

STANDARD SPECIFICATION FOR MEDIUM AND LOW VOLTAGE ELECTRICITY DISTRIBUTION WORKS

PART B-01: MEDIUM VOLTAGE SWITCHGEAR UP TO AND INCLUDING 33KV

PART B-01

TITLE: SWITCHGEAR FOR RATED VOLTAGES UP TO AND INCLUDING 33KV.

SPECIFICATION NO: B-01

INCEPTION DATE: AFTER GAZETTING (WORKING DOCUMENT FOR A 3 YEAR PERIOD)

AMENDMENTS/REVISIONS

DATE	PAGE	PARAGRAPH	DESCRIPTION	ORIGINATOR	APPROVED

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1 SCOPE

1.1 This standard covers the manufacture, supply, delivery, erection on site, testing and commissioning of the following equipment:

- (a) Medium Voltage Regulators up to and including 33kV
- (b) Circuit Breaker Boards for use with medium voltages up to and including 33kV
- (c) Automatic Reclosing Circuit Breakers for medium voltage applications up to and including 33kV
- (d) Manual and Automatic Line Sectionalizers and load break switches for voltages up to and including 33kV
- (e) Pole mounted drop-out fuse switches (cut outs) for rated voltages up to and including 33kV
- (f) Surge arrestors for rated voltages up to and including 33kV

The following standards shall be applicable to this part of the standards document:

GENERAL INFORMATION

The following Standards and Acts shall take precedence:

- National Electricity Act of Namibia
- Occupational Health and Safety Act of Namibia
- Labour Act of Namibia
- Quality of Service Standard
- Quality of Supply Standard
- NamPower Specifications for the Erection of Overhead Power Lines
- NamPower Specifications and General Conditions for Survey and Route Clearing for New Power Lines

The following Standard shall be used as reference:

- NRS 033 : Electricity Distribution – Guidelines for the application design, planning and construction of medium voltage overhead power lines up to and including 33kV, using wooden pole structures and bare conductors.
- NRS 034 : Guidelines for the provision of electrical distribution networks in residential areas.
- NRS 043 : Code of practice for the joint use of structures for power and telecommunication lines
- NRS 059 : Recommendations to minimize problems associated with the theft of transformer neutral and neutral earthing copper conductors
- NRS 060 : Code of practice for clearances for electrical systems with rated voltages up to and including 145kV, for the safety of persons

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NRS 082 : Recommended maintenance policy for electricity networks

SANS 10280 : Overhead power lines for conditions prevailing in South Africa

FUSES AND DROP OUT FUSES

NRS 035 : Outdoor Distribution Cut-Outs (Drop –out fuse assemblies or solid - link assemblies): Pole – Mounted Type

SANS 172 : Low – Voltage Fuses

SANS 60269 : Low Voltage Fuses

SANS 1779 : High-voltage Fuses

SANS 60282 -1 : High voltage Fuses Part 1: Current Limited Fuses

SANS 60282 -2 : High voltage Fuses Part 2: Expulsion Fuses

SURGE ARRESTERS

NRS 039 : Surge arrestors for use in distribution systems

SANS 60099-1 : Surge arresters Part 1: Non-linear resistor type gapped surge arresters for a.c. systems

SANS 60099-4 : Surge arresters Part 4: Metal oxide surge arrestors without gaps for a.c. systems

SANS 60099-5 : Surge arresters Part 5: Selection and application recommendations

SWITCHGEAR

Regional Standards

NRS 003 : A.C. metal enclosed switchgear and control gear for rated voltages above 1kV and up to and including 36kV.

SANS 555 : Unused and reclaimed mineral insulator oils for transformers and switchgear.

SANS 1473-1 : Low voltage switchgear and control gear assemblies Part 1: Type tested and partially type tested assemblies

SANS 1473-2 : Low voltage switchgear and control gear assemblies Part 2: Busbar trunking systems

SANS 1885 : Metal – Clad switchgear for rated a.c voltages above 1kV and up to and including 36kV- General requirements and methods of test.

