

## SCOPE BACKGROUND

The scope of work includes the supply of labour, materials and services for the design, manufacture, Factory testing, delivery to site, off-loading, installation and commissioning as specified below.

All equipment and services shall comply with the mandatory requirements of the Mines Health and Safety Act 29 of 1996 and regulations (as amended), Foskor COPS and all applicable standards.

The scope of work includes.

- a) Design, manufacture, and supply of 6.6kV panels as per specification for Incomers
- b) Design, manufacture, and supply of 6.6kV panels as per specification for Bus Section /and bus Riser
- c) Design, manufacture, and supply of 6.6kV panels as per specification for Motor Feeders
- d) Design, manufacture, and supply of 6.6kV panels as per specification for Transformer Feeder
- e) Design, manufacture, and supply Battery tripping unit with batteries
- f) Site work and installation of panels, this includes removing existing switchgear (see Annexure A), installing new switchgear and cable termination.
- g) Commissioning

## TECHNICAL

### Acronyms

a. KV	–	Kilo Volts
b. MCC	–	Motor Control Centre
c. REM	–	Rotating Electrical Machines
d. RWPS	–	Return Water Pump Station
e. XLPE cable	–	Cross-linked polyethylene cable

### Applicable Standards

In general work and materials shall be in accordance with the latest practice and in particular in accordance with the latest revision of the following specifications, and any amendments thereto, the SANS specification taking precedence:

- a. Foskor COPS.
- b. Foskor's Engineering Specification (GES-001) – Instrumentation General Specification and Procedures.
- c. Foskor's Engineering Specification (GES-002) – Instrumentation installations and commissioning.
- d. Foskor's Engineering Specification (GES-003) – Instrumentation General Specification.
- e. Foskor's Engineering Specification (GES-004) – Field Instrumentation Standard.
- f. SANS 1885 (NRS 003) - AC-metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 36 kV.
- g. SANS 60044-7 & -8 Instrument transformers (EVTs and ECTs).
- h. SANS 61869-1, -2 & -3 Instrument transformers (CTs and VTs).

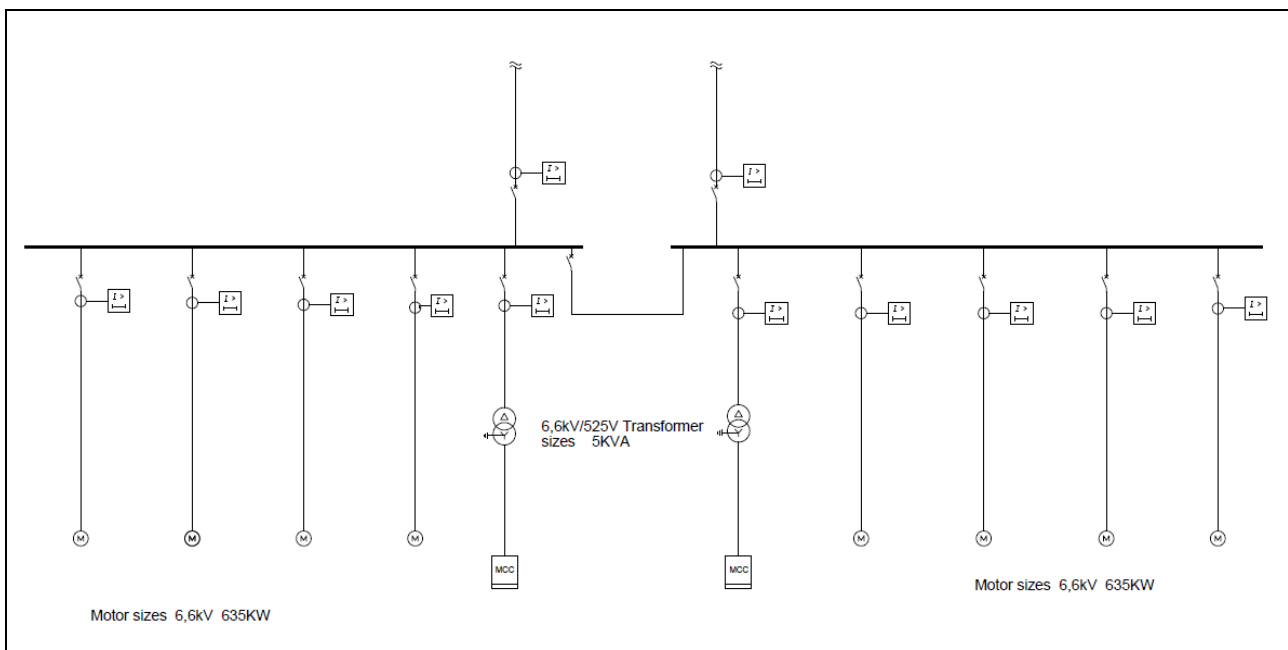
- i. SANS 62271-1 High-voltage switchgear and control gear - Part 1: Common specifications.
- j. SANS 62271-100 High-voltage switchgear and control gear - Part 100: Alternating-current circuit-breakers.
- k. SANS 62271-102 High-voltage switchgear and control gear - Part 102: Alternating current disconnectors and earthing switches.
- l. SANS 62271-103 High-voltage switchgear and control gear - Part 103: Switches for rated voltages above 1 kV and up to and including 52 kV.
- m. SANS 62271-105 High-voltage switchgear and control gear - Part 105: Alternating current switch-fuse combinations.
- n. SANS 62271-106 High-voltage switchgear and control gear - Part 106: Alternating current contactors, contactor-based controllers, and motor starters.
- o. SANS 62271-200 High-voltage switchgear and control gear - Part 200: AC-metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV.
- p. SANS 10142-1 The Wiring of Premises Part 1 – Low-voltage Installations.
- q. BSCP 1014 Protection of Electrical Power Equipment against Climatic Conditions.
- r. BSS 1322 Amino plastic Molding Materials.
- s. BSS 152 Electric Power Switchgear and Associated Apparatus.
- t. BSS 158 Marking and Arrangement for Switchgear Busbars Main Connections of Auxiliary Wiring.
- u. SANS 60076/BSS 3535 Transformers.
- v. SANS 1091 National Colour Standards for Paint.
- w. IEC 60185/BSS 3938 Current Transformers.
- x. IEC 60186/BSS 3941 Voltage Transformers.
- y. IEC 6043/BSS 37 Meters.
- z. IEC 6051/BSS 89 Indicating Instruments.
- aa. BSS 142 Protective Relays.
- bb. SANS 156 MCBs and MCCBs.
- cc. SANS 1995 Busbars.
- dd. BSS 1767 Grommets.

#### Scope of work

- a. Design, supply, manufacture, delivery to site, off-loading, installing, and commissioning of 2 x 6.6kV switchgear for Incomers (Vacuum Circuit Breakers with protection relays and current transformers).

- b. Design, supply, manufacture, delivery to site, off-loading, installing, and commissioning of 1 x 6.6kV switchgear for Bus Section (Vacuum Circuit Breakers with no protection relays).
- c. Design, supply, manufacture, delivery to site, off-loading, installing, and commissioning of 1 x 6.6kV Bus Rise panel.
- d. Design, supply, manufacture, delivery to site, off-loading, installing, commissioning of 8 x 6.6kV switchgear for 625 kW Motor feeders (6 operational + 2 spares) (Vacuum Contactors with motor protection relays).
- e. Design, supply, manufacture, delivery to site, off-loading, installing, commissioning of 2 x 6.6kV switchgear for 5kVA 6.6kV/525V Transformer Feeder (Vacuum Circuit Breakers with protection relays and current transformers).
- f. Design, manufacture, and supply a Battery Tripping Unit with batteries of sufficient capacity to provide the necessary tripping power. The BTU voltage needs to be the same as the breaker tripping and closing coil.
- g. Execute site work and installation of panels, this includes removing existing switchgear (see Annexure A), installing new switchgear and cable termination.
- h. Commissioning of new switchgear.

#### RWPS 6.6kV SLD



#### Technical Specifications.

#### Environmental conditions.

##### Temperature of Ambient Air

Maximum Value	45 °C
Minimum Value "Indoor"	- 5 °C
Installation Altitude above Sea Level up to	1000 m

## General Specification.

Information	Requirement
<b>Particulars of the system (not equipment rating):</b>	
Nominal voltage kV	6.6 kV
Frequency Hz	50 Hz
Number of phases	3 phase
Type of network neutral earthing	solid
<b>Characteristics of the assembly</b>	
Number of poles	3
Class – indoor, outdoor (or special service conditions)	Indoor
Type of compartment (specify type for each high voltage compartment) if applicable: <ul style="list-style-type: none"> <li>• Interlock-controlled accessible compartment</li> <li>• Procedure-based accessible compartment</li> <li>• Tool-based accessible compartment</li> <li>• Non-accessible compartment</li> </ul>	a) Busbar compartment: <ul style="list-style-type: none"> <li>• Tool-based accessible</li> </ul> b) Main device compartment: <ul style="list-style-type: none"> <li>• Interlock-controlled accessible</li> </ul> c) Connection compartment: <ul style="list-style-type: none"> <li>• Interlock-controlled accessible</li> </ul> d) CB compartment: <ul style="list-style-type: none"> <li>• Interlock-controlled accessible</li> </ul> e) VT compartment: <ul style="list-style-type: none"> <li>• Tool-based accessible</li> </ul> f) Connection/CT compartment: <ul style="list-style-type: none"> <li>• Tool-based accessible</li> </ul> g) Main switching <ul style="list-style-type: none"> <li>• Procedure-based accessible</li> </ul>
Partition class <ul style="list-style-type: none"> <li>• Class PM</li> <li>• Class PI</li> </ul>	PM
Withdrawable/non-withdrawable (main device type)	Withdrawable
Loss of service continuity category (LSC) per type of functional unit LSC2 LSC2A LSC2B LSC1	LSC2 (earthing provision on cable side)
Rated voltage Ur 3,6 kV; 7,2 kV; 12 kV; 17,5 kV; 24 kV; 36 kV, etc.	12 kV
Number of phases 1, 2 or 3	3
Rated insulation level: power-frequency withstand voltage Ud Lightning impulse withstand voltage Up	28 / 32 kV 60 / 70 kV
Rated frequency Fr	50 Hz
Rated continuous current Ir a) Incomer	a) 1250 A

b) Busbar c) Feeder (motors) d) Feeder (Transformers)	b) 1250 A c) 800 A d) 800 A
Rated short-time withstand current a) Main circuit (incomer/busbar/feeder) I <sub>k</sub> b) Phase-to-earth earthing circuit I <sub>ke</sub>	a) 31.5 kA b)
Rated peak withstand current a) Main circuit (incomer/busbar/feeder) I <sub>p</sub> b) Phase-to-earth earthing circuit I <sub>pe</sub>	a) 63 kA b)
Rated duration of short-circuit a) Main circuit (incomer/busbar/feeder) t <sub>k</sub> , b) Phase-to-earth earthing circuit t <sub>ke</sub>	a) 3 sec b)
Rated supply voltage of closing and opening devices and of auxiliary and control circuits U <sub>a</sub> a) Closing and tripping b) Indication c) Control	110 Vdc (as per BTU spec)
Rated supply frequency of closing and opening and of auxiliary circuits	50 Hz
Internal arc fault IAC Types of accessibility to the assembly (specify the side(s) for which they are required) a) restricted to authorized personnel only b) unrestricted accessibility (includes public) Classification current value in kA and duration in s	Yes  Must be arc resistant between adjacent compartments within the assembly, as well as around the entire perimeter of the equipment (Front, Lateral and Rear)
Rated cable test voltages U <sub>ct</sub> AC a) U <sub>ct</sub> ac b) U <sub>ct</sub> dc	a) 36 kV b) 54 kV
Low- and high-pressure interlocking and monitoring devices (state requirements e.g. lock-out on low pressure indication, etc.)	
Locking devices (state any additional requirements to 5.11)	
Degrees of protection by enclosures (if not IP2X): With doors closed With doors open Weatherproofing test	IP54
Partial discharge tests	
Partial discharge measurement	

*Note: Substation fault level = 16 kA*

#### Installation Specifications.

<b>Installation</b>	
Arrangement of Switchgear (Rear)	Free-Standing
Minimum Ceiling Height	3200 mm
Minimum Clearance to Building Rear Wall	900 mm
Minimum Clearance Front	1500 mm
Minimum Clearance to Side Left	900 mm
Minimum Clearance to Side Right	900 mm

**Panel heaters**

Heating Resistor In Breaker Compartment	With
Heating Resistor In Cable Compartment	With

**Properties**

Main Busbars	Copper
Busbar Segregation	With
Busbar Type	Sleeved
CB Racking Trolley	Manual
IAC Classification	AFLR
Degree of Protection Front Unit	IP 54
Earth Circuit Material	Copper
Internal Arc Fault Configuration	25kA for 1Sec
Pressure Relief Attachment	Tunnel with Internal Exhaust
Shrouds on Main Busbar	With
Superior shunt	Sleeved
Superior Collector	Long Riser
Switchboards	Standard
Temperature as per IEC 62271	45 °C
Earthing Switch Locks	ES Open

**Incomer Specifications.**

Quantity	2
Rated Power Frequency Withstand Voltage	28 kV
Rated Operating Current Outgoing	1250 A

**Properties**

Cable clamping	With
Cables per Phase	2
Earthing Switch Locks	Key Lock & Electro Magnetic Interlock
Type of Cable Connection	Bottom Cable Entry
Type of Gland Plate	Split Type
Upper Busbar	Copper
Voltage Indication System	With
VPIS voltage output	With
Voltage Transformer Attachment	Withdrawable
Voltage Transformer Fuse	With
VT Installed	On Rear
VT Quantity of Cores	2

**Type of Construction**

Current Transformer	With
Earthing Switch Outgoing	With
Primary Connection	Cable
Type of Cubicle	Feeder
Voltage Transformer Outgoing	With

**Breaker type**

Drive	Vacuum Circuit Breaker
Auxiliary Make Release	100-125V DC
• Break Release	100 to 130 VDC - 100 to 130 VAC
	100 to 130 VDC - 100 to 130 VAC

• Break Release	100 to 130 VDC - 100 to 130 VAC
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<b>Voltage Transformer</b>
<p>Voltage Transformer with 2 Secondary Winding</p> <p>Make: ECS</p> <p>Transformation-Ratio VT: 6.6/V3 / 0,11/V3 / 0,11/V3 kV</p> <p>Nameplate acc. to: IEC61869-3, 2pcs. (1x loose)</p> <p>VT-Winding 1: Accuracy Class 1 / 50 VA</p> <p>VT-Winding 2: Accuracy Class 3P / 50 VA</p> <p>Rat. Voltage-Factor: 1.9 x Ur, 8h</p> <p>Installation Altitude Up to 1000 m</p> <p>Test Certificate: PDF</p>

