

Bid invitation

Information

Description: Supply of Lighting System- CMRL Project
Bid invitation number: 6300039573

Bid invitation rules

Bid invitation currency: INR

Other permitted currencies: JPY, EUR

Timezone: UTC+53

Submission period: 10.06.2025 14:00:00

Tech Opening date: 10.06.2025 14:30:00

Created On: 31.05.2025 05:32:42

Bid invitation text:

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

Please find attached tender documents in C-folder of SRM portal

Attachments:

PTS-ANN-6

PTS-LIGHTS

PTS-ANN-1

PTS-ANN-2

PTS-ANN-3

PTS-ANN-4

PTS-ANN-5

NIT_TENDER

PTS-ANN-7

PTS-ANN-8

ANNEXURE-A

Bid invitation details

Item	Product	Description	Vendor product	Delivery date/	Quantity
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Bid invitation

Information

Description: Supply of Lighting System- CMRL Project
 Bid invitation number: 6300039573

Item	Product Price Condition Price Condition	Description	Vendor product number number	Delivery date/ performance period performance period	Quantity
1	5242100007	KIT OF LIGHTING SYSTEM - DM CAR		31.12.2025 00:00:00	140.000 SET
Item long text: KIT OF LIGHTING SYSTEM - DM CAR CONFIRMING TO PTS DOC NO. GR/TD/7054 LAT EST REVISION ((Head and Tail/Marker Light Excluded)					
	Basic Price		INR		
2	5242100008	KIT OF LIGHTING SYSTEM - T CAR		31.12.2025 00:00:00	70.000 SET
Item long text: KIT OF LIGHTING SYSTEM - T CAR CONFIRMING TO PTS DOC NO. GR/TD/7054 LATEST REVISION					
	Basic Price		INR		
3		Design and Submission of design Document		31.12.2025 00:00:00	1 AU
Item long text: Design and Submission of design Documents for Lighting System.					
	Basic Price		INR		
4		FAI Reports and Type Test & Report for L		31.12.2025 00:00:00	1 AU
Item long text: FAI Reports and Type Test & Report for Lighting System					
	Basic Price		INR		
5		Deliverables as per ERTS Clause 8.2,8.3.		31.12.2025 00:00:00	1 AU
Item long text: Deliverables as per ERTS Clause 8.2,8.3.1, 8.3.2,8.4.2, 8.4.3,8.4.4, 8.5, 8.6,14.3.1, 14.7.13 for Lighting System.					
	Basic Price		INR		
6		Printed Circuit Boards (PCB) details asp		31.12.2025 00:00:00	1 AU
Item long text: Printed Circuit Boards (PCB) details asper ERTS 19.55 for Lighting System					
	Basic Price		INR		
7		Microprocessor Details as		31.12.2025 00:00:00	1 AU

Bid invitation

Information

Description: Supply of Lighting System- CMRL Project
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Item	Product Price Condition	Description	Vendor product number	Delivery date/ performance period	Quantity
		per ERTS 19.57			
Item long text:					
		Microprocessor Details as per ERTS 19.57 for Lighting System			
	Basic Price		INR		
8	5242100031	Spares as per Annx-A for Lighting system		31.12.2025 00:00:00	1.000 SET
Item long text:					
		Spares as per Annexure-A for Lighting system CONFIRMING TO PTS DOC NO. GR/TD/7054 LATEST REVISION			
	Basic Price		INR		
9	5242100032	Tools for Lighting System		31.12.2025 00:00:00	1.000 SET
Item long text:					
		Tools required for Lighting system CONFIRMING TO PTS DOC NO. <u>GR/TD/7054 LATEST REVISION</u>			
	Basic Price		INR		
10		Training on O&M to the CMRL/BEML on Ligh		31.12.2025 00:00:00	1 AU
Item long text:					
		Training on O&M to the CMRL/BEML on Lighting System			
	Basic Price		INR		
11		Training Manual, System/ Technical Manua		31.12.2025 00:00:00	1 AU
Item long text:					
		Training Manual, System/ Technical Manuals, Software Manuals, Operation Manuals, Maintenance Manuals, Fault Diagnostic & Trouble shooting Manuals & Spares Part Catalogue <u>for Lighting System</u>			
	Basic Price		INR		

BEML LIMITED

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

NOTICE INVITING TENDER

BID INVITATION NO: 6300039573

Dt:31.05.2025

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

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

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

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

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

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

Note: - The tender consists of 56 Nos. of pages including this page.

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3. General Instructions to Bidders:

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

2. Abbreviations used in this NIT

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

3. In case any person/persons, Company, firm, Associations having any litigation, arbitration cases between themselves and BEML Ltd, pending before any court of law/ Arbitrator shall not be eligible to participate in this tender.
4. Non-compliance with any of the tender conditions, incomplete offers, conditional and ambiguous offers are not acceptable and liable for rejection.
5. The bidder shall fill in all the required particulars in the blank space provided for the purpose in the tender document.

6. All the documents shall be uploaded in BEML SRM Portal.
7. Fax/email quotations are not acceptable.
8. BEML reserves the right to accept or reject all tenders or any tender in part or full without assigning any reasons thereto, which is final & binding on the Bidder

4. DETAILS OF THE TENDER

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

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

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

2) Details of Items & Services:

Table-1.1 List of items for Lighting System:

Sl No	Part No	Description	UoM	Qty/ T.Set	Qty for 210 Cars (70 T.Sets)
1	5242100007	KIT OF LIGHTING SYSTEM – DM CAR CONFIRMING TO PTS DOC NO.GR/TD/7054 LATEST REVISION ((Head and Tail/Marker Light Excluded)	SET	2	140
2	5242100008	KIT of Lighting system- T car	SET	1	70

Scope shall also cover the following:

- i. Testing & Commissioning activities for Lighting System for one Train for each of three corridors 3, 4 & 5

Corridor 3 from Madhavaram to Sipcot
 Corridor 4 from Lighthouse to Poonamalle
 Corridor 5 from Madhavaram to Sholingnallur
- ii. Spares and consumables including Service for Defect Notification period (DNP)/ Defect Liability Period (DLP) as per ERTS requirements. Detailed BOM for DNP/DLP Spares and Consumables for warranty period to be provided by the bidder.

Table-1.2: Non-Recurring Cost (NRC)

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

Table-1.3 FAI Reports and Type Test & Report

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

Table-1.4 Deliverables:

Sl No	Part no	Description	UoM	Qty/ Project
1	----	Deliverables as per ERTS Clause 8.2,8.3.1, 8.3.2,8.4.2, 8.4.3,8.4.4, 8.5, 8.6,14.3.1, 14.7.13 for Lighting System.	AU	1
2	----	Printed Circuit Boards (PCB) details as per ERTS 19.55 for Lighting System	AU	1
3	----	Microprocessor Details as per ERTS 19.57 for Lighting System	AU	1

Comprehensive Maintenance Contract (CMC)**Table 2.1: Spares & Tools required for CMC period**

Sl No	Part No	Description	UoM	Qty/ Project
1	5242100031	Spares as per Annexure-A for Lighting System	SET	1
2	5242100032	Tools for Lighting System	SET	1

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

Training & Manuals**Table 3.1: Training**

Sl No	Description	UoM	Qty/ Project
1	Training on O&M to the CMRL/BEML on Lighting System	AU	1

Table 3.2: Manuals

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

Required Delivery Schedule: For Lighting System

Sl No	Part No / Description	Total Qty (Trainsets)	Schedule	No of Train Sets (3 Cars/TS)
1	Equipment with DNP/DLP	70 TS (210 cars)	Apr'26	1
			Jul'26	3
			Nov'26	3
			Feb'27	4
			May'27	4
			Jul'27	3
			Aug'27	3
			Sep'27	4
			OCT'27	3
			Nov'27	4
			Dec'27	3
			Jan'28	3
			Feb'28	3
			Mar'28	3
			Apr'28	3
			May'28	4
			Jun'28	4
			Jul'28	3
			Aug'28	4
			Sep'28	4
			Oct'28	4
3	Non-Recurring activities- Design and Submission of Design Documents	PDR: Jul-25 PFDR: Mar-26 FDR: Jun-26		
4	FAI Reports and Type Test & Report	Jun.26		
5	Deliverables as per ERTS Clause 8.2,8.3.1, 8.3.2,8.4.2, 8.4.3,8.4.4, 8.5, 8.6,14.3.1, 14.7.13 for Lighting System	Apr.26		
	Printed Circuit Boards (PCB) details as per ERTS 19.55 for Lighting System	Mar-26		
	Microprocessor Details as per ERTS 19.57 for Lighting System	Mar-26		
6	Spares for Lighting System	To be supplied as per BEML requirement		
7	Tools for Lighting System	Dec.'26		
8	Training	Jan.'28		
9	Manuals	Jan.'28		

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

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

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

5. SUBMISSIONS OF TECHNICAL BID

<p style="text-align: center;">Technical Bid submission Conditions</p>	<p><u>TECHNICAL BID (Without Price Details)</u> shall be uploaded and submitted in the BEML SRM Portal, wherein only technical Bid /technical information in BEML SRM Portal shall be uploaded as indicated below:</p> <ol style="list-style-type: none"> a. Bidders should upload duly filled, signed & stamped Integrity Pact with two witnesses [Appendix – A]. b. Clause by Clause compliance for the BEML Procurement Technical Specification (PTS): Doc no: PTS Doc No GR/TD/7054 (Latest rev). [Appendix – B] Bidders to refer “PTS” (Annexure-I) enclosed along with this tender document. Bidders should upload the following documents duly filled, signature & stamped under technical bid. Formats as per PTS also to be submitted. c. Bidder to upload enclosures related to technical & other information deemed appropriate in respect of this tender on the letter head of the company, if any. Photographs / Drawings if any, may be uploaded. d. Bidders to refer “GENERAL TERMS AND CONDITIONS (GTC)” (Annexure-II) enclosed along with this tender document and upload clause by clause compliance of GTC duly filled, signature & stamped along with the supporting documents as specified therein. [Appendix – C] e. Bidders to refer “SCOPE OF CMC” (Annexure-IV) enclosed along with this tender document f. Bidders to commit that they will support BEML for requirement of any additional equipment, spares, service required at the later stage ie after 1st year of taking over and up to completion of CMC period. (Appendix- D) g. Bidders to upload duly filled, signature & stamped confidentiality agreement in plain paper [Appendix – E] h. Bidders to upload duly filled, signature & stamped Compliance to Land border sharing Clause – [Appendix – F] i. Bidders to upload duly filled, signature & stamped Compliance to purchase preference under public procurement policy – [Appendix – G] j. Bidders to upload duly filled, signature & stamped Compliance to Contact Details of Supplier/ Bidder – [Appendix – H] k. Bidders to upload duly filled, signature & stamped Compliance to Delivery Schedule – [Appendix – I] <p>BEML at its sole discretion reserves the right to seek the Soft/ Hard copies of the documents which are already been uploaded in SRM Portal, through Courier / post pertaining to technical bid of this tender enquiry at a later date, if required. In such cases, only the documents uploaded in SRM portal in original has to be couriered at the request of BEML. Any irrelevant documents furnished through courier will not be considered.</p> <p>NOTE: Please note Commercial Bid /Price details should not be indicated in TECHNICAL BID, else bid will not be considered for further evaluation.</p>
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6. SUBMISSIONS OF COMMERCIAL BID

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

Table-1. Equipment with DNP/DLP						
Sl. No	Kit Part no	Description	UoM	Total Quantity for 210 Cars (70 T. Sets)	Unit Rate in INR	Total Quantity for 210 Cars (70 T. Sets)
1	5242100007	KIT OF LIGHTING SYSTEM – DM CAR CONFIRMING TO PTS DOC NO.GR/TD/7054 LATEST REVISION ((Head and Tail/Marker Light Excluded)	Set	140	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
2	5242100008	KIT of Lighting system- T car	Set	70	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
3		Design and Submission of design Documents for Lighting System.	AU	1	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
4		FAI Reports and Type Test & Report for Lighting System	AU	1	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
5		Deliverables as per ERTS Clause 8.2,8.3.1, 8.3.2,8.4.2, 8.4.3,8.4.4, 8.5, 8.6,14.3.1, 14.7.13 for Lighting System.	Set	1	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
6		Printed Circuit Boards (PCB) details as per ERTS 19.55 for Lighting System	AU	1	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
7		Microprocessor Details as per ERTS 19.57for Lighting System	AU	1	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
Sub total (Table 1)						
The prices are firm and fixed prices and PVC is not applicable.						

TABLE 2 Comprehensive Maintenance Contract (CMC)						
Sl. No	Part No	Description	UoM	Quantity /Project	Unit Rate in INR	Total Price in INR
1	5242100031	Spares as per Annexure-A for Lighting System	Set	1	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
2	5242100032	Tools for Lighting System	Set	1	Price to be uploaded in commercial bid only	Price to be uploaded in commercial bid only
Sub total (Table 2)						
The prices are firm and fixed prices and PVC is not applicable.						

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

Note:

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

b) **EURO (EUR)**

c) **JAPANESE YEN (JPY)**

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

[ANNEXURE – II]

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

1. GLOSSARY, DEFINITIONS & INTERPRETATIONS

1.

- a) The Purchaser means “(include company name and address)” (A Government of India Undertaking) incorporated under the Companies Act having its registered office at “BEML Soudha, No 23/1, 4th main, S.R. Nagar, Bengaluru – 560027” and shall be deemed to include its successors and assignee.
- b) Supplier’ means a person having been included in a contract as a Contractor and also means a firm or company with whom the order for supply/execution of work is placed and shall be deemed to include the supplier’s successors, (approved by BEML Ltd.,) representatives, heirs, executors and administrators. The supplier may also be referred to as the supplier, Contractor or vendor.
- c) Parties to the Contract’ shall mean the Supplier and the Purchaser as named in the main body of the Purchase Order.
- d) Tender’ means and includes quotation, invitation to tender and all other documents like drawings, specifications, quality plan, etc that form part of the tender document.
- e) Acceptance of Tender’ Means the letter of memorandum communicating supplier, the acceptance of the Tender and includes advance acceptance of this tender.
- f) Purchase Orders (PO) / Contract’ means and includes the invitation to tender, instruction to Tenderers, acceptance of tender, Letter of intent / letter of award, the general terms and conditions of Purchase Order / contract, special conditions of Purchase Order /contract, particulars, descriptions, specifications, schedule of prices, quantities, quality plan, drawings enclosed and other condition specified in the acceptance of tenders and includes the repeat order which has been accepted or acted upon by / for the supplier for the supply of stores and includes an order for performance of service and includes amendments, if any, that may take place subsequent to the discussions, negotiations, mutual agreement if any.
- g) Stores / Materials / Services’ means the goods or services as described in Procurement Technical Specification (P.T.S.) and in the Purchase Order which the supplier has agreed to supply under the Purchase Order.
- h) Specification means technical specifications of the Equipment / Material as set forth in Procurement technical specification (PTS) / technical drawings, which is part of tender. Employer(CMRL) Requirement Technical specification (ERTS) & Employer (CMRL) General Condition of contract(GCC) and Employer Particular condition of Contract (PCC)
- i) End-Customer / End-user means: Chennai Metro Rail Limited (CMRL).
- j) Words in singular include the plural & vice-versa.

- k) Words imparting the masculine gender shall be taken to include the feminine gender and words imparting persons shall include any firm, company or associations or body of individuals whether incorporated or not.
- l) The heading of these conditions shall not affect the interpretations or construction thereof
of the contract.
- m) C.F.R / F.O.B / F.D.D / DAP. is to be interpreted in accordance with the provisions of INCOTERMS 2020, unless otherwise specified in this Tender Document / Purchase order.

2. SUBMISSION OF THE TENDER:

Tender is in TWO-BID system (Technical & Commercial Bid)

Bids should be submitted online mode only as follows:

a) Submission of Technical bid (without price):

- i. The Bidder should upload all the requisite technical documents along with respective supporting documents and other information deemed appropriate in respect of the Tender.
- ii. **The price details/commercial bid details should not be given in the Technical bid.** If any of the bidder have given any price/commercial details in the Technical bid, their offer is liable for rejection and will not be considered for further evaluation.
- iii. Technical Bid will be opened on date and time of bid opening and the commercial Bids of those bidders whose technical bids are qualified (accepted) only will be opened for commercial evaluation.

b) Submission of Commercial bid:

- i. The Commercial Bids of those bidders whose technical bids are qualified (accepted) only will be opened for commercial evaluation.
- ii. Price details in specified field on BEML SRM Portal to be submitted.
- iii. Bidder to quote for all the items /Services.

c) General:

- i. If dealers are submitting the bids in place of OEM, Dealer should submit Authorization letter from OEM.
- ii. BEML reserves right to reject the tender due to unsatisfactory past performance in the execution of a contract at any of BEML projects / units.
- iii. Bidders participating in the tender should declare in their offer that whether they have been black-listed / kept on hold for a specified period / given Business holiday for a specified period by any Public sector undertaking or Government departments. The reasons for such action with details and the current status of such hold shall be furnished to BEML.
- iv. In case any person/persons, Company, firm, Associations having any litigations, arbitration cases between themselves and BEML Ltd, pending before the Court /

Arbitrator or initiated litigations/arbitrations in connection with any contract / tender issued by BEML Ltd and any contractor has defaulted against the BEML's orders, they are not eligible to participate in this tender.

- v. BEML may decide to scrap the tender/refloat the tender without assigning any reasons thereof before LOI/PO is committed. BEML reserves the right to accept, split, divide, negotiate, cancel or reject any tender or reject all tenders at any time prior to the award of the contract without incurring any liability to the affected tenderers or any obligation to inform affected tenderer, the grounds of such action.
- vi. BEML reserves the right to verify, in its sole discretion, any information given by the bidders independently through any third-party agencies. During this process, if it is found that any of the information given by the bidder is false / misleading, offers of such bidders would be out rightly rejected.
- vii. BEML also reserves the right to independently assess the capability and capacity of the bidder for execution of the order/contract. BEML's decision on any matter regarding short listing of bidders shall be final.
- viii. The Tender / Notice Inviting Tender is not an offer or a contract.
- ix. Bidders will not be compensated or reimbursed for the costs incurred in preparing Proposals. Proposals shall become BEML property.
- x. BEML's decision is final for Evaluation of the offers which is also based on Employer's (CMRL) requirement and conditions of contract for ARE02A Project.

3. SUPPLIERS SHARING LAND BORDER WITH INDIA:

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

4. PREFERENCE TO MAKE IN INDIA:

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

5. DELIVERY TERMS:

- a) In case of foreign Supplier: F.O.B (Free on Board) to nearest port basis. The intimation for shipment should be provided 21 days prior to the delivery schedule to our nominated freight forwarder and the consignment to be handed over to our freight forwarder before the cut-off date for sailing.
- b) In case of Domestic Supplier: F.O.R (Free on Road) /F.D.D. (Free Door Delivery), BEML, Bangalore Complex.
- c) For CMC - Supply of Spares & Tools: F.O.R- Designated CMRL depots, Chennai

6. PAYMENT:

I. SUPPLIES (Equipment)

b) APPLICABLE TO THE DOMESTIC BIDDERS

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

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

II. NON-RECURRING (NRC) AND SERVICE ACTIVITIES:

- i. **NRC:** 100% payable on 60th day after completion of NRC activities subject to acceptance by BEML R&D and for MSEs 45 days after completion of NRC activities subject to acceptance by BEML R&D
- ii. **FAI Reports and Type Test & Report:** 100% payable on 60th day after completion of FAI activities and submission of FAI reports and type test reports subject to acceptance by BEML R&D and for MSEs 45 days after completion of FAI activities and submission of FAI reports and type test reports subject to acceptance by BEML R&D
- iii. **Services :** 100% payable on 60th day after completion of service activities subject to acceptance by BEML R&D /Depot T&C/End Customer and for MSEs 45 days after completion of service activities subject to acceptance by BEML R&D /Depot T&C/End Customer

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

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

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

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

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

The payment is further subject to the following:

- a) The Invoice shall be compliant with GST laws.
- b) GST liability is to be discharged and ensure filing of outward supply details on GSTN portal within timeline prescribed.
- c) Any debit note/supplementary invoice if any, is to be raised within September month following the respective financial year of filing of annual return by BEML, which ever is earlier.
- d) Any loss of tax credit due to the reason attributable to supplier shall be recovered from supplier along with applicable interest and penalty.
- e) Bidders to indicate the GST and other levies applicable. GST shall be paid only after confirmation of payment of GST by vendors on GST Website.
- f) Relevant TDS / TCS as applicable shall be deducted as per prevailing Income Tax / GST / GOI notifications
- g) The supplier should submit the following documents for each supply:
 - Tax Invoice; GSTR-1 return filed with authorities with the relevant abstract
 - GSTR-3B return or any other form of return prescribed by the authorities.
 - Copy of Challans regarding deposit of GST
 - Certificate of Chartered Accountant

7. PRICE BID VALIDITY:

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

8. FIRM PRICE FOR SUPPLY, NON-RECURRING SCOPE AND DELIVERABLES:

The prices remain firm for the entire supplies of the purchase order and no escalation shall be entertained under any circumstances. The prices are to be firm & no increase in finalized price will be entertained after awarding contract during the period of Contract for any reasons whatsoever.

9. INSPECTION:

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

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

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

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

The supplier guarantees that the delivery complies with the customary norms and standards in the relevant branch of trade or industry. The supplier shall be responsible for compliance

with applicable technical, safety, quality, environmental requirements and other regulations in relation to his product, packaging, and raw and ancillary materials.

10. WARRANTY:

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

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

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

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

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

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

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

For detailed scope of DLP/DNP, Bidders to refer PTS doc no: GR/TD/7054 Latest revision.

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

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

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

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

d) Extension of DLP:

- i. Train/System/Sub-system level extension of DLP will be applicable in the case where reliability targets defined as per ERTS 18.6 are not met.
- ii. In case of any retrofits/modifications done by the suppliers in any specific system/sub-system/function/component/software shall be subjected to 24 months warranty from the date of completion of retrofit/modification in that train spares. This specific 24-month warranty is irrespective of the train DLP/warranty
- iii. There shall be no delay in start of CMC period of car, However, If the DLP / DNP extension arose on account of non-fulfilment of the Reliability Demonstration targets for subject aggregate for which the tendering is done (as defined in ERTS-RS clause 18.6), then payments against Rolling stock CMC shall be reduced by 65% by CMRL on payment to BEML. The same will be reduced in payment to the supplier on back-to-back basis.

e) Comprehensive Maintenance Contract (CMC):

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

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

f) Guarantee / Warranty replacement:

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

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

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

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

Firm shall submit the following 2 Performance Bank Guarantees:

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

- a) Supplier should submit Performance Bank Guarantee for amount equivalent to 10% of the Contract value for supply of equipment, Non-recurring scope, FAI, Deliverables and service activities which will be valid till issue of taking over certificate for last trainset by end customer (CMRL). The bank guarantee has to be submitted within 60 days from the date release of Purchase order from BEML but

not later than 30 days before commencement of supplies pertaining to first delivery schedule indicated in the purchase order

- b) In case BEML is constrained to extend the Performance Bank Guarantee to its customer (CMRL), due to the failure of aggregates attributable to the supplies made by the supplier or non-fulfilment of NRC and other activities as applicable, then the costs involved to BEML for such PBG extensions shall be borne by the supplier.
- c) Performance Bank Guarantee shall be returned back only after completion of issue of taking over certificate for last trainset by end customer (CMRL) and if there is no defect /failure/negligence/complaints and /or any claims notified to BEML on part of supplier in fulfilling the supplies and activities
- d) If the minor outstanding works as incorporated in the taking over certificate are not attended by the Supplier within the specified time frame, full amount of Performance Security due to the Supplier shall not be released

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

- a) Supplier should submit Performance Bank Guarantee for amount equivalent to 10% of the Contract value for supply of spares & Tools for comprehensive maintenance contract period valid for entire Warranty period for CMC. The bank guarantee has to be submitted within 60 days from the date release of Purchase order from BEML but not later than 30 days before commencement of supplies pertaining Spares & tools indicated in the purchase order
- b) In case BEML is constrained to extend the Performance Bank Guarantee due to the failure of aggregates attributable to the supplies made by the supplier, then the costs involved to BEML for such Performance Bank guarantee/security extensions to its customer (CMRL) shall be borne by the supplier.
- c) General terms of PBG:
 - a) In case of foreign bank guarantees, the BGs from foreign banks, authorized /recognized by RBI to issue a Bank Guarantee, in their own letter head will be accepted. In the case of PBG/s submitted from Indian Bank, the PBG shall be furnished by Scheduled Commercial Banks authorized by RBI to issue a Bank Guarantee.

