
STANDARD SPECIFICATION

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1. **SCOPE OF WORK**

1.1 **GENERAL**

The sub-contract works to be carried out consists of the engineering, supply, erection, testing, commissioning into service, guarantee and maintenance of the electrical installation as described herein.

The engineering and management, equipment selection, shop drawings, testing, commissioning and preparation of operating and maintenance manuals, and inspections are to be executed in a systematic manner, once programmed, under the Engineer's general supervision and direction. The preparation and submission for approval shall include:

- a) Equipment Selection
- b) Shop Drawings
- c) Testing and Commissioning Documentation
- d) Operating and Maintenance Manuals
- e) Inspection Reports / Checklists.

1.2 **SPECIFICATION AND DRAWINGS**

1.2.1 **Engineer's Drawings and Specification**

The drawings prepared by the Consulting Engineer show general layout of all equipment and distribution systems complete with schematic arrangements. These, together with the specification, give sufficient information to enable the Sub-contractor to estimate the cost and to determine how the system must be installed, tested, inspected, operated, service and maintained.

These drawings are not dimensioned installation drawings, and cannot be used as construction/shop drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

1.3 **INSTALLATION DRAWINGS**

1.3.1 **Structural Drawings**

The Sub-contractor shall supply to the Engineer marked up structural drawings or other drawings showing any changes or additional requirements to be made in structure in order to fit apparatus and materials to be installed by him. However, it will be the Sub-contractor's responsibility to ensure that sufficient installation clearance is provided for positioning the selected equipment into the building space provided.

1.3.2 Shop Drawings

Copies of shop drawings of all parts of the Sub-contract works shall be submitted to the Engineer for approval. These drawings shall indicate all

equipment, distribution systems, access requirements and builders work requirements.

The Sub-contractor may purchase transparencies of the Engineer's drawings for modifications into shop drawings. No portion of the Sub-contractor's works shall be commenced until the shop drawings have been approved by the Engineer.

'As Built' drawings on plastic foil shall be furnished on completion. These shall comprise the shop drawings as specified above, embodying all modifications made during construction. (The works shall not be certified as complete unless these drawings and the specified Operating and Maintenance Manuals have been submitted).

1.4 SUBMISSION

Submission for approval will consist of the following activities executed by the Sub-contractor.

The Sub-contractor shall review, stamp, date and sign to signify his approval all shop drawings and samples required by the Sub-contract documents.

By submitting drawings and samples, the Sub-contractor represents that he has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and co-ordinated each Contractor's drawing and sample with the requirements of Works and of the sub-contract documents.

The Sub-contractor shall make any corrections required by the Architect and shall re-submit the drawings or new samples until approved.

1.5 PROGRAMMING

The Sub-contractor shall submit within two weeks of receipt of the Main Contractor's overall programme, a practicable work programme in reproducible form, based on the Main Contractor's programme.

Regular meetings to monitor progress will be held under the chairmanship of the Main Contractor.

The purpose of such meetings will be to review progress against the programme, to investigate and establish actual or impending causes of delays, to instruct on such remedial action as may from time to time be necessary and generally to ensure that the progress of the work remains on programme at all times.

1.6 **ONE YEAR'S MAINTENANCE**

The Sub-contractor shall furnish free of charge all maintenance on the entire sub-contract works for a period of twelve months after handover. Maintenance shall include systematic examination and adjustment of equipment at least once a month.

The Sub-contractor shall in the course of such maintenance, or on call during the maintenance period, repair or replace defective parts if required, and shall use only genuine standard parts produced by manufacturer of the original part. Renewals or repairs resulting from misuse or fair wear and tear, however, shall not be made at the expense of the Sub-contractor.

Specified spares shall not be used during this period.

The maintenance and guarantee includes the supply and replacement of discharge lamps and ballasts, but excludes incandescent lamps.

1.7 **TESTING AND COMMISSIONING**

Procedures shall include the following:

- a) Checking of all safety features of equipment by simulation and abnormal conditions.
- b) Setting of protective devices to stop operation of equipment at overload or abnormal conditions.
- c) Checking of performance of equipment and systems by simulation through the range of maximum to minimum operating conditions.