<b>Current Transformer</b>
<p>Triple Core Ring Type Current Transformer</p> <p>Make: ECS/NPT</p> <p>Transformation-Ratio CT: 1250/1/1/1 A</p> <p>CT-Core 1: 1250 A / 1 A / 5P 20 / 10 VA</p> <p>CT-Core 2: 1250 A / 1 A / 0,5FS 5 / 10 VA</p> <p>CT-Core 3: 1250 A / 1 A / PX</p> <p>Additional Data CT-Core 3: High impedance, number of turns must be exactly equal to the transformation ratio</p> <p>Rat. Permanent Overcurrent Factor (thermal): 1.2 x Ir</p> <p>Rat. Short-time Withstand Current: 25 kA</p> <p>Rat. Short-Circuit Duration: 1 s</p> <p>Test Certificate: PDF</p>

<b>Master Trip &amp; Lockout Relay</b>
Communication Port & Protocol: Modbus Rs485
<p>Multifunction Meter, Modbus-Rs485 capable of</p> <ul style="list-style-type: none"> <li>• Current,</li> <li>• Voltage,</li> <li>• Frequency,</li> <li>• Power factor,</li> <li>• Energy Active, and</li> <li>• reactive power</li> </ul>
Test block (preferable MiCOM P991)
Dual Coat Paint + Interlock
ARC SENSING MODULE, AUX VOLTAGE - 24-240VAC/DC
Three Phase Digital Ammeter with in-built Selector Switch
Socket to connect the Remote switching pendent, preferable the PKF16F435 or any other socket that is rated for 16A, 3P+N+E, IP44 and 50Hz

#### Transformer feeder specification.

Quantity	2
Rated Power Frequency Withstand Voltage	28 kV
Rated Operating Current Outgoing	800 A

<b>Properties</b>	
Cable clamping	With

Cables per Phase	2
Coil Voltage for Rear Cover Interlock	110 V AC/DC
Earthing Switch Locks	Key Lock & Electro Magnetic Interlock
Rear Cover Interlock	With
CT Connection	Copper
Type of Cable Connection	Bottom Cable Entry
Type of Gland Plate	Split Type
Upper Busbar	Copper
Voltage Indication System	With
VPIS voltage output	With

<b>Type of Construction</b>	
Current Transformer	With
Earthing Switch Outgoing	With
Primary Connection	Cable
Type of Cubicle	Feeder

<b>Breaker</b>	
Breaker type	Vacuum Circuit Breaker
Drive	100-125V DC
Auxiliary Make Release	100 to 130 VDC - 100 to 130 VAC
<ul style="list-style-type: none"> <li>1. Break Release</li> </ul>	100 to 130 VDC - 100 to 130 VAC
<ul style="list-style-type: none"> <li>2. Break Release</li> </ul>	100 to 130 VDC - 100 to 130 VAC

<b>Current Transformers</b>	
Dual Core Block Type Current Transformer ECS/NPT	
Nameplate acc. to: IEC61869-2, 2pcs. (1x loose)	
CT-Core 1: 400 A / 1 A / 1FS 5 / 10 VA	
CT-Core 2: 400 A / 1 A / 5P 20 / 10 VA	
Rat. Permanent Overcurrent Factor (thermal): 1.2 x I <sub>r</sub>	
Rat. Short time Withstand Current: 25 kA	
Rat. Short-Circuit Duration: 1 s	
Installation Altitude Up to 1000 m	
Test Certificate: PDF	

Master Trip & Lockout Relay
Communication Port & Protocol: Modbus Rs485
Multifunction Meter, Modbus-Rs485 capable of <ul style="list-style-type: none"> <li>Current,</li> <li>Voltage,</li> <li>Frequency,</li> <li>Power factor,</li> <li>Energy Active, and</li> <li>reactive power</li> </ul>
Dual Coat Paint + Interlock
Three Phase Digital Ammeter with in-built Selector Switch
ARC SENSING MODULE, AUX VOLTAGE - 24-240VAC/DC
Socket to connect the Remote switching pendent, preferable the PKF16F435 or any other socket that is rated for 16A, 3P+N+E, IP44 and 50Hz



## Motor feeder specification.

<b>Quantity</b>	8
Rated Power Frequency Withstand Voltage	28 kV
Rated Operating Load	Motor: 635kW, 0.8PF at 6.6kV

<b>Properties</b>	
Cable clamping	With
Cables per Phase	2
CT Connection Type	Sleeved
Earthing Switch Locks	Key Lock & Electro Magnetic Interlock
Rear Cover Interlock	With
CT Connection	Copper
Type of Cable Connection	Bottom Cable Entry
Type of Gland Plate	Split Type
Upper Busbar	Copper
Voltage Indication System	With
VPIS voltage output	With

<b>Type of Construction</b>	
Current Transformer	With
Earthing Switch Outgoing	With
Primary Connection	Cable
Type of Cubicle	Feeder

Breaker	Vacuum Contactor
Drive	100-125V DC
Auxiliary Make Release	100 to 130 VDC - 100 to 130 VAC
• 1. Break Release	100 to 130 VDC - 100 to 130 VAC
• 2. Break Release	100 to 130 VDC - 100 to 130 VAC

<b>Current Transformers</b>
Dual Core Block Type Current Transformer ECS/NPT
Nameplate acc. to: IEC61869-2, 2pcs. (1x loose)
CT-Core 1: 400 A / 1 A / 1FS 5 / 10 VA
CT-Core 2: 400 A / 1 A / 5P 20 / 10 VA
Rat. Permanent Overcurrent Factor (thermal): 1.2 x I <sub>r</sub>
Rat. Short-time Withstand Current: 25 kA
Rat. Short-Circuit Duration: 1 s
Installation Altitude Up to 1000 m
Test Certificate: PDF

<b>Master Trip &amp; Lockout Relay</b>
Protection Relay that supports overcurrent protection, Earth fault protection, Undervoltage, Motor jamming protection, single phasing protection, block rotor protection Communication Port & Protocol: Modbus RS485
Wiring Kit - Export Projects
Test block
Dual Coat Paint + Interlock
Three Phase Digital Ammeter with in-built Selector Switch, Class - 0.5
ARC SENSING MODULE, AUX VOLTAGE - 24-240VAC/DC
Socket to connect the Remote switching pendent

Single Phase Surge Arrester
Multifunction Meter, Modbus-Rs485 capable of <ul style="list-style-type: none"> <li>• Current,</li> <li>• Voltage,</li> <li>• Frequency,</li> <li>• Power factor,</li> <li>• Energy Active, and</li> <li>• Reactive power</li> </ul>

Bus Section (right) specification.

<b>Quantity</b>	1
Rated Power Frequency Withstand Voltage	28 kV
Rated Operating Current Outgoing	1250 A

<b>Properties</b>	
Earthing Switch Locks	Key Lock & Electro Magnetic Interlock
CT Connection	Copper
Upper Busbar	Copper
Voltage Indication System	With
VPIS voltage output	With

<b>Type of Construction</b>	
Current Transformer	With
Earthing Switch Outgoing	With
Primary Connection	To the Left
Type of Cubicle	Bus Coupler Right

<b>Vacuum Circuit Breaker</b>	
Drive	100-125V DC
Auxiliary Make Release	100 to 130 VDC - 100 to 130 VAC
<ul style="list-style-type: none"> <li>• 1. Break Release</li> <li>• 2. Break Release</li> </ul>	100 to 130 VDC - 100 to 130 VAC 100 to 130 VDC - 100 to 130 VAC

<b>Current Transformers</b>
Triple Core Ring Type Current Transformer Make: ECS/NPT Transformation-Ratio CT: 1250/1/1/1 A CT-Core 1: 1250 A / 1 A / 5P 20 / 10 VA CT-Core 2: 1250 A / 1 A / 0,5FS 5 / 10 VA CT-Core 3: 1250 A / 1 A / 5P 20 Rat. Permanent Overcurrent Factor (thermal): 1.2 x I <sub>r</sub> Rat. Short-time Withstand Current: 25 kA Rat. Short-Circuit Duration: 1 s Test Certificate: PDF

Dual Coat Paint + Interlock
Three Phase Digital Ammeter with in-built Selector Switch, Class - 0.5
ARC SENSING MODULE, AUX VOLTAGE - 24-240VAC/DC
Socket to connect the Remote switching pendent
Multifunction Meter, Modbus-Rs485 capable of <ul style="list-style-type: none"> <li>• Current,</li> </ul>

- Voltage,
- Frequency,
- Power factor,
- Energy Active, and
- Reactive power

#### Accessories

Earth Switch Lever  
 CB Open-Close Stick  
 LV Compartment Door Lock  
 Extraction Ramp for 600mm  
 Operating Handle for Rear VT  
 Pendant

#### Bus Riser (left) + PT specification.

Quantity	1
Rated Power Frequency Withstand Voltage	28 kV
Rated Operating Current Outgoing	1250 A

#### Properties

CT Connection Type	Sleeved
CT Connection	Copper
Upper Busbar	Copper

#### Type of Construction

Primary Connection	To the Right
Truck Assembly	Without Breaker (Only Riser)
Type of Cubicle	Bus Riser Left

#### Voltage Transformer

Voltage Transformer with 2 nos. Secondary Winding  
 Make: ECS  
 Transformation-Ratio VT: 6/V3 / 0,11/V3 / 0,11/V3 kV  
 Nameplate acc. to: IEC61869-3, 2pcs. (1x loose)  
 VT-Winding 1: Accuracy Class 1 / 50 VA  
 VT-Winding 2: Accuracy Class 3P / 50 VA  
 Rat. Voltage-Factor: 1.9 x Ur, 8h  
 Installation Altitude Up to 1000 m  
 Test Certificate: PDF

ARC SENSING MODULE, AUX VOLTAGE - 24-240VAC/DC

#### Earthing Design Requirements.

##### Earthing of the high-voltage conductive parts.

- All high-voltage conductive parts to which access is provided with the assembly in service, shall have the possibility of being earthed before becoming accessible. This does not apply to removable parts which become accessible after being separated from the assembly and to

- withdrawable parts in the test position or disconnected position.
- ii. Where earthing connections shall be able to carry the full three-phase short-circuit current (as in the case of the short-circuiting connections used for earthing devices), these connections shall be dimensioned accordingly.
  - iii. The connection from the short-circuiting point between phases to the earthing circuit may be dimensioned to the specifications of the earthing circuit.

#### Earthing of enclosure(s).

- i. Metal enclosure(s) shall be electrically connected to the earthing point provided.
- ii. Small parts fixed to the metal enclosure(s), up to a maximum of 12,5 mm in diameter, for example, screw heads, need not be electrically connected to the earthing point provided.
- iii. All the metallic parts intended to be earthed and not belonging to a high-voltage or auxiliary circuit shall also be electrically connected to the earthing point provided.
- iv. The interconnections within each functional unit shall be made by adequate means (e.g. fastening by bolting or welding), providing electrical continuity between the frame, covers, doors, metal partitions or other structural parts to the earthing point. Doors of the high-voltage compartments shall be electrically connected to the frame by adequate means.

#### Earthing of withdrawable and removable parts.

- i. The normally earthed metallic parts of a withdrawable part shall remain connected to earth in the test and disconnected positions and in any intermediate position. Connections to earth in any position shall provide a current-carrying capability not less than that required for enclosures.
- ii. On insertion, the normally earthed metallic parts of a removable part shall be connected to earth before the making the contacts of the fixed and removable parts of the main circuit.
- iii. If the withdrawable or removable part includes any earthing device, intended to earth the main circuit, then the earthing connection in the service position shall be considered as part of the earthing circuit with associated rated values.

#### Earthing circuit

- i. The parts of the earthing circuit of the assembly connecting each functional unit to the earthing point shall be capable of carrying the rated short-time and peak phase-to-earth withstand current ( $I_{ke}$ ,  $I_{pe}$ ) and duration ( $t_{ke}$ ).
- ii. For transport units to be assembled during final installation, the resulting earthing circuit shall be capable of carrying its rated short-time and peak withstand currents and duration.
- iii. Parts of metal enclosures may form part of the earthing circuit.
- iv. If a dedicated earthing conductor is applied as the earthing circuit of the assembly, its cross-section shall be not less than 30 mm<sup>2</sup>.
- v. for the rated short-time withstand current, a current density in the earthing conductor, not exceeding 200 A/mm<sup>2</sup> for a rated duration of 1 s or 125 A/mm<sup>2</sup> for a rated duration of 3 s is generally sufficient.
- vi. In case the earth mat is insufficient, the contractor shall make means to improve the earth mat.

## Metal enclosure requirements

### General

- a. The enclosure shall be metal. The following exceptions apply:
  - i. Parts of the enclosure may be of non-metal material, provided that all high-voltage parts are completely enclosed by metal partitions or shutters that are connected to the earthing circuit.
  - ii. Inspection windows complying with clause 6.102.4 of SANS62271-200:2021.
  - iii. The floor surface below the installed assembly is solid and does not allow access underneath the assembly.
- b. When the assembly is installed, the enclosure shall provide at least the degree of protection IP54, the specified degree of protection shall be provided by the enclosure with all the doors and covers closed as under normal operating conditions, irrespective of how these doors and covers are held in position.
- c. Enclosures shall also ensure protection in accordance with the following conditions:
  - i. Metal parts of the enclosures shall be designed to carry 30 A (DC) with a voltage drop of a maximum of 3 V to the earthing point provided.
  - ii. Parts of the enclosure enclosing tool-based-accessible high-voltage compartments shall be provided with a clear labelling of the electrical risk if removed or opened.
  - iii. The horizontal surfaces of enclosures, for example, roof plates, are normally not designed to support personnel or additional equipment not supplied as part of the assembly. If the manufacturer states that it is necessary to stand or walk upon the assembly during operation or maintenance, the design shall be such that the relevant areas will support the weight of the operator. In such a case, the IP degree shall not be affected as well as no permanent deformation is allowed and the areas on the equipment where it is not safe to stand or walk, for example, pressure relief flaps, shall be clearly identified.

### **a. Selection of components**

- i. All components used in the auxiliary and control circuits shall operate within their rated characteristics over the full range of service conditions inside auxiliary and control circuit enclosures.
- ii. Suitable precautions (for example, heaters, ventilators, insulation, etc.) should be taken to ensure that those service conditions essential for proper operation of relays, contactors, low-voltage switches, meters, operation counters, pushbuttons, etc. are maintained.
- iii. The loss of “suitable precautions” shall not cause the failure of the auxiliary and control circuits within the enclosure or untimely operation of the switchgear within the specified time.
- iv. Selection of components should consider the temperature obtained in the cabinet of the control and auxiliary circuit during a 2-hour period following the loss of the “suitable precautions” to ensure the proper operation of switchgear and control gear until the end of this 2-hour period.
- v. After this 2-hour period non-operation is acceptable. If the loss of the “suitable precautions” is longer than 2 hours but does not exceed 24 hours in total, the functionality of the switchgear and control gear shall come back to its original characteristics when the service conditions are recovered.
- vi. All panels shall be installed with heaters that can switch ON and OFF automatically. Switching ON

and OFF shall be controlled by a thermostat.

#### **b. Accessibility**

- i. Closing and opening actuators and emergency Switch system actuators shall be located between 0,4 m and 2 m above the floor.

