



Standard

Technology

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JUNCTION BOXES FOR
TRANSMISSION.**

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Compiled by

Tejin Gosai

Chief Engineer -
Telecommunications

Date: 02/03/2018

Approved by

Stuart van Zyl

Chief Engineer -
Protection

Date: 2 March 2018

Authorized by

Richard McCurrach

PTM&C Senior Manager

Date: 6/3/2018

Supported by SCOT/SC

Anita Oommen

SCOT PASC Chairperson

Date: 06 March 2018

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1. Introduction

This document specifies Eskom Transmission's requirements for outdoor Yard Digital Interface Junction Boxes used at Eskom substations.

2. Supporting clauses

2.1 Scope

This document details technical requirements of the following equipment:

- Large junction box steelwork shall be fitted with circuit breaker bay innards or transformer/shunt reactor innards; and
- Small junction box steelwork which shall be fitted with circuit breaker bay innards.

2.1.1 Purpose

This specification provides potential suppliers with a framework against which their offered products will be adjudicated. Further, this specification shall be the technical basis for any supply contract to be awarded.

Subsequent to the award of an Eskom National Contract (ENC), once manufacture of the Yard Digital Interface Junction Boxes commences, further technical considerations that may arise will be negotiated between the Supplier and the Purchaser. Once an agreement has been reached with regards to these technical considerations, the new or modified items will be added to the contract. The supplier will also be required to produce design drawings.

2.1.2 Applicability

This document shall apply to Eskom Transmission with possible application to Eskom Distribution.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

The following national, international and Eskom specifications and standards shall be read in conjunction with this specification. In cases of conflict, the order of preference shall be as follows: the South African Compulsory Specifications, SANS 10142-1, the requirements of this specification and thereafter the International Standards.

- [1] SANS 1091, National Colour Standards for Paints, SANS, Latest
- [2] SANS 10142-1, The wiring of premises part 1: low-voltage installations, SANS, Latest
- [3] SANS 60529, Degrees of protection provided by enclosures (IP Code), SANS, Latest
- [4] 240-75655504, Corrosion protection standard for new indoor and outdoor Eskom equipment, components, materials and structures manufactured from steel standard, Eskom, Latest
- [5] 240-55151908, AC Reticulation Application Design Guideline for Substations, Eskom, Latest
- [6] 240-62629353, Specification for panel labelling standard, Eskom, Latest
- [7] 240-62773019, Specification for Low Voltage Auxiliary Electrical Components Standard, Eskom, Latest
- [8] 240-64636794, Standard for Wiring and Cable Marking in Substations, Eskom, Latest
- [9] 240-6400247, Standard for Earthing of Secondary Plant Equipment in Substations, Eskom, Latest

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- [10] TSP 41-1043, Specification for Control, Selector, Isolation and test switches, Eskom , Latest
- [11] 240-70413291, Specification for Electrical Terminal Blocks, Eskom, Latest
- [12] 240-65336348, Standard for Transmission and Distribution Protection Schemes: Common Requirements, Eskom, Latest
- [13] 240-64139144, AC boards and Junction Boxes for Substations, Eskom, Latest

2.2.2 Informative

- [14] 32 - 9, Definition of Eskom documents, Eskom, Latest
- [15] 32 – 644, Eskom documentation management standard, Eskom, Latest

2.3 Definitions

2.3.1 General

Definition	Description
Barrier	A part providing protection against direct contact from any usual direction of access (minimum IP2X) and against arcs from internal arc faults, if any.
Disconnecter	Mechanical switching device that:- a) For reasons of safety, provides in the open position, an isolating distance in accordance with specified requirements b) Is capable of opening and closing a circuit either when negligible current is broken or made, or when no significant change in the voltage across the poles of the disconnecter occurs, and c) Is capable of carrying currents under normal circuit conditions and of carrying for a specified time, currents under specified abnormal circuit conditions such as those of short circuit.
Innards	Internal sub-assemblies within junction boxes which consist of auxiliary components, wiring, terminals, blanking plates, cable gland plates, trunking and electrical components as per the relevant drawings.
Intelligent Electronic Device (IED)	A microprocessor-based device that encompasses all or some of the following functionalities: protection, control and automation, metering, telecontrol, substation DC and auxiliary supply systems, quality of supply monitoring, and disturbance and event recording.
Process Interface Unit (PIU)	Also referred to as a ‘digital merging unit’ or ‘binary input/output device’; an Intelligent Electronic Device (IED) that collects binary data from process devices, typically electrical primary plant equipment, by way of status contacts, and processes and publishes this data to other IEDs in a digital format (e.g. IEC 61580-based communication). The device similarly converts digital commands from other IEDs into electrical control signals to the primary equipment. PIUs are typically installed on or near the primary equipment with which they exchange data.
Purchaser	Eskom Holdings SOC Limited
Supplier	A successful tenderer, with whom a supply contract is placed. In other words, all tenderers are potential suppliers.
Switch	Mechanical device that is capable of safely making, carrying and breaking currents under normal conditions (which may include specified operating overload conditions) and of carrying, for a specified time, currents under specified abnormal circuit conditions such as those of short-circuit

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Definition	Description
Switch disconnecter	Switch that, in the open position, satisfies the isolating requirements specified for a disconnecter.

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
CT	Current Transformer
DC	Direct Current
ENC	Eskom National Contract
FAT	Factory Acceptance Testing
IED	Intelligent Electronic Device
IP	Ingress Protection
JB	Junction Box
LED	Light Emitting Diode
MCB	Miniature Circuit Breaker
PIU	Process Interface Unit
PTM&C	Protection, Telecommunication, Measurement and Control
SANS	South African National Standards

2.5 Roles and responsibilities

The document is a SCOT document.

2.6 Process for monitoring

The SCOT Protection & Automation study committee shall evaluate and monitor the compliance to this standard.

2.7 Related/supporting documents

This document is based in part on requirements from 240-64139144 AC Boards and Junction Boxes for Substations.

