SITA Electrical Technical Specification

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Notice

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Approval

The signatories hereof, being duly authorised thereto, by their signatures, hereto authorise the execution of the work detailed herein, or confirm their acceptance of the contents hereof and authorise the implementation/adoption thereof, as the case may be, for and on behalf of the parties represented by them.

Contents

1 General Requirements

1. The works shall be designed to facilitate easy accessibility, equipment replacement, maintenance, handling, inspection cleaning and repairs and to ensure satisfactory operation in which safety of plant, personnel and public and continuity of service is the first consideration.
2. All plant, equipment and apparatus shall operate satisfactory under the ambient and other conditions prevailing at the site.
3. All apparatus shall be designed to prevent the risk of accidental short circuits due to animals, birds, ants, and vermin.
4. All moving, rubbing, or wearing surfaces shall be machined or ground where they bear upon each other.
5. The plant and equipment shall be designed and constructed to keep maintenance costs and the number of persons employed for maintenance to a minimum.
6. All the equipment shall be to the approval of the Engineer and shall, unless otherwise specified, be suitably designed for operation on normal electrical supply systems, with voltage fluctuations of plus and minus 10% and under such sudden variations of load and voltage as may be exposed to under working conditions.
7. All dimensions, units and design parameters shall be in accordance with the international metric (SI) system.

2 Electrical Distribution Boards Requirements

2.1 Quality of Material

All material shall be new and of a design and class suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions arising under working conditions without distortion, deterioration, or the setting up of undue stresses in any part such as to affect the efficiency and reliability of the plant and also without affecting the strength and suitability of the various parts for the duty which they have to perform.

2.2 Standard Specifications

1. All electrical equipment shall be of approved manufacture and its construction, design and testing shall be in accordance with the requirements of the most recent SANS Standards including all amendments issued thereto up to the date of tender. The installation and equipment shall comply in all respects with the requirements of the Occupational Health and Safety Act of the regulatory institution, and the regulations promulgated in terms of the Act, and with the SANS Wiring Regulations. All DB's should be fully type tested in accordance with IEC 61439.
2. The Assembly and all its constituent components and equipment shall comply with the latest published edition of all relevant national standards, as well as IEC 61439-1&2, including the following in Table 1.
3. All boards, panels and cubicles shall be vermin and dust proof and the minimum degree of protection shall be per Table 2
4. The distribution board requirements are as shown on the schematic drawings and bills of materials.
5. Shop drawings shall be submitted to the Engineer for formal approval.
6. It shall further be noted that late approval of drawings and distribution boards due to non-compliance with the specification shall not relieve the Contractor from their obligation to complete the installation according to the programme. No claims for delays or extension of time in this regard, will be entertained.
7. All phase, neutral and earth busbars shall be adequately sized to accept all circuits and connections. Proper type tested busbars (i.e. the busbar should consist of extruded aluminium, flexible insulated busbars, Poly pacts, Poly Blocks, Distribution Blocks). Manufactured copper busbar connections will not be accepted, where type tested equipment is available.
8. Distribution boards shall be provided with arc flash sensors and busbar temperature sensors.

9. The distribution boards shall be OEM certified as IEC 61439 compliant as tested by an independent testing facility. The OEM shall provide a letter stating that the specific boards for this project has been assembled in accordance to their requirements and is IEC 61439 complaint.
10. The outer frame, face plates and internal frames shall be finished with high quality paint. Only baked enamel or electro statically applied powder coating shall be used and accepted. Powder coat quality shall be verified during distribution board inspections. Colour finish required for each distribution board is indicated on the drawings.
11. Internal form of the distribution board separation shall be “FORM 2B”
12. All distribution boards shall be manufactured with a minimum of 30% spare space capacity, unless otherwise specified.
13. All distribution boards shall be inspected and accepted in the factory prior to dispatching.
14. The exact wording of the engraved labelling shall be as per schematic drawings.
15. Clearly engraved labels are to be provided below all equipment. An engraved label is to be provided on the outside of the doors indicating the name of the distribution board and the point of supply (DB and Circuit breaker).
16. A comprehensive, neatly typed legend card, identifying all circuits shall be provided before the distribution board is commissioned.
17. The positions of the distribution boards are indicated on the layout drawings. The DB Manufacturer shall ensure that the distribution boards can fit into the space provided.
18. Each distribution board shall be equipped with the I/O module or similar for the integration of all the instruments, sensors, signal or devices. This I/O module shall be BMS compatible with LAN connection, MODBUS or BACnet communication protocol. The module shall have minimum 30% spare capacity and capable to add expansion modules.