Format for PBG is attached for reference.

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

- b) In the absence of performance bank guarantee to be submitted by the supplier as per contract terms, BEML will not open Letter of Credit (LC) in the cases of LC in favor of supplier pertaining to the shipment / stores to be supplied as per first delivery schedule indicated in the purchase order. Any delay in submission of performance bank guarantee by the supplier, the subsequent delay in opening in Letter of Credit by BEML and supplies to be effected by the supplier are to the account of the supplier, which attracts liquidated damage charges as per contract terms.
- c) No claim shall lie against BEML Ltd., in respect of interest on cash deposits or Govt. Securities depreciation thereof.

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

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

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

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

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

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

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

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

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

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

- a) BEML reserves the right to increase or decrease the quantity specified in the schedule of requirements without any change in the unit price or other terms and conditions within the agreed delivery schedule
- b) BEML may at its discretion may advice the supplier in writing about the increase of the total quantity up to 10 complete train sets requirement of 3 cars each i.e. 30 cars. and upto additional 50% qty of spares and tools within CMC period.
- c) Supplier shall be required to supply increased ordered quantities at the contracted terms & conditions and determined prices (Excluding design cost, Type test cost, FAI test cost, Training & Manuals cost and Testing & commissioning cost) and no additional amount on account of quantity variation or escalation or any other account whatsoever payable to the supplier
- d) In case of increase in quantity beyond the original bid quantity, the delivery schedule for the increased quantities shall be mutually decided at the time of exercise of quantity variation by the Purchaser

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

13. LIQUIDATED DAMAGES CLAUSE:

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

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

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

14. RISK PURCHASE CLAUSE:

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

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

or

- b. To cancel the purchase order.

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

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

15. SECRECY AND CONFIDENTIALITY:

- a) All the information, know-how, technical data, specification and drawing models or specimens furnished by BEML for the purpose of or in connection with the manufacture and supply of the stores hereby tendered constitute the property of BEML and the supplier shall keep them in strict confidence and he/ she shall not divulge the same to anyone else except under the authority and for the purpose of BEML. All such documents, data, drawing, models and specimens are the property of BEML and shall be returned when done with or when demanded by BEML.
- b) The supplier shall not supply the material ordered by BEML to anyone else other than BEML and shall not disclose any initiations, development or adaptations thereof to anyone.
- c) BEML shall be entitled to prevent a breach of the above and claim damages in case of breach. In case of non-performance in this PO, BEML will have to take procurement action at your risks and cost apart from levy of liquidated damages.
- d) Confidentiality agreement to be executed as per Appendix E.

16. AUTHORITY OF PERSONS SIGNING DOCUMENT:

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

17. ACCEPTANCE OF ORDER:

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

18. OTHER CONDITIONS:

- a) Refer BEML Purchase Manual (can be accessed in BEML website www.bemlindia.in) for Important terms and conditions of tender and General Terms & conditions applicable to contracts & purchase orders refer General Terms & Conditions
- b) The firm shall take necessary permission for their employees to enter the factory premises and the firm shall arrange ESI & PF coverage to their employees / labourers if any from their end. The firm shall indicate ESI NUMBERS for the labourers hired or employed in advance in order to prepare work permit inside the factory.
- c) BEML will not have any kind of binding towards the compensation on case of injury / death to the firms employees while working in BEML premises or other wises.

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

19. PRICE, INVOICING AND PAYMENT:

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

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

- i. Commercial Invoice
- ii. Delivery Challan
- iii. Packing List
- iv. BEML's Inspection clearance document(s), material test certificates and other applicable quality documents pertaining to the supplies.

Postal Address

The Deputy General Manager,
Metro Purchase Department
BEML, Bangalore Complex,
PB No.7501, New Thippasandra post,
Bangalore, Karnataka, India,
Postal Code - 560 075

20. PROGRESS REPORT:

The supplier shall regularly inform the progress of work and in such form as may be called for by the Purchaser from time to time. The submission and acceptance of such reports shall not prejudice the rights of the Purchaser in any manner.

21. QUALITY & WORKMANSHIP:

The stores supplied shall be of the best quality and Workmanship shall be in strict conformity with all the drawings and specifications furnished with the Purchase Orders and shall answer to the description in all respects. All supplies shall be accompanied by supplier's works inspections / test certificates duly certifying, the Stores are in strict conformity with the drawings / specifications. However, final acceptance will be subject to inspection and approval at BEML works. Once the materials are rejected and communicated to the supplier, no request shall be entertained for re-inspection or acceptance of the stores. However, BEML reserves the right to re-inspect the stores and consider acceptance at its discretion.

22. QUALITY, CONDITION OF DELIVERY:

The Supplier shall guarantee that the delivery is of good quality and free from all defects and in the case of services rendered that they are performed by skilled personnel and that new materials are used. The Supplier shall guarantee that the delivery corresponds exactly with the provisions of the agreement, the reasonable expectations of Purchaser regarding the characteristics, quality and reliability of delivery. The Supplier guarantees that the delivery is suitable for the purpose for which it is intended by its very nature or which is evident from the specifications listed and from the order.

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

23. SUPPLY OF SAMPLE: (if applicable)

The Contractor shall produce samples of all materials and shall obtain approval before he places bulk order for the material for incorporation in the works. In respect of materials for which samples are not kept or detailed specifications is not given hereinafter, such materials shall comply with the latest relevant Indian Standard Specifications a published up to the date of issue of this tender. The Contractor shall on demand produce original receipts vouchers/invoices in respects of materials supplied by him.

24. INSPECTION, TESTING & CONSEQUENCE OF REJECTION:

The goods and stores shall be of approved design and each part /component may be inspected and tested by the Purchaser prior to shipment and shall fully comply with relevant requirements of purchaser.

Purchaser has the right to inspect the delivery. In the event of rejection, Purchaser shall inform the Supplier accordingly and Purchaser shall be entitled to replacement or repair at its discretion or may proceed to terminate or annul the agreement. All this does not affect Purchaser's right to compensation.

In case the goods / stores are rejected at the time of inspection at BEML or the rejections are noticed at the time of further processing the supplier will be informed of these rejections. On receipt of this information the supplier shall immediately arrange to collect the rejected items at his cost and risk and arrange for the replacement of goods within the shortest possible time. Under no circumstances the supplier shall compel the Purchaser to rework the rejected goods.

Wherever the supplier has not collected the rejected items within 60 days from the date of intimation, BEML shall have the right to dispose the goods and all cost related to the cost of material, statutory levies incurred both in procurement and disposal shall be recovered from the supplier from any of the bills that are due. The supplier shall have no claims whatsoever against the Purchaser for such disposal.

Purchaser or his authorized representative shall be entitled at all reasonable times during execution to inspect, examine and test at the Supplier's premises the material and workmanship of all stores to be supplied under the Contract, and if the part of the stores are being manufactured at other premises the Supplier shall obtain Purchaser's or his authorized representative's permission to inspect, examine and test as if the said stores are being manufactured at the Supplier's premises. Such inspection, examination and testing, if made shall not release the Supplier from any obligation under the Contract.

All costs related to inspections and re-inspections shall be borne by the Supplier. The cost of inspection staff / third party specified by the Purchaser shall be borne by Purchaser, unless otherwise specifically agreed. Whether the Contract provides for tests on the premises of the Supplier or any of his Sub-contractor/s, Supplier shall be responsible to provide assistance such as, labour, materials, electricity, fuels, stores, apparatus, instruments as may be required and as may be reasonably demanded to carry out such tests efficiently. Cost of any type test or such other special tests shall be borne by the Purchaser only if specifically agreed.

The supplier shall give the authorized representative of the Purchaser reasonable prior notice in writing of the date on and the place at which any stores will be ready for inspection / testing as provided in the Contract.

25. RAW MATERIALS ARRANGEMENT:

The supplier shall make his own arrangement to procure all raw materials required and BEML shall not be responsible for any assistance in such procurement or whatsoever.

26. IDENTIFICATION OF ITEMS / PIECES:

The supplier shall indicate / emboss / engrave, suitable identification marks (Viz. BEML stock number, supplier code number, batch no. etc.,) on each item/piece (or) on all components at convenient non-machinable place as per drawing, wherever applicable.

Also, shall indicate BEML part number, PO No. and date in all delivery documents, invoices and correspondence, wherever applicable.

27. PACKING AND MARKING:

- a) Packing to be in such a way that it should avoid transit/storage/handling damage.
- b) The supplier shall package the deliveries safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by Sea / Air / Rail / Road to its destination suitably protected against loss, damage, corrosion in transit and the effect of tropical salt laden atmosphere. The packages shall be provided with fixtures / hooks and sling marks as may be required for easy and safe handling by mechanical means.
- c) The packing, shipping, storage and processing of the delivery must comply with the prevailing legislation and regulations concerning safety, the environment and working conditions. Items packed with raw / solid wood packing material shall be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitary / Fumigation certificate. If

safety information sheets exist for a delivery or the packaging, the Supplier must always supply these sheets direct (at the same time).

- d) Supplier shall indicate approximate net weight, gross weight and dimension of the package to enable BEML to determine the mode of dispatch. The packing should withstand the weather conditions during transit. The packing should not damage the contents in the package while transporting and handling. The safety and handling precautions should be clearly marked on the packages. The packing should be easily transportable without any damage. Each consignment should have individual packing list.
- e) Marking shall include the following information in sequence on the frame commensurate with the size of package.

**To: M/s. BEML Limited, Bangalore Complex,
New Thippasandra,
Bangalore – 560075,
Karnataka State, India.**

Purchase order number:

Shipper's mark:

Package number:

Identification number:

Caution marks, if applicable:

Net weight, gross weight and cubic measurement, whichever is appropriate for the shipment.

28. APPLICABLE LAWS AND JURISDICTION OF COURTS:

Indian laws both substantive and procedure, for the time being in force including modifications thereto, shall govern Contract. The competent Indian courts of shall have sole jurisdiction over disputes between purchaser and the Supplier.

29. JURISDICTION:

Courts of Bangalore alone shall have jurisdiction to decide any issue / dispute arising out of the Arbitration or this Purchase Order in exclusion of all other Courts. However, jurisdiction of any other court may be accepted by mutual discussion and agreement by and between BEML and the Supplier.

30. ARBITRATION:

Any disputes and differences that may arise between the parties in connection with this Agreement/Contract shall be settled by the parties amicably by way of mutual discussion / negotiation / conciliations. In case parties fail to settle the dispute amicably, then the dispute or difference shall be referred to India International Arbitration Centre for resolution. The Arbitration Tribunal shall consist of Sole / three Arbitrator /s. The Arbitrator /s shall be appointed and Arbitration proceeding shall be conducted in accordance with the provision of India International Arbitration Centre (Conduct of Arbitration) Regulations, 2023.

During Arbitration, “Supplies under this Purchase Order, if reasonably possible, may continue by mutual agreement during the dispute / Arbitration proceedings”

31. INTELLECTUAL PROPERTY RIGHTS; LICENSES:

If any Patent design, trademark or any other intellectual property rights apply to the delivery or accompanying documentation, Purchaser shall be entitled to the legal use thereof free of charge by means of a non-exclusive, worldwide, perpetual license. All intellectual property rights that arise due to the execution of the delivery by the Supplier and by its employees or third parties involved by the Supplier for performance of the agreement belong to Purchaser. The Supplier shall be obligated to do everything necessary to obtain or establish the above-mentioned rights. The Supplier guarantees that the delivery does not infringe on any of the intellectual property rights of third parties. The Supplier shall also be obligated to do everything necessary to obtain or establish the alternate acceptable arrangement pending resolution of any (alleged) claims by third parties.

The Supplier shall defend and indemnify BEML against any claims, costs or expenses incurred by reason of any infringement of alleged infringement of any letters, patent, registered design, trademarks or trade name by the use of sale of the stores / goods /material and against all costs or damages which BEML may undergo in legal action for such infringement or for which the BEML may become liable in any such action.

The supplier shall at all times indemnify BEML and shall take all risk of accidents or damage which causes a failure of the supply. The supplier shall comply with the provisions of Contract Labour (Regulation and Abolition) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules 1971-as modified from time to time wherever applicable and shall also indemnify the Company from and against any claims under the aforesaid Act and the Rules.

32. BRIBES AND GIFTS:

Any bribe, commission, gift or advantage given, promised or offered by or on behalf of the supplier or his partner, agent or servant or anyone on his or their behalf to any officer, servant, representative or agent of BEML or any person on his or their behalf in relation to the obtaining or to the execution of or any other contract with BEML shall in addition to any criminal liability which the supplier may incur, subject the supplier to the cancellation of the PO and all other contracts with BEML and also to payment of any loss or damage resulting from any such cancellation to like extent as is provided in case of cancellation under **Clause-15** hereof. Any question or dispute as to the committing of any offence under the present clause shall be settled by BEML in such manner and on such evidence of information as they may think fit and sufficient and their decision shall be final and conclusive.

33. FORCE MAJEURE CLAUSE:

Notwithstanding anything contained in the Contract, neither the Supplier nor the Purchaser shall be held responsible for total or partial non-execution of any of the contractual obligations, shall the obligation become unreasonably onerous or impossible due to occurrence of a 'Force Majeure' conditions which directly affect the obligations to be performed by the Purchaser or the Supplier. Such events include war, military operations of any nature, blockages, revolutions, insurrections, riots, civil commotions, insurgency, sabotage, acts of public enemy, fires, explosion, epidemics, quarantine restrictions, floods, earthquake, or acts of God, restrictions by Govt. authorities over which the Supplier or the acts on which the Purchaser has no control.

The party claiming to be affected by Force Majeure shall notify the other party in writing without delay, within two weeks on the intervention and on the cessation of such circumstance. Extension of time sought by the Supplier along with supporting evidence and so granted by the Purchaser for the supply / work affected, if any, shall not be construed as waiver in respect of remaining deliveries. In the case of vendor seeking force majeure then it is discretion of BEML to consider the same based on authenticate document.

Notwithstanding above provisions, Purchaser shall reserve the right to cancel the order/ Contract, wholly or partly, in order to meet the overall delivery schedule and make alternative arrangements including arrangements with third party for completion of deliveries and other schedules. Purchase may takeover partly processed material at a mutually agreed price.

34. FALL CLAUSE:

- a) The prices charged for the stores supplied under this P.O by the supplier shall in no event exceed the lowest price at which the supplier sells the stores of identical description to any other BEML Office / Division during the pendency of this PO.
- b) If at any time, during the said period, the supplier reduces the sale price of such stores or sells such stores to any other BEML Office / Division at a price lower than the price chargeable under this P.O and the price payable under this PO for the stores supplied after the date of coming into force of such reduction shall stand correspondingly reduced.

35. NON-DISCLOSURE AND INFORMATION OBLIGATIONS:

The supplier shall provide Purchaser with all information pertaining to the delivery in so far as it could be of importance to Purchaser. The Supplier shall not reveal confidential information to its own employees not involved with the tender / Contract & its execution and delivery or to third parties. The supplier shall not be entitled to use the Purchaser's name in advertisements and other commercial publications without prior written permission from Purchaser.

36. ASSIGNMENT OF RIGHTS AND OBLIGATIONS; SUBCONTRACTING:

The supplier is not permitted to sub-contract the delivery or any part thereof to third parties or to assign the rights and obligations resulting from this agreement in whole or in part to third parties without prior written permission from Purchaser. Any permission or approval given by the Purchaser shall, however, not absolve the supplier of the responsibility of his obligations under the contract.

37. DIVISION OF PATRONAGE:

BEML at its discretion reserves to issue order 100% on L1. BEML reserves the right to avail the price offered for full quantity of the tender or part thereof or ignore the offer completely without assigning any reason whatsoever.

38. INTEGRITY PACT:

The bidder / contractor should upload duly signed & stamped **Integrity Pact** (if the tender value is more than or equal to Rs.1.00 crore) as per prescribed format (**APPENDIX- A**) on plain paper as part of technical bid.

The bidder should put their authorized signature in the Integrity pact as a Contractor / bidder with their company seal along with witness's signature, name & address. **The agreement shall be in full as per format enclosed on a plain A4 size paper duly signed & stamped on all pages.**

The Integrity Pact envisages an agreement between the prospective tenderer and the buyer committing the persons/officials of both the parties not to exercise any corrupt influence on any aspect of the contract.

For the successful bidder, the integrity pact will remain valid up to 12 months after the last payment under the contract, and for all other Bidders 6 months after the contract has been awarded.

The Central Vigilance Commission (CVC) has appointed Shri Kasi Vidyasagar & Shri Lt. Gen. Abhay Krishna as Independent External Monitor (IEM) to oversee the implementation of the Integrity Pact.

Address of IEM is as below:-

Shri Kasi Vidyasagar, IAS (Retd.)

House no. 55,

Dream valley gated community,

Manikonda, Hyderabad – 500089.

Mobile no. +91 9771407778

Email : kasividyasagar@gmail.com

Shri Lt. Gen. Abhay Krishna , (Retd.)

4A-902, Gurjinder Vihar,

AWHO Township, Sector CHI-1

Greater Noida, UP - 201310

Mobile no: +91 9871234353

Email: abhayabk@gmail.com

39. GST TERMS & CONDITIONS:

1. The Supplier is required to comply with all the applicable provisions of the GST Laws/Rules/Notifications/Circulars and to furnish required documents/details within the prescribed time limit to enable BEML to claim the benefits of GST Input Tax Credit or any other benefit.

2. The Supplier is required to furnish proper Invoice/Supplementary Invoice/Debit Note/Credit Note in the form and manner prescribed under GST Laws/Rules/Notifications/Circulars containing all the particulars mentioned therein and within the prescribed time limit as per prevailing GST Laws/Rules/Notifications/Circulars. In case of non-compliance by the Supplier, BEML shall not make any payment towards GST against such invoice until it is complied with within the timeline prescribed under GST Laws/Rules/Notifications/Circulars, and also subject to BEML being in a position to avail GST Input Tax Credit as per applicable GST Laws/Rules/Notifications/Circulars.
3. In case of discrepancy in the data uploaded by the Supplier in the GSTN portal or in case of any shortages or rejection in the supply, BEML will notify the Supplier of the same. Supplier has to rectify the data discrepancy in the GSTN portal or issue Credit note (details to be uploaded in GSTN portal) for the shortages or rejections in the supplies, within the prescribed time limit to enable BEML to avail GST Input Tax Credit.
4. In case, the availment of GST Input Tax Credit by BEML is delayed for any reason other than those attributable to BEML, interest at applicable rate as prescribed under GST Laws/Rules/Notifications/Circulars for such delays shall be recovered from the Supplier.
5. In case Supplier delays declaring such invoice in his GST Return and GST Input Tax Credit availed by BEML is denied or reversed subsequently as per GST Laws/Rules/Notifications/Circulars, GST amount paid by BEML towards such reversal as per GST Laws/Rules/Notifications/Circulars shall be recoverable from Supplier along with applicable interest.

If BEML has not paid/short paid to the Supplier for any invoices within the time limit prescribed under GST Laws/Rules/Notifications/Circulars due to non-compliance of GST Laws/Rules/Notifications/Circulars by Supplier or any other reason attributable to Supplier and leads to any GST Input Tax Credit reversal by BEML, any losses/expenses/cost/penalty, etc., incurred by BEML shall be recoverable from the Supplier.

6. Wherever applicable, BEML will have the right to deduct “Tax Deducted at Source” at the rate prescribed under the GST Laws/Rules/Notifications/Circulars and to remit the same to the Government
7. In case of supplies made under Reverse Charge Mechanism, the Supplier needs to comply with the provisions under the GST Laws/Rules/Notifications/Circulars in terms of supply of Goods/Services and raising of invoice, so as to enable BEML to remit applicable GST to Govt., within the prescribed time limit and avail GST Input Tax Credit on the same. If the Supplier fails to comply with the above and as a result if BEML incurs any losses/expenses/cost/penalty, BEML shall be entitled to recover the same from the Supplier. Further the Supplier has to mention that “the liability of payment of GST amounting to Rs is on the Recipient of Service” in the invoice raised on BEML.
8. The Supplier is required to comply with the E-Way Bill Provisions under GST Laws/Rules/Notifications/Circulars. If the Supplier fails to comply with the said provisions and as a result if BEML incurs any losses/expenses/cost/penalty, BEML shall be entitled to recover the same from the Supplier.

9. In case of materials/goods issued to Supplier for Job Work, the Job Work Supplier is required to return the goods within the time limit prescribed in the Purchase Order. If the Job Work Supplier fails to return the goods as above, BEML will be entitled to raise a GST Supply Invoice on the Job Worker Supplier with applicable interest as per the provisions of GST Laws/Rules/Notifications/Circulars. In such cases, BEML will be entitled to recover all such GST/interest on GST /losses/expenses/cost/penalty, etc. incurred by BEML along with interest from the Job Work Supplier. Further in such cases where the GST invoice has been raised by BEML, on return of such goods after the prescribed time limit, the Job Work Supplier needs to return the same under GST invoice.
10. The Supplier have the option to give one Bank Guarantee of appropriate value after considering his estimated value of GST involved in invoices raised on BEML instead of Bank Guarantee for each Contract/Invoice. In case of payment through LC, suitable provisions/clause will be inserted while opening LC to ensure compliances of above conditions. However, if at any point of time value of such Bank Guarantee falls short of GST plus interest thereof, Supplier will have to either furnish Bank Guarantee for Differential value or such shortfall value of Bank Guarantee vis-à-vis GST plus interest thereof shall be withheld till Suppliers fulfils its obligations specified under above clauses.

BEML will be entitled to recover all losses/expenses/cost/penalty, etc. incurred by BEML along with applicable interest from the Supplier due to reasons other than those attributable to BEML.

11. If the Supplier is a Composition/Unregistered Dealer, the Supplier needs to comply with the provisions under the GST Laws/Rules/Notifications/Circulars in terms of supply of Goods/Service and raising of invoice. In case, the Supplier fails to comply with the above and as a result if BEML incurs any losses/expenses/cost/penalty, BEML shall be entitled to recover the same from the Supplier along with applicable interest.

40. TAX CLAUSE:

Any tax and/or duty, which may hereafter be imposed outside India, shall be on Supplier's account. **On the other hand, any tax and/or duty, which may hereafter be imposed in India, shall be on BEML's account.** Notwithstanding the foregoing, tax on supervising fee and/or other training fees shall be on Supplier's account, however, it shall be withheld and paid by BEML in India on behalf of Supplier according to provisions of the corporation tax law, the local inhabitant tax law and convention between Republic of India and the respective Suppliers country, for the avoidance of double taxation and the prevention of fiscal evasion with respect to taxes on income.

Where the government of the supplier's country exempts goods in export from any or all of such taxes, levies, duties on imports, the supplier shall charge the purchase price, which are exclusive of and free from such taxes, levies, and duties on imports.

Any downward revision in taxes or duties imposed in supplier's country should be informed and that benefit should be passed on to the BEML.

Any increase in statutory levies during the period wherein supplier has defaulted to effect supplies as per delivery schedule indicated in contract has to be borne by the supplier.

HSN CODE/CHAPTER ID and SAC Code details are to be indicated against each item.

TDS (Tax deducted at source) will be applicable for service purchase orders and will be deducted as per law of land. SAC (Service Account code) shall be indicated for the services /NRC that will be carried out by the supplier.

41. PROJECT IMPORT REGISTRATION:

Customs duty on input content imported by domestic bidders to manufacture tendered items.

Chennai Metro Rail Project is eligible for the concessional rate of custom Duty under chapter 98.01 of Custom Tariff Act for Project Import registration mode. In case if an indigenous supplier imports some items from outside India, the firm has to register with customs for availing concessional rate of duty i.e. 7.5% BCD plus cess, through project import registration mode.

To avail the concessional customs duty benefit, Bill of Material (BOM) of such imported material in the prescribed template (containing part number, description, qty, price, source of supply, mode of shipment – Air/Sea, port of arrival etc.,) should be submitted by bidders to BEML within 02 months from finalization of the contract for obtaining PIR sponsoring letter from CMRL. The PIR sponsoring letter should be registered by the bidders with the concerned Customs Authorities at designated Port of Arrival.

