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KOEBERG NUCLEAR POWER STATION
TECHNICAL SUPPORT
DESIGN ENGINEERING

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TITLE : TECHNICAL SPECIFICATION FOR LOW VOLTAGE
POWER DISTRIBUTION BOARDS.

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KOEBERG NUCLEAR POWER STATION
TECHNICAL SUPPORT
DESIGN ENGINEERING
Technical Specification
 for
LOW VOLTAGE POWER DISTRIBUTION BOARDS

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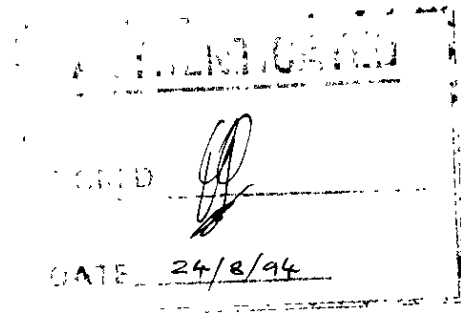
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TECHNICAL SPECIFICATION
FOR
LOW VOLTAGE DISTRIBUTION BOARDS

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1.0 SCOPE

1.1 General

This specification applies to the design, manufacture and delivery of power distribution boards for Eskom at Koeberg Nuclear Power Station.

1.2 Scope of Supply

All equipment and material as described on the attached drawings which in turn must comply with all standards and codes referred to herein.

2.0 REFERENCES, STANDARDS AND CODES

All boards shall be designed, constructed, wired and tested in accordance with the latest practice and amendments of the following specifications, recommendations and codes.

Precedence shall be given to SABS publications wherever content matter conflicts:-

SABS 0142-1993	-	Code of Practice for the Wiring of Premises
SABS 152	-	Low-voltage air-break switches, air-break disconnectors air-break switch-disconnectors and fuse combination units
SABS 156	-	Moulded case circuit breakers
SABS 767	-	Earth Leakage Protection Units
SABS 767-1	-	Earth Leakage Protection Units - Part 1 : Fixed earth leakage protection circuit breakers
SABS 1180	-	Electrical distribution boards
SABS 1091	-	Paintwork Specification
BS 158	-	Colour coding of PVC wiring, busbars etc.
BS 159	-	Specifications for Busbars
BS 3983	-	Specification for Current Transformer
KBA 1216 GO 1055	-	Eskoms Standard Labelling Procedures

3.0 DESIGN REQUIREMENTS

3.1 Service Conditions

The boards and associated equipment supplied shall be suitable for the following environmental conditions:-

Temperature	:	Min 15°C Max 35°C
Pressure	:	Atmospheric
Humidity	:	50%
Radiation	:	Background
IP. Ratings	:	As specified

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3.2 Construction Design

Prior to commencing any manufacture, the Board Supplier shall submit three copies of a full set of general arrangements, schematic and working drawings to Eskom for approval. The Board Supplier shall allow two weeks for such approval.

In the design the Board Supplier shall take note of all references, standards and codes as stipulated in Clause 2.0

4.0 MANUFACTURING REQUIREMENTS

4.1 Construction of Boards

- 4.1.1 All distribution boards shall be either wall mounted or floor standing boards as indicated on the Schematic Diagrams of Distribution Boards.
- 4.1.2 All boards shall be of mild sheet steel construction with a thickness not less than 2,0 mm. All folds shall be neatly and accurately made and any welding carried out shall not distort or deform the panels. Free standing boards to have rear access panels, as indicated on the schematic diagrams.
- 4.1.3 All floor standing boards shall be provided with basic frames 100 mm high for bolting to floors. Maximum overall height of floor standing boards to be 2300 mm from floor.
- 4.1.4 Wall mounted boards with doors having a height greater than one meter shall have three hinges and be suitably braced inside for strengthening. All doors to have lockable handles.
- 4.1.5 All large boards shall be provided with lifting lugs which shall be removable and the lugs shall be bolted to the main framework of the board. The framework shall be designed so that no distortion of the boards will take place when hoisted and handled.
- 4.1.6 Unless otherwise specified all boards shall be designed for bottom cable entry and arranged with incoming switchgear at the bottom of the panel. Gland plates to be positioned in such a manner allowing easy cable access.
- 4.1.7 The boards shall be designed to have not less than 100 mm clearance all round and a minimum clearance of 200 mm between cut-outs.
- 4.1.8 All boards to have minimum 20% spare capacity unless otherwise indicated and spare cut-outs to have individual covers.
- 4.1.9 The boards shall be designed to suit the fault levels required as indicated on the Schematic Diagrams.
- 4.1.10 All boards to have air vents at top and bottom on sides. Wire meshing to be put over vents on the inside to prevent the ingress of insects.