3. Technical Specification

This specification defines the Purchaser's technical requirements for the following types of Yard Digital Interface Junction Boxes for Transmission:

- Large junction box steelwork fitted with circuit breaker bay innards or transformer/shunt reactor innards.
- Small junction box steelwork fitted with circuit breaker bay innards.

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To assemble any one of the Yard Digital Interface Junction Boxes listed above the following components will need to be ordered depending on the project application:

- a) Large Junction Box Steelwork
- b) Small Junction Box Steelwork
- c) Circuit Breaker Bay Innards for large junction box
- d) Transformer/Shunt Reactor Innards for large junction box
- e) Circuit Breaker Bay Innards for small junction box

3.1 Description of line items

All Yard Digital Interface Junction Boxes are outdoor junction boxes. The JB's main purpose is to house and interface Process Interface Unit (PIU) electronic devices which digitise binary signals for interfacing with an IEC 61850-based substation protection and telecontrol system. PIU devices are to be mounted in 19-inch rack apertures provided within the junction box and plugged into the box wiring via standardised industrial connectors. PIU devices and their wiring tails and male connector sockets will be free issued to site, and fitted by Eskom project staff (and are thus excluded from the scope of this document).

Fibre optic patch boxes will be installed inside the Yard Digital Interface Junction Boxes for termination of fibre optic cables. Patch boxes will be free issued to site and fitted by the fibre contractor (and are excluded from the scope of this document).

Junction boxes shall otherwise be constructed complete with the necessary connections, interconnecting wiring, MCBs, supporting steelwork, bolts, nuts, washers, labels and necessary sundries to provide a complete assembly. Nothing in this specification shall lessen the contractor's obligations detailed in any other documents forming part of the contract.

The latest revision of the supporting documents must be read in conjunction with this specification. However, in cases of conflict, the provisions of this specification shall take precedence.

The following main contract line items are envisaged:

3.1.1 Large junction box steelwork

A steel junction box as per drawing 0.52/30548 including double roof, thermal insulation, internal steel frames for rack mounting system and provisions for earthing that will be used to house the innards and patch boxes for Breaker Bay applications and for Transformer/Reactor junction boxes.

The basic dimensions are:

- Width: 2200 mm
- Height: 2021 mm
- Depth: 880 mm

This item will be ordered together with any one of items 3.1.3 or 3.1.4.

3.1.2 Small junction box steelwork

A steel junction box as per drawing 0.52/30549 including double roof, thermal insulation and provisions for earthing that will be used to house the innards and patch boxes for breaker bay applications and, in future, small Transformer/Reactor junction boxes.

The basic dimensions are:

- Width: 1650 mm
- Height: 1930 mm
- Depth: 880 mm

This item will be ordered with item 3.1.5.

3.1.3 Circuit breaker bay innards for large junction box

Used in conjunction with item 3.1.1.

The innards will consist of:

- a) All auxiliary components, wiring, terminals, blanking plates, cable gland plates and trunking as per drawing 6JB#100-0.52/30545.
- b) Includes the female half of “Harting” type connectors for interfacing of Main 1 and Main 2 circuit-breaker Process Interface Units (PIUs). The “Harting” type connector details (type number, number of pin, etc.) are listed in drawing 6JB#100-0.52/30545. The PIU devices (two), their wiring tails and the male half of the “Harting” type connectors will be free issued to site, fitted by the contractor and are not part of this scope.

To be fitted into a large box (see 3.1.1)

This design of the innards caters for interfacing of:

- 1 x three-mechanism circuit breaker with single pole tripping on Main 1 and Main 2 and phase segregated closing.
- 4 x phase segregated motorized disconnectors; and
- 4 x manually operated earth switches.
- Current Transformers.

3.1.4 Transformer/Shunt Reactor innards for large junction box

Used in conjunction with item 3.1.1.

The innards will consist of:

- a) All auxiliary components, wiring, terminals, blanking plates, cable gland plates and trunking as per drawing 6JB#200-0.52/30546. The Point-on-Wave switching device option on sheets 23 to 27 is addressed separately (see 3.1.6).
- b) Includes the female half of “Harting” type connectors for interfacing of Main 1 and Main 2 transformer PIUs, and a tap change PIU. The “Harting” type connector details (type number, number of pin, etc.) are listed in drawing 6JB#200-0.52/30546. The PIU devices (three), their wiring tails and the male half of the “Harting” type connectors will be free issued to site, fitted by the contractor and are not part of this scope.

To be fitted into a large junction box (see 3.1.1).

Caters for interfacing of:

- A single power transformer or shunt reactor with on-load tap changer.
- Point-on-Wave switching device option (see 3.1.6).

3.1.5 Circuit breaker bay innards for small junction box

Used in conjunction with item 3.1.2.

The innards will consist of:

- a) All auxiliary components, wiring, terminals, blanking plates, cable gland plates and trunking as per drawing 6JB#300-0.52/30547.
- b) Includes the female half of “Harting” type connectors for interfacing of Main 1 and Main 2 circuit-breaker process interface units. The “Harting” type connector details (type number, number of pin, etc.) are listed in drawing 6JB#300-0.52/30547. The PIU devices (two), their wiring tails and the male half of the “Harting” type connectors will be free issued to site, fitted by the contractor and are

not part of this scope. The Process Interface Unit devices, their wiring tails and the male half of the "Harting" type connectors are excluded from the scope (to be free-issued).

To be fitted into a small junction box (see 3.1.2).

Caters for interfacing of:

- 1 x three-mechanism circuit-breaker with single pole tripping on Main 1 and Main 2 and simultaneous closing of all phases.
- 1 x three mechanism motorised disconnectors and 2 x single mechanism motorised disconnectors.
- 3 x manually operated earth switches: one independently operated per phase, two ganged.