SANS 60282-1 : High Voltage fuses Part 1: Current limiting fuses

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SANS 60282-2 : High Voltage fuses Part 2: Expulsion fuses

SANS 60298 : A.C. metal enclosed switchgear and control gear for rated voltages 1kV and up to and including 52 kV

SANS 61264 : Ceramic pressurised hollow insulators for high voltage switchgear and control gear.

International Standards

BS 159 : Specification for high voltage busbars and busbars connections.

BS 2631 : Switches

BS 116 : Fuse Switches

BS 2692 : Fuses

BS 7354 : Specification for electric power switchgear and associated apparatus

ANSI/IEEE C37.60 : IEEE standard requirements for overhead, pad mounted, dry vault and submersible automatic circuit reclosers and fault interrupters for ac systems.

IEC 60694 : Common clauses for high voltage switchgear and control gear standards.

IEC 60439 : Low Voltage switchgear and control gear

IEC 60298 : A.C. Metal enclosed switchgear and control gear for rated voltages greater than 1kV up to and including 52kV

IEC 62271 : High voltage switchgear and control gear

A.C. DISCONNECTORS , EARTHING SWITCHES AND ISOLATORS

Regional Standards

NRS 031 : Alternating current disconnectors and earthing switches.

NRS 036 : Auto – Reclosers and Sectionalizers – Pole Mounted Types

NRS 046 : Electricity Distribution – Load break switch disconnectors – pole mounted type for rated A.C. voltages above 1kV and up to and including 36kV

SANS 60129 : Alternating current disconnectors and earthing switches

International Standards

BS 3078 : Isolators

BS EN 60137 : Specification for bushings for alternating voltages above 1000 V

IEC 60129 : Alternating current disconnectors (isolators) and earthing switches.

IEC 61129 : Alternating earthing switches induced current switching

CIRCUIT BREAKERS

Regional Standard

- SANS 767-1 : Earth leakage protection units Part 1: Fixed earth leakage protection circuit breakers
- SANS 767-2 : Earth leakage protection units Part 2: Single phase portable units
- SANS 60934 : Circuit breakers for equipment (CBE)
- SANS 10142-1 : The Wiring of premises Part 1: Low-voltage installations
- SANS 152 : Low voltage air break switches, air break disconnections, air break switch disconnections and fuse combination units.
- SANS 156 : Moulded case circuit breakers
- SANS 60056 : High-voltage alternating current circuit breakers
- SANS 60265-1 : High voltage switches Part 1: Switches rated for voltages 1kV and less than 52kV
- SANS 6227 -100 : High voltage switchgear and control gear Part 100: High Voltage alternating current circuit breakers

International Standard

- IEC 60056 : High voltage alternating current circuit breakers.
- IEC 60376 : Specification and acceptance of new sulphur hexafluoride (SF₆).
- IEC 60898 : Electrical accessories – circuit breakers for over current protection for household and similar installations
- VC 8036 : Industry Standards for Circuit Breakers

PAINT AND FINISHING

- NRS 002 : Graphical Symbols and Labelling for electrical diagrams
- SANS 121 : Hot dip galvanised coatings on fabricated iron and steel articles.
- SANS 10064 : The preparation of steel surfaces for coating

BOLTS, FASTNERS AND GLANDS

- SANS 134 : Metallic materials - Hardness test - Calibration of standardized blocks to be used for Rockwell superficial hardness testing machines (scales 15N, 30N, 45N, 15T, 30T and 45T)
- NRS 028 : Cable lugs and ferrules – for copper and aluminium conductors
- IEC 61238 : Compression and mechanical connectors for power cables with copper and aluminium conductors
- SANS 1213 : Mechanical Cable Glands
- SANS 1282 : High Strength bolts, nuts and washers for friction grip joints.