After physical completion has been reported and all defects made good, "switch-on" shall take place and the above checkout procedures shall be carried out.

The Sub-contractor shall provide all labour, supervision and equipment required for testing and operating. The Employer may assign operating personnel as observers but such observation time shall not be counted as instruction time.

1.8 **COMPLETION OF SUB-CONTRACT WORKS**

Completion of works will occur after the following procedure has been certified by the Architect as having been carried out in accordance with the specification: -

- a) Physical completion has been reported to the Architect by the Sub-contractor, and all defects made good.
- b) "Switch-on" has taken place.

- c) Commissioning and testing has taken place as specified and test results have been witnessed (where required), recorded and approved by the Architect.
- d) One set of 'as built' drawings, on plastic foil has been furnished to the Architect. These shall comprise the "Shop Drawings" as specified in Clause 1.03 above, embodying all equipment. Should the contractor fail to provide these within 1 week of practical completion the Engineer reserves the right to deduct the allowance from the final account.
- e) The number of copies specified below of indexed loose leaf manuals containing complete Operating and Maintenance Instructions have been furnished to the Architect.

2. **DEFINITIONS AND ABBREVIATIONS**

Definitions of terms used in these documents shall mean:

'Approved'	As approved by the Architect.
'Commissioning'	Work necessary to place the installation and work covered by this specification into normal operating condition.
'Install'	To erect, mount and connect complete with all related accessories
'Provide'	To supply, install and connect up complete and ready for safe regular operation the particular work referred to.
'Wiring'	Conduit, fittings, wire, junction and outlet boxes, switches, cutouts and socket outlets and all related items.
'Work'	All labour, materials, equipment, apparatus, controls, accessories and other items required for proper complete installation.

Abbreviations used in these documents shall mean:

'BS'	British Standards Specification.
'BS CP'	British Standards Code of Practice.
'SABS'	South African Bureau of Standards.

Further definitions and abbreviations shall be as set out in Section I of the Standard Regulations for Wiring of Premises.

3. **COMPLIANCE WITH REGULATIONS AND STANDARDS**

It shall be the responsibility of the Sub-contractor to ensure that all equipment and methods used in the installation, comply with all relevant statutory regulations, in particular the latest amendments of the following:

- a) The SABS Code of Practice for the Wiring of Premises (SABS 0142 – Latest Edition)
- b) The Occupational Health and Safety Act (OHS Act).
- c) Government, Provincial and Local Authorities Ordinances, Regulations, By-Laws, Rules and other legal instructions.
- d) Specifications and Codes of practice issued by the South African Bureau of Standards and British Standards Institute.
- e) The Sub-contractor shall immediately refer any anomalies to the Engineer for a decision.

4. **STORAGE OF MATERIALS**

Materials shall be stored in areas allocated by the main contractor. Stored material shall be safely stacked and shall not overload floor construction beyond design limits.

5. **ACCESSIBILITY**

Equipment shall be installed so as to be readily accessible for operation, maintenance and repair. Minor deviations from drawings may be made to accomplish this, but changes of magnitude or which involves extra cost shall not be made without approval of the Architect.

6. **SUPPORTS**

The Sub-contractor shall supply and erect all brackets required for fixing cables or conduits or for supporting items of equipment. All brackets and support steelwork shall be protected against corrosion before the erection of any other equipment onto them.

The welding of brackets or supports to structural steelwork is not permitted unless specific approval has been given.

7. **IDENTIFICATION**

7.1 **CABLES**

All cables shall be identified for reference numbers, which shall correspond to the number shown on the 'as built' drawings.

All cable cores, excepting special cables for sound or telephone services shall be coloured, or bear coloured sleeves to identify them. The cores of cables connected to equipment having marked terminals shall be fitted with interlocking ferrules bearing markings corresponding to those on the terminals.

7.2 EQUIPMENT

Labels shall be engraved laminated plastic having black characters on a white background.

Labels may be either individually secured by means of bolts and nuts or may be held in a purpose made holder. Labels glued in position are not acceptable.