*Note: The actuator may take the form of a handle, knob, push-button, roller, plunger, etc.*

- ii. Other actuators shall be located at such a height that they can be easily operated, and indicating devices shall be located at such a height as to be readily legible.
- iii. Where a component may need adjustment during its service life, access shall be provided with a protection level of at least IP XXB.
- iv. Where switchgear is withdrawable, the manufacturer shall ensure protection from contact with high-voltage live parts provided by either an electrical protection barrier or an enclosure (Protection degree IP XXD).

#### **c. Identification**

- i. Identification of components installed in enclosures shall be in agreement with the indication on the wiring diagrams and drawings. If a component is of the plug-in type, an identifying mark should be placed on the component and on the fixed part where the component plugs in.

#### **d. Cables and wiring**

- i. Terminal blocks should be fixed. Cables between two terminal blocks shall have no intermediate splices or soldered joints.
- ii. Cables and wiring shall be adequately supported and shall not rest against sharp edges.
- iii. The available wiring space for external connection shall permit the spreading of the cores of multi-core cables and the proper termination of the conductors without undue stresses.
- iv. Conductors connected to components mounted on doors shall be so installed that no mechanical damage can occur to the conductors as a result of the movement of these doors.

#### **e. Terminals**

- i. If facilities are provided for connecting incoming and outgoing neutral, protective and PEN (protective earthed neutral) conductors, they shall be situated in the vicinity of the associated phase conductor terminal.

#### **f. Auxiliary switches**

- i. Auxiliary switches shall be suitable for the number of operating cycles specified for the high-voltage switching device to which they are linked.
- ii. Auxiliary switches that are operated in conjunction with the main contacts shall be positively driven in both directions.
- iii. An auxiliary switch may consist of a set of two one-way positively driven auxiliary contacts (one for each direction).

#### **g. Heating elements**

- i. All heating elements shall be designed to prevent touching an electrically live part.
- ii. Where contact with a heater or shield can occur accidentally, the surface temperature shall not

exceed the temperature limits for accessible parts not to be touched in normal operation.

#### **h. Operation counter**

- i. Operation counters shall be suitable for their intended duty in terms of environmental conditions and for the number of operating cycles specified for the switching devices.

#### **Covers and Doors**

- a. Covers and doors that are part of the enclosure shall be made of metal. However, covers and doors may be made of insulating material, provided that high-voltage parts are enclosed by metal partitions or shutters connected to the earthing point provided.
- b. When covers and doors that are part of the enclosure are closed, they shall provide the degree of protection specified for the enclosure.
- c. Covers and doors shall not be made of woven wire mesh, expanded metal or similar. When ventilating openings, vent outlets or inspection windows are incorporated in the cover or door. Covers and doors that exclusively give access to compartments that are not high-voltage compartments are not subject to this subclause.
- d. Covers and doors that give access to tool-based accessible compartments.
  - i. These covers and doors (fixed covers) shall not be possible for them to be opened, dismantled, or removed without the use of tools.
  - ii. Special procedures are required to safeguard that opening can only be realized if precautions to ensure electrical safety have been taken.
- e. Covers and doors that give access to interlock-controlled accessible or procedure-based accessible compartments.

These covers and doors shall not require tools for their opening or removal and shall have the following features.

- i. Interlock-controlled accessible compartments shall be provided with interlocking devices so that opening of the compartment shall only be possible when the high-voltage parts contained in the compartment being made accessible are isolated and earthed or are in the disconnected position with corresponding shutters closed.
- ii. procedure-based accessible compartments shall be provided with provision for locking, for example, padlocking.

#### **Partition or shutter being part of the enclosure.**

- a. If partitions or shutters become part of the enclosure with the removable part in any of the positions, they shall be metal, earthed and provide a minimum degree of protection IP2X.

#### **Inspection windows**

- a. Inspection windows shall provide at least the degree of protection specified for the enclosure.
- b. Inspection windows shall be covered by a transparent sheet of mechanical strength comparable to that of the enclosure. Precautions shall be taken to prevent the formation of dangerous electrostatic

charges, either by clearance or by electrostatic shielding (e.g. a suitable earthed wire mesh on the inside of the window).

- c. The insulation between high-voltage live parts and the accessible surface of the inspection windows shall comply with the rated insulation levels  $U_d$  and  $U_p$  according to 5.3 of IEC62271-200:2021.

#### Ventilating openings, vent outlets

- a. Ventilating openings and vent outlets shall be so arranged or shielded that the same degree of protection as that specified for the enclosure is obtained. Such openings may make use of wire mesh or the like provided that it is of suitable mechanical strength.

#### Manually operated actuators.

- i. The direction of operation of manually operated actuators shall be self-evident or explicit.
- ii. Preferred operation principles are to
  - turn clockwise to close and anti-clockwise to open, or
  - push in to close and pull out to open, or
  - move right to close and move left to open, or
  - move upwards to close and move downwards to open.

The designer can recommend other designs to be approved by Foscort.

#### Operation of releases

##### a. Shunt release

- i. A shunt closing release shall be able to operate within a voltage range of the power supply, measured at the input terminals, between 85 % and 110 %
- ii. A shunt opening release shall be able to operate under all operating conditions of the switching device up to its rated short-circuit breaking current (if any), and between 70 % in the case of DC – or 85 % in the case of AC – and 110 % of the rated supply voltage of the opening device measured at the input terminals.

##### b. Under-voltage release

- i. Shall operate to open and prevent closing of the switching device for all values of the voltage at its terminals below 35 % of its rated supply voltage.
- ii. Between 70 % and 35 % of its rated supply voltage, the under-voltage release may operate, opening the switching device and preventing its closing.
- iii. Under-voltage release shall not operate to open the switching device when the voltage at its terminals exceeds 70 % (AC or DC) of its rated supply voltage.
- iv. The closing of the switching device shall be possible when the value of the voltage at the terminals of the release is equal to or greater than 85 % of its rated voltage.

#### Nameplates

- i. Switchgear and control gear (and their operating devices where applicable) shall be provided with durable and clearly legible nameplates that contain the information required to identify the equipment, its ratings and appropriate operating parameters as specified in the relevant latest IEC standards.
- ii. The removable parts, if any, shall have a separate nameplate which, if applicable, may contain



data relating to the functional unit(s) they are designed for.

- iii. These nameplates need only be legible when the removable part is in the removed position.

### Locking devices

- a. Switching devices, the incorrect operation of which can cause damage, or which are used for assuring isolating distances, shall be provided with locking facilities (for example, provision for padlocks).
- b. Interlocks shall not be damaged by attempted incorrect operations of any associated switching devices under the conditions specified below.
- c. For removable parts of assemblies
  - i. the withdrawal or engagement of any switching device shall be prevented unless it is in an open position.
  - ii. the operation of any switching device shall be prevented unless it is only in the service, disconnected, removed or test position.
  - iii. the interlock shall prevent the closing of any switching device in the service position unless any auxiliary circuits associated with the automatic opening of these devices are connected. Conversely, it shall prevent the disconnection of the auxiliary circuits with the circuit breaker closed in the service position.
- d. For other parts of assemblies.
  - i. Interlocks shall be provided to prevent operation of disconnectors under conditions other than those for which they are intended.
  - ii. The operation of a disconnector shall be prevented unless the circuit is open. The following are exempt:
    - switch-disconnector.
    - double busbar system designed to have a busbar transfer without current interruption.
  - iii. the operation of the circuit breaker, switch or contactor shall be prevented by interlocks as long as the associated switching devices, i.e., disconnector and/or earthing switch, have not reached their dedicated closed or open position.
  - iv. if the earthing of a circuit is provided by the main switching device (circuit-breaker, switch, or contactor) in series with an earthing switch (or any earthing device), the earthing switch shall be interlocked with the main switching device. Provision shall be made for the main switching device to be secured against unintentional opening, for example by disconnection of tripping circuits and/or blocking of the mechanical trip.
  - v. earthing switches having a rated short-circuit making capacity less than the rated peak withstand current of the main circuit should be interlocked with the associated switching devices.
  - vi. Regarding removable fuse-links, their withdrawal or engagement shall be prevented unless the fuse-base contacts are earthed or isolated from all sources of supply.
  - vii. The manufacturer shall give all necessary information on the character and function of interlocks.
  - viii. If electrical interlocks are provided, the design shall be such that no improper situations can occur in case of lack of auxiliary supply. However, for emergency control, the manufacturer may provide additional means for manual operation without interlocking facilities. In such a case, the manufacturer shall clearly identify this facility and define the procedures for operation.

## Position Indication

- i. Indication of the actual position of the main contacts of the switching devices shall be provided unless the contacts themselves are visible in all positions.
- ii. Requirements for position-indicating devices are as follows:
  - it shall be possible to read the position-indicating device when operating locally.
  - all stable positions such as open, closed and test positions shall be clearly indicated.
- iii. Identification of the open, closed and where appropriate earthed positions should use symbols and/or colours defined by the relevant IEC publications: IEC 60073 [25] for colours, IEC 60417 [26] for symbols and IEC 60617 [27] for diagrams.

## Degrees of protection provided by enclosures

- i. Protection of persons against access to hazardous parts and protection of the equipment against ingress of solid foreign objects (IP coding) shall be at least IP1XB.
- ii. Protection against mechanical impact under normal service conditions (IK coding) shall be at least IK07.

## Electromagnetic compatibility (EMC)

Switchgear and control gear shall be capable of satisfying the EMC tests specified in SANS 62271-1:2023.

## X-ray emission

Vacuum interrupters shall be designed in such a way that the acceptance criteria about X-ray emission levels specified SANS 62271-1:2023 are adhered to.

## Instrumentation

All instrumentation designs, installation and commissioning shall be done to comply with the following Foskor's General Engineering Specifications as follows;

- a. Foscok's Engineering Specification (GES-001) – Instrumentation General Specification and procedures
- b. Foscok's Engineering Specification (GES-002) – Instrumentation installations and commissioning
- c. Foscok's Engineering Specification (GES-003) – Instrumentation General Specification
- d. Foscok's Engineering Specification (GES-004) – Field Instrumentation Standard

## High-voltage compartments requirements

### General

- a. High-voltage compartments should also be classified as accessible or non-accessible.
- b. A high-voltage compartment shall be designated by the main component contained therein, for example, circuit-breaker compartment, busbar compartment, or by the main functionality provided, for example, connection compartment.

- c. Electrical connections between the main circuit of the assembly and the external conductors (cables or bars) to the electrical network or high-voltage apparatus of the installation shall be made within a high-voltage accessible compartment. This compartment shall be designated as a "connection compartment".
- d. Where other main components (e.g. circuit-breakers, busbars) are contained in the connection compartment, then the designation should primarily remain as the connection compartment.
- e. The connection compartment may be further identified according to the several components enclosed, for example, connection/CT, or connection/circuit-breaker compartment. However, for the purposes of LSC categorization, the designation is "connection compartment".
- f. Busbar compartments may extend through several functional units without the need for bushings or other equivalent means. However, in the case of LSC2, LSC2A, and LSC2B assemblies with accessible busbar compartments, separate compartments shall be provided for each set of busbars, for example in double busbar systems and for sections of switchable or disconnectable busbars.
- g. Parts of the busbar systems, in between two high-voltage compartments of functional units, shall be considered as part of their adjacent compartments if IP2X is ensured for these "in-between" parts by the enclosures of both adjacent high-voltage compartments. In case IP2X is not met, a separate compartment shall be defined for these "in-between" parts.
- h. Parts of the busbar at the end of the busbar system shall be considered as part of the adjacent compartment if their length out of the enclosure of the high-voltage compartment is less than 12,5 mm. If this criterion is not met, a separate compartment shall be defined for these busbar extension elements.

#### Partitions and Shutters

- a. A compartment can contain barriers, structures or components that are designed to provide various functions, such as mechanical or dielectric integrity.
- b. A compartment shall not be designed to function as a partition or enclosure.
- c. Partitions and shutters, when accessible in service, shall provide at least the degree of protection IP2X according to IEC 60529:1989
- d. Conductors passing through partitions shall be provided with bushings or other equivalent means to provide the required IP level.
- e. Openings in the enclosure of an assembly and in the partitions between compartments accessible during service, through which contacts of removable or withdrawable parts engage fixed contacts, shall be provided with automatic shutters to ensure the protection of persons in any of the positions defined.
- f. Means shall be provided to ensure the reliable operation of the shutters, for example by a mechanical drive, where the movement of the shutters is positively driven by the movement of the removable or withdrawable part.
- g. The status of shutters may not in all situations be readily confirmed from an open high-voltage compartment, (e.g. connection compartment is opened, but shutters are located in the circuit-breaker compartment). In such situations, verification of the shutter status may require access to the second compartment or provision of an inspection window or reliable indicating device.

- h. If one or more set(s) of fixed contacts can be made accessible through opened shutters (e.g. for maintenance or test purposes), then the shutters shall be provided with means of locking each set independently in the closed position.
- i. If the automatic closing of shutters can be made inoperative to retain them in the open position (e.g. for maintenance or test purposes), then it shall not be possible either for the switching device to return to the service position or to close the switching device in the service position until the automatic operation of the shutters is restored. This can be realized for example by preventing the switching device from returning to its service position or by automatic restoration when returning the switching device to the service position.
- j. It may be possible to use a temporary inserted partition to prevent the live set of fixed contacts from being exposed. Insertion of such a temporary partition shall be possible before the compartment is opened and exposes the high-voltage parts that are intended to be kept energized.
- k. For class PM, partitions and shutters between opened compartments and remaining high-voltage live parts of the assembly shall be metal; otherwise, the class is PI.

### ***Metal partitions and shutters***

- a. Metal partitions and shutters or metallic parts shall be connected to the earthing point provided with a voltage drop of less than 3 V at 30 A (DC).
- b. Discontinuity in the metal partitions and closed metal shutters that may become accessible shall be less than 12,5 mm.

### ***Non-metal partitions and shutters***

- a. Non-metal partitions and shutters, made or partly made of insulating material, which may become accessible shall meet the following requirements:
  - i. The insulation between high-voltage live parts and the accessible surface of insulating partitions and shutters shall withstand the test voltages specified in 5.3 of IEC 62271-1:2017 for voltage tests to earth and between poles.
  - ii. the insulating material shall withstand the power-frequency test voltage specified in item a). The appropriate test methods given in IEC 60243-1 [9] should be applied.
  - iii. the insulation between high-voltage live parts and the inner surface of insulating partitions and shutters facing these shall withstand at least 150 % of the rated voltage of the equipment if a separate insulating medium, i.e. gas or liquid, is in-between.  
NOTE Solid-insulation embedding high-voltage conducting parts is not considered as a partition.
  - iv. if a leakage current can reach the accessible side of the insulating partitions and shutters by a continuous path over insulating surfaces or by a path broken only by small gaps of gas or liquid, it shall be not greater than 0,5 mA under the specified test conditions.

### ***Removable parts***

- a. If the assembly incorporates removable parts that may be exchanged, for example, fuse-links, then the manufacturer shall provide a reference list. IEC 62271-105 provides further information.
- b. Removable parts for ensuring the isolating distance between the high-voltage conductors shall comply with IEC 62271-102:2018.

