



## ZIMBABWE ELECTRICITY TRANSMISSION & DISTRIBUTION COMPANY

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OUR REF:..... FN/ec .....

YOUR REF .....

WHEN CALLING WITH REFERENCE  
TO THIS LETTER PLEASE ASK FOR

..... F. Nyamakambo.....

28 November 2023

**To All Bidders**

Dear Sir/Madam

**ADDENDUM NO. 5 FOR TENDER NO. ZETDC/INTER/06/2023 FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF 20MVA, 132/88/11KV POWER TRANSFORMER AT GLENVILLE 88/11KV SUBSTATION**

The above subject matter refers.

Attached herewith is **ADDENDUM NO. 5** for Tender No. ZETDC/INTER/06/2023 for the Supply, Delivery, Installation and Commissioning of 20MVA, 132/88/11kV Power Transformer at Glenville 88/11kV Substation being amendments to the Standard Bidding Document (SBD) after mandatory site visit.

The amendment is in relation to additional Technical Specifications.

The other terms and conditions of the tender remain the same.

Yours faithfully

A handwritten signature in black ink, appearing to read 'E. Chimoyo', is written over a horizontal line.

**E. CHIMOYO**  
**SUPPLY CHAIN MANAGER (A)**

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28 NOV 2023

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## ADDENDUM NO. 5

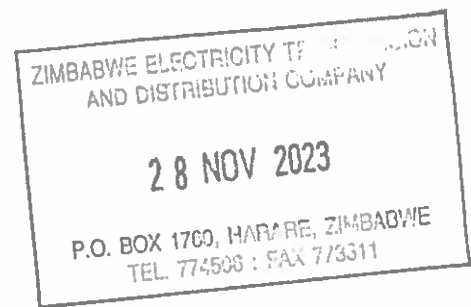
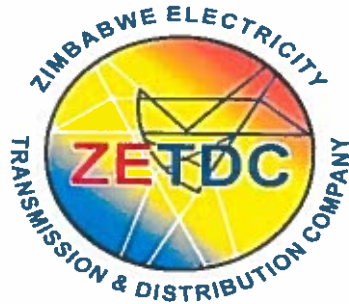
**TO STANDARD BIDDING DOCUMENT (SBD) FOR  
TENDER NO. ZETDC/INTER/06/2023**

**FOR THE SUPPLY, DELIVERY, INSTALLATION AND  
COMMISSIONING OF 20MVA, 132/88/11kV POWER  
TRANSFORMER AT GLENVILLE 88/11kV  
SUBSTATION**

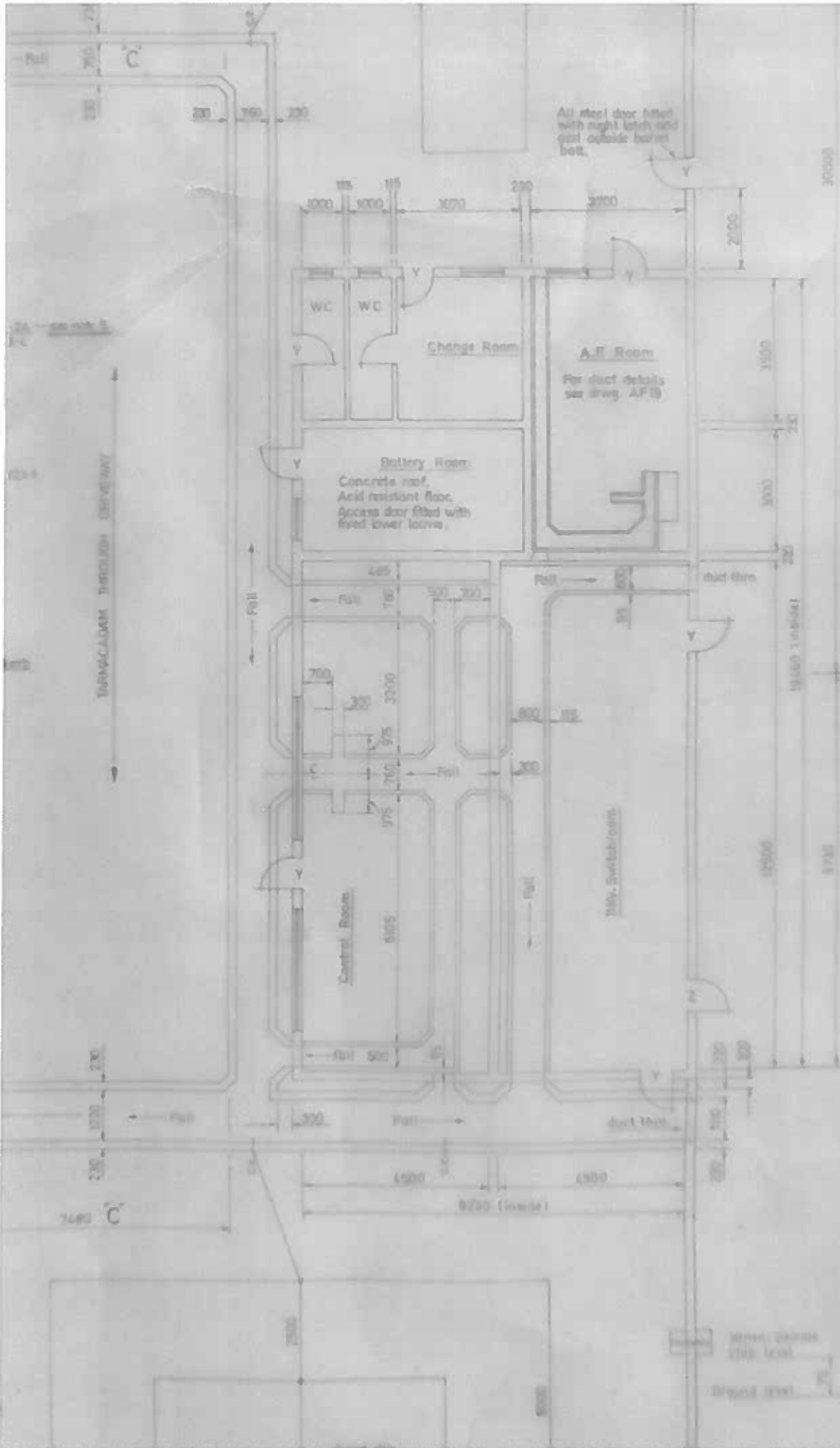
### ATTACHED:

- **Glenville 88/11kV Substation Floor Plan**
- **Technical Specification for Outdoor Circuit Breakers rated up to 132kV**
- **Technical Specification for Current Transformers rated up to 132kV**
- **Technical Specification for Outdoor Ganged Centre Rotating Isolators rated up to 132kV**
- **Technical Guarantee Schedule for 11-132kV Surge Arrestors**
- **Technical Guarantee Schedule for Jointing and Termination Kits up to 132kV**
- **Technical Specification for XLPE Power Cables rated up to 132kV**
- **Technical Specification for Remote Terminal Unit (RTU) for the Glenville 88/11kV Substation**

# ZIMBABWE ELECTRICITY TRANSMISSION & DISTRIBUTION COMPANY



## GLENVILLE 88/11KV SUBSTATION FLOOR PLAN



ZIMBABWE ELECTRICITY TRANSMISSION  
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**2 8 NOV 2023**

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**ZETDC**



**DISTRIBUTION DEPARTMENT**

**ZETDC SPECIFICATION NO. DS17092018CB**

**SPECIFICATION FOR**

**OUTDOOR CIRCUIT BREAKERS RATED UP TO 132KV**

ZIMBABWE ELECTRICITY  
AND DISTRIBUTION COMPANY  
28 NOV 2023  
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**ZETDC SPEC NO: DS17092018CB**  
**SPECIFICATION FOR OUTDOOR CIRCUIT BREAKERS**

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**ZETDC SPEC NO: 11082017  
SPECIFICATION FOR OUTDOOR CIRCUIT BREAKERS**

**1. DEFINITION AND INTERPRETATION**

**AC** – Alternating Current

**ASTM** – American Society for Testing and Materials

**BS** – British Standards

**DC** – Direct Current

**DIN** - German Institute for Standardization

**EN** - European Norm

**Hz** – Hertz

**IEC** – International Electromechanical Commission

**ISO** - International Standards Organisation

**KV**- Kilovolt

**MVA** - Mega Volt Amp

**NC** – Normally Close

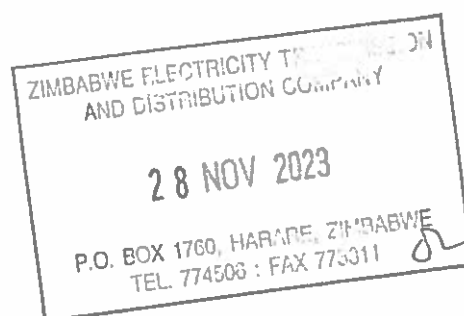
**NO** – Normally Open

**PCB** – Poly Chlorinated Biphenyl

**SF6** - Sulphur hexafluoride

**V** – Volt

**ZETDC** – Zimbabwe Electricity Transmission and Distribution Company



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## 2. SCOPE

This specification covers the technical requirements of design, materials, manufacture, performance requirements, testing at the Vendors's works of high voltage, three-phase, S<sub>6</sub> insulated alternating current Circuit Breakers for rated voltages from up to 132 kV. Details of each breaker are as specified in Schedule of Requirements.

The supplier shall state name, place and country of manufacture.

The supplier shall state whether or not the circuit breakers are produced under licence, in which case licence holders name shall be stated.

Tenderers shall include a complete statement of compliance with this Specification. For every clause in this Specification the Tenderers shall state compliance or non-compliance and shall elaborate where appropriate.

Tenderers shall use the words "comply", "do not comply" with this Specification or in the clauses of an informative nature, "noted". Where the words "do not comply" are used the Tenderer shall state whether modifications could be made and whether modifications would be undertaken. The cost implications of such modifications must be indicated in the statement of compliance as well as the pricing schedules.

Spares as recommended by the supplier should be included in the scope of supply.

**The manufacture of the circuit breakers should only commence after inspection of the prototype by at least two (2) ZETDC Engineers. The supplier will meet all the costs associated with the inspection of the prototype circuit breakers.**

Tenders should quote for delivery of the Circuit Breakers complete with ancillary equipment, fully wired, but dismantled to suitable components for delivery purposes, to ZETDC Central Stores.

Full assembly instructions, wiring diagrams and schematics together with all equipment operation and maintenance instructions and manuals which shall be in the English language shall be provided by the successful Tenderer at least two weeks prior to delivery of the equipment and shall be to the approval of the Authority. Each breaker shall have at least (2) two sets of schematics.

**The circuit breakers shall be provided from manufactures, who have at least 300 units in operation and manufactured such equipment for at least three years.**



All tenders should be fully supported with manufacturers' brochures and technical literature, illustrations, outline dimensional drawings and copies of performance and type test certificates or results done by an independent institution. Bidders shall complete the Technical guarantee schedule included with this Specification.

Failure to comply with these requirements will render the tender liable to rejection.

### 3. STANDARDS, UNITS AND LANGUAGE

The circuit breakers covered by this specification shall be designed, manufactured, inspected and tested in accordance with latest revisions of the following standards:

- (i) IEC 56 and subsequent amendments and I.E.C. Recommendation 298 or equivalent.
- (ii) IEC 62271-100 High Voltage AC Circuit Breakers
- (iii) Any other standard, provided the Tenderer can provide documentary evidence that the standard and which are acceptable to ZETDC or which is equal to or better than the above standards.
- (iii) IEC 60376, 197 Specification and acceptance of new sulphur hexafluoride

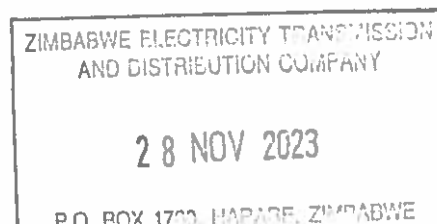
Circuit breakers not complying with the above standards will be rejected.