The supplier shall submit the following documents for reimbursement of Custom Duty:

- i) Bills of Entry
- ii) Challan for deposit of Custom Duty
- iii) Declaration that the Sub-contractors/Sub-vendors have neither claimed the deemed export benefit nor they will claim the same.

42. INSURANCE COVERED BY BEML UPTO START OF CMC:

BEML has insured the Material being procured and the risk Coverage under the MCE policy shall commence from the moment of the first goods/consignments are lifted, mechanically or manually or otherwise, from anywhere in the world for loading onto the transport (all modes included) and remain in force during transit up to BEML's works and designated CMRL depot available till handing over of trainset with 24 months DNP/DLP.

43. RETENTION MONEY:

Retention money shall be deducted at the rate of 5% against each Invoice value of PO (excluding CMC) upto cumulative value equal to 5% of the total Material PO value excluding taxes & duties. Firm to raise Invoice for 100% value indicating that 5% of the Invoice value shall be payable by BEML only after completion of DLP/DNP period of all the trainset.

Upon the request of the Supplier, the purchaser may release the withheld retention money on submission of Bank Guarantee for an equivalent amount in respective currencies from a public sector bank (PSB) of India or Scheduled Commercial Banks in India or any Japanese Bank as listed under Schedule of Commercial Banks by The Reserve Bank of India (RBI).

E- bid no: 6300039573

Retention amount shall be released upon completion of DLP period i.e, a period of 24 months from the date of supply upto taking over of last trainset (70th trainset) by end customer, CMRL

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ANNEXURE-IV: SCOPE OF CMC

1. One Set of Special tools, jigs, measuring devices, to be considered as per OEM recommendations.
2. CMC period list of mandatory Spares to be positioned at the depot in schedule manner and delivery schedule to be discussed and finalized during techno commercial discussion. Mandatory spares to be placed at the depot after completion of DLP period as per **Annexure-A**.
3. Any modifications carried out During DLP/warranty period, also to be implemented in spares supplied under this contract.
4. OEM is required for special support which needs some technical review and discussion.
5. On Train Maintenance is Under BEML scope.
6. During DLP warranty period OEM's has to maintain the DLP spares at Chennai depot.
7. OEM to give the storage procedure for the spares supplied at the depot.

Annexure-A

(Ref document, Light system PTS, Doc No.: GR/TD/7054, Latest Revision)

S.No	Items	Mandatory Spares Qty	Unit	Remarks
1	Flasher Light	04	nos	Two Trainset Materials
2	Flasher Light PC Cover	06	nos	Three Trainset Materials
3	UTO/RM Light (Dual colour- Color will decided during design phase)	08	nos	One Trainset Material
4	External Car Indicator Light (Dual colour- Green & Red)	12	nos	Two Trainset Materials
5	Outside Door indication lamp (Dual colour- Green & Red)	24	nos	One Trainset Material
6	Inside Door indication lamp (Dual colour- Green & Red)	24	nos	One Trainset Material
7	Driver Console Light	08	nos	Two Trainset Materials
8	Cab Main Light	04	nos	Two Trainset Materials
9	24V DC Cubicle Lights (Tentative qty)	40	nos	Two car Materials (Tentative Qty)
10	Saloon Light (1800mm length)	20	nos	One TC car Material
11	Saloon Light (690mm length)	12	nos	Two DMC car Material
12	Saloon Light LED Strip (1800mm length)	50	nos	No. of strips placed in 1800mm Lights multiplied by 50 nos to be provided

13	Saloon Light LED Strip (690 mm length)	30	nos	No. of strips placed in 690mm Lights multiplied by 30 nos to be provided
14	Saloon Light diffuser cover (1800mm length)	36	nos	Two DMC car Material
15	Saloon Light diffuser cover (690mm length)	12	nos	Two DMC car Material
16	Gangway Light	04	nos	One Trainset Material
17	Gangway Light PCB's	04	nos	One Trainset Material
18	Auto Dimmer	06	nos	Two Trainset Material
19	Sensor	12	nos	Two Trainset Material
20	Dummy cover for Saloon Light of different length	As Required	nos	Two Trainset Material
21	DC/DC Converter (110V DC to 24V DC converter for cubical lights)	10	nos	
22	Set of all electrical items auxiliary's - Mating connectors for lighting system equipment's (male / female connectors along with male / female crimp contacts, etc.), pins, LED, etc (Trainset means DMC+TC+DMC)	2	Trainset	
23	Set of mechanical items auxiliary's- Namely mounting fasteners, Mounting bolts, Washers, rubber items, etc, which are under vendor scope. (Train set means DMC+TC+DMC cars)	2	Trainset	

Note: BOM & BOM quantity after design freeze is applicable for the above.

(To be executed on plain paper and applicable for all tenders of value _ Rs. 1 Crore and above)

INTEGRITY PACT

Between

**BEML Limited (BEML) hereinafter referred to as
“The Principal”**

And

**..... hereinafter referred to as
“The Bidder/Contractor”**

Preamble

The Principal intends to award, under laid down organizational procedures, contract/s for

.....
The Principal values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness / transparency in its relations with its Bidder(s) and / or Contractor(s). In order to achieve these goals, the Principal will appoint an independent External Monitor (IEM), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

(1) The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:

- a) No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
- b) The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
- c) The Principal will exclude from the process all known prejudiced persons.

(2) If the principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act, or it there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section 2 – Commitment of the Bidder(s)/ contractor(s)

- (1) The Bidder(s)/ Contractor(s) commit themselves to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.
 - a) The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.
 - b) The Bidder(s)/ Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
 - c) The Bidder(s)/ Contractor(s) will not commit any offence under the relevant IPC/PC Act; further, the Bidder(s) / Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or documents provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
 - d) The Bidder(s)/ Contractor(s) of foreign origin shall disclose the name and address of the Agents/ Representatives in India, if any. Similarly, the Bidder(s)/ Contractor(s) of Indian Nationality shall furnish the name and address of the foreign Principals, if any. Further, as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines all the payments made to the Indian agent/representative have to be in Indian Rupees only. Copy of the "Guidelines on Indian Agents of Foreign Suppliers" is placed at **Appendix (A-1)**.
 - e) The Bidder(s) / Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- (2) The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/Contractor(s), before award or during execution has committed a transgression through a violation of Section 2, above or any other form such as to put his reliability or creditability in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or act as per the procedure mentioned in the "Guidelines on Banning of business dealings".

Section 4 – Compensation for Damages

- (1) If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.
- (2) If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the contract value or the amount equivalent to Performance Bank Guarantee.

Section 5 – Previous Transgression

- (1) The Bidders declares that no previous transgressions occurred in the last three years with any other Company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprises in India that could justify his exclusion from the tender process.
- (2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as per the procedure mentioned in “Guidelines on Banning of business dealings”.

Section 6 – Equal treatment of all Bidders /Contractors /Sub-contractors

- (1) The Bidder(s)/ Contractor(s) undertaker(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.
- (2) The Principal will enter into agreement with identical conditions as this one with all Bidders, Contractors and subcontractors.
- (3) The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section 7 – Criminal charges against violating Bidder(s) / Contractor(s) / Subcontractor(s)

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or of the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer

Section 8 – Independent External Monitor / Monitors

- (1) The Principal appoints competent and credible Independent External Monitor for this Pact.

The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement

- (2) The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. It will be obligatory for him to treat the information and documents of the Bidders/Contractors as confidential. He

reports to the CMD, BEML.

- (3) The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Contractor. The Contractor will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Subcontractor(s) with confidentiality.
- (4) The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.
- (5) As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or to take other relevant action. The monitor can in this regard submit non- binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.
- (6) The Monitor will submit a written report to the CMD, BEML, within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise submit proposals for correcting problematic situations.
- (7) If the Monitor has reported to the CMD, BEML, a substantiated suspicion of an offence under relevant IPC/PC Act, and the CMD, BEML has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner.
- (8) The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

This pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the contract, and for all other Bidders 6 months after the contract has been awarded. If any claim is made/lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by CMD of BEML

Section 10 – Other provisions

- (1) This agreement is subject to Indian Law. Place of performance and jurisdiction is the Corporate Office of the Principal, i.e. Bangalore.
- (2) Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- (3) If the Contractor is a partnership or a consortium, this agreement must be signed

by all partners or consortium members.

- (4) Should one or several provisions of this agreement turn out to be invalid, the reminder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.
- (5) The bidder shall not approach the Courts while representing the matters to IEMs and he/ she will await their decision in the matter.
- (6) In case of joint venture, all the partners of the joint venture should sign the Integrity Pact. In case of sub-contracting, the Principal contractor shall take the responsibility of the adoption of IP by the sub-contractor. It is to be ensured that all sub- contractors also sign IP.
- (7) In the event of any dispute between the management and the contractor relating to those contracts where Integrity Pact is applicable, in case, both the parties are agreeable, they may try to settle dispute through mediation before the panel of IEMs in a time bound manner. If required, the organization may adopt any mediation rules for this purpose.

In case, the dispute remains unresolved even after mediation by the panel of IEMs, the organization may take further action as per the terms and conditions of the contract.

The fees / expenses on dispute resolution shall be equally shared by both the parties.

- (8) In the event of any contradiction between the Integrity Pact and its Annexure, the Clause in the integrity pact will prevail

(For & On behalf of the Principal)

(For & On behalf of Bidder/Contractor)

(Office Seal)

(Office Seal)

Place-----

Place-----

Date -----

Date -----

Witness 1:
(Name & Address)

Witness 1:
(Name & Address)

Witness 2:
(Name & Address)

Witness 2:
(Name & Address)

Appendix A-1

(Applicable Agents / Suppliers to Sign, Seal & Upload / Submit)

GUIDELINES FOR INDIAN AGENTS OF FOREIGN SUPPLIERS

- 1.0 There shall be compulsory registration of agents for all Global (Open) Tender and Limited Tender. An agent who is not registered with BEML LTD shall apply for registration in the prescribed Application-Form available on www.bemlindia.in.
- 1.1 Registered agents will file an authenticated Photostat copy duly attested by a Notary Public/Original certificate of the principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/remuneration/salary/ retainer ship being paid by the principal to the agent before the placement of order by BEML LTD.
- 1.2 Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.
- 2.0 DISCLOSURE OF PARTICULARS OF AGENTS/ REPRESENTATIVES IN INDIA, IF ANY:
 - 2.1 Tenderers of Foreign nationality shall furnish the following details in their offer:
 - 2.1.1 The name and address of the agents/representatives in India, if any and the extent of authorization and authority given to commit the Principals. In case the agent/representative be a foreign Company, it shall be confirmed whether it is real substantial Company and details of the same shall be furnished.
 - 2.1.2 The amount of commission/remuneration included in the quoted price(s) for such agents/representatives in India.
 - 2.1.3 Confirmation of the Tenderer that the commission/ remuneration if any, payable to his agents/representatives in India, may be paid by BEML LTD in Indian Rupees only.
 - 2.2 Tenderers of Indian Nationality shall furnish the following details in their offers:
 - 2.2.1 The name and address of the foreign principals indicating their nationality as well as their status, i.e, whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents/representatives.
 - 2.2.2 The amount of commission/remuneration included in the price (s) quoted by the Tenderer for himself.
 - 2.2.3 Confirmation of the foreign principals of the Tenderer that the commission/remuneration, if any, reserved for the Tenderer in the quoted price (s), may be paid by BEML LTD in India in equivalent Indian Rupees on satisfactory completion of the Project or supplies of Stores and Spares in case of operation items.
- 2.3 In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission /remuneration, if any payable to the agents/representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.
- 2.4 Failure to furnish correct and detailed information as called for in paragraph-2.0 above will render the concerned tender liable to rejection or in the event of a contract materializing, the same liable to termination by BEML LTD. Besides this there would be a penalty of banning business dealings with BEML LTD or damage or payment of a named sum.

Signature

(For & On behalf of Bidder/Contractor)

(To be submitted along with technical bid)

**COMPLIANCE REPORT FOR PROCUREMENT TECHNICAL SPECIFICATION
(PTS)**

Compliance to PTS GR/TD/7054, Rev Latest				
PTS Clause No	Description	Complied	Not Complied	Remarks
1. Introduction	1.1. General			
	1.2 Environmental Criteria (ERTS clause 2.11)			
	1.3. Track structure Parameters (ERTS clause 2.9.6)			
	1.4. Shock and Vibration (ERTS clause: 2.13)			
	1.5. Current Collection System (ERTS clause: 2.14.1 (a))			
	1.6. Signaling System			
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	10.7 Service Trials			
11 Submittals – Technical offer				
12 Attachments				

Authorized signatory with company seal / stamp

COMPLIANCE REPORT OF GENERAL TERMS & CONDITIONS

(To be submitted along with Technical Bid)

Bid Invitation No :**Firm** :**Item details** :

Sl. No.	Terms / Clause	Complied	Not Complied	Remarks
1.	GLOSSARY, DEFINITIONS & INTERPRETATIONS			
2.	SUBMISSION OF THE TENDER			
3.	SUPPLIERS SHARING LAND BORDER WITH INDIA			
4.	PREFERENCE TO MAKE IN INDIA			
5.	DELIVERY TERMS			
6.	PAYMENT			
7.	PRICE BID VALIDITY			
8.	FIRM PRICE			
9.	INSPECTION			
10.	WARRANTY			
11.	PERFORMANCE BANK GUARANTEE (PBG)			
12.	RIGHT TO VARY QUANTITIES & QUANTITY OPTION CLAUSE			
13.	LIQUIDATED DAMAGES CLAUSE			
14.	RISK PURCHASE CLAUSE			
15.	SECRECY AND CONFIDENTIALITY			
16.	AUTHORITY OF PERSONS SIGNING DOCUMENT			
17.	ACCEPTANCE OF ORDER			
18.	OTHER CONDITIONS			
19.	PRICE, INVOICING AND PAYMENT			
20.	PROGRESS REPORT			

Authorized signatory with company seal / stamp

COMPLIANCE REPORT OF GENERAL TERMS & CONDITIONS

(To be submitted along with Technical Bid)

Bid Invitation No :**Firm** :**Item details** :

21.	QUALITY & WORKMANSHIP			
22.	QUALITY, CONDITION OF DELIVERY			
23.	SUPPLY OF SAMPLE (If Applicable)			
24.	INSPECTION, TESTING & CONSEQUENCE OF REJECTION			
25.	RAWMATERIALS ARRANGEMENT			
26.	IDENTIFICATION OF ITEMS / PIECES			
27.	PACKING AND MARKING			
28.	APPLICABLE LAWS AND JURISDICTION OF COURTS			
29.	JURISDICTION			
30.	ARBITRATION			
31.	INTELLECTUAL PROPERTY RIGHTS; LICENSES			
32.	BRIBES AND GIFTS			
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34.	FALL CLAUSE			
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39.	GST TERMS & CONDITIONS			
40.	TAX CLAUSE			
41.	CUSTOMS DUTY ON INPUT CONTENT			
42.	INSURANCE COVERED BY BEML UPTO START OF CMC			
43.	RENTION MONEY			

Authorized signatory with company seal / stamp

COMMITTEMENT TO SUPPLIES
(To be submitted along with Technical Bid)

This is to certify that we M/s against SRM tender No..... as a Bidder commit that we will support BEML for requirement of any additional Equipment, Spares, Service required at the later stage i.e. from taking over of first trainset and up to completion of CMC by end customer CMRL for all the cars of contract Chennai Metro Rail Project-Phase II (ARE02A).

Authorized signatory with company seal / stamp

CONFIDENTIALITY AGREEMENT**(To be typed on plain paper and submitted along with the technical bid)**

This Confidentiality Agreement is made and entered into between M/s BEML, (hereinafter referred to as BEML), a Govt. of India Undertaking under Ministry of Defence, having its Registered Office at BEML Soudha, No.18/1, 4th Main, Sampangirama Nagar, Bangalore – 560 027 and M/s ----- (hereinafter referred as XXXX) having its Registered Office at..... M/s. BEML, has been patronizing XXXX for components / spares listed in Annexure hereto. A need has been felt to revitalize the business relationship for mutual advantage.

- 1) It is mutually, therefore, agreed that the following shall form part of the terms and conditions for continued business:
 - a) The supplier shall not divulge to anyone else except under the authority and for the purposed of BEML, all information such as technical data, specifications, drawings, models of specimens furnished / supplied by BEML for the purpose of manufacture or in connection with developmental activities, constitute the property of BEML and the supplier shall keep them in strict confidence. This has been explicitly stated in all the details to the supplier through Purchase Order / Drawings etc., released.
 - b) The supplier shall not supply the components / spares exclusively manufactured for BEML with the Technical Data / Specifications / assistance furnished by BEML and shall not disclose my initiations, development of adaptations thereof to anyone else except with the written consent of BEML.
 - c) BEML shall be entitled to prevent breach of the above and to claim damages in case of any breach. It is hereby mutually agreed that for breach of this agreement the Vendor shall pay, without actual proof of damages, a liquidated amount of Rs. 1.00 Crore (Rupees One Crore only).
 - d) **ARBITRATION:** Any disputes and differences that may arise between the parties in connection with this Agreement/Contract shall be settled by the parties amicably by way of mutual discussion / negotiation / conciliations. In case parties fail to settle the dispute amicably, then the dispute or difference shall be referred to India International Arbitration Centre for resolution. The Arbitration Tribunal shall consist of Sole / three Arbitrator /s. The Arbitrator /s shall be appointed and Arbitration proceeding shall be conducted in accordance with the provision of India International Arbitration Centre (Conduct of Arbitration) Regulations, 2018.
- 2) BEML shall be entitled to prevent breach of the above and to claim damages in case of any breach.
- 3) The Signatories hereto declare that they have the sanction and power to execute and deliver this binding agreement.

IN WITNESS WHEREOF, the parties hereto have set their respective hands to this Confidentiality Agreement on written in the presence of Witness.

For BEML**For M/s. XXXX****WITNESS:****1.****2.**

Land Border Sharing Declaration

(To be submitted in the bidder's letter head along with technical bid)

In-line with Department of Expenditure's (DoE) Public Procurement Division Order vide ref. F.No.6/18/2019-PPD dated 18.07.2020 & 19.7.2020 and subsequent orders

Tender no.

Job:

"I/ we have read the clauses pertaining to Department of Expenditure's (DoE) Public Procurement Division Order (Public procurement no 1, 2 & 3 vide ref. F.No.6/18/2019-PPD dated 18.07.2020 & 19.7.2020) regarding restrictions on procurement from a bidder of a country which shares a land border with India. I/We hereby certify that I/ we the bidder < name of the bidder.....> is / are

a) Not from such a country and eligible to be considered for this tender.

OR

b) From such country, has been registered with the competent authority and eligible to be considered for this tender. (Evidence of valid registration by the competent authority shall be attached)

For and behalf of _____ (Name of the bidder)

(Signature, date & seal of authorized representative of the bidder)"

**DECLARATION REGARDING MINIMUM LOCAL CONTENT IN LINE WITH
REVISED PUBLIC PROCUREMENT (PREFERENCE TO MAKE IN INDIA),
ORDER 2017 DATED 04TH JUNE, 2020 AND SUBSEQUENT ORDER(S)**
(To be typed and submitted in the Letter Head of the Entity/Firm providing certificate as applicable)

To,
BEML Limited, Bangalore

Dear Sir,

Sub: Declaration reg. minimum local content in line with Public Procurement (Preference to Make in India), Order 2017-Revision, dated 04th June, 2020 and subsequent order(s).

Ref : 1) NIT/Tender Specification No:,
2) All other pertinent issues till date

We hereby certify that the items/works/services offered by..... *(specify the name of the organization here)* has a local content of _____ % and this meets the local content requirement for **‘Class-I local supplier’** / **‘Class II local supplier’**** as defined in Public Procurement (Preference to Make in India), Order 2017-Revision dated 04.06.2020 issued by DPIIT and subsequent order(s).

The details of the location(s) at which the local value addition is made are as follows:

- | | |
|----------|----------|
| 1. _____ | 2. _____ |
| 3. _____ | 4. _____ |
| ... | |
| ... | |
| ... | |

Thanking you,
Yours faithfully,

**(Signature, Date & Seal of
Authorized Signatory of the Bidder)**

**** - Strike out whichever is not applicable.**

Note:

1. Bidders to note that above format duly filled & signed by authorized signatory, shall be submitted along with the techno-commercial offer.
2. In case the bidder's quoted value is in excess of Rs. 10 crores, the authorized signatory for this declaration shall necessarily be the statutory auditor or cost auditor of the company (in the case of companies) or a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.
3. In the event of false declaration, actions as per the above order necessary action will be taken against bidder.

Authorized signatory with company seal / stamp

CONTACT DETAILS OF THE SUPPLIER
(To be filled and submitted by supplier along with the technical bid)

1) Contact Person details in Marketing Office

(a) Name :
(b) Designation :
(c) Telephone :
(d) Fax :
(e) Mobile :
(f) Email :

2) Head Office :

3) Complete address
including the website :

4) Details of the proposed plant from
where item is to be supplied :

5) Complete address of the Plant
including Website :

6) Contact person details in plant

(a) Name :
(b) Designation :
(c) Telephone :
(d) Fax :
(e) Mobile :
(f) Email :

7) Bank Details: (Will used during L/C Execution)

a) Name of the Bank :
b) Full Address of the Bank :
c) Suppliers Account Number and Type :
b) IBAN No :
e) Swift Code :

APPENDIX – I**(To be submitted along with technical bid)****DELIVERY SCHEDULE**

Sl No	Part No / Description	Total Qty (Trainsets)	Schedule	No of Train Sets (3 Cars/TS)
1	Equipment with DNP/DLP	70 TS (210 cars)	Apr'26	1
			Jul'26	3
			Nov'26	3
			Feb'27	4
			May'27	4
			Jul'27	3
			Aug'27	3
			Sep'27	4
			OCT'27	3
			Nov'27	4
			Dec'27	3
			Jan'28	3
			Feb'28	3
			Mar'28	3
			Apr'28	3
			May'28	4
			Jun'28	4
			Jul'28	3
			Aug'28	4
			Sep'28	4
			Oct'28	4
3	Non-Recurring activities- Design and Submission of Design Documents	PDR: Jul-25 PFDR: Mar-26 FDR: Jun-26		
4	FAI Reports and Type Test & Report	Jun.26		
5	Deliverables as per ERTS Clause 8.2,8.3.1, 8.3.2,8.4.2, 8.4.3,8.4.4, 8.5, 8.6,14.3.1, 14.7.13 for Lighting System.	Apr.26		
	Printed Circuit Boards (PCB) details as per ERTS 19.55 for Lighting System	Mar-26		
	Microprocessor Details as per ERTS 19.57 for Lighting System	Mar-26		
6	Spares for Lighting System	To be supplied as per BEML requirement		
7	Tools for Lighting System	Dec.'26		
8	Training	Jan.'28		
9	Manuals	Jan.'28		

Note: a) Delivery schedule proposed above is tentative. However, it can be mutually discussed and agreed in line with key dates of CMRL contract. b) CMC shall start after completion of DLP/DNP activity for 70th Trainset and shall end 15 years after the start of CMC . c) 1 Trainset comprises of 2 DM car and 1 T car

PERFORMANCE BANK GUARANTEE

Bank Guarantee No.....
Dated
Amount
Valid upto
Claim upto

The General Manager (Materials- Management)
BEML
Bangalore Complex
PB No 7501
New Thippasandra
Bangalore 560075

1. This deed of Guarantee made this day of..... (Month& year) between Bank of..... (Hereinafter called the "Bank") of the one part, and BEML LIMITED (Hereinafter called "the Employer") of the other part.
2. Whereas BEML LIMITED has awarded the contract for..... (Name of work as per PO) (Hereinafter called the "Contract") to..... (Name of the Contractor) (Hereinafter called "the Contractor").
3. AND WHEREAS the Contractor is bound by the said Contract to submit to the Employer a Performance Security for a total amount of.....(Amount in figures and words).
4. Now, We the Undersigned.....(Name of the Bank) being fully authorized to sign and to incur obligations for and on behalf of and in the name of.....(Full name of Bank), hereby declare that the said Bank will guarantee the Employer the full amount of Rs. (Amount in figures and words) as stated above.
5. NOW THEREFORE, We hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor and we hereby unconditionally, irrevocably and without demur undertake to immediately pay to the Employer upon first written demand and without cavil or argument, any sum or sums within limits of.....(Amount of Guarantee) as aforesaid without reference to the Contractor and without your needing to prove or show grounds or reasons for your demand for the sum specified therein. The Bank shall pay to the Employer any money so demanded notwithstanding any dispute/disputes raised by the Contractor in any suit or proceedings pending before any Court, Tribunal or Arbitrator/s relating thereto and the liability under this Guarantee shall be absolute and unequivocal.
6. This Guarantee is valid till.....(The initial period for which this Guarantee will be valid must be for at least 6-months (six months) longer than the anticipated expiry date of defect liability period / Warranty period as stated in Clause 11 of Annexure IV - Notice Inviting Tenders.
7. At any time during the period in which this Guarantee is still valid, if the Employer agrees to grant a time extension to the Contractor or if the Contractor fails to complete the Works within the time of completion as stated in the Contract, or fails to discharge himself of the liability or damages or debts as stated under Para 5, above, it is understood that the Bank will extend this

Guarantee under the same conditions for the required time on demand by the Employer and at the cost of the Contractor.

