 16SQ.MM CABLE SHOULD BE PROPERLY CRIMPED
8. AIR TURBULATOR(AC AXIAL COMPACT FAN) SHALL BE PROVIDED IN EDB PANEL TO ACHEIVE UNIFORM COOLING. LOCATION FOR INSTALLATION SHALL BE DECIDED ACCORDINGLY.
9. LED LIGHTS TO BE PLACED PROPERLY IN SUCH A WAY THAT ALL COMPONENTS ARE ILLUMINATED.
10. ALL ITEMS, CABLE ACCESSORIES USED IN PANELS SHALL CONFORM TO EN45545, HL3.
11. THE GOLD PIN CONTACT TO BE PROVIDED FOR ALL SHIELD CABLES(CORE+SHEILD).
12. PART NO & QUANTITY WILL BE FINALISED DURING DESIGN STAGE WITHOUT ADDITIONAL COST TO BEML

SL.No.	QTY	PART / STOCK No.	DESCRIPTION	SIZE	COMPANY STD./I.S	Wt. (Kg) MATERIAL
43	6	CR + BRB SERIES SEE NOTE:12	MCB + REMOTE BREAKER, 1P, 10A, C CURVE, 10KA WITH AUXILIARY CONTACT	ASSY	MAKE: MORSSMITT	
42	1	CH16	SWITCH	ASSY	MAKE: K&N	
41	1	704.032.518(3A1B,green)	PUSH BUTTON	ASSY	MAKE: EAO	
~~40~~	~~1~~	~~C60H, 2P~~	~~MCB, 3A, 2P~~	~~ASSY~~	~~MAKE: SCHNEIDER~~	
39	1	LADN406 ~~LA1DZ40~~	AUXILIAY CONTACT	ASSY	MAKE: SCHNEIDER	
38	17	B400 115 EG SV F1	RELAY	ASSY	MAKE: MORSSMITT	
37	4		LED LIGHT	ASSY	LIGHT SUPPLIER SCOPE SEE NOTE 9	
36	8	HAN 108 DD	CONNECTOR	ASSY	MAKE: HARTING	
34	2	4656 N	FAN	ASSY	MAKE: EBM PAPST SEE NOTE 8	
33	2	PMF 100444	PROTECTIVE VENT	ASSY		
32	1	26004,W26424,W26403A	SOCKET OUTLET	ASSY		
31	1		CABLE GLAND	ASSY	M50	
30	1		COMPANY NAME PLATE	SUS304	0.6T	
29	1	CR SERIES/ GR SERIES/ IC60N SERIES	MCB,3A,2P,C CURVE,10KA,230VAC WITH AUXILIARY CONTACT	ASSY	MAKE:MORSSMITT/ SCHNEIDER	
28	1		PROTECTION COVER	ACRYL	T=3	
27	70	D-U204-LK	RELAY	ASSY	MAKE: MORSSMITT	
26	~~6~~ 2	A9A26929	AUXILIARY SWITCH (AC)	ASSY	MAKE:SCHNEIDER	
~~25~~	~~90~~	~~A9N26929~~	~~AUXILIARY SWITCH (DC)~~	~~ASSY~~	~~MAKE:SCHNEIDER~~	
24	2	CR SERIES / C120H	MCB,80A,3P,K CURVE WITH AUX CONTACT	ASSY	MAKE:MORSSMITT/ SCHNEIDER	
	1	CR/GR SERIES/IC60N	MCB,32A,3P,K CURVE WITH AUX CONTACT			
23	2	DPna VigiA	MCB, 20A, 30mA	ASSY	MAKE:SCHNEIDER	
22	1	CR/GR SERIES / C60H SERIES	MCB,5A,1P,C CURVE,10KA,110VDC WITH AUXILIARY CONTACT	ASSY	MAKE:MORSSMITT/ SCHNEIDER	
21	1		PANEL	SPCC	t=2.3	
20	45	2002-880(3A)	TERMINAL BLOCK-DIODE	ASSY	2002-880(3A)	
19	1	ST6-TWIN(6P)	TERMINAL BLOCK	ASSY	ST6-TWIN(6P)	
18	1	HV-M8(9P)+HV-M6(3P)+ UK16N(6P)	TERMINAL BLOCK	ASSY	MAKE: PHOENIX	
17	5		EARTH PAD	ASSY	M6-20MM	
16	4	96-MA-80-24	HINGE	ASSY		
15	1		PANEL DOOR COVER	ASSY	T=2.3	
14	3		LOCKING DEVICE	ASSY	AB-2401-2	
13	2		CABLE GLAND	ASSY	M63	
12	1		BOX	CRCA	t=2.3	
11	4	5ST3 010(5SU1,2P,6A)	MCB AUX	ASSY	MAKE: SIEMENS	
10	4	5SU1154-7KK06	MCB	ASSY	MAKE: SIEMENS	
9	5	2002-1301(70P)	TERMINAL BLOCK	ASSY	MAKE:WAGO	
7	70	V31	SOCKET RELAY	ASSY	MAKE: MORSSMITT	
6	1	KH-9015-PBL	LIMIT SWITCH	ASSY		
5	1	LC1D40A6FD S207 ~~LC1-D65A6FD~~	MAGNETIC CONTACTOR	ASSY	MAKE: SCHNEIDER	
4	3	LC1DT256FD S207 ~~LC1-DT256FD~~	MAGNETIC CONTACTOR	ASSY	MAKE: SCHNEIDER	
3	69	EA103BF EG	RELAY SOCKET	ASSY	MAKE: MORSSMITT	
2	52	BK400 115 EG S V F1	RELAY	ASSY	MAKE: MORSSMITT	
1	1		PANEL	SPCC	t=2.3	

22	8	~~C60H,1P,C CURVE~~ CR SERIES / GR SERIES / C60H SEE NOTE NO:12	MCB, 1P, 3A	1P, 110VDC OPEARTED, C CURVE, 10KA WITH AUXILIARY CONTACT	ASSY	MAKE: MORSSMITT / SCHNEIDER
	~~53~~ ~~59~~		MCB, 1P, 10A			
	3		MCB, 1P, 20A			
	2		MCB, 1P, 40A ~~MCB, 1P, 50A~~			
	5		MCB, 1P, 2A			
	10		MCB, 1P, 6A			
	1		~~MCB, 1P, 25A~~			
	3		MCB, 1P, 1A			

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~

FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227

UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM) | QUALITY OF WELD JOINTS REF, RD 230 MEDIUM

VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.

