भारत सरकार, रेल मंत्रालय

**GOVERNMENT OF INDIA**

**MINISTRY OF RAILWAYS**

सत्यमेव जयते

कर्षण संस्थापन निदेशालय

**TRACTION INSTALLATION DIRECTORATE**

# TECHNICAL SPECIFICATION FOR

# LOW TENSION DISTRIBUTION PANELS

# FOR

# RAILWAY AC TRACTION SUBSTATIONS

**SPECIFICATION**

**~~NO. ETI/PSI/29(12/79)~~**

**SPECIFICTION NO. - TI/SPC/PSI/LTDPNL/0300**

**Issue date:**



ISSUED BY

GOVERNMENT OF INDIA: MINISTRY OF RAILWAYS

RESEARCH DESIGNS & STANDARDS ORGANISATION

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| | **PREPARED BY** | **CHECKED BY** | **APPROVED BY** |
|---|---|---|---|
| **SIGNATURES** | | | |
| **DATE** | | | |
| **DESIGNATION** | SSE/PR | DTI/ III | PEDTI |

1.0 SCOPE:

1.1 This specification covers the 230 V ac distribution panel and the 110 V dc distribution panel to be installed in the control room of an unattended 132/25 kV, 110/25 kV or 66/25 kV traction substation for control and distribution of 230 V single phase ac and 110 V dc supplies respectively. This supersedes specification No. ETI/PSI/29(7/72).

1.2 The equipment offered shall be complete in all respects and shall include all accessories or materials which are useful or necessary for efficient operation of the distribution panel. Each accessories and materials shall be deemed to be within the scope of this specification whether specifically mentioned or not.

2.0 SERVICE CONDITIONS

2.1 The distribution panels are intended for use in moist tropical climate in India where the maximum ambient temperature may reach 45 deg. C with relative humidity reaching up to 100%.

2.2 Two 10 kVA, 25 kV/230 V single phase LT supply transformers are installed in a traction substation connected to the 25 kV bus of the substation, to give 230 V single phase supply for relay and control board, battery chargers, control room and yard lighting, space heaters for circuit breakers/ interrupters etc. PVC insulated, PVC sheathed and armoured two core 25 sq.mm, 1100 V grade aluminium cable, conforming to IS: 1554(latest version) is laid from each of the two transformer and terminated on the ac panel.

2.3 Two battery chargers suitable for trickle and boost charging of the 110 V, 180 AH lead acid installed at each traction substation. PVC insulated 1100 V grade heavy duty, 2x 2.5 sq.mm copper cable (two cables in parallel), complying with IS:1554, Pt. I (latest version) shall be brought from each of the two chargers and the battery and terminated on the 110 V dc panel.

3.0 GOVERNING SPECIFICATION

3.1 The panels and their main components shall comply with the latest edition of various latest versions of the following specifications which shall be applied in the manner altered, amended by this specification and the Indian Electricity Rules, where applicable.

| | | |
|---|---|---|
| i) | Heavy duty switches. | ~~IS:4047~~ IEC 60947 |
| ii) | Distribution fuses boards | IS:2675 |
| iii) | Miniature circuit breakers. | ~~BS:3871~~ BS EN 60898-1:2003+A13:2012 |
| iv) | Bus bars | BS: 159 |
| v) | Electrical indicating instruments. | IS:1248 |
| vi) | General requirements for LT switchgear | ~~IS:4237~~ IEC 60947 : PART 1 : 2007 |

3.2 Any deviation from this specification calculated to improve the performance, utility and efficiency of the equipment proposed by the tenderer will be given due consideration provided full particulars thereof and justification therefore, are furnished.

4.0 GENERAL DESCRIPTION

4.1 230 v AC DISTRIBUTION PANEL.

4.1.1 The two incoming 230 V ac supplies from the two LT supply transformers shall be brought through independent switch-fuse units and connected to the 230 V ac bus bar through a double pole two position change over switch. There shall be no other position for the change over switch. Only one supply is to be fed into the bus bar at a time. Four outgoing circuits shall be connected to the 230 V ac bus bar through separate switch-fuse units each with a sub distribution circuit. The schematic of circuit arrangement is shown in Appendix-I.

