

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

2023/Proj./UPMRCL/AGRA-METRO/D1-D2/30/56

New Delhi, dated 29.11.2023

Managing Director,

Uttar Pradesh Metro Rail Corporation Limited
(UPMRCL), Administrative Building,
Near Dr. Bhimrao Ambedkar Samajik Parivartan Sthal,
Vipin Khand Gomti Nagar, Lucknow – 226010

Sub: In-Principal Approval for Traction & Power Supply System (3rd Rail Bottom Current Collection - 750 V DC) and SCADA System as per Annexure D-2 for Agra Metro Rail Project of Uttar Pradesh Metro Rail Corporation Limited (UPMRCL).

Ref: Annexure D-2 and related certificates/documents submitted by UPMRCL on RDSO's online Portal dated 21.09.2023 & 13.07.2023

Uttar Pradesh Metro Rail Corporation Limited (UPMRCL)'s request for technical approval of Traction & Power Supply System (3rd Rail Bottom Current Collection - 750 V DC) and SCADA System as per Annexure D-2 (copy enclosed) for Agra Metro Rail Project has been examined in Board's office in consultation with RDSO and 'In-Principal Approval' of the competent authority is hereby conveyed for the same for following sections:

- (a) Corridor-1 (Sikandra to Taj East Gate - 14.25 km - Depot cum workshop at PAC and 02 nos. RSS) and
- (b) Corridor-2 (Agra Cantt to Kalindi Vihar –15.40 Km -Depot cum workshop at Kalindi Vihar and 01 RSS)

The approval is subject to submission of following documents before commercial operation of corresponding section:-

1. Traction Power Supply Simulation report for Corridor-II (Agra Cantt to Kalind Vihar) of Agra Metro Rail Project.
2. The soil resistivity test report for Kalindi Vihar RSS along with Calculations of Earth Mat & Overall Grid Resistance.
3. Factory Acceptance Test report of 33 KV GIS and 200 KVA Auxiliary Dry Type Transformer.
4. UPMRCL shall regularly monitor the performance of following items up to two years from the commencement of the commercial operation of proposed section of Agra Metro project and will submit the failure report of the items, if any
 - a) SCADA System
 - b) Battery
 - c) Battery Charger
 - d) Mid - Point Anchor Assembly
 - e) Expansion Joints Assembly
 - f) Bracket Support Assembly
 - g) Third Rail DC Traction Equipments i.e. Conductor Rail, Splice Joint assembly for Third Rail, Expansion Joint, Anchor Assembly, Insulated Joint Assembly, Power Feed Assembly, Ramp, Support Assembly, Protective Cover System
 - h) 400 sq mm & 120 sq mm Al Power Cable
 - i) 300 Sq mm Cu DC Cable
 - j) 2850 KVA Rectifier Transformer
 - k) 200 KVA Auxiliary Transformer
 - l) Rectifier Unit in 12 Pulse Connection

Contd...2/-




5. UPMRCL must submit following items before Oscillation Trial:-

- (a) Final EIG Sanction for proposed Section of 3rd Rail Traction & Power Supply System
- (b) Witnessed Protocol tests report of SCADA for Agra Metro Rail Project
- (c) Witnessed SCADA Software Functionality Tests and SCADA System Integration Tests for Agra Metro Rail Project

Any dilution in the stipulations/compliance as submitted as well as detailed above suo-moto by UPMRCL shall automatically invalidate the technical clearance.

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/124/Agra/Elect. dated 25.10.2023
 2. **OSD/UT & Ex-Officio Joint Secretary**, Ministry of Housing & Urban Affairs (MoHUA), Nirman Bhavan, New Delhi-110001
 3. **ED/EEM**, Railway Board
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Annexure-I to RDSO's letter No: UTHS/124/AGRA/Elect. dated 25.10.2023

