

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)**

2023/Proj./MMRCL/D-1/30/50

New Delhi, dated 08.11.2023

Managing Director,
Mumbai Metro Rail Corporation Limited (MMRCL),
Transit Office, E-Block, North side of City Park,
Behind Income Tax Office, 'A' Wing Bandra (E) BKC,
Mumbai – 400051 (Maharashtra)

**Sub: In-Principle Approval of 25 kV AC Traction & Power Supply and SCADA System–
Annexure D1 on Standard Gauge (1435 mm) Section (COLABA-BANDRA-SEEPZ) including
01 Depot at Aarey for Mumbai Metro Line 3 Project of Mumbai Metro Rail Corporation
Limited (MMRCL).**

Ref: Annexure D-1 and related certificates /documents submitted by MMRCL on RDSO's online Portal
dated 05.09.2023, 11.08.2023 and 11.04.2023

Mumbai Metro Rail Corporation Limited (MMRCL)'s request for technical approval of 25 kV AC Traction & Power Supply and SCADA System as per Annexure D1 on Standard Gauge (1435 mm) Section (COLABA – BANDRA - SEEPZ - Ch.: -473.762m to Ch.: 33349.300m) including 01 Depot at Aarey for Mumbai Metro Line 3 Project of Mumbai Metro Rail Corporation Limited (MMRCL) has been examined in Board's office in consultation with RDSO and 'In-Principle Approval' of the competent authority is hereby conveyed for the same subject to the submission of following documents before commercial operation of Rolling Stock:

- (a) Factory Acceptance Tests (Material Tests, Dimension & Visual Tests, Functional Tests) on Modular Cantilever
- (b) Final EIG Sanction letter for the proposed Section of MMRCL Line 3 Project COLABA–BANDRA - SEEPZ (Ch.: -473.762m to Ch.: 33349.300m), before Oscillation Trial of Rolling Stock
- (c) Software Functionality Tests & Integration Tests of SCADA System before Oscillation Trial of Rolling Stock
- (d) MMRCL shall regular monitor the Performance of following items up to two years from the commencement of the commercial operation of proposed Section of MMRCL Line 3 project and will submit the failure report of the items, if any –
 - (i) Bonomi make Stay/Bracket Insulators
 - (ii) EB REBOSIO Make 25 kV Support Insulator
 - (iii) SCADA System with Panto Flashover Relay
 - (iv) 32/45 MVA Auxiliary Power Transformer
 - (v) 2 MVA & 4 MVA Auxiliary Transformer

A copy of the approved Annexure D-1 for the same is enclosed.

Encl: As above


(F. A. Ahmad)

Director/Gati Shakti (Civil)-IV
Railway Board
Ph: 011-47845480
Email: dmtprb@rb.railnet.gov.in

Copy to:

1. **Executive Director/UTHS,** RDSO, Manak Nagar, Lucknow w.r.t letter No. UTHS/107/MMRCL/Elect. dated 12.09.2023
2. **OSD/UT & Ex-Officio Joint Secretary,** Ministry of Housing & Urban Affairs (MoHUA), Nirman Bhavan, New Delhi-110001
3. **ED/EEM,** Railway Board

Annexure D1 to RDSO's letter No. UTHS / MMRCL / MMRCL/P01/032021 Dated 12.09.2023

| SN | 25 kV AC Traction & Power Supply and SCADA System –Annexure D1, on Standard Gauge (1435 mm) Section of Line 3 Project of Mumbai Metro Rail Corporation Limited, i.e. COLABA-BANDRA-SEEPZ (Ch: - 473.762m to Ch: 33349.300m) , including 01 Depot at Aarey. | | |
|-----|--|---|--|
| | SYSTEM | FEATURES | STANDARDS/ DRAWINGS |
| 1.0 | POWER SUPPLY: Incoming 110kV | | |
| 1.1 | Traction Sub-Station (RSS/TSS) | 110kV/27.5 kV | RSS Overall SLD Drawing No. PSS-PSS-RS3-1001-001 R04 |
| 1.2 | Traction Transformer | <ul style="list-style-type: none"> ➤ Capacity: 30/42 MVA (02Nos.) ➤ Primary/Secondary: 110 kV/27.5 kV ➤ Phase: Single Phase Transformer ➤ On Load tap changing – HV side (+10% to - 15% in steps of 1.667%) ➤ Cooling: ONAN/ONAF ➤ Rated Power: 30/42 MVA <ul style="list-style-type: none"> a) Oil Temperature Rise 50° C above ambient temperature b) Winding temperature rise 55° C above ambient temperature ➤ Overload Capacity: <ul style="list-style-type: none"> a) 50% for 15 minutes b) 100% for 5 minutes. ➤ After overload: Temperature rise shall not be more than – <ul style="list-style-type: none"> a) 65° C above ambient Temperature for oil. b) 75° C above ambient temperature for windings. ➤ Operating Voltage: 110 / 27.5 kV (rms) + 10% and -15% at 50Hz. ➤ Cooling Mode: Mineral Oil ➤ Type- Outdoor | IEC 60076 IEC 60137 IEC 60296 IEC 61869 |
| 1.3 | Auxiliary Power Transformer | <ul style="list-style-type: none"> ➤ Capacity: 32/45 MVA (02Nos.) ➤ Primary: Three Phase 110kV ➤ Secondary: Three Phase 33 kV ➤ On Load tap changing – HV side (+10% to - 15% in steps of 1.6667%) ➤ Cooling: ONAN/ONAF ➤ Rated Power: 32/45 MVA | IEC 60076 IEC 60296 |