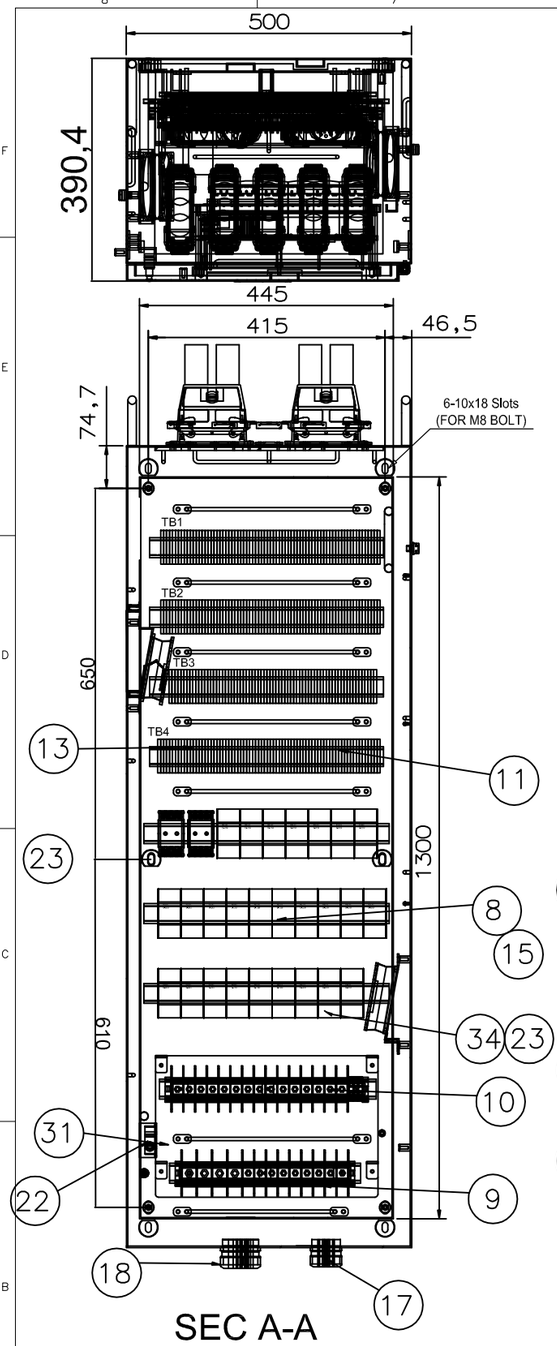
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96 | STATUS:

ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD
1	BOM UPDATED & REVISED	31.12.2019	V.SARANYA	V.SARANYA	V.SYLAJA

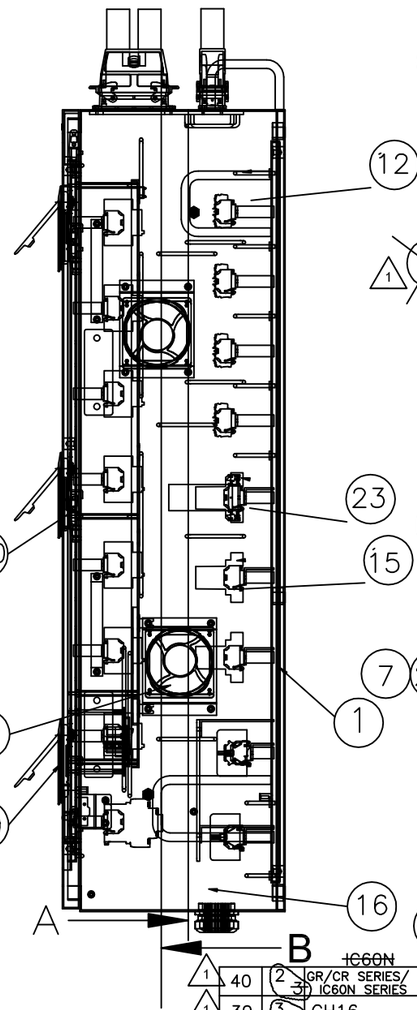
PRODUCT	MUMBAI METRO CARS L2 & L7		
REF DRG			
MATERIAL			
HEAT TREAT.		APPD	V.SYLAJA 25.11.2019
SURFACE TREAT.		REVD	PRASHANT KUMAR 25.11.2019
TITLE	EDB PANEL (DMC CAR)	CHKD	V.SARANYA 25.11.2019
		DRWN	V.SARANYA 25.11.2019
		SCALE	NTS
		SHEET	1 OF 1
		Wt.(Kg)	-
BEML LIMITED		DRG No.	525-21095
		ALT	1
		A2	

GRADE No.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
VALUE	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
SYMBOL												