All tenders, correspondence, and all description upon drawings, illustrations or instruction shall be in the English Language.

SI units of measurements shall be used throughout.

The circuit breakers shall be manufactured to high quality standards under ISO 9001/2 or better Certification. Documentary proof of ISO Certification shall be provided with the bid.

Tenders should advise to which standard the circuit breakers are manufactured and tested, and shall supply relevant test certificates or test results, such as ASTA for tests in accordance with ASTA 18: 1966 or I.E.C. 267.



#### 4. PARTICULARS OF ELECTRICAL SYSTEM

The network conditions under which the 11kV and 33kV circuit breakers will operate are as follows:

- (a) Outdoor, earthed, 3-phase system with earth fault factor less than 1.5 at any location for 33 kV and 11 kV network.
- (b) All networks above 33 kV have the neutral effectively earthed.

Unless otherwise specified in the Schedule of Requirements, it must be assumed that the electrical system in which the 132 kV circuit breaker will be used in is or has:

- ✓ HV Equipment, 132kV - Maximum operating voltage 145kV, 3-phase, 50Hz, effectively earthed neutral.
- ✓ Lightning impulse withstand voltage 650kV peak. Short duration power-frequency withstand voltage 275 kV.
- ✓ Phase Relationship - The phase relations and designations shall be in accordance with the existing system of the Employer. The phase sequences will be made known to the Contractor at a later date, but not later than 1 month from date of commencement. The standard phase colours are Red, Yellow, Blue (RYB).
- ✓ The equipment shall be designed to withstand the most severe short circuit stresses expected during service conditions.
- ✓ The minimum symmetrical short circuit capacity at nominally operating voltage for the 132kV system shall be 31.5kA.
- ✓ For all current carrying parts, the permissible short circuit duration shall be at least 1 second.
- ✓ Indoor equipment shall be arc tested in accordance with IEC 60298 amendment 2.

DESCRIPTION	Unit	Circuit Breakers		
		132	33	11
Nominal Voltage	KV	132	33	11
Highest System Voltage	KV	145	36	12
Symmetrical R.M.S. Short Circuit and Earth Fault Currents	kA	31.5	31.5	31.5

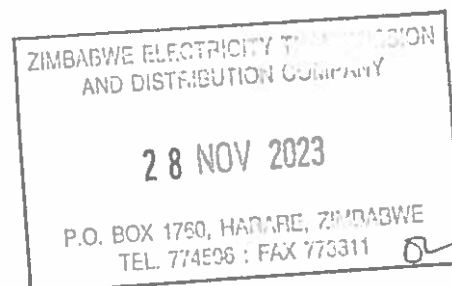
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## 5. PARTICULARS OF THE ENVIRONMENT

The circuit breakers shall be capable of operation under the following environmental conditions.

- (a) At an average altitude of 1,500 m above sea level.
- (b) Ambient air temperatures not exceeding a maximum of +45°C or below -10 °C with a daily maximum average of 35°C.
- (c) Exposed to direct tropical sun.
- (d) Humidity 13 mg per cubic metre absolute and 65% relative before storms with vapour pressure 17 mm.hg.
- (e) Equipment will operate within the tropics and is subject to sudden ambient air temperature changes of the order of 10 degrees centigrade occurring at the onset of rain, but the barometric pressure at any given place does not vary by more than approximately 10 mm mercury.
- (f) Frequent and severe lightning storms occur during summer months, with isoceraunic levels varying between 50 and 100 thunderstorm days per annum.
- (g) Particular attention should be paid in the design of all equipment to ensure that there is no damage to working parts or insulation through the ingress of dust, insects, vermin which are prevalent for long periods in the year.



## 6. CIRCUIT BREAKER DESIGN AND CONSTRUCTION

### 6.1 General

The three-phase circuit breakers shall be of the outdoor, single pressure SF6 type.

The outdoor breakers shall be mounted on steel structures.

The total breaking time (opening time plus duration of the arc) of the breakers shall be as short as possible, but in no case is it to be longer than 60 msec for 33 kV and 11 kV breakers and 50msec for 132kV.

The circuit breakers shall be provided with means to prevent contact pumping while the closing circuit remains energised should the circuit breaker either fail to latch or be tripped during closing due to the operation of the protective relays.

A motor charged or electromagnetic spring operated mechanism is preferred. Pneumatic or hydraulic operating mechanism is not accepted.

The operating mechanism shall be provided for electrical, local and remote control.

The control voltage for closing and opening commands and for the operating mechanism, unless otherwise stated in the Schedule of Requirements, shall be:

DC voltage shall be 50V or 110 V DC + 10% - 20% from unearthed battery for closing, opening and indication. Motor operated mechanism shall be supplied from 230 V AC.

A local position indicator, visible with the panel door closed, shall be mounted in the front panel of the operating mechanism cubicle.

A crank, lever or other similar suitable device shall be provided to permit charging the operation mechanism by hand in the event of a failure of the auxiliary supplies or in the event of a failure of the energy storing device.

It shall be possible to determine the available operating energy stored by the mechanism prior to operating the circuit breaker. An alarm shall be given in the event of the stored energy falling below a minimum rated level.

If the stored energy is below a minimum rated level in one or more of the mechanisms, tripping, closing and auto-reclosing shall be blocked in all phases.

The complete operating mechanism, including the controls, shall be built-in water-tight and dust-proof lockable cubicles (min. IP 54). All parts shall be easily accessible without dismantling other parts. Openings, covered with dust filters, shall allow a good ventilation of these cubicles. In order to avoid any moisture, thermostat controlled heaters for 230 V AC shall be built-in. Push buttons for operating the breaker shall be located not more than 1.7 m above ground.

A lockable local/remote control selector switch shall be provided in the cubicle. With the selector switch set to local control, operation from any remote source including the protective relays shall be inhibited. The switch shall have spare contacts for remote operation.

A sufficient number of auxiliary contacts, with at least 10 NO and 10 NC contacts as spare, for 50VDC and 110 V DC shall be provided for control and interlock purposes.

The Customer shall furnish detailed operation and maintenance manual of the mechanism along with the operation manual for the circuit breaker. The instruction manuals shall contain exploded diagrams with complete storage, handling, erection, commissioning, troubleshooting, servicing and overhauling instructions. The manual shall be written in the English language and where it is in any other language, a complete written translation into the English language shall be provided.

Motors shall be designed in accordance with valid IEC publication and shall be effectively protected by miniature circuit breakers, with alarm contacts.

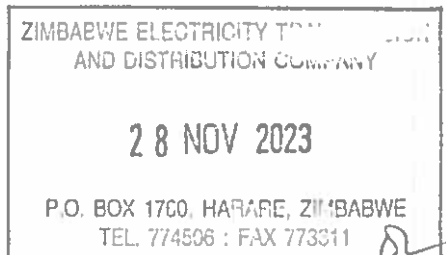
All wiring shall lead to terminals. 10% of the terminals shall be spare.

## 6.2 Circuit Breaker Mounting Details

The breakers shall be mounted on steel structures.

The following minimum distances and conditions shall be observed for 11kV and 33kV breakers:

DESCRIPTION	UNIT	CIRCUIT BREAKERS	
Nominal Voltage	kV	33	11
Phase to Ground	mm	400	230
Phase to Phase	mm	520	260



Busbar Phase to Phase	mm	520	260
Distance from ground to live parts	mm	2000	2000
Distance from roads to live parts	mm	5200	5200
Nearest part of insulators to ground level	mm	2000	2000
Maximum Temperature rise of conductors above ambient (40 °C)	°C	40	40
Maximum Wind Pressure on Conductors and Cylindrical Objects	N/m <sup>2</sup>	430	430
Maximum wind pressure on flat surfaces	N/m <sup>2</sup>	820	820

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## 6.3 Material

### 6.3.1 Electrical Equipment Materials

All materials incorporated in the equipment supplied shall be new and of first class commercial quality, free from defects and imperfections.

Nuts, bolts and washers below 16 mm shall be provided in stainless steel.

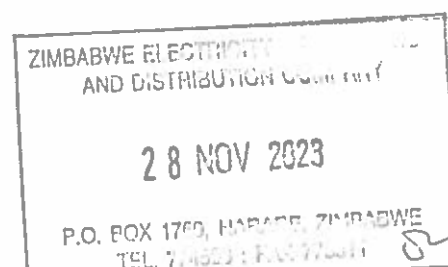
### 6.3.2 Quality of Material

All materials shall be new and of the best available quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions arising under working conditions without distortion or deterioration in the setting up of undue stresses in any parts and also without affecting the suitability of the various parts of the Works for which they were designed. No toxic material (such as Halon, PCB, Asbestos) shall be utilised.

### 6.3.3 Surface Treatment and Painting

Outdoor installations and indoor installations in wet and damp rooms shall at least have one priming coat and two layers of paint on zinc powder basis applied after perfect cleaning and/or sandblasting. Parts that cannot be readily painted shall be hot-dip galvanised. Outdoor fittings for distribution boxes, etc. shall be hot-dip galvanised, minimum zinc coating shall be 600 g per m<sup>2</sup>. All interior surfaces of electrical apparatus, cabinets, etc. including contactors, relays, coils, etc. shall be treated in an approved manner to prevent mould growth. Such treatment shall in no way interfere with the proper operation of the equipment either electrically or mechanically. All galvanising shall be in accordance with BS EN ISO 1461-2009 or other internationally approved standards. Steel below ground shall in addition to galvanising be protected with Bitumen or a substance of similar quality.

The particulars of priming and finishing paintings shall be stated in the Tender, with specifications of paint, together with a listing of colours available, for each of the plant and equipment. The Employer is not bound to accept the finishing colour proposed by the Tenderer. Determination of colour shall be at the option of the Employer and shall be finalised at the time of approval of drawings.



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#### 6.4 Bushings

The bushings shall be made of porcelain/silicone rubber. The bushings shall have specific creepage distance of not less than 25 mm/kV line voltage. The radio influence voltage shall not exceed 100 micro volts when tested at rated voltage and 1000 kHz.

#### 6.5 Bolts, Studs, Nuts, Screws, Washers, etc

All bolts, studs, nuts, etc., shall have a standard metric threading and conform to the relevant standards as regards shape and tolerance. They shall be marked by the manufacturer's symbol and class of strength.

All bolts, studs, nuts, washers, screws, etc., above 10mm diameter, if not in stainless steel or other corrosion-resistant material, shall be hot-dip galvanised, except for bolts above Strength Class 8.8. In this case, corrosion-resistant material will be preferred. Bolts, etc., smaller than 10mm diameter shall be electrolytic zinc-coated if not provided in stainless steel or other corrosion-resistant material.

Bolts, nuts, studs and screws which require frequent tightening and unbolting during inspection or maintenance procedures shall be of stainless steel.

All bolts and nuts shall be hexagonal, either normally or of the round head socket type and secured in an approved manner against becoming loose during operation.

The Contractor shall supply the net quantities plus 5% of all permanent bolts, screws and other similar items and materials required for installation of the works at the site. Any such rivets, bolts, screws, etc., which are surplus after the installation of the equipment has been completed shall become spare parts and shall be wrapped, marked and handed over to the Purchaser.

Taper pins shall have threaded stems with nuts where dismantling of the pins is likely to be required. Bolts shall not protrude more than 10 mm beyond the nut but not less than two full threads.

#### 6.6 Constructional Features

The features and constructional details of circuit breakers shall be in accordance with requirements stated hereunder:

- a) The gap between the open contacts shall be such that it can withstand continuously the rated phase to ground voltage at zero-gauge pressure of SF6 gas due to the leakage.



The breaker should be able to withstand all dielectric stresses imposed on it in open condition at lock out pressure continuously (i.e. 2 p.u. across the breaker continuously).

- b) If multi-break interrupters are used, these shall be so designed and augmented that a uniform voltage distribution is developed across them. Calculations/ test reports in support of the same shall be furnished. The thermal and voltage withstand of the grading elements shall be adequate for the service conditions and duty specified.