Note: Any dilution in the Stipulation/Compliances as submitted as well as detailed above suo-moto by Mumbai Metro Rail Line 3 of Mumbai Metro Rail Corporation Limited shall automatically invalidated the technical clearance.



Annexure-1

Annexure D1 to RDSO's letter No. UTHS / MMRCL / MMRCL/P01/032021 Dated 12.09.2023

| SN | 25 kV AC Traction & Power Supply and SCADA System –Annexure D1, on Standard Gauge (1435 mm) Section of Line 3 Project of Mumbai Metro Rail Corporation Limited, i.e. COLABA-BANDRA-SEEPZ (Ch: - 473.762m to Ch: 33349.300m) , including 01 Depot at Aarey. | | |
|-----|--|--|---|
| | SYSTEM | FEATURES | STANDARDS/ DRAWINGS |
| | | <ul style="list-style-type: none"> a) Oil Temperature Rise 50° C above ambient temperature b) Winding temperature rise 55° C above ambient temperature ➤ Overload Capacity: <ul style="list-style-type: none"> a) 50% for 15 minutes b) 100% for 5 minutes. ➤ After overload: Temperature rise shall not be more than – <ul style="list-style-type: none"> a) 65° C above ambient Temperature for oil. b) 75° C above ambient temperature for windings. ➤ Operating Voltage: 110/33kV (rms) +10% and -15% at 50Hz. ➤ Cooling Mode: Mineral Oil ➤ Type- Outdoor | |
| 1.4 | Auxiliary Transformer | <ul style="list-style-type: none"> ➤ 02nos identical Dry Type Transformer ➤ 33/0.433 kV (3 phase) ➤ ONAN ➤ Secondary Voltage 433 V ➤ Rating: 200 KVA, 630 KVA, 2000 KVA, 2500 KVA, 3150 KVA, 4 MVA ➤ Type-Indoor | IEC 60076-11:2018 |
| 1.5 | Gas Insulated Switchgear | <ul style="list-style-type: none"> ➤ 3Ph, 110kV, 3150A, 50Hz, 40kA for 4sec, Indoor SF6 Gas Insulated Switchgear. ➤ 3Ph, 33kV, 1250A, 50Hz, 25kA for 3sec, Indoor SF6 Gas Insulated Switchgear ➤ 1Ph, 27.5Kv, 2000A, 50Hz, 16Ka for 3 sec, Indoor SF6 Gas Insulated Switchgear | IEC 62271-1, IEC 62271-100, IEC 62271-200, 203 IEC 62271-1, 100, 102 IEC 62271-200 IEC 62271-100, 200 |
| 1.6 | Gas Insulated Switchgear (Depot) | <ul style="list-style-type: none"> ➤ 3Ph, 33kV, 1250A, 50Hz, 25kA for 3sec, Indoor SF6 Gas Insulated Switchgear | IEC 62271-1, 100, IEC 62271-200, IEC 60694 |
| 2.0 | Overhead Equipment Flexible OHE | | |