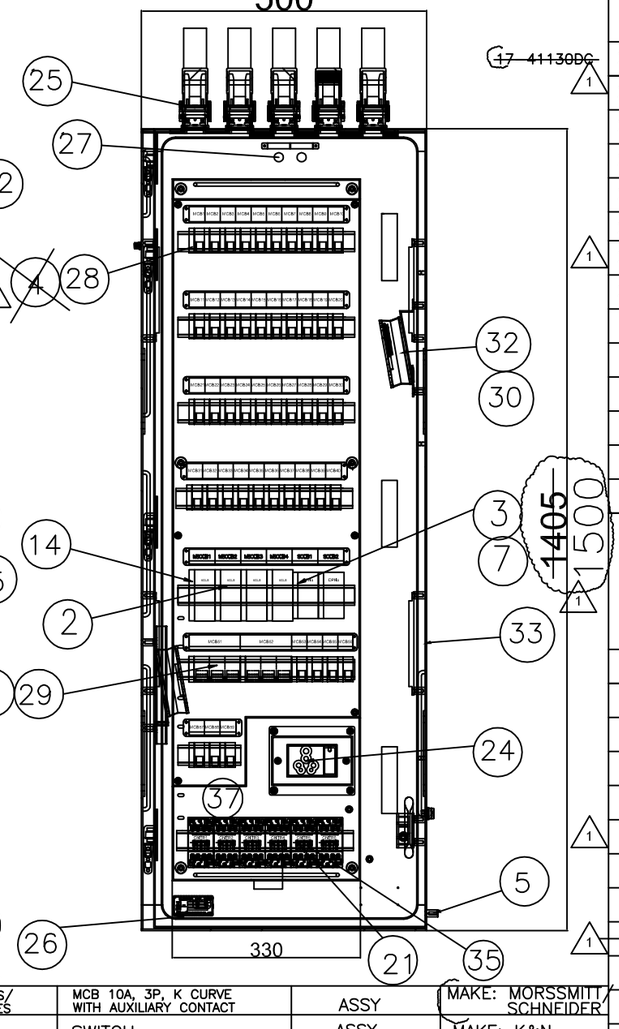
SURFACE ROUGHNESS



SEC A-A



SEC B-B



MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~

FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227

UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM) — QUALITY OF WELD JOINTS REF, RD 230 MEDIUM

VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.

WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96 — STATUS:

SL NO.	QTY	PART NO.	DESCRIPTION	MATERIAL	REMARKS
41	5	CR+BRB SERIES	MCB + REMOTE BREAKER, 1P, 10A, C CURVE, 10KA WITH AUXILIARY CONTACT	ASSY	MAKE: MORSSMITT
28	27		MCB, 1P, 10A	1P, 110VDC OPEARTED, C CURVE, 10KA WITH AUXILIARY CONTACT	MAKE: MORSSMITT/ SCHNEIDER
	3	~~C60H,1P,C CURVE~~	MCB, 1P, 20A		
	3	CR SERIES/GR SERIES/ C60H SERIES SEE NOTE NO :12	MCB, 1P, 40A		
	6		~~MCB, 1P, 50A~~ MCB, 1P, 2A		
	6		MCB, 1P, 6A		
	1		MCB, 1P, 25A	ASSY	
27	2	~~17-411130DC~~ 17-411132DC	INDICATOR RED(1P), INDICATOR GREEN(1P)	ASSY	MAKE: EAO, DIA:16MM
26	1		COMPANY NAME PLATE	SUS304	0.6T
25	7	HAN 108 DD	CONNECTOR	ASSY	MAKE: HARTING
24	1	W26004, W26424, W26403A	SOCKET OUTLET	ASSY	
23	4	EA103BF EG	RELAY SOCKET	ASSY	MAKE: MORSMITT
22	1	KH-9015-PBL	LIMIT SWITCH	ASSY	
21	5	LC1D256FD S207 ~~LC1-D256FD~~	MAGNETIC CONTACTOR	ASSY	MAKE: SCHNEIDER
20	4	96-MA-80-24	HINGE	ASSY	
19	3	AB-2401-2	LOCKING DEVICE	ASSY	
18	1		CABLE GLAND	ASSY	M63
17	1		CABLE GLAND	ASSY	M50
16	1		BOX	SPCC	t=2.3
15	24	V23	RELAY SOCKET	ASSY	MAKE: MORSMITT
14	4	5ST3 010(5SU1 2P 6A)	MCB AUX	ASSY	MAKE: SIEMENS
13	75	2002-1301(70P)	TERMINAL BLOCK, TB4		
	70		TERMINAL BLOCK, TB3		
	74		TERMINAL BLOCK, TB2		
	74		TERMINAL BLOCK, TB1	ASSY	MAKE: WAGO
12	2	PI 15 200X120	HANDLE	SS400	
11	20	2002-880(3A,13EA&10A,1EA)	DIODE	ASSY	MAKE: WAGO
10	1	HV-M6(15P)+UK6N(3P)	TERMINAL BLOCK, TB5	ASSY	MAKE: PHOENIX
9	1	HV-M8(4P)+HV-M6(9P)	TERMINAL BLOCK, TB6	ASSY	MAKE: PHOENIX
8	24	D-U204-KL	RELAY	ASSY	MAKE: MORSMITT
7	~~3~~ 9	A9A26929	AUXILIARY SWITCH (AC)	ASSY	MAKE: SCHNEIDER
6	2	B400	RELAY	ASSY	MAKE: MORSMITT
5	5		EARTH PAD	SS400	M6-20MM
~~4~~	~~46~~	~~A9N26929~~	~~AUXILIARY SWITCH (DC)~~	~~ASSY~~	~~MAKE: MORSMITT~~
3	3	DPna VigiA-9034620	MCB	ASSY	
2	4	5SU1154-7KK06	MCB	ASSY	MAKE: SIEMENS
1	1		PANEL	SPCC	t=2.3
40	2	~~IC60N~~ GR/CR SERIES/ IC60N SERIES	MCB 10A, 3P, K CURVE WITH AUXILIARY CONTACT	ASSY	MAKE: MORSSMITT/ SCHNEIDER
39	3	CH16	SWITCH	ASSY	MAKE: K&N
38	1	704.032.518(3A1B,green)	PUSH BUTTON	ASSY	MAKE: EAO
37	3	LC1DT256FD S207	MAGNETIC CONTACTOR	ASSY	MAKE: SCHNEIDER
36	1		BRACKET HANGER	SPCC	t=2.3
35	1	LADN406 ~~LA1DZ40~~	AUXILIAY CONTACT BLOCK	ASSY	MAKE: SCHNEIDER
34	2	BK400115 EGSVF1	RELAY	ASSY	MAKE: MORSMITT
33	4		LED LIGHT	ASSY	LIGHT SUPPIER SCOPE SEE NOTE.9
32	2	4656 N	FAN	ASSY	MAKE: EPM PAPST SEE NOTE.8
31	1		PROTECTION COVER	ACRYL	t=3
30	2	PMF 100444	PROTECTIVE VENT	ASSY	
29	3	~~C120H~~ CR SERIES / C120H SERIES	MCB,80A,3P,K CURVE WITH AUX CONTACT	ASSY	MAKE: MORSSMITT/ SCHNEIDER

NOTE:

1. PAINTING SPECIFICATION & PROCESS SHALL BE AS PER THE APPROVED PAINTING SPECIFICATION PROVIDED BY BEML.
2. ALL SHARP EDGES TO BE SMOOTHENED AND GROMMETS TO BE PROVIDED AT EDGES IN THE PANEL. ALL THE CABLES ARE TO BE PROPERLY SECURED WITH PROTECTIVE SLEEVES.
3. THE SPECIFICATION, QUANTITY AND LOCATION etc., OF COMPONENTS SUCH AS RELAYS, CONTACTORS, MCB, TB's etc., PROVIDED IN THE BOM OF THE DRAWINGS WILL UNDERGO SOME CHANGE DURING FINAL DESIGN FREEZE / PROTO TRAIN & DESIGN DOCUMENT BY DMRC. THE SUBCONTRACTOR SHALL ABSORB THOSE DESIGN CHANGES WITHOUT ANY ADDITIONAL COST TO BEML.
4. MATING PART OF HARTING CONNECTOR, CODE PINS & HOODS TO BE SUPPLIED BY THE VENDOR.
5. THE CABLE MARKERS PROVIDED SHALL BE FIRE RETARDANT & HEAT SHRINKABLE TYPE.
6. THE CABLE MARKERS SHALL BE PROTECTED AGAINST FADING BY PROVIDING FIRE RETARDANT HEAT SHRINKABLE CLEAR SLEEVES.
7. ALL 1.5SQ.MM, 6SQ.MM & 16SQ.MM CABLE SHOULD BE PROPERLY CRIMPED WITH FERRULES TB's.
8. AIR TURBULATOR(AC AXIAL COMPACT FAN) SHALL BE PROVIDED INN EDB PANEL TO ACHEIVE UNIFORM COOLING. LOCATION FOR INSTALLATION SHALL BE DECIDED ACCORDINGLY.
9. LED LIGHTS TO BE PLACED PROPERLY IN SUCH A WAY THAT ALL COMPONENTS ARE ILLUMINATED.
10. ALL ITEMS, CABLE ACCESSORIES USED IN PANELS SHALL CONFORM TO EN45545, HL3.
11. THE GOLD PIN CONTACT TO BE PROVIDED FOR ALL SHIELD CABLES(CORE+SHEILD).
12. PART NO & QUANTITY WILL BE FINALISED DURING DESIGN STAGE WITHOUT ADDITIONAL COST TO BEML

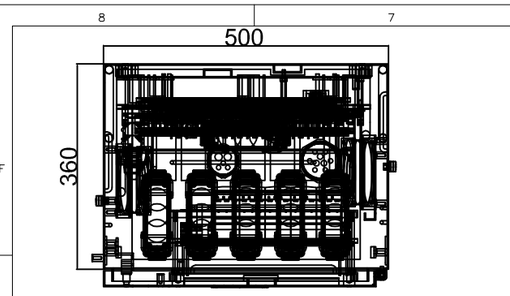
ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD
1	BOM UPDATED & REVISED	31.12.2019	V.SARANYA	V.SARANYA	V.SYLAJA

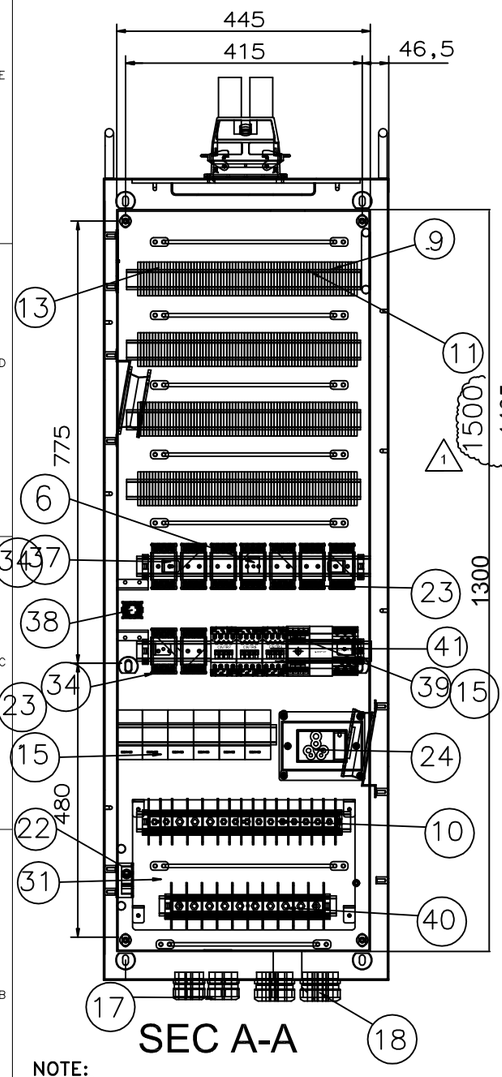
PRODUCT	MUMBAI METRO CARS L2 & L7		
REF DRG			
MATERIAL			
HEAT TREAT.		APPD	V.SYLAJA 25.11.2019
SURFACE TREAT.		REVD	PRASHANT KUMAR 25.11.2019
TITLE	EDB PANEL (TC CAR)	CHKD	V.SARANYA 25.11.2019
		DRWN	V.SARANYA 25.11.2019
SCALE	NTS	SHEET	1 OF 1
Wt.(Kg)	-		
DRG No.	525-21096	ALT	1