3.1.6 Point-on-Wave switching device option

Optional item used in conjunction with item 3.1.4, but may be integrated into items 3.1.3 and/or 3.1.5.

The module consists of:

- a) All auxiliary components, wiring, terminals, blanking plates, cable gland plates and trunking as per drawing 6JB#200-0.52/30546 sheets 23 to 27, and layout detail elsewhere in the drawing set.
- b) Includes 2 x Secucontrol type FTL 8-way test blocks.
- c) Point-on-Wave switching device to be free issued by Eskom and mounted/wired by Supplier as per drawing.

3.2 Mechanical design

3.2.1 Construction

- a) Outdoor Yard Digital Interface Junction Boxes shall be fabricated from 3CR12 (corrosion resisting steel) with a minimum thickness of 1.6mm. These boxes shall be vermin proof.
- b) All outdoor equipment shall be manufactured with a minimum IP rating of 54.
- c) After fabrication, metal surfaces including doors and removable covers shall be prepared and finished in accordance with Eskom's corrosion protection specification 240-75655504.

All boxes must be seam welded. Cognisance shall be taken of the fact that any area where water or dirt can accumulate such as inadequate welds, bolted surfaces and sharp areas will result in accelerated corrosion. The box shall be manufactured in such a manner that contamination from other metals, including steel, is not possible. Contamination would occur if, for example, an angle grinder that has just been used on mild steel was used in the manufacture of the box. Contamination can also occur if the box is left in an environment where metal particles can make contact with the box. Contamination is not permitted due to its corrosive effect on the 3CR12 and also causes rust to occur on the mild steel.

- d) All doors shall have a fixed earth stud. All JB's and equipment within the JB's shall have fixed earth studs. All individual metal parts used in the construction of the outdoor JB's must have an earth stud.

The junction box shall be fitted with a brass earth stud of dimension M16 x 75mm and complying with brass quality specification 303. The stud shall be secured to the junction box with 2 brass nuts including normal brass washers. The earth bar in the junction box shall be secured with 1 brass nut and normal brass washer. The brass stud shall have an electrical contact resistance with the junction box body of less than 0,1 ohms.

- e) Trunking used in all JB's must be permanently secured. All dimensions shall be strictly adhered to. Should any small changes need to be made, this shall be done with the written approval of the appropriate Eskom technical specialist.

- f) All parts and fixtures shall be made from 3CR12. All welds shall be waterproof. The welds shall be completed with a MIG welder and 3CR12 or stainless steel wire. Treatment of 3CR12 shall be done in accordance with the recommendations of Columbus Steel, selected details of which are included in Annex B.
- g) The box shall be painted and treated in accordance with 240-75655504. The box shall be powder coated to a semi-gloss finish and to colour SANS 1091 G12 Dark Grey.
Suppliers to ensure tolerances are within requirements to ensure movable components (e.g. doors) are not hindered.
- h) The ventilation shall be provided according to the Eskom drawings 0.52/30548 for the large junction steel box and 0.52/30549 for the small junction steel box. Vents shall be protected by a gauze (mesh) that will prevent insects from entering the box, Fans shall not be allowed in the box.

3.2.2 Insulation

The junction boxes shall include double roof structures. They shall feature thermal insulation on the insides of the doors and side walls. Insulation shall be 25mm mineral wool reinforced with aluminium foil: "U Thermo Board 3" from ISOVER Saint-Gobain or Eskom approved equivalent. The wool insulation shall be covered with 3CR12 sheeting.

3.2.3 Doors

- a) The right hand doors of each pair of doors shall be provided with a non-ferrous handle which operates a vertical locking rod assembly. The left hand door shall be secured behind a locking ridge on the right hand door. The handle shall be capable of being padlocked in the fully closed position. A minimum of two non-ferrous hinges of substantial section and approved pattern shall be provided per door, together with a door stay. The door stay must be of hook and eye type and not window stay type. The hook must be made from a stainless steel rod that has a minimum diameter of 6mm. The eye and/or additional steelwork welded to the JB to accommodate the door stay must be constructed from 3mm 3CR12 Stainless steel. The door stay must be robust to withstand wind pressure.
- b) Doors shall be provided with gaskets of neoprene or approved material. Rubber or felt gaskets are not acceptable.
- c) Two drain holes of 6mm diameter shall be provided in the lower door-fold, at each end of the door.

3.2.4 Anti-condensation heater and ventilation

A thermostatically-controlled 230V AC heater unit must be installed in order to prevent condensation. Silicone wires, un-insulated lugs and heat resistant sleeving must be used to terminate the heaters. Encapsulated heaters can be used.

3.2.5 Label mounting

Mounting holes for an external label shall be provided on the lip of the double roof structure. JBs shall be supplied with these holes filled with plastic caps.

The dimensions of the holes to be drilled are indicated in Eskom drawings 0.52/30548 for the large junction steel box and 0.52/30549 for the small junction steel box

3.2.6 Gland Plates and Din Rails

- a) The gland plate shall be made of 2mm thick 3CR12. The plate shall have pre-punched cut-outs for the cable glands.
- b) Gland plates shall not be painted/powder coated, but shall be zinc coated and passivated blue or silver. Hexavalent yellow passivation shall not be used for any steel work including nuts and bolts owing its hazardous nature.

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- c) The gland plate shall be bolted to the junction box with stainless steel bolts. Spring washers shall be used between the junction box body and the fastening nut. The primary function of the spring washers is to allow for improved electrical connectivity between the gland plate and the junction box body.
- d) In addition to the fastening bolts, the gland plate shall be earthed to the brass earth stud by means of a braided tinned-copper earth strap with an effective copper cross sectional area of 12mm².
- e) The contact resistance between the brass stud and any part of the gland plate shall be less than 0,1 ohms.

3.2.7 Damaged Paint Work

Paint work damaged during transportation and delivery shall be made good as per manufacturer repair specification at no cost to the Purchaser. If site re-painting is necessary, the equipment and labels shall be carefully masked and any overpaint which occurs in spite of the masking must be removed. The cost for the repair of damage paint work will be directed to the transport company.