Traction & Power Supply System (3 rd Rail Bottom Current Collection-750 V DC) of "Agra Metro Rail Project of UPMRCL"			
S. N.	System	Features	Standards/Drawings
1.0	POWER SUPPLY: Incoming 132 kV		
1.1	Receiving Sub-Station (RSS/TSS)	132 kV/33kV (AC)	DRG No. 022014-e-re-sy-1I-1001, DRG No. 022014-e-re-sy-1I-3001, DRG No. 022014-e-re-sy-1I-4001
1.2	Earth Resistance at RSS	< 0.5 Ω	IEEE 80, IS 3043
2.0	Power Transformer at RSS	132kV/33kV (02 Nos.) <ul style="list-style-type: none"> Capacity: 20/25 MVA (02 Nos) Three Phase Transformer Vector Group: YNyn0 On Load Tap Changing: HV side (+10% to -15% in steps of 1.667%) Cooling Mode: ONAN/ONAF Rated Power: 20/25 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) 25 % for 2 Hours (b) 50% for 10 minutes (c) 100 % for 3 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: 132kV/33kV (rms)+ 10% to -15% at 50Hz. Type : Outdoor 	IEC 60076:2018 IEC 60076-5:2006 IS 2026
2.1	Transformer Oil	<ul style="list-style-type: none"> Mineral Oil 	IEC 60296 latest
2.2	Oil Conservator	<ul style="list-style-type: none"> Separate 	IEC 60076
2.3	Noise Level-Transformer	<ul style="list-style-type: none"> Not more than 70 dB 	
3.0	Traction Sub-Station (TSS)	33 kV (AC)/585-585 (AC)/750V (DC)	As per Design of Agra Metro Rail Project
3.1	Earth Resistance at TSS	< 1.0 Ω	IEEE 80, IS 3043
4.0	Transformer – Rectifier unit	<ul style="list-style-type: none"> Cast Resin Dry Type Transformer Capacity: 2850 KVA (02 Nos) One Primary & Two Secondary Winding 	IEC 60076-11 IS 2026 EN 50329



		<ul style="list-style-type: none"> • Vector Group: Dd0y5 • Cooling Mode: AN • Overload Capacity: <ul style="list-style-type: none"> (a) 150% for 2 Hours (b) 300 % for 60 second • Tap Changer: ± 5 % by off circuit tap links • Insulation Class: (HV/LV1/LV2): F/H/H • Type : Indoor 	
5.0	Auxiliary Sub-station (ASS)	33 kV /415 V	
5.1	Earth Resistance of ASS	<1.0 Ω	IS 3043, IEEE 80
6.0	Auxiliary Transformer	<ul style="list-style-type: none"> • Cast Resin Dry Type Transformer • Capacity:2000 KVA, 500 KVA, 200 KVA • 33 KV/0.415KV, 3 phase • Vector Group: Dyn11 • Cooling Mode: AN • Overload Capacity: <ul style="list-style-type: none"> (a) 150 % for 4 minutes (b) 200 % for 2 minutes • Tap Changer: ± 5 % in steps of 2.5% • Insulation Class: (HV/LV1/LV2): F/H/H • Type : Indoor 	IEC 60076-11
7.0	Gas Insulated Switchgear	3 \emptyset , 50Hz,132kV, 1250 Amp, 40kA for 1 sec, Indoor SF6 Gas Insulated Switchgear	IEC 62271-1, IEC 62271-203:2011, IEC 62271-306, IEC 60099-4, IEC 61869-1,2,3
		3 \emptyset , 50Hz,33kV, 1250 Amp, 25kA for 3 sec, Indoor type SF6 Gas Insulated Switchgear	IEC 62271-1, IEC 62271-100, IEC 62271-102, IEC 62271-103, IEC 62271-200, IEC 61869, IEC 61850
	Air Insulated Switchgear	3 \emptyset , 50Hz,33kV, 1250 Amp, 25kA for 3 sec, Outdoor, Air Insulated Switchgear,	IEC 62271-1, IEC 62271-100, IEC 62271-200, IEC 61869, IS 15227, IS 61850
8.0	750 V DC Traction System (Bottom Current Collection)		
8.1	Conductor Rail (Third Rail)	Steel & Aluminium (Co-extruded)	As per Design Aspects of Agra Metro Rail Project of UPMRCL 
8.2	Nominal Current at 45° C ambient (without exceeding 45°C heat rise)	4500 A DC	
8.3	Nominal Voltage	750 V DC	
8.4	Designed voltage	1000 V DC	
8.5	Transient Voltage	3000 V DC	
8.6	Max. Electrical Resistance at 20° C	6.35 $\mu\Omega$ /meter	
8.7	Maximum Heat Rise at an Ambient Temp. of 50° C	36.2 °C	
8.8	Short Circuit Level (1 Second)	50000A	