4.1.2 The 230 V ac distribution panel shall comprise the following: -

| | | |
|---|---|---|
| i) | Double pole switch-fuse unit, 63 A, rating for controlling the incoming supplies to the panel. | No. off<br>2 |
| ii) | Double pole changeover switch, 63 A capacity | 1 |
| iii) | Electrolytic copper bus bars, tinned, of 100 A capacity, natural air cooled and supported on porcelain insulators for phase and neutral | 1 set |
| iv) | Double pole switch-fuse unit 32 A with two nos. of 10 A and two nos. 32 A sub-distribution fuses and links | 1 set |
| v) | Double –pole switch-fuse unit, 32 A, with three nos. 16 A sub- distribution fuses and links | 1 set |
| vi) | Double pole switch-fuse unit, 32 A with two nos. 10 A and 4 nos. 5 A sub distribution fuses and links. | 1 set |
| vii) | Double pole switch-fuse unit 16 A, with 5 nos. 5 A sub-distribution fuses and links. | 1 set |
| viii) | 230 V red ~~neon~~ LED lamps removable from the front of the panel for indication of supply in the two incoming and four main outgoing circuits | 6 nos. |
| ix) | Moving iron voltmeter 144 sq. mm, 90 deg. Scale, 0-300 v range, Grade ‘A’ accuracy to IS: 1248 | 1 |

NOTE: The double pole switch-fuse units envisaged above shall have fuse of appropriate rating in phase carrying pole and solid copper link in the neutral carrying pole.

4.1.3 The switch- fuse units, bus bar chamber and sub-distribution fuse boards etc. shall be of totally enclosed type housed preferably in heavy sheet steel housings of completely dust, weather and vermin proof. The bus bar chamber shall be provided with detachable covers at both ends and the switch –fuse units, sub-distribution boards etc. with hinged covers to facilitate inspection and maintenance. The switch-fuse unit enclosure shall have suitable inter-lock to ensure that the door cannot be opened unless the switch is in the off position and that the unit cannot be switched ON unless the door is properly closed. The internal arrangement in the switch fuse units, change-over switch and sub-distribution boards etc. shall be such that all live metal and terminals etc. are suitably shrouded so as to protect against contact with live parts when the door is open. The various units on the panel shall be provided with top and bottom or side entries fitted with suitable glands for incoming and out-going cables as required.

4.1.4 The various units constituting the panel shall be neatly and securely mounted on the channel iron frame work designed for wall mounting or floor mounting. The change over switch and the two incoming switches shall be mounted below the bus bar chamber and the outgoing feeder switches shall be mounted above the bus bar chamber. The sub-distribution fuse boards may be mounted on top of the respective feeder switches or beside them as convenient. The voltmeter shall be mounted in a central position at bottom of the panel and shall be connected to the bus bar.

4.2 110 V dc Distribution panel:

4.2.1 Two incoming circuits from the dc output terminals of the battery chargers shall be connected through a double pole change over switch to a bus bar housed inside the panel. The 110 V, 180 AH lead acid battery will be directly connected to these bus bars. There shall be six outgoing circuits from the bus bars each controlled by a double pole switch-fuse unit or double pole miniature circuit breaker. ~~Neon~~ LED lamps shall be provided for each of the outgoing circuits to indicate the availability of supply and also for bus bar supply indication. A schematic arrangement is shown in Appendix-I for guidance.

4.2.2 The dc distribution panel shall comprise the following:-

| | | |
|---|---|---|
| i) | Double pole change over switch, 63 A rating. | No. off<br>1 |
| ii) | Double pole switch- fuse unit or miniature circuit breaker of 32 A rating for each of the outgoing circuits. | ~~6~~ 7 |
| iii) | Electrolytic copper bus bar, tinned, 100 A capacity for positive as well as negative, natural air cooled and supported on porcelain insulators. | 1 set |
| iv) | Flush mounted red ~~neon~~ LED indicating lamps removable from front of the panels for each outgoing circuit and bus bar supply indication. | 7 |

| | | |
|---|---|---|
| v) | Moving coil volt-meter 144 sq. mm 90 deg. Scale, 0-200V range. Grade 'A' accuracy to IS: 1248 | 1 |