3.2.8 Nuts, Bolts and Washers

All nuts, bolts and washers used are to be stainless steel. Where referred to as per drawings, brass bolts, nuts and washers must be used. Self-tapping screws shall not be used.

3.2.9 Base Frame

A base frame made of 2.5mm steel U-channel, hot-dip galvanized to SANS ISO 1461 shall be provided as per drawings for the outdoor foundation mounted junction boxes.

3.2.10 Insert Trays

- a) The Junction Box insert trays shall be manufactured from 2mm thick 3CR12 steel or 304 stainless steel of the same thickness. The tray shall be bonded to the brass earth stud using a 12mm² braided tinned-copper strap. The contact resistance between any part of the chassis or metal fixtures and the brass earth stud shall be less than 0,1 ohms.
- b) The insert trays shall be smooth powder coated to SANS 1091 colour white.

3.3 Electrical

3.3.1 Safety

- a) The mounting and wiring of components shall ensure that with the Junction Box front doors open, no hazardous parts are accessible using a 2.5mm diameter conductive probe. With the rear doors open (exposing the terminal strips), no hazardous parts shall be accessible using a 12.5mm diameter test finger.
- b) Components mounted within the inner doors of the Junction Box shall be such that hazardous parts are not accessible by the back of a hand (a probe of diameter 50mm).

3.3.2 Terminals

- a) All terminals shall be as per 240-70413291 (Terminal block specification), subject to Eskom approval. Not more than two conductors shall be connected to any side of a terminal. Terminal block types are indicated in the applicable drawings.
- b) Terminals shall be permanently and indelibly marked in an approved manner. Each terminal shall be clearly and unambiguously identifiable by suitable marking which is on or adjacent to it.
- c) The associated end caps, terminal spacers and labels shall be used. The mounting rails and fixing screws or rivets shall be rust proof, consistent with the requirements of the 3CR12 or 304 stainless steel.

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3.3.3 Terminal Strips

The terminal strips shall be legibly numbered: X1, X2, etc. To improve visibility, the label shall be placed above each terminal strip. Refer to drawings 6JB#100-0.52/30545, 6JB#200-0.52/30546 and 6JB#300-0.52/30547.

Terminal arrangement as viewed from rear of panel shall appear on every panel cabling diagram.

3.3.4 Wiring trunking

Wiring trunking shall be provided for all wires. Each trunking shall be fitted with a cover of insulating material. These covers shall be designed so that they can be fixed in position, and removed without the use of tools. Trunking shall be adequately dimensioned to accommodate the maximum number of cables especially where the cables enter the trough.

The specific trunking type used shall be subject to Eskom approval.

3.3.5 Wiring supports

Any support for wiring must be of a non-conductive material. Vertical lacing supports of non-magnetic material shall be provided for securing cable tails. Wiring and cabling shall be adequately supported and clamped. Where wiring is routed from the inside of a panel to a panel door, its' wiring shall be routed through a protective wiring sock. Grommets or bushes shall be used where wires or cables pass through metalwork. Wiring and cabling shall be routed such that its insulation is not subject to injurious temperatures or stresses.

3.3.6 Wiring terminations

- a) Joints or splices in any wire are not acceptable.
- b) Not more than two conductors shall be connected to any side of a terminal and where two conductors are connected to a terminal, care shall be taken to ensure that lugs and ferrules are fitted to the conductors so as to allow the wires to approach the terminal as near parallel as possible.
- c) The stripping of insulation shall be carried out so that no damage to conductors occurs. Any nicked wiring will be rejected. The stripping tools used shall be of the type which permits the length of strip to be pre-set. JB's shall include the required terminals as per drawings 6JB#100-0.52/30545, 6JB#200-0.52/30546 and 6JB#300-0.52/30547.
- d) Wiring terminations shall be of such a length and executed in such a manner that the conductors are not subject to injurious tensile stresses or flexing which might cause fatigue failure, whether as a result of vibration or otherwise.
- e) Spare cable leads to be left long enough to reach the furthest terminal in the panel.
- f) All loops must be supplied by the Supplier.
- g) All terminations shall be made with the tool recommended by the manufacturer of the lugs. Crimping tools shall be of the type which will not release the termination during normal operation until the crimp has been correctly formed. A double die crimping tool shall be used in order to effect both the lug and insulation support crimp simultaneously.
- h) All wires and cables less than 6 mm² shall be terminated with pre-insulated crimped connectors of approved types. Other types of lug which are to Eskom's approval may be considered. There shall be no bare wire exposed between a lug and the insulation of the wire to which it is crimped.
- i) All wires and cables larger than 6 mm² shall be terminated with an approved lug. The lug shall be crimped with a hydraulically actuated hexagonal die tool as recommended by the manufacturer of the lug. There shall be no bare wire exposed between a lug and the insulation of the wire to which it is crimped.

- j) All tools used shall be regularly inspected and tested with approved gauges, and maintained or repaired as necessary. Tools shall be inspected and tested initially at weekly intervals, but this period may be extended in the light of experience. A log of inspections shall be maintained for Eskom's inspection.
- k) The lugs selected shall be the correct barrel size for the size of wire or cable with which they are to be used, and the dimensions of the tongue shall match the stud, screw or aperture of the terminal to which they will be connected. Lug tongue lengths shall be such that with a completed termination onto each component, no hazardous parts are accessible via a 2.5mm diameter conductive probe. A sample of each type of lug, wire, tool and finished connection if not previously approved shall be submitted to Eskom for approval before wiring is commenced. The size, current and voltage rating shall match the wire and cable used.