8.9	Linear mass	17.2 kg/meter	
8.10	Thickness	6.0 mm	
8.11	Stainless Steel Strip	Chromium, Cr: 17%	
9.0	Cables	<ul style="list-style-type: none">400 mm², 1Rx1C, XLPE, 132 kV, Al Cable, Corrugated Al sheathed & HDPE outer sheathed Power Cable.Conductor & Insulation Screen Material- Extrusion Semi-conducting compound	IEC 60840: 2020, IEC 60228
		<ul style="list-style-type: none">300 mm², 2Rx1C & 1Rx1C, XPLE (Al), 33 kV, FRLS/FRLSOH, Power Cable,Conductor Screen Material- Extruded Semi-conducting compoundInsulation Screen- Extruded Bonded type semi-conducting compound	IEC 60502-2, IEC 60811, IS 7098-II, IEC 60228
		<ul style="list-style-type: none">120 mm², 1Rx1C, XPLE, FRLS/FRLSOH, 33 kV, Power Cable,Conductor Screen Material- Extruded Semi-conducting compoundInsulation Screen- Extruded Bonded type semi-conducting compound	IEC 60502-2, IEC 60811, IS 7098-II
		<ul style="list-style-type: none">300 mm², XLPE, Copper(Cu), DC Cable,Type: CU C2/XLPE/AWA/PVC-FRLS BKAT cable & CU C2/XLPE/AWA/LSZH BKAT cable	IEC 60502-1, IEC 60332-1,3, IEC 60228
10.0	Insulator	<ul style="list-style-type: none">Bulk Molding Compound Insulator	As per Design Aspects of Agra Metro Rail project
10.1	Creepage Distance	<ul style="list-style-type: none">159.1mm	
10.2	Fume index	<ul style="list-style-type: none">≤20	
10.3	Impact Resistance (Min)	<ul style="list-style-type: none">400J/mminimum	
10.4	Deflection Temperature	<ul style="list-style-type: none">190°Cat1.82N/mm²	
10.5	Water Absorption	<ul style="list-style-type: none">0.3% (Max.) in 24 hrs at23°C	
10.6	Dielectric Strength	<ul style="list-style-type: none">>10kV/mm	
10.7	Flame Spread Index	<ul style="list-style-type: none">15 (Max)	
11.0	Horizontal & Vertical Clearances of Third Rail	As Per Agra Metro’s SOD approved by Railway Board	
12.0	Stay Current Mitigation System	Agra Metro Rail Project has followed stray Current Monitoring System (SCMS) as per EN 50122-2	EN 50122-2(latest)
13.0	Control Relay Panel & Switchgears	132 KV CRP I/C FDR 132KV CRP TRAFO FDR 132 KV CRP B/C FDR 132 KV CRP B/B Prot. FDR 33KV SWDB I/C 33KV SWDB B/C 33KV SWDB T/R	IEC 61850, IEC 60529, IEC 60255, IEC 60870-2, IEC 61000-4, IEC 60068.



		33KV SWDB O/G																						
		DC SWGR	IEC 61850, IEC 60870-5-104																					
14.0	SCADA	<ul style="list-style-type: none">In SCADA System -<ul style="list-style-type: none">a) RTU is provided with redundant Ethernet switchesb) Redundant communication serverc) Redundant communication Links between RTU & CFEd) Redundant application cum data base serverSNTP Protocol support for the synchronizationData Transfer Protocol followed as per IEC60870-5-104Network Protocol between RTU & Relay is found as per IEC 61850.Time synchronizing equipment is IEEE 1588 PTP protocol for time sync.RTU is using MODBUS Protocol.Dataspeed-100mbps	IEC60870-5, IEC60870-5-104 Master, IEC60870-5-104 Slave, IEC 61850, IEEE 802.3 IEC 60870-2-1, IEC 61191																					
		<table><tr><td rowspan="5">Battery</td><td>Capacity</td><td>180 AH</td><td>320 AH</td><td>450 AH</td></tr><tr><td>material</td><td>Ni-Cd</td><td>Ni-Cd</td><td>Ni-Cd</td></tr><tr><td>No. of Cell</td><td>85</td><td>85</td><td>85</td></tr><tr><td>Electrolyte</td><td>KOH solution</td><td>KOH solution</td><td>KOH solution</td></tr><tr><td>Approx. Cell weight</td><td>10.5 kg</td><td>16.6 kg</td><td>21.5 kg</td></tr></table>	Battery	Capacity	180 AH	320 AH	450 AH	material	Ni-Cd	Ni-Cd	Ni-Cd	No. of Cell	85	85	85	Electrolyte	KOH solution	KOH solution	KOH solution	Approx. Cell weight	10.5 kg	16.6 kg	21.5 kg	IEC 62259 IEC 62259 Type 3
Battery	Capacity	180 AH		320 AH	450 AH																			
	material	Ni-Cd		Ni-Cd	Ni-Cd																			
	No. of Cell	85		85	85																			
	Electrolyte	KOH solution		KOH solution	KOH solution																			
	Approx. Cell weight	10.5 kg	16.6 kg	21.5 kg																				
		UPS: 2x10 KVA 415 V AC input, 240 V AC Output , 50Hz	IEC 62040-3																					
		Battery Charger : 110 V DC/ 100A Dual Float Cum Boost Charger	As per Design Aspects of Agra Metro Rail project																					
		SCADA software	As per Design Aspects of Agra Metro Rail project																					

Note: Any dilution in the stipulation/compliances as submitted as well as detailed above suo-moto by UPMRCL shall automatically invalidate the technical clearance.