INSTRUMENTATION AMPLIFIERS (CURRENT & VOLTAGE TRANSFORMERS)

Regional Standards

- NRS 029 : Current Transformers for rated A.C. voltages from 3.6kV up to and including 420kV (Maximum voltage for equipment)
- SANS 60044-1 : Instrumentation transformers Part 1: Current transformers
- SANS 60044-2 : Instrumentation transformers Part 2: Inductive voltage transformers
- SANS 60044-7 : Instrumentation transformers Part 3: Electronic voltage transformers
- SANS 1652 : Battery Charges – Industrial type

International Standards

- IEC 60044 : Instrument Transformers
- BS 7626 : Specification for current transformers.

2 MEDIUM VOLTAGE REGULATORS UP TO AND INCLUDING RATED VOLTAGES OF 33kV

2.1 Scope

This specification covers the manufacture, supply, delivery, erection on site, testing and commissioning of three phase Voltage Regulators for use in medium voltage applications up to and including 33kV.

2.2 Bypass Arrester

A MOV-type arrester in accordance with SANS 60099 will be used to protect the series winding from surges. An operator will be able to verify that the arrester continues to protect the winding.

2.3 Threaded-Stud Bushings

The threaded-stud terminals will provide a high-amp junction to the connectors and the easy connector change-out.

2.4 Pressure Relief

All regulators will be equipped with a pressure relief valve that automatically vents at 28 kPa to avoid pressure build up. It will have an insect shield, and will be link stick operable.

2.5 Position Indicator

The large, downward-angled position indicator will show the present and extreme raise and lower tap positions. Drag hands will be resettable from the control. The adjustable internal micro-switches will allow for reduced range of regulation with resultant increase in demand.

2.6 Dual Nameplates

Two identical nameplates will be supplied on every regulator – one located on the control enclosure and one on the tank. Nameplates shall be in accordance with NRS 002.

2.7 Pole-Mounting Brackets

Lighter weight regulators will have pole-mounting brackets. The style of bracket will vary with regulator weight and shall be subject to the approval of the Engineer.

2.8 Drain Valve

A brass drain valve with sampling devices will be standard on every regulator. This valve and the upper fill plug will aid oil sampling and filtration.

2.9 Liquid Sight Gauge

This sight gauge will provide a simple, visible indication of the level and colour of the insulating liquid.

2.10 Hand Hole

The covered hand hole on all ratings will provide access to terminal connections used for lower voltage operation. It will also allow for limited inspection.

2.11 Sealed Tank

A sealed tank will be used to prevent air from entering the regulator, thus reducing the oxidation rate of the insulating liquid.

2.12 Higher Temperature Rating

The 55/65°C temperature rise rating will provide 12 percent more continuous capacity at 65°C without reduced regulation or loss of insulation life. This capability will result from the use of terminally-upgrade paper and a sealed-tank design. This rating will be shown on the nameplates.

2.13 Lifting Eyes

The entire cover-suspended internal assembly will be lifted via these eyes.

2.14 Upper Filter Press Connection

Insulating liquid will be added and a filter press hose will be connected at this fitting.

2.15 Arrester Mounting Bosses

Line-to-ground arresters will be installed adjacent to all three bushings.

2.16 Lifting Lugs

These lugs will be used to lift the entire unit and to secure it during transit.

2.17 Ground Bosses

Two tank-grounding bosses will be located on each tank.

2.18 Mounting Provisions

Tanks without a rectangular base will have four loops for attachment of the regulator to a shipping pallet, "H" platform or elevating structure.

2.19 Control Enclosure

The fully-gasketed and lockable enclosure will have a screened vent at its base. With a long cable it will be located at the base of the pole for operator convenience.

2.20 Junction Box

The junction box will provide the oil-tight junction of the position indicator flex cable and internal control leads through the cover and the weather-tight junction of the control cable.

2.21 Specific Requirements

Voltage regulators will be supplied where needed as required by design specifications. They will be rated as required at nominal voltages and approved by the Engineer.