3.3.7 Wiring identification

- a) Wiring leads shall be permanently marked with an approved type of marking device, with black letters impressed on a white background or black letters on a yellow background provided that the colour selected is consistent throughout the JB and is to Eskom's approval.
- b) Interlocking slip-on types of ferrules or one piece ferrules may be used and shall match the size of wire onto which they will be fitted. For heavy conductors and very light telephone type wiring where the preferred type of marking ferrule is not available, other methods will be subject to Eskom's prior approval.
- c) All wiring shall be identified using numbers, at each end using the alphanumeric wire numbers indicated in the applicable drawing.

3.3.8 Wiring sizes and practices

- a) The wiring sizing and practices shall be as per the wiring standard 240-64636794. The overload rating of the scheme/module wiring shall be higher than the protective MCB rating which is prescribed.
- b) The supplier shall use wiring schedules to ensure that all commodities of the same type are wired identically. The wiring schedules for the circuit breaker bay innards for the large junction box, transformer/shunt reactor innards for the large junction box and the circuit breaker bay innards for the small junction box shall be provided by the supplier and approved by Eskom after contract has been awarded.

3.3.9 Earthing

All earthing shall be done in accordance with the Eskom Standard, [9] 240-64100247. Each component shall be connected separately to the earth bar: daisy chain earthing of components is not acceptable.

Earthing tails shall be provided for the free issued patch boxes.

3.3.10 Labelling

All internal JB labelling shall be done in accordance with the Eskom Standard, [6] 240-62629353.

3.3.11 Packaging for transport

- a) JBs shall be securely packed before transporting by road to site or store, as specified per batch order. If the Supplier is required to deliver and off-load, he must ensure that he uses transport with suitable off-loading facilities.

- b) The Supplier shall pack junction boxes in a manner that is designed to prevent damage or deterioration during transit to the final destination. The products ordered shall be packed in high specification impact resistant corrugated cardboard or a wooden crate. This shall ensure that the equipment is protected from damage in the event of a light drizzle as well as protected from bumps and scratches that could occur from normal handling and transport. The package shall be clearly labelled with the substation name, full delivery address, Eskom and supplier order number, despatch date and the contents of the package.
- c) Acceptance of junction boxes or any other equipment by the Eskom representative at the time of delivery is subject to inspection by the Eskom representative. Unless instructed otherwise by the Eskom representative, the Supplier shall promptly replace lost parts and repair damage to the junction box as identified by the Eskom representative.

3.3.12 Auxiliary electrical components

- a) All auxiliary electrical components including terminal blocks, auxiliary relays, diodes, indication lamps, test points and rotary switches shall comply with Eskom Standard, [7] 240-62773019.
- b) Rotary switches shall also comply with Eskom Standard, [10] TSP 41-1043.
- c) Auxiliary component makes and types are indicated in the applicable innard design drawings. Suppliers may substitute the indicated makes and types with alternatives subject to the alternate components meeting the same or higher performance and quality specifications as per the specified components. All auxiliary components shall be subject to Eskom acceptance.
- d) Snubber circuits
Snubber circuits, where indicated in the standard junction box innard designs, shall provide the protected contacts with the ability to break 500VA at 250Vdc, L/R = 20ms. The snubber circuits shall have been tested by a reputable testing agency, its documentation confirming fulfilment of Eskom's current breaking capacity requirements.
- e) Miniature circuit-breakers ratings
Miniature circuit breakers (MCB's) shall comply with the requirements of the Eskom Standard 240-62773019 with current ratings as per the applicable innard design drawings. All MCB's shall be wired with the source supply at the top, and the load supply at the bottom. The MCB ratings are:
 - 1. For AC – 5kA
 - 2. For DC – 10kAMCBs with Curve B shall be used for DC supply MCBs except for MCBs on spring rewind and motorised isolator DC motor circuits which should be Curve C (due to short duration high loading in some applications). The incomer DC isolating MCBs shall be to Curve C. Curve C MCBs shall be used for AC MCBs.

4. Testing

All instruments used for testing shall be of suitable quality and of sufficient accuracy for the particular test application. Eskom reserves the right to request instruments that have been certified by the National Calibration Service. The cost of obtaining such certificates shall be for the Supplier's account. In order to enable Eskom to witness tests, the Supplier shall inform Eskom in writing at least three weeks prior to commencement of type testing and at least two weeks prior to routine testing.

The first manufactured Yard Digital Interface Junction Box will be checked and tested at the supplier premises before being allowed for dispatched in Eskom's network. The type and routine tests will be done in accordance with section 4.1 and 4.2 of this document.

4.1 Type testing

- a) When the first unit is manufactured, prior to delivery, the unit shall be provided for type testing (FAT) to establish performance characteristics and to demonstrate compliance with all requirements of this specification. The contractor shall draw up a test schedule for Eskom approval prior to testing. Eskom representatives shall witness these tests at the Supplier's works. Eskom will at the same time examine the unit with regard to mechanical construction, layout and labelling. Type tests at the Supplier's works shall include operational tests, wiring tests and any additional tests that may be required by Eskom.
- b) In the event of any changes that may be necessary after type testing, written approval shall be obtained from Eskom prior to the introduction of such changes. Repeated type tests as a result of changes in the design shall be at Eskom's discretion, and for the Supplier's cost.
- c) The type tests that will be required are:
- 1) the "Insulation resistance test" from Eskom standard, [12] 240-65336348.
 - 2) the "Electrical impulse test 1,2/50 us" from Eskom standard [12] 240-65336348.
 - 3) Crimped ends mechanical strength testing - The wiring shall be tested according to standard [8] 240-64636794, section 4.9.8.
 - 4) Continuity Tests
 - I. The wiring shall be tested for continuity where the continuity test shall give a reading of less than 0.1 Ω . Where MCB's are used, they shall be all switched ON.
 - II. The wiring insulation to earth as well as between unique circuits shall be checked with a 500 V DC insulation resistance tester. Ensure that a reading of greater than 20 Mega Ohms is obtained between any part of the circuit and the chassis and also any separate circuit. The test must be performed with the MCB in the OFF and ON positions, where applicable. This test shall also be applied between each individual circuit.
 - III. The insulation resistance tester must be periodically tested and calibrated by an accredited test laboratory. The supplier or sub-contractor shall be able to provide proof that these tests are performed at least once in six months. A test certificate shall accompany each unit.