2. The SF6 Circuit Breaker shall meet the following additional requirements:

- a) The circuit breaker shall be single pressure type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surfaces of the circuit breaker.

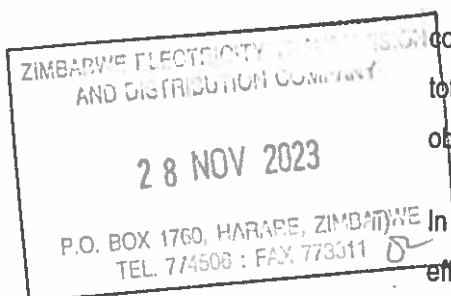
- i) All gasket surfaces shall be smooth, straight and reinforced, if necessary, to minimise distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 1% per year. In case the leakage under the specified conditions is found to be greater than 1% after one year of commissioning of circuit breaker, the Supplier will have to supply free of cost, the total gas requirement for subsequent ten (10) years, based on actual leakage observed during first year of operation after commissioning.

In the interrupter assembly there shall be an absorbing product box to minimise the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as fully compatible with SF6 gas decomposition products.

- iii) Each pole shall form an enclosure filled with SF6 gas independent of two other poles, the SF6 density of each pole shall be monitored.

- iv) The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale and shall meet the following requirements:

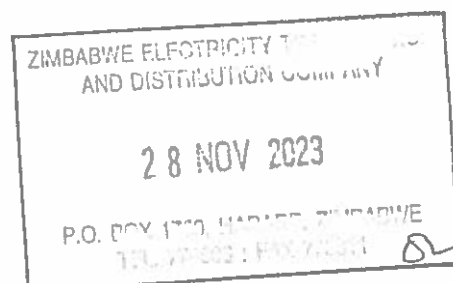
3. It shall be possible to dismantle the density monitor for checking/replacement without draining the SF6 gas by providing suitable interlocked non-return valve coupling.



4. Each Circuit Breaker shall be capable of withstanding a vacuum of minimum 8 millibars without distortion or failure of any part.
5. Sufficient SF6 gas including that which will be required for gas analysis during filling shall be provided to fill all the circuit breakers installed. In addition, 30% of total gas requirement shall be supplied in separate cylinders as spare requirement.
6. Provisions shall be made for attaching an operational analyser after installation of circuit breakers at site to record contact travel, speed and making measurement of operating timings, pre-insertion timings of closing resistors if used, synchronisation of contacts in one pole. In case operation analyser is already available at a particular site, the Supplier shall have to supply a suitable adopter/transducer so that the offered circuit breaker can be used with the operational analyzer.

#### Sulphur Hexafluoride (SF6) Gas

1. The SF6 gas shall comply with IEC 376, 376A and 376B and shall be suitable in all respects for use in the switchgear under the operating conditions.
2. The high-pressure cylinders in which the SF6 gas is shipped and stored at site shall comply with requirements of the relevant standards and regulations.
3. Test: SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water content as per IEC 376, 376A and 376B and test certificates shall be furnished to the project manager indicating all the tests as per IEC 376 for each lot of SF6 gas in stipulated copies as indicated in Volume I Section 1.6.1. Gas bottles shall be tested for leakage at site.
4. The circuit breakers shall have a gas density monitor system. The system shall comprise alarm contacts which close at low and critically low gas densities. At low gas density, the circuit breaker shall be blocked against closing. At a critically low density the circuit breaker shall be blocked against opening.



## 6.7 VOLTAGE AND CURRENT RATINGS

The circuit breakers shall operate under the voltage conditions specified in the schedule of requirements  
The insulation levels shall be:

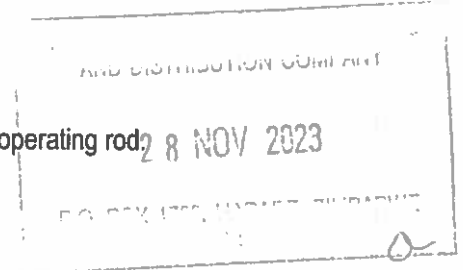
DESCRIPTION	UNIT	CIRCUIT BREAKER		
		132	33	11
Nominal Voltage	kV	132	33	11
Basic Insulation Level	kV	650	170	75
Power Frequency Withstand Voltage	kV	275	70	28

## 6.8 Control

- (a) The close and trip circuits shall be designed to permit use of momentary contact switches and push buttons.
- (b) The breaker shall be provided with two (2) independent tripping circuits, pressures switches and coils each connected to a different set of protective relays.
- (c) The breaker shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coils. However, provisions shall be made for local electrical control. For this purpose, a local/remote selector switch and close and trip control switch/push buttons shall be provided in the breaker central control cabinet
- (d) The trip coils shall be suitable for trip circuit supervision during both open and close position of breaker. The trip circuit supervision relay would be provided on relay panels
- (e) Closing coil and associated circuits shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip coil and associated circuits shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage. However, even at 50% of rated voltage the breaker shall be able to operate. If additional elements are introduced in the trip coil circuit their successful operation and reliability for similar applications on outdoor circuit breakers shall be clearly brought out in the additional information schedules.

(f) Density meter contacts and pressure switch contact shall be suitable for direct use as permissive in closing and tripping circuits. Separate contacts have to be used for each of tripping and closing circuits. If contacts are not suitably rated and multiplying relays are used then fail-safe logic/schemes are to be employed. DC supplies for all auxiliary circuits shall be monitored and provision shall be made for remote annunciations and operation lockout in case of D.C. failures. Density monitors are to be so mounted that the contacts do not change on vibration during operation of circuit breaker.

(g) The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.



### 6.9 Spring operated mechanism

- (i) Spring operated mechanism shall be complete with motor. Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall also be provided.
- (ii) As long as power is available to the motor, a continuous sequence of the closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty.
- (iii) After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.
- (iv) Breaker operation shall be independent of the motor, which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided. The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring.
- (v) Closing action of circuit breaker shall compress the opening spring ready for tripping.
- (vi) When closing springs are discharged after closing a breaker, closing springs shall be automatically charged for the next operation and an indication of this shall be provided in the local and remote control cabinet.
- (vii) Provisions shall be made to prevent a closing operation of the breaker when the spring is in the partial charged condition. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is already in the closed position.
- (viii) The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide the required energy for the tripping mechanism in case the tripping energy is derived from the operating mechanism.

## 6.10 Support Structure

- (a) The structure design shall be such that during operation of circuit breaker, vibrations are reduced to minimum.
- (b) If required, the Supplier shall provide suitable platform with steps on both sides of the circuit breaker for easy accessibility for monitoring the density/pressure of gas.

## 6.11 Terminal Connector Pad

The circuit breaker terminal pads shall be made up of high quality electrolytic copper or aluminium. The terminal pad shall have protective covers, which shall be removed before interconnections.

## 6.12 Interpole Cabling

- (a) All cables shall be armoured and shall be as per IS - 1554 (1100 Volts Grade). All cables within and between circuit breaker poles shall be supplied as part of the Project.
- (b) Only stranded conductor shall be used. Minimum size of the conductor shall be 2.5sq. mm. (Copper).
- (c) The cables shall be with oxygen index Min-29 and temperature index as 250°C as per relevant standards.

## 7. IDENTIFICATION AND MARKING:

### 7.1 General

All outdoor nameplates and signs shall be made of non-corrosive weatherproof material as aluminium or stainless steel. For labels protected from solar radiation fibreglass reinforced polyester with embedded colour layers can be used. All labels shall be fixed by stainless steel screws or rivets. The Contractor shall supply all label plates and other labelling (of the screw-on type) on control boards, control desks, panels and other places where required for operational, functional and safety reasons. The labelling, size of the plates and their location shall be subject to approval by the Employer. A sample label plate indicating the material and lettering to be used shall be submitted for this purpose. The number of sizes of the various plates shall be kept to a minimum.

### 7.2 Nameplates

All permanent equipment of the works shall be provided with a securely fixed nameplate showing the maker's name, model, serial number, year of manufacture, main characteristic data of the respective equipment and further relevant information specified in the applicable standards or necessary for the proper identification of the equipment involved. All main equipment shall have the nameplates in English. The Employer may direct special labelling or nameplates to be written in local language.

### 7.3 Designation Labels

All bays including towers, busbars, apparatus as well as components in operating devices, wiring, cables etc. shall be equipped with designation labels. Labels shall have white letters engraved on a black background. For aluminium and steel signs black labels on metallic background shall be used. Letter height shall be 100 mm. Labels shall be subject to approval by the Employer. Phase identification labels shall be coloured red-yellow-blue for

phases R(R)-S(Y)-T(B). The Employer's Standard marking system shall be followed. The marking system shall be subject to approval by the Employer during detail design. Reference is made to Document No. S-S-03 A-1: Key for Designation.

#### 7.4 Warning Labels

For warning labels, yellow background with black text, black borders and red lightning symbol shall be used. Warning labels shall be mounted on all dangerous parts of the installation. This means: On low voltage distribution boards, a general warning label. On all cubicles where back voltage can appear after switches are opened, special warning labels shall be applied. Labelling, as is deemed necessary to prevent dangers arising from maloperation of equipment. Text on warning labels shall be approved by the Employer. A first aid instruction poster shall be placed inside the buildings, near the exit doors. The poster shall show steps and methods to be taken and used in case of electrical accidents where persons are hurt, i.e. first aid principles and how to proceed.

#### 7.5 Labels and Plates

A corrosion-resistant nameplate with clearly legible writing shall be permanently attached to each assembled piece of equipment at an easily visible place. It shall provide all necessary information pertaining to the equipment, but as a minimum, the following must be included: manufacturer's name, type of equipment, serial number, year of manufacture, project identification number, weight, EDS code and other relevant information in compliance with applicable standards. Any special maintenance instructions shall also be shown at this or other suitable location. For other major components i.e., pumps, motors, etc., the following shall be added: Rated power, speed, total head, capacity, direction of rotation, and any other pertinent information.

#### 7.6 PACKAGING:

The Contractor shall be responsible for proper storage for equipment under his responsibility. Care shall be taken to ensure adequate storage to avoid damage to equipment due to rain, dust or strong sunshine. The storage shall be in an environment similar to the installed location, i.e., indoor equipment shall be stored indoors (without heating and ventilation), and outdoor equipment shall be stored outdoors. Where required to protect against condensation and humidity, a desiccant shall be provided and its presence, with the need of periodic removal and dry-out, shall be so marked.

When electric space heaters are provided for that purpose, these should be wired to the outside of the equipment so that energising immediately upon receipt is possible without disassembly of crates, etc. This also requires that no combustible materials be left in the inside of the equipment. Items, which may be subjected to open storage for several months on site shall be suitably packed and protected from the weather. The Contractor shall provide storage and handling instructions including descriptions for periodic inspection and/or storage maintenance to ascertain that no deterioration will occur during storage. One set of these instructions shall be fastened securely to the outside of the shipping unit.

The Contractor shall provide at the Employer's request, the Contractor recommended instructions for long-term storage. When equipment is specified for export shipment, the Contractor shall include packaging adequate for

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export shipment, and this packaging shall be such as to obtain approval and acceptance by transportation companies. All equipment shall be shipped from the factory completely assembled as far as practicable, subject to the limitations of length, height, depth, and weight, etc. described in the Conditions of Contract or in the Technical Data Sheets for each of the equipment under this specification.

## 8. ACCESSORIES/ DELIVERABLES

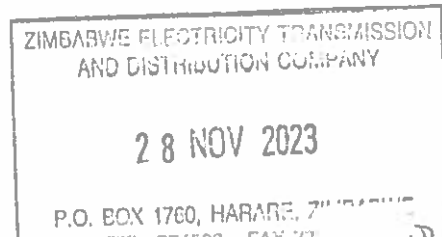
- Following is a partial list of some of the major fittings and accessories to be supplied by Supplier in the Central Control cabinet.
  - i) Cable glands (Double compression type), Lugs, Ferrules etc.
  - ii) Local/remote changeover switch.
  - iii) Operation counter
  - iv) Pressure gauges.
  - v) Control switches to cut off control power supply.
  - vi) Fuses as required.
  - vii) The number of terminals provided shall be adequate enough to wire out all contacts and control circuits plus 24 terminals spare for future use.
  - viii) Anti-pumping relay.
  - ix) Pole discrepancy relay.
  - x) D.C. Supervision relays.
  