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Annexure-1

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|-----|--|---|---|
| | SYSTEM | FEATURES | STANDARDS/ DRAWINGS |
| 2.1 | <u>Aluminum Modular Cantilever Assembly</u> | Bracket Tube <ul style="list-style-type: none"> Outer Diameter: 70mm Thickness: 5mm Weight: 2.86 kg/m Tensile Strength (at 20° C): 310 MPa Yield Strength (at 20° C): 260 MPa | EN-AW-6082 T6 UNI EN 755 & EN-1706 |
| | | Stay Tube & Register Tube <ul style="list-style-type: none"> Outer Diameter: 60mm Thickness: 4mm Weight: 1.91 kg/m Tensile Strength (at 20° C): 310 MPa Yield Strength (at 20° C): 260 MPa. | EN-AW-6082 T6 UNI EN 755 & EN-1706 |
| | | Reinforced & Wind stay Tube <ul style="list-style-type: none"> Outer Diameter: 38mm Thickness: 4mm Weight: 0.63 kg/m Tensile Strength (at 20° C): 290 MPa Yield Strength (at 20° C): 260 MPa | EN-AW-6082 T6 UNI EN 755 & EN-1706 |
| | | Steady Arm(straight) <ul style="list-style-type: none"> Outer Diameter: 36mm Thickness: 3mm Unit Weight: 1.36 kg/m Tensile Strength (at 20° C): 290 MPa. Yield Strength (at 20° C): 260 MPa Permissible Operating Load: 185 daN Minimum Failing Load: 555 daN | EN-AW-6082T6 & EN754 |
| 3.0 | Span Length (max.) | 45 meter (max.) | |
| 4.0 | Messenger Wire (Catenary Wire) | 65 mm ² Cu-Cd Diameter : 10.5 mm Strands : 19 Diameter of each Strand : 2.1±0.02 mm. | RDSO's latest revised specification No.ETI/OHE/50 (6/97) with A & C Slip No.1 to 5. |
| 5.0 | Contact Wire | BC-150 mm ² Cu-ETP, Hard Drawn Grooved Copper (Diameter-14.5 mm) Drawn out of 22.5mm to 26.5mm Continuous Cast Copper Wire Rod. | EN 50149 |
| 6.0 | Rigid Over Catenary System (ROCS) | Conductor Rail Details: <ul style="list-style-type: none"> Material : Al alloy 6106 T5 | 1. EN AW 6106 T5, UNE- |

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|------|--|--|---|
| | SYSTEM | FEATURES | STANDARDS/ DRAWINGS |
| | | <ul style="list-style-type: none"> • Cross section Area : 2223.22 mm² • Current carrying capacity: 4000 A • Tensile Strength : 250 N/mm² • Maximum Electrical Resistance at 20°C : 0.0144 Ω/km. • Maximum Length of Conductor :12000 mm • Density: 2.69 g/cm³ Conductor Rail Splice : <ul style="list-style-type: none"> • Material : Al Alloy 6106 T6 • section Area :1209.60mm² (Single Splice Plate) • Density: 2.69 g/cm³ • Weight : 1.55 kg(Single Splice Plate) • Breaking Load: 345 N/mm² • Joint Plate : Al alloy | EN 755 and EN 38337-2001. 2. DWG NO: DTR0000511617 & DWG NO: DTR0000477162 3. DWG. NO: OCS-ROC-T00-1512-001 |
| | | <ul style="list-style-type: none"> • Screw & Washer : Stainless Steel A2 AISI 316 | Screw: DIN 933 Washer: DIN 125 |
| | | <ul style="list-style-type: none"> • Spring Lock Washer: Stainless Steel A2 AISI 316 | DIN 127 |
| 7.0 | Neutral Section in ROCS | Air Gap type Neutral Section(NS) | - |
| 8.0 | Tension in OHE | | |
| 8.1 | Catenary Wire | 1200 kgf | - |
| 8.2 | Contact Wire | 1200 kgf | - |
| 9.0 | Jumpers | <ul style="list-style-type: none"> • Potential Equalizing Jumper - 50 mm² • Continuity Jumper - 2 run of 105mm² | <ul style="list-style-type: none"> • RDSO's latest Specification No. ETI/OHE/3(2/94) with A&C Slip no-01 |
| | | <ul style="list-style-type: none"> • Feeding Jumper - 164 mm² | <ul style="list-style-type: none"> • NFF-55-681 |
| 10.0 | Droppers | <ul style="list-style-type: none"> • Current Carrying Flexible Bronze dropper • Cross section Area-12mm² • Diameter -5mm • Dropper Contact wire Assembly | <ul style="list-style-type: none"> • NFC-34-110-2 • EN 50119 |
| 11.0 | Automatic Tensioning Device | <ul style="list-style-type: none"> • 3 Pulley Type ATD • Minimum Breaking Load: 125 KN • Efficiency > 97 % | <ul style="list-style-type: none"> • CEI EN 50119:2013 • EN ISO 3506 • EN 10025 • EN 1706 • DWG No 65245/C |