4.2 Routine testing

The supplier shall, at his works, subject each unit to routine tests. The supplier shall draw up a routine test schedule for Eskom's approval prior to routine testing.

Witnessing of routine tests shall be left to the discretion of Eskom's Group Technology Quality Management. In the event of routine tests not being witnessed, Eskom reserves the right to request verification of any test results.

The routine tests shall include:

- a) Crimped ends mechanical strength testing - The wiring shall be tested according to standard [8] 240-64636794, section 4.9.8.
- b) Routine testing shall comprise of a series of checks/tests to confirm that individual production equipment has been manufactured and setup correctly.
- c) Visual inspections.
- d) These checks shall be done on each production unit and produced during QA inspections.
- e) An inspection of manufacturing processes such as plating encapsulating and welding.
- f) Wiring tests.
- g) any additional tests requested by Eskom.

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- h) Continuity Tests
 - 1) The wiring shall be tested for continuity where the continuity test shall give a reading of less than 0.1 Ω. Where MCB's are used, they shall be all switched ON.
 - 2) The wiring insulation to earth as well as between unique circuits shall be checked with a 500 V DC insulation resistance tester. Ensure that a reading of greater than 20 Mega Ohms is obtained between any part of the circuit and the chassis and also any separate circuit. The test must be performed with the MCB in the OFF and ON positions, where applicable. This test shall also be applied between each individual circuit.
 - 3) The insulation resistance tester must be periodically tested and calibrated by an accredited test laboratory. The supplier or sub-contractor shall be able to provide proof that these tests are performed at least once in six months. A test certificate shall accompany each unit.

4.3 Test certificates

The test certificates shall be kept on file with the Supplier for the duration of the contract period. A copy of the test certificate shall be supplied with each order.

The test certificate shall as a minimum have the following information:

- a) Type of product tested
- b) Person performing the test
- c) Date of test
- d) Signature
- e) Continuity test reading – detail the worst reading in ohms
- f) Insulation resistance test reading – detail the worst reading in ohms
- g) Item serial no
- h) Test meter detail – type, serial number, date of last accuracy test

5. Installation

The installation of the Junction Boxes shall be specified in the project scope of works document which will include off-loading, positioning on the plinths and fitting of hold-down nuts (supplied by Eskom).

6. Drawings

The construction of the Junction Boxes shall be according to the approved Eskom Drawings. However if the construction of the Junction Boxes is to differ from Eskom Master Drawings then the general arrangement drawings (GA's) from the Supplier must be submitted to Eskom, for approval, prior to construction. The Master drawing numbers for the Junction Boxes are listed below.

[1] Drawing 0.52/30548	Large Junction Box Steelwork	Eskom	Latest
[2] Drawing 0.52/30549	Small Junction Box Steelwork	Eskom	Latest
[3] Drawing 6JB#100-0.52/30545	Circuit breaker bay innards for large junction box	Eskom	Latest
[4] Drawing 6JB#200-0.52/30546	Transformer/Shunt Reactor innards for large junction box	Eskom	Latest
[5] Drawing 6JB#300-0.52/30547	Circuit breaker bay innards for small junction box	Eskom	Latest

7. Authorization

Name and surname	Designation
Andre de la Guerre	Manager – Protection Technology & Support, PTM&C
Danie du Plessis	Transmission
Pravind Orrie	Distribution
Prudence Madiba	Generation
Comfort Masike	System Operator

8. Revisions

Date	Rev	Compiler	Remarks
March 2018	1	Tejin Gosai	First issue

9. Development team

The following people were involved in the development of this document:

- Chris van Reenen
- Alpheus Majozi
- Stuart van Zyl
- Bongani Qwabe
- Thys Bower

10. Acknowledgements

Not applicable.

Annex A – Technical Schedule A/B

The supplier shall state clearly, for each clause that requires a statement of compliance in the Technical Schedule A/B. The supplier must respond by either stating “Comply” or “Do not Comply” and state any deviations. Suppliers are to substantiate their statement of compliance or partial compliance to the requirements in the “Supporting information to validate response” column in the Technical Schedule A/B.

Schedule A: Purchaser's specifications

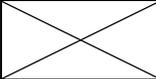
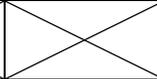
Schedule B: Guarantees, compliance and technical particulars of equipment offered

	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3		Technical Specification					
3.1		Description of line items					
3.1.1		Large junction box steelwork					
		a) Complies with drawing 0.52/30548	Comply		3		
		b) Width: 2200 mm	Comply		2		
		c) Height: 2021 mm	Comply		2		
		d) Depth: 880 mm	Comply		2		
3.1.2		Small junction box steelwork					
		a) Complies with drawing 0.52/30549	Comply		3		
		b) Width: 1650 mm	Comply		2		