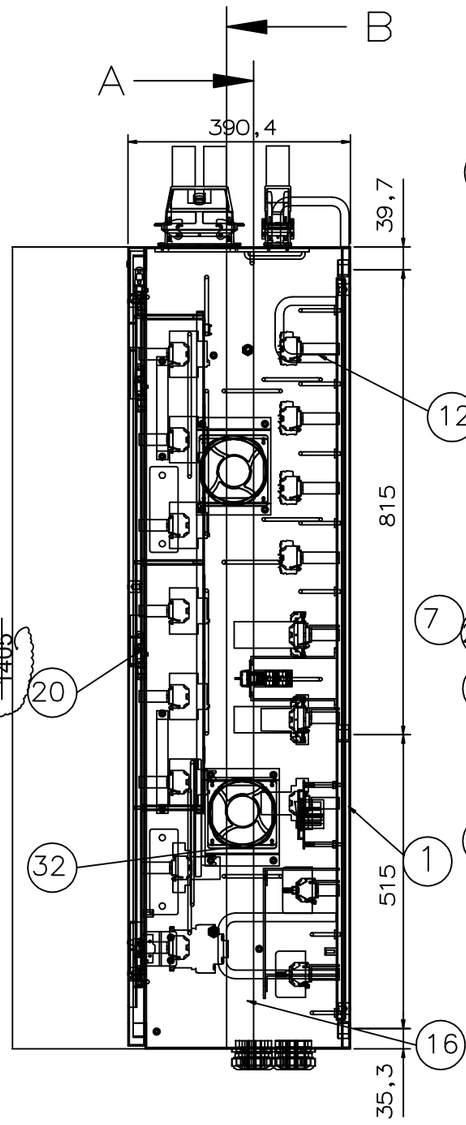
BEML LIMITED

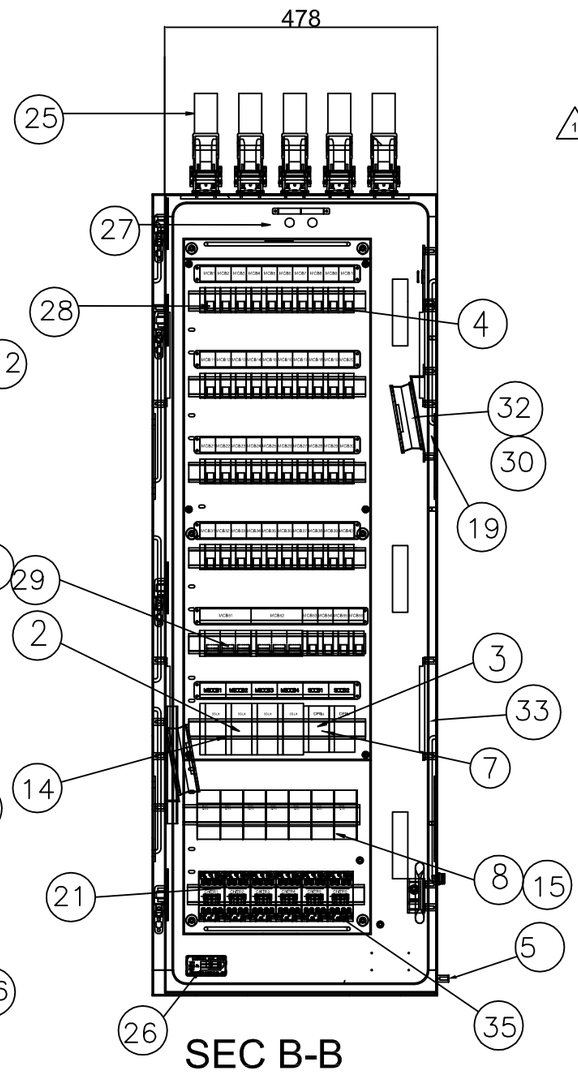
GRADE No.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
VALUE	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
SYMBOL												

SURFACE ROUGHNESS









NOTE:

1. PAINTING SPECIFICATION & PROCESS SHALL BE AS PER THE APPROVED PAINTING SPECIFICATION PROVIDED BY BEML
2. ALL SHARP EDGES TO BE SMOOTHENED AND GROMMETS TO BE PROVIDED AT EDGES IN THE PANEL. ALL THE CABLES ARE TO BE PROPERLY SECURED WITH PROTECTIVE SLEEVES.
3. THE SPECIFICATION, QUANTITY AND LOCATION etc., OF COMPONENTS SUCH AS RELAYS, CONTACTORS, MCB, TB's etc., PROVIDED IN THE BOM OF THE DRAWINGS WILL UNDERGO SOME CHANGE DURING FINAL DESIGN FREEZE / PROTO TRAIN & DESIGN DOCUMENT BY DMRC. THE SUBCONTRACTOR SHALL ABSORB THOSE DESIGN CHANGES WITHOUT ANY ADDITIONAL COST TO BEML.
4. MATING PART OF HARTING CONNECTOR, CODE PINS & HOODS TO BE SUPPLIED BY THE VENDOR.
5. THE CABLE MARKERS PROVIDED SHALL BE FIRE RETARDANT & HEAT SHRINKABLE TYPE.
6. THE CABLE MARKERS SHALL BE PROTECTED AGAINST FADING BY PROVIDING FIRE RETARDANT HEAT SHRINKABLE CLEAR SLEEVES.
7. ALL 1.5SQ.MM, 6SQ.MM & 16SQ.MM CABLE SHOULD BE PROPERLY CRIMPED WITH FERRULES TB's.
8. AIR TURBULATOR(AC AXIAL COMPACT FAN) SHALL BE PROVIDED INN EDB PANEL TO ACHEIVE UNIFORM COOLING. LOCATION FOR INSTALLATION SHALL BE DECIDED ACCORDINGLY.
9. LED LIGHTS TO BE PLACED PROPERLY IN SUCH A WAY THAT ALL COMPONENTS ARE ILLUMINATED.
10. ALL ITEMS, CABLE ACCESSORIES USED IN PANELS SHALL CONFORM TO EN45545, HL3.
11. THE GOLD PIN CONTACT TO BE PROVIDED FOR ALL SHIELD CABLES(CORE+SHEILD).
12. PART NO & QUANTITY WILL BE FINALISED DURING DESIGN STAGE WITHOUT ADDITIONAL COST TO BEML

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~

FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227

UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM) | QUALITY OF WELD JOINTS REF, RD 230 MEDIUM

VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.

WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96 | STATUS:

SL NO.	QTY	PART NO.	DESCRIPTION	MATERIAL	REMARKS
30	2	PMF 100444	PROTECTIVE VENT	ASSY	
29	3	CR SERIES/C120H	MCB , 80A, 3P K CURVE WITH AUXILIARY CONTACT	ASSY	MAKE: MORSSMITT/ SCHNEIDER
28	3	CR SERIES/ GR SERIES/ C60H SERIES SEE NOTE NO:12	C60H 1P 20A	ASSY	MAKE: MORSSMITT / SCHNEIDER
	3		C60H 1P 40A ~~C60H 1P 50A~~		
	4		C60H 1P 2A		
	5		C60H 1P 6A		
	(27 ~~28~~)		C60H 1P 10A		
			1P, 110VDC OPEARTED, C CURVE, 10KA WITH AUX CONTACT		
27	2	17-41130DC(GREEN&RED)	INDICATOR	ASSY	MAKE: EAO, DIA:16MM
26	1		COMPANY NAME PLATE	SUS304	0.6T
25	7	HAN 108 DD	CONNECTOR	ASSY	MAKE: HARTING
24	1	W26004,W26424,W26403A	SOCKET OUTLET	ASSY	
23	(13 ~~8~~)	EA103BF EG	RELAY SOCKET	ASSY	MAKE: MORSSMITT
22	1	KH-9015-PBL	LIMIT SWITCH	ASSY	
21	5	LC1D256FD S207 ~~LC1-D256FD~~	MAGNETIC CONTACTOR	ASSY	MAKE: SCHNEIDER
20	4	96-MA-80-24	HINGE	ASSY	
19	3	AB-2401-2	LOCKING DEVICE	ASSY	
18	2		CABLE GLAND	ASSY	M63
17	2		CABLE GLAND	ASSY	M50
16	1		BOX	SPCC	t=2.3
15	15	V23	RELAY SOCKET	ASSY	MAKE: MORSSMITT
14	5	5ST3 010(5SU1 2P 6A)	MCB AUX	ASSY	MAKE: SIEMENS
13	4	2002-1301(74P)	TERMINAL BLOCK(TB1-TB4)	ASSY	MAKE: WAGO
12	2		HANDLE	SS400	PI 15 200X120
11	20	2002-880	DIODE	ASSY	MAKE: WAGO
10	1	HV-M6(12P)+HV-M8(3P)	TERMINAL BLOCK, TB5	ASSY	MAKE: PHOENIX
9	1	2002-880(RESISTOR(5P))	TERMINAL BLOCK	ASSY	MAKE: WAGO
8	14	D-U204-LK	RELAY	ASSY	MAKE: MORSSMITT
7	(3 ~~6~~)	A9A26929	AUXILIARY SWITCH (AC)	ASSY	MAKE: SCHNEIDER
6	(8 ~~3~~)	B400	RELAY	ASSY	MAKE: MORSSMITT
5	5		EARTH PAD	SS400	M6-20MM
~~4~~	~~43~~	~~A9N26929~~	~~AUXILIARY SWITCH (DC)~~	~~ASSY~~	~~MAKE: SCHNEIDER~~
3	3	DPna VigiA-9034620	MCB, 20A	ASSY	MAKE: SCHNEIDER
2	5	5SU1154-7KK06	MCB 6A, 10mA	ASSY	MAKE: SIEMENS
1	1		PANEL	SPCC	t=2.3
44	4	CR+BRB SERIES	MCB + REMOTE BREAKER, 1P, 10A, C CURVE, 10KA WITH AUXILIARY CONTACT	ASSY	MAKE: MORSSMITT
43	1	CH16	SWITCH	ASSY	MAKE: K&N
42	1	704.032.518(3A1B green)	PUSH BUTTON	ASSY	MAKE: EAO
41	4	LC1DT256FD S207	MAGNETIC CONTACTOR	ASSY	MAKE: SCHNEIDER
40	1	HV-M8(10P)	TERMINAL BLOCK, TB6	ASSY	MAKE: PHOENIX
39	1	(MONITORING) ACD-U204 /MTDV-U204	RELAY BATTERY VOLTAGE	ASSY	MAKE: MORSSMITT
38	1	704 101.0+(704-900.5)X2	DISTRIBUTION BOARD SWITCH	ASSY	
~~37~~	~~3~~	~~BK400 115 EG SV F~~	~~RELAY~~	~~ASSY~~	~~MAKE: MORSSMITT~~
36	1		BRACKET HANGER	SPCC	t=2.3
35	1	LADN406 ~~LA1DZ40~~	AUXILIAY CONTACT BLOCK	ASSY	MAKE: SCHNEIDER
34	5	BK400 115 EG SV F1	RELAY	ASSY	MAKE: MORSSMITT
33	4		LED LIGHT	ASSY	LIGHT SUPPLIER SCOPE SEE NOTE 9
32	2	4656 N	FAN	ASSY	MAKE: EBM PAPST SEE NOTE 8
31	1		PROTECTION COVER	ACRYL	t=3

ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD
1	BOM UPDATED & REVISED	31.12.2019	V.SARANYA	V.SARANYA	V.SYLAJA

PRODUCT: MUMBAI METRO CARS L2 & L7
REF DRG:
MATERIAL:
HEAT TREAT.:
SURFACE TREAT.:
TITLE: EDB PANEL (MC CAR)

APPD	V.SYLAJA	25.11.2019
REVD	PRASHANT KUMAR	25.11.2019
CHKD	V.SARANYA	25.11.2019
DRWN	V.SARANYA	25.11.2019

SCALE: NTS | SHEET: 1 OF 1 | Wt.(Kg): -

BEML LIMITED

DRG No. 525-21097 ALT 1

A2

GRADE No.	N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1
VALUE	50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025
SYMBOL												

SURFACE ROUGHNESS

Date: Proforma No: MRS1/BEML/V.NNO/CAT- __ /_____ /M/ _____

CHECKSHEET FOR
SUBMISSION OF DOCUMENTS FOR
NOTICE OF NO OBJECTION FOR SUB-CONTRACTOR/VENDOR FROM DMRC

ITEMS:

Category	**A**	Items manufactured outside India and proposed to be used in all MRS1 trains.	☐
	B	Items manufactured outside India and proposed to be used in all MRS1 trains but likely to be localised after some part quantity from OEM (shall be declared by BEML).	☐ Equivalent Localisation Quantity : __ Trainsets
	C	Locally manufactured items proposed to be used in all MRS1 trains.	☐

1	**Proforma for Submission of documents**		☐ YES ☐ NO
2	**Vendor Details**	Annexure-I	☐ YES ☐ NO
3	**Sub-Vendor Detail**	Annexure-I	☐ YES ☐ NO
4	**Certificate from BEML**	Annexure-II	☐ YES ☐ NO
5	**Copy of technical purchase specification of BEML**		☐ YES ☐ NO
6	**Inspection and Test Plan**		☐ YES ☐ NO

Note:	**1**	Incomplete documents will not be reviewed by DMRC.
	2	Items used in DMRC's existing rolling stock do not automatically qualify for use unless specifically approved by DMRC for this project.

(BEML Limited) **_____ (Proposed Vendor)**

Date: Proforma No: MRS1/BEML/V.NNO/CAT- __ /_____ /P1/ _____

PROFORMA FOR SUBMISSION OF DOCUMENTS FOR NOTICE OF NO OBJECTION FOR SUB-CONTRACTOR/VENDOR FROM DMRC

1	**Item description**	
2	**Vendor particulars alongwith proposed manufacturing unit submitted in Annexure-I**	☐ YES ☐ NO
3	**Technical Specifiaction & Inspection Plan**	—
3.1	Enclosed copy of Technical Purchase Specification of BEML	☐ YES ☐ NO

4 Details of experience/ satisfactory performance to establish compliance with ERTS 3.2.2.

The Information shall be submitted in following format:

S.No.		Mass Rapid Transit System where proposed sub-system/equipment/component has been used	Country	Quantity Used	Period in satisfactory Revenue Service [from/to] (Min 3 yrs in each MRTS)	Manufacturing Unit
		1	2	3	4	5
1	1					
	2					
	3					
2	1					
	2					
	3					
3	1					
	2					
	3					
4	1					
	2					
	3					

4.1	Based on above, is the proposed item compliant with ERTS 3.2.2	☐ YES ☐ NO
4.2	Is the proposed manufacturing unit compliant with ERTS 3.2.2	☐ YES ☐ NO
4.3	Confirmation that the subsystems used in MRS1, as proposed herein, shall have NO CHANGE in source, manufacturing unit, components, specification, material etc. from those approved unless got specifically approved from DMRC.	☐ CONFIRMED ☐ NOT CONFIRMED
4.4	Information submitted herein as above is certified as correct, strictly in accordance with the MRS1 contract conditions and has been verified by BEML. In case any information is found to be factually incorrect or at variance with contract conditions at any stage, BEML commits to replace the concerned 'sub-system' in complete fleet as per the instructions of engineer, which shall be final and binding. In such case, BEML shall not be eligible either for seeking any claim whatsoever or for seeking extension of contract delivery period.	☐ CONFIRMED ☐ NOT CONFIRMED
4.5	Confirmation that DMRC may depute a team of Engineers (around six) at Sub-contractor/vendor's office for requisite duration with a view to expedite finalization of designs in accordance with contract 'MRS1' conditions ERGS 5.11.3.	☐ CONFIRMED ☐ NOT CONFIRMED
5	Notwithstanding the vendor approval communicated by DMRC on the proposal of BEML, reponsibility for manufacture, testing, supply, commissioning and quality control shall continue to rest solely with BEML and BEML will be solely responsible for meeting all contracual requirments.	☐ CONFIRMED ☐ NOT CONFIRMED

(BEML Limited) **_____ (Proposed Vendor)**

6	**Category B - Sourcing from facilities in India after supply of agreed quantity from approved manufacturing unit.**	
6.1	In case OEM wants to use manufacturing facilities in India (other than his own) for items for which the OEM has been approved, it shall enter into an agreement with such selected Indian equipment manufacturer and obtain prior approval from DMRC. No change in composition, rating, type, model no., manufacturing process, quality standards, design, etc. and make of the components used in assemblies/sub-assemblies of such equipment as manufactured by the approved parent vendor shall be made without specific prior approval of the Engineer.	
6.2	In case the vendor uses his own facilities for indigenization after part supply of equipment from the approved manufacturing unit, no change in design, component type/make, quality standards, manufacture procedure, sourcing of materials etc. shall be made without specific prior approval of the Engineer.	
6.3	In case OEM wishes to change/make/type specifications, etc. of any sub-components for supplies to be sourced from Indian facility, specific prior approval of the Engineer shall be obtained for changes made, model, specification, etc. Responsibility for obtaining such prior approval shall rest solely with the contractor.	
6.4	In case of local manufacturing of carbody or any other item(s) manufactured by BEML/OEM and used in initial trains, BEML shall be exclusively responsible for all quality assurance and inspection and their implementation and also ensure provision of physical partition as per the ERGS 1.1.7	
7	**Category C- Locally Manufactured Items**	
7.1	Does the manufacturing unit satisfy ERTS 3.2.2	☐ YES ☐ NO
7.2	If not, basis/justification for proposal to be submitted for DMRC review	☐ YES ☐ NO
8	**BEML confirms that in terms of ERTS 3.2.2, they would seek Notice of No Objection for Sub-Contractor/Vendor from DMRC notwithstanding the item(s) being used in DMRC's existing rolling stock.**	☐ YES ☐ NO
9	**BEML shall submit Certificate as per enclosed Annexure-II confirming:**	
9.1	Compliance with Clause 6.6 of ERGS and GCC Clause 5.8 regarding supply of software tools/documents/materials etc.	
9.2	Compliance with Clause 8.12 of ERGS regarding supply of all drawings, specifications, patterns etc. in case the manufacture of these items is discontinued by the proposed vendor.	
10	**Commitment from the vendor that in case of any future procurement action by DMRC, he shall quote directly to DMRC.**	
11	**BEML commits that the vendor shall be complying with all relevant contract clauses.**	

(BEML Limited) **_____ (Proposed Vendor)**

Date: Proforma No: MRS1/BEML/V.NNO/CAT- __ /_____ /A1/ ___

Annexure-I

SUB-Contractor/VENDOR/SUB-SUPPLIER DETAILS

1	Vendor/Sub-supplier OEM Name	
2	Details of item proposed to be sourced	
3	Sourcing by:	(a) BEML ☐
		(b) Proposed Main vendor ☐
4	Marketing Office/Head Office	
4.1	Complete address (including website)	
4.2	Contact person details in Head Office	
●	Name	
●	Designation	
●	Telephone	
●	Fax	
●	Mobile	
●	Email	
5	Details of proposed compliant plant/manufacturing unit from where item is proposed to be sourced	
5.1	Complete address (including website)	
5.2	Contact person details	
●	Name	
●	Designation	
●	Telephone	
●	Fax	
●	Mobile	
●	Email	
5.3	Supply details of the manufacturing unit for the proposed item or item with similar design.	
5.4	It is confirmed that the proposed manufacturing unit and the vendor are fully compliant with ERTS 3.2.2	
5.5	We commit that in case of any future procurement action by DMRC, the proposed vendor shall quote directly to DMRC without any involvement of BEML.	
5.6	We have carefully gone through all relevant clauses of the MRS1 Contract and shall fully abide by the contract conditions and decisions communicated by DMRC during contract execution without exception.	