8. The Bank agrees that no change, addition, modifications to the terms of the Contract Agreement or to any documents, which have been or may be made between the Employer and the Contractor, will in no way release us from the liability under this Guarantee; and the Bank, hereby, waives any requirement for notice of any such change, addition or modification to the Bank.
9. The Guarantee here in before contained shall not be affected by any change in the Constitution of the Bank or of the Contractor.
10. The neglect or forbearance of the Employer in enforcement of payment of any moneys, the payment whereof is intended to be hereby secured or the giving of time by the Employer for the payment hereof shall in no way relieve the bank of their liability under this deed.
11. The expressions "the Employer", "the Bank" and "the Contractor" hereinbefore used shall include their respective successors and assigns.
12. Notwithstanding anything contained herein:
 - (a) Our liability under this Bank Guarantee shall not exceed Rs.....
(Rs.....)
 - (b) This Bank Guarantee shall be valid up to.....
 - (c) We are liable to pay the Guarantee amount or part thereof under this Bank Guarantee only & only if you serve upon us a written claim or demand on or before

In witness whereof I/We of the bank have signed and sealed this Guarantee on the.....day of..... (Month & year) being herewith duly authorized.

For and on behalf of theBank.

Signature of Authorized Bank officials.

Name :.....

Designation :

Stamp/Seal of the
Bank.....

Signed, sealed and delivered for and on behalf of the Bank by the above namedin the presence of:

Witness 1.




Signature.....
Name.....
Address.....

Witness 2.

Signature.....
Name.....
Address.....

	BEML LIMITED BANGALORE	DOC. No.	GR/TD/7054
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Procurement Technical Specification
of Lighting System for CMRL - Phase 2
ARE02A Contract (210 Cars)

	Name	Date	Signature
Approved By	SADHASIVAM M	21.05.2025	
Reviewed By	RAM KUMAR M	21.05.2025	
Prepared By	RAHUL KUMAR E	21.05.2025	




	Procurement Technical Specification of Lighting System	DOC. No.	GR/TD/7054
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1. Introduction

1.1. General

This document, Procurement Technical Specification (PTS) describes the complete technical requirement of Lighting system to be supplied for cars under the Chennai Metro Rail Limited (CMRL)-Phase 2 contract hereafter 'ARE02A' (210 cars).

S. No.	Lines/Corridor	Distance (km)	Grade of Automation	Signaling system
1	Corridor 3 (Madhavaram to Sipcot)	45.8 km	GoA4	CBTC
2	Corridor 4 (Lighthouse to Poonamalle)	26.1 km	GoA4	CBTC
3	Corridor 5 (Madhavaram to Sholinganallur)	47 km	GoA4	CBTC

The Lighting System shall comply in all respects with ARE02A Employer's Requirements Technical Specification (ERTS).


BEML will carry out all required works and activities as Contractor for ARE02A project while the subcontractor shall be responsible for all works required in this PTS with regard to Design, Development, manufacture, supply, testing & commissioning of Lighting system and shall be responsible for supporting the BEML activities as subcontractor for ARE02A contract.

The scope of work covers design, development, testing, manufacture, supply, commissioning and integrated testing of the Lighting System and the training of Operation and Maintenance personnel of the owner on the Lighting system. The scope also covers supply of spares, special tools, testing and diagnostic equipment, jigs and fixtures for maintenance, repair and overhaul of Lighting System during DLP period..

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 1.3.8 (i) to (viii)

As per ERTS 1.4.3, Based on operational requirement, rakes may have to be operated in GoA2 mode with driver / in GoA3 mode with attendant / in GoA4 (UTO). However, the Phase 2 project is planned with operations in GoA4 (UTO) from the initial passenger service inauguration itself.

The Lighting system shall be suitable for Unattended train operation conforming to Grade of Automation-GOA4 as specified in IEC62290 all parts (latest version), including the training of operating and maintenance staff of the BEML/CMRL, for Corridor 3 (Madhavaram to Sipcot), Corridor 4 (Lighthouse to Poonamalle) and Corridor 5 (Madhavaram to Sholinganallur) of Chennai Metro Rail.

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The rake formation shall be as follows:

DMC + TC + DMC - 3 car train formation (67% Traction power)

Where:

- 1)
 - DMC: Driving Motor Car, MC: Motor Car, TC: Trailer Car (with pantographs)
- 2)
 - * : Automatic Coupler (AC)
 - + : Semi-Permanent Coupler (SPC)

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

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

As per ERTS 2.2.19, Electronic equipment shall be designed, constructed and tested in accordance with EN 50155.

As per ERTS 2.2.21, It shall be demonstrated that all electronic equipment shall be immune to surge and transients typically expected in the Rolling Stock environment in accordance with EN 50155.


As per ERTS 2.2.29, All electrical and electronic components shall comply with the EMC and EMI requirements of EN50121 (all parts), IEEE 16, EN 55011 and IEC 61000 standards or other equivalent international standards. The requirements of EMC EMI requirements referred in clause 10.19 & clause 2.18 of the rolling stock shall be met.

As per ERTS 2.2.30, Fire properties of the materials used shall comply with EN 45545 part 1 to part 7 latest editions (Category 4-A, Hazard level HL3) as a minimum or better international standard applicable for similar Metro applications. Requirements of ERTS clause 2.26 shall be met. Material requirements of all sub systems of train shall be compliant with the requirements of ERTS Chapter 19.

1.2. Environmental Criteria (ERTS clause 2.11)

Environmental conditions for the on-board equipment shall conform to EN 50125-1. The rake shall be capable of being operated, stored, and maintained at specified performance levels within the environmental conditions of the Chennai area.


The ARE02A Car shall operate reliably and safely under Chennai climatic and Environmental conditions as per as per ERTS 2.11 shown in following Table. Accordingly, the Lighting system shall be designed to operate with satisfactory performance under the following climatic and environmental conditions.

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Condition	Maximum	Minimum
Climate	Tropical Wet, Dry, and humid	
Ambient temperature	45°C	16°C
Monsoons	October through December	
Humidity	92% saturation during rainy season.	
Rainfall	1333 mm average annual. (Very heavy/continuous with heavy lightning discharges).	
Relative humidity	100 % saturation during rainy season which may be as long as 3 ~ 4 months. Other times, 82 % humidity.	
Atmosphere during hot season	Extremely dusty	
Maximum wind speed	130 kmph	
SO ₂ level in atmosphere	5 ~ 40micro g/m3	
NO _x level in atmosphere	10 ~ 40 micro g/m3	
Respiratory Suspended Particles Matter in atmosphere (RSPM)	45 ~ 100 micro g/m3	
Total Suspended Particles Matter in atmosphere (TSPM)	150 ~ 320 micro g/m3	
Altitude	Sea Level	
Conditions in stations	All underground stations will be A/C. Above ground stations will have A/C for certain designated rooms only.	

Note:

- 1) The temperature of stationary rake exposed to sun for long periods may go as high as 70° C. The equipment shall not be adversely affected in any way due to exposure to such high temperatures.
- 2) As the Chennai Metro lines will have elevated and underground portions, there may be sudden change in the ambient temperature to rolling stock. The equipment shall be designed to take care of such thermal shocks.
- 3) The rakes shall be continuously exposed to highly corrosive, salty atmosphere along with industrial pollutants.
- 4) With maximum allowable wheel and rail wear, the rake must be able to operate successfully under the above conditions with no entry of moisture or other contaminants into any compartment, component, or device that could cause equipment on the rake to malfunction or be damaged; that could increase maintenance requirements; or that could cause premature wear or failure.


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- 5) The Water used in Chennai for washing is likely to have a high level of dissolved matter which may aid corrosion.

1.3. Track structure Parameters (ERTS clause 2.9.6)


The Track Structure Parameters for At-grade, Elevated and Underground Corridors are shown in Table.

Description	Elevated and At-grade sections	Under ground sections
Track Laying Gauge	1435 ± 2 mm	
Rail Type		
Main Line	60E 1 Head hardened as per IRS T 12 – 2009 With All Amendments / Correction Slips. (1080 deleted as per latest draft no more 1080)	
Depot	60E 1 (880 Grade) as per IRS T 12 – 2009 With All latest Amendments / Correction Slips.	
Rail profile	60 E1 Profile	
Inclination of Rail	1 /20	
Rail seat spacing, Main line	Nominal 650 mm ± 5 mm	
Sleeper Spacing (Depot)	650 mm ± 5 mm; Inspection Lines 1000 mm	
Ballast Cushion		
Depot	Ballast less Track in Madhavaram Depot Ballasted Track in Poonamalle Depot	
Rail panel lengths	Continuous welded rails	
Minimum Radius of curvature	Depot – 100 m Main line (At grade and elevated) – 120 m	200m

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Minimum Turn Out Mainline	Madhavaram Depot: 1 in 7 R140 Poonamalle Depot: 1 in 7 R140,
Minimum Turn Out Depot	1 in 7 R 140
Maximum Cant Permissible in curves	125 mm
Maximum Cant Deficiency permissible	100 mm
Maximum Permissible Cant Gradient	1 in 440
Turn-out Speed: Turn-out Mainline	1 in 9 R 300 = 45 kmph; 1 in 9 R 190 = 35 kmph 1 in 7 R 190 = 35 kmph; 1 in 7 R 140 = 25 kmph
Maximum gradient (main line)	4 % Including Grade Compensation.
Minimum vertical curve radius crest	1500m
Maximum track axle load (AW4)	16 tons
Widening of track Gauge on curves	Up to 9 mm
Structural gauge and passing clearance in straight line, in curves, in open air grade, in tunnel	As per SOD of CMRL Refer to Appendix D of this document for typical Sections
Tunnel Profile	As per SOD of CMRL Drawings showing section of cut and cover and bored tunnel in the Underground sections and details of various equipment's/cables etc located therein are mentioned in are enclosed in Appendix D
Line profile	The drawings showing the line profiles of all corridors are enclosed in Appendix D of this document:

Note: For Track Tolerance and Platform interface detail refer ERTS section 2.9.6 (b) & 2.9.6 (c) Table 2-4 & 2-5.

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1.4. Shock and Vibration (ERTS clause: 2.13)


Component design criteria:

- 1) All car equipment shall be designed to operate without damage or degradation of performance when subjected to vibration and shocks encountered during normal service.
- 2) Equipment design and mounting arrangements shall be based on the specific location of the equipment on the rake and shall take into account the influence of adjacent components as well as the effect of normal car operation. It shall be the supplier's responsibility to assure that the operating environments specified below are not exceeded.
- 3) The Contractor shall ensure that equipment will withstand all normally occurring random shock and vibration magnitudes transmitted through the car axles and suspension, and present at the support points for each piece of equipment.
- 4) All mechanical, electrical and electronic equipment fitted to the rake shall operate without damage or suffer any reduction in reliability when subjected to the shock and vibration occurring in normal service for the Service Life of the equipment.
- 5) To demonstrate compliance with this requirement, each equipment shall have been subjected to a series of shock and vibration tests, or simulations, representing the real environment. In the case of a proven design component/equipment which has been previously tested, the car builder may submit the previous test results for BEML/CMRL review and approval, and not have to re-conduct the shock and vibration test.
- 6) Where acceptable results from prior testing are not available for any item of equipment, tests shall be performed in accordance with IEC 61373 or EN 12663.
- 7) The equipment design and mounting arrangements for testing shall be based on specific mounting locations on the rake and shall take into account the influence of adjacent components when mounted in-situ.
- 8) In cases where components are mounted in a partially sprung environment, the Contractor shall be responsible for defining the environment to avoid failure of the components.

1.5. Current Collection System (ERTS clause: 2.14.1 (a))

The general particulars of 25 KV, 50 HZ, Single Phase AC Traction Power Supply System shall be as follows:

System Particulars	For all sections and depot
Nominal Voltage	25 KV
Normal variation in voltage	19 ~ 27.5 KV
Occasional maximum voltage (Cut off)	30 KV
Occasional minimum voltage	17.5 KV

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Voltage for guaranteed performance	22.5 KV
Frequency variation	47 ~ 52 Hz

1.6. Signaling System

The proposed system shall meet the principal details of Signal and Train Control System are set out as per ERTS Appendix C: clause 2.3. The following details are listed for reference only.


Item	Description
Train control System	CBTC based On board Continuous Automatic Train Control system (CATC) consisting of i) Automatic Train Protection (ATP) ii) Automatic Train Operation (ATO) iii) Automatic Train Super-vision (ATS) iv) Automatic Turn Back (ATB) v) Attended/Unattended train operation (GoA2/GoA4)
Train control mode	i) Automatic mode ii) Coded Manual modes iii) Restricted Manual Forward mode iv) Standby mode v) Restricted Manual Reverse mode vi) Run on Sight mode vii) Cut-out mode viii) UTO ix) OFF mode

1.7. General requirements

As per ERTS 2.17.1.2, The Contractor shall devote particular attention to the design of the rake and equipment to obtain quiet operation, and shall ensure that the noise criteria specified herein are not exceeded.

As per ERTS 2.17.1.4, All equipment shall be designed to eliminate rattling and resonance at all speeds up to 10% above maximum normal operating speed by the use of damping, gaskets, resilient mounts, or similar methods.

As per ERTS 2.17.1.5 & 2.17.1.6, In general, the noise-control features of the equipment shall last for the useful life of the car. Designs based upon ISO 3095 (external) and ISO 3381 (internal), as well as, ANSI S1.4 / IEC 61672-2:2013, ANSI S1.6, ANSI S1.11 and ANSI S1.13 will be acceptable

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As per ERTS 2.18.9.2, Each item of Rake mounted equipment shall be tested in accordance with the Contractor's EMC Test Plan which shall be based on the requirements of the relevant part of EN 50121 and the results shall be submitted for approval of the BEML/CMRL.

As per ERTS 2.18.9.3, The maximum levels of radiated EMI of any individual item of rake mounted equipment shall not exceed the levels specified in EN 50121-3-2. The emissions of the rake shall not exceed the levels specified in EN 50121-3-1. These limits shall apply under all normal conditions.

As per ERTS 2.18.10.1, All electrical and electronic equipment on board the Rolling Stock shall not exceed the conducted interference levels as defined in EN 50121-3. These limits shall apply under all normal conditions.

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

As per ERTS 2.18.12.1, Any equipment sensitive to electrostatic discharge likely to be touched by personnel shall be protected against electrostatic discharge. Equipment shall be tested to 3 kV with contact discharge, as defined in EN 50121-3.

As per ERTS 2.26.1 (v), The design and the materials used in the cars shall conform to fire safety requirements of EN45545 Part 1 to 7 (Category 4-A, Hazard level HL3) latest editions or better international standards for similar metro operations, subject to the acceptance of BEML/CMRL.

As per ERTS 19.61.14, Windows and lighting diffusers shall have a flame propagation index (IS) of 100 or less when tested in accordance with ASTM E162; and shall have a (Ds) of 100 or less at 90s and 200 or less at 4 min when tested in accordance with ASTM E662.

2. Definition and Abbreviations:

The following definitions and abbreviations are applicable to the PTS.

2.1. Definitions


"CMRL" means the Employer for the Mass Rapid Transport System (MRTS) for Chennai.

"CMRL's Representative" mean such persons appointed by CMRL to act as Engineers for the purpose of the MRTS.

"Contract" means the contract between subcontractor and BEML in relation to the supply of Lighting system for ARE02A project.

"BEML" means the customer to procure the Lighting System for ARE02A contract.

"Contractor" means the persons or person appointed by the Employer to undertake the execution of the works for ARE02A project. In order to avoid misunderstanding of the roles of

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the contractor in ERTS the term “Contractor” shall be read as “Subcontractor” in ERTS for those ERTS clauses referred to in this PTS.

“**Subcontractor**” means the subcontractor of Lighting system to BEML for ARE02A contract.

“**ERTS**” means Employer’s Requirements-Technical Specification of ARE02A contract.

“**PTS**” means BEML’s Procurement Technical Specification.

“**GTC**” means General Terms & Conditions of the Tender issued by BEML for procurement of the Lighting system for ARE02A contract.

2.2. Abbreviations


GoA	:	Grade of Automation
UTO	:	Unattended Train Operation
EMC	:	Electro-Magnetic Compatibility
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
LED	:	Light Emitting Diode
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 Organization
SOD	:	Schedule of Dimension
SPC	:	Semi-Permanent Coupler
TCMS	:	Train Control Management System
DNP	:	Defect Notification Period

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

3. Precedence of Documents

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

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

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

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

Order of precedence	Document Title
1	CMRL Phase2 ERTS clause RS, ERTS Clause CMC & Depot M&P ERTS Clause
2	PTS
3	GTC

4. Standards and Codes (Appendix B of ERTS)

All equipment and software supplied shall be in accordance with the requirements of the standards and codes specified in the ERTS. The subcontractor may propose an alternative equivalent international standard during the design stage. The acceptance of alternative standard will however be subject to review by BEML/CMRL. When a Standard or Code is referred to, it shall be assumed that the revision that is current during the design finalization shall be applicable, unless otherwise stated.

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

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


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

- General Standards : UIC, EN, BS, JIS, NF, NFPA, ASTM etc.

5. Requirements of Documentation


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

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

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

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

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6. Qualifying Criteria for subcontractor.

6.1. Design Life

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

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

6.2. Service-Proven Design (ERTS clause 2.4)

The proposed Lighting system by the sub-contractor against this PTS shall satisfy the "Service Proven Design" clause 2.4 of ERTS. To establish a design's service-proven history, the Sub-Contractor shall submit as part of the proposal specific details of the application history. The Contractor is free to propose design improvements; provided the service proven design basis is substantially unchanged.


Proposed changes to the design or method of manufacture must be supported by reasonable justifications such as resolution of obsolescence, meeting specific BEML/CMRL technical requirements or for the improvement of product reliability.

Submitted change proposals must specify the reason for the proposed changes and be supported by evidence to demonstrate the risk of adversely effecting operation and performance is mitigated.

For such service proven designs, the Sub-Contractor shall produce for BEML/CMRL's review and approval test documents from the other systems/projects for which the Contractor is providing the proven design application.

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

The Subcontractor shall manufacture and supply the lighting system only from such manufacturing units that have supplied the lighting system that fulfill the service proven design requirements as above (Refer ERTS clause 2.4).


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7. Scope Of Supply and Work

7.1. Hardware

The Subcontractor shall be responsible for the design, manufacture, supply, testing, commissioning and integrated testing of the Lighting system as per ERTS 8.2, 8.3, 8.4 & 8.5. The subcontractor shall provide all components related to the Lighting system, but not limited to, the following.

1. All components to meet the performance requirements of the Lighting system.
2. Complete tools, software, Hardware, Facilities, Jigs, Fixture diagnostic etc. for whole Lighting system shall be in line with contractual & Engineers Requirement.
3. Dust and Water-tightness and at least IP 65 or higher shall be ensured as per ERTS for all type of exterior equipment & enclosure/cubicles etc.
4. Enclosures & Mounting arrangements has to be provided by the subcontractor for the all the equipment's supplied by subcontractor.
5. Cables between equipment's:
 - i. Subcontractor shall supply if any special cable required other than the cables provided by BEML. The special cable shall be provided 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.
 - ii. Specification of Special cables proposed by the subcontractor shall be submitted with the tender. (Cables from sources approved by CMRL only will be used.).
 - iii. Cable Number/Tagging must be under transparent heat shrinkable tube and should have a life of 35 years. Same is also applicable for Name Plate or Name labels.
6. Mating connectors for vehicle side with all pins even if pin is not used, back shells and accessories. The subcontractor shall supply approx. 10% additional pins during manufacturing.
7. Non-screwed and self-locking type connectors for complete system shall be ensured.
8. Unused connector shall be covered with protective cover plug (or dummy cap) to prevent dust form accommodating on the contacts.
9. Name plates or Name Labels
10. Rubber (packing or gasket) for the water-tightness when the subsystem or components are installed on the exterior of vehicle.
11. PC cover for Exterior lights to cab mask such as Flasher Light to be supplied
12. Gasket required for PC cover mounting to be supplied
13. Hardwares required for mounting interior and Exterior Lights to be supplied
14. One full set of connectors and its contacts as mounted on the equipment's for each car-type (DM, T & M cars) to carry out vehicle level voltage withstand test at BEML factory.
15. All information and contact details of the sub-suppliers shall be provided to contact the sub-suppliers after expiry of warranty.


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7.1.1. Lighting System

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

Total Number of Cars: 210 cars (*DM + T + DM*)

Sl. No	ITEM	Qty in Nos.			Remarks
		DMC	TC	DMC	
Exterior LED Lights					
1	Flasher Light	01	-	01	ERTS 6.9.22 & Appendix C: 2.9.2
2	UTO/RM Light (Dual colour- Color will decided during design phase)	02	-	02	ERTS 8.5
3	External Car Indicator Light (Dual colour- Green & Red)	02	02	02	ERTS 8.4.3
4	Outside Door indication lamp (Dual colour- Green & Red)	08	08	08	ERTS 8.4.4
5	Inside Door indication lamp (Dual colour- Green & Red)	08	08	08	ERTS 8.4.4
Interior LED Lights					
6	Driver Console Light	02	-	02	ERTS 8.3.2
7	Cab Main Light	01	-	01	ERTS 8.3.2
8	24V DC Cubicle Lights (Tentative qty)	20	18	20	
9	Saloon Light (1802mm length)	18	20	18	ERTS 8.3
10	Saloon Light (690mm length)	06	02	06	ERTS 8.3
11	Gangway Light	01	02	01	ERTS 8.3
12	Auto Dimmer	01	01	01	ERTS 8.3
13	Sensor	02	02	02	ERTS 8.3
14	Dummy Cover for saloon light 92.5mm	02	-	02	(Tentative length & qty projected and actual qty & length will be finalized in design phase)
15	Dummy Cover for saloon light 123mm	02	-	02	
16	Dummy Cover for saloon light 187 mm	-	04	-	

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Sl. No	ITEM	Qty in Nos.			Remarks
		DMC	TC	DMC	
17	DC/DC Converter (110V DC to 24V DC converter for cubical lights)	As required			
18	Mating connectors for all equipment's (male / female connectors along with male / female crimp contacts, etc.).	As required			
19	Various required Software (complete package including manuals, training)	1 SET			ERTS 15.11.6 & 20
20	Mating connectors for all Di-electric Test	As required			1 TS material- car side connector only

Table: Scope of Supply - On-board equipment

NOTE:

1) Scope of supply mentioned in above table are tentative and subjected to change during design stage, quantity can be modified by the proposal of subcontractor depending on how the system is considered.

2) Approximate length is provided for saloon lights, final length will be finalized during design stage and width of the saloon light must be slim design with approx. 86mm width to match the ceiling panel design requirements.

3) Mechanical mounting interface for saloon light has provided in Annexure-5, the propose saloon light shall fit properly in space provided & mounting arrangement of light shall be provided in line with annexure-5, details will be discussed & finalized during design stage.


Saloon lights (1802x86mm, 690x86mm) dimension shall be maintained as per Annexure-5 (Fig.2), details will be discussed & finalized during design stage.