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4.2 Busbars

- 4.2.1 All busbars shall be of suitable rating (at not less than 1,92 amps per square millimetre) and strength throughout. The bars shall be mounted on insulated supports of adequate strength.
- 4.2.2 All busbars, busbar connections and clearances, etc., shall be in accordance with the requirements of BS 159. All busbars shall be colour coded to BS158, PVC tape or insulated with thick shrink-on sleeving, to the approval of Eskom, except where they are fully enclosed in a separate busbar chamber.
- 4.2.3 The busbar, connections and their insulated supports shall be of approved construction, mechanically strong, and shall withstand all the stresses which may be imposed upon them in ordinary working due to fixing, vibration, fluctuations in temperature, short circuit or other causes. No material used for busbar connections or for supporting the connections where insulated or otherwise shall be stressed to more than one-fourth of its breaking load or one-third of its elastic limit, whichever is the lesser.
- 4.2.4 Provision shall be made for variation of temperature.
- 4.2.5 The busbars shall be so arranged that they may be extended in length without difficulty.
- 4.2.6 The busbars and connections shall be so arranged and supported that under no circumstances including short circuit conditions can the clearance from earthed metalwork or from other conductors be less than the distances specified in BS 159.
- 4.2.7 The board manufacturer shall include for copper busbars throughout unless otherwise specified in the Project Specification.

4.3 Switchgear

- 4.3.1 Circuit breakers shall be of adequate continuous rating and breaking capacity and shall be rated a minimum of 5 kA. Merlin Gerin type breakers or equal approved to be used throughout.
- 4.3.2 All moulded case circuit breakers shall comply with SABS 156 or equivalent international standard.
- 4.3.3 Triple-pole circuit breakers shall be rated for a system voltage of not less than 380 volt, 3-phase, 50 Hz and shall be non-draw-out, non-adjustable and of the values detailed. All circuit breakers shall carry a SABS test certificate of fault-breaking capacity satisfying the specified predicted fault levels at the distribution boards. All circuit breakers of the same frame size shall be of the same make, and the same make is to be used throughout the installation.

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4.3.4 Circuit breakers used for motor starting, with high transient currents, will be of the 'D tripping curve range.

4.3.5 Final sub-circuits shall be protected by single-pole magnetic circuit breakers of Merlin Gerin manufacture or equal approved, breaking capacity SABS 5kA, with non-adjustable over-current protection and suitable for flush mounting. Single-pole circuit breakers shall be rated for not less than 250 volt system operation. Circuit loading to be balanced out evenly over the three phases.

4.3.6 All contactors to be of Merlin Gerin type or equal approved.

4.4 Earth Leakage Units

4.4.1 Earth leakage units shall be of 30 mA sensitivity to SABS 767.

4.4.2 Where an earth leakage unit feeds sub-circuit breakers an isolating switch can be installed instead of a circuit breaker, thus allowing the earth leakage unit to trip on earth fault only and not on over-current.

4.4.3 All earth leakage units to be of Merlin Gerin type or equal approved.

4.5 Current Transformers

4.5.1 The passage of the maximum specified short circuit fault current through any items of equipment shall not damage the instruments associated with the equipment and current transformers shall be provided to achieve this condition, whether specified in the schedule or not.

4.5.2 Current transformers shall be included for all ammeters and for other instruments where necessary. Ammeters connected directly in the power circuit will not be accepted. Ammeter scales shall be calibrated to read the primary current of the C.T, which must be rated and braced for the system conditions.

4.5.3 All current transformers used for energising instruments shall have an accuracy not less than that specified in BS 3983 for class 1 transformers, unless otherwise approved by Eskom.

4.6 Internal Wiring

4.6.1 All internal wiring of boards shall be neatly grouped and run in PVC wiring channels of adequate size, with covers, and additional spare capacity of 25%, unless otherwise indicated, shall be provided.

4.6.2 All internal circuit wiring will terminate in KLIPPON type terminals suitably mounted on rails, at the bottom of the distribution board, 100 mm to underside of terminal above the boards bottom plate. Final positions of terminals to be agreed by Eskom's Engineer.

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- 4.6.3 Each phase of the alternating current and each pole of direct current switchgear and connections shall be coloured in an approved manner to distinguish phase or polarity. The colouring shall, unless otherwise approved, be in accordance with BS 158.
- 4.6.4 All control connections and instruments and relay wires shall be provided with numbered ferrules at each terminal and the numbering shall be in accordance with an approved system. All wiring diagrams shall be clearly marked with the numbers shown on the ferrules of the individual cores. The clip-on type of ferrule or self-adhesive labels will not be acceptable.
- 4.6.5 Mechanically crimped lugs shall be used.
- 4.6.6 Each set of current transformer secondary connections shall be complete in itself and shall be earthed at one point only. Each such earthing connections to the earth bar shall be made through a link or other connection of approved design which can be removed when insulation tests are required without breaking any circuit which normally carries current.
- 4.6.7 Unless otherwise approved, no insulated wire shall have less than three strands with a combined cross sectional area, in the case of power wiring, of at least 2,5 mm².
- 4.6.8 On control cables each core shall be "rung through", fitted with numbered ferrules in accordance with the wiring diagram of the equipment to be connected, neatly laced and connected up. Some slack shall be allowed on each core, as well as slack in the cable itself.

4.7 Neutral and Earth Bars

Amply sized neutral and earth bars shall be provided. An earth strap shall positively earth each door.

4.8 Metering

All Main Boards to have suitable metering viz. ammeters and voltage meters on the incoming supply, as indicated on the schematic diagrams.

4.9 Corrosion Protection

Where power distribution boards are situated in a corrosive atmosphere the boards shall be manufactured from 316 stainless steel. For board clarification refer to the Project Specification.

4.10 Paintwork

Unless otherwise specified the colour coating shall be blue with a satiny aspect according to SABS 1091 F09 (1975).

Paintwork to be in accordance with Koebergs' Paint Specification Ref. KMM/CP.1.3.

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4.11 Labelling

4.11.1 All items of equipment such as circuit breakers, isolators, earth leakage units etc. mounted in boards shall be clearly labelled by means of a screwed or riveted nameplate in accordance to Koebergs' KBA 1216 GO 1055 and the respective Schematic Diagrams of each board.

4.11.2 Each component is identified as follows:-

- a serial number
- an equipment identification, i.e.
JA for the circuit breaker
JS for the isolator

e.g.: for a circuit breaker the label is : 001 JA

4.11.3 Each board shall have a drawing envelope to A4 size, with "Perspex" pane, mounted inside the door.

Where boards do not have doors this holder is to be mounted in a suitable position so as not to interfere with the local circuits.

4.12 Verification and Test

4.12.1 Distribution boards shall be pre-tested by the manufacturer before the Eskom Engineer and QA representative do their final inspection prior to delivery.

4.12.2 Earth leakage units must be tested and assured of tripping on earth fault.

4.12.3 All metering instruments to have certificates of calibration SABS markings.

5.0 DOCUMENTATION

5.1 On receipt of Eskoms' board schematic diagrams the Board Manufacturer shall before commencing manufacture submit 3 copies of a full set of general arrangements, schematic and wiring diagrams to Eskom for approval.

5.2 The Board Manufacturer shall allow two weeks for such approval.

5.3 The Board Manufacturer shall not work off any drawings not bearing the official 'APPROVED FOR MANUFACTURE' stamp and duly signed by the Eskom Engineer.

5.4 An Eskom titleblock must appear on all drawings.

6.0 SHIPPING, PACKAGING & STORAGE

The manufacturer is to ensure that all recommendations regarding shipping and packaging are adhered to and to advise Eskom of any special provisions with regard to storage.