TABLE 1: Distribution Boards Reference Standards

STANDARD NUMBER	DESCRIPTION
SANS 152	Low-voltage air-break switches, air-break disconnectors, air-break switch-disconnectors, and fuse-combination units
SANS 156	Moulded case circuit-breakers
SANS 172	Low Voltage Fuses
SANS 1091	National colour standards for paint
SANS 1973	Low-voltage switchgear and control gear assemblies
SANS 9000	Quality management systems
SANS 10108	The classification of hazardous locations and the selection of apparatus for use in such locations
SANS 10142	Standard Regulations for Wiring of Premises.
SANS 60044	Instrument Transformers
SANS 60204	Safety of machinery. Electrical equipment of machines.
SANS 60269	Low-voltage fuses.
SANS 61439	Low-voltage switchgear and control gear assemblies
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 61558	Isolating transformers and safety isolating transformers.
SANS 60947	Low-voltage switchgear and control gear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61643-1	Low-voltage surge protective devices Part 1: Surge protective devices connected to low-voltage power distribution systems

Table 2: Minimum levels of ingress protection

Location	Description	Minimum rating
Indoor	Clean, dry areas (e.g., inside substations or motor control rooms)	IP44 (doors closed) IP2X (inter-compartment & doors open)
Outdoor	Located outside buildings	IP65 (doors closed) IP2X (inter-compartment & doors open)

2.3 Specific Construction Requirements

1. Distribution Board shall comply with requirement of IEC 61439-1 and SANS 61439-1
2. The DB shall be TTA compliant. The assembly manufacturer has to be successfully tested to IEC 61439-1 Ed. 2. Alternatively, under IEC 61439-1/Ed. 2, paragraph 10.1 as per Design Verification, "where tests on the assembly have been conducted in accordance with the IEC 60439 series, and the test results fulfil the requirements of the relevant part of IEC 61439, the verification of these requirements need not be repeated".
3. DB to be floor standing on steel plinth, no concrete plinth needs to be constructed.
4. Legend cardholder, and space for maintenance and operational manuals to be fixed to the inside of the door.
5. Size of Busbar Trunking: See single line diagrams drawings/ relevant for information
6. Maximum LV board construction size: To be confirmed per DB drawing and on-site available space
7. Size of Busbar Trunking: See single line diagrams drawings/ relevant for information
8. All busbar and breaker ratings indicted shall be achieved at the full load stated after derating of all equipment and at an ambient temperature of 40 deg C.
9. Colour: Refer to data sheets

Table 3: Distribution Boards Cable/Busbar Entry Requirement

Description	Requirement
Busbar Trunking Entry	Top and Bottom
Material type of Busbar Trunking	Aluminium
Cable and conduit entry	Top and Bottom
Main Supply Cable/Busbar entry	Top and Bottom

Table 4: Distribution Boards Colour coding

Description	Requirement
Frame	Grey (code to be confirmed)
Face Plate - Normal Supply	Electric Orange (code to be confirmed)
Face Plate – Emergency Generator Supply	Red (code to be confirmed)
Face Plate - UPS Supply	Blue (code to be confirmed)

2.3.1 Equipment

1. All circuit breakers shall be selected according to the cascading tables of the offered manufacturer. Cognisance shall be taken of the existing product inside DB's, when selecting circuit breakers, ensuring compatibility to cascading tables, where new circuit breakers are to be installed.
2. All circuit breakers shall be monitored by the BMS the status Open/Close/Trip.
3. All Circuit breakers shall be provided with phase dividers (flash barriers), installed between all phases.
4. All circuit breakers above 630A shall be draw out air circuit breakers.
5. All circuit breakers and isolators above 630A shall be MasterPact MTZ or Equivalent/Similar
6. All circuit breakers and isolators below 630A shall be ComPacT NSX or Equivalent/Similar
7. All circuit breakers and isolators shall be equipped with digital control unit with display.
8. All miniature circuit breakers shall be Acti 9 or Equivalent/Similar
9. Busbars to be colour coded with shrink insulation for full length.
10. Minimum earth wire connection between Surge Protection devices and Earth Bar: 25mm² Green Insulated wire, Max length 400mm
11. Switching shall be provided with 2 x NO and 2 x NC Auxiliary contacts.