4.2.3 The panel shall be of totally enclosed type made of heavy sheet steel housing being completely dust, weather and vermin proof. The bus bars inside the panel shall be centrally located. The switch-fuse units/MCBs shall be mounted below the bus bars and so provided inside the panel that their operating levers/ knobs shall not be accessible from outside unless the panel cover is opened. The flush mounted change over switch and the voltmeter shall be mounted above the bus bars. The busbar chamber of the panel shall have detachable covers at both ends, whereas the other portion of the panel housing switch-fuse units/ MCBs and change over switch etc. can have hinged covers. The arrangements inside the panel shall be such that all live metals and terminals etc. are suitably shrouded so as to protect against contact with liver parts, when the door is open. The frame of the panel shall be provided with the necessary number of openings duly fitted with suitable glands for cables entry. The distribution panel shall be suitable for wall mounting.

5.0 GENERAL REQUIREMENTS

5.1 The ac and dc panels shall be dust, weather and vermin proof. They shall be light, compact and at the same time robust in construction. They should be adequately dimensioned so that the various equipments installed inside the panels do not get overheated, beyond permissible temperature rise for bare copper conductors of 35 deg. C over an ambient of 45 deg. C.

5.2 Wiring:

5.2.1 All panel wiring shall be done with switch- board typically, 1100 V grade, PVC insulated single core, tinned, annealed copper conductors for service in extremely humid tropical climate. The wiring shall be flame retarding and shall not be prone to attack by vermin i.e. mice. White ants, cockroaches etc.

5.2.2 The size of wiring for connection of in-coming switches to busbars shall not be less than 16 sq. mm stranded copper conductors whereas for those circuits connecting out-going switches with busbars and sub distribution fuse boards shall not be less than 10 sq. mm stranded copper conductors. These stranded wires shall generally comprise of seven strands. The wiring for meters/ indication lamps etc. shall be of 1.6 sq. mm copper stranded conductors. The terminations on the bus bar shall be provided with tinned copper crimped lugs and brass bolts, nuts and spring washers. All wiring shall be neatly done and supported properly where necessary.

5.2.3 The colour scheme for the wiring shall be as under:

Red - For positive of dc circuits and phase conductors of ac circuits.

Black - For negative of dc circuits and neutral conductors of ac circuits.

5.3 Painting:

The panels, switch-fuse units etc. shall be stove enameled, the colour finish being light green (EAU- DE- NIL Green) on the exterior and white in the interior. The sup[porting frame shall be given a coat of rust resisting primer and a finishing coat of light green paint matching with the enamel paint. If any painted surface gets damaged during transit, the surface furnish shall be restored at site.

5.4 Earthing:

All current free metallic bodies of the equipments on the distribution panels shall be connected to the frame-work and the framework to the main earth ring inside the control room. The connections shall be by means and bare copper wire/ strip of size not less than 12 SWG suitable earth terminals for this purpose shall be provided on individual equipments as well as the panel. Duplicate earthing shall be provided for the framework.

5.5 Name Plates:

5.5.1 All switch- fuse units/ MCBs, sub-distribution fuse boards and instruments etc. shall have name plates with rating date, serial number and manufacturer's name etc.

5.5.2 A schematic circuit diagram, printed in plastic sheet/adhesive waterproof paper, shall be provided ~~the front side of~~ inside the panel at a prominent place.

5.5.3 Suitable identification labels indicating functions shall be provided on each of the switch-fuse unit, sub-distribution fuse boards etc. In case of change over switch, the operating handle positions shall be distinctly marked indicating the corresponding incoming source of supply.

5.5.4 All the fuse units in the panels shall be provided with marking indicating the rating on the top of fuse carriers. Further, suitable identification labels with engraved markings indicating the fuse rating and the circuit to which connected, shall be provided below the fuse bases in the sub-distribution fuse boards. The link bases shall also be identified in the similar manner as the fuse units mentioned above.

5.5.5 The bus bar chamber shall be identified by a suitable label provided on the cover thereof. The phase/ positive and neutral / negative bus bars shall be identified by red and black indelible markings on the respective bus bars.

5.5.6 Black plastic plates about 50 mm wide bearing suitable captions to be approved by the purchaser, with 30 mm wide engraved letters shall be mounted on the top of each panel.

6.0 TESTS: -

6.1 Prototype and routine tests shall be conducted on the main components as per standard specifications mentioned in para 3.1

6.2 The following checks and tests shall be carried out on the complete panels:

i) Checking the wiring for correctness and continuity.

ii) Voltage test on the panels and the wiring for withstand voltage of 200 V (rms) to earth for 1 minute.

iii) Insulation resistance of the complete wiring.

7.0 TECHNICAL DATA AND DRAWINGS

7.1 The tenderer shall furnish guaranteed performance data and other technical particulars for the equipments offered in the Performa attached as Annexure-A. He shall also submit, along with the tender, the manufacturer's descriptive literature/ catalogue of the panels switches fuse units, sub distribution boards etc. offered, together with the proposed layout of panels showing disposition of various equipments. Thereon.

7.2 The tenderer shall indicate their compliance or otherwise against each clause and sub-clause of the technical specification. The tenderer shall for this purpose enclose a separate statement, if necessary, indicating the clause reference and compliance or otherwise wherever the tenderer deviates from the provisions of the clause, he shall furnish his detailed remarks.

7.3 Successful tenderer shall be required to submit detailed dimensioned drawings including reproducible copies for the equipments offered, as per Railways standards in sizes of ~~230~~ 210 mm x 297 mm or any integral multiple thereof, for approval of the purchaser. After successful protype unit, the final drawings along with softcopy in Auto CAD shall be submitted to RDSO.

Annexure -A to the Specification No. ~~ETI/PSI/29(12/79)~~ TI/SPC/PSI/LTDPNL/0300

SCHEDULE OF GUARANTEED PERFORMANCE, TECHNICAL AND OTHER PARTICULARS.

| S. No. | Description | Units of measurement | Remarks |
|---|---|---|---|
| I | 230 V AC panel<br>1. Name of manufacturer.<br>2. Country of origin.<br>3. Governing Specification.<br>4. Make, type, specification and ratings of switch-fuse units.<br>5. Make type ratings and specification of fuse units.<br>6. Change over switch:<br>i) Make<br>ii) Type<br>iii) Specification<br>iv) Rating. | | |
| 7.(a) | Size and material for bus bar<br>b) Normal current carrying capacity.<br>c) Whether the busbars are tinned. | | |
| 8. | Voltmeter:<br>i) Make<br>ii) Type<br>iii) Range.<br>iv) Specification<br>v) Class of accuracy | | |
| 9. | Type of indication lamp, whether neon or low watt, resistor type & consumption. | Watts | |
| 10. | Overall width, height and breadth of panel | mm | |
| 11. | Weight of panel. | kg | |
| 12. | Type of mounting. | | |
| II | Do Panel | | |
| 1. | Name of manufacturer. | | |
| 2. | Country of origin. | | |
| 3. | Whether switch-fuse units are used or miniature circuit breakers are used. | | |
| 4. | Specification. | | |

| | | | |
|---|---|---|---|
| 5. | Make, type specification and ratings of fuse-switch/ MCBs | | |
| 6. | Chageover Switches<br>i) Make<br>ii) Type<br>iii) Specification<br>iv) Rating | | |
| 7(a) | Size and material for busbar. | mm | |
| b) | Normal current carrying capacity. | A | |
| c) | Whether the busbars are tinned. | | |
| 8. | Voltmeter<br>i) Make<br>ii) Type<br>iii) Range<br>iv) Specification<br>v) Class of accuracy | | |
| 9. | Type of indication lamps whether neon or low watt resistor type and consumption | watts | |
| 10. | Overall height, width and breadth of panel. | mm | |
| 11. | Weight of panel | kg | |
| 12. | Type of mounting | | |
| | | | |

Schematic Diagrams