- c. If removable parts are intended to be used as a disconnect or intended to be removed and replaced more often than only for maintenance purposes, then testing shall also include the mechanical operation tests according to IEC 62271-102:2018.
- d. It shall be possible to know the operating position of the disconnect function or earthing switch function is met if one of the following conditions is fulfilled:
  - i. The isolating distance is visible with the removable part removed.
  - ii. in case of a withdrawable part:
    - the position of the withdrawable part, in relation to the fixed part, is clearly visible and the positions corresponding to full connection and full isolation are clearly identified.
    - the position of the withdrawable part is indicated by a reliable indicating device.
- e. Any removable part shall be so attached to the fixed part that its contacts will not open inadvertently due to forces that may occur in service, in particular those due to a short-circuit.
- f. In IAC classified assemblies, the transfer of withdrawable parts to or from the service position shall not reduce the specified level of protection in the event of an internal arc. This is achieved, for example when the operation is only possible when doors and covers intended to ensure personnel protection are closed. Other design measures providing an equivalent level of protection are acceptable.

#### Provisions for dielectric tests on cables

- a. Assemblies shall be designed to allow the testing of cables while they are connected to the assembly. This may be performed either from a dedicated test connection or from the cable terminations. In both cases, the assembly shall have rated cable test voltage(s) as specified in clause 5.102 of IEC62271-200:2021 applied to those parts that remain connected to the cable, at the same time as the rated voltage is applied to those parts of the main circuit designed to remain live during testing cables.

#### Internal arc fault

- a. The manufacturer shall ensure the IEC 61850 protocol is enabled.
- b. The design of assemblies shall be designed and manufactured to satisfy the requirements of preventing the occurrence of internal arc faults.
- c. Switchgear shall be certified as arc-resistant and be designed to safely contain and redirect arc flash energy away from the operator.
- d. The assembly shall be designed to give a defined level of protection to persons in the event of an internal arc when the assembly is in normal operation.
- e. Switchgear should have the provision of dissipating the arc energy at the top of the panel when it explodes.
- f. Install the arc flash duct which will carry the arc energy if the panel explode to the outside of the room to the open environment.

- g. Arc protection should be for both the light and current options.
- h. Arc Fault on the incomer cable should be isolated at the upstream panel for the tripping of the upstream feeder.
- i. The IAC designation shall be included in the nameplate.
- j. The manufacturer shall ensure all necessary measures are adopted to protect persons in case of an internal arc. These measures are aimed at limiting the external consequences of such an event.
- k. The incomer and motor feeder relay settings calculation should be part of the switchgear.
- l. The manufacturer shall ensure the following basic measures are adhered to.
  - rapid fault clearance times initiated by detectors sensitive to light, pressure or heat or by differential busbar protection.
  - application of suitable current-limiting devices (e.g. fuses, or devices that employ pyrotechnic means to commutate current to a current-limiting fuse) to limit the let-through current and fault duration.
  - fast elimination of arc by diverting it to metallic short-circuit using fast-sensing and fast-closing devices.
  - remote operation instead of operation in front of the assembly.
  - pressure-relief device.
  - transfer of a withdrawable part to or from the service position only when the front door is closed.

#### Assemblies' requirements

- a. Assemblies shall be designed so that the operations in normal use can be carried out safely.
- b. In the case where a high-voltage compartment may be opened, i.e. accessible compartment, safe operation of the assembly requires (irrespective of whether of fixed or withdrawable pattern) that the high-voltage parts are isolated from all sources of supply and earthed.

Exempted from this requirement are:

- high-voltage parts that are moved to the disconnected position with corresponding shutters closed.
  - high-voltage parts, if embedded by solid-insulation material and complying with at least protection category PA of IEC 62271-201:2014.
- c. If a withdrawable or removable part does not include an earthing device that is intended to earth the main circuit of that removable part before becoming accessible, it shall be possible, by manual earthing means, to safely discharge trapped charges from that removable part. The manufacturer shall define the recommended procedure in the manufacturer's instructions reference.
  - d. All removable parts and components of the same type, rating, and construction shall be mechanically and electrically interchangeable.
  - e. Removable parts and components of equal or greater current and insulation ratings may be installed in place of removable parts and components of equal or lesser current and insulation ratings where the design of these removable parts and components and compartments allows mechanical interchangeability.

- f. Components contained in an assembly shall be in accordance with their various relevant standards.
- g. For main circuits with current-limiting fuses, the manufacturer of the assembly may assign the maximum peak and Joule integral of the let-through current of the fuses to the main circuit downstream of the fuse.
- h. Upon assembly, the installation shall ensure that only type of terminations from a list provided by the manufacturer of the assembly.

#### IAC classification

The manufacturer shall ensure the ratings are specified, the ratings shall be indicated using designations as specified under 5.103 of IEC 62271-200:2021

- classification: IAC
- Type of accessibility: 2BC
- Classified sides of the enclosure: FLR
- Rated three-phase arc fault values: current  $I_A$  [ kA ] and duration  $t_A$  [ s ]
- Rated single-phase arc fault values (where applicable): current  $I_{Ae}$  [ kA ] and duration  $t_{Ae}$  [ s ]

#### Testing Requirements

##### Factory Acceptance Testing - Requirements

- a. The entire installation shall be tested according to SANS 62271-1:2023, SANS 62271-200:2022, SANS 60060-1:2011, ANSI/IEEE C37.20.7 testing guide.
- b. Routine testing shall be made at the manufacturer's works on each apparatus manufactured. Any routine tests that cannot be done on the manufacturer's site can be done elsewhere, only upon agreement with Foskop.
- c. Test reports of the routine tests done at the manufacturer's site shall be furnished to Foskop.
- d. The manufacturer shall demonstrate the validity of these tests made on all transport units conducted when the switchgear and control gear are not completely assembled before transport,
- e. The Foskop Representative shall have access, at all reasonable times, to those parts of the manufacturing facilities engaged in the manufacture of items in terms of this specification. He is authorised to witness any stage of manufacture, tests and inspect documentation.
- f. The Foskop Representative is authorised to reject any items not manufactured to the requirements of the specification.
- g. All equipment shall be inspected at the service provider's works before delivery, to ensure compliance with the specification.
- h. No unit shall be considered complete until acceptance by Foskop.
- i. The minimum testing/pre-delivery checklist shall be as follows:
  - The Foskop representative must carry out a clause-by-clause check of each panel/ switchgear, before delivery.
  - This panel/ switchgear list is intended to assist this process but does not relieve him/her of the responsibility described above.

## Site Acceptance Testing – Requirements

The Switchgear Supplier shall carry out the following site tests: -

### a. Resistance Tests of Main Circuit

Micro-ohm meter tests shall be carried out on all busbars, main connections, and across the circuit breaker and disconnecter contacts.

Which shall include:

- Micro-ohm meter tests between all primary test access points and their associated MV cable termination box connection.
- Micro-ohm meter tests between all common earthing connections between the Circuit Breaker housings.

### b. Switchgear Operation, Mechanical Interlock Checks and Function Tests

The following basic operational checks on switchgear shall be carried out by the Supplier: -

- i. The mechanical functionality of the switchgear shall be checked.
- ii. The operation of all electrical and mechanical interlocks on the switchgear shall be checked to ensure that they operate correctly in both permissive and preventative modes.
- iii. Functionality of switchgear operation counters shall be checked.
- iv. Each panel shall be operated electrically for all sources of initiation (trip/close) to ascertain that its function is correct to the wiring diagram/schematic.
- v. Any remote features shall only be checked to the multicore box terminals.
- vi. Bus-wiring and Schemes involving the interrelationship of a group of panels of any one switchboard shall be checked between each other for correct operation.
- vii. Functionality of earthing arrangements shall be checked.

### c. Check of Panels and Connections

- i. A physical examination of each panel shall be made to ensure that all wiring, positioning of equipment, fuse ratings and labels are in accordance with the wiring diagram and general arrangement drawings and that all relay ratings are appropriate.
- ii. All electrical connections shall be proved for mechanical integrity, e.g. terminal tightness, shrouding etc. The panels, relays and control modules shall be visually inspected to ensure freedom from debris and mechanical damage.
- iii. The following shall also be checked by the Supplier:
  - Wiring identification including ferrules.
  - Electrical Location and Polarity of fuses, links and auxiliary components.
  - Component values, e.g. resistor values.
  - Terminations fit for purpose, e.g. current rating, spring-loaded where applicable.

### d. Phasing Out Tests



All Suppliers' phasing out devices, such as IVIS, VDS, or neon indicators, shall be tested by the switchgear Supplier before use as part of the on-site testing.

Site verification shall be done in the presence of the Foskop engineer or his representative.

**e. HV Tests**

- i. The following High Voltage (HV) Tests shall be completed on-site by the Supplier.
- ii. All site testing shall be done in the presence of the Foskop Engineer or his representative.
- iii. Each group of busbars shall have an HV pressure test completed between each phase and to earth.
- iv. All circuit breakers shall have an HV pressure test completed between phases, across the contacts and to earth.
- v. All CT chambers shall have an HV pressure test completed between phases, across the contacts and to earth.
- vi. IR checks of the primary circuit shall be completed before and after any HV tests. A 5kV test device shall be used.
- vii. All results are to be recorded on the manufacturer's approved documents and submitted to Foskop with the handover file.
- viii. Parts of the equipment that have external primary connections made off shall not be included in the HV test.

**f. HV Tests of any IVIS, VDS or VPIS-type voltage/phase indication devices.**

Tests by the Supplier shall include: -

- i. The strike voltage of the device
- ii. The secondary terminal voltage of the device at system associated system voltage level.
- iii. The proving of phasing between each device and between adjacent CBs (switchgear bays) using the testing/phasing device supplied by the manufacturer.

**g. HV Tests of any Voltage Transformers:**

Tests by the Supplier shall include: -

- i. Primary / Secondary Ratio check of the device at the associated system voltage level.
- ii. Tertiary Winding Ratio check of the device at the associated system voltage level.

**h. Current Transformer (CT) Magnetisation Curve Tests.**

The Supplier's CT Magnetisation Curve Bench and Factory Test Results shall be supplied to Foskop as part of the On-Site Tests.

**i. Settings.**

- i. The contractor/supplier shall conduct electrical fault level calculations and protection grading study between 22kV, 6.6kV and 525V busbar levels.
- ii. The study will include protection settings calculations and application for the 6.6kV incomers to the busbar, 6.6kV/525V transformer feeders and 6.6kV pump feeders.
- iii. All settings implementations shall be in accordance with Foskop specifications and protection settings philosophy.

**j. Electrical protection schemes testing.**

- i. All circuits, relays, voltage transformers, current transformers and circuit breakers/contactors shall be tested by secondary injection as well as primary injection.
- ii. The results must be notified in proper test reports showing all the relevant test currents, test voltages, operating current, operation voltages and tripping times.
- iii. A magnetising curve shall be drawn for each current transformer.
- iv. Protective relays including arc protection and motor protection relays must be tested for all the settings and functions in use to determine and confirm the selectivity, sensitivity, and speed of the devices to adequately isolate system faults during operation.
- v. Devices used for electrical protection and measurements shall be tested accordingly for alarms, indications, and tripping.

#### Transport, storage, installation, operating instructions and maintenance

- a. Transport, storage and installation of switchgear and control gear shall be in accordance with instructions given by the manufacturer.
- b. The manufacturer shall provide the appropriate version of the instruction manual for the transport, storage, installation, operation and maintenance of switchgear and control gear.
- c. The instructions for the transport and storage should be given at a convenient time before delivery.
- d. The instructions for the installation, operation and maintenance should be given by the time of delivery at the latest.

#### Mechanical Construction - General

- a) The Motor Control Centres (MCC) shall be fixed pattern, comprising one or more fully interchangeable modular, rigid, free-standing sections, bolted together to form an extensible, composite, rigid, free-standing and vermin proof MCC of uniform appearance. Each section shall be divided vertically into panels. Each panel shall be divided into one or two cubicles one above the other.
- b) A channel iron frame (minimum 100mm x 50mm) shall be provided under each completed section of transportable length which shall be so constructed that it can be used for lifting the transportable section without distortion taking place. The maximum length of the transportable sections shall not exceed 3000mm.
- c) All completed sections shall be provided with lifting lugs and shall have sufficient strength to withstand all stresses occurring during transportation, installation and operation without distortion or damage.
- d) The Motor control centre shall be compartmentalised to segregate busbar, cable, circuit-breaker and instrument zones, in such a manner that prospective damage resulting from electrical faults will be minimised and confined to the zone cubicle or compartments in which the fault occurs. Power busbars shall be completely separated from any other compartment using suitably earthed metallic barriers.
- e) Separate compartments shall be provided for each circuit breaker and instrument section.

- f) Access to all power busbar compartments shall be by removable bolted covers. Removable covers shall be provided with captive screws.
- g) The incoming feeder, outgoing feeder, relay, control transformer and metering and instrumentation cubicles shall have doors suitably constructed to ensure rigidity. Doors shall be fitted with robust steel or brass (Barker Nelson 41200 EMB or equivalent) hinges with at least two 6mm square recessed quick close/open latches (Barker Nelson 26013 Dinlock or equivalent).

Hinges shall be provided at 500mm intervals per door with a minimum of two hinges per door. Each door shall be fitted with an equal number of hinges and latches. At least one of these latches shall be pad-lockable.

Doors and covers shall be provided with a high-density neoprene gasket to form a firm seal. The neoprene seal shall be a nominal 5mm thick and compressed to 3mm on the closing of the door. The entire switchboard shall be effectively dust and splashproof to IP 54.

- h) All hinged doors shall be fitted with a robust mechanism to latch and hold the door in the wide-open position, to minimise inadvertent contact with live parts during maintenance operations.
- i) All hinged doors shall open to a minimum of 135° from the closed position, to facilitate easy access for maintenance.
- j) Under no circumstances should rear doors have a width exceeding 750mm.
- k) Attention shall be given to ventilation to prevent the accumulation of ionised gases. Suitable drip-proof, fine mesh-screened, vermin-proof openings shall be provided to facilitate air movement by convection. These openings shall be arranged such that the hot gasses or other materials cannot be discharged in a manner injurious to operating personnel.
- l) Sectionalised removable gland plates shall be fitted and shall be fixed using captive nuts or screws and so located that ample space is available for the satisfactory entry and termination of cables. Cable entry shall be at the bottom of the board. All gland plates are to be connected to the main panel earth bar via suitably sized copper conductors and unused sections shall be left blank. Gland plates for the three-core cable of cross-sectional area 70mm<sup>2</sup> and above shall be a minimum 5mm plate.

Gland plates shall be galvanised. The cable gland compartments shall have removable covers attached with standard 6mm square recessed quick close/open latches.

- m) Suitable termination points shall be provided to enable any multiple three-core cables to be terminated without cross-overs of different phases and with minimum lengths of cable "tails". All cable termination points and associated connections shall be suitably braced to withstand the available fault currents without damage. If necessary, cable support clamps shall be provided for the individual cores after glanding off.