  - xi) Rating and diagram plate in accordance with IEC incorporating year of manufacture.

## 9. TEST REQUIREMENTS

### 9.1 TYPE TEST

The circuit breaker along with its operating mechanism should have been successfully type tested as per IEC-56. The test report and certificates shall be submitted with this report. The type test report shall include:

- i) Short time and peak withstand current test.
- ii) Short circuit breaking capacity and making capacity.
- iii) Single Capacitor Bank current switching test
- iv) Dielectric test i.e., power frequency withstand and impulse withstand test
- v) Temperature rise test.
- vii) Measurement of resistance of the main circuit.



The test reports of the type tests and the following additional type tests shall also be submitted for ZETDC's review.

- i) Corona extinction voltage test (as per Annexure-A of Volume I).
- ii) Out of phase closing test as per IEC-267 & IEC-56.
- iii) Line charging breaking current.
- iv) Test to demonstrate the Power Frequency withstand capability of breaker in open condition at Zero Gauge pressure and at lockout pressure.
- v) Seismic withstand test in unpressurised condition.

## 9.2 Routine Tests

- a) Routine tests as per IEC-56 shall be performed on all circuit breakers. All test reports should be submitted and should be approved before despatch of the equipment.

In addition to the mechanical and electrical tests specified by IEC, the following tests shall also be performed.

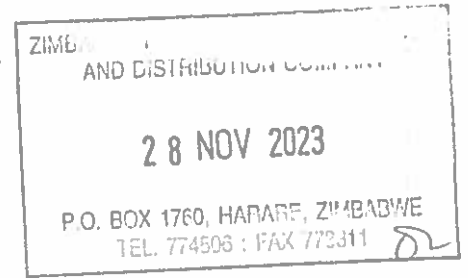
- 1) Speed curves for each breaker shall be obtained with the help of a suitable operation analyser to determine the breaker contact movement during opening, closing, auto-reclosing and trip free operation under normal as well as limiting operating conditions (control voltage, pneumatic/hydraulic pressure etc.). The tests shall show the speed of contacts directly at various stages of operation, travel of contacts, opening time, closing time, shortest time between separation and meeting of contacts at break make operation etc. This test shall also be performed at site for which the necessary operation analyser along with necessary transducers, cables, console, etc. where included in scope of supply shall be furnished and utilised. In case of substations where operation analyser exists the Customer shall utilise the same. However necessary adopter and transducers etc. if required shall have to be supplied by the Supplier.
- 2) Measurement of Dynamic Contact Resistance for arcing and main contacts. Signature of Dynamic contact resistance measurements shall be taken as reference for comparing the same during operation and maintenance in order to ascertain the healthiness of contacts.

## 9.3 Testing and Commissioning

- a) An indicative list of tests is given below. The Customer shall perform any additional test based on specialties of the items as per the field Q.P./instructions of the equipment Supplier or ZETDC without any extra cost to ZETDC. The Customer shall arrange all instruments required for conducting these tests along with calibration certificates. Where any of these tests were reasonably carried out at the factory, Test Certificates shall be provided to ZETDC.



- (a) Insulation resistance of each pole.
- (b) Check adjustments, if any suggested by manufacturer.
- (c) Breaker closing and opening time.
- (d) Slow and Power closing operation and opening.
- (e) Trip free and anti-pumping operation.
- (f) Minimum pick up voltage of coils.
- (g) Dynamic Contact resistance measurement.
- (h) Functional checking of compressed air plant and all accessories.
- (i) Functional checking of control circuits interlocks, tripping through protective relays and auto reclose operation.
- (j) Insulation resistance of control circuits, motor etc.
- (k) Resistance of closing and tripping coils.
- (l) SF6 gas leakage check.
- (m) Dew Point Measurement
- (n) Calibration of pressure switches and gas density monitor.
- (o) Checking of mechanical 'CLOSE' interlock, wherever applicable.



## 9.4 Factory Acceptance Tests

Factory acceptance test shall be carried out prior to delivery and shall be at the expense of the supplier

## 10. DOCUMENTATION REQUIREMENTS

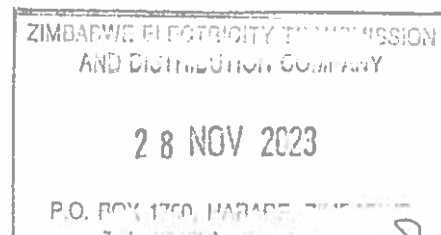
- a) Drawing, showing contacts in close, arc initiation, full arcing, arc extinction and open position.
- b) The temperature v/s pressure curves for each setting of density monitor along with details of density monitor.
- c) Method of checking the healthiness of voltage distribution devices (condensers) provided across the breaks at site.
- d) Data on capabilities of circuit breakers in terms of time and number of operations at duties ranging from 100% fault currents to load currents of the lowest possible value without requiring any maintenance or checks.
- e) The effect of non-simultaneity between contacts between poles and also show how it is covered in the guaranteed total break time.
- f) Sectional view of non-return couplings if used for SF6 pipes.

- g) Details & type of filters used in interrupter assembly and also the operating experience with such filters.
- h) Details of SF6 gas:
  - (i) The test methods used in controlling the quality of gas used in the circuit breakers particularly purity and moisture content.
  - (ii) Proposed tests to assess the conditions of the SF6 within a circuit breaker after a period of service particularly with regard to moisture contents of the gas.
  - (iii) The precise procedure to be adopted by maintenance personnel for handling equipment who are exposed to the products of arcing in SF6 gas so as to ensure that they are not affected by possible irritants of the skin and respiratory system. Recommendations shall be submitted for suitable protective clothing, methods of disposal of circuit breaker cleaning utensils and other relevant matters.
  - (iv) A complete catalogue on operation analyser satisfying all the requirements of this Chapter.
  - (v) Curves supported by test data indicating the opening time under close open operation with combined variation of trip coil voltage and pneumatic/hydraulic pressure.
  - (vi) All duty requirements as applicable to CBs specified in this section shall be provided with the support of adequate test reports to be.
  - (vii) Field test report or laboratory test report in case of CB meant for reactor switching duty.

## 11. TRAINING REQUIREMENTS

Training for the installation, maintenance and operation of the breakers shall be provided locally and should be included in the quotation.

The Contractor shall give thorough instruction on site concerning the operation and maintenance of all Works supplied by him to the staff appointed by the Employer. Such training shall be organised by the Contractor under the supervision of the Employer and shall be performed by qualified, English-speaking personnel. It shall take place prior to and during the Commissioning Period. The training programme shall be subject to the Employer's approval. Candidates for training selected from among the Employer's organization should have basic relevant qualifications. Their experience should be of a broad and general technical nature, including general familiarity with electronic systems and testing facilities.



### Training Objectives

The training shall be designed to:

- Enable staff to perform maintenance and take part in repair of the substation components and its associated equipment by teaching principle of operation trouble-shooting methods and procedures leading to the identification and replacement of faulty piece of equipment, modules, units and components, with the objective that the Employer 's personnel will become capable of carrying out repair and maintenance without outside assistance;
- Enable staff to perform routine maintenance of the substation components and its associated equipment by way of electrical and mechanical adjustments, lubrication and/or replacement of parts subject to wear or with a limited life.

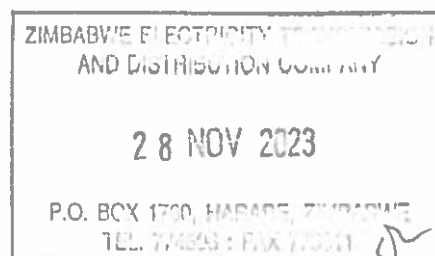
### 12. CUSTOMER SUPPORT

The Supplier shall provide adequate customer support in the following form of spares backup for at least 10 years.

### 13. TECHNICAL SCHEDULES

#### 13.1 Preamble

- 13.1.1 The Technical Schedules shall be filled in and completed by the Bidder, and submitted with the Bid.
- 13.1.2 All documentation necessary to evaluate whether the equipment offered is in accordance with this Specification shall be submitted with the Bid.
- 13.1.3 All data entered in the Schedules of Technical Guarantees are guaranteed values by the Bidder and cannot be departed from whatsoever.
- 13.1.4 All data entered in the Schedules of Informative Data are also guaranteed values by the Bidder. These data may only be altered following the Engineer's written consent.



**13.2 TECHNICAL GUARANTEE SCHEDULE: 11kV Circuit Breakers**

Please complete this schedule by stating the actual tendered circuit breaker specification in the column

Labelled Actual and sign as indicated

Name of Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Type: \_\_\_\_\_

28 NOV 2023

P.O. BOX 1750, HARARE, ZIMBABWE  
TEL: 090 184 7441

Item	Description	Units	Requirement	Guaranteed Value	Reference page in technical brochure (e.g. Found on page 3, section 3.2 paragraph/line etc.)
1	Type/Designation		State		
2	Interrupting medium		SF6		
3	Insulating medium		SF6		
3.1	Applicable Standards		IEC And BS		
4	Voltage rating				
4(i)	Nominal	kV	11		
4(ii)	Maximum	kV	12		
4(iii)	Power frequency	Hz	50		
4 (iv)	Basic Insulation Level	kV	75		
5	Current rating				
5(i)	Continuous Load Current	Amps	1250/800A		
5(ii)	Short time 3 seconds	Amps	At least 31.5kA		
5(iii)	Interrupting	Amps	31.5kA-3seconds		
6	Operation sequence		[0-0.3s-CO-3min-CO]		
7	Opening time (trip initiation to contact separation)	ms	<=60		
8	Closing time (close initiation to contact make)	ms	<=90		
9	Type of Operating Mechanism				
	- Trip mechanism		Spring		
	- Closing mechanism		Spring		
10	DC closing voltage	V	See schedule of requirements		
	DC trip voltage	V	See schedule of requirements		
11	Accessories				
	- Bushing ct's	Yes/no	No		
	- Metering amps	Yes/no	No		
	- Remote trip	Yes/no	Yes		
	- Remote close	Yes/no	Yes		

12	Dimensions				
	- Height	mm	state		
	- Width	mm	state		
	- Depth	mm	state		
13	Weight	kg	state		
14	Manufacturer		state		
15	Country of origin		state		

Tenderer's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

ZIMBABWE ELECTRICITY TRANSMISSION  
AND DISTRIBUTION COMPANY  
**28 NOV 2023**  
P.O. BOX 1760, HARARE, ZIMBABWE  
TEL: 273900 : FAX: 273911

### 13.3 TECHNICAL GUARANTEE SCHEDULE: 33kV Circuit Breakers

Please complete this schedule by stating the actual tendered circuit breaker specification in the column

Labelled Actual and sign as indicated

Name of Manufacturer: \_\_\_\_\_  
 Model: \_\_\_\_\_  
 Type: \_\_\_\_\_

Zimbabwe  
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28 NOV 2023

P.O. BOX 1700, HARARE, ZIMBABWE

Item	Description	Units	Requirement	Guaranteed Value	Reference page in technical brochure (e.g. Found on page 3, section 3.2 paragraph/line etc.)
1	Type/Designation		State		
2	Interrupting medium		SF6		
3	Insulating medium		SF6		
3.1	Applicable Standards		IEC And BS		
4	Voltage rating				
4(i)	Nominal	kV	33		
4(ii)	Maximum	kV	36		
4(iii)	Power frequency	Hz	50		
4 (iv)	Basic Insulation Level	kV	170		
5	Current rating				
5(i)	Continuous Load Current	Amps	1600		
5(ii)	Short time 3 seconds	Amps	At least 31.5kA		
5(iii)	Interrupting	Amps	31.5kA-3seconds		
6	Operation sequence		[0-0.3s-CO-3min-CO]		
7	Opening time (trip initiation to contact separation)	ms	<=60		
8	Closing time (close initiation to contact make)	ms	<=90		
9	Type of Operating Mechanism				
	-Trip mechanism		Spring		
	-Closing mechanism		Spring		
10	DC closing voltage	V	See schedule of requirements		


	DC trip voltage	V	See schedule of requirements		
11	Accessories				
	- Bushing ct's	Yes/no	No		
	- Metering amps	Yes/no	No		
	- Remote trip	Yes/no	Yes		
	- Remote close	Yes/no	Yes		
12	Dimensions				
	- Height	mm	State		
	- Width	mm	State		
	- Depth	mm	State		
13	Weight	kg	State		
14	Manufacturer		State		
15	Country of origin		State		

Tenderer's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

ZIMBABWE ELECTRICITY  
AND DISTRIBUTION COMPANY

28 NOV 2023

P.O. BOX 1700, HARARE, ZIMBABWE  
TEL: 774008 : FAX: 773009



### 13.4 TECHNICAL GUARANTEE SCHEDULE: 132kV Circuit Breakers

Please complete this schedule by stating the actual tendered specification and sign as indicated.