2.3.2 Metering

1. CT's and Metering should be provided as per single line drawing. This energy meter display shall be mounted in such a way that it can be easily read, and the interface selection panel is easily accessible. All readings shall be captured by a concentrator, which shall communicate this data to the future BMS, via a LAN connection, MODBUS or BACnet.

2. Each outgoing single-phase circuit shall be provided with WiFi enabled split CT's. The electrical consumption of each of the circuit shall be captured by a concentrator, which shall communicate this data to the future BMS, Ethernet connection, MODBUS or BACnet. Each distribution board shall be provided with its own dedicated concentrator. The meters can be A9MEM1570 or Similar/Equivalent
3. For ease of manufacturing and construction, a common display multi circuit metering type system will be preferable.
4. The energy metering shall be able to read:
   (a) Date and time
   (b) kWh
   (c) Ph to Ph Volts (V)
   (d) Ph to N Volts (V)
   (e) All phase currents (A)
   (f) Frequency (Hz)
   (g) kVA
   (h) kW
   (i) Power factor

2.3.3 Labelling

1. Care shall be taken to ensure that all equipment is fully labelled, and accurate descriptions appear in English.
2. Labels shall consist of either:
   - Engraved sandwich board/ laminated engraving board
   - Transparent reverse engraved acrylic material with filled letters and reverse sprayed.
   - Labels shall be rectangular in form with proportions appropriate to the wording, and shall have true, parallel, lightly bevelled edges and shall be neatly and squarely fastened.
   - Engraving shall be of uniform height, character, and line width. The type of material or process shall be such as to finish with black letters against a white background, except in the case of cautionary labels where the letters shall appear white on a red background. The labels for outdoor applications (where specified), shall be brass or aluminium (with letters filled in black), lightly sanded with fine grit paper, and finished off with clear lacquered. All lettering shall be in upper-case letters except where standard abbreviations of units are used, e.g., kWh, kVA, etc. The material used shall be selected having regard to the size and fixing methods of the label and the label shall not warp in service.

3. Straight sections of busbars should be labelled at every 5.0m.
4. Busbars shall be labelled at each change of direction.
5. Each busbar termination shall be labelled.
6. Labels shall be fixed by the use of either:
    - Self-tapping screws
    - Metal-thread screws and nuts.
    - These shall be nickel plated in either case and adequate clearance shall be allowed around lettering to accommodate these. Adhesive fixing alone will not be accepted. Extruded aluminium section is preferred, provided the label is firmly fixed.
    - All terminal strips shall be labelled in conformity with the associated circuit and connecting diagrams.
    - Labels shall contain the following minimum information:
7. Lettering:
    - The equipment name in English. Main switchboards shall have a main designation label prominently displayed on the outside of the switchboard. The lettering shall be 10mm high. Distribution boards shall be identified by means of a label fixed to the architrave frame or doors. Flush equipment within doors or front panels shall be identified with labels fixed to the doors or front panels. The labels for equipment installed behind panels shall be fixed to the chassis close to the equipment. Where the positioning of equipment is such that descriptive labels cannot be accommodated or where the equipment is identified by means of labels containing circuit numbers, the abbreviations and/or circuit numbers shall be identified on a legend card. Where blanked off slots are provided for future equipment, these spaces shall be labelled in accordance with the circuit numbers and/or the code used for existing circuits on the switchboard and shall not bear the inscription "SPARE". The codes for spare circuits shall be identified as "SPARE" on the legend card. The legend cardholder shall be of A4 size acrylic plastic panels and shall be installed on the inside of the switchboard door or in any other prominent position. All information contained on the legend card shall be typed in black. Hand-written descriptions shall not be accepted. All labels identifying equipment shall have 5mm high lettering.

2.3.4 Shop Drawings

1. Copies of the following drawings shall be submitted for approval:
   (a) Dimensions outline drawings of the distribution boards
   (b) Typical layout of the equipment in the distribution boards (rating of equipment to be indicated)
   (c) Busbar Configuration in Board

2.3.5 Delivery and Installation

The DB manufacturer needs to test the DBs after manufacturing. The DB manufacturer will also be responsible for the packing and crating of all DB's. The electrical contractor will be responsible for the delivery of the DB's from the DB manufacturer to site.

2.3.6 Inspection

The successful tenderer shall allow the representative of the Engineer access to the manufacturer's works at all reasonable times to inspect the progress of the work and to witness all tests. The manufacturer shall notify the Engineer timeously when assemblies are ready for inspection and shall arrange a suitable time for the inspection.

3 Busbar Trunking Requirements

3.1.1 Quality of Material

1. All material shall be new and of a design and class suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions arising under working conditions without distortion, deterioration, or the setting up of undue stresses in any part such as to affect the efficiency and reliability of the plant and also without affecting the strength and suitability of the various parts for the duty which they have to perform.
2. The busbar trunking system shall be capable of being mounted in any position without de-rating. Plug-in and feeder sections shall be interchangeable without the use of special adapter joint covers. The complete installation shall be coordinated throughout and where possible, shall consist of standard 5m, sections with special sections and fittings provided to suit the installation.
3. Horizontal runs of busbar trunking system shall be supported by hangers at every 3 meters. Vertical runs of busbar trunking system shall be supported by hangers not more than 4m apart.
4. Busbar trunking system shall be terminated by 'end closure'.

3.2 Standards and Specification

1. The busbar trunking system shall be of low impedance and air insulated typed technology. It shall be totally enclosed galvanised steel sheet with aluminium conductors; suitable for a 3 phase 4 wire 415 volts system @65kA, with full neutral and continuous internal earth conductor of half size similar to the presently installed product range.
2. All electrical equipment shall be of approved manufacture and its construction, design and testing shall be in accordance with the requirements of the most recent SANS Standards including all amendments issued thereto up to the date of tender. The installation and equipment shall comply in all respects with the requirements of the Occupational Health and Safety Act of the regulatory institution, and the regulations promulgated in terms of the Act, and with the SANS Wiring Regulations.
3. The power busbar trunking system shall be complete with all necessary fittings, tap-off unit brackets, etc. and tap-off point on both sides of the busbar trunking system. All busbar trunking fittings (elbow, tees, end Cable Tap Box, etc.) shall be IP55 in accordance with IEC 60529 and from the same manufacturer as the busbar trunking system.
4. All the stages of design, manufacturing and tests of the lighting busbar trunking system including its accessories shall be in compliance with all the requirements of IEC 61439-2 standard, and related certificates, issued by a third party such as ASEFA shall be available

3.3 Conformity to Standard

1. It shall be constructed in accordance with the applicable requirements of the latest IEC 61439 Part 1 and Part 2.
2. Verification of fire barrier in accordance of the latest ISO 60834
3. Resistance to flame propagation conforming IEC 60332 Part 3.
4. Resistance of the materials to abnormal heat conforming IEC 60695 Part 2.

3.4 Environment

1. The busbar trunking system shall be suitable for continuous operation without de-rating at an average ambient temperature of 35º C for 24h (40°C maximum peak)

3.5 Conductors

1. Conductors shall be of hard drawn 99% purity Aluminium. Live conductors shall be air insulated and supported on fibreglass reinforced polyester isolators, at 250mm intervals.
2. Conductors shall be fitted with bimetal silver-plated copper/aluminium laminate riders, electrically welded to junctions, and tap off positions.
3. Full size neutral of the same cross-sectional area as the phase conductor shall be provided for all ratings of the busbar trunking system.
4. The busbar trunking system shall have the following characteristics:

Table 5: Busbar Characteristics

Description	Requirement
Rated Insulation Voltage (A/C)	660V
Rated Operating Voltage (A/C)	660V
Frequency	50Hz
Rupturing capacity	65kA

3.6 Protective Conductor

1. Integral continuous internal Aluminium conductor of cross-section area equal to 50% that of the corresponding phase conductor shall be provided.

3.7 Short Circuit Capacity

1. The whole busbar trunking system shall be capable of withstanding the short circuit capacity of the electrical installation without damaging the electrical, mechanical, and thermal stress under fault condition at a service voltage of 415V 50Hz.
2. Co-ordination of the distribution should be guaranteed such that the Circuit breaker / trunking combination will limit the peak current to a value less than the rated peak current of the busbar trunking. The successful bidder shall be responsible to co-ordinate with the DB manufacturer to ensure that the above is accomplished.

3.8 Temperature Rise

1. The maximum hot-spot temperature rise at any point of the busbar enclosure at continuous rated load shall not exceed 40˚C above the maximum ambient temperature of 50˚C in any position, as required by IEC 61439.