Preliminary Saloon lights layout provided in Annexure-5, dummy covers shall be provided accordingly, details will be discussed & finalized during design stage. Final shape of light will be discussed and finalized during design stage.

4) All lights shall be provided along with its diffuser assembly and sub-contractor has to supply all required items for installation of lights aggregates.

5) The LED light fitting and Diffuser dimension, mounting aspects, Aesthetic appearance, Profile/Shape of Diffuser, Paint finish, etc. shall be finalized during Design Stage

6) During UTO/GOA4 service start, the partition door of cab will be removed, there may be rearrangement of lights required at DM cab end, the same will be discussed and finalized during design stage.

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- 7) As only DC110V will be provided by from vehicle end, therefore subcontractor shall propose the appropriate numbers of DC/DC converters (if required).
- 8) Subcontractor shall supply the required dummy cover to fill the gap in continuous appearance of saloon light in saloon & cab.
- 9) Subcontractor to submit the light simulation report to verify the lux requirement as per ERTS.
- 10) Sub-contractor to propose the high standard Aesthetic appearance aggregates for interior lighting system
- 11) All mating connectors to be supplied by the supplier along with supplies of each light.
- 12) Hardware's required for mounting Interior and Exterior Lights to be supplied

Item	Q'ty	Spec.
(1) Training	As per ARE02A contract	ERTS 15.12, 15.13, 15.14 & 15.15.
(2) Deliverables for ARE02A project	As per ARE02A contract	
(3) Operation & Maintenance (O&M) Manuals	As per ARE02A contract	ERTS 15.8,15.9,15.10 & 15.11

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


7.2. Technical Requirements

7.2.1. General

The subcontractor shall be responsible for meeting the entire technical requirement in PTS and shall provide all required data for lighting design.

The general requirements for Lighting shall be met to the following requirements specified in ERTS.

1. Interface Activities
2. Quality Assurance
3. System Safety
4. Reliability & Availability
5. Maintainability
6. Electromagnetic Compatibility
7. Noise and Vibration


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8. Fire and Toxicity Standards.

The system requirements for Lighting shall meet, but not be limited to, the following sections in ERTS:

- ERTS 1 System Description
- ERTS 2 System Requirements
- ERTS 5 Emergency Operator's Desk
- ERTS 6 Passenger Doors
- ERTS 9 Auxiliary Electrical Equipment
- ERTS 14 Train Control Management Systems
- ERTS 15 System Support
- ERTS 16 Management Program
- ERTS 17 Test Program
- ERTS 18 System Assurance
- ERTS 19 Material and Workmanship
- ERTS 20 Software Management Requirements
- ERTS Appendix A1: Detailed Software Development V-Cycle
- ERTS Appendix A2: Description of the Software Development Phases
- ERTS Appendix A: Abbreviations
- ERTS Appendix B: International Standards
- ERTS Appendix C: Interfaces
- ERTS Appendix D: Guidelines and Drawings
- ERTS Appendix G: Documentation and CAD Drawing Requirements
- ERTS Appendix H: Deliverables List
- ERTS Appendix F: Train Withdrawal Scenarios for 3-car Train.

The subcontractor shall submit the clause-by-clause compliance matrix for the above chapters of ERTS.

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7.2.2. System requirement

7.2.2.1. Interior Lighting


The Following ERTS Clauses to be followed:

General requirements of lighting system:

- i The lighting system of the train concerns:
 - a) Interior lighting for the saloon and the emergency operator's desk,
 - b) Exterior car lighting.
- ii Door indicator lights, call-on function, all interior lights & exterior lights in train shall conform to latest International Standards related to railway lighting systems.
- iii All the 100% of interior and exterior lighting of train shall be powered directly from train's batteries. Train battery shall be of sufficient capacity to maintain the all the train lights for one hour duration in case of failure of auxiliary supply. This function shall be achievable in parallel working with other essential loads of train as defined in Section VI A ERTS (RS) Clause 9.4.2.
- iv The power supply and voltage level requirements of all the internal and exterior lights of train shall match with the voltage supply requirements and voltage ranges mentioned in Section VI A ERTS (RS) Chapter 9.3.
- v Electrical lighting shall be of similar or equivalent performance to EN 13272 as applicable to urban rail transport systems.
- vi Relevant type test Certifications such as LM 79, LM 80 for all the types of proposed interior and exterior LED lights shall be submitted to CMRL for review and approval.
- vii The Contractor shall submit the details of complete interior and exterior LED lights' energy simulation calculations, details regarding energy efficiency, service life of lights, heat dissipation arrangement to CMRL during the design stage for review and approval.
- viii Lighting System functions has to meet the all the criteria defined in Chapter 14 - TCMS.
- ix The All electrical and electronic components of lighting system shall comply with the EMC and EMI requirements of EN 50121 (all parts), IEEE 16, EN 55011 and IEC 61000-4 standards or other equivalent international standards. The requirements of EMC EMI requirements referred in Section VI A ERTS (RS) Chapter 10.19 & 2.18 of the rolling stock shall be met.

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


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Interior Lighting (ERTS 8.3)


Saloon lights (ERTS 8.3.1):

The interior lighting system shall comprise of “Dimmable” type LEDs with a minimum of six (6) step lighting control, conforming to EN13272. The following requirements shall also apply:


- i. The saloon shall be provided with lighting using energy efficient, long service life (burning hours) power LED lights fitted in luminaries which shall achieve the requirements of flame, smoke and toxicity for passenger service metro rolling stock applications. All the light fittings shall prevent entry of dirt, moisture and insects.
- ii. All interior LEDs shall be fed by the train battery supply. Each car shall have two separate wiring circuits with individual MCB protection, such that a single point of failure cannot cause a total loss of interior lighting.
- iii. The guaranteed life of the LEDs with their control system and optics / luminary shall not be less than 60,000 burning hours. The level of illumination shall not degrade to less than 70% of the originally specified rating in lumens.
- iv. The Contractor shall propose the colour of the LEDs as warm white (corresponding to a colour temperature range of 3000~3300 K) or cool white (corresponding to a colour temperature range of 4000~4300 K) for approval by CMRL. All LEDs are to be procured from the same batch to avoid any risk of differences in color and/or performance.
- v. The Colour Rendering Index Ra of all interior LED lights shall not be less than 90.
- vi. The saloon interior lighting intensity shall be uniformly distributed. The level of illumination shall be at least 300 lux at the floor level of the Coach and not less than 500 lux at seating positions. Lighting intensity requirements inside coaches shall also comply with EN13272.
- vii. The system shall be designed to limit glare; especially night time reflections on windows.
- viii. Luminaire efficiency inclusive of LEDs/control gears & optics etc. shall not be less than 100 lm/W at the working junction temperature; higher values of lm
- ix. /W shall be preferred. LED(s) shall have lumen rating as 100 lm/W or above.
- x. The layout and wiring design for LEDs & their strings / blocks shall ensure that a failure of one LED does not cause the loss of a complete string/block. Similarly, failure of one controller on one string / block should not adversely affect other strings / blocks. Details shall be submitted to CMRL during the design stage for review and approval.
- xi. Cars may remain unpowered in open sunshine causing internal temperature to rise to 70° C. Suitable protection measures shall be taken to ensure that this does not adversely affect the performance, reliability or efficiency of the lighting system and its components. A suitable test plan to verify / validate the above shall be proposed by the Contractor during design stage.

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- xii. The junction temperature (T_j) of the LED chips and efficiency of the heatsink, shall be considered in the proposed design to ensure the long term reliability. The design shall ensure that consequential degradation (E.g. lumen depreciation and permanent colour shift) are within the allowable limits specified in this chapter.
- xiii. The change of chromaticity over the lifetime of the product shall be within 0.007 on CIE 1976 (u' , v') diagram or equivalent.
- xiv. After Two-year, five year and 60,000 operation hours, the color temperature of the interior lighting shall be within $\pm 5\%$, $\pm 8\%$ and $\pm 10\%$ of the initial value respectively.
- xv. LED luminaires shall be designed to withstand switch cycles of 100,000. A test certificate shall be provided to evidence compliance.
- xvi. LED luminaires shall be sealed to IP 53 and control gears shall be sealed to IP 54 as per EN 60529 to prevent the ingress of dust, moisture and insects etc.
- xvii. The Contractor shall propose LED manufacture(s) during design stage and seek the prior approval of CMRL based on submission of appropriate evidence to demonstrate the reliability and reputation of the proposed supplier / LED design.
- xviii. The Contractor shall replace all the LED lighting with a newly improved LED lighting in fleet of trains if either of the following occurs:
 - (a) The total cumulative failure rate of the LED luminaires or control gears within Defect Notification Period (DNP) exceeds 5% of the total units, with 20% of LEDs failed in a LED luminaire unit is constituted as a failure of the LED luminaire unit. (or)
 - (b) The illumination level at floor level of any five trains drops below 90% of the initial values at the end of two- year operation of each train, by assuming maximum of 18 hours daily operation and 365 days of operations.
- xix. The Since LED technology is fast evolving and the rolling stock supply is a long-drawn process, the Contractor shall commit to supply latest generation of LEDs available at the time of design approval.
- xx. In case of LED lights failure, it shall be possible to easily replace new lights from outside portion of the fixture and shall be maintenance friendly.
- xxi. Maximum number of LEDs which a driver / power supply can feed shall not exceed 1,000 LEDs.
- xxii. Train interior lights shall be compliant to the overall Train Interior Noise requirements in static and dynamic conditions as specified in clause 2.17.


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- xxiii. All the controls of the saloon lighting of the train shall be provided from train' s TCMS and from RSC consoles of OCC, BCC & DCCs as an override to automatic control of train. In general, automatic working of interior saloon lights shall be as per clause 8.3.1.26.
- xxiv. Activation & Dimming Control of the lights shall be available from the TCMS DDU display of controlling cab. RSC consoles of OCC, BCC & DCCs shall also have the option to control the lights remotely. TCMS shall automatically control the lighting during transmission from Viaduct section to Underground section vice versa. This shall be possible when the train state is not in the "Off" mode.
- xxv. The saloon lighting shall switch off automatically when the train state is in the "Off" condition.
- xxvi. A provision to select "Maintenance Mode" for saloon lights shall be provided. On activation of one of the switches, all Saloon lights shall be lit even if the Master Controller' s Mode Selector is in OFF position. These switches shall be provided at each side of the car' s exterior at platform level. A detailed proposal shall be agreed with CMRL during design stage.
- xxvii. The lighting control logic shall propose real-time automatic selection of the saloon lighting circuits based on individual levels of natural daylight illumination present in each car. This is to minimize power consumption and provide uniformity of lighting levels in all cars.
- xxviii. The Contractor shall submit the Specifications, Data Sheets and energy efficiency details of all interior lights.

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Emergency Operator Cab Lights (ERTS 8.3.2)

- i. The internal Emergency Operator cab lights shall be power LED type, separately switched and electrically independent of the saloon LED lighting. It shall be operated automatically by opening of detrainment door, during coupling, during operation in GoA4 / GoA3 / GoA2 / GoA1, and shall also be controlled manually from TCMS and RSC consoles of OCC, BCC & DCCs.
- ii. The internal emergency operator cab lights shall incorporate passive illumination of at least 200 lux at 1 m above floor level and having sufficient intensity to see and operate all the cabin controls, switches and other cabin equipment comfortably during train operation in GoA1 to GoA4.
- iii. The illumination of the emergency operator cabin or saloon LED lights shall not create any glare or reflection on the front end windshield and shall not create any discomfort to the train operator / attender to operate the train in all times of service operation.
- iv. The illumination level in the cab shall provide sufficient illumination throughout the cab in compliance with EN 13272 or equivalent internationally recognized standards.
- v. All the internal lights and its fixtures shall be proposed such that the aesthetic appearance of the train as specified in ERTS Chapter 3 shall suitably match with the interior lighting system of train.

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7.2.2.2. Exterior Lighting

The Following ERTS Clauses to be followed:

Flasher Light:

i. In order to attract the attention of the train operator of the following train or a train approaching from the opposite direction, in emergency, a powerful flashing amber light in addition to the tail lamps shall be provided in the front panel of each driving car. This light shall be switched ON by the train driver in case of emergency and shall not be switched OFF even while disconnection of DC supply.

ii. Flasher light when lit and flashing shall be able to attract attention at a distance of 300m under clear sunny daylight.

iii. The fixation of the Flasher Light cover panel shall be with fasteners and sealed to prevent the ingress of draughts, water and foreign matter and cover panel for flasher light to suit the cab mask to be supplied by the Flasher Light supplier.

As per ERTS 6.9.22: When an attempt is made to operate the door actuating mechanism, or it is unstowed / unlatched the supervised interlock circuits shall trigger the following chain of events:


c): Driving console light and Flasher lights are automatically lit, and CCTV cameras shall automatically focus on this area.

i): The detrainment process shall be monitored with CCTV cameras of the train. One CCTV camera dedicated to the detrainment process shall be provided. Flasher light shall automatically turn ON when detrainment door is open.

As per ERTS, Appendix C 2.9.2: The Signalling and Train Control Contractor and Rolling Stock Contractor shall coordinate to allow the following functions, as a minimum, to be performed remotely from OCC in ATS work-station under UTO mode but not limited to the following functions. BEML/CMRL shall request a few other operational requirements during the project execution stage: x) Flasher light ON/OFF

Call-on Light Function (ERTS 8.4.2):

Control for Call-On function shall be provided in the train's TCMS and in RSC consoles of OCC, BCC & DCCs to cater for Emergency Pull/Push rescue operations. Operation of the Call-On switch on a failed train, with the Mode Selector in any non-UTO mode, shall cause the taillights at the front

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& rear of the sick train to flash on and off, indicating to the train operator of the rescuing train that he may proceed to effect coupling.

External Car Indicator Light (ERTS 8.4.3):

- i A LED based indication lamp shall be located at an appropriate location at the mid length of exterior side of each car and on both lateral exterior sides.
- ii This LED lamp on each car side shall be sufficiently large and shall be visible to all the passengers on the entire length of CMRL station platform.
- iii The functions of this exterior car indicator LED light shall be as per the below requirements:
 - (I). The light shall remain in green colour during the below conditions:
 - a. When no condition of 8.4.3.3 (2) occurs in a specific car, both side car indicator lights shall be glowing in static green colour.
 - (II). The light shall flash in red colour in any of the below conditions:
 - a. When any passenger emergency communication is done in any car, both side car indicator LED lights shall flash in red for that specific car.
 - b. when any train door of the particular side of car has locking mechanism failed to register its feedback to TCMS / OCC, preventing traction circuit from picking up.
 - c. when any train door of the particular side of car is locked out mechanically due to failure
 - d. when any train door of the particular side of car has communication failure between door and TCMS / OCC.
 - e. When the corresponding exterior Platform Screen Door (PSD) of the same car side is having communication fault or opening / closing fault.
 - f. In any other cases where any door of the car is unable to/should not be opened.

UTO / RM INDICATING LIGHT (ERTS 8.5):

One dedicated indicating LED light visible from lateral sides and front side of the train indicating UTO or Restricted Manual mode status, shall be fitted on each external side of the emergency operator's desk. The light shall have the below functions:

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a) Shall indicate when Train is under UTO mode.

b) Shall indicate in a distinct colour when UTO not being used. It shall be used to understand that it is safe for operation and maintenance personnel to board the train and/or to carry out coupling during rescue operation when this colour is lit.

c) Shall indicate in a distinct colour when Restricted Mode is activated.


Operating scheme of these light shall be submitted during design stage to CMRL for approval. These lights shall be continuously switched on in all modes of operation and even during train switched off condition.

UTO Operation (ERTS 8.6):

- i All the exterior and interior lighting of the trains shall be fully automatic and can be remotely over-ride from RSC consoles of OCC, BCC & DCCs.
- ii The design of train lighting system and its relevant components in train shall support for the UTO / GoA4 in the CMRL Phase 2 corridors defined in Chapter 1. Trains shall be operated in GoA4 / UTO mode from the initial stage of commissioning and revenue operations. Hence all the feed-backs, information and train controls which are available on TCMS screen shall also be available in OCC (operational control Centre) and DCC (Depot Control Centre) for smooth operation of passenger service. The Contractor shall submit the details of controls to be provided in OCC & DCC for review and approval of CMRL.

7.2.2.3. External and Internal Door Indicator Light (ERTS 8.4.4):

- i A LED based indication lamp shall be located at an appropriate location near each door in both interior side and on exterior side. The lamp shall be informative type showing the door signage and other faulty conditions specified below.
- ii The functions of both interior and exterior door indicator light shall be same and as per the below requirements:
 - a) The lamp shall remain extinguished when respective door is fully closed and locked.
 - b) The lamp shall continuously flash in red color whenever door close command button from the active cab is pressed / UTO door close command is available. It shall continue to flash till such time the door is closed and locked.
 - c) The lamp shall continuously flash in green color whenever door open command from the active cab is pressed / UTO door open command is available. It shall continue to flash till such

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time the door is completely opened.

d) The lamp shall be illuminated in static green color when the door is fully opened.

e) The lamp shall be illuminated in static red color when

(i) the door locking mechanism has failed to register its feedback to TCMS / OCC, preventing traction circuit from picking up.

(ii) the door is locked out mechanically due to failure.

(iii) the communication between door and TCMS / OCC fails.

(iv) the corresponding exterior Platform Screen Door (PSD) is having communication fault or opening/closing fault.

(v) In any other cases where the door is unable to/should not be opened.

Note:

i. Door Indication Light Outside & Inside:


The door indication light shall be with the operating voltage of 110V DC/24V DC which is based on the door system supplier. The proposed lighting system shall comply with above operating voltages. Also, lighting system shall comply with ERTS clause 9.6.14: The control elements taking power from the battery shall be capable of operating between 77V to 138V DC to meet the above requirements as per ERTS 8.4.4.

7.3 TCMS interface

- (i) *As per ERTS 14.3.1, Network Interfaced Systems or Hardwire Interfaced Systems:* TCMS shall schedule, initiate and control data acquisition, processing and analysis by interfacing with all microprocessor/ microcontroller based on-board systems. These systems shall include, as a minimum with Signaling System, Train Radio System, Platform Screen Door System, VAC System, Auxiliary Power Supply System, Brake System, On-Board Communication System (PAPIS & CCTV), Door System, Propulsion System, High Voltage System, **Lighting System**, Wayside Wireless Communication, Wheel Flange Lubrication (WFL) System, Fire Detection system, Asset Maintenance Management System (AMMS), etc.,

All interface signals with ATP, ATO & UTO and selected interface signals with other on-board systems shall be monitored and recorded with time stamp.

- (ii) *As per ERTS 14.3.2: Hardwired Inputs-*TCMS will also acquire status data via hardwire from the various identified vehicle control circuit nodes, train lines, ATP, ATO, UTO, or any other interface subsystems. This data acquisition shall be


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fully redundant, bus monitored and duly recorded in TCMS. The interface units provided for this purpose shall be dual homing compliant.


- (iii) *As per ERTS 14.3.3: **Communication Protocol Details***-The software and communication protocols used throughout the TCMS and the interfaces to subsystems shall be compliant to a common standard or standards. The Contractor shall submit details of the communication protocols used in their design clearly indicating how the requirements of monitoring and control are complied with. The Contractor shall also define the dual-homing compliant communication protocols for all EDs. Further details along with any hardware / software tools required shall be submitted during design stage.
- (iv) *As per ERTS 14.3.4: **Signal List Modification***-It shall be possible for authorized maintenance personnel to update and modify the list of data acquisition signals and its associated parameters like periodicity, task cycle, data acquisition routine etc. Suitable graphical configuration editors shall be provided for this purpose.
- (v) *As per ERTS 14.3.5: **Clock Synchronisation***-TCMS shall synchronize its clock with the system master clock through STC Contractor interface. All the microprocessor / microcontroller based on-board systems shall synchronize respective clocks with TCMS clock. The event and fault logging of the respective sub-systems of train shall always be in-line with the TCMS clock in all the UTO, Non-UTO and other degraded modes of train operation. Detailed clock synchronisation proposal shall be submitted for CMRL approval.
- (vi) *As per ERTS 14.6.2: **Subsystem Self-Diagnostic Tests***- All the on-board microprocessor/ microcontroller-based subsystems shall also perform self-diagnostic tests and report the detailed health status to TCMS, both automatically and on specific request (using DDU) by maintenance personnel.
- (vii) *As per ERTS 14.7.1.3: **Real-time fault data*** shall be available from at least, but not limited to the following systems: Lighting System.

7.4 General and interface requirements

- 7.4.1** The subcontractor shall fully meet the requirement of ERTS for the proposed Lighting system for ARE02A contract.
- 7.4.2** The Lights shall fully meet the requirement of EMI/EMC as per ERTS 2.2.29, ERTS 10.19.
- 7.4.3** The subcontractor shall comply with the Noise & Vibration requirements as specified in ERTS 2.17, ERTS 2.18.
- 7.4.4** The subcontractor shall comply with the RAMS requirements as specified in ERTS 18.
- 7.4.5** All wires & Cables shall comply with ERTS 19.35, ERTS 19.36, ERTS 19.38, ERTS 19.39, ERTS 19.41 & 19.43.

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- 7.4.6** An expected power consumption of the Equipments should be declared as a realistic value at the tender level and/or early design concept phase. The sub-contractor shall make every effort to minimize the energy consumption of each equipment. The actual power consumption must not derate by 2% of the estimated power consumption.
- 7.4.7** The sub-contractor shall be fully responsible for integrated testing and commissioning including Commissioning Type tests and Commissioning Routine tests of the lights at BEML works (Factory test) and at ARE02A site (Depots at Chennai & Main line tests).
- 7.4.8** The sub-contractor shall be responsible to maintain the DLP/DNP and commissioning spares at ARE02A site. The list of DLP/DNP and commissioning spares shall be furnished by the sub-contractor for review and approval by BEML/CMRL.
- 7.4.9** The sub-contractor shall provide all the documents for CMRL ARE02A project and shall also provide any other documents required by CMRL as per ERTS 2, ERTS 5, ERTS 9, ERTS 14, ERTS 15, ERTS 10, ERTS 17,18,19 & 20 Appendix- B, C, H & I of ERTS and ERTS 8.2, 8.3, 8.4, 8.5 & 8.6.
- Design documents – Preliminary, Pre-final & Final.
 - Technical Description of Lighting System with drawings.
 - Quality assurance plan (QAP)
 - Type test procedure for Lighting System and aggregates
 - Routine test procedure for Lighting System and aggregates
 - Inspection and test plan (ITP)
 - Factory tests, Depot tests and main line test procedures
 - Testing and commissioning plan
 - Interface plan
 - Operation and maintenance manual
 - Spare parts catalogue
 - Special tools & Testing equipment
 - Any other documents requested by BEML/CMRL.
 - Type test certificates / documents and Routine test certificates / documents.
- 7.4.10** During the Maintenance Period (DLP/DNP), the supplier shall, at its own cost and expense, maintain sufficient stock of all spares and consumables required to meet the DLP/DNP obligations at all times.
- 7.4.11** The sub-contractor shall provide training in operation and maintenance to BEML and CMRL staff.

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7.4.12 Only 110V D.C(Proposed system shall be operable with 77V to 138V DC) would be made available on train for control power supply of Lighting system. The Lighting system shall continue to operate correctly with the 110 V DC car battery voltage supply as per ERTS 9 & 9.6.14.

7.4.13 Unused connectors of equipment shall be covered with protective cover plug or dummy cap to prevent dust from accumulating on the contacts.

7.4.14 The subcontractor shall also comply the ERTS Clause ERTS 2, ERTS 5, ERTS 9, ERTS 14, ERTS 15, ERTS 10, ERTS 17, ERTS 18, ERTS 19 & ERTS 20.

7.4.15 As per ERTS Appendix C, 2.4.51: During train movement in Depot, Air conditioning and Lighting shall be switched off automatically through interface between Signalling and Rolling Stock. Percentage of required switch OFF VAC & Lighting will be finalized during detailed design stage.

7.4.16 As per ERTS Appendix C, 2.4.56: No train with defective safety equipment's, cab signalling, leading cab controls, interior lighting, ventilation, brakes or doors, including emergency doors, shall remain in passenger service, and it shall be removed from service at the earliest opportunity as per special instructions. Failure of these equipment's shall generate indications and/or alarms and/or messages at Operations Control Centre for above defects. Remote commands (where provided) shall isolate the defective equipment in safe manner.