2.22 Erection and testing on site

The contractor will be required to erect, line up, provide first filling of oil, test and commissioning of the voltage regulator on site. Erection will also include the positioning of the control unit, provide, install and connect all integral wiring to the voltage regulators, between terminations and all wiring required to provide a complete operational installation. The contractor will be responsible for providing temporary power with voltages as required for the effective testing and commissioning and operation of the control relays by means of temporary cables or standby power.

After installation the following tests and additional tests will be performed to prove full operation of the plant. All test equipment will be provided by the contractor.

2.23 Tests to be carried out on site

- (a) Such other test as are required by the Engineer to prove compliance with the Specification independently of any test which may already have been carried out at the Manufacturer's Works, or elsewhere.
- (b) Soil resistivity test. (Where required)
- (c) Insulation resistance test
- (d) Continuity test
- (e) Polarity test
- (f) Voltage test
- (g) Relay test
- (h) Protection test
- (i) Current metering functioning
- (j) Voltage and current injection testing

2.24 Labelling

The voltage regulator label will comprise of the traffolyte type or any other type approved by the Supply Authority in accordance with the Engineer, at least 200mm wide and 200mm high, the largest possible characters will be used. The label will state the name of the voltage regulator. The label will be fixed to the gate of the enclosure.

3 METAL CLAD SWITCHGEAR FOR MEDIUM VOLTAGES UP TO AND INCLUDING 33KV

3.1 Scope

This standard covers the manufacture, supply, delivery, erection on site, testing and commissioning of metal clad switchgear, circuit breaker boards and associated equipment for rated medium voltages up to and including 33kV. Metal clad switchgear shall conform to the relevant applicable standards listed in section 1.

3.2 General design

The switchgear shall be designed for indoor operation and shall be installed in a switch room provided by others.

The circuit breaker board shall be made up of circuit breaker panels and associated equipment panels bolted together to provide a floor standing, totally enclosed with sheet steel. An Extensible switchboard suitable for the erection over or adjacent to a cable trench for easy cable entry to the individual panels shall be provided.

Coastal areas or corrosive environments may require corrosive resistant panel materials measures.

The circuit breaker panel and other equipment panels shall be of standard dimensions so that all panels are interchangeable. Panels shall be of strong rigid steel construction suitably formed and reinforced to prevent distortion but shall be modern, clean, clear and over-look able for operator's convenience. Circuit breakers shall be fully retractable from the panels, interchangeable and be in accordance with SANS 60056.

Each panel shall be made up of three sections or chambers and the cable end box:

- (a) Busbar chamber (in accordance with SANS 1195 and BS 159)
- (b) Circuit breaker or equipment chamber (SANS 60056 and SANS 156)
- (c) Metering and protection chamber

The busbar shall be a single set of 3 phase busbars housed in the busbar chamber and shall consist of unit lengths of copper bars bolted together to facilitate future extensions. All bars shall be separately insulated and suitably supported to take short circuit stresses and the mechanical forces on the T-off contacts caused by racking-in the circuit breaker.

Retractable circuit breakers and equipment shall be connected to isolating contacts suitably sized and rated. These contacts shall be mounted behind shutter barriers automatically operated when equipment retracted. A danger signs well as the wording "busbars" or "cable" respectively shall be clearly marked on the shutters.

The retractable circuit breaker or set of VTs or associated equipment shall be housed in the circuit breaker and equipment chamber together with the CT's, leads and necessary equipment specified.

The metering and protection compartment shall be accessible from the front of the board by means of a hinged door. Indication instruments shall be fitted on the fascia of the compartments but protection relays and integrating meters may be fitted inside the compartment. All secondary wiring shall be neatly bundled and each conductor from the compartment shall be terminated on terminal blocks which shall be provided in an easily accessible position inside the compartment. In all panels provision shall be made for the following wiring to be terminated at terminal blocks.

- (a) CT wiring shall be terminated at two adjacent bridged terminals to provide for test facilities and future additional relays or instruments.
- (b) Bus wiring to each panel:
 - (i) Circuit breaker operating supply from the battery suitably fused inside the compartment for each panel.
 - (ii) VT wiring, although not always required shall be brought into each panel and terminated on terminal blocks.
- (c) Circuit breaker auxiliary contacts 2 N/O and 2 N/C contact shall be wired and terminated on terminal blocks to provide for remote indication.
- (d) Where differential protection relays are specified terminal blocks shall be provided for connecting the pilot cable.

Easily accessible gland plates shall be provided suitable to terminate the necessary control, pilot and auxiliary cabling.

Each circuit breaker panel shall be provided with a cable end box and compression gland suitable for terminating cable with sizes up to 3 core 240mm², XLPE or PILC cables.

An external tinned copper earth bar shall be mounted on the rear of each panel and to which all bonding and earthing leads are connected. When the board is assembled the earth bars shall be connected to provide a continuous earth bar 25mm x 4mm, over the whole length of the board.

All access openings to live parts shall be covered when erection of the board is completed. The covers shall be securely bolted into position and be individually marked with a danger sign.

3.3 Circuit breakers

Each circuit breaker panel shall be equipped with a fully retractable circuit breaker, in accordance with SANS 60056, SANS 6227 and IEC 60056, fitted into a track with wheels to be moved into the panel provided with suitable guides to ensure the correct opening of the shutter barriers and the engagement of the isolating contacts.

The circuit breakers shall be of the totally enclosed, vertical or horizontal plug in, horizontal draw-out, triple pole, oil immersed, low oil content, vacuum or SF6 type and shall conform to VDE 0670, BS5311 and IEC 60056 where applicable.

In case of vacuum type switchgear offered precautions must be taken against voltage spikes and the maximum guaranteed arc interruption amperage must be identified.

Provision shall be made for operating the circuit breakers from the front of the board manually by mechanical means and a trip coil shall be provided for automatic tripping via protection relays. Clearly visible indicators and locking facilities shall be provided for the "ON" and "OFF" positions. Means shall be provided for earthing the cable and to ensure that no circuit breaker may be isolated when in the closed position.

3.4 Voltage transformers

Each busbar section shall be equipped with a busbar connected three phase voltage transformer to in accordance to SANS 60044.

The voltage transformer shall be equipped with HRC fuses to protect the primary and secondary windings in accordance with SANS 60282.

For each circuit breaker board a metering board shall be provided with meters and selector switches for phase to phase and phase to earth voltage indication. The meter shall be calibrated reading according to the required readings required.

It is mentioned that the metering and protection compartment of the bus coupler circuit breaker panel may be used for the voltage transformer metering.

3.5 Current transformers

The circuit breaker panels shall be equipped with current transformers in accordance with BS 7626 and SANS 60044 for protection and metering purposes.

For panels with differential protection separate CT's approval by the Engineer shall be gained. CT data and magnetization curves shall be stipulated in accordance with NRS 029 to enable the purchaser in future when the remote end switchgear is installed to order and install a matching set.

3.6 Ammeters

All cable feeder circuit breaker panels shall conform to the required specifications required by the Supply Authority. One ammeter shall be connected to each phase of the CT's metering cores.

For the multi-ratio CT's, the instruments shall be connected to and fitted with scales for the lower ratio. The scales for the other ratios shall be supplied loose to be stored in the metering chamber for future use.

3.7 Instrument test block

An instrument test block shall be provided for testing and injection testing purposes. When the test block is removed, the CT is to be short circuited.

3.8 Overload and earth fault

A three phase directional over-current and directional earth fault relay combined as a draw-out unit in one common case for panel mounting shall be provided in each cable feeder circuit breaker panel. Where two overload relays are provided on a feeder they shall be connected According to the Supply Utilities specifications and pricing conditions.

3.9 Differential protection

Where differential protection is specified the protection shall be of equal standard to a relay with 2 NO contacts and the necessary CTs.

The CT's shall be installed in all feeders with which differential protection is called for. Secondary wiring shall be provided complete and terminated on the specific terminal blocks. Room shall be left in the metering and protection chamber for the relays to be fitted when required. Relays complete and wired shall only be provided for these feeders specifically mentioned in the schedules.