3.9 Joints

1. All busbar joints shall be of silver-plated copper.
2. Electrical connection shall be via a joint with spring and silver graphite contacts. This joint shall absorb the differential conductor/casing expansion of each length equally.
3. For ratings from 100A to 400A, the joint shall automatically and simultaneously connect all the live conductors.
4. For ratings from 500A to 1000A, electrical connection shall be made by a ¼ screw turn for each conductor.
5. The joints shall be so designed as to allow removal of any length without disturbing adjacent lengths.

3.10 Enclosure

1. The metal enclosure of the busbar trunking system shall be of hot dip galvanised steel painted white to provide high protection and mechanical resistance for the phase conductors along the entire length.
2. In order to limit magnetic field around the busbar system, aluminium enclosures are not acceptable.

3.11 Specific Construction Requirements

1. The busbar requirements are as shown on the layout drawings and bills of materials.
2. Shop drawings shall be submitted to the Engineer for formal approval.
3. All phase, neutral and earth bus bars shall be adequately sized to accept all circuits and connections.
4. The outer covers shall be finished with high quality paint. Only baked enamel or electro statically applied powder coating shall be used and accepted. Powder coat quality shall be verified during busbar inspections.
5. The Busbar Supplier shall ensure that all earth continuity conductors and earth bars in the busbar, as well as the housing of the busbar, are all connected to the main earth system via the earthing of each DB where is connected to.
6. All busbars and Tap-off boxes must be inspected and accepted in the factory prior to dispatching.
7. The engraved labelling shall identify each busbar, from where it exits the DB that it is fed from. The Label will show the name of the busbar as well as the circuit breaker that it is being fed from.
8. For ease of intergrating new busbars with existing busbars, it would be of advantage to consider a compatible product as presently installed.
9. The power busbars will generally be suspended from the slab soffit above. Sufficient hanger supports shall be installed according to the manufacturers specification, of the product offered in the tender.
10. The preferred material of the busbar conductors will be aluminium

Table 6: Busbar Trunking Colour coding

Description	Requirement
Normal Supply	Electric Orange (code to be confirmed)
Emergency Generator Supply	Red (code to be confirmed)
UPS Supply	Blue (code to be confirmed)

3.12 Labelling

1. Care shall be taken to ensure that all equipment is fully labelled, and accurate descriptions appear in one or both of the official languages.

2. Labels shall consist of either:

   (a) Engraved sandwich board/ laminated engraving board
   (b) Transparent reverse engraved acrylic material with filled letters and reverse sprayed.
   (c) Labels shall be rectangular in form with proportions appropriate to the wording, and shall have true, parallel, lightly bevelled edges and shall be neatly and squarely fixed.
   (d) Engraving shall be of uniform height, character, and line width.
   (e) The type of material or process shall be such as to finish with black letters against a white background, except in the case of cautionary labels where the letters shall appear white on a red background.
   (f) For outdoor applications (where specified) labels shall be brass or aluminium (with letters filled in black), lightly sanded with fine grit paper and clear lacquered.
   (g) All lettering shall be in upper-case letters except where standard abbreviations of units are used, e.g., kWh, kVA, etc.
   (h) The material used shall be selected having regard to the size and fixing methods of the label and the label shall not warp in service.

3. Labels shall be fixed by the use of either:

   (a) Self-tapping screws
   (b) Metal-thread screws and nuts.
   (c) These shall be nickel plated in either case and adequate clearance shall be allowed around lettering to accommodate these. Adhesive fixing alone will not be accepted. Extruded aluminium section is preferred, provided the label is firmly held.

4. All terminal strips shall be labelled in conformity with the associated circuit and connecting diagrams.
5. Labels shall contain the following minimum information:

   (a) The equipment name in English.
   (b) The equipment plant reference number (tag no).

6. All labels identifying equipment shall have 12mm high lettering.
7. The Rating of busbars

   (a) The rating and configuration of the busbars should be clearly identified with a printed label. The labels should be provided on every length of the busbar run.

3.13 Shop Drawings

1. Copies of the following drawings shall be submitted (electronically) for review:

   (a) Layout drawings with dimensions of the busbar installation
   (b) Isometric single line diagram of the Busbars

3.14 Delivery and Installation

The Busbar systems shall be designed and installed in the positions ensuring minimal routing deviations around existing services and generally just below the existing services.