In addition to any support/bracing required by the electrical conditions, the busbars shall also have sufficient support to prevent stresses from being transmitted to the circuit breakers or any components by cable terminations. Particular attention must be paid to the termination arrangements of any multiple incoming three-core cables.

- n) Flash barriers shall be furnished to increase creepage distance between phases and shall be furnished on all circuit breaker cradles between the phases on the busbar riser section.
- o) Spare compartments shall be equipped generally as detailed on the single-line diagram, and shall include all circuit breakers, busbars, wiring, and instruments.

- p) The general structure of the board shall be designed and fabricated to ensure that no excessive vibration caused by the operation of any component is transmitted to any other components, thereby causing spurious tripping of any device.
- q) Unless otherwise agreed or stated in this Specification, all screws, bolts and nuts shall be hexagonal to ISO metric commercial standards and shall be rustproof. Loose "bolts and nuts shall not be used on steelwork. "Avdel Burnside" blind threaded fastening system bushings or equivalent shall be used for thread sizes M5 and above. Studs projecting from the exterior surfaces of the board shall have chrome or cadmium-plated dome nuts. Self-tapping screws shall not be utilised for any purpose on any equipment.
- r) The switchboard steelwork shall be a minimum of 2mm thick, irrespective of the type of steel used.
- s) Each cubicle/compartment door shall be labelled with the reference letter(s) of that compartment, and labels shall be discussed with the Foscort engineer during the construction stage.
- t) Every door and/or removable cover giving access to a cubicle shall bear a durable designation label suitably inscribed with the description and the equipment number where applicable, using engraved black characters at least 6mm high on a white background. Incomers shall be labelled.
- u) The MCC shall be provided with an identity label, engraved with 30mm high black-on-white characters and shall be mounted on top of the switchgear.
- v) All removable covers/doors protecting live equipment shall be fitted with warning labels. Warning labels shall be engraved red characters 6mm high on a white background.

Each circuit shall be provided with a blank white/black white traffolyte type label (or engraved in accordance with designations on drawings).

All electrical components/equipment shall be labelled (with designations corresponding to those of the Purchaser's schematic diagrams) to facilitate recognition. Engraving shall be left to the discretion of the manufacturer but shall be legible and durable. The component labels shall be affixed adjacent to the component they refer to.

All labels and label brackets shall be affixed by machine screws. Adhesive labels are not acceptable.

- w) Incomers shall be labelled "Incomer from ..... " and the bus section shall be labelled "Bus Section".
- x) Over and above the labelling requirements of this specification, the labelling requirements of SANS 10142-1 and SANS 62271 must also be met.
- y) Doors to compartments shall be so arranged that normally they cannot be opened whilst the apparatus contained is live unless this apparatus is fully shrouded or screened to the correct IP protection to prevent inadvertent contact. Doors shall be designed to ensure rigidity and shall be a neat fit in the framework and around the circuit breaker escutcheon plate.
- z) Circuit breakers / Vacuum contactors shall be interlocked with the panel door to prevent the opening of the door when the circuit breaker is in the "ON" position.

A non-apparent interlock defeat shall be provided for the opening of the door with the circuit breaker in the "ON" position for testing and maintenance. In addition, there shall be provision for the attaching of three padlocks to each operating handle in the "OFF" position, which prevents the circuit breaker from being operated.

All the access doors are to be effectively and permanently earthed to the main panel enclosure of the switchgear, using a suitable braided copper earth strap, not less than 35mm<sup>2</sup>, crimped with lugs and bolted at each end to the door and enclosure.

#### Mechanical Construction - Busbar Ducts (where required).

- a) The bus ducting shall have suitable sealing at each end, between the bus duct and switchgear, and shall be constructed to ensure that any fire or other fault cannot spread between the various sections.
- b) Busbar ducts shall utilise copper complying with this Specification and shall have a minimum current rating of 2000 Amps. The bus ducts shall be metal enclosed, non-segregated phase type, suitable for indoor use and positively vermin proof. Ventilation slots, if any shall be suitably screened with a fine mesh.
- c) If necessary, provision shall be made for expansion or contraction of the busbars and the housing due to loadings, temperature changes and short circuit conditions.
- d) Busbars, insulators and supports shall be braced to withstand the mechanical and thermal effects of the fault current.
- e) Bus duct housing shall have bolted covers for access to busbars, insulators and joints.
- f) Insulators shall be mounted on their supports in such a way that they can be easily removed and replaced.

#### Electrical Construction – general.

- a) Cooling - Artificial cooling of any component will not be acceptable. All design and construction shall be based on natural cooling by convection or radiation.
- b) Busbars and connections shall generally comply with the relevant latest standard and all solid copperwork shall be made of hard drawn high conductivity copper of constant cross-section throughout their lengths with a maximum design current density of 1,66A/mm<sup>2</sup>.
- c) all copperwork (including connections to, from and between equipment) shall have applied solid insulation suitable for the rated voltages. Heat shrink insulation shall be used wherever possible.
- d) Main busbars shall be rated for 2000 amps. Busbar droppers shall be manufactured from solid copper bar and rated for the maximum possible current (determined by the breaker frame size) in that section with a minimum rating of 1000 amps.
- e) The use of flexible conductors as droppers from the main busbars to circuit breakers shall not be permitted.
  - Busbars and droppers shall be housed in separate metal enclosures.
  - All busbar joints shall be silver-plated or tinplated. High pressure bolted lap joints shall be used and all bolts shall be of the high tensile type.
  - All busbars and droppers shall be securely supported by heavy, high dielectric, non-hygroscopic material with bracing to withstand stresses due to short circuits of 3-second duration and at least equal to the interrupting rating of the circuit breaker protecting the busbars.
  - All insulation used on electrical conductors/connections and wiring shall be flame retardant types, constructed of low-toxicity materials.
  - Power wiring on the "live" side of the circuit breakers (busbar dropper to circuit breaker) shall be as short as possible, sized to carry the maximum current continuously of the frame size of the respective breakers and shall be a flexible conductor. The flexible connection shall be

provided on all such connections and shall be designed to prevent the transmission of any forces that may arise between the busbar droppers and the circuit breaker. In terms of SANS 60439, this connection is deemed to be a fault-free zone and the design and use of the flexibles shall in no manner compromise this zone.

- This connection may be from insulated stranded conductor, laminated, insulated conductor or multistrand braid.
- f) hexagonal die-type hydraulic crimping shall be used for all wiring greater than 16mm<sup>2</sup>.

#### Electrical Construction – Telecontrol.

- a) All switchgear shall be provided with equipment to interface with Foskor control room telecontrol (300 Ft control room).
- b) This equipment should preferably be mounted in a position accessible through the hinged door of the instrument panel.
- c) Telecontrol close and trip relays shall be required on each circuit.
- d) It is the contractor's responsibility to connect and commission the telecontrol cables in the multicore box for correct and proper operational functionality.
- e) All relays and position switches for Telecontrol shall be wired to a terminal block suitably placed for the termination of multicore cables.
- f) The location of the terminal block is to be agreed between Foskor and the service provider.
- g) Each circuit, including the bus-section where protection is fitted, shall be equipped for remote indication of current by using a wedding ring CT, provided and wired by the switchgear manufacturer.
- h) The panel must have the following remote/plc/SCADA 24 VDC signals ready for interconnecting with Foskor's 300ft control room.
  - Start
  - Stop
  - Local/Remote
- i) The following indications must also be ready for interconnecting with Foskor's 300ft control-rooms.
  - Run/Stop
  - Trip/Healthy
  - Local/remote

#### Wiring.

- a) Each MCC shall be equipped and completely wired at the factory and, only after satisfactory testing, be split, if necessary, for transport.
- b) Control and instrumentation wiring shall be Silicone insulated throughout and of flexible, stranded, annealed, untinned copper construction. All wiring shall comply with the specifications below. Conductors shall comply with SANS 1411, Part 1, Table 4, Class 5.

CT Wiring                      2.5mm<sup>2</sup> phase coloured, common return black insulated, earth link.

General Control Wiring (AC) 1.5mm<sup>2</sup> grey

	(DC) 1.5mm <sup>2</sup> (positive – red, negative – black)
LED and PLC Inputs	(AC) 0.75mm <sup>2</sup> grey
	(DC) 0.75mm <sup>2</sup> (positive – red, negative – black)
Control Neutral	(AC) 2.5mm <sup>2</sup> black
Terminal Links	2.5mm <sup>2</sup> (

- c) Notwithstanding the above-mentioned requirements, the manufacturer shall ensure the wire size used is amply rated for the applicable current, under ambient conditions. Each end of every wire shall be marked with a wire number using plastic cable ferrules (black lettering on a white or yellow base).
- d) Control and instrumentation shall **not** be coloured yellow or blue, yellow or blue being restricted for use as bridge wires and interlocking wires respectively.
- e) All control/instrument panel wiring shall terminate using suitably sized compression crimp lugs unless terminals of the pressure pad type are employed. The minimum voltage rating of the control wiring shall be 600/1000V grade to SANS 1507 and SANS 1411 Pt I and III.
- f) All wiring shall be of the stranded type. Wiring shall be run in plastic trunking. Only where a space problem exists will loomed wiring be acceptable.

*Note: Stick-on harness holders are not acceptable.*

#### Wire Numbering

- a) Cable/wire marking ferrules shall be to the codes laid down in BSS 158 and shall correlate to the appropriate schematic or wiring diagrams.
- b) Split or open-type marking ferrules shall not be used.

#### Terminals

- a) The minimum rating for terminal blocks shall be 40A. Terminal strips/blocks shall be marked with designations corresponding with the supplier's/buyers' drawings. Generally, terminal numbers shall be the same as the relevant wire number. No more than two wires may be connected to any one side of a terminal. 10% additional spare terminals shall be furnished.
- b) Terminals are to be provided for all door-mounted components, diodes, etc.

#### Circuit Breakers

- a) Circuit breakers shall be either fixed pattern moulded case circuit breakers or withdrawable pattern air circuit breakers complying with the following requirements:
- b) Vacuum Circuit Breakers (VCBs)
  - VCBs shall be of the withdrawable type with self-aligning disconnecting devices with the disconnecting fingers preferably mounted on the breaker for ease of maintenance. The draw-out mechanism shall hold the circuit breaker rigidly in the fully connected, test and fully disconnected positions.
  - Safety shutters shall be provided to shield the fixed part automatically when the draw-out parts are removed preventing access to the conductors (main and auxiliary circuits). These shutters shall be clearly labelled indicating busbar and cable sections and in addition "live" section shall be labelled "6600V – LIVE". VCBs shall be equipped with inter-phase barriers.

- Each bus section VCB shall be equipped with three appropriate direct-acting non-adjustable over-current trip devices.
- Each incomer shall be equipped with three direct-acting, thermal inverse time over-current trip devices with an adjustable current set point and three direct-acting magnetic short time delay over-current trip devices with an adjustable current set point and short time delay.
- Fokor's Protection Engineer shall take particular care to ensure that the VCB protection is correctly coordinated with the upstream and downstream protective devices.
- Where current and time delay set points on VCBs are adjustable these shall be accessible from the front of the panel without removing the VCB from its cradle and shall be adjustable with the switchgear in alive.
- Interlocks shall be provided to ensure the following:
  - - that the main circuit breaker cannot be removed from or to the fully connected position unless the VCB is open.
  - - that the compartment doors cannot be opened should any accessible portion of the VCB frame be energised.
  - - that the breaker cannot be closed unless in the fully connected, test or fully disconnected positions.
- Provision shall be made for the padlocking of any VCB in any one of the fully connected, test or fully open positions. In addition, all VCBs shall have a padlocking facility to prevent the close push button from being operated when padlocked.
- The VCBs supplied shall be three pole, magnetically operated. The mechanism shall be of the stored energy type having hand charged spring with mechanical and electrical releases for closing.
- The ACB control/protection unit shall be fitted with a transparent cover that can be sealed in the closed position to prevent tampering with the settings.
- The VCB shall be cable of remote tripping and closing e.g. via remote pendant.
- Each remote pendant shall be 10 meters long.

#### Insulation Materials

- Any insulation, filling putty, etc, used shall be selected such that it can withstand without injurious effect (mechanically or electrically), all temperatures encountered within the switchboard. All ACB boards shall have a surge arrester fitted to the incoming ACB. This surge arrester shall be fitted to the LIVE side of the breaker.

#### Instruments and Meters

- a) In general voltmeters and ammeters are a minimum requirement and shall be included as follows:
- b) Incoming Feeders shall be equipped with a single 96mm x 96mm, combined maximum demand and instantaneous ammeter. The maximum demand portion shall have a thermal movement with a 15-minute time lag and a drag pointer having a reset facility. It shall have a built-in saturation transformer for increased overload capacity to 90 times the rated current for one second.
- c) In addition, incoming feeders shall have a 96mm x 96mm voltmeter connected to measure phase-to-phase voltage via a set of fuses suitably rated for voltage and short circuit current.
- d) Outgoing feeders shall be equipped with a suitably sized CT operated 96mm x 96mm 90° movement suppressed maximum ammeter having an overload rating of 40 x rated current for one second.
- e) All current transformers shall conform to IEC 285.
  - For protection purposes class 10P CTs are to be used:



- for indicating purposes class 1 CTs are to be used and
  - for metering purposes class 0,5 CTs are to be used.
- f) In general, current transformer mechanical and thermal ratings shall be coordinated with the short circuit ratings of the equipment. All instruments are to be mounted internally with a protective Perspex or similar.

#### Types of motor starting

- a) The following are the types of motor starters that are available on the market:
- Direct-on-line (DOL) type motor starting.
  - Star/Delta (S/D) type motor starting.
  - Soft starting (SS) type motor starting.
  - Variable Frequency (Speed) Drive (VFD/VFD) type motor starting.
- b) The type of motor starting required shall be project-specific and shall be discussed with the Foskop project engineer.

#### Mechanical equipment protection devices

- a) All the protection devices, i.e. motor thermistors, motor heaters, gearbox oil flow switches etc on mechanical equipment shall be accommodated onto the individual motor starter circuits.

#### Painting and protective coating

- (a) All chassis plates shall be painted white.
- (b) Specific external colours will be provided by Johannesburg Water.
- (c) All gland plates shall be galvanised for improved cable earthing.

#### Cable work

- a. Disconnect cables from the existing switchgear and re-terminate them to the new switchgear.
- b. Terminations shall be properly done on the switchgear terminals with required accessories. Installation, glands, lugs and cable termination to comply with the Foskop and the industry specifications for the issue of the COC. Supply and installation of the required cable putty and tape are also to be catered for in the pricing.
- i. All terminals of the cable ends shall be properly tightened as per the manufacturer's recommended torque to avoid heating due to loose connection.*
  - ii. Service provider to ensure the cable is properly secured. Under no conditions shall the cable weight be imposed on the switchgear terminals /bus bar*
  - iii. All cable ends shall be similar to **HEATSHRINK** or approved equivalent. The termination procedure specified by the manufacturer shall be strictly followed.*
  - iv. Terminations may only be carried out by a certified electrician who has completed a termination / jointing course with the manufacturer. Proof of the cable joiner's qualification shall be submitted with the bid. This forms part of the pre-qualifying criteria.*

- v. *The phase conductors shall be terminated to the switchgear terminal box/bus bars with suitable cable lugs. The conductors shall be crimped to the cable lugs. Cable lugs shall be insulated using a special boot rated for the nominal voltage of the cable.*
- c. Cable joints shall only be done provided the following is addressed and adhered to.
- i. *All MV-cable joints used shall be similar to RAYCHEM or approved equivalent. The jointing procedure stipulated by the manufacturer shall be strictly followed.*
  - ii. *No crossing of cores shall be made in joints of medium-voltage cables.*
  - iii. *Joints may only be carried out by a certified electrician who has completed a termination / jointing course with the manufacturer. Proof of the cable jointer's qualification shall be submitted to the Engineer before task execution.*
- d. All cables shall be painted with fire-retardant paint upon completion of the installation for a length not less than 1 meter on both sides of the cable entry.
- e. Contractor to Pressure Test or conduct AC overvoltage test commissioning test on the cable installation between the two substations. Testing shall be witnessed by the Foscort representative.
- i. *After the installation, jointing or termination of a medium voltage cable, one of the following voltage tests shall be carried out before the energizing of the cable:*
  - ii. *It should be noted that damage to the cable as a result of any form of pressure testing due to a faulty test or test equipment will be for the account of the Contractor. Special care shall be taken to ensure that testing equipment is calibrated and that the correct test is carried out.*
- f. After all testing, the contractor shall hand over a healthy report inclusive of the COC for the work done.

*Note.*

- i. *If there are any exclusions on the scope that may affect the issuing of the COC, the contractor is to highlight them as part of the tender response and quote for any additional items whatsoever as extras.*

## Excavations

- a. All cable trench excavation and backfilling shall be in accordance with this Foscort E50/2/14.7 specification, with the title "Typical underground details of cables and details of sniff pipes."
- b. Cables shall be installed at a depth of 1000mm from the final ground level to the top of the cable. For any deviation from the depths for the installation of the cable specified, written approval shall be obtained from the Engineer.
- c. Excavation of trenches may be done either by mechanical excavators or by hand.
- d. The bottom and sides of trenches must be smooth and shall have no sharp dips or rises.
- e. Trenches shall be set out and excavated in such a manner that the minimum bending radii of the cable are achieved when laying the cable

## Marking of cable

- a. The following information shall be punched onto the lead tape for the cable under consideration:

- Voltage:
- Cable size (mm<sup>2</sup>):
- Date of installation:
- Connected to:
- Parallel cables must be marked:

#### Battery Tripping Unit (BTU) special requirements

**Certifications:** The BTU must meet the applicable safety and performance standards, as specified in IEC 60950-1

**Alarms and Indications:** The BTU shall be required to have alarms and indications to warn of faults and other conditions that could affect its operation, including the critical alarm system via cellular network.

The BTU shall be the **thyristor Type**, preferably Static Power BTU

**Communication Capabilities:** The BTU may be required to have communication capabilities, such as Modbus or Ethernet, to allow it to be monitored and controlled remotely.

The BTU shall have a built-in battery charger and batteries.

#### PERFORMANCE AND GUARANTEE

- (a) The performance of the items supplied in terms of this specification, as defined by the order, shall be warranted by the service provider and, if specified, be tested in accordance therewith.
- (b) The service provider shall not be specifically required to conduct a performance test on-site.
- (c) A minimum guarantee period of 12 months is required.

### Battery Limits – Inclusions and exclusions

All live switching activities shall be performed by Foskop, however, it will be the responsibility of the contractor to ensure that no work is performed without locking out.

The table below must be taken into consideration for inclusions and exclusions.

WHO WILL SUPPLY THE FOLLOWING?					
N/A = NOT APPLICABLE C = CONTRACTOR FF = FOSKOR, FREE OF CHARGE FC = FOSKOR, AT COST TO CONTRACTOR					
<b>1. Sanitary –</b>		<b>2. Transport</b>		<b>3. Electrical</b>	
1.1 Water on-site and toilet facilities / janitorial services	C	2.1 Labour	C	3.1 Generators	C
1.2 Potable connection point	C	2.2 Materials	C	3.2 Electrical Extensions	C
1.3 Connection to construction water supply	C	2.3 Equipment	C	3.3 COC Site Establishment	C
1.4 Change rooms	C	2.4 All TMMS	C	3.4 Temporary lighting	C
				3.5 Electrical connection point	FF
				3.6 Connection to Electrical Supply	C
				3.7 Electric panel + distributing wiring	C
				3.8 Power for tools on site from existing Foskop electrical supply point (Welding plugs and 220v plugs)	C
<b>4. Quality –</b>		<b>5. Security</b>		<b>6. Lifting and Rigging</b>	
4.1 Plan, Management, QA, QC, etc.	C	5.1 Site Security	C	6.1 All rigging equipment (Slings, Chain blocks, turfers, etc.	C
4.2 All quality tests Civil, Paint, Mechanical, etc.	C	5.2 Foskop ID Card	C	6.2 Rigger	C
4.3 Sampling and laboratory testing	C			6.3 Mobile cranes and any other lifting devices	C

<b>7. Medicals -</b>		<b>8. Communication devices</b> – All communication devices like laptops, computers, networks, radios, cellphones, etc.	C	<b>9. PPE</b>	
7.1 Entry and Exit	C			9.1 Supply, Issue, inspect and manage	C
7.2 First aid box at the place of work	C				
10 Site Surveys	C	<b>11. Safety File</b> - Foskop will issue a template	FF	<b>12 Training &amp; Authorizations</b>	
		Ensure the file conforms/ populate to Foskop standards	C	12.1 All Required Training	C
				12.2 Authorisation - As Per Foskop COP	FF
<b>13. Site Establishment</b>		<b>14 Waste management on site</b>		<b>15 Painting</b> - All Equipment and tools paint, labour , etc.	C
13.1 Site office/s with suitable facilities for daily “Green Area” meetings, and lunch area	C	14.1 Transport all waste to Foskop designated waste sites	C		
13.2 Site establishment space	FF				
<b>16 Scaffolding</b>		<b>17 Labour</b>		<b>18. Compressed air</b>	
16.1 Scaffolding Supply & Erect	FF	17.1 All labour as per Scope of Work to execute task including management	C	18.1 Sandblasting or flash blast	C
16.2 Scaffolds be managed by the Contractor	FF			18.2 Compressor	C
16.3 Cherry Picker’s – only if and when available by pre-booking	FF			18.3 Air for power tools - If available	FF
16.4 Cherry Picker’s Driver– Trained and authorized driver	FF				
<b>19 Fuel</b>		<b>20. Storage and inventory control</b>		<b>21 Consumables</b>	
19.1 Fuel Supply	C	20.1 Protective coverings/tarpaulins	C	21.1 Welding rods	C

19.2 Fuel storage	C	20.2 Storage area and inventory control	C	21.2 Bolts & Nuts	C
19.3 Fuel fire protection	C			21.3 Etc.	C
19.4 Refueling	C				
<b>22 Tools &amp; Equipment</b>		<b>23 Certificates -</b>		<b>24 Training</b>	
22.1 All Portable Electrical Equipment	C	Supply All certificates as required	C	All required training and training manuals as required to ensure that FOSKOR can train its workforce and operate the plant/equipment safely	C
22.2 Hot Work Equip as per FOSKOR COP - Welding Machines, Gas Cutting, Grinding, Gauging, etc.	C			All manuals and related documents are to be supplied to the project Eng and FOSKOR Drawing office for safekeeping	C
22.3 Tools as required to execute the task	C				

Equipment such as the crane, scaffolding, excavator etc will be supplied by FOSKOR as may be required. The rest of the tools and materials for the installation shall be provided by the contractor unless specified to be a free issue.

FOSKOR has made provision for the supply of crane, scaffolding, and excavator free of charge depending on the size and nature of the works. It is expected that arrangements will be communicated to the appointed Scaffolding contractor at least 3 days before the requirement. Proof of request and arrangements and actual scaffolding installation for Scaffolding are to be provided to FOSKOR on request. It should be noted that FOSKOR has an existing appointed and accredited scaffolding supplier

The rest of the tools and materials for the installation shall be provided by the contractor unless specified to be a free issue.

#### As-Built Drawings

- a. The service provider shall supply FOSKOR with as-built drawings at the end of the project. This shall form a package with all other requested documents e.g., maintenance manual, etc.

Note! – All drawings are to be delivered in AutoCAD electronic format and PDF format. All drawings are to be detailed engineering drawings and approved for Construction.

#### QUALITY

- a. The contractor must provide the necessary quality management systems and plans to ensure that the quality of his work complies with the requirements of this scope of work

- b. The contractor shall during all phases of construction comply with the Foskop-approved Quality Assurance Plan
- c. The contractor shall be responsible for all the resources required for executing the Quality Management System including but not limited to, developing the Quality Assurance Plan & performing the Quality Control measures to ensure that the deliverables comply with the specifications & standards mentioned in the scope of work
- d. Any change requests / additional work resulting from an inadequate quality management system will be to the account of the contractor
- e. Foskop might appoint a third party for Quality Control Inspections
- f. The Contractor will have to provide an approved quality system for all work executed.
- g. This will include the following but is not limited to:
  - i. *Quality plan*
  - ii. *Quality compliance – Performance and reports*
  - iii. *Quantity Surveying*
  - iv. *Quality Assurance*
  - v. *Quality Authorization matrix – part of the Quality plan*
  - vi. *Quality control*
  - vii. *Quality administration. – All documents, checks, measurements, reports, variances, analysis, Corrective actions, etc. need to be properly filed and available on request at any time. The file will require an index*
  - viii. *Includes all test work, laboratories, Filing, etc.*
  - ix. *Survey and survey verifications*
  - x. *Construction versus design - Any Deviations from the approved “Construction Drawings”*
  - xi. *Quality communication – What needs to be reported to whom and at what frequency*
- h. Foskop envisage a complete quality System driven by the Contractor and this system/plan will be approved by Foskop and the appointed designer (if applicable) before construction/fabrication will be started.
- i. Compliance with this plan will be measured and failure to adhere to the quality plan will result in the stopping of construction activities until concerns have been addressed. The cost for this delay will be for the contractor's account.
- j. Foskop may appoint a third party to measure and control Foskop’s interest in the terms of quality in this contract and the contractor is expected to work in conjunction with this company
- k. Hold points will be discussed and finalized with the successful contractor based on the approved Quality plan

## CONTRACTOR DELIVERABLES

The deliverables for this project should include:

Documents and Manuals are to be submitted in the following formats:

Type of Document	Hard Copy	Electronic Format
Design documents	X	X
Comprehensive test reports and fault details	X	X
Quality File	X	X
A copy of all installation, operation and maintenance manuals shall be submitted with the tender. These manuals shall, preferably, be on a USB in an Adobe Acrobat format. However, hard copies are also acceptable	x	x

Hard Copy: Book or binding arch file format and must be durable and of high quality.

Soft Copy: Manuals, Reports and Data Books – Word, Excel, PDF, etc.  
Storage – Compact Disk or Data Traveller.

Language: English.

The contractor shall inform Foskop in writing and the contractor must have confirmation from Foskop that it has been accepted if there is an exclusion on the tender Scope when the order is placed on the contractor. Failure to have that confirmation will mean that the full scope is still applicable.

## SUPERVISION REQUIRED

- A full time 2.9.2 appointed supervisor will be on this site for the entire duration of site work.
- A 2.6.1 appointed site manager for overall site management.
- Appointed SHE Rep for the entire duration of site work.

Note: A Foskop work permit before the commencement of site work

## TENDER DELIVERABLES

The deliverables will include: -

- a. Submit Pricing for the Project as specified.
- b. Complete Foskop pricing schedule (BOQ)
- c. Company training Matrix indicated minimum training requirement compliance or the
- d. Copy of Certificate of Passing Foskop 2.6.1 and 2.9.2 Legal Exam for the people that is intended to be used in this task /project.



- e. Valid B-BBEE Certificate.
- f. Valid Company Registration documents.
- g. Valid letter of good standing.
- h. Valid tax certificate.
- i. Valid ID documents for Directors.
- j. Letter of technical operation guarantee addressing a situation in case of supply interruptions (also during operations) that exceed the duration limit declared by the manufacturer for normal operation. The letter shall guarantee that.
  - I. There shall be no false operation, false alarms or false remote signalling resulting from the interruption or reinstatement of the supply.
  - II. The manufacturer shall state the behaviour of the device when the supply voltage gets interrupted (for example impact on internal energy storage).
  - III. The manufacturer shall state the behaviour of the device when the supply voltage returns.
  - IV. Subsequent actions shall only be completed in response to a new valid operational command (where applicable).
- k. letter of guarantee assuring that all components installed in enclosures have been selected taking into account the temperature obtained in the cabinet of the control and auxiliary circuit during a 2-hour period following the loss of the “suitable precautions” to ensure the proper operation of switchgear and control gear until the end of this 2-hour period.
  - V. After this 2 h period non-operation is acceptable. If the loss of the “suitable precautions” is longer than 2 h but does not exceed 24 h in total, the functionality of the switchgear and control gear shall come back to their original characteristics when the service conditions are recovered.
  - VI. Where heating is essential for the correct functioning of the equipment, monitoring of the heating circuit shall be provided.
- l. General arrangement drawings. These drawings shall include overall dimensions, headroom for erection and/or operation, withdrawal space where appropriate, and positions of main and multicore cables.
- m. A copy of all installation, operation and maintenance manuals shall be submitted with the tender. These manuals shall, preferably, be on a USB in an Adobe Acrobat format. However, hard copies are also acceptable.
- n. If the crane is required, indicate the required crane size for off-loading of switchgear to the site.
- o. If scaffolding is required for construction, indicate this with the tender.

Not submitting the required documentation or not completing the documentation (Pricing Schedule) correctly will lead to a disregard of the tender.

## CONSTRUCTION METHODOLOGY

Construction Methodology shall be as per the contractor's execution plan and will be discussed later at the Kick-off meeting once the successful tenderer has been appointed.

## DOCUMENTS / DRAWINGS ISSUED BY FOSKOR

Drawing or Document No	Title	Revision
	<ul style="list-style-type: none"><li>• Scope Of Work</li><li>• Bill of Quantities</li></ul>	
Foskor, GE – 1, Rev 8	Design criteria for electrical installations	
Foskor, EC -1 Rev 4	Conditions Applicable to the installation, testing & commissioning of electrical equipment	
<b>Note</b>	Please read your Scope of Work	

## LEGISLATIVE REQUIREMENTS

- a. The successful or appointed Bidder shall comply with:
  - i. The Mines Health and Safety Act with Regulations (Latest revision)
  - ii. The National Road Traffic Act with Regulations (Latest revision)
  - iii. All applicable national and international legislative requirements and regulations.
  - iv. Foskor (Pty) Ltd. COP (Compendium Of Procedures) No. 25 for Service Provider Control (Available on request)
  - v. Foskor (Pty) Ltd. COP (Compendium Of Procedures) No. 59 for Trackless Mobile Machinery (Available on request)
  - vi. All Foskor procedures and policies applicable to the successful application of the contract. (Available on request)
- b. The successful or appointed Bidder shall comply with the following Environmental Specifications, Policies and Procedures:
  - i. COP 41 Housekeeping and workplace organisation
  - ii. COP 49 Waste Management
  - iii. COP 51 Resource conservation, energy, and materials
  - iv. COP 70 Storage of petroleum products and other hazardous material
  - v. National Environmental Management Act 107 of 1998 (NEMA)

- vi. National Environmental Management Waste Act 59 of 2008 (NEMWA) as amended.
- vii. The successful Bidder shall include in his/her SAFETY FILE, and comply with, the following documents:
  - Environmental Aspect and Impact Register (Applicable to this contract).
  - Environmental Objectives and Targets (Applicable to this contract).
  - Waste Management Plan (Applicable to this contract).
  - FOSKOR Atmospheric Emissions License (Copy available on request)
  - FOSKOR Waste Management Licence (Copy available on request)
  - FOSKOR Water Use Licence (Copy available on request)
- c. Before entering and operating a service vehicle (Own vehicle) on the Foskor site, the appointed Bidder shall:
  - i. Ensure that his driver/s has a valid national driver's licence for the specific class of vehicle, has been tested by the Foskor mobile equipment training centre and authorised by a Foskor MHSA (Mines Health and Safety Act) regulation 2.13.1 appointee for the class of vehicle to be used on site.

(Contact the Foskor mobile equipment training centre on 015 789 2840 to make an appointment for competence testing and authorisations)
  - ii. Ensure that his service vehicle complies with the requirements of Foskor COP 59, Trackless Mobile Machinery, before entering a red-flag area (i.e. phosphate and magnetite stockpile areas).

Minimum requirements: Vehicle fitted with conspicuity marking standards according to DMR (Department Mineral Resources) guidelines for vehicle visibility livery, rotating orange strobe light, buggy-whip flag and 9.0 kg SANS approved fire extinguisher.
- d. The appointed Bidder shall, before entering and operating a vehicle on the Foskor premises:
  - i. Obtain permission from the Foskor Safety & Security manager to operate his nominated service vehicle/s on the Foskor site. (Forms will be provided)
  - ii. Obtain a certificate of fitness from the Foskor Light Vehicle maintenance workshop supervisor or appointed Foskor inspector for his nominated service vehicle/s. Inspections are conducted daily between 08:00 and 08:30 and between 13:30 and 14:00 (Excl Fridays) at the Light Vehicle Maintenance workshop.
  - iii. Submit the above permission and COF at the main security office for the issue of a vehicle access disk.
  - iv. Ensure that his service vehicles have been inspected (Daily) by the Foskor standard (COP 59) to ensure that they are safe and fit for use. (Forms will be provided)

- v. See Foskop COP 59, Trackless Mobile Machinery for details.
- e. Before entering and operating/working on the Foskop site the appointed Bidder shall ensure that his driver/workmen are:
  - i. Briefed on the required task and have been informed of any abnormal conditions/situations.
  - ii. Physically, emotionally and mentally fit to perform their duty.
  - iii. Issued with the necessary PPE (Personal Protective Equipment) to safely operate his service vehicles and perform the duty of maintaining, servicing, inspecting and testing earthmoving- and mobile equipment.
  - iv. Before commencement of work:
    - All tools and equipment shall have been inspected and tested to be in good and safe working order.
    - All workmen have participated in the completion of a standard Foskop site risk assessment (Commonly known as a HIRA or Hazard Identification and Risk Assessment) and taken appropriate actions to mitigate any identified hazards.
- f. The Bidder shall perform NO lifting or rigging tasks. (Request assistance from the requesting Foskop supervisor)
- g. Before entering and operating/working on the Foskop site the appointed Bidder shall ensure that his portable electrical equipment has been tested and declared safe to use by the Foskop electrical services workshop.
- h. Before accessing earthmoving- and mobile equipment whereupon work is to be conducted, the earthmoving- or mobile equipment shall be locked out at the battery power source. The lock shall be marked and tagged. The tag shall contain the Bidder's business name, the employee name responsible for the lock and contact numbers. See Foskop COP 53, Lock-out system and usage for details.
- i. Before accessing the earthmoving- or mobile equipment where working at height is required (Above 2 meter ground level) the appointed Bidder's employees shall have inspected the 1) safety lanyard (Full body harness) to be of correct standard and safe to use, 2) life-line or anchorage points and 3) that access ladders in good and safe working order. See Foskop COP 96, working at heights for details.
- j. Although every effort has been made to ensure that the information contained within this document is correct, it remains the responsibility of the bidder to verify the actual status and site conditions. (A site visit can be arranged)

#### Additional safety requirements for the Pits (North and South) and Tailings

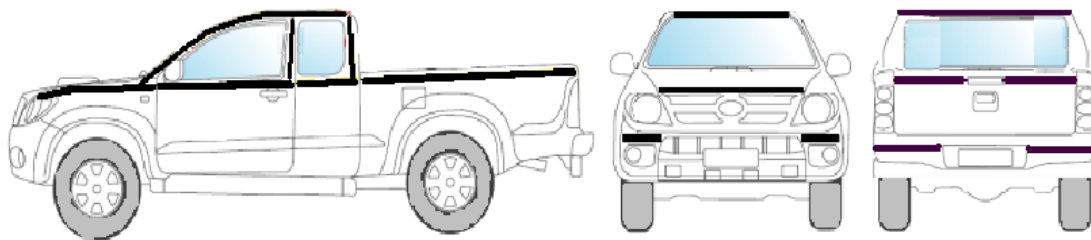
The following are mandatory at the South Pit

- A pit and tailings license is required for driving in the Pit.
- ROPS to be installed in the vehicle to be used to transport the working team to the Pit & Tailings.
- Vehicles will be required to have reverse hooters to access the mine area.
- Vehicles will be required to be fitted with a buggy whip to access the mine area.
- 

To access restricted areas (Mine open pits and Tailings dams) the supplier's service vehicle (Own vehicle) must be:

- a. Equipped and capable of travelling on rough, uneven and sometimes wet, muddy and slippery gravel surfaces.

- b. Fitted with seatbelts by the National Road Traffic Act, Regulation 213. (Seatbelt construction and anchorage must comply with SANS standards 1430 and 10168)
- c. Fitted with an internally or externally mounted ROPS safety cell that has been designed, fabricated, tested and certified to comply with the requirements of ISO 3471:2008 - EARTH-MOVING MACHINERY – ROLL-OVER PROTECTIVE STRUCTURES or similar specifications. (Provide certification)
- d. Equipped with a portable PDS (Pedestrian Detection System) supplied by Electro Diesel Group
- e. Fitted with an intermitting sounding reverse hooter.
- f. Be issued with a valid illumination certificate.
- g. Fitted with an amber LED strobe light mounted in the centre on the vehicle roof, rear window protector or cab guard.
- h. Vehicle to be provided with two heavy-duty stop-blocks (Chock blocks)
- i. Fibreglass flagpole (buggy whip) and reflective flag.
- j. By the requirements of the National Road Traffic Act, vehicles are to be supplied with a set (2) of emergency warning triangles securely mounted and easily accessible in the driver's cab
- k. Vehicle to be supplied with a 9.0kg charge, SANS approved, dry powder, 40% Mono Ammonium Phosphate, 45% Ammonium Sulphate and 0% Calcium Carbonate fire extinguisher with scrubber valve behind gauge. Fire rating 3A:3B.
- l. Vehicle shall be provided with conspicuous marking strips (Tape) as follows (3M Diamond grade. Front white, rear red and sides yellow):



## PERMIT TO WORK REQUIREMENTS

Before any on-site work under this contract may commence, the appointed or successful Bidder shall obtain from Foscok a PERMIT TO WORK. The following guidelines are provided to assist the appointed Bidder in obtaining a PERMIT TO WORK. (See Foscok COP 28, Permit to work and COP 25, Service provider control for details):

- a. The PERMIT TO WORK can be obtained from- and on completion returned to the Legal Administrator, Foscok Safety department.
- b. Obtain a contract/order number from the Foscok procurement department.
- c. Appoint a subordinate manager in accordance with Regulation 2.6.1 and an on-site supervisor in accordance with Regulation 2.9.2 of the Mines Health and Safety Act.
  - i. The appointed subordinate manager and -supervisor shall be required to write and pass the Foscok 2.6.1 and 2.9.2 legal examinations within 30 days of being awarded this contract.
  - ii. Attend the hour-long legal exam briefing any Thursday between 08:00 and 09:00 at the Security training hall.
  - iii. Write legal examination any Friday between 07:30 and 10:30 at the Security training hall.  
(Please book)
- d. Appoint an on-site SHE-Rep in accordance with section 29(1) of the MHSA to assist Regulation 2.6.1 and 2.9.2 in the daily on-site management of health, safety and environmental issues.
  - i. The designated SHE Rep must have the ability to read, write and express him/herself.
  - ii. The appointed SHE-Rep shall be required to attend a five-day SHE-Rep training course within 30 days after being awarded this contract (Training free of charge). Make booking on 015 789 2531.
  - iii. A pre-requisite for attending the SHE-Rep training course is successful completion of Basic Health & Safety Principals- and HIRA training. (See item 8(a) below)
  - iv. See Foscoks COP 5 Health and Safety Representatives for details.
- e. Provide a name list, including ID numbers, residential and postal addresses and telephone numbers of all of the appointed Bidders' on-site employees.
- f. All of the appointed Bidders' on-site employees shall undergo a full medical examination at the Foscok on-site Clinic. The clinic can be contacted at 015 789 2427 for an appointment.  
*(NOTE: All new employees and those leaving the service of the appointed Bidder must undergo an entry or exit medical examination)*
- g. The appointed bidder's designated on-site drivers shall receive competence testing and authorisation to operate vehicles on the Foscok site (See item 2 under the heading LEGISLATIVE REQUIREMENTS).
- h. All of the appointed Bidders' employees shall receive/have received training in:
  - i.
    - First aid level 1 (Provide own training)
    - Basic Health & Safety Principals (Provide own training)
    - HIRA (Provide own training)
    - Basic firefighting. (Provide own- or receive Foscok training, contact 015 789 2531 to book)
    - Lockout. (Provide own- or receive Foscok training, contact 015 789 2531 to book)
  - ii. All training not provided by Foscok must be verified by the Foscok training superintendent Mr. Johan Fouche. Please contact him on 015 7789 2525 to make an appointment or

alternatively, email proof of training and certificates to [johanfo@foskor.co.za](mailto:johanfo@foskor.co.za) to confirm compliance before requesting his approval on the PERMIT TO WORK.

- i. All of the appointed Bidder's on-site employees shall receive the basic Foskor site induction training at the Foskor Security office.
- j. All of the appointed Bidder's on-site employees shall receive site-specific induction training provided by the Foskor area Regulation 2.6.1 appointee/s.
- k. A HIRA (Hazard Identification and Risk Assessment) shall be completed for ALL "typical" tasks that will be completed under this contract. HIRA's to be signed by all Bidder employees. Make use of Foskor's own HIRA document, Annexure 1.2, contained in of COP 1, Foskor risk management (Available on request)
- l. Attach a detailed scope of work describing the required task and -outcome of this contract.
- m. All Foskor's appointed MHSA Regulation 2.9.2, 2.6.1, 2.13.1 and 3.1(a) managers must undersign/approve the PERMIT TO WORK.
- n. Registration and proof of payment under the Compensation for Occupational Injuries and Diseases Act, no. 130 of 1993. Registration number must be provided.
- o. SARS issued tax clearance certificate.
- p. All relevant documentation and/or evidence of compliance must be attached to the PERMIT TO WORK.
- q. Upon successful completion and approval of the PERMIT TO WORK the security department will issue the appointed Bidders' employees with access ID cards valid for 12 months.
- r. Any other documents, certificates or records as requested by a Foskor official deemed necessary to ensure that all safety, legislative and administrative requirements have been met must be attached to the PERMIT TO WORK.
- s. The appointed Bidder must allow at least three to ten working days to complete all the PERMIT TO WORK requirements.

## SAFETY

The Bidder is to refer to the full and updated Foskor COPs available.

- a. The Bidder and subcontractors need to comply with the Mine Health and Safety Act at all times. All Foskor COP's Policies and procedures need to be adhered to.
- b. A Bidder 2.9.2 to be permanently on site.
- c. Medical, Induction, Foskor ID Card, etc. is approximately R800 per person. Exit medicals need to be done at the termination of the contract.
- d. The Successful tenderer will be required to compile a Foskor Work permit and at least 3 weeks should be allocated for this. The Bidder must provide the following appointed persons in terms of the MHSA: 2.6.1; 2.9.2 and Section 29(1) – SHE REP for the duration of the contract.
- e. All vehicles and cranes and other TMM's to be inspected before entering Foskor Premises.
- f. All employees'/contractors' competencies are to be verified before being allowed to work on Foskor premises for a specific task.
- g. The Bidder must compile a Safety File as per Foskor standard for all contractors and sub-contractors.
- h. The Bidder shall provide the safety fill for all contractors that shall be appointed by him/her under this contract and that safety file shall be approved by Foskor Health and Safety official.
- i. Site access will need to be controlled and all persons must receive site-specific induction before entering the site.
- j. Conduct inspections as per the Foskor Safety System. Analyse data and trends and recommend preventative measures where required.

- k. Ensure all authorizations are in place as per the Foskop Safety System. Arrangement with Foskop training to be done by the Bidder to ensure that authorization and training are conducted. Arrange timeously.
- l. Ensure all worker's competencies are available and have been validated.
- m. Ensure proper security, sign boards, fencing and barricading are in place on-site where applicable.
- n. The Bidder shall in general comply with the FOSKOR General Engineering Specifications, COPs, latest revisions and all relevant regulations.
- o. The Bidder must complete a Baseline risk assessment (COP 26) before a work permit can be issued for the installation.
- p. All Bidders not in possession of a valid Foskop ID card have to complete the Foskop induction course and have to undergo a medical examination at the Foskop clinic for the Bidder's account.
- q. The Bidder shall be responsible for coordinating and integrating his schedule and responsibilities with another FOSKOR-appointed contract manager on site for this Scope of Work.
- r. All personnel operating mobile equipment including LDV must have a Foskop driver's permit.
- s. All the required PPE and Safety Equipment are for the Bidder's account.
- t. All Bidders must ensure that:
  - i. His workers are issued with the correct personal protective equipment free of charge.
  - ii. That the workers wear the PPE in accordance with the project area's requirements or as given by the Supervisor.
  - iii. Training is provided in the correct use of PPE to workers.
  - iv. Daily inspections are done on PPE.
  - v. The registers will be completed at least monthly on findings on PPE. (All PPE must be kept in good condition)
- u. All providers of services need to be informed of the following minimum training applicable to all contractors (irrespective of the tasks or scope of work) that will enter the Foskop Phalaborwa site with effect from 1 April 2014. This training is not presented by the Foskop Training section and Bidders must ensure that the training is sourced through accredited external training companies:
  - i. Basic health and safety principles
  - ii. HIRA
  - iii. First Aid Training
- v. All other training requirements must be aligned with the baseline risk assessment. Risks identified in the baseline risk assessment will guide the requirements for training. A summary of the training must be completed as well as the status on required authorization as per Foskop COP's. Except for the minimum training requirement, all other training will be provided by the Foskop Training Department and should be booked in advance.
 

**Note 1:** See Attached extracts from Foskop COP's.

**Note 2:** You need a Foskop Driving license and your vehicle needs to be inspected for Roadworthiness before being allowed inside the mine. You need an open pit license to drive in the Mine's open pit area.

**Note 3:** Bidder can obtain an updated CD/Disk with all Foskop COPs from Bridget Cole at Projects.
- w. All the required PPE and Safety Equipment is for the Bidder's account.

## SAFETY FILE

The appointed Bidder must compile a SAFETY FILE specifically for this contract. The SAFETY FILE must at all times be available for inspection by a Foskop official: The following guidelines are provided to assist the appointed Bidder in compiling a SAFETY FILE:



- a. Title and index cover page (Required safety file index is available from Foskor Safety Department)
- b. A copy of the PERMIT TO WORK.
- c. A copy of the MHSA Regulation 2.6.1 and -2.9.2 and SHE Rep appointment letters.
- d. A copy of Foskor COP 25, Contractor control.
- e. Baseline risk assessment of ALL and ANY POTENTIAL tasks that may be performed on-site under this contract. See Foskor COP 01, Risks and Opportunities Management for details.
- f. Copies of critical task descriptions and standard operating/maintenance procedures.
- g. Copies of the appointed contractor's safety, health, environmental, and Wellness Management including HIV/AIDS and COVID-19 pandemic, smoking and waste management policies.
- h. Training records of all on-site employees.
- i. Employee records of actual time worked (Normal and overtime).
- j. Copy of on-site induction training.
- k. Records of inspections of TMM (Trackless Mobile Machinery) and trailers. See Foskor COP 59, Trackless Mobile Machinery for details.
- l. Records of issues and inspections of PPE (Personal Protective Equipment) and safety equipment. See Foskor COP 65, Personal Protection Equipment for details.
- m. Records of issues and inspections of PEE (Portable Electrical Equipment). See Foskor COP 60, Portable Electrical Equipment for details.
- n. Records of issues and inspections of tools and equipment. See Foskor COP 63, hand tools for details
- o. Records of daily, weekly and monthly 2.6.1, 2.9.2 / SHE Rep safety inspections. See Foskor COP 22, SHE Inspections for details.
- p. Records of daily green areas and safety talks. See Foskor COP 7, Communication for details.
- q. Any other documents, certificates or records as requested by a Foskor official deemed necessary to ensure that all safety, legislative and administrative requirements have been met.

**Note:** The Bidder can obtain an updated Safety file pack with all updated COP from the SHEQ department.

## PPE

Any contractor that does not provide employees with his/her protective equipment, use it incorrectly or use damaged equipment in the opinion of an authorised Foskor official, will be prevented from starting or continuing the work.

All contractors must ensure that:

- a. His workers are issued with the correct personal protective equipment free of charge.
- b. That the workers wear the PPE in accordance with the project area's requirements or as given by the Supervisor.
- c. Training is provided and records of training are kept in the correct use of PPE to workers.
- d. Daily inspections are done on PPE.
- e. The registers will be completed at least monthly on findings on PPE. (All PPE must be kept in good condition)

## Training

Prospective service providers, who intend to tenders/quotes, must be informed that evidence must be provided that employees received the minimum training in Safety, Health and Environmental issues and submit this with their tender or quotation.

All providers of services need to be informed of the following minimum training applicable to all contractors (irrespective of the tasks or scope of work) that will enter the Foskop Phalaborwa site with effect from 1 April 2014. This training is not presented by the Foskop Training section and service providers must ensure that the training is sourced through accredited external training companies:

- Basic health and safety principles
- HIRA
- First Aid Training

All other training requirements must be aligned with the baseline risk assessment as defined in the scope of work. Risks identified in the baseline risk assessment will guide the requirements for training. As an example, if work entails working with overhead cranes, the employee/s needs to be trained in lifting equipment and lifting tackle. The Foskop COP (COP 56), however, also required that the person/s is not only trained but also authorised to perform lifting tasks.

The training matrix (see Annex 2) is a summary of the training completed as well as the status of required authorization as per Foskop COPs, except for the minimum training requirement.

EXTRACT OF LETTER ISSUED TO CONTRACTORS BY FOSKOR

07 April 2014

To all contractors at Foskor

Dear Sir or Madam

Please note that as from 1<sup>st</sup> April 2014, Foskor will no longer prioritise offering of training for contractor's employees due to the current business restructuring exercise in the company. Contractors are expected to ensure that their training should be in place before they are engaged at Foskor. For your convenience, we have attached the contact details of accredited training providers which have been verified by our training department but contractors are not limited to use these only, any SETA accredited training service providers may be used but it remains the responsibility of the contractor to verify the accreditation of the service provider they choose to use.

Training certificate will be accepted if the following is on the certificate:

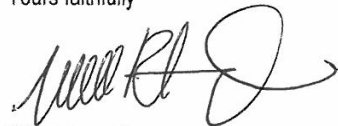
- Unit standard title
- Learner full names
- Learner ID number
- Competency achieved
- Date of assessment
- Assessors signature
- Training provider logo
- Training provider registration number and accreditation number
- SETA logo

Prior to any work permits being issued for work to be carried out on Foskor's premises, evidence of all training must be handed in at our training department and the following will be all the minimum requirements before access is granted to perform any contract work on Foskor:

- Basic health and safety principles (Induction)
- HIRA
- First aid training

It must further be re-emphasized that no access will be granted to contractor's employees before the basic training requirements are fully complied with.

Yours faithfully



R Rammupudu  
Divisional Procurement Manager



Jakkie Dodds  
Senior Manager: SHE

# TRAINING AND COMPETENCY OF TEAM

		Minimum training			Legal Appointees				Job Specific/Risk based training requirements														Environm ent			
		Basic health and safety principles	COP 1: HIRA – Including Authorization	First Aid Training	SHEQ COP Level 1	COP 25: 2.9.2. Legal Exams	COP 25: 2.6.1 and 2.9.2 Legal Exams	COP 25: SHE REP	COP 56: Lifting equipment & lifting tackle	COP 94: Perform Hot work	COP 53: Lock Out	COP 59: Operate TMM (Foskor Licence and Clean Pit	COP 96: Working at Heights	COP 93: Working on a conveyor belt	COP 94: Operate gas-cutting equipment	Basic fire fighting	Artisan (red seal)	COP 96: Mobile Elevating Work Platform	COP 95: Confined Space	COP 86: Noise	Drowning Hazard & Water	COP 62: General electrical equipment	Radiation Awareness	ISO 14001 Awareness	Environmental Awareness	ISO 9001 Awareness
Require authorization			Yes			Yes	Yes	Yes		Yes	Yes				Yes							Yes			Yes	
Requirement based on risk assessment		Yes	Yes	Yes																		Yes			Yes	
Comp nr	Name																									

Legend:

Completed training

√

Trained & Authorized as per COP

A

Outstand  
ing

X

## PARAMETERS

### Design parameters

All plant and equipment will be designed to:

- a. Operate satisfactorily under atmospheric, ambient and other conditions present at the site location.
- b. Ensure interchangeability of units and/or sub-parts throughout the plant to reduce spare holding requirements – take old plant equipment into account.
- c. Ensure reliability and maintainability. A minimum availability of 98% is required.
- d. Operate without undue vibration, stress (temperature and built-in) and excessive noise.
- e. Comply with legal requirements in terms of the water license and DWA

### Layout Parameters of the site

The appointed will have to conduct the feasibility study of the pump station and also familiarize himself with the layout of the area and all associated parameters.

## SPECIFICATIONS, CODES, STANDARDS AND REGULATORS

The latest addition of the South African National Standards and standard building in effect at the date of project design shall establish the minimum requirements for design, materials and construction. This should be referenced with the Foskop General Engineering specifications and requirements of the Foskop SHEQ system (COP's)

No work shall be contemplated which is in breach of any of the following regulations:

- a. Water license (04/B72K/ACGIJ/962)
- b. Occupational Health and Safety Act
- c. South African Mine Health and Safety Acts and Regulations (Act 29 of 1996)
- d. Explosive acts and regulations - South Africa
- e. DWA and the National Water Act.
- f. Foskop COP's
- g. Foskop Engineering Specifications
- h. The latest revisions of the SANS standardized specifications and Foskop Specifications as applicable at the time of quotation shall apply to this contract.

The equipment is to be capable of continuous operation 24 hrs/day, 365 days/year with operating availability equal to or exceeding 100%.

## SITE GEOGRAPHY

The plant is located at Phalaborwa, Limpopo, South Africa

## Ambient conditions

### a. Ambient temperature

Summer	35 Degrees Avg	50 Degrees Max
Winter	17 Degrees Avg	2 Degrees Min


### b. Site Altitude : 380m

### c. Prevailing wind direction: Generally South Easterly - Maximum design velocity 40m/s (144km/h)

### d. Very dusty conditions

### e. Average annual rainfall = 540 mm

FOSKOR GENERAL ENGINEERING SPECIFICATIONS (should be consulted before finalization of any design or specification)

 FOSKOR LIMITED	<b>GENERAL ENGINEERING SPECIFICATIONS INDEX</b>			DOC NO:	Index
				REVISION:	0
				ISO 9001 REF:	7.5.1
				ISO 14001 REF:	4.4.6
				OHSAS18001 REF:	4.4.6
DOCUMENT NUMBER	DOCUMENT TITLE	REVISION NUMBER	DATE REVISED	LOCATION	
GS001	General Design Information	0	01/11/2011		
GS002	Engineering drawings	0	01/11/2011		
GS003	Quality control procedures for general fabrications	0	01/11/2011		
GS004	Site work associated with civil construction works	Future			
GS005	Concrete and formwork	0	01/11/2011		
GS006	Masonry and building work.	Future			
GS007	Plate and workshop fabrications	0	01/11/2011		
GS008	Welding standards and procedures	0	01/11/2011		
GS009	Structural fabrication and erection.	0	01/11/2011		
GS010	General Mechanical Equipment	Future			
GS011	Piping	0	01/11/2011		
GS012	Pressure vessels	0	01/11/2011		
GS013	Painting and Protective coatings	0	01/11/2011		
GS014	Rubberlining	0	01/11/2011		
GS015	Fencing	0	01/11/2011		
GS016	Roofing and side cladding	0	01/11/2011		
GS017	Fuel for use in combustion engines	0	01/11/2011		
GS018	Lubrication	0	01/11/2011		
GS019	Bund walls for liquid containment	0	01/11/2011		
GS020	General Purpose Valves	0	01/11/2011		
GS021	Gearboxes	0	01/11/2011		
GS022	Repair of Chain blocks and Lever hoists	0	01/11/2011		
GS023	Slurry Pumps	Future			
GS024	Overhead Cranes	Future			
GS025	Conveyors	Future			

Contractor /Supplier - Please ensure that you have the latest copy of Specifications before any activity is committed

SPECIFICATION NUMBER	REVISION	TITLE
GV - 1	Latest Revision	General Engineering Specifications Mine Health & Safety Act for contractors
GV - 2	Latest Revision	Conditions for admission to and employment within the Foskor works
GM - 3	Latest Revision	Surface preparation and protection specification
GM - 2	Latest Revision	Engineering Specifications – Mechanical erection
GS - 1	Latest Revision	Engineering Specifications – Structural steelwork, platework, fabrication and installation.
GC-1	Latest Revision	Engineering Specifications – Civil, excavation and concrete work
GC-3	Latest Revision	Engineering Specifications – Packing and grouting
GQ-1	Latest Revision	Engineering Specifications – Quality control
GI-4	Latest Revision	Instrumentation specifications
GA - 2	Latest Revision	Recording of underground services & structures
GS - 2	Latest Revision	Metal roofing & cladding of structures
GM - 1	Latest Revision	Mechanical Equipment
GM - 5	Latest Revision	Pipe standards
GM - 6	Latest Revision	Engineering drawing & document requirements
Foskor Electrical Specifications	Latest Revision	Foskor Electrical Specifications
Applicable FOSKOR COPs	Latest Revision	Applicable FOSKOR COPs

ELECTRICAL SPECIFICATIONS		
SPECIFICATION NUMBER	REVISION	TITLE
EE-1	Latest Revision	Motor Control Centre & Switchgear
EE-2	Latest Revision	Squirrel Cage Induction & Wound Rotor Motors
EE-11	Latest Revision	Power Factor Correction Equipment
GE-1	Latest Revision	Design Criteria for Electrical Installations

GA-1	Latest Revision	Procedures for Enquiries & Tenders
GD-1	Latest Revision	General Requirements for Design, Project Management & Tenders
GD-2	Latest Revision	Engineering Change Order (E.C.O) Procedure
GM-1	Latest Revision	Mechanical Equipment
GM-5	Latest Revision	Pipe Standards
GM-6	Latest Revision	Engineering Drawing & Document Requirements
GM-8	Latest Revision	Surface Protection
GM-3	Latest Revision	Painting & Surface Protection of Steel
GS-1	Latest Revision	Structural Steelwork & Plate work Fabrication & Erection
GQ-1	Latest Revision	Quality Control
GI-1	Latest Revision	<i>General specifications &amp; Procedures</i>
GI-2	Latest Revision	<i>Installation &amp; Commissioning</i>
GI-3	Latest Revision	<i>General Equipment Specification</i>
GI-4	Latest Revision	<i>Field Instrumentation Specification</i>

#### PROJECT MANAGEMENT - CONTRACTOR

- a. Nominate a single window of communication to FOSKOR – Typically the appointed contractor 2.6.1
- b. Attend meetings as agreed during the project kick-off meeting.
- c. Submit Progress reports (Format & interval) as defined in the Kick-off Meeting (Invoicing, Labour, Performance against plan, Contractor purchases, Quality Management, Safety, Etc.
- d. Manage and participate in the “Daily Journal” as part of executing the project.
- e. All meetings will be held at FOSKOR offices unless otherwise stated.
- f. The contractor shall provide updated project management plans on progress as defined by the FOSKOR Project Engineer.

The Service provider is responsible for managing the project and this is graphically displayed below indicating where what functions lie. Graphical presentation only covers some basic aspects.

#### LIAISON AND CO-OPERATION WITH OTHERS

- a. The contractor shall be required to cooperate and liaise with FOSKOR appointed project manager.
- b. The contractor must note that construction is within an operational plant.



- c. The contractor may appoint a Foscov approved subcontractor.
- d. The contractor shall be required to work in conjunction with the Foscov appointed structural-, electrical-, equipment- and instrumentation installation contractor.

**ANNEXURE A – Existing 6.6kV switchgear.**