Name of Manufacturer: \_\_\_\_\_  
 Model: \_\_\_\_\_  
 Type: \_\_\_\_\_

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 AND DISTRIBUTION COMPANY

28 NOV 2023

P.O. BOX 1760, HARARE, ZIMBABWE  
 TEL. 774306 : FAX 773311

Item	Particulars	Unit	Required	Actual	Remarks	Reference page in technical brochure (e.g. Found on page 3, section 3.2 paragraph/line etc.)
1	Rated voltage	kV	132			
2	Maximum service voltage	kV	145			
3	Rated frequency	Hz	50			
4	Rated continuous current	A	2 500			
5	Type of breaker and designation		Specify			
6	Reference standard		IEC62271-100			
7	total length of break per pole	mm	110			
8	Number of main breaks per pole		1			
9	Average velocity of each single break	m/s	4.5			
1	<b>One-minute power frequency withstand voltage, dry and wet</b> -to earth -across open breaker pole	kV rms kV rms	275 315			
1	<b>Impulse withstand voltage 1.2/50ms</b> -to earth -across open breaker	kV peak	650 750			
1	<b>Breaker capacity at rated voltage</b> -symmetrical -asymmetrical	kA	25 25			



1	First phase to clear factor	kA	1.5			
1	Making capacity		100			
1	Breaking capacity of the capacitive current	kA peak	400			
1	Overvoltage factor for disconnection of unloaded transformers (without voltage limitation by lightning arrestors)	A	<2.3 p. u			
1	Rated inductive current switching capacity	A	0 - 25			
1	Switching surge withstand voltage to ground, dry and wet	kV peak	510			
1	Permissible 1 second short-time current	kA rms	25			
2	Dynamic short-time current	kA peak	100			
2	Opening time, interval of time between the instant of application of the tripping impulse to the instant when the main contacts have separated in all poles	ms	25			
2	Make time, interval of time between the initiation of the closing operation and the instant when the current begins to flow in the main circuit	ms	100			
2	<b>Total break time, interval of time between the instant of application of tripping impulse to the instant of</b>	ms	30			

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	<b>final arc extinction in all poles</b> -at 100% breaking capacity -under phase opposition					
2	Dead time (for rapid auto-reclosing) interval of time between final arc extinction in all poles on the opening operation and the first re-establishment of current in any pole in the subsequent closing operation	ms	300			
2	<b>Maximum arc duration for</b> -3-phase symmetrical -1-phase	ms ms	40 40			
2	Minimum corona starting voltage of closed and open circuit breaker (voltage to earth)	kV	84			
2	<b>Rate of rise of recovery voltage (RRRV) at 100% short circuit current</b> -3-phase -1-phase	kV/ms kV/ms	2 000 2 000			
2	RRRV out of phase duty	kV/ms	1.54			
2	Minimum temperature rise at rated current of main contact	oC	65			
3	Specific creepage distance across insulator	mm/kV	31			
3	Bending moment at base of support insulator	kN	21.1			
3	Bending moment at base of support structure	kN	30.1			
3	Max. percentage of recovery voltage across any break	%	104			

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3	Is any provision made of equalizing the voltage across breaks on breaking	mm	Yes			
3	Type of main contacts	mm	Self elastic			
3	Material in main contacts		Copper			
3	Minimum clearance between live parts and earth, in SF6 gas	mm	1100			
3	Minimum distance between phase centres	mm	1100			
3	<b>Distance between terminals</b> -Horizontal direction -Vertical direction	mm mm	1100 1200			
4	Height of lowest terminal	mm	Specify			
4	Total height of breaker	mm	Specify			
4	<b>Number of opening operations permissible before inspection and maintenance of contacts, gas treatment, etc</b> -At rated current -At short-circuit currents under normal service conditions -At rated short-circuit current		6000 20 20			
4	Type of operating system (hydraulic or spring)		Spring			
4	<b>Normal gas density for SF6 circuit breaker (represented by gas pressure)</b> -at 20°C -at 40°C	Bar Bar	5 5			

4	<b>Minimum gas density for operation</b> -at 20°C -at 40°C	Bar Bar	4 4			
4	Quantity of gas required per 3-pole breaker	kg	Specify			
4	Operating pressure of relief valve	Bar	Specify			
4	Method of monitoring pressure and temperature compensation		Density Controller			
4	Max permissible dew point temperature	oC	55			
5	Max permissible acidity level		0.3ppm			
5	Max permissible leak rate	%	0.5			
5	Type reference of Alumna/Molecular sieve		Specify			
5	Material in SF6 pipe work		Stainless Steel			
5	Type of operating device		Specify			
5	<b>Power consumption of</b> -closing coil -Trip Coil -Heater	W W W	<b>Specify</b>			
5	<b>Auxiliary switch</b> -Rupturing current at 110 V -Number of free NO contacts -Number of free NC contacts -Test voltage 50 Hz, 1 min	A A V	5 8 8 2000			

5	<b>Motor operated spring system</b> -Mechanism type reference -Motor voltages Rated voltage Max. permissible service voltage minimum service voltage -starting current of motor	          V d.c. V d.c. V A	Specify   110 121 93.5 Specify			
5	<b>Power consumption of motor</b> -When starting -When running -Running time of motor for one tensioning operation -stored energy of tensioned closing spring(s) -Charging time	      W W s kN s	Specify Specify Specify Specify Specify			
5	<b>Weights</b> -Net weight of 3-pole circuit breaker complete with operating device but excluding separately mounted -Net weight of one separately mounted operating equipment (if any) -Weight of support insulator	      Kg Kg Kg	Specify   Specify Specify			
6	<b>Manufacturers of</b> -Support insulators -breaker insulators -Operating mechanism		Specify Specify Specify			

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 AND DISTRIBUTION COMPANY  
 28 NOV 2023

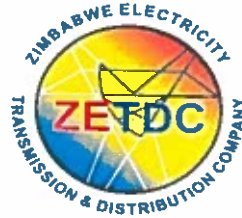
6	<b>Spare parts, for each circuit breaker</b> Complete driving mechanism Complete CB pole Trip coils Closing coils Set of contactors Set of gaskets/seals for each CB pole Heating resistors for driving mechanism Set of MCBs for driving mechanism		1(one)  1(one) 4(four) 4(four) 1(one) 1(one)  2(two)  1(one)			
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Tenderer's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

ZIMBABWE ELECTRICITY AND DISTRIBUTION COMPANY  
 28 NOV 2023  
 P.O. BOX 1760, HARARE, ZIMBABWE  
 TEL: 775061 (02) 775 000

*Handwritten initials*

**ZETDC**

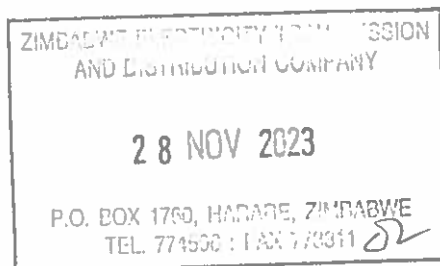


**DISTRIBUTION SERVICES DEPARTMENT**

**SPECIFICATION NO. DS26092018CT**

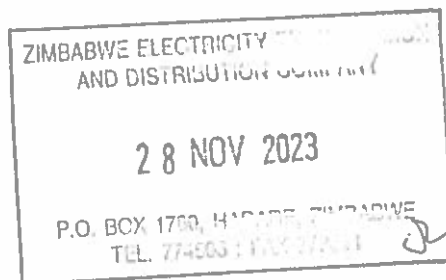
**SPECIFICATION FOR**

**CURRENT TRANSFORMERS RATED UP TO 132KV**



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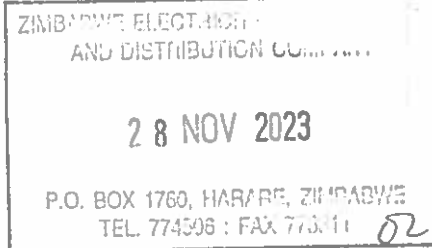
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ZETDC SPECIFICATION NO. DS26092018CT

CURRENT TRANSFORMERS



**1 SCOPE**

This specification covers the design, manufacture, testing and inspection before dispatch and delivery of 11kV, 33kV and 132kV oil immersed, natural air cooled outdoor type current transformers and accessories. All current transformers' secondary connections shall be brought out to terminal blocks where wye or delta connection will be made.

The Supplier shall state name, place and country of manufacture. The Supplier shall state whether or not the current transformers are produced under license, in which case licence holders name shall be stated.

Tenders shall include a complete statement of compliance with this specification and the Technical Guarantee Schedule shall be completed. For every clause in this specification the Tenderer shall state compliance or non-compliance and shall elaborate where appropriate, i.e. "Comply", "Do Not Comply" or "Noted".

Spares as recommended by the manufacturer should be included in the scope of supply.

**2. PARTICULARS OF THE ELECTRICAL SYSTEM**

Unless otherwise specified in the Schedule of Requirements, it must be assumed that the electrical system in which the Current transformers will operate in is;

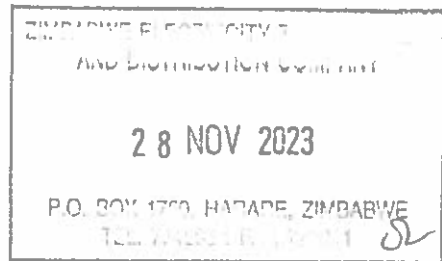
- a) Three phase overhead-line construction and underground system. The maximum earth fault factor on the network is 1.5.
- b) Operated at 50 Hz, with approximately sinusoidal wave form.
- c) The highest system voltage does not normally exceed the nominal system voltage by more than 10%.  
The nominal system voltages are 132kV, 33 kV and 11 kV.
- d) The system frequency variation does not exceed plus or minus 2.5% from 50 Hz.

Designs should allow for these variations

**3. PARTICULARS OF THE ENVIRONMENT**

Current transformers will operate within the tropics and will be subjected to sudden ambient air temperature changes of the order of 10 °C per hour, occurring at the onset of rain, but the barometric pressure at any given place does not vary by more than approximately 10mm Mercury. Frequent and severe lightning storms occur during summer months, with isoceraunic levels varying between 50 and 100 thunderstorm days per annum.

The Current transformers shall be capable of operating under the following environmental conditions.



a) **Ambient temperatures:**

- (i) Maximum: 45 °C
- (ii) Minimum: minus 10 °C
- (iii) Maximum daily average: 35 °C

b) **Altitude:**

Maximum altitude of 1 500 metres above sea level. The design shall allow for reduced cooling effect due to high altitude.

c) **Humidity:**

Humidity of 13mg per cubic metre absolute and 65% relative before storms with vapour pressure of 17mmHg.

d) **Lightning:**

Frequent and severe lightning storms occur during summer months, with isoceraunic levels varying between 50 and 100 thunderstorm days per annum.

e) **Dust:**

Particular attention should be paid in the design of all equipment to ensure that there is no damage to working parts or insulation through the ingress of dust, insects, vermin which are prevalent for long periods in the year.