(BEML Limited) _____ (Proposed Vendor)

Date: Proforma No: MRS1/BEML/V.NNO/CAT- __ /_____ /A2/ _____

Annexure-II

Certificate for compliance with Contract conditions regarding Software requirements.

This is certified that in the contract between BEML and _____ (proposed vendor) for supply of _____, specific conditions for confirming total compliance with the following contract condition/clauses have been included and agreed to between BEML and _____(proposed vendor):

(a)	**Clause 6.6 of ERGS and GCC 5.8**
	It is certified that we shall provide full access of application software(s) and any other software /hardware tools to DMRC which they may specifically require for the intended purpose specified in this specification. For all commercial software BEML shall provide all available documentation for the application and maintenance of that software. Complete documentation along with the software to be supplied by BEML and its Vendor(s) shall comprise of Signal flow diagram, flow charts, functional blocks, details of signals, interpretations so as to enable engineer to debug and implement vehicle/train level modifications based on DMRC's experience, operational & maintenance requirements. Full access to the application software to DMRC shall be provided for this purpose. It shall be possible for DMRC to modify/change various parameters/logics used in the software and implement the changes on trains. Full facilities including any software/hardware tools, simulation/test bench which are essential for this purpose shal be supplied. It is committed to supply the software/hardware etc. within the scope specified in respective clauses of ERTS relevant for the proposed item/vendor and we would be fully complying with GCC 5.8
(b)	**Clause 8.12 of ERGS:**
	It is certified that _____ (proposed vendor) will supply all drawings, specifications, patterns and any other information required by DMRC for arranging such items in case the manufacture of these items is discontinued within 10 years by the proposed vender.

(BEML Limited) _____ (Proposed Vendor)

LIST OF SPARES OF ELECTRICAL PANELS FOR MUMBAI METRO MRS1 LINE 2 & 7 [AS PER COST CENTER. G]

Annexure-2 OF PTS

I. Appendix GA1: Unit Exchange Spares:				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
1	All Electrical monitoring, control and protection panels/cubicles comprising of relays, MCBs	Trainset	4	

II. Appendix GA2: Mandatory Spares:				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
1	Set of all relays for 3 car unit of MAKE A, B….. (Tenderer to specify)	Set	4	
2	Set of all contactors for 3 car unit of MAKE A, B….. (Tenderer to specify)	Set	4	
3	Set of all MCBs for 3 car unit of MAKE A, B….. (Tenderer to specify)	Set	4	
4	Set of all connectors with pins for 3 car unit of MAKE A, B….. (Tenderer to specify)	Set	4	

III. Appendix GA3: Recommended Spares:				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
	NIL			

IV. Appendix GA4: Consumable Spares:				
(A) Mandatory Consumable Spares For 378 Cars (63 Trainsets Of 6 -Car)				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
	NIL			
(B) Recommended Consumable Spares For 378 Cars (63 Trainsets Of 6 -Car)				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
	NIL			

V. Appendix GA5: Special Tools, Jig, Fixtures, Gauges, Testing and Diagnostic Equipment:				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
	NIL			

VI. Appendix GA6: Overhauling Spares:				
(A) Mandatory Intermediate Overhauling Spares For 5 Trainsets Of 6 - Car Configuration:				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
1	NIL			
(B) Recommended Intermediate Overhauling Spares For 5 Trainsets Of 6 -Car Configuration:				
S. No.	**Description**	**Unit***	**Qty**	**Remarks**
	NIL			

Note:

1. *Wherever the Unit is mentioned as 'set' means as used in ' 3-car unit'; 'Trainset' means as used in '6-car trainset'.

2. For Milestone G4: In case of increase/decrease of quantities of ordered train sets on account of exercising of option by the Employer, the declared quantity by the Bidder of consumables required under this Milestone will be increased/decreased on pro-rata basis. There shall be no change in the unit cost of consumables quoted by the Bidder.

3. Employer at his sole discretion may exercise the option to increase/decrease the quantities (to any extent) of spares indicated under milestones G1, G2, G3,G4, G5 and G6. For increased quantities, payment to the contractor shall be on the basis of actual supplies made and quoted unit rates and no escalation or any other additional sums shall be payable. Any decrease in quantities, if considered by the Employer, shall be intimated by Employer within two years of the commencement date. However increase in quantities may be intimated at any time during the execution of Contract and the delivery period for the enhanced quantities only shall be mutually agreed.

ANNEURE-3 OF PTS

	TECHNICAL OFFER SUBMITTALS CHECK SHEET	**Project MRS1**
Aggregate :	**Electrical Panels**	**PTS DOC No.: GR/TD/4504**
BEML Enquiry/ RFQ Reference :		

SL.NO.	DETAILS	SUBMITTED	NOT SUBMITTED	DOC. REF
1	Complete Technical Offer for Electrical Panels indicating the make of the components and other Technical details	☐	☐	
2	Supporting documents for qualification criteria as per Clause 6.2	☐	☐	
3	Duly filled and signed (along with company seal) Vendor approval Documents including QAP, ITP, company profile with infrastructure facilities, product range etc., as per Clause 6.3 and Annexure-1 (refer Clause 10)	☐	☐	
4	Clause-wise comments against the PTS (refer Clause 10)	☐	☐	
5	Clause-wise comments to ERTS & ERGS (refer Clause 10)	☐	☐	
6	Spares technical offer as per Annexure-2 (refer Clause 7.8 & 8.7)	☐	☐	
7	Training Technical offer (refer Clause 7.10)	☐	☐	
8	Project Management Plan and CV's of personnel of the team(refer Clause 8.4)	☐	☐	
9	DLP spares list (refer Clause 8.7.9)	☐	☐	
10	Compliance to list of deliverables as per ERTS 12.13	☐	☐	

Note : Incomplete submissions are liable for Rejection.

Signature of the Bidder with Seal