The following components shall be labelled:

- a) Switches controlling outgoing feeders shall be labelled to indicate the destination of that feeder.
- b) Control switches, relays and indicating lights shall be labelled as to their function.
- c) Fuses shall be labelled as to function and rating.
- d) Where electrical and/or mechanical interlocks are employed, labels shall fully describe the operating procedure.

7.3 SMALL WIRING

Small wiring shall be labelled in power skirting and in ducting. Labels shall be affixed securely to wiring and labels shall be affixed to each wire at intervals not exceeding 2 metres. Labels shall state circuit number and distribution board number.

8. PLANTROOM INSTRUCTIONS

- 8.1 A copy of the main single line diagram shall be located in each switchgear bay, transformer bay and diesel generator bay where applicable.

The diagram shall show the electrical distribution system from incoming supply to final sub-distribution boards and shall include:

- a) Detailed legend.
- b) Type, rating and setting of switchgear.
- c) Geographic location and designation of distribution and sub-distribution boards.
- d) Rating, ratio and percentage impedance of transformers.

- e) Fault level at each busbar.
- f) Type and size of feeders.
- g) Instrumentation and instrument transformer location and ratio.
- h) Point of measurement and application.
- i) Emergency supply feeders and changeover contracts.

8.2 Supplementary instructions shall be given where appropriate. These shall include but shall not be limited to:

- a) Switching procedures.
- b) Earthing procedures for high voltage equipment.
- c) Start-up procedure for diesel generator.
- d) Details of battery standby system.
- e) Electric shock treatment card.

9. **OPERATING AND MAINTENANCE MANUALS**

The Sub-contractor shall supply three (3) comprehensively indexed Operating and Maintenance Manuals, bound in loose-leaf plastic covers.

The manuals shall be arranged in two parts:

- Part I - Systems Operation
- Part II - Equipment.

10. **TEMPORARY USE OF EQUIPMENT**

No equipment, which is part of the permanent installation, shall be operated or used, during the course of the construction without the written permission of the Engineer.

11. **HT, LT AND TRANSFORMER ROOMS**

All equipment is to be supplied in accordance with the detailed specification in Part V.

Earthing of the rooms shall be in accordance with the wiring regulations.

The sub-contractor in accordance with the regulations shall supply all required signage, warning notices and fire extinguishers.

HT and LT reticulation diagrams of the system shall be framed and hung in the

HT and LT rooms respectively.

The contractor shall be responsible for liaison with the supply authorities to ensure their requirements are met and to ensure their work is programmed into the overall programme.

12. **MAIN EARTH AND LIGHTNING PROTECTION**

All earthing and lightning protection shall be in accordance with the SABS Code of Practice for Wiring of Premises and in accordance with Government, Provincial and Local Authorities Regulations and By-laws.

The Sub-contractor shall where required follow the procedures as detailed in Part V of this specification.

13. **DISTRIBUTION AND FUSEGEAR**

13.1 **GENERAL**

All equipment shall be supplied as detailed in Section V and the location of all items is shown on the drawings. All floor-mounted equipment shall be adequately fixed to prevent movement. Unless otherwise specified, all wall-mounted equipment shall be mounted at a height of 2,15m above finished wall level to the top.

13.2 **BUSBAR TRUNKING**

Busbar trunking shall be securely fixed in the positions shown on the drawings. At each floor level a fire-resisting barrier shall be fitted both within the trunking and between the trunking and the duct walls in the thickness of the slab.

14. **CABLES**

14.1 **GENERAL**

Cables shall comply with the following standard specifications as appropriate:

SABS 97
SABS 150
BS 6207

All runs of cable shall be direct without straight-through joints. Any cable lengths shown are for guidance only and no allowances have been made for cutting, draw lengths, etc. Under no circumstances should these figures be used for ordering purposes.

14.2 **INSTALLATION IN BUILDINGS**

14.2.1 **Cable Supports**

All cables shall be adequately supported throughout their length as required by the Wiring Regulations or where not so specified as recommended by the cable manufacturers.

Particular attention is to be paid to the support at joint positions to prevent strain on the joint.

14.2.2 **Cables in Ducts**

The total cross sectional area of all cables installed in a duct shall not exceed 50% of the internal cross sectional area of the duct. After installation of the cables, duct stopper shall be fitted to each end of each duct run and at the entry to the building to effectively seal the duct from ingress of vermin etc.