***It is the supplier's responsibility to make himself familiar with any other climatic and physical conditions pertaining in Zimbabwe and to supply current transformers which meet all such conditions.***

#### **4. LANGUAGE, UNITS AND STANDARDS**

All tenders, correspondence, description upon drawings, illustrations or instructions shall be in unambiguous English Language. SI Units of measurements shall be used throughout.

Except where modified by ZETDC's Specifications, IEC Recommendations (*IEC 60044-1 (1996-12) Instrument Transformers Part 1: Current Transformers*) shall apply throughout or British Standards (BS) where they amplify the IEC 60044-1. In the case of conflict between the above stated standards and this specification, the ruling of this specification shall prevail.

#### **5. DEFINITIONS**

Throughout this document, the following terms shall be used in the manner defined below:

- May** - indicates the existence of an option
- Shall** - indicates that a statement is mandatory
- Should** - indicates a recommendation

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## 6. CURRENT TRANSFORMER DESIGN

### 6.1 GENERAL

- The current transformers shall be single-phase, oil-immersed, post mounted on one insulator for mounting on a steel structure. The number of cores and ratios shall be as specified in the Technical Guarantee Schedule.
- The characteristics of the current transformers shall comply with the provisions stipulated in the IEC 185 standard.
- The current transformers shall be outdoor post type and shall be suitable for mounting on individual steel structures.
- The primary connections shall be silver-plated.
- The different ratios specified shall be achieved by secondary taps only without any recourse to primary connection.
- Core laminations shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores used for protection shall produce undistorted secondary current under transient conditions at all ratios with specified CT parameters.
- The output of the current transformers for measuring and protection purposes shall be determined according to the technical requirements, but shall not be less than 125% of the overall design burden of the connected apparatus and conductors.
- The current transformer characteristics shall be such as to provide satisfactory performance of burdens ranging from 25% (0.25 p. u) to 100% (1.0 p. u) of rated burden over a range of 10% to 100% rated current in case of metering CTs and up to the accuracy limit factor/knee point voltage in case of relaying CTs. The guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
- The instrument security factor at all ratios shall be less than five (5) for the metering core.
- The current transformer secondary shall be designed for insulation adequacy at the following voltages:

Power frequency test voltage on secondary windings, 1 min                      2.5kV

Overvoltage inter-tern test, 1 min                                                              3.5kV.

The Contractor shall demonstrate that the current transformers selected will ensure correct functioning of the associated protective equipment.

## 6.2 INSULATION MEDIUM

The supplied current transformers shall be oil filled. Each current transformer shall be equipped with an oil level gauge to be easily visible from the ground. The oil of the current transformer shall be hermetically sealed against the ambient air. In order to compensate fluctuations for the oil volume owing to temperature changes, flexible metal bellows or oil-resistant rubber covers shall be provided. The sealing method shall be described in the Bid. The current transformers shall be guaranteed against oil leaks for at least 5 years.

## 6.3 PRESSURE RELIEF DEVICE

The CT shall be designed so as to achieve the minimum risks of explosion in service. The Bidder shall indicate what measures are provided for relieving dangerous pressure rises that may develop due to an internal electrical fault. The expansion chamber at the top of the porcelain insulators should be suitable for expansion of oil.

## 6.4 SHORT TIME CURRENT RATING

All current transformers shall have a maximum short-time current rating, at rated output of not less than 31.5 kA for three seconds.

## 6.5 TERMINAL BOX

All secondary connections shall be connected to a terminal block which shall be located in a dust-proof and watertight housing. The current transformer shall have single primary either ring type or hair pin type and suitably designed for bringing out the secondary terminals in a weather proof (IP 55) terminal box mounted at the bottom. The secondary terminals shall be terminated to stud type non-disconnecting terminal blocks inside the terminal box. An earth connection to the housing shall be provided. In case of Bar Primary inverted type current transformers being offered, the following additional requirements shall be met by the supplier:

- i. The secondaries shall be totally encased in metallic shielding providing a uniform equipotential surface for even electric field distribution.
- ii. The lowest part of the insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses.
- iii. The upper part of the insulation assembly resting on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome.
- iv. Nitrogen if used for hermetic sealing (in case of live tank design) should not come in contact with oil.

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## 6.6 CURRENT RATING

The current transformers shall be designed to carry continuously a current of 120% of the rated current. For 132kV Class CTs the rated extended primary current shall be 120% on all cores on the CTs. The characteristics of the current transformers shall comply with the provisions stipulated in IEC 60185. The rated current of the secondary windings shall be 1A unless specified otherwise.

## 6.7 CREEPAGE DISTANCE

The current transformer insulator creepage distance shall not be less than 25mm/kV.

## 7. TESTS

### 7.1 TEST CERTIFICATES AND REPORTS

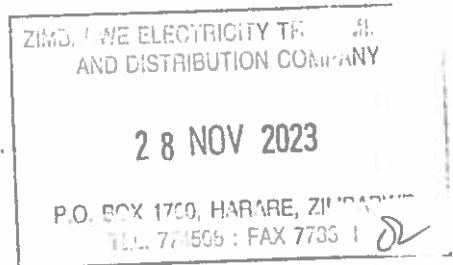
The current transformers shall pass the manufacturer's standard test routine, and such test report shall be submitted with the bid. The report shall clearly indicate the tests performed and to which international standard they conform to. In addition, the bid shall be submitted with type tests certificates from independent internationally recognized test laboratories of the following tests in accordance with the latest IEC 60044-1 recommendations. The type tests shall include the following tests

- Short time current test
- Lightning impulse test
- Wet test for outdoor type transformer
- Determination of error. Radio interference test.
- Seismic withstand test.
- Thermal stability test, i.e. application of the rated voltage and rated extended current thermal current simultaneously by synthetic test circuit.
- Thermal co-efficient test, i.e. measure of Tan delta as a function of temperature (at ambient and between 80°C & 90°C) and voltage (at 0.3, 0.7, 1.0 and 1.1  $U_{m/N3}$ ). The current transformer shall be subjected to fast transient test by any one of the following two methods given below to assess the CT performance in service to withstand the high frequency over voltages generated due to closing and opening of isolators as per method specified in IEC 44-1.

### 7.2 ROUTINE (TYPE) TESTS.

The following routine tests shall be carried on the current Transformers.

- i. Measurement of capacitance.
- ii. High voltage power frequency withstand tests on secondary windings.



- iii. Overvoltage inter turn test (as per IEC: 600601).
- iv. Oil leak test.
- v. Measurement of tan delta at 0.3, 0.7, 1.0 and 1.1 Um/ $\sqrt{3}$ .
- vi. Measurement of partial discharge shall be carried as per IEC.

### 7.3 FACTORY ACCEPTANCE TESTS

FACTORY ACCEPTANCE TEST SHALL BE CARRIED OUT PRIOR TO DELIVERY AND SHALL BE AT THE EXPENSE OF THE SUPPLIER.

### 8. Rating Plate

Ratings and data of the current transformers shall be provided on the name plate, which shall be weather and corrosion proof. The name plate shall be securely attached to the side of the (lower part) current transformers so that it could be easily read from the ground level when it is installed at a height of 2.5 m from the ground level. It shall consist of the following information: -

- (a) Number and year of the standard adopted.
- (b) The manufacturer's identification.
- (c) A serial number and type designation.
- (d) The rated primary and secondary currents.
- (e) The rated primary and secondary Voltage.
- (f) The rated frequency.
- (g) The rated output and the corresponding accuracy class of current transformer.
- (h) Class of insulation.

Details of a specimen of the rating plate shall be furnished with the bid.



### 9. MATERIAL

#### 9.1 QUALITY OF MATERIAL

All materials shall be new and of the best available quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions

arising under working conditions without distortion or deterioration in the setting up of undue stresses in any parts and also without affecting the suitability of the various parts of the Works for which they were designed. No toxic material (such as Halon, PCB, Asbestos) shall be utilised.

## **9.2 Electrical Equipment Material**

All materials incorporated in the equipment supplied shall be new and of first-class commercial quality, free from defects and imperfections. Copper and aluminium used as electrical conductors shall be of the electrolytic type and comply with the respective ASTM or DIN Standards.

## **9.3 Surface Treatment and Painting**

Outdoor installations and indoor installations in wet and damp rooms shall at least have one priming coat and two layers of paint on zinc powder basis applied after perfect cleaning and/or sandblasting. Parts that cannot be readily painted shall be hot-dip galvanised. Outdoor fittings for distribution boxes, etc. shall be hot-dip galvanised, minimum zinc coating shall be 600 g per m<sup>2</sup>. All interior surfaces of electrical apparatus, cabinets, etc. including contactors, relays, coils, etc. shall be treated in an approved manner to prevent mould growth. Such treatment shall in no way interfere with the proper operation of the equipment either electrically or mechanically. All galvanising shall be in accordance with BS EN ISO 1461-2009 or other internationally approved standards. Steel below ground shall in addition to galvanising be protected with Bitumen or a substance of similar quality.

The particulars of priming and finishing paintings shall be stated in the Tender, with specifications of paint, together with a listing of colours available, for each of the plant and equipment. The Employer is not bound to accept the finishing colour proposed by the Tenderer. Determination of colour shall be at the option of the Employer and shall be finalised at the time of approval of drawings.

## **9.4 INSULATING OIL**

Insulating oil for use in instrument transformers shall be of EHV grade and shall conform to IEC: 156.

## **9.5 BOLTS, STUDS, NUTS, SCREWS, WASHERS, ETC**

- All bolts, studs, nuts, etc., shall have a standard metric threading and conform to the relevant standards as regards shape and tolerance. They shall be marked by the manufacturer's symbol and class of strength.
- All bolts, studs, nuts, washers, screws, etc., above 10mm diameter, if not in stainless steel or other corrosion-resistant material, shall be hot-dip galvanised, except for bolts above Strength Class 8.8. In this case, corrosion-resistant material will be preferred. Bolts, etc., smaller than 10mm diameter shall be electrolytic zinc-coated if not provided in stainless steel or other corrosion-resistant material.
- Bolts, nuts, studs and screws which require frequent tightening and unbolting during inspection or maintenance procedures shall be of stainless steel.
- All bolts and nuts shall be hexagonal, either normally or of the round head socket type and secured in an approved manner against becoming loose during operation.

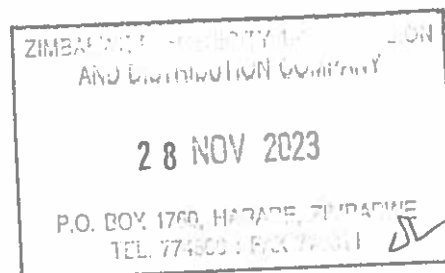
- The Contractor shall supply the net quantities plus 5% of all permanent bolts, screws and other similar items and materials required for installation of the works at the site. Any such rivets, bolts, screws, etc., which are surplus after the installation of the equipment has been completed shall become spare parts and shall be wrapped, marked and handed over to the Purchaser.
- Taper pins shall have threaded stems with nuts where dismantling of the pins is likely to be required. Bolts shall not protrude more than 10 mm beyond the nut but not less than two full threads.

#### 9.6 CONSTRUCTIONAL FEATURES

- (a) The features and constructional details of current transformer shall be in accordance with requirements stated hereunder:

#### 9.7 BUSHING/INSULATORS.

- a) The instrument transformers shall be oil filled, with shaded composite bushings/insulators for outdoor service and upright mounting on steel structures.
- b) The bushing/insulator shall be one piece without any metallic flange joint.
- c) Bushings shall be provided with oil filling and drain plugs, oil sight glass of CT. The bushing/insulator of instrument transformer shall have cantilever strength of not less than 350kg.
- d) Instrument transformers shall be hermetically sealed units. The supplier shall furnish details of the arrangements made for the sealing of the instruments transformers.
- e) The supplier shall again furnish the details of site tests to check the effectiveness of the hermetic sealing.
- f) Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.





### 10. TECHNICAL GUARANTEE SCHEDULE: 11kV CURRENT TRANSFORMERS

Please complete this schedule by stating the actual tendered current transformers specification and sign as indicated.

Name of Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Type: \_\_\_\_\_

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TEL: 77306 : FAX 77306

Item	Description	Unit	Requirement	Guaranteed Value	Corresponding reference page in spec sheet/technical brochure
1	Reference standard		IEC 60044-1		
2	Rated voltage (Un)	kV	11		
3	Maximum service voltage (Um)	kV	12		
4	Rated Frequency	Hz	50		
5	Accuracy Class Metering Core	-	0.5		
6	Rated Burden Metering Core	VA	15		
7	Rated Secondary Current Metering Core	A	1		
8	Accuracy Class Protection Core	-	5P20		
9	Rated Burden Protection Core	VA	20		
10	Rated Secondary Current Protection Core	A	1		
11	Number of protection cores	-	2		

12	Number of metering cores	-	1		
13	Power Frequency Withstand Voltage	kV	28 rms		
14	Lightning Impulse Withstand Voltage	kV	75 peak		
15	Secondary Winding Resistance at 75°C	Ω	specify		
16	Knee point E.M.F.	V	specify		
17	Rated Accuracy Limit Factor	-	specify		
18	Rated Dynamic Peak Current	kA	specify		
19	Rated Short Time Thermal Current	kA	31.5 per 3 seconds		
20	Specific creepage distance across insulator	mm/ KV	25		
21	Arcing distance across insulator	mm	Specify		
	<b>Overall dimensions</b>				
22	- Length	mm	Specify		
23	- Width	mm	Specify		
24	- Height	mm	Specify		
25	Total weight of one current transformer	kg	Specify		

Tenderer's Signature.....

Date.....

File: .....  
AND DISTANCE.....

### 11. TECHNICAL GUARANTEE SCHEDULE: 33kV CURRENT TRANSFORMER

Please complete this schedule by stating the actual tendered current transformer specification and sign as indicated.

Name of Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Type: \_\_\_\_\_



ITEM	Description	Units	Requirement	Guaranteed value	Reference page in technical brochure
1	Reference standard		IEC 60044-1		
2	Rated voltage (Un)	kV	33		
3	Maximum service voltage (Um)	kV	36		
4	Rated Frequency	Hz	50		
5	Accuracy Class Metering Core	-	0.5		
6	Rated Burden Metering Core	VA	15		
7	Rated Secondary Current Metering Core	A	1		
8	Accuracy Class Protection Core	-	5P20		
9	Rated Burden Protection Core	VA	20		
10	Rated Secondary Current Protection Core	A	1		
11	Number of protection cores	-	2		
12	Number of metering cores	-	1		
13	Power Frequency Withstand Voltage	kV	70 rms		
14	Lightning Impulse Withstand Voltage	kV	170 peak		

15	Secondary Winding Resistance at 75°C	Ω	specify		
16	Knee point E.M.F.	V	specify		
17	Rated Accuracy Limit Factor	-	specify		
18	Rated Dynamic Peak Current	kA	specify		
19	Rated Short Time Thermal Current	kA	31.5 per 3 seconds		
20	Specific creepage distance across insulator	mm/ KV	25		
21	Arcing distance across insulator	mm	Specify		
	<b>Overall dimensions</b>				
22	- Length	mm	Specify		
23	- Width	mm	Specify		
24	- Height	mm	Specify		
25	Total weight of one CT	kg	Specify		

Tenderer's Signature.....

Date.....

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28 NOV 2023

P.O. BOX 1700, HARARE, ZIMBABWE  
TEL: 774036 ; FAX: 774037

## 12. TECHNICAL GUARANTEE SCHEDULE: 132kV CURRENT TRANSFORMERS

Please complete this schedule by stating the actual tendered current transformer specification and sign as indicated.

Name of Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Type: \_\_\_\_\_

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P.O. BOX 1760, HARARE, ZIMBABWE  
TEL: 774506 : FAX 773311 *SR*

Item	Description	Units	Required	Guaranteed Value	Remarks	Corresponding reference page in spec sheet
1.	Reference standard		IEC 60044-1			
2.	Rated voltage (Un)	kV	132			
3.	Maximum service voltage (Um)	kV	145kV			
4.	Rated frequency	Hz	50			
5.	<i>One-minute power frequency test voltage of</i>					
6.	- primary winding	kV rms	275			
	- Secondary Winding	KV rms	3			
7.	Lightning impulse withstand voltage	kV peak	650			
8.	Switching impulse withstand voltage	kV peak	510			
9.	Rated primary current	A	400			
10.	Rated secondary current	A	1			
11.	Turns Ratio		See schedule of requirements			
12.	Reconnection (Primary and/or		None			

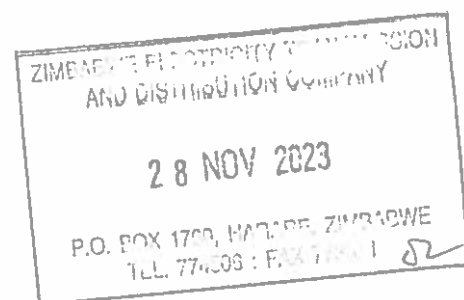
	Secondary)					
13.	<b>Short time thermal rating</b>					
	- 1 second	kA rms	25 (min)			
	- Short time dynamic rating	kA peak	78			
14.	<b>Temperature rise for continuous full load operation</b>					
	- in the windings	°C	65			
	- in the oil	°C	55			
15.	Number of Cores		7			
16.	<b>Thermal current rating factor burden and accuracy class of :</b>					
	- 3 x protection cores - Core 1-3	VA/Class	15 VA 5P20			
	Instrument Accuracy limit factor equal to or greater than		10			
	- 2 x measuring cores - core 4-5 (main and check)	VA/Class	15VA 0.2s			
	Instrument Security factor less than or equal to		5.0			
	- 2 x busbar protection cores - core 6 - 7	VA/Class	15VA X			
17.	Permitted static load (primary terminals)	KN	3			
18.	Permitted dynamic load (primary terminals)	KN	3			

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19.	Specific creepage distance across insulator	mm/ KV	31			
20.	Arcing distance across insulator	mm	Specify			
21.	<b>Overall dimensions</b>					
	- Length	mm	Specify			
	- Width	mm	Specify			
	- Height	mm	Specify			
22.	Total weight of one current transformer	kg	Specify			
23.	Weight of oil of one current transformer	kg	Specify			
24.	Commercial name of oil used		Specify			
25.	<b>Current density</b>					
	- in primary winding	A/mm <sup>2</sup>	Specify			
	- in secondary winding	A/mm <sup>2</sup>	Specify			
26.	Core type		round			
27.	Core material		Silicone steel			

Tenderer's Signature: \_\_\_\_\_ Date: \_\_\_\_\_



**ZETDC**



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TRANSMISSION AND DISTRIBUTION COMPANY  
28 NOV 2023  
P.O. BOX 1700, HARARE, ZIMBABWE  
TEL: 774906 : FAX 772311 *DL*

**DISTRIBUTION DEPARTMENT**

**ZETDC SPECIFICATION NO. DS17092018ISL**

**SPECIFICATION FOR**

**OUTDOOR GANGED CENTRE ROTATING ISOLATORS RATED UP TO**

**132KV**



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ZIMBABWE ELECTRICITY SUPPLY AND DISTRIBUTION BOARD

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P.O. BOX 1700, HARARE, ZIMBABWE  
TEL: 773030 : FAX 773011

**ZETDC SPECIFICATION NO. DS17092018ISL  
ISOLATORS**

**DEFINITION AND INTERPRETATION**

**AC** – Alternating Current

**ANSI** – American National Standards Institute

**ASTM** – American Society for Testing and Materials

**BS** – British Standards

**DC** – Direct Current

**DIN** - German Institute for Standardization

**EN** - European Norm

**Hz** – Hertz

**IEC** – International Electromechanical Commission

**ISO** - International Standards Organisation

**KV**- Kilovolt

**MVA** - Mega Volt Amp

**NC** – Normally Close

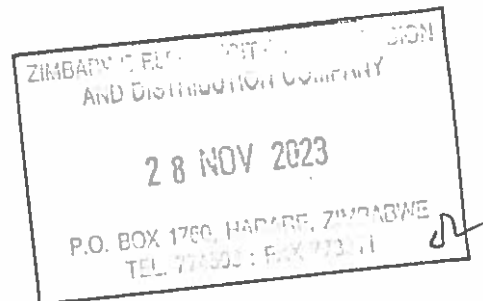
**NO** – Normally Open

**PCB** – Poly Chlorinated Biphenyl

**SCADA** - Supervisory Control and Data Acquisition

**V** – Volt

**ZETDC** – Zimbabwe Electricity Transmission and Distribution Company



## 1. SCOPE

The specification provides for the design, engineering, manufacture, inspection and testing before dispatch, supply and delivery of 3 phases, Ganged, Double Break Centre Rotating Isolators with earth switch, all accessories for outdoor use and an operating handle for manual operation standing on ground level. The isolator shall be used in 3phase AC 50Hz power circuit, it shall be used as switching on and off at the voltage with no load.

The Supplier shall state name, place and country of manufacture. The Supplier shall state whether or not the isolators are produced under license, in which case the licence holders' name shall be stated.

Tenderers shall include a complete statement of compliance with this specification. For every clause in this specification the Tenderer shall state compliance or non-compliance and shall elaborate where appropriate.

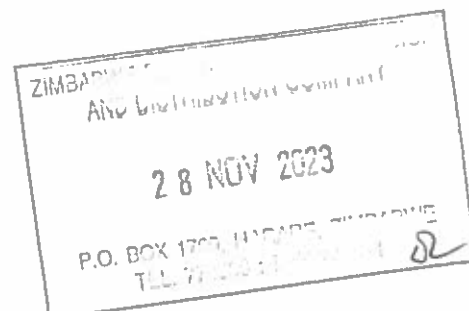
Tenderers shall use the words "comply", "do not comply" with this specification or in the clauses of an informative nature, "noted". Where the words "do not comply" are used the Tenderer shall state whether modifications could be made and whether modifications would be undertaken. The cost implications of such modifications must be indicated in the statement of compliance as well as the pricing schedules.

## 2. PARTICULARS OF THE ELECTRICAL SYSTEM

Unless otherwise specified in the Schedule of Requirements, it must be assumed that the electrical system in which the isolators will be used in is;

- a) Three phase overhead-line construction and underground system. The maximum earth fault factor on the network is 1.5.
- b) Operated at 50 Hz, with approximately sinusoidal wave form.
- c) The highest system voltage does not normally exceed the nominal system voltage by more than 10%. The nominal system voltages are 132kV, 33 kV, 11 kV and 0.4kV.
- d) The system frequency variation does not exceed plus or minus 2.5% from 50 Hz.
- e) Phase Relationship - The phase relations and designations shall be in accordance with the existing system of the Employer. The standard phase colours are Red, Yellow, Blue (RYB).
- f) The equipment shall be designed to withstand the most severe short circuit stresses expected during service conditions.
- g) The minimum symmetrical short circuit capacity at nominally operating voltage shall be 31.5kA for 132kV, 33 kV and 11 kV system.
- h) For all current carrying parts, the permissible short circuit duration shall be at least 1 second.
- i) Indoor equipment shall be arc tested in accordance with IEC 60298 amendment 2.

Designs should allow for these variations.



### 3. PARTICULARS OF THE ENVIRONMENT

Isolators will operate within the tropics and will be subjected to sudden ambient air temperature changes of the order of 10 °C per hour, occurring at the onset of rain, but the barometric pressure at any given place does not vary by more than approximately 10mm Mercury. Frequent and severe lightning storms occur during summer months, with isoceraunic levels varying between 50 and 100 thunderstorm days per annum.

The Isolators shall be capable of operating under the following environmental conditions.

- a) **Ambient temperatures:**
- (i) Maximum: 45 °C
  - (ii) Minimum: minus 10 °C
  - (iii) Maximum daily average: 35 °C

b) **Altitude:**

Maximum altitude of 1 500 metres above sea level. The design shall allow for reduced cooling effect due to high altitude.

c) **Humidity:**

Humidity of 13mg per cubic metre absolute and 65% relative before storms with vapour pressure of 17mmHg.

d) **Lightning:**

Frequent and severe lightning storms occur during summer months, with isoceraunic levels varying between 50 and 100 thunderstorm days per annum.

j) **Dust:**

Particular attention should be paid in the design of all equipment to ensure that there is no damage to working parts or insulation through the ingress of dust, insects, vermin which are prevalent for long periods in the year.

*It is the supplier's responsibility to make himself familiar with any other climatic and physical conditions pertaining in Zimbabwe and to supply isolators which meet all such conditions.*

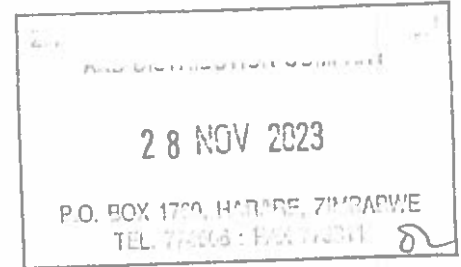
### 4. LANGUAGE, UNITS AND STANDARDS

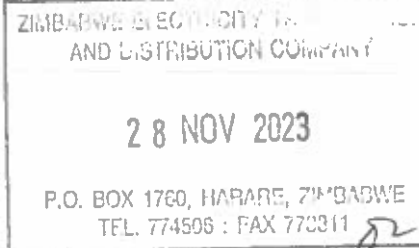
All tenders, correspondence, description upon drawings, illustrations or instructions shall be in unambiguous English Language. SI units of measurements shall be used throughout.

Except where modified by ZETDC's specifications, IEC recommendations (IEC 60964: 1996, IEC62271-102:2002) shall apply throughout. In the case of conflict between the above stated standards and this specification, the ruling of this specification shall prevail.

### 5. TECHNICAL SCHEDULES

The Technical Schedules shall be filled in and completed by the Bidder, and submitted with the Bid. All data entered in the Schedules of Technical Guarantees are guaranteed values by the Bidder and cannot be departed from whatsoever. All data entered in the Schedules of Informative Data are also guaranteed values by the Bidder. These data may only be altered following the Engineer's written consent.





## 6. DESIGN & CONSTRUCTION

### 6.1 TYPE

The Isolators shall be outdoor type with three phases. All Isolators offered shall be suitable for horizontal upright mounting on steel structures. Each pole unit of the Isolators and earth switches shall be of identical construction and mechanically linked for gang operation. Each pole of the Isolator shall be provided with two sets of contacts to be operated in series and the moving contact blades shall rotate in a horizontal plane. The angle of rotation of the moving contact blades should be such that it does not make contact with the other phases. It should be suitable for continuous service at the system voltages specified herein. The isolators shall be suitable to carry the rated current continuously and full short circuit current at site condition without any appreciable rise in temperature. These shall also be suitable for operation at 110% rated (normal) voltage. The isolators shall be so constructed that they don't open under the influence of short circuit conditions. The Isolators and earth switches are required to be used on electrically exposed installation and this should be taken into account while fixing the clearance between phases and between phase and earth.

### 6.2 MAIN CONTACTS

Isolator shall have heavy duty, self-aligning and high pressure line type contacts made of high conductivity, corrosion resistant, hard -drawn electrolytic copper. All copper contact points shall be silver plated to 25 micron thickness or more. Fixed contact should be of reverse loop type with adequate number of copper strips which shall be backed by powerful phosphor bronze/stainless steel springs. The Isolator moving arm/blade shall be made out of high conductivity, corrosion resistant, hard -drawn electrolytic copper of proper length, thickness and contact/surface. The dimensions of the contacts should conform to the drawing approved during type test.

These fixed and moving contacts shall be able to carry the rated current continuously and the maximum fault current without any appreciable rise in temperature. The isolator blades shall retain their form and straightness under all conditions of operation including all mechanical stress arising out of operation as well as under rated short circuit condition. The Isolator shall be self-cleaning type so that when Isolator remains closed for long periods in a heavily polluted atmosphere, binding does not occur. No undue wear or scuffing shall be evident during the mechanical endurance tests. Contacts and springs shall be designed so that adjustment of contact pressure shall not be necessary throughout the life of the isolator. Contact springs shall not carry any current and shall not lose their characteristics due to heating effects. Each contact or part of contacts shall be independently sprung so that full pressure is maintained on all contact at all times.

### 6.3 BASE

Each single pole of the isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure. Base channel shall be rigid in construction and capable of taking all the loads like short circuit force, terminal load, wind load and vibration caused due to seismic / operation of Isolator. Leveling screws of adequate size shall be provided on either side of the base channel under the Insulator for the alignment of Isolator.

### 6.4 AUXILIARY SWITCHES

All isolators and earth switches shall be provided with 110V DC auxiliary switches for remote position indication on the control panel. The auxiliary switches and auxiliary circuits shall have a continuous current carrying capacity of at least 10 Amps.

Auxiliary switches shall not be used as limit switches. Details of make, rating and type of auxiliary switch along with the type test report shall be furnished in the offer.

### 6.5 EARTH SWITCH

Earth switches shall include the complete operating mechanism and auxiliary contacts. The earth switch shall be operated by a separate mechanism. The earth switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator. Earth switches shall be only locally operated. The earth switches shall be constructionally interlocked with the isolator so that the earth switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator.

The isolator and the earthing switch shall be interlocked according to the following principle:

- Isolator only ON when earthing switch is OFF.
- Earthing switch only ON when isolator is OFF and earthing senses no volts.

The total breaking time or close time of the isolator shall be as short as possible, but in no case is it to be longer than 12 sec.

Each earth switch shall be provided with flexible copper braids or any other improved design for connection to earth terminal. These braids shall have the same short time current carrying capacity as the earth blade. The plane of movement and final position of the earth blades shall be such that adequate electrical clearances are obtained from adjacent live parts in the course of its movement between ON and OFF position. Isolator design shall be such as to permit addition of earth switches at a future date. It should be possible to interchange position of earth switch to either side. The earth switch should be able to carry the same fault current as the main blades of the Isolators and shall withstand dynamic stresses.

### 6.6 INSULATORS

Support insulators for all type of isolators shall be of solid core type. All insulators types shall have a polymeric rubber housing of a sound quality, free from defects and thoroughly vitrified. The insulators shall be unaffected by atmospheric conditions due to weather, fumes, ozone's, acids, alkalis, dust or rapid changes of temperature between minus 10<sup>o</sup> C and plus 50<sup>o</sup> C under working conditions.

The polymeric rubber shall not engage directly with hard metal and, where necessary, an approved resilient material shall be interposed between the polymeric rubber and end fittings. All fixing material used shall be of approved quality and shall not enter into chemical action with the metal parts or cause fracture by expansion during service. Where cement is used as a fixing medium, the thickness of cement shall be as small and even as possible and proper care shall be taken to centre and locate the individual parts correctly during cementing.

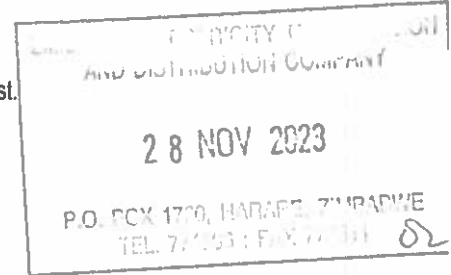
All insulators shall comply with technical requirements listed in schedule of requirements below. The insulators shall have a design life of at least 40 years when operating under the specified conditions. This shall be verified through accelerated life cycle tests. The total creepage distance of the insulators shall not be less than the minimum values specified. The design of insulators and fittings shall be such as to avoid local corona formation and no significant radio interference shall be exhibited. The insulator units conform to the electrical and mechanical design criteria stated in the technical tables in this Specification.

Wherever galvanising is specified, the galvanising shall be by the hot dip process with a minimum zinc layer of 610g/m<sup>2</sup>.

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All insulators shall conform to IEC-233. All routine and sample tests shall be conducted on the insulator columns as per these standards with requirements and procedures modified as under:

- i) Bending load test as a routine test.
- ii) Bending load test as a sample test on each lot.
- iii) In addition to above, ultrasonic test shall be carried out as additional routine test.



## 6.7 OPERATION

### 6.7.1 11kV and 33kV Isolators

The isolators shall be manual operated. The main Isolator and earth switches shall be mechanically gang operated. The operating mechanism of the three poles shall be well synchronized and interlocked. The Isolator blades shall be in positive continuous control throughout the entire cycles of operation. The operating rods and pipes shall be rigid enough to maintain positive control under most adverse conditions and to withstand all torsional and bending stresses arising from operation. Operation of the switches at any speed should not result in improper functioning, in displacement of parts / machines after final adjustment has been made. All holes in cranks, linkages etc. having moving pins shall be drilled and fitted accurately so as to prevent slackness and lost motion. The isolator and earth switches shall be provided with "dead center mechanism" to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures. The isolator shall satisfactorily withstand the high stresses imposed on it during fault clearing, load rejection and re-energisation of lines with trapped charges.

### 6.7.2 132kV isolators

The isolators shall have a motor-operated mechanism. Pneumatic operating mechanism is not accepted.

The mechanism shall be provided for electrical local and remote control. The control voltage for closing and opening commands and for the operating mechanism motor(s) shall be:

110 V DC + 10% - 20%, unearthed, operated from battery.

A local position indicator, visible with the panel door open, shall be mounted in the front panel of the operating mechanism cubicle. Push buttons for operating the isolator shall be located not more than 1.7 m above ground.

A local/remote control selector switch shall be provided in the cubicle. With the selector switch set to local control, operation from any remote source including the protective relays shall be inhibited. The switch shall have spare contacts for remote operation.

A crank, lever or other similar suitable device shall be provided to permit close/open operation of mechanism by hand in the event of a failure of the auxiliary supplies.

The main Isolator and earth switches shall be mechanically gang operated. The operating mechanism of the three poles shall be well synchronized and interlocked. The Isolator blades shall be in positive continuous control throughout the entire cycles of operation. The operating rods and pipes shall be rigid enough to maintain positive control under most adverse conditions and to withstand all torsional and bending stresses arising from operation. Operation of the switches at any speed should not result in improper functioning, in displacement of parts / machines after final adjustment has been made. All holes in cranks, linkages etc. having moving pins shall be drilled and fitted accurately so as to prevent slackness and lost motion. The isolator and earth switches shall be provided with "dead center mechanism" to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures. The isolator shall satisfactorily withstand the high stresses imposed on it during fault clearing, load rejection and re-energisation of lines with trapped charges.

The complete operating mechanism, including the controls, shall be built in water-tight and dust-proof cubicle (min. IP 54). All parts shall be easily accessible without dismantling other parts. Openings, covered with dust filters, shall allow a good ventilation of the cubicle. In order to avoid any moisture, thermostat controlled heaters for 220 V AC shall be built-in.

A sufficient number of auxiliary contacts, with at least 4 NO and 4 NC contacts as spare, for 110 V DC shall be provided for control and interlock purposes.

Motors shall be designed in accordance with valid IEC publication and shall be effectively protected by miniature circuit breakers, with alarm contacts.

All wiring shall lead to terminals. 10% of the terminals shall be spare.

## 6.8 DESIGN, MATERIALS AND WORKMANSHIP

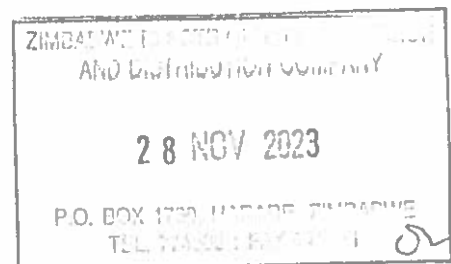
### