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This Specification covers Portnet's requirements for low voltage general electrical equipment to be supplied with machinery and plant for Ports and must be read in conjunction with the main specification governing the mechanical requirements of the equipment.

## **2.0 STANDARDS**

The following standards are referred to in this specification:-

### **2.1 South African Bureau of Standards (SABS)**

SABS 064	Code of practice for the preparation of steel surfaces for coating
SABS 086	Electrical equipment in explosive atmospheres
SABS 0108	Classification of hazardous locations
SABS 0111	Engineering drawings
SABS 0142	Code of practice for the wiring of premises
SABS 152	Air break isolators
SABS 172	Cartridge
SABS 314	Enclosures for electrical apparatus for hazardous locations
SABS 743	Low voltage isolating transformers
SABS 948	3 Phase induction motors
SABS 1092	Contactors
SABS 1274	Coatings applied by the powder coating process
SABS 1507	Cables

### **2.2 British Standards (BS)**

BS 89	Indicating instruments
BS 308	Engineering drawing practise
BS 587	Motor starters and controllers
BS 3939	Graphical symbols for electrical power diagrams
BS 4749	Control switches
BS 5419	Combination fuse switches

### **2.3 International Electrotechnical Commission (IEC)**

IEC 51	Indicating instruments
IEC 117	Recommended graphical symbols
IEC 144	Enclosures

Users of this specification must ensure that they are in possession of the latest issues of the above-mentioned standards.

Where equipment offered complies with the recognised standards of the country of manufacture and not specifically with the standards required by this specification, such equipment will be considered by Portnet. Tenderers shall however state the

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standards to which the equipment is manufactured and supply Portnet (on request) with the relevant specification in English.

## 2.4 Annexures

The following annexures form part of this specification:-

Annexure 1 - Schedule of requirements

Details specific requirements and/or deviations to this specification

Annexure 2 - Technical data sheet

Calls for specific information to be submitted with tenders.

## 2.5 Service conditions

All electrical equipment shall be suitable for service under the following conditions:-

Environmental conditions:-

Altitude	- sea level
Ambient temperature	- minus [-] 5°C to plus [+] 45°C
Relative humidity	- frequently 100%
Air pollution	- industrial fumes, dust laden and heavy saline

## 2.6 Electrical conditions

Voltage	- 220V $\pm$ 5% single phase AC or 380V $\pm$ 5% three phases AC, 4 wire, earthed neutral
Frequency	- 50 Hz $\pm$ 2Hz
Interference	-severe switching surges and noise typical of heavy industrial environment
Wave form distortion	-high percentage harmonic content
Phase imbalance	- up to 2.5% transient

## 2.7 Environmental requirements

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All electrical equipment shall be suitably treated for use in a tropical environment where rapid changes in weather conditions produce severe moisture condensation problems. The equipment shall also be capable of withstanding the high corrosive effects of moist saline and dust-laden atmosphere, which is also contaminated with sulphurous smoke. All electrical equipment used indoors shall be housed in enclosures with minimum degree of protection of IP44 and equipment to be used outdoors at least IP 55 unless otherwise stated in the schedule of requirements.

## **2.8 Hazardous locations**

Where the electrical equipment is required to operate in hazardous locations the details of locations and the type of enclosure protection for use in such location shall be in terms of SABS 0108 or as stated in Annexure 1. The equipment shall be certified by a recognised testing authority. Details of the testing authority and the relevant test certificates shall be submitted.

Equipment in hazardous locations shall be installed in accordance with SABS 086.

Where flame proof equipment is required it shall be in accordance with SABS 314.

## **2.9 Electrical installation**

The tenderer shall guarantee that the rating and size etc. of the electrical equipment offered will be adequate to perform the duties required by the machine.

Installation of the electrical equipment offered shall comply with SABS 0142, Code of practice for the wiring of premises.

## **2.10 Spares and accessories**

Tenders shall submit separate quotations for the following spares and accessories (as applicable):

Servicing aids such as printed circuit board extender and special tools recommended by the manufacturer of the equipment:

Special test instruments essential for testing/calibrating of the equipment which are not normally considered as standard maintenance test equipment in the electronics industry;

Non standard semi-conductor devices and control equipment not freely available in the local market and from more than one source of supply;

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All printed circuit boards and modules.

### **2.11 Training of Portnet's maintenance staff**

Tenderers shall submit proposals and indicate their preparedness to undertake training of Portnet's maintenance staff in the principles of operation, maintenance and fault finding of the equipment. Tenderers may quote separate costs in respect of such training. This applies to complex equipment only.

### **2.12 Drawings**

All electrical drawings must conform to specifications SABS 0111, BS 308, BS 3939 or IEC 117.

Drawings must be supplied in printed A3 versions as well as one set of microfilms.

Drawings shall be prepared on ISO "A" series size sheets and shall not be bigger than A3 in size.

### **2.13 Technical support facilities available from tenderers.**

Tenderes shall state the following: -

The address of their nearest servicing centre to the point of installation/use of the equipment on tender;

To what extent complete electronic and electrical maintenance and repairs to the equipment under consideration can be carried out by their own maintenance staff at the service centres mentioned:

Whether all electronic and electrical spares for the equipment under consideration are kept as local spares holding.

### **2.14 Electronic equipment**

The production standard of all electronic equipment shall be in accordance with the relevant and recognised standards and recommendations for the electronics industry such as contained IEC Publications, British standards Din specifications SBS specifications and other standards recommended by the Electronics Industries Association or other pertinent and widely accepted standards and recommendations.

Anti-condensation heaters shall be fitted when called for by the main specification.

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### 3. AC CONTACTORS

Contactors shall comply with IEC 947-4-1/latest.

Contactors shall be chosen by taking the following factors into account:-

Load to be switched:

Utilization category, e.g. AC1, AC2, AC3, AC4, AC11;

Electrical life (Clause 3.3);

Short circuit immunity;

Starting time;

Mechanical life:- All contactors shall have a mechanical life of at least 10 million operations. (1 operation equals 1 make and 1 break).

The electrical life shall be not less than that laid out below for the following utilization categories:-

Utilisation Category	Electrical Life In Hours
AC 1	8 000
AC 2	6 000
AC 3	8 000
AC 4	2 500
AC 3/4	5 000

The category AC 3/4 is defined as one where the usual operation is in category AC 3 with more than 1% of total operations occurring in AC 4.

For the purpose of determining life in this category the percentage operations in category AC 4 shall be equivalent to the expected value, but shall in any case not be less than 20% of the total.

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The duty class shall be at least class 3. Should the operating class exceed that of class 3, i.e. 300 cycles per hour, the actual value shall be used when computing the expected electrical life.

Block type contactors shall be used for all low voltage motor control applications.

The maximum thermal current rating shall be at least 1.25 times the rated full load current.

Auxiliary contacts shall be contained in a separate unit directly operated from the main armature.

Visual indication by means of a pin or protrusion that the contactor is energized must be provided.

#### **4. SWITCH DISCONNECTERS**

Switch disconnecters shall comply to BS 5419 and/or SABS 152.

The rating of the disconnector shall suit the system fault level and the breaking capacity of the associated moulded case circuit breaker (where used), or fuses, and shall be rated for fault make load break operation.

The mechanical endurance shall not be less than:-

10 000 operating cycles for rated currents between 0 and 63 A;

3 000 operating cycles for rated currents between 63 and 250 A;

1 000 operating cycles for rated currents exceeding 250 A.

The electrical endurance in the appropriate utilization category shall not be less than 20% of the mechanical endurance.

Where the neutral link is external to the disconnector and is removable without first opening the disconnector it shall be labelled in terms of SABS 0142.

The disconnector shall be interlocked with the front cover of the enclosure in a way to prevent opening of the cover if the switch is "ON". The switch must be able to be switched on with the cover open, only by a competent electrician for maintenance purposes.

The disconnector shall be suitable for padlocking in the off position.

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## 5. INDICATING INSTRUMENTS AND PROTECTION RELAYS

All indicating instruments shall be flush-mounted industrial type that comply with the relevant clauses of IEC 51-1, IEC 51-2, IEC 51-7, IEC 51-8 and IEC 51-9 and shall have a minimum accuracy of 3% or better and shall have a scale length of not less than 90 mm.

All scales except for thermal ammeters shall be linear and shall be marked in accordance with BS 3693 with the scale selected for the accuracy class.

All instrument glass shall be glare free.

All current operated instruments and protection relays shall be protected against continuous over current of up to 120% of the nominal value as well as short circuit currents that may be experienced.

Ammeters shall be marked with the ratios of the associated current transformer.

Ammeter full-scale deflection shall be 120% of primary current of the associated current transformer.

Voltmeter scales shall indicate 80%-120% of the nominal system voltage. Where 0-120% indication is needed the nominal voltage shall be approximately 75% of full scale. The nominal voltage shall be marked with a red line.

If required by the system or main specification ammeters shall incorporate a thermal maximum demand indicator with a time lag of 15 minutes. A built in saturation current transformer shall be provided to protect the indicator against the maximum fault currents that may be experienced. A resettable pointer shall be provided to indicate the maximum value reached.

## 6. CONTROL SWITCHES

Control switches shall comply with BS 4749.

"Emergency-stop" push buttons shall be of red colour, shall have one normally closed and one normally open contact and shall be of the mushroom head twist lock type and be lockable in the "off" position.

All push buttons shall have non corrosive appropriately engraved and anodised escutcheon plates fitted.

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## **7. RATING PLATES AND LABELS**

Rating plates complying with the relevant requirements of IEC 298 showing the following information shall be provided:-

Manufacturer's name;

Manufacturer's type number;

Manufacturers serial number

Portnet contract number;

Year of manufacture;

Rated values, etc.

Identification labels is required on or adjacent to all electrical control equipment, switches, relays, instruments, meters, fuses, MCCB's, test blocks, terminal strips etc. The text shall be in black letters on a white background and shall be at least 5mm in height.

These identification labels shall correlate with the corresponding schematic and wiring diagram and the wording shall be in English.

All labels shall be of a corrosion resistant material and shall be securely attached.

Labels shall be placed adjacent to all fuses and circuit breakers to indicate their rating.

All switching devices shall be provided with labels that indicate ON, OFF, EARTH, as required. These labels shall be permanently marked with characters at least 10 mm in height, and shall be visible to the operator in a normal operating position, in a fixed position or located on a moving component of the switch that is visible through an opening and shall be as follows:-

I - white lettering on black background for the ON position;

O - white lettering on a green background for the OFF position:

Earth symbol in black on a yellow background for earth position.

## **8. MOULDED CASE CIRCUIT BREAKERS**

Moulded case circuit breakers shall comply with SABS 156.

## **9. FUSES**

Fuse links shall be of a high rupturing capacity type complying with SABS 172 and/or BS 88. Fifty percent spare fuse links of each size shall be supplied loose at handover of the equipment.

## 10. WIRING AND CABLES

All cables for fixed installations must comply with SABS 1507, except where special cables have otherwise been specified.

Steel wire armoured cables must be used where the possibility of mechanical damage exists.

Armouring of cables will not be used for earthing purposes or any return circuit but shall be bonded to earth. An earth conductor shall be provided in each cable for earthing purposes. If an earth core is not provided a separate, appropriately coloured, insulated earth wire shall be run.

Metallic structures shall not be used for any return or earthing circuit under normal operating conditions but all structures shall be electrically bonded together with welding type cables.

Spare cores and terminals for all control cables shall be provided as follows:

<u>Number of Conductors/Cables</u>	<u>Spare Cores</u>
3 - 6	1
7 - 12	3
Over 12	4

The standard method for numbering small wiring shall be as indicated in NRS 003, Annex A.

### 10.1 Colour coding of cables

Unless otherwise agreed to the colour of all auxiliary and control wiring (except earth wires) shall be grey. The colour of earth wires shall be green/yellow.

All three phase supplies shall be colour coded red, white and blue.

Single-phase supply cables shall be blue for neutral and brown for live.

DC supply cables to motors, fields, magnets etc. shall be orange.

If the correct colour cables are not available cable ends may be marked with "air-shrink" or "heat shrink" type insulation material for

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± 200 mm. Colour coding of cables with insulation or marking tape is not acceptable.

**10.2 Cable Installation on structures and in electrical rooms etc:**

Except where otherwise specified, the entire electrical installation including the wiring, shall where applicable, be in accordance with the "Code of Practice for the Wiring of Premises" (SABS 0142-1978) or the IEEE Wiring Regulations for Electrical Installations.

**11. PROTECTION AGAINST CORROSION**

All enclosures, cabinets etc. shall be manufactured from 2 mm mild steel or 3CR12 sheeting, as called for in the main specification and shall be painted according to Specification HE9/2/8.

All fixing screws, bolts, nuts, washers, clips, terminals, brackets, etc. shall be stainless steel. Bolts and nuts above 12 mm may be hot dipped galvanized steel bolts.

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END OF SPECIFICATION HE8/2/1 [Version 1]

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