The contractor shall provide the CT data and magnetizing curves for all CTs to enable the purchaser to specify matching CTs when required.

3.10 Battery and battery charger

The circuit breaker board shall be provided with an automatic battery charger complete with maintenance free battery of voltage not below 30V and not higher than 125V in accordance with SANS 1652 and ample capacity according to the philosophy of the Supply Authority and specifications of the substation. All designs shall be approved by the Engineer according to requirements for operation of the switch board.

The battery charger shall comprise a double wound transformer with solid state type rectifier and shall be designed for operation on a 230/110V, 50Hz supply. It shall be designed for continuous operation capable of automatic booster and trickle charging the battery. Charging rates shall be as recommended by the battery manufacturer.

The battery charger shall be equipped with a charge ammeter pilot light and a push button operated voltmeter with the required charge voltage specially marked. Simultaneously the push button shall disconnect the charger from the battery, switch a load resistor onto the battery for testing and status of the battery.

Two sets of outgoing supply fuses shall be provided on the housing in accordance with SANS 172 and SANS 60269. One set of fuses for the supply to the circuit breaker panels and the second a set of 10A fuses for spare.

3.11 Accessories and spares

For maintenance and operation purposes tenderers shall include the supply and delivery of such equipment in sufficient quantity as may be required for the operation and maintenance of the switchboard as per tender specifications.

3.12 Information

Tenderers shall submit when tendering pamphlets, type test certificates and detailed information and maintenance instructions of all equipment offered.

Tenderers shall provide dimensioned drawings indicating space requirements, door sizes and such requirements as may be necessary for positioning, fixing and erection of the boards in the switch rooms.

As soon as possible after the contract has been awarded and before the manufacturer of the separate parts of the works is actually put in hand, the contractor shall at his own expense submit to the Engineer for approval, three prints of all general arrangements and detailed dimensioned drawings of all plant and equipment in such a form as the Engineer may reasonably indicate.

The approval of drawings shall not relieve the contractor of his responsibility for the design, detailing and dimensioning of all plant and shall in no way exonerate him from his liability to carry out the work in accordance with the terms of the contract. No drawing approved by the Engineer shall be departed from or amended, without the instructions of the Engineer in writing.

At time of handing over the contractor shall provide copies of each board properly filed information including:

- (a) Equipment schedules and specification pamphlets
- (b) Circuit diagrams
- (c) Operating and maintenance instructions
- (d) Spare parts lists

3.13 Erection and testing on site

The contractor will be required to erect, line up, provide first filling of oil where required , (in accordance with SANS 555 applicable to transformers) test and commission the switchgear on site and in switch rooms. Erection shall also include the positioning of the battery, provide, install and connect all integral wiring to the panels, between panels and all wiring required to provide a complete operational installation. The contractor shall be responsible for providing temporary power with voltages as required for the effective testing and commissioning and operation of the protection relays be means of temporary cables or standby power. Costs for the provision of the power shall be allowed for and included in the itemized rates as part of the cost of the circuit breaker. No extra remuneration shall be provided for the provision of the testing and commissioning power.

3.14 Tests to be carried out on site

After installation the following tests and additional tests shall be performed in accordance with requirements stipulated by the Supply Authority in order to prove full operation of the plant. All test equipment shall be provided by the contractor.

- (a) Such other test as are required by the Engineer to prove compliance with the Specification independently of any test which may already have been carried out at the Manufacturer's Works, or elsewhere.
- (b) Soil resistivity test (if called for)
- (c) Insulation resistance test
- (d) Continuity test
- (e) Polarity test
- (f) Voltage test
- (g) Relay Test
- (h) Protection Test
- (i) Current metering functioning
- (j) Voltage and current injection testing

4 MEDIUM VOLTAGE AUTOMATIC RECLOSING CIRCUIT BREAKERS FOR USE WITH RATED VOLTAGES UP TO AND INCLUDING 33kV.

4.1 Scope

The circuit breaker shall be suitable for the protection of medium voltage overhead supply systems with the possibility of clearing transient faults and isolating faulty T-off lines protected by fuses, and shall be of the automatic self-contained type with electronically controlled reclosing facilities. The auto-recloser shall conform to the applicable standards as referenced in section 1 above. .