7.4.17 As per ERTS Appendix C, 2.9.2 (p, x & z): Remote Control from OCC in ATS work-station: The Signalling and Train Control Contractor and Rolling Stock Contractor shall coordinate to allow the following functions, as a minimum, to be performed remotely from OCC in ATS work-station under UTO mode but not limited to the following functions. BEML/CMRL shall request a few other operational requirements during the project execution stage:

- Interior Light Control
- Flasher light On/ Off
- Exterior light control (flasher, stop, etc.)
External car indicator light & UTO/RM light.

The details shall be submitted by the Contractors as a joint interface document for CMRL review.

7.5 Other Clauses

- (i) The Diffuser of all the light fittings shall be designed to eliminate glare and ensure that there is no glare by night time reflections in windows. Hot spots of power LED should not be visible and same to be ensured. No different colour patches shall be visible in the Light fitting/Diffuser and the light distribution shall be uniform across the diffuser. Uniform distribution of light should be maintained throughout the light fitting and also on car level. Luminaries shall be designed to conform to relevant international standards.
- (ii) Globe/ Diffuser for Passenger Saloon Light shall be made from laminated toughened glass/ Polycarbonate to be taken care as per the drawing and shall meet the Fire


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standards as per EN 45545 Part 1 to 7 HL-3. The Vendor may offer better material for the Globe / Diffuser. The same shall be discussed during design stage.

- (iii) All the capacitive components used inside the light fitting should be Ceramic type and if any other capacitor other than ceramic is used, then same shall be discussed during design stage.
- (iv) Potting shall not be provided on the PCB's. Suitable design shall be adopted to withstand Shock & vibration as per IEC 61373.
- (v) The LED light fitting and Diffuser dimension, Mounting aspects, Aesthetic appearance, Profile/Shape of Diffuser, Paint finish etc shall be finalized during Design Stage.
- (vi) Locking mechanism shall be fail safe and shall be easily accessible and operable for maintenance.
- (vii) The design of light fitting will be in such a way that no screws shall be visible from outside.
- (viii) **A rubber gasket meeting the International fire standards to be provided for each LED light for mounting on the Car body.** That is, Gasket required to mount Flasher Light to the cab mask.
- (ix) Paint: The applicable paint sample will be provided by BEML and vendor shall apply the approved paint shade on the fitting which shall be reviewed and finalized during design stage.
- (x) Separate Dimmer unit for each car mountable in the cubicle along with Sensors (2 sensor/car) shall be provided for control of LED saloon Lights with the following functions:
 - i) Dimming of Lights based on Ambient light and Sensor input.
 - ii) Setting of Lux level will be finalized during design stage.

However, as per ERTS 8.3.1.26, supplier shall propose to meet the requirement.


- (xi) Failure of Dimmer Unit / Power Supply Unit/ Sensor shall not affect illumination of all light fitting in the car, there shall not be any black out (Complete darkness of the car) due to above cause, this will lead to train withdrawal in turn penalty will be deducted from light supplier for each such failure (Complete darkness) as this is related to train withdrawal scenario.
- (xii) ERTS 19.54.1: Electronic components shall be free of storage and handling damage. Components shall be clearly and permanently labelled with values or type identification.
- (xiii) ERTS 19.54.2: Carbon resistors shall not be used on printed circuit boards, unless otherwise approved by CMRL.
- (xiv) ERTS 19.54.3: All electronic equipment shall comply with IEC 60571 and/or EN50155 and additionally type tested for,

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

(ii) Salt Mist test (ST3 category):

- a. Cyclic Humidity tests (IEC 60571).
 - b. Dust and sand test & Mold growth tests: The tests shall be done as per IEC 60068 & IEC 60721. The dust settlement rate shall be taken as 6gm/m²/day and dust particle size shall not be larger than 100 microns.
- (xv) ERTS 19.54.4: Electronic equipment shall not be damaged, nor shall malfunction when subjected to direct spikes and surges one the supply and indirect burst transients are defined in IEC 60571/EN 50155.
 - (xvi) ERTS 19.55.1: Printed circuit boards (PCBs) shall be of glass epoxy construction, complying with ANSI/IPC- 4101 and PCB's shall generally comply with IEC 60326-3: 1991 Printed Boards – Part 3: Design and Use of Printed Boards.
 - (xvii) ERTS 19.55.2: PCBs shall be uniformly coated.
 - (xviii) ERTS 19.55.3: Conductor materials shall be determined on the basis of current carrying capacity.
 - (xix) ERTS 19.55.4: Edge connectors and boards shall be keyed to prevent insertion of any board in a wrong position, and mounted for ease of board removal and replacement.
 - (xx) ERTS 19.55.5: To the greatest extent practicable, component labeling shall be provided on PCBs. PCB's shall be connected to the case or rack wiring using multi-pin connectors, which shall have a successful service history in rail applications. Details shall be provided in any electronic rack system, the failure of any one module or individual circuit board shall neither cause loss of the electronics power supply within the rack, nor cause subsequent failure of circuits on other PCB's or modules. PCB's shall have mechanical polarisation to prevent insertion into a wrong socket. The use of PCB edge connectors in not permitted unless reviewed by CMRL, on a case by case basis. PCB's and modules shall be positively retained in the rack or case by a fastener or spring loaded locking pin. All PCBs shall be adequately lacquered to isolate from environment pollution.
 - (xxi) ERTS 19.55.6: The Contractor shall furnish the following information in respect of printed circuit boards as part of contract:
 - a) Voltage and/or waveform expected at each critical test point.
 - b) Instructions for carrying out testing and troubleshooting and the function of each


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circuit block.

c) Block Diagram and functional descriptions of the PCBs.

d) Connection or interfacing diagrams for the printed circuit boards and assemblies.

- (xxii) ERTS 19.56.1: The Contractor shall be responsible for ensuring that all electrical and electronic circuitry, including those of suppliers and subcontractors, as a minimum meet the criteria for the use of semiconductors and/or integrated circuits listed in this section, unless otherwise approved.
- (xxiii) ERTS 19.56.2: The Contractor shall be responsible for ensuring that all electrical and electronic circuitry, including those of suppliers and subcontractors, as a minimum meet the criteria for the use of semiconductors and/or integrated circuits listed in this section, unless otherwise approved.
- (xxiv) ERTS 19.56.3: All semiconductors shall be JEDEC registered and numbered and shall be available from at least two different manufacturers unless otherwise approved by CMRL. Non-JEDEC registered devices may be used, provided that the Contractor obtains CMRL's prior approval based on submission of appropriate justifications. These shall include, but not be limited to the complete procurement specifications, details of each semiconductor device, evidence of available alternative replacements as well as any applicable diagnostic connectors / capability that would otherwise be offered by JEDEC compliant devices.
- (xxv) ERTS 19.56.4: Non-JEDEC registered devices which carry more than 100 Amps may be used with prior BEML/CMRL approval, based on submission of complete procurement specifications defining each such device and evidence of availability from two or more manufacturers.
- (xxvi) ERTS 19.56.5: All semiconductor/integrated circuits shall be rated to properly perform in the range 25° to +85°C unless otherwise approved by BEML/CMRL.
- (xxvii) ERTS 19.56.6: The Contractor shall not utilize obsolete components, or components for which the manufacturer is intending to discontinue manufacture. The Contractor shall make reasonable efforts to verify this requirement with each sub-supplier/manufacturer.
- (xxviii) ERTS 19.57.1: Microprocessor-based components, assemblies, and power supplies shall be provided with voltage/current regulation and protection to ensure proper operation.
- (xxix) ERTS 19.57.2: All interfacing wiring shall be protected against interference from other on-car or wayside electrical radiation.
- (xxx) ERTS 19.57.3: The microprocessor shall be of a family shown to be suitable for the rugged environmental conditions encountered in rail applications, and shall be supported by software development language and diagnostic programs which are acceptable to BEML/CMRL.
- (xxxi) ERTS 19.57.4: The microprocessor assembly shall be housed in an enclosure that

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shields the microprocessor assembly and the surrounding circuits from EMI radiation and interference. Incoming and outgoing cables shall be shielded.

(xxxii) ERTS 19.57.5: All integrated circuits shall be screened for defects. The Contractor shall submit for approval screening methods based on a minimum of a 24-hour burn-in for the completed assembly.

(xxxiii) ERTS 19.57.6: The burn-in shall be performed with the equipment operational and with all input signals and loads (output signals) connected to simulate normal operating and power dissipating conditions within the devices and system.

(xxxiv) ERTS 19.57.7: The microprocessor shall have external buffers provided and shall be protected from external voltage and current transients and EMI.

(xxxv) ERTS 19.57.8: The Contractor shall not utilize obsolete components, or components for which the manufacturer is intending to discontinue manufacture. The Contractor shall make reasonable efforts to verify this requirement with each sub-supplier or manufacturer.

(xxxvi) ERTS 19.57.10: Microprocessor systems shall incorporate self-test and diagnostic facilities to locate and indicate faults within the system. The system shall have sufficient built-in diagnostic capabilities to automatically identify all system faults.

(xxxvii) ERTS 19.57.11: Faults occurring during system operation shall be logged, the information being stored in a non-volatile memory. LED's shall be used to indicate faulty modules, to allow rapid fault diagnosis and maintenance.

(xxxviii) ERTS 19.57.12: Microprocessor system hardware block diagrams shall be provided.

7.6 Deliverables

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

i. Preliminary Design Review (PDR)

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

a) Conceptual Design of Lighting System.


ii. Pre-Final Design Review (PFDR)

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

a) Technical description of Lighting System

b) Drawings of all aggregates of Lighting System.

c) Electrical Specification of Lighting System

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d) TCMS interface specification of Lighting System

iii. Final Design Review (FDR).

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

- a) Product level Test Specification of Lighting System
- b) Factory level Test Specification of Lighting System
- c) Test Report of Lighting System
- d) Factory level Test report of Lighting System

Also, subcontractor shall submit the following deliverables as per ERTS Appendix H: Table 2 requirements;


Sl. No.	Reference	Description
1	[PDR-8-1]	Conceptual Design of Lighting System
2	[PFDR-8-1]	Technical Description & Drawing of Lighting System
3	[FDR-8-1]	Product level Test Specification of Lighting System
4	[FDR-8-2]	Factory level Test Specification of Lighting System
5	[RPT-8-1]	Test Report of Lighting System
6	[RPT-8-2]	Factory level Test report of Lighting System

7.7 Split of Responsibilities

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

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

Upon receipt of the review comments, the subcontractor shall resubmit the updated documents and drawings, if required these documents must be supported through other calculation /

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drawings document. Each re-submission shall be enclosed with response sheet format of response sheet will be advised by BEML during the design review process. For avoidance of doubt, in any case reply of subcontractor along with revised documents incorporating end-client request shall be submitted not later than 2 weeks.

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

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

7.8 Interface

The Lighting System has to be interfaced mechanically and electrically with different subsystems such as car structure, interior, exterior & cab equipment layout arrangement, interior panels, Vehicle Control Circuits, Communication system, TCMS, etc.,. The subcontractor must participate in the interface meeting/workshop in order to discuss and finalize the interface issues to the satisfaction of BEML/Engineer and shall be implemented in the system design.

7.8.1 Mechanical Interface


The location of the mounting points and the design of equipment installation comprising of the Lightings shall be defined by the Subcontractor and approved by BEML in order to avoid the mechanical interference with other equipment for the vehicle. Subcontractor shall be responsible for confirming the mounting method and providing all materials for mounting the Lightings as specified in the drawings.

BEML shall be responsible for defining the technical and the design constraints and the technical requirements. The Subcontractor shall be responsible for the optimum design of the Lightings, 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 Lightings design shall be submitted in a timely manner to BEML 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 labour 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 remainder of the warranty period.

The following is a brief of requirements for Mechanical Interface

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- 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 fitting frame & Size and distance dimension of fitting hole.
- Cooling & Clearance for ventilation
- Interface with interior facilities & train body
- Anti-vibration material such as rubber.


7.8.2 Electrical Interface

The subcontractor shall provide the interface specification between vehicle equipment. Time to time BEML will facilitate direct face to face meeting between other sub-supplier either at sub-contractors works, BEML works, and another sub-supplier works or at Employer place.

Subcontractor is responsible to resolve the interface issues to achieve the ERTS requirement.

The following is a brief of requirements for Electrical Interface

- Power requirements.
- Technical specification.
- Rated current, voltage characteristic and consumption.
- Cable specification (power, control and grounding).
- Connector (male and female) with pin and socket part no.
- Signal input/output list and interface specification.
- Connector/terminal arrangement
- Cable inlet/outlet diagram.(Size for cable gland of holes)
- Connector Working Procedure for Workmanship.

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

7.8.2.1 Interface Responsibilities

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

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

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

The Subcontractor shall be responsible for interface with TCMS and other sub-system.

7.9 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 BEML/CMRL.


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

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

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

The Design Phase will be undertaken in three stages:

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

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Sl. No	Description of Stage	Submission from subcontractor to BEML (From LOI / contract award)
1	Preliminary design completion including CMRL approval	2 weeks
2	Pre final design completion including CMRL approval	2 months
3	Final design completion including CMRL approval	4 months

The design details for the above 3 stages shall comply with the requirements of chapter 16.12 and 16.13 of ERTS.


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.

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


Also, the Subcontractor shall submit the design deliverable submission schedule for acceptance within following requested due date, and resubmit it whenever updated.

The Subcontractor shall submit, but not limit to, the following design deliverables in accordance with the required schedule:


Design Stage	Document/Deliverables	Submission date required (from LOI/ contract award)
Evaluation Stage	Compliance Matrix List (Clause by Clause)	Within 2 weeks after receiving PTS.
	General Technical Description of Proposed LIGHTING SYSTEM	
	Service/Delivery History of Proposed LIGHTING SYSTEM and other required documents/information	
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,	Within 2 weeks

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Design Stage	Document/Deliverables	Submission date required (from LOI/ contract award)
	- Configuration Management Plan	
	Schedule Plan for	Within 2 weeks.
	- Design Deliverables/Drawing submission	Shall update/ submit whenever any change happens.
	- Design, Validation, Test & Inspection and Manufacturing	
	Compliance certification to all required Standards of LIGHTING SYSTEM	Within 2 weeks
	Concept design drawings (Dimensional Installation Drawings: AutoCAD or CATIA file)	Within 1 month
	-General description	Within 2 weeks
	- Detailed Tech. Spec. & data of LIGHTING SYSTEM	
	- Details of LIGHTING SYSTEM construction	
	- Spec. & Life of Components for LIGHTING SYSTEM	
	- The details of Components for LIGHTING SYSTEM	
	Technical Description (incl. at least following information) : The detailed submission schedule of each item shall be submitted for approval according to required design stage.	
	Preliminary/Final Power Consumption	
	Constraint of Electric connection (if applicable)	
	Electrical Function description	
	Preliminary Design Drawings	Within 1 month

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Design Stage	Document/Deliverables	Submission date required (from LOI/ contract award)
PFDR	(Dimensional Assembly Drawing: AutoCAD or CATIA file)	
	Water-Tightness and Acoustic Improvement Method	Within 1 month
	Operating Instruction (if applicable)	Within 1 month
	Preliminary/Final 3D modeling data	Within 1 month
	Cleaning details & maintenance instruction of Equipment	Within 1 month
	Safety Analysis	Within 1 month
	Preliminary/Final Samples	Within 1 month
	Estimated/Measured Light Transmission and Solar Heat Transmission value of LIGHTING SYSTEM	Within 1 month
	Estimated/Measured Noise attenuation data	Within 1 month
	Estimated/Measured weight of all LIGHTING SYSTEM components	Within 1 month
	Material List/Spec. & Certification for Fire safety	Within 1 month
	Surface Finish Specification (Painting to TS 18.30, anodizing, etc.)	Within 1 month
	LIGHTING SYSTEM Strength Calculation & Energy consumption calculation with reports	Within 1 month
	Manufacturing tolerance of LIGHTING SYSTEM	Within 1 month
	Function Description	Within 1 month
	System block diagram (if applicable)	
	Caution Instruction for LIGHTING SYSTEM Installation	Within 1 month
	Replacement Instruction & Demonstration of LIGHTING SYSTEM	Within 1 month

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Design Stage	Document/Deliverables	Submission date required (from LOI/ contract award)
	Life expectancy of major parts and LRUs	Within 1 month
	Consumables List for LIGHTING SYSTEM	Within 1 month
	Preliminary Plan/schedule for Testing & Inspection	Within 1 month
	O&M Manual, IPC submission List	Within 1 month
	Preliminary list of spares, special tools and test equipment	Within 1 month
	List of equipment identification labels	If required
FDR	Final Design Drawings (Dimensional Sub-assembly drawings: AutoCAD or CATIA file)	Within 2 month
	The manufacturing details of all LIGHTING SYSTEM	Within 2 month
	-Compliance certificate to Standard applied for design, test & manufacture	Within 2 month
	Installation Instruction of all LIGHTING SYSTEM	Within 2 month
	Cleaning, storage and handling instruction of LIGHTING SYSTEM	Within 2 month
	Maintenance & Inspection Instructions	Within 2 month
	Detailed Test & Inspection Plan/Schedule	Within 2 month
	Type Test Procedure (incl. record sheet) & Report	Within 2 month
	Routine Test Procedure (incl. record sheet) & Report	Within 2 month
	FAI Procedure & Report	Within 2 month
	Type/Routine Test Procedure (incl. record sheet) & Report in Completed car	If required
	Commissioning Type Test Procedure & Report	If required
	Updated list of LRUs	Within 2 month
	Final List of Special Tools, Spare Parts, Test Equipment	Within 2 month

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Design Stage	Document/Deliverables	Submission date required (from LOI/ contract award)
	Draft & Final O/M manuals	Within 2 month
	Draft & Final IPC (Illustrated Parts Catalogue)	Within 2 month
	Training Manuals & Materials	Within 2 month
	Details of equipment identification labels	If required
	All relevant Operation & Maintenance Information and Training Manual for Special Tools and Test Equipment	Within 2 month
	As-built drawings & List	Within 2 month
All Stages	<p>Monthly Progress Report including followings at minimum (Sub-contractor shall use the attached template for Monthly progress report.)</p> <ul style="list-style-type: none"> - . Design Progress Report (Schedule & achieved Activity) - . All Design Deliverable Submission Plan/progress Status - . Estimated/Measured Weight - . Open Items List - . Master test plan and progress - . Waiver Request/Spec. Clarification Items - . Any information required by BEML 	Monthly
	Any other design data requested	During design stage

It is subcontractor's responsibility to provide sufficient support and information for obtaining No Objection Advice for design document pertaining to sub-supplier in accordance with ERTS. Failure to submit such deliverables in time by sub-supplier may attract Liquidated Damage as defined in GTC.

BEML will furnish the review comments about the submission to the subcontractor. The subcontractor shall meet with BEML to discuss the review comments. Should BEML deem the submission to be unacceptable, the subcontractor shall revise and re-submit the submission as soon as possible.

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7.10 O & M Manuals and Spare Parts Catalogues (ERTS 15)

Sub-system operating manuals shall provide detailed instructions for the operation of all equipment provided as part of the Works.

As per ERTS 15.10.4: The information contained within the various Sub-system operating manuals and technical descriptions by OEM's shall include, but not be limited to the following:

- General functional description of the equipment, other relevant or connected equipment and subsystems.
- Theory of operation of all elements complete with block diagrams/exploded diagrams.
- Detailed operating instructions.
- Illustrations depicting equipment locations and layouts together with appropriate nomenclature to facilitate identification of all controls and indications.
- Common fault handling procedures including recovery procedures where appropriate.
- Electrical schematic connections within the equipment and with the other equipment.
- Input – Output pin diagrams for the electronic equipment.
- Digital interface of each component with TCMS.
- Network interface of the equipment.
- Details of software protocols and firmware protocols utilized for the individual equipment.


As per ERTS 15.11.1: The Contractor shall provide the maintenance manuals for all equipment supplied as part of the Works. The Contractor shall provide maintenance manuals explaining the components description, maintenance requirements, failure rectification and trouble-shooting, software installation, trouble-shooting, over-hauling maintenance details of the complete system together with its component subsidiary systems and individual item of equipment. This shall show details of all the various systems and sub-systems from a maintenance and fault-finding standpoint, with particulars of operating parameters, tools for dismantling and testing, methods of assembly and disassembly, tolerances, repair techniques and all other information necessary to set up a repair and servicing program.

The maintenance manual shall also include Maintenance Work Instructions (MWIs) of all major systems and sub-systems of the train in detail. The MWIs shall include details of the required materials and consumables, general tools, special tools and facilities in tabular form.

The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment. The documentation of software shall be supplied after conditional acceptance (put in-to revenue service) of First train. The maintenance manual shall also include inspection/overhaul procedure and periodicity of various inspection / overhaul schedules in detail including the tools, special tools/plants, and facilities required. The manual shall be subject to review by CMRL.

The characteristics, ratings and any necessary operating and maintenance limits of the Equipment and Sub-systems shall be provided in O&M manuals. Any additional technical information which the Contractor intends to share to CMRL could also be mentioned in these O&M manuals.

A preliminary maintenance schedule specifying the frequency of inspections and the scope of work during such inspections, including facilities, manpower and down-time required shall be included within the O&M manuals.

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The Subcontractor shall provide the Operation/Maintenance Manuals and Spare Parts Catalogues of the Lighting System both in the hard 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:

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

Also, sub-contractor shall provide the compliance as per ERTS 15.8, 15.9, 15.10 & 15.11.

The Supplier shall submit the draft of all manuals to BEML for approval of CMRL/BEML. The final manuals shall be provided after duly incorporating the changes indicated. Failure to submit the deliverables in time by subcontractor may attract Liquidated damage as defined in GTC. Requirements of Operation Manual shall be designed as per UTO, Non-UTO and degraded modes of train operation.

7.11 Spares, Special Tools and Testing Equipment (ERTS chapter 15):

The Subcontractor shall hand over the One set of Special tools, Jigs, Measuring & testing equipment in accordance with the delivery schedule of BEML. The supplier shall maintain the Lighting system aggregates and supply of spares for at least 20 years from the last date of taking over of whole of Works.

As per ERTS 15.11.9: Equivalent manuals shall also be provided for all training equipment, special tools, software tools and test equipment, supplied under the Contract, to enable maintenance personnel to operate, maintain, calibrate, adjust, repair and overhaul such tools and equipment.


As per ERTS 15.11.10: The Contractor shall submit detailed instructions for daily maintenance check, periodical scheduled maintenance, periodical overhaul of Rolling Stock and all sub-systems / all equipment of Rolling Stock.

The detailed requirements are specified in ERTS 15.

7.11.1 Commissioning and DLP/DNP Spares

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

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

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liability period. During DLP warranty period OEM's has to maintain the DLP spares at Chennai Depot.

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

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

7.12 DLP(Defect liability period) / DNP (Defect Notification Period)

1. Refer General condition & ERTS related clauses of the tender.
2. Sub-contractor shall ensure minimum spare parts that he intends to make available during the installation, erection, commissioning and DNP/DLP/Warranty period.
3. The sub-contractor shall keep on site, throughout the installation, erection, commissioning and warranty period, stocks of spare parts, to enable rapid replacement of any item found to be defective or in any way in non-conformance with the specification.
4. Any modifications carried out during DLP/Warranty period, also to be implemented in spares supplied under this contract.

DLP/DNP details mentioned below,

The supplier shall remedy, at no extra cost to BEML, the defect or failure (fair wear and tear excluded) after any part of the work until the end of defect Liability Period.


The supplier shall be responsible for any defect attributable to defective design, material or workmanship during warranty period. The supplier will not be liable for damages caused BEML or any other third parties did not follow the written operation and maintenance instructions or did not use the metro trains in accordance with the technical documents.

The warranty of the sub-system for which outstanding works are to be completed by the supplier shall start only after completion of all outstanding works.

"Defects Liability Period" shall mean the defects liability period stated in the PO calculated from the date of taking over of whole of the scope of supplies and not any sub-section or part thereof. Provided that, if any part of the Scope of supplies or sub-systems or component of that part has been replaced, renewed or repaired, the "Defects Liability Period" in respect of that part or sub-system or components of that part shall start from the date of such replacement, renewal or repair has been completed to the satisfaction of BEML.