14.2.3 **Cables Externally**

Unless otherwise specified this sub-contract excludes responsibility for all work associated with the excavation and subsequent backfilling of trenches and for the supply of all materials and plant.

14.2.4 **Protection of Cables**

All cables shall be protected by a continuous running cable lint of such a width as will extend for at least 50mm each side of the cable. For single cable runs the width of the cable lint shall be at least 10mm greater than the cable diameter and for multiple cable runs at least 100mm greater than the aggregate of the cable diameters.

15. **CONDUIT AND FITTINGS**

15.1 **GENERAL**

Conduit shall be screwed and welded seamless to SABS 162, but threadless and PVC conduit systems will be considered for approval provided the system to be used has the approval of the SABS and is acceptable to the Supply Authority. The whole system shall be the product of one manufacturer.

All conduit fittings shall be galvanised except where cast within concrete or concealed behind false ceilings where black enamel finish shall be used. All screws used in conduit work exposed to the weather shall be brass.

15.2 **INSTALLATION**

Where accessories are fixed directly to tapped holes in conduit boxes, the boxes shall be fixed independently of the conduit system.

Conduits fixed in voids over suspended ceilings shall be rigidly supported from

the structural ceiling.

Conduit shall not be installed within 150mm of hot or chilled water pipes and shall be run below the former.

16. **TRUNKING**

16.1 **GENERAL**

Cable trunking shall consist of butting sections constructed from high-grade sheet steel of minimum thickness of 1,6mm. It shall be electrically continuous and earthed at the distribution board. Covers shall be removable over the whole length of the trunking and shall be adequately secured.

Manufacturer's standard accessories are to be used wherever possible and site fabrication will only be accepted in abnormal circumstances.

16.2 **INSTALLATION**

Surfaces shall be prepared to receive trunking to achieve proper alignment. Where trunking is not directly fixed to surfaces it shall be hung from straps or rod-hangers which shall rigidly support it in all directions.

Trunking and fittings shall be free from sharp edges and care shall be taken to ensure that water, concrete and other foreign matter is not allowed to enter.

Wiring in inverted trunking shall be retained by clips at not more than 300mm intervals.

17. **CABLE TRAY AND CABLE LADDERS**

Cable trays and cable ladders shall be earthed and electrically continuous. They shall be of steel and shall be galvanised. Manufacturer's standard accessories shall be used wherever possible. Site fabrication will only be allowed in abnormal circumstances. Cables shall be provided with continuous support.

18. **SMALL WIRING**

18.1 **GENERAL**

All circuit wiring in conduit and trunking shall be PVC insulated single core copper 1000-volt grade and the minimum size of conductor shall be 1,5mm². A separate bare copper wire shall be run in all conduits and trunking to form the earth continuity system.

18.2 **SIZING**

Wiring shall be sized to carry the load of the circuit as shown plus an allowance of 10% for future connections and in accordance with the overall voltage drop requirements of the Wiring Regulations. The same allowance shall be made

when determining the wiring capacity of each conduit run. Minimum wiring sizes shall be 2,5mm² for lighting and 4mm² for power outlets.

18.3 **WIRING COLOURS**

For three phase circuits, wires shall be coloured to correspond with the phase colour and the neutral shall be black. For single phase circuits the live wire shall be red and the neutral wire black.

All wiring for emergency lighting circuits and other specialised services shall be separately coloured so that it is readily identifiable.

19. **GENERAL EARTHING**

The whole installation is to be effectively earthed as required by the Code of practice (SABS 03A-1976). Separate earth conductors are to be provided from the main switchboard earth bar to each distribution board and from thence to each terminal outlet.

Conductors shall be adequately sized and supported to carry the prospective fault currents.

At all untapped entries into distribution equipment, conduit accessories and trunking, effective means of ensuring proper continuity shall be provided.

20. **PENETRATIONS THROUGH WALLS/FIRE WALLS**

Where, cables, cable trays, trucking etc penetrate walls, these penetrations shall be foam filled using a suitable fire rated expansive foam, and cut and sand-papered to the original face of the wall.