4.2 Recloser control function

The recloser control provides the intelligence that enables the recloser to sense short circuits, over-currents, earth faults, select timing operations, time the tripping and reclosing functions (automatically) and lock out, or isolate the faulted section according to Supply Authority requirements and approved by the Engineer.

4.3 General design

4.3.1 Ratings (Minimum)

All ratings regarding the Automatic Circuit Breakers shall be design specific and in accordance with NRS 036 and other applicable standards listed.

4.3.2 Information and drawings

The manufacturer's specifications of the equipment offered showing trip characteristics, the method of operation and indicating recommended methods of mounting shall be submitted to the Engineer for approval.

4.4 Installation of Auto-Recloser

Installation of the recloser and control box shall be installed in accordance with the manufactures specification and shall conform to the requirements of the Supply Authority, subject to approval of the Engineer.

The auto-recloser shall be installed as specified in NRS 033 with the minimum height of 5500mm to the top of the medium voltage bushes or any other live part.

As a reference for installation reference can be made to IEC 60068 – Environmental Testing which covers issues such as protection and sensitive earthing faults.

4.5 Labelling

The auto-recloser label shall comprise of the traffolyte type or other type approved by the Supply Authority in accordance with the Engineer, at least 200mm wide and 200mm high, the largest possible characters shall be used. The label shall state the name of the auto-recloser, phase over-current, i.e. 80 A Ph O/C and 20 A E/D Fault i.e. fuse of solid links with amperage where applicable. The label shall be screwed to the pole 1000mm below the drop out fuse assembly.

5 MANUAL AND AUTOMATIC LINE SECTIONALIZERS AND LOAD BREAK SWITCHES FOR USE WITH MEDIUM VOLTAGES UP TO AND INCLUDING 33kV.

5.1 Scope

The load break switches described in this specification are intended to correspond to typical outdoor, pole mounted, manual operated by polyethylene rope, easily installed, maintenance free, compact, light weight, air interrupting media, metal clad type, totally enclosed load break devices. Also automatic line sectionalizers shall be suitable for the isolation of permanent faults to confine outages to small sections of a distribution network, and shall be of the automatic self-contained type.

Standards to be applied are the applicable standards referenced in the preamble and in section 1 above.

5.2 Current sensitive sectionalizer

A current sensitive sectionalizer is an over-current counting device and shall be in accordance with the applicable standards.

5.3 Loss-of-voltage sectionalizer

A loss-of-voltage sectionalizer operates on timers that start running when source voltage is restored after a back-up protection device (recloser) has operated. This type of sectionalizer shall be in accordance with NRS 036.

5.4 General design

The sectionalizer shall be rated for voltages up to specific to its application. Current and BIL characteristics shall be in accordance with NRS 036 and NRS 046.

The sectionalizer shall be suitable for mounting on one pole with a combined control cabinet.

All interior and exterior ferrous surfaces of sectionalizers, control cabinets and associated equipment, all support structures and bolt and nuts shall be hot-dip galvanized in accordance with SANS 121 and painted to match colour No G29 (light grey) to SANS 1091.

5.5 Installation of sectionalizer

The electronic control box shall be part and secured to the side of the sectionalizer.

The sectionalizer shall be installed as specified in NRS 033 in accordance with the requirements of the Supply Authority and subject to the approval of the Engineer with the minimum height of 5500mm to the top of medium voltage bushes or any other live part. The sectionalizer shall always be applied downstream from a backup auto-recloser.

5.6 Labelling

The sectionalizer label shall comprise of the traffolyte type or other type approved by the local Supply Authority in accordance with the approval of the Engineer, at least 200mm wide and 200mm high, the largest possible characters shall be used. The label shall state the name of the sectionalizer, phase actuating current and ground actuating current, i.e. 80 A Ph and 20 A Grnd. The label shall be screwed to the pole 1000mm below the sectionalizer.

6 POLE-MOUNTED DROP OUT FUSE SWITCHES (CUT OUTS) FOR USE WITH MEDIUM VOLTAGES UP TO AND INCLUDING 33kV

6.1 Scope

This standard covers distribution open fuse cut-outs (or drop-out fuses) of the expulsion type to the standards of NRS 035, intended for overload and short circuit protection of distribution equipment of rated voltages up to and including 33kV. Conversion of a cut-out into a disconnect link by replacing the fuse holder assembly with a solid disconnect link is also covered by this specification. Alternate standards to be consulted include SANS 1779 and SANS 60282. Reference should also be made to the standards listed in section 1 for fuses.

6.2 General design

Number of phases	3
Operating voltage	Design Specific and in accordance with the requirements of the Quality of Supply Code
Max. continuous voltage	In accordance with requirements of NRS 035
Rating of contacts	Refer to NRS 035
Finish	All ferrous metal parts will be galvanized to SANS 121
Operation	Suitable to be operated by link stick from ground
Fuses	HRC expulsion type, minimum rupturing capacity of 325MVA. Fuses to give positive indication on failure and to make provision for easy replacement from ground level by means of a link stick
Terminal connectors	Suitable to connect copper or aluminium conductors from 6mm to 16mm diameter

6.3 Installation

Fuse switches will be installed on cross-arms of galvanized steel to SANS 121, suitably drilled and fitted with support brackets.

Where possible, fuse switches will be installed on the last pole before the transformer installation but not more than 3 spans away and always completely visible from the position of the transformer. Fuse switch installation on the transformer structure are to be avoided as far as possible but will be installed on end-pole transformer structures where aerial bundled conductors are sharing poles along the MV in-feed line.

The NamPower Technical Standard for Equipment Installations shall be consulted as a reference for all installations.

If the T-off (from the backbone feeder line towards the village or load) is visible from the transformer position, the fuse switch will be installed at the T-off only.

The drop out fuse cross-arm will be installed at least 6500mm above the natural ground level.

The L-bracket for steel cross-arm mounting will be used and will be in accordance with NRS 035.

6.4 Labelling

The drop-out fuse assembly label will comprise of the traffolyte type or other type approved by the local Supply Authority in accordance with the approval of the Engineer, at least 200mm wide and 200mm high, the largest possible characters will be used, indicating the name and type of cut out, i.e. DOF No 5, Fuses or solid links with amperage where applicable. The label will be screwed to the pole 1000mm below the drop out fuse assembly.

7 SURGE ARRESTERS FOR USE IN MEDIUM VOLTAGE EQUIPMENT WITH RATED VOLTAGES UP TO AND INCLUDING 33kV.

7.1 Scope

This standard covers the supply, delivery, installation, testing and commissioning of outdoor surge arresters in accordance with NRS 039 and SANS 60099 and IEC 60076.

7.2 Outdoor surge diverters

Surge diverters will be the gapless metal oxide units or Silicon Carbide type specification and shall be approved by the Engineer and in accordance with the requirements of NRS 039 and SANS 60099.

Rated Voltage	As required by NRS 039 and The Quality of Supply Code.
High current impulse withstand	In Accordance with NRS 039
Rated discharge current at 8/20 μ s	In Accordance with NRS 039
Location	outdoor, transformer mounted
Support bracket	Suitable for transformer mounting
Line terminal connectors	Suitable to connect copper or aluminium conductors from 5mm to 16mm diameter
Earth terminal connectors	Suitable to connect copper or aluminium conductors from 5mm to 15mm diameter

7.3 LV outdoor surge arresters

Surge arresters are not required on LV circuits that comprise of cable feeders or aerial bundled conductors. However transformers shall have surge arrestors on the LV side according to the applicable standards and approval of the Engineer.