The supplier shall ensure implementation of all improvements/corrective actions against all technical issues reported (during Design, Manufacturing, Installation, Commissioning, Interface Testing, Operation & Maintenance etc.) in earlier projects/supplies of their sub-system and submit the compliance documents during design stage. The supplier shall certify the implementation of such engineering change proposals, before dispatch of items.

The supplier shall attend & close all snags, defects, deficiencies, punch points w.r.t.

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suppliers' sub-system reported by BEML/ CMRL in various stages of the project (at BEML Factory & CMRL Depot) promptly before ROD (revenue operation date) of Trains. The list of unattended pending issues (which does not affect the operation of train) along with action plan & timeline to attend/close the same shall be submitted by the supplier.

The supplier shall be required to investigate any design issues, interface issues, field failures (conveyed through NCRs, CMRL Inspection Notes, Minutes of meetings etc.) of supplied sub-system in detail & submit investigation report along with corrective action report to BEML in a time bound manner for obtaining CMRL's approval. Based on CMRL's approval, the supplier shall be required to implement the corrective action (viz. Hardware modification), without any additional cost, in all Trains during entire DLP/DNP.

The supplier shall not convey their recommendations on replacement of items/anything related with DLP/DNP process directly to CMRL without prior information to/consent of BEML. If the supplier recommends any spares/consumables/other items besides the items quoted to BEML during the PO/Design finalization stage, then the supplier should supply these items free of cost for entire DLP/DNP of all trains.

The supplier shall provide Training of their sub-system to BEML T&C personnel for familiarization of their sub-system in terms of testing, commissioning & comprehensive maintenance.

Submission of detailed hardware modification fleet replacement proposal based on detailed investigation to address the recurrence of the fault/improving the reliability of sub-system towards closure of CMRL Inspection Notes/MoM Points/Open Technical Issue/Punch points/Epidemic Failures etc.

Implementation of hardware modification/fleet replacement of component/complete unit/complete sub-system in all Trains as well as in supplied Spares. Monitoring of sub-system/Train's performance after implementation of hardware modification/fleet replacement.


Submission of OEM Maintenance Manuals, Maintenance Work Instructions, Maintenance Schedule [Specifying the frequency of various inspections/service checks synchronized with Master Maintenance Schedule of Train (As Per RAMs documents viz. Daily, 72 Hrs., A, B1, B4, B8, C1, C2,C3,C4 service checks,C5 Mid life refurbishment etc.), detailed scope of work during such inspections/service checks including facilities & manpower requirement, Down-time of Train etc.] of supplied sub-system. Finally, the frequency of various inspections/service checks shall be followed as per approved Train level "Operation & Maintenance Manual" and "Master Maintenance Schedule".

Handling obsolescence issues of supplied sub-system's component/sub-assembly/assembly/maintenance terminals/tools/ special tools/ spares/consumables or any item related with supplied sub-system during Life cycle of the supplied sub-system.

Failures of 3-Car Train sets caused by the failures of the individual equipment/ subsystems or any other defects shall only be treated as warranty failures. BEML decisions in this regard shall be final.

The final acceptance will not cancel the particular conditions specified in the contract, such as hidden defects, reliability requirements, life span, etc

After sale services

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During this period, the supplier will undertake the necessary repair works due to failure at his own risk and expense including spare parts and labour.

All the equipment and material necessary for testing, defects and repair in connection with warranty obligations will be provided by the supplier bearing all the connected expenses.

Spare parts for faulty components replaced shall be provided by the supplier and are not included in the stock of spare parts that will be provided for the regular maintenance purpose. In the other case a specific agreement between the BEML and the supplier shall be set up.

"After sale" service organization set up by the supplier during all the warranty period including any extension shall be described in term of permanent resident staff, with requisite qualification and experience. During the warranty period, the supplier shall be responsible free of charge for the detection and repair of defects and components replacements where the metro train does not conform to the Functional specification and performance requirements. Normal wears and tears are excluded from these defects.


The repair and or replacement of failed components and equipment and installation of repaired/replaced components/equipment shall be undertaken by the supplier free of charge at Site. The supplier shall bear 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 component or equipment as a consequence of failure analysis, the minimum period of warranty i.e 24 months shall recommence from the date when the modified part is commissioned into service and modification shall be carried out free of charge. In all such cases, warranty will be applicable on complete sub-assembly; even when only component has been modified/replaced/repared due to design change

All replacement and repairs under the warranty shall be carried out by the supplier promptly and to the complete satisfaction of BEML/CMRL on notification of the defect by the BEML so that no car is unfit for revenue service for more than 48 hours, which shall exclude time taken for withdrawal/ induction of trains from/to revenue services. In case any train remains out of revenue operation beyond specified duration above due to reasons attributable to supplier, BEML may at his sole discretion impose a penalty on the supplier, commensurate with the revenue and opportunity loss to the BEML/CMRL. Decision of BEML/CMRL shall be final and binding.

BEML will notify the supplier in writing of any defect together with a brief description thereof. Upon receipt of such notice, the supplier shall within a reasonable period of time and at his own costs remedy this defect. If within reasonable time, the supplier fails to full fill his obligations after a reasonable number of trials for repair (at least three trials), the BEML may fix by written notice a reasonable final time for completion of the supplier's obligations. In case the supplier fails to fulfil his obligations within such final time, BEML may himself undertake the necessary repairs works employ a third party to do so, always at the risk and expense of the Supplier.

Specific warranty in case of pattern/serial or Hidden defects

The aim of this chapter is to define specific warranty requirements for serial and hidden

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defects including modifications, parts and labour. Serial or Hidden defects will be covered by a specific warranty period over the general warranty period as defined above.

Serial or Hidden defect is defined as an identical failure on a part or components which occurs on at least 15 % of total identical part and components with the same function of the rolling stock fleet during the General Warranty period. The occurrence of serial defects is calculated with the personal computer-based Failure Reporting and Corrective Action (FRACAS) System in charge to demonstrate compliance with specified train and equipment reliability as required in Chapter 19 clause no 19.2.6 (iv) of the (Employer' s Requirements) - Technical Specification.

In the case of Serial or Hidden defects, the supplier shall investigate all the concerned parts and present a technical solution or modification including spare parts modification or replacement for all the metro train fleet including the metro trains no more covered by the General Warranty period. The Serial or Hidden defects shall be repaired by the supplier free of charge (modification, material and labour).

In the case of Serial or Hidden defect, a period of specific warranty of 24 months shall recommence from the date when the modified part is commissioned into service (including spare parts) and modification carried. In all such cases, specific warranty will be applicable on complete sub-assembly, even when only one component has been modified/replaced/repared due to design change.

"The warranty period of unit exchange, mandatory and overhauling spares, special tools, testing and diagnostic equipment, special jigs, fixtures and gauges, or any other item / equipment delivered shall be either 24 months from the date of acceptance or up to expiry of the defect liability period of trains, whichever is later. "

Supplier shall position the sufficient DLP/DNP spares at CMRL depots in three months advance of the train receipt at the depots. The list shall be submitted along with technical offer.


The DLP/DNP spares shall be proposed by the supplier based on MDBCF & LCC of each assembly/sub-assembly item (The minimum qty. shall be one number per depot) and upon approval of the same from BEML & CMRL, the same shall be positioned at Depot at least Three months before delivery of First Train-set. The spares shall be jointly reviewed/audited quarterly and qty/item shall be increased based on the failure pattern of items and recoument lead time.

The list of DLP/DNP spares will be reviewed on the actual MDBCF/Failure pattern of the items and the quantity/items shall be increased on the actual failure of the system.

The Contractor shall agree that if any identical defect or deficiency occurs on more than 10% (ten per cent) of the equipment or parts of the Train sets in any rolling period of 36 (thirty six) months commencing from the second year of Supply, such defect or deficiency shall be deemed to be an epidemic defect (the "Epidemic Defect") and the Contractor shall promptly take corrective actions for such Epidemic Defect under an epidemic defect warranty to be maintained by the Contractor for the Maintenance Period (the "Epidemic Defect Warranty").

The Vendor shall Pick up of the faulty items from CMRL Depot, sending (if required) to their Factory/OEM for investigation, repair, testing etc. & return to CMRL Depot along with final testing/quality clearance documents, in a time bound manner.

During entire DLP/DNP, the supplier shall be required to demonstrate the FRACAS, RAMS,

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LCC of their supplied sub-system. In case, the supplier is not able to achieve the desired targets (as approved during design stage of the sub-system), the supplier shall take all required actions to improve the FRACAS, RAMS, LCC and provide warranty support till the targets are demonstrated by the supplier. Also, all open technical issues shall be attended /closed by the supplier before closure of DLP/DNP. Any penalty imposed or payment deductions made by CMRL will have been borne by the supplier and deductible from the payments due to the supplier.

Any penalty imposed or payment deductions made by CMRL during entire DLP/DNP, for the reason attributable to the Supplier, on account of De-boarding, Trip delays, Trip Cancellation, Non-availability of Trains for service due to supplier's sub-system failures, improper workmanship, non-availability of required spares of supplier's sub-system or for any other reason whatsoever, such amount shall have been borne by the supplier and deductible from the payments due to the supplier.

7.13 Storage, Packing Crafting 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 CMRL, 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 CMRL as suitable for open storage. For detail information refers to ERTS 18.15.


7.14 Training

The subcontractor shall provide the training for CMRL's operating staff and maintenance staff. The training activities and works shall be approved by BEML.

The detailed requirements are specified in ERTS 15.12, 15.13, 15.14 & 15.15.

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

The Subcontractor shall propose the required days for the supplied equipment for Operation and Maintenance staffs.


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As per ERTS 15.15.5: The training for Maintenance staff should enable CMRL Inspectors and Staff to achieve the following broad objectives:

- Full understanding of all aspects of the system design and functions of all the equipment including proprietary and third-party equipment, software etc.
- Full understanding of all aspects of programmed maintenance and overhaul requirements of cars and equipment.
- Procedures to be followed for unscheduled maintenance and repair of cars / equipment.
- Identification of failed components and sub-systems in electronic equipment by use of special test equipment, as necessary.
- Maintenance Management Information System and documentation.
- Installation of software in all the components of train

Additionally, the Subcontractor shall be quoted on daily basis for the further training course for Employer's staffs.

- 1) The subcontractor shall submit CV of instructor and training material of proposed training at least 6 weeks in advance of actual training schedule.
- 2) Subcontractor shall depute the trainer(s) to the end user works/depots at Chennai and / or BEML's plant for based on the relevant duration of each training course.
- 3) The Subcontractor shall provide the training according to BEML's Training Plan for End user.
- 4) The Subcontractor shall provide, but not be limited to, training materials (Hard copies & Electronic files), tools and equipment.
- 5) In addition to the training material, subcontractor shall provide computer based inter-active tutorial module. These interactive tutorials modules may include animation, videos, flash programs, etc.
- 6) Repair service training should provide the explanation and practical experience about the technical competence and operation of the system for the trainees who are responsible for troubleshooting and repairs.
- 7) Subcontractor should provide training program about operating and maintaining all the system devices provided. Training should be provided enough so that the corporate personnel may practice and learn how to use the operation, interface with other devices and testers.
- 8) The program should also contain the theoretical background and practical experiences for troubleshooting, repairing procedure and preventive maintenance to the trainees,

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who should be provided with the training about personally operating the systems and using testers/maintenance devices in case failing to troubleshoot.

- 9) Sub-contractor shall also submit training evaluation module
- 10) The training material and the entire training program shall be approved by BEML.
- 11) Subcontractor shall propose necessary hours for each subject.
- 12) If End user or BEML request more training courses, subcontractor should provide them.
- 13) All expenses for trainings are to be borne by Subcontractor.

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

This section lists extensive requirements for the development and implementation of the training.

(a) Specifies include;

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

(b) Specific Objectives for operating and maintenance personnel;

- Proficiency in operation, inspections, maintenance, servicing, troubleshooting and repair of Lighting system to instruct and train other personnel
- Qualify individuals as Qualified Maintenance Person (QMP) or Qualified Person (QP)


i. Daily and periodic inspections

- Understand and effectively use the technical documents developed
- Select, order and stock replacement parts


(c) Course Categories

- Introduction and Familiarization
- Major systems and sub-systems
- Operation and fault isolation

i. Fault isolation via TCMS/Hardware switches

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- Servicing and maintenance
 - i. Detail maintenance and fault isolation via TCMS/Hardware switches
- Special tools and test equipment
- (d) Personnel by function
 - Maintenance
 - i. Field – daily inspections and running repairs
 - ii. Electrical
 - iii. Non-electrical
 - iv. Shop – periodic inspection and heavy repair
- (e) Classroom and hands-on
 - Sufficient time in both to do all diagnostics correct malfunction and use special tools
- (f) Instructor qualifications
 - Fluent in English
 - Experienced trainers
 - Adult education techniques
- (g) Lesson Plans to include:
 - Student prerequisites
 - Safety, fault isolation and inspections up to 5-year level
 - Time frames for each unit
 - List of training aids and other training technology
 - Set-up time and equipment lists for hands-on
 - Safety, protective equipment, hazards
 - Instructor preparation
 - Student preparation
 - Evaluations of students
 - Lesson summary
 - Student application of material
 - Student assignments
- (h) Training Aids and Standards (all training aids and lesson plans become the property of End-User)
 - Manuals, catalogs, OEM's
 - ii. Lighting system compatible format (no overhead projections)

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iii. Specifics – visual aids

- a) Component locations, cut-away, schematics, wiring diagrams
- b) Flow direction on hydraulic, pneumatic, air conditioning
- c) Maintenance schedules, diagnostic process diagrams, special tools usage, test equipment application
- d) Engineer approval electronic medium for review

iv. Mock-ups units for hands-on

- a) Nomenclature, operation, inspection, maintenance, troubleshooting repairs

v. Training aids list

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

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

(i) Classroom Instruction:

- Outlined in classroom and hands-on information
- Qualified instructors

(j) Field Instruction


- Instructor must be qualified
- All materials available and ready
- Access to cars per authority
- Participants must demonstrate competency

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

The subcontractor shall provide comprehensive training to the CMRL / BEML Employer's staff in operation, maintenance, and engineering, etc., of the Lighting system in accordance with the training activities and works.

The supplier shall provide according to requirement of BEML and CMRL training schedule, time, method and site etc.

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

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manuals shall cover all requirements specified in **ERTS 15.12** After completion of the training, training aids and materials used shall become the property of BEML to enable and further training to take place.

The below table shows the tentative training plan. However, it shall be finalized during design stage.

MILESTONE	Training	Man Days
RS-H4	ONSHORE – VCC (Lighting)	1 Man days
RS-H5	ONSHORE- MAINTENANCE & Troubleshooting Training	20 Man days

Tentative Training Plan

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

7.15 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

Apart from the above requirement, subcontractor has to attend the VC meetings regularly as scheduled by BEML for finalization of design.

- 2) Installation guide for first train: Depending on manufacturing schedule
- 3) Testing
 - Equipment Type / Routine test (at subcontractor's place)
 - Combination test with TCMS at any time whenever required
 - Factory Acceptance (Complete car) test: Full support depending on the test schedule
 - On-Site (Depot at Chennai & Mainline) Test: Full support depending on the test schedule
 - Subcontractor shall provide additional days to resolve faults and defects of Lighting sy

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stem.

- 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.

7.16 Comprehensive Maintenance Contract period

On Train maintenance is under BEML scope and OEM is required for special support which needs some technical review and discussion.

However Test Benches to be provided for Lighting system for maintenance activity with Special Tools, Jigs, Fixtures, Gauges, Testing and Diagnostic Equipment, Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools and any other items required for all types of maintenance activities carried out on Rolling Stock for Lighting system as per ERTS Part- 2: Section VI C, CMC -RS & DMP.

"All types of LED Spares" and "Tools" with Consumables need to be supplied along with Test Benches.


7.17 Spares required during Comprehensive Maintenance Contract(CMC) period

List of Mandatory Spares required during CMC period to be supplied by the sub-contractor as per **Annexure-A**

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

8. Warranty

1. Refer General Conditions & ERTS chapter 18 and related clauses of the tender.
2. Sub-contractor shall ensure minimum spare parts that he intends to make available during the installation, erection, commissioning and warranty period.
3. The sub-contractor shall keep on site, throughout the installation, erection, commissioning and warranty period, stocks of spare parts, to enable rapid replacement of any item found to be defective or in any way in nonconformance with the specification.

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9 General Requirements

9.1 Weight

The subcontractor shall submit estimated weights and center of gravity of all lights aggregates and be approved by BEML. The actual weights must not deviate by $\pm 4\%$ of the estimated weights.

9.2 Electrical Requirement

- a) Load current for minimum switching of each switch, relay and contactor to sub-system should be over 10mA.
- b) Scope of mating connector assy.
 - Mating connector such as plug or receptacle including accessories (pin / socket / clamp / back shell) should be supplied for train side connectors.
 - All the part number of connector assy. should be listed in the bill of material
 - Connector pin or socket crimp size should match with train side cable conductor size. And electrical capacity should be considered and selected under responsibility of sub-system supplier.
 - Unless otherwise mentioned, each control line and communication/signal line of train side is 1.5 sq. mm. cable conductor size. However, power cable will depend on system's load capacity.
 - Contact material of connector shall be gold-plated.
- c) Scope of wire/cable.
 - Any other special cable for connection of Lighting system than regular cables supplied by car builder shall be supplied by subcontractor.
 - If the subcontractor supplies its product as a "harness system", the same has to be informed and supplied drawings need to clearly indicate it.
 - The cable markers provided shall be fire retardant heat shrinkable type. The cable markers shall be protected against fading by providing Fire retardant heat shrinkable clear sleeve.
- d) Surge Suppressor
- e) All relays, contactors and magnet valves such as inductive loads should have suppressor to be protected by arc. The kind of suppressor can be used with varistor, diode or others.
- f) Subsystem should have an obligation to inform the rating/inrush current and time constant to train side regarding each load when requested.
- g) Circuit breaker installed on train side is for circuit wiring. If system needs a sensitive circuit protection such as fuse or others, it is restricted to install into their own system.
- h) All the workmanship guides to ensure the subcontractor's system functionality associated with shielding method, connector crimping, protection methods against electrical interference should be supplied to car builder in order to get a proper application when requested.
- i) Except for electronic equipment, all cable termination shall be of the crimped type in accordance with BS 4579: Part 1: 1988, Compression joints in copper conductors, or other service proven type. Soldered connections will not be accepted.
- j) Variable resistors shall be avoided wherever possible.
- k) The requirement of Microprocessors based system requirement; Equipment shall be met as per ERTS 19.57.
- l) The requirement of PCB and connectors shall be met as per ERTS 19.55.

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- m) All electrical circuits shall be fully insulated from the superstructure on both the positive and negative sides and the super-structure shall not be used as any portion of an earth return circuit as per ERTS 19.51.20.
- n) The subcontractor shall meet the requirements of ERTS Chapter 19: Material and Workmanship although other requirements are not described here in PTS.

9.3 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. Also, subcontractor shall meet the requirements of ERTS Chapter 19.25.

9.4 Label Requirements

- a) All items shall be labeled in English with the maker's name and type and form of the piece or item, discrete serial number and rating data and the date of manufacture of the particular piece of equipment. It is desirable that the labels used for different equipment / subsystems / systems on the train are of standard pattern.
- b) The labels shall be clearly stamped, cast or engraved and securely attached to the equipment. Where appropriate equipment shall be labeled with warnings of high temperature and electric shock risk. The subcontractor shall meet the requirements of ERTS Chapter 16.11.7.

9.5 Product breakdown structure


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

Breakdown of the material used in each component include:

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

9.6 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 and commissioning, and setting to work, shall be clearly defined.

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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 organizations 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.
- The subcontractor shall nominate a suitably qualified and experienced English-speaking engineer from his staff to be Project Manager. The proposed Project Manager shall have total experience of minimum 15 years and shall have been the Project Head in at least one Rolling Stock Project in last 10 years. The proposed project Manager shall be the employee of the subcontractor. The CV of the Project manager shall be submitted along with the technical offer.
- To fulfill the subcontractor's obligations during the Testing and Commissioning and the Defect Liability Period, the subcontractor shall nominate experienced maintenance engineers and organize deployment before undertaking testing and commissioning in depots at Chennai. Separate maintenance engineer shall be positioned in each depot.
- The subcontractor shall submit relevant CVs of the Design Manager, Production Manager, Quality Manager, Interface Manager and Maintenance Engineer in addition to the Project manager in the technical offer.

9.7 RAMS requirements


The sub-contractor shall meet RAMS (Reliability, Availability, Maintainability and Safety) requirements given in the ERTS 18.4, 18.5 & 18.6. Also, the sub-contractor should provide all information related to the RAMS requirements as per EN50126.

9.7.1 Reliability Analysis

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

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

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

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

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

9.7.2 Reliability Target

The MDBCf (Mean Distance Between Component Failure) per 3 car train-set shall be as follows:

System / Equipment	MDBCf target (Equip-km)	Failure Rate (1/MDBCf)
Lighting System	8,000,000	1.25E-07

The reliability performance shall be assessed by the following measure:

$$MDBCf = \frac{\sum \text{Travelled kilometer per train set}}{\sum \text{Number of Service Failures}}$$


Were,

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

Type 1 / Service Failure: As per ERTS 18.6.4.1 (a): Any Failures that result in service operational delay in the specific train for more than 2 minutes at any location of the mainline or during induction from depot/mainline in the CMRL Phase 2 Network. These failures also include the list of scenarios for which the train shall be withdrawn from revenue service (refer Appendix I). Unscheduled removal of train from revenue service, prevention of scheduled entry of a train into service due to a failure at starting from depot / mainline shall also be included in this category.

The train withdrawal scenarios are described in Appendix I. It includes possible anticipated failure scenarios which can affect safety, punctuality and passenger comfort. This list shall be further developed during DNP/ DLP. It is clarified that when such failures occur, the incident will not be categorised as a Type-1 / Service Failure if the train had continued running until the end of service without affecting punctuality.

Type 2 / Relevant Failure: As per ERTS 18.6.4.1 (b): A relevant failure of an item is an independent failure which results in a loss of function of that item caused by a fault in an equipment / sub-system

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of the train while operating within its design and environmental specification limits or a maintenance error made by the Contractor in undertaking its obligations during DLP/DNP period. Improper operation, maintenance, or testing of the item as a result of the Contractor supplied documentation or Failures of transient nature including those with post investigation status as 'No fault found', shall be considered as relevant failure if in the opinion of BEML/CMRL these are attributable to rolling stock. The decision of BEML/CMRL shall be final. The reliability data for extension of sub-system level DLP/DNP extension will be based on the targets set by the Contractor as in Clause 18.6.

As per ERTS 18.6.4.2: Any above Type 1 / Service Failure of failure occurring in any part of the train shall be considered as train failure.

The sub-contractor shall submit list of typical train withdrawal scenarios for review and acceptance by the BEML. The list shall include all anticipated failure scenarios, which can affect safety, punctuality and passenger comfort.

9.7.3 Availability Requirements

Availability Requirements shall be assessed by the following measure


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

Total Time Where:

- (i) Total Time is the time in hours in the assessment period multiplied by the number of trains commissioned under this Contract.
- (ii) DT(SC) Down Time due to Service Checks, is the total down time in hours due to service checks summed over all the trains during the assessment period.
- (iii) DT(OPM) Down Time due to Other Preventive Maintenance, is the total down time in hours due to Preventive Maintenance other than service checks, summed over all sessions carried out on all trains during the assessment period.
- (iv) DT(CM) Down Time due to Corrective Maintenance, is the total down time in hours due to corrective maintenance, summed over all sessions carried out on the trains in revenue operation during the assessment period. Any unreasonable delay in handing-over the train for repairs for reasons not attributable to the Contractor shall be excluded. Time spent on train integrity inspections after train reformations arising from corrective maintenance work shall be included.
- (v) DT(CM) shall be counted starting from the moment when the defective train is handed over to the Contractor, and shall end when the train is restored to service condition.
- (vi) The down times DT(SC), DT(OPM) & DT(CM) shall also cover the full content of the maintenance work concerned, including safety precautions, inspections, servicing, replacement of equipment, defect detection and rectification, testing and restoration to service condition.

9.7.3.1 Availability Targets

The trains supplied shall achieve minimum average availability of 95.0% for fleet of trains for the assessment durations mentioned below.

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9.7.4 Maintainability Requirements


9.7.4.1 Design criteria

- (i) Systematic fault isolation procedures shall be developed for inclusion in maintenance manuals.
- (ii) Built-in test points shall be provided and marked.
- (iii) Failure indicators should be provided and identified. Color-keyed indicators shall be used wherever possible.
- (iv) All test points, fault indicators, modules, wire junctions, pipes, tubes, and wires shall be identified by name plates, color coding, number coding, or other means.
- (v) Components shall be placed in equipment cabinets, enclosures, or confined places so that the most accessible positions are given to those items requiring the most frequent maintenance or adjustment.
- (vi) Standard, commercially available industrial components and hardware shall be used wherever possible.
- (vii) Captive fasteners shall be used on covers and access panels.
- (viii) Access to structural components shall be provided to the greatest extent practicable to enable inspection for cracks and corrosion.
- (ix) Major components shall be designed for ease of removal.
- (x) Means shall be provided to verify the operability of redundant or parallel hardware components and associated switching devices during maintenance, troubleshooting, and testing.

The sub-contractor shall also comply with the maintenance requirement of ERTS 18.7.4.

1.1.1.1. Maintenance Interval

Session	Interval (Minimum)	Manpower and downtime requirements (Maximum)	
		Downtime	Expected staff
A Service Check	15 days or 6,250km	2.5 hours	8 persons per train
B1 Service Check	45 days or 18,750km	10 hours	8 persons per train
B4 Service Check	180 days or 75,000km	20.5 hours	8 persons per train
B8 Service Check	360 days or 150,000 km	47.5 hours	8 persons per train
C1 Intermediate Overhaul1	Minimum 4 years+ or 600,000km+	5.5 days	4 persons per car
C2 Periodic Overhaul1	Minimum 8 years+ or 1200,000 km+	11.5 days	4 persons per car
C3 Intermediate Overhaul2	Minimum 12 years+ or 1800,000km+		
C4 Periodic Overhaul2	Minimum 16 years+ or 2400,000 km+		
C5 Mid-life refurbishment	Minimum 18 years+ or 2700,000km+		

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Session	Interval (Minimum)	Manpower and downtime requirements (Maximum)	
		Downtime	Expected staff
Corrective Maintenance operations that do not require car lifting	-	4 hours	-
Corrective Maintenance operations that require car lifting, excluding time required for shunting	-	6 hours	-

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

Component Change-Out Requirements:

The Lighting system aggregates/Equipment shall meet the following table, the Contractor shall design the car such that the component changeout requirements listed in below table can be met. The person-hours are based on fully trained maintenance personnel using standard tools and test equipment.

Item	Maximum Person-Hours
Saloon light (each)	0.25


In addition, the Sub Contractor shall demonstrate that Lighting Mean Time to Restore (MTTR) that does not exceed 1.5 hours, with a maximum maintenance repair time of 3 hours, is achievable for at least 95% of all failures using the diagnostic tools and procedures provided by the Sub Contractor.

9.7.5 Life Cycle Costs

The Subcontractor shall comply with ERTS clause for the life cycle cost. The Subcontractor shall develop a life cycle cost plan in accordance with IEC 60300-3-3 with an aim to minimize the overall life cycle cost whilst meeting the safety, quality and reliability requirement of this particular specification. This plan shall be submitted during the PDR stage for approval by BEML/GC-CMRL.

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

The LCC shall include the capital cost, cost of operation (including energy consumption), maintenance (both material and labor), depreciation, refurbishment, inflation etc. Per unit energy consumption cost may be considered as INR 8.50.

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Subcontractor shall provide the year-by-year maintenance cost per Lighting system per trainset, shall be submitted along with technical offer. This shall include complete list of Bill of materials (BOM), components failure rate, replacement intervals, material cost, labour cost (including for preventive maintenance and, corrective maintenance and overhaul maintenance).

9.7.6 Reliability and Maintainability Demonstrations

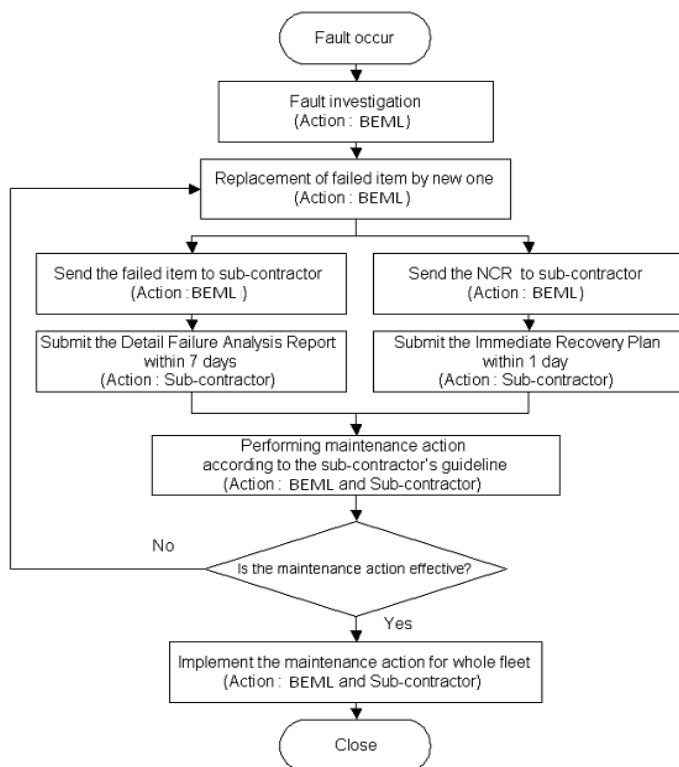



Figure: Maintenance Procedure of BEML

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

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

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

The sub-contractor also has to comply the ERTS clause 18.6.5 & 18.7.7.3.

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9.7.7 Safety Requirements

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

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

- 1) System assurance plan as per Clause-18.3 of ERTS.
- 2) Hazard Analysis including preliminary hazard analysis, sub-system Hazard Analysis, operating and support hazard Analysis and interface hazard analysis as per clause 18.5.4 of ERTS.
- 3) FMECA (Failure Mode, Effects and Criticality Analysis)
- 4) Fault Tree Analysis (FTA) for Safety Critical Events

The subcontractor shall fully compliance with the System Assurance given in the ERTS Chapter 18.

9.7.8 RAMS Deliverables

The subcontractor shall submit the following RAMS Deliverables.


- 1) FMECA
- 2) List of LRU
- 3) RAM Analysis (MDBCf, MDBCf & MTTR)
- 4) Maintenance Schedule (CM, PM & OH)
- 5) Reliability Block Diagram (RBD)
- 6) Hazard Analysis
- 7) Subsystem Hazard Analysis (SSHA)
- 8) Interface Hazard Analysis (IHA)
- 9) Operating Hazard Analysis (OHA)
- 10) Fault Tree Analysis
- 11) Safety Analysis
- 12) Life Cycle Cost (CM, PM & OH)

9.8 Software requirement

The Subcontractor shall provide the requirements of the specification with respect to the production and verification and validation of software as per ERTS 20.

9.8.1 General requirement

9.8.1.1 The Subcontractor shall provide, as a minimum, the following:

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- i. Systems containing software: Indicating the principles for identification of the systems including software,
- ii. Software breakdown: Indicating the principles that shall follow the hierarchical decomposition of the software,
- iii. Software Development Status: Indicating whether the software is New, Modified or Proprietary,
- iv. Software Safety Integrity Level: Indicating from 0 to 4, whether the software is "Non-Safety-Related" to "Very High",
- v. Software quality assurance: Indicating the link with ISO 9001 and ISO 9000-3,
- vi. Software lifecycles: Mandating the concept of double V-cycle,
- vii. Software documentation: Setting the classification between development documentation and safety documentation.


All this is detailed in the ERTS chapter 20.4.

9.8.1.2 All software to be developed or modified (re-engineered software) shall follow the standardization requirements of EN 50128 or latest version (Railway Applications: Software of Railway Control and Protection Systems). The subcontractor shall define within the Software Quality Assurance Plan what techniques and measures are to be applied for software development. The Plan shall require the subcontractor to provide all changes, bug fixes, up-dates, modifications, amendments and new versions of the programmers, as required by the Engineer. Engineer may also direct to provide the copy of previous version of software till such time the new version of software is proven.

9.8.1.3 The subcontractor shall, within 25 days of the commencement date, Notice to Proceed, submit a Software Quality Assurance Plan for review by BEML.

9.8.1.4 Subcontractor shall provide the properties and all requested material for BEML's software quality & safety audit to Subcontractor. Corrective action against NCR and OBS should be returned to BEML within one week after software audit. And also, Implementation of corrective actions against to Identified NCR (Nonconformance Report) and OBS (Observations) should be finalized within one-month after software audit. BEML will not pay the amount of money for software development without the completion of the identified NCR and OBS.

9.8.1.5 The Subcontractor shall be obliged to take care of any software change if BEML and CMRL request the change for the correction of software during commissioning phase, commissioning and Warranty Period, etc. The change shall be implemented by the Subcontractor. In the event, when any non-conformity arises to the specified requirements, the Subcontractor shall take remedial measures at its own cost within the schedule to be agreed with BEML. The Subcontractor shall provide all tools, Laptop computers or any special device to upload /download the software, equipment, manuals and training necessary for the Project Owner, Employer and

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Engineer to maintain and re-configure all software provided under this Contract. The documentation of software shall be supplied after the expiry of the warranty period.

9.8.1.6 The Subcontractor shall be obliged to abide by the software change control procedure in order to enhance the regulation of software change in train-set. It should be not allowed to upload the changed software into train-set without the approval by BEML/ CMRL under software change control by BEML. Subcontractor has to supply test report of system integration testing or bench testing of the updated software performed subcontractor's premises before formal release of the updated software. The required documentation for approval on software change will be defined in the later stage. At the minimum, Problem Report, Engineering Change Proposal (ECP), Software Release Certification, Software Regression Testing Procedure/Report, internal testing report, and updated software documents etc. It will be incumbent upon the Subcontractor to take responsibility for any changes required to software.


9.8.1.7 As a minimum, the following software documentation shall be furnished.

- i. Detailed Work Schedule
- ii. Product Breakdown Structure
- iii. Software Documentation Submission Schedule
- iv. Review Programme
- v. Traceability Matrix
- vi. Software Development Plans
- vii. Software Specifications
- viii. Software Verification Plan
- ix. Software Verification Report
- x. Software Validation Plan
- xi. Software Test Specifications
- xii. Software Test Reports
- xiii. Software Validation Report
- xiv. Safety Cases
- xv. Supporting Documentation
- xvi. Software Quality Assurance Plan

9.8.1.8 The subcontractor shall provide with the detailed Software Quality Assurance Management Plan.

9.8.2 Software Update:

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

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The subcontractor shall provide necessary support to resolve all pending or new interface related issues arising during the operation of the trains till completion of Defect Liability Period (DLP/DNP) which are expected throughout the project execution stage and shall extend up to few months after commencement of UTO operation based on operational requirements.

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

Materials used in the cars shall meet the Flammability, Smoke Emission and Toxicity requirements of the specification EN 45545 part 1 to 7 (Hazard level HL3) latest editions or equivalent standard as per ERTS 2.26.


1. The cables used for Lighting System comply the requirement of EN 50200.
2. ERTS 19.36.13: Fire resistant cables shall be proposed for circuits, which should survive for long periods during fire, as per applicable international standards. As a minimum, the cables and wires for Public Address System, emergency lighting, door opening and warning systems shall be fire resistant in compliant to EN 50200 PH15 & EN 50200 PH90.
1. ERTS 14.1.11: The cables which are intended to be used in emergency circuit for alarms and communication shall have intrinsic fire-resistant property in compliance with EN 50200 for PH90 and EN 50289.
2. Fire resistant cables which should survive for long periods during fire and compliant to EN 50200 shall be ensured for complete Lighting system.

9.9.1 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.

9.9.2 Fire Performance Deliverables

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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

9.10 EMC Requirement

9.10.1 General Requirements

The subcontractor shall meet all EMC requirements specified in the ERTS 2.2.29, ERTS 2.18 and ERTS 10.19 where applicable and shall work together with BEML to assure that all electronic and electrical equipment on the rolling stock works properly without any interference.


9.10.2 Electro-Magnetic Compatibility performances (EMI & EMC)

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

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

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

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

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

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

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

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

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

9.10.3 EMC Control Plan

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


9.10.4 EMC Laboratory Tests

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

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

9.11 Maintenance Requirement

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

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

9.12 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.

As per ERTS 18.8.1.3: The Quality Assurance Program shall include an Inspection and Test Plan that provides a narrative description of the manufacturing, inspection, and testing processes and a schedule showing major manufacturing and inspection milestones.

The Inspection and Test Plan shall also include a rectifying feedback system that provides information to the Contractor's or subcontractor's engineering, industrial and production groups. The plan shall be updated as milestone dates or other significant items change. CMRL's quality representative will use the Inspection and Test Plan to identify the Contractor's inspection, witness, test, and hold points.


As per ERTS 18.8.1.4: The Quality Assurance Program shall include a system of Configuration Control and Software Management and Verification. The Contractor shall establish and implement measures to ensure that engineering procedures are well defined and designs are controlled, prepared, verified, issued, and revised in accordance with the requirements of the Quality Assurance Program. The Contractor's QA staff shall verify that each component, assembly and car is manufactured and tested in accordance with the approved drawings, procedures, software, and documentation.

As per ERTS 18.8.1.5: The Quality Assurance Program shall include a system and procedure to ensure that all measuring and test equipment is calibrated, adjusted, and maintained at prescribed intervals against certified equipment, to adhere to national or international standards

9.12.1 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 ERTS 18.8. 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

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The subcontractor shall provide with the detailed Quality Assurance Plan.

9.12.2 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 ERTS 18.8.

- 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.

9.12.3 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.

9.13 Inspection and Test Plan (ITP)

ITP shall be submitted to BEML QC team for review and approval as following no later than 30 days after purchase order by BEML. Subcontractor shall comply with ERTS 18.8 & 18.9.

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.

10 Testing

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10.1 General

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

10.1.1 Inspection Hold Points

The subcontractor shall propose a set of inspection hold points in the Inspection, Testing and Commissioning Plan in accordance with the requirements specified in ERTS 17.9 & ERTS 18.9.

10.2 First Article Inspection

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All the materials, fittings, equipment, manufacturing processes, and assembly workmanship shall be subject to inspection by BEML and CMRL, wherever carried out in accordance with the requirements specified in ERTS 18.9.

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

10.3 Test Procedure

Each Test procedure shall include all information necessary to ensure the successful, accurate and safe performance of the described test as stipulated in ERTS 17.3. At a minimum, each test procedure shall include:

- 1) Test objectives, which, as a minimum, will reference the Technical Provisions and the design parameters.
- 2) Scope.
- 3) Prerequisite tests and follow-up activities, indicating testing that should be completed successfully before, and testing that should be completed after, the tests described in the test procedures.
- 4) Equipment, instrumentation and measurement tools required.
- 5) Test setup, including sketches and drawings indicating the proper equipment setup.
- 6) Instructions to ensure that the equipment is calibrated and in good working order.
- 7) Test methodology.
- 8) Operational monitoring requirements.
- 9) Pass-fail criteria for each item in the methodology.
- 10) Provisions for re-testing.
- 11) Means for updating test procedures with proper revision details.
- 12) Means for collecting test data and for formatting and representing results.
- 13) Proper approvals by the test procedure author, validation and test experts.
- 14) Provision for signature of Cognizant engineer, QA engineer, test engineer, and safety officer (if safety-related).
- 15) References to ERTS clauses.
- 16) Organization/entity and person(s) conducting the test.
- 17) Safety Precautions.
- 18) Identification of the specification section(s) that are verified by the test.
- 19) Test equipment required (by model number, make) and latest calibration information.

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20) Other personnel required.

21) Any special conditions required, including condition of the equipment under test.

22) Reference drawings, schematics, or documents.

23) Clearly understood step-by-step instructions for performing the test, test equipment set-up.

24) Data sheets to record test results, including confirmation of test equipment certification.

25) Raw data correlation procedures.


26) 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.

10.4 Test Reports

- 1) All test reports of the component, system, factory and field acceptance test for Lighting system shall be prepared by the Subcontractor and they shall be submitted to BEML. The Test reports shall include, but not be limited to, the followings:
 - (a) Test procedure with cross-reference to the specification requirements satisfied.
 - (b) Summary of results indicating, as a minimum, that the test was successful.
 - (c) Statement of whether criteria were met.
 - (d) Description of failures and corrective action.
 - (e) Analysis.
 - (f) Listing of all serialized components.
 - (g) Raw test data sheets.
 - (h) Copies of inspection records.
 - (i) Identification of personnel conducting and witnessing the testing.
 - (j) Proper approvals by the author, cognizant engineer, test engineer, and safety officer (if safety related).
 - (k) Observations of the CMRL.
 - (l) Action taken report for the CMRL's observations.
 - (m) Pictures conducted during testing.
 - (n) Details of previous test references and proper version numbers.

10.5 Sequence of Tests

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

10.6 Routine and type tests of equipment and sub-systems

The Lighting System shall comply with the requirements of ERTS 17.

10.6.1 Equipment Type and Routine Test

The test plan and test procedures shall be submitted according to approved test schedule.


The Subcontractor shall notice BEML for the request of witness at least 1 month prior to the commencement of testing. Prior to the notification of test witness, the test procedure shall be approved. The Subcontractor shall conform to all requirements pertinent to Lightings in Relevant to TS Chapter and ERTS 17 requirements.

Test items, applied standards and its procedures can be changed or added due to Employer's request. In case of test item addition, subcontractor shall carry out the additional test with no additional cost.

This test is required to verify that the Lighting system operate in accordance with the Approved Design Data and Subcontractor has responsibility for the type & routine test of the component.


The test for lighting system shall include, but not be limited to, the followings:

Sl. No.	Test Item	Type	Routine	Requirement
1	Visual & Dimensional Inspection (Incl. weight)	O	O	Approved standard/spec. Test Any optical distortion is not allowed.
2	Insulation Resistance Test	O	O	Approved standard/spec. Test
3	Cooling test	O	-	Approved standard/spec. Test
4	Insulation resistance and Dielectric Test	O	O	Approved standard/spec. Test
5	Shock & Vibration Test	O	-	IEC 61373

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6	General Starting Test	O	O	IEC 925
7	Low Temperature Test	O	-	Approved standard/spec. Test
8	Characteristic Test	O	O	Approved standard/spec. Test
9	Temperature Test 1) Dry Heat Test 2) Salt mist Test	O	-	Approved standard & TS 19.54.3 Test
10	Abnormality of Heat Resistance Test	O	-	Approved standard/spec. Test
11	Life Time Test	O	-	Approved standard/spec. Test
12	Supply variation Test	O	O	Approved standard/spec. Test
13	Supply interruption Test	O	-	Approved standard/spec. Test
14	Earth continuity Test	O	O	Approved standard/spec. Test
15	Surges, electrostatic discharges (ESD) & Transient burst susceptibility Tests	O	-	Approved standard/spec. Test
16	Radio Interference tests	O	-	Approved standard/spec Test
17	Salt mist test	O	-	Approved standard/spec Test
18	IP Test	O	-	Approved standard/spec Test
19	Fire Performance Test	O	-	Refer to ERTS clause 2.26.
20	Other required tests	O	O	Approved standard/spec. according to customer's requests Test
21	EMI/EMC	O	-	EN 50121-3-2, EN 55011, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-9, IEC 61000-4-10, IEC 61000-4-11, IEC 61000-4-12.

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

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ved drawing.

- ※ Type tests for certain equipment may be waived if these were carried out earlier on equipment of identical design, same Manufacturing Plant, witnessed by a reputed organization, and the service performance of such equipment was found to be reliable. The sub-contractor shall submit a proposal in this regard to BEML for review. The waiver of Type Test is entirely at the discretion of the BEML's Engineer and CMRL. Change of manufacturing place may require re-type test. Incase waiver of certain type test is accepted by BEML's Engineer or CMRL, sub-supplier must carry out type test in accordance with approved test plan.
- ※ Above lists are indicative and sub-supplier shall be responsible to carry out any additional test required by client within the scope of ERTS without any commercial implications.
- ※ Separately from any other test stipulated in PTS, all the electronic devices with PBA (PCB Ass embling) shall be subjected to Environmental Aging test (Temperature cycling test) according to burn-in test procedure by means of followings.
 - First article: 20 cycles (1 cycle: 25°C, 1h ---- - 40°C, 0.5h ---- 85°C, 0.5h)
 - Mass production: 2 cycles (1 cycle: - 40°C, 0.5h ---- 85°C, 0.5h)
 - * Temperature rising/falling speed: 5 ~ 10°C/ min

10.6.2 Static Commissioning Test (Accordance with IEC 61133)

10.6.2.1 Type commissioning Test, Complete Car, Unit and Train Tests

The Type commissioning Test for the Lightings at the vehicle level shall be performed, with all necessary test equipment prepared by the subcontractor, at BEML by the subcontractor or at Depot/Mainline in CMRL premises. And the test shall be conducted in accordance with a test procedure to be prepared by the subcontractor and approved by BEML under BEML and/or End User participation.


The subcontractor shall submit the type commissioning test details for Lightings of complete vehicle and be responsible for correcting any defects.

Failure to achieve the successful vehicle level performance type test by sub-supplier may attract Liquidated Damage as defined in GTC.

10.6.2.2 Routine commissioning Test, Complete Car, Unit and Train Tests

The Routine Test at the vehicle level shall be performed at BEML Factory in Bangalore or CMRL Depot/Mainline in Chennai on the basis of information and with the necessary test equipment offered from subcontractor, by BEML under subcontractor's assistance for the Lightings. The subcontractor shall be responsible for correcting any defects.

These tests will be a subset of those tests performed at Type Test, complete vehicle to

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demonstrate that the principal features of the Lightings are compliant with ERTS.

10.6.3 Running Test on Main Line Track

The Running Test on Mainline Track for the Lightings of first train set at the vehicle level shall be performed by the subcontractor, with necessary test equipment prepared by the subcontractor, at BEML Factory/ARE02A Premises. The test shall be conducted in accordance with a test procedure to be prepared by the subcontractor and approved by BEML under BEML and/or End User participation. Any fine-tuning requirement needed by CMRL/BEML, the same shall be carried out with the prior approval.

One car has to be tested by the light supplier for power consumption for LED light along with Sensor and Dimmer unit in Main Line.

10.7 Service Trials

BEML will perform the service trial for ARE02A corridor and the sub-contractor shall supply the sufficient information and assistance if necessary, according to ERTS 17.

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

11 Submittals – Technical offer:

The Subcontractor shall provide as a minimum, the following along with the technical offer. The submittals check-list as per Annexure-7 of this PTS shall also be submitted.

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

(ii) Clause wise compliance against


- PTS - Doc no. GR/TD/7054
- ERTS (With appendix)

in the following format

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

Complied: “Complied” shall be indicated by the supplier where the supplier is able to comply with the clause.

Noted: Where a clause merely provides information.

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“Complied with comments” will be considered as fully complied for the clause with no additional commercial impact.

Offers with Non-compliance and deviations to any of the ERTS & PTS clauses with regard to Lighting system, are liable for rejection.

(iii) Supply details with references for service proven design to support the qualification criteria as per ERTS 2.4

(iv) DLP/DNP & commissioning Spares offer

(v) Duly filled RAMS and LCC format as per Annexure-III and IV

(vi) Compliance for Preliminary ECN Specific Requirements shared by TCMS supplier

(vii) Duly filled vendor approval format (Annexure-1) along with proposed Manufacturing plant details for CMRL contract along with performance certificate for the proposed manufacturing plant from the Metro operator.

(viii) Duly filled submittals check list (Annexure-7)

12 Attachments:

- ERTS
- Annexure-1: Vendor approval format
- Annexure-2: Tentative shape & size of lights
- Annexure-3: Format for LCC
- Annexure-4: RAMS formats
- Annexure-5: Preliminary Saloon Lights Layout & Mounting interface.
- Annexure-6: General ICD of TCMS
- Annexure-7: Submittals check list
- Annexure-8: Compliance Matrix format
- Annexure-A: List of Mandatory Spares to be positioned at Depot during CMC Period