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|------|--|---|---|
| | SYSTEM | FEATURES | STANDARDS/ DRAWINGS |
| 12.0 | Feeder Wire | 25kV, 2R x 1C x 240sqmm, XLPE Cu Cable for feeding from TSS, FP to OHE | <ul style="list-style-type: none"> MMRCL General Arrangement Drawing No. OCS-PSS-DOO-2595-002. |
| 13.0 | Insulators | <ul style="list-style-type: none"> Porcelain Insulators | <ul style="list-style-type: none"> Section Insulator RDSO drawing no. ETI/OHE/P/6100 in Depot area and Galland make Light Weight Section Insulator with drawing no. EJG3430/202-21 Operating Rod Insulator RDSO's Specification No. TI/SPC/OHE/INS/0070 with A&C slips no. 1 & 2 or latest. Post Insulator RDSO's Specification No. TI/SPC/OHE/INS/0070 with A&C slips no. 1 & 2 or latest. |
| | | <ul style="list-style-type: none"> Silicone Composite Insulators | <ul style="list-style-type: none"> 9-Tonne Insulator RDSO Specification no. TI/SPC/OHE/INSCOM/1071 (with latest revisions) Stay & Bracket Insulator As per IEC 61109: 2008, IEC 61952: |

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|------|--|---|--|
| | SYSTEM | FEATURES | STANDARDS/ DRAWINGS |
| | | | 2008& IEC 60815-3 • Support Insulator for ROCS As per - IEC 61952-1: 2019, UNI EN 10083-1 IEC 60815-3 IEC 61952 BS EN 62621 IEC 62497-1 BS EN 62621 |
| 14.0 | SCADA | i. Interfaces to control facilities at OCC, BCC ii. Dedicated HMI maintenance terminals iii. Head-end servers and databases iv. Remote Terminal Units (RTU) v. Remote Input / Output (I/O) Units vi. Data communications between all of the above vii. Marshalling Cabinets; and Equipment are provided at the OCC/BCC, substations and other locations viii. Provision of Emergency Trip Switch at underground stations | a) Network & Hardware as per IEEE 802.3 & IEEE 802.3u Ethernet standards b) Network Protocol as IEC 61850-8-1 c) Time Synchronization : SNTP d) Communication Media: OFC e) Data Speed: 100 Mbps f) SCADA Software: ABB – Micro SCADA pro 9.4 g) RSS SAS conforming to IEC 61850 h) Communication Protocol as per IEC 60870-5-104 i) RTU: ABB Make RTU 560 |
| 15.0 | Protection System | Traction Transformer | IEEE C37.94-2008, IEC 60255 |
| | | Feeder Protection Instantaneous Over current Protection Wrong Phase Coupling Protection High Resistance Delta-I | IEC 60255-12, IEC 60255-16, IEC 61850 |

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|------|--|---|--|
| | SYSTEM | FEATURES | STANDARDS/ DRAWINGS |
| | | Control & Relay Panel | IEC 60255-12, IEC 61850 |
| 16.0 | Buried Earth Conductor (BEC)/Overhead Protection Conductor (OPC) | <ul style="list-style-type: none"> ACSR Conductors 7 Steel Wire & 12 Aluminum Wires. Cross-section Area; 93.3 mm² Overall Dia. of Conductor; 12.5 mm Diameter of each wire; 2.5 mm | <ul style="list-style-type: none"> IS-398 Part-II with latest revision. |
| 17.0 | Earthing | <ul style="list-style-type: none"> Resistance earth Electrodes – shall not exceed 10 Ohm Combine earth resistance < 0.5 ohm | <ul style="list-style-type: none"> IS- 3043 IEEE 80 (with latest revision) EN 50122-1 EN 50122-2 |
| 18.0 | Height of Contact Wire | <p>Minimum Height from Rail level to underside of live conductor wire-</p> <ul style="list-style-type: none"> In tunnel portal to Ramp area..... 4388 mm Under the bridges.....4640 mm (approx.) In the open (Elevated & At-grade sections).....5000 mm At level crossing.....5500mm In Running and carriage sheds wherever the staffs are expected to work on the roof of Rolling Stock5500 mm In Depot Open Area5500 mm | <ul style="list-style-type: none"> Railway Board's approved SOD (Standard Gauge) for Mumbai Metro Rail Corporation Ltd. |
| 19.0 | Maximum variation of the live conductor wire on either side of the center line of the track under static conditions | <ul style="list-style-type: none"> On Straight ± 200 mm On Curves ± 300 mm | <ul style="list-style-type: none"> Railway Board's approved SOD (Standard Gauge) for Mumbai Metro Rail Corporation Ltd. |
| 20.0 | Electrical Clearances for At-Grade sections Elevated Sections | <p>Long Duration (Static) : 320 mm Short Duration (dynamic) : 270 mm</p> | <ul style="list-style-type: none"> Railway Board's approved SOD (Standard Gauge) for Mumbai Metro Rail Corporation Ltd. |

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