INDEPENDENT POWER TRANSMISSION OPERATOR

**TNPRD/ SUBSTATION SPECIFICATION & EQUIPMENT SECTION**

April 2024

# SPECIFICATION SS-44/6

# CONTROL, RELAY & DISTRIBUTION BOARDS

## PART I

## I. SCOPE

This specification covers manufacturing and supplying of the control boards as shown on the attached prints of our drawings (preliminary).

## II. GENERAL REQUIREMENTS

1. The control boards shall be fabricated in sections suited to shipment and capable of being readily assembled at ultimate destination for unit operation and connection to external circuits.

2. All control and distribution boards shall be of the indoor steel cubicle type, unless otherwise noted on the drawings. These boards shall be extendable and complete with all wiring, terminal blocks, labels, indicating lamps etc.

3. The front part of the cubicle, upon which the relays and other apparatus are mounted shall be made from sheet steel through bending and forming operation.
   The top of the cubicle, as well as the door, shall also be made through bending and forming operation.
   The indoor cubicles, except the low voltage distribution cubicles for A.C. and D.C. auxiliary supply which form a set, shall be delivered without exterior side partitions.
   The fastening of the relays and apparatus on the interior side partitions shall be made by screws permanently fixed (spot welded) on the metallic partition or by DIN hat rails, in such a way as to assure easy removal and re-installment of the apparatus. For the fastening of the incoming cables, two (2) metallic supporting plates of “U” profile will be provided at the bottom of the panel. Thickness of the sheet steel of the cubicles shall not preferably be less than 2.3 mm.
   Cubicles shall preferably be of the dimensions 0.80 x 0.60 x 2.30 m. Handles and padlocks shall not be mounted higher than 2.1 m above the floor level.

The above dimensions are indicative and could follow the manufacturer design if needed, under IPTO approval.
All relays shall be mounted suitably and not lower than 0.35 m and not higher than 1.8 m above floor level.
The wiring of the relays shall be from the rear side.

4. Cubicle door shall be hinged to lie flat back and not restrict areas to the panel. Hinges shall be of the lift-off type. Doors shall be secured with integral handles and provision shall be made for locking. On the lower part of the door, louvers shall be provided, covered on the interior side by a metallic screen.

5. The drilling and wiring required for instruments, relays or other apparatus shall be carried out by the Contractor supplying the panels.

6. Cubicles shall be painted with electrostatic paint.
The inside of cubicles shall be painted white and the outside grey.

7. A fluorescent lamp (or any other equivalent) shall be fitted inside each cubicle in order to illuminate as much as possible all wiring without dazzle. The cubicle lamp shall be controlled from a door switch.
Indicating lamp glasses on control and relay panels shall conform to the following standard color code:

RED : Circuit breaker closed. This color is to be reserved for the aforementioned function.

GREEN : Circuit breaker open. This color is to be reserved for the aforementioned function.

WHITE : Lamps normally alight: Voltage healthy, trip circuit healthy etc.

YELLOW : Alarm indications requiring action. Transformer over-temperature, circuit breaker trip-on fault, Buchholz relay actuated, charger failure etc.

8. The incoming cables, as well as the current transformers and voltage transformers secondary circuits, shall be able to be earthed at one central point in an accessible position connected to the earthing system of the switchgear’s nearby panels or bulding.
Apparatus located inside of the cubicle shall be mounted on the sides of the cubicles in a way that provides free access to the panel wiring and terminals.

9. Apparatus, cables and all metallic parts of the boards shall be electrically connected, via a copper tinned grounding bar 25 x 3

mm, leading to the earthing terminals provided for the connection to the earthing system.

10. Panel wiring shall consist of single core, copper stranded wire of 2.5 sq. mm section, insulate, and shall conform to the requirements of specification SS-140, Color of insulation shall be black or grey. For internal wiring, the cross section of the cables shall not be less than 1.5 sq. mm.
Terminal blocks shall be suitable for connection of a stranded copper wire of at least 6 sq. mm section, unless otherwise noted on the drawings.
Cabling shall be running placed in plastic ducts and shall conform to the following standard code:

a. Connections in A.C. circuits:
Brown for phase A
Black for phase B
Grey for phase C
Blue for neutral
Yellow + Green for ground

b. Connections in D.C. circuits:
Black for plus and white for minus D.C.

All wires and multi-core cables on panels shall have ferrules which bear terminal/device designation and connection point at each end. Ferrules shall be of insulating material long-lived under industrial conditions of service and shall be provided with glossy finish to prevent adhesive of dirt.

11. Terminal blocks shall be mounted preferably vertically at the three (3) sides of the cubicle and the distance of their lowest edge from the floor level will be about 30 cm long to give easy access to connection.
All connections shall be made to the front of terminal blocks which shall have pairs of terminals for incoming and outgoing wires.

12. Main buses and bus taps shall be made of high conductivity tinned copper bars with half-round edges. All tap joints shall be heavily bolted.

13. Fuses and links, auxiliary protective gear and test links shall be accommodated inside the cubicle. In each control or distribution board a minimum of 10% of spare terminal blocks mounted on the channel shall be provided. The final quantity of spare blocks will follow the manufacturer design.
For each type and rating of fuses and indicating lamps, fuse extractors (if required) and one spare fuse and one indicating lamp shall be provided for each board.

14. Labels provided for all apparatus shall be of approved material to ensure permanency of the lettering. The surface of the label shall have a mat or satin finish to avoid dazzle from reflected light. Mimic diagram shall be provided on the 150 kV and 15 kV control panels and shall be white metal (aluminum alloy).

15. In case of use of voltage isolation sockets type "Ω", they should be installed near panel door providing easy control. They will also be located in groups (per bay or bus). At any case, incoming voltages will be at the female part of "Ω" socket.

## PART II

## TEST REQUIREMENTS

Switch-gear assemblies, as stated above, shall be able to withstand the following dielectric tests to determine the adequacy of the insulation. All these dielectric tests shall be made phase to phase and phase to ground.

Devices used as a part of switch-gear assemblies shall be capable of meeting the dielectric requirements for such devices.

1. A.C. assembled equipment rated from 60 to 600 V shall withstand for one minute a low frequency A.C. voltage test of twice the rated voltage plus 1000 V, with a minimum of 1500 V.

2. Tests for D.C. assembled equipment rated 110 V shall be 1500 V.
The above tests shall be made at the point of manufacture.

3. In addition, tests may be made by using 75% of the given values in paragraphs 1 and 2 at the point of installation.

## PART III

## DRAWINGS & CONNECTION DIAGRAMS

Drawings of the general arrangement and diagrams of connections shall be submitted by the contractor for approval before starting any work.
Upon delivery of the equipment the contractor shall furnish reproducible copies according to the Inquiry.
Pamphlets, technical descriptions, operation manuals etc., shall be submitted in ten copies (in English or French language) for each type of apparatus or relay.

The supplier shall submit (if possible) the final "as manufactured" drawings in digital format, as follows:

The wiring drawings of the equipment shall be submitted in Autodesk AutoCAD format (dwg files), using attributed symbol blocks and attributed title block on every page, following IEC standards for the symbols and the

design. Alternatively, the wiring drawings shall be submitted in Autodesk AutoCAD / Electrical Toolset project format, following IEC standards. The wiring drawings shall be also submitted in Adobe Acrobat format (pdf files).

All above Autodesk AutoCAD drawings should be open for editing and preferred to be submitted with digital sign by the manufacturer.

## PACKING

The panels must be delivered on an appropriately covered for transport and within of an entirely closed robust wooden box 20 mm of thickness.