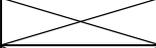
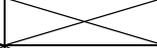
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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
		c) Height: 1930 mm	Comply		2		
		d) Depth: 880 mm	Comply		2		
3.1.3		Circuit breaker bay innards for large junction box	X	X			
3.1.3a)		a) Complies with drawing 6JB#100-0.52/30545.	Comply		3		
3.1.3b)		b) Includes the female half of "Harting" type connectors for interfacing of Main 1 and Main 2 circuit-breaker process interface units.	Comply		3		
3.1.3b)		Caters for 1 x 3 - mechanism circuit breaker with single pole tripping on Main 1 and Main 2 and phase segregated closing.	Comply		1		
3.1.3b)		Caters for 4 x phase segregated motorized disconnectors.	Comply		1		
3.1.3b)		Caters for 4 x manually operated earth switches.	Comply		1		
3.1.3b)		Caters for Current Transformers.	Comply		2		
3.1.4		Transformer/Shunt Reactor innards for large junction box	X	X			
3.1.4a)		a) Complies with drawing 6JB#200-0.52/30546.	Comply		3		
3.1.4b)		b) Includes the female half of "Harting" type connectors for interfacing of Main 1 and Main 2 circuit-breaker process interface units.	Comply		3		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3.1.4b)		Caters for a single power transformer or shunt reactor with on-load tap changer.	Comply		1		
3.1.4b)		Caters for optional fitment of free issued point of wave switching device.	Comply		2		
3.1.5		Circuit breaker bay innards for small junction box					
3.1.5a)		a) Complies with drawing 6JB#300-0.52/30547.	Comply		3		
3.1.5b)		b) Includes the female half of "Harting" type connectors for interfacing of Main 1 and Main 2 circuit-breaker process interface units.	Comply		3		
3.1.5b)		Caters for 1 x 3 - mechanism circuit breaker with single pole tripping on Main 1 and Main 2 and phase segregated closing.	Comply		1		
3.1.5b)		Caters for 1 x three mechanism motorised disconnectors and 2 x single mechanism motorised disconnectors.	Comply		1		
3.1.5b)		Caters for 3 x manually operated, ganged earth switches.	Comply		1		
3.1.6		Point-on-Wave switching device option					
3.1.6a)		a) Complies with drawing 6JB#200-0.52/30546 sheets 23 to 27.	Comply		3		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3.1.6b)		b) Includes 2 x Secucontrol type FTL 8-way test blocks.	Comply		3		
3.1.6c)		c) Point-on-Wave switching device to be free issued by Eskom and mounted/wired by Supplier as per drawing.	Comply		3		
3.2		Mechanical Design					
3.2.1		Construction					
3.2.1a)		a) Comply with clause 3.2.1a) of this specification	Comply		3		
3.2.1b)		b) Comply with clause 3.2.1b) of this specification	Comply		3		
3.2.1c)	240-75655504	c) Comply with clause 3.2.1c) of this specification	Comply		3		
3.2.1d)		d) Comply with clause 3.2.1d) of this specification	Comply		3		
3.2.1e)		e) Comply with clause 3.2.1e) of this specification	Comply		2		
3.2.1f)		f) Comply with clause 3.2.1f) of this specification	Comply		3		
3.2.1g)		g) Comply with clause 3.2.1g) of this specification	Comply		3		
3.2.1h)		h) Comply with clause 3.2.1h) of this specification	Comply		3		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3.2.2		Insulation	Comply	Comply			
3.2.2		a) Comply with clause 3.2.2 of this specification	Comply		3		
3.2.3		Doors	Comply	Comply			
3.2.3a)		a) Comply with clause 3.2.3a) of this specification	Comply		3		
3.2.3b)		b) Comply with clause 3.2.3b) of this specification	Comply		3		
3.2.3c)		c) Comply with clause 3.2.3c) of this specification	Comply		3		
3.2.4		Anti-condensation heater and ventilation	Comply	Comply			
3.2.4		a) Comply with clause 3.2.4 of this specification	Comply		3		
3.2.5		Label mounting	Comply	Comply			
3.2.5		a) Comply with clause 3.2.5 of this specification	Comply		2		
3.2.6		Gland Plates and Din Rails	Comply	Comply			
3.2.6a)		a) Comply with clause 3.2.6a) of this specification	Comply		3		
3.2.6b)		b) Comply with clause 3.2.6b) of this specification	Comply		2		
3.2.6c)		c) Comply with clause 3.2.6c) of this specification	Comply		2		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3.2.6d)		d) Comply with clause 3.2.6d) of this specification	Comply		2		
3.2.6e)		e) Comply with clause 3.2.6e) of this specification	Comply		2		
3.2.7		Damaged Paint Work	Comply				
3.2.7		Comply with clause 3.2.7 of this specification	Comply		3		
3.2.8		Nuts, Bolts and Washers	Comply				
3.2.8		Comply with clause 3.2.8 of this specification	Comply		2		
3.2.9		Base Frame	Comply				
3.2.9		Comply with clause 3.2.9 of this specification	Comply		3		
3.2.10		Insert Trays	Comply				
3.2.10a)		a) Comply with clause 3.2.10a) of this specification	Comply		3		
3.2.10b)		b) Comply with clause 3.2.10b) of this specification	Comply		2		
3.3		Electrical	Comply				
3.3.1		Safety	Comply				
3.3.1a)		a) Comply with clause 3.3.1a) of this specification	Comply		3		
3.3.1b)		b) Comply with clause 3.3.1b) of this specification	Comply		3		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3.3.2		Terminals					
3.3.2a)	240-70413291	a) Comply with clause 3.3.2a) of this specification	Comply		3		
3.3.2b)		b) Comply with clause 3.3.2b) of this specification	Comply		3		
3.3.2c)		c) Comply with clause 3.3.2c) of this specification	Comply		3		
3.3.3		Terminal strips					
3.3.3		a) Comply with clause 3.3.3 of this specification	Comply		2		
3.3.4		Wiring trunking					
3.3.4		a) Comply with clause 3.3.4 of this specification	Comply		2		
3.3.5		Wiring supports					
3.3.5		a) Comply with clause 3.3.5 of this specification	Comply		2		
3.3.6		Wiring terminations					
3.3.6a)		a) Comply with clause 3.3.6a) of this specification	Comply		3		
3.3.6b)		b) Comply with clause 3.3.6b) of this specification	Comply		3		
3.3.6c)		c) Comply with clause 3.3.6c) of this specification	Comply		3		

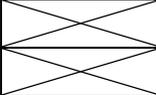
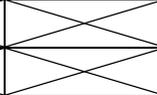
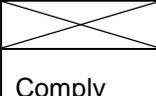
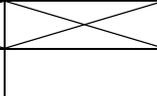
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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3.3.6d)		d) Comply with clause 3.3.6d) of this specification	Comply		2		
3.3.6e)		e) Comply with clause 3.3.6e) of this specification	Comply		1		
3.3.6f)		f) Comply with clause 3.3.6f) of this specification	Comply		3		
3.3.6g)		g) Comply with clause 3.3.6g) of this specification	Comply		1		
3.3.6h)		h) Comply with clause 3.3.6h) of this specification	Comply		2		
3.3.6i)		i) Comply with clause 3.3.6i) of this specification	Comply		2		
3.3.6j)		j) Comply with clause 3.3.6j) of this specification	Comply		2		
3.3.6k)		k) Comply with clause 3.3.6k) of this specification	Comply		3		
3.3.7		Wiring identification	Comply	Comply			
3.3.7a)		a) Comply with clause 3.3.7a) of this specification	Comply		2		
3.3.7b)		b) Comply with clause 3.3.7b) of this specification	Comply		2		
3.3.7c)		c) Comply with clause 3.3.7c) of this specification	Comply		2		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
3.3.8		Wiring sizes and practices	Comply	Comply			
3.3.8a)	240-64636794	a) Comply with clause 3.3.8a of this specification	Comply		3		
3.3.8b)		b) Comply with clause 3.3.8a of this specification	Comply		3		
3.3.9		Earthing	Comply	Comply			
3.3.9	240-64100247	a) Comply with clause 3.3.9 of this specification	Comply		3		
3.3.10		Labelling	Comply	Comply			
3.3.10	240-62629353	a) Comply with clause 3.3.10 of this specification	Comply		2		
3.3.11		Packaging for transport	Comply	Comply			
3.3.11a)		a) Comply with clause 3.3.11a) of this specification	Comply		1		
3.3.11b)		b) Comply with clause 3.3.11b) of this specification	Comply		3		
3.3.11c)		c) Comply with clause 3.3.11c) of this specification	Comply		2		
3.3.12		Auxiliary electrical components	Comply	Comply			
3.3.12a)	240-62773019	a) Comply with clause 3.3.12a) of this specification	Comply		3		
3.3.12b)	TSP 41-1043	b) Comply with clause 3.3.12b) of this specification	Comply		3		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
		specification					
3.3.12c)		c) Comply with clause 3.3.12c) of this specification	Comply		3		
3.3.12d)		d) Comply with clause 3.3.12d) of this specification	Comply		2		
3.3.12e)		e) Comply with clause 3.3.12e) of this specification	Comply		3		
4		Testing					
4.1		Type Testing					
4.1a)		a) Comply with clause 4.1a) of this specification	Comply		3		
4.1b)		b) Comply with clause 4.1b) of this specification	Comply		3		
4.1c)1)	240-65336348	c)1) Comply with clause 4.1c)1) of this specification	Comply		3		
4.1c)2)	240-65336348	c)2) Comply with clause 4.1c)2) of this specification	Comply		3		
4.1c)3)		c)3) Comply with clause 4.1c)3) of this specification	Comply		3		
4.1c)4)I)		Comply with clause 4.1c)4)I) of this specification	Comply		3		
4.1c)4)II)		Comply with clause 4.1c)4)II) of this specification	Comply		3		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
4.1c)4)III)		Comply with clause 4.1c)4)III) of this specification	Comply		3		
4.2		Routine Testing	Comply				
4.2a)		a) Comply with clause 4.2a) of this specification	Comply		3		
4.2b)		b) Comply with clause 4.2b) of this specification	Comply		3		
4.2c)		c) Comply with clause 4.2c) of this specification	Specify		3		
4.2d)		d) Comply with clause 4.2d) of this specification	Comply		3		
4.2e)		e) Comply with clause 4.2e) of this specification	Comply		3		
4.2f)		f) Comply with clause 4.2f) of this specification	Comply		3		
4.2g)		g) Comply with clause 4.2g) of this specification	Comply		3		
4.2h)1)		h)1) Comply with clause 4.2h)1) of this specification	Comply		1		
4.2h)2)		h)2) Comply with clause 4.2h)2) of this specification	Comply		1		
4.2h)3)		h)3) Comply with clause 4.2h)3) of this specification	Comply		1		

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	Other references	Description	Schedule A	Schedule B	Weighting	Supporting information to validate response	Comments
4.3		Test Certificates					
4.3		a) Comply with clause 4.3) of this specification	Comply		3		
5		Installation					
5		a) Comply with clause 5) of this specification	Comply		3		
6		Drawings					
6		a) Comply with clause 6) of this specification	Comply		2		

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Annex B – Treatment of Columbus Stainless 3CR12

The processes followed shall conform to that of Columbus Steel from whose guide the following general considerations were extracted. The supplier shall attach a description of the 3CR12 treatment process to their tender. This will be shared with Columbus Stainless to ensure that the process is to the correct standard. This includes but is not limited to pickling, passivation and coating. Further information may be obtained from the Columbus webpage.

1) Surface preparation

The surface must be as clean and as grease-free as possible. Surface preparation is to be done after the fabrication process.

1a) Cleaning method – pickling

Mill scale and weld oxidation may be removed by pickling. Fabricated particles can be pickled by either full immersion in a pickling bath, if the size allows, or by pickling pastes. Pickling formulations should be based on nitric acid. Hydrochloric acid solutions should not be used. Pickling pastes can cause staining if allowed to dry. Contact times can be determined by experimentation, but should allow sufficient time to remove the scale and heat tint.

Although pickling is usually followed by passivation in order to achieve optimum corrosion resistance, passivation prior to coating can lead to paint adhesion problems. Fabricated articles can be coated straight after pickling provided that the pickled surfaces are thoroughly rinsed in cold water and dried thereafter.

2) Coating

The paint used must comply with the specification provided. It is advised that the paints used for a particular paint system be sourced from the same supplier. Due to the inherent smooth surface of Columbus Stainless 3CR12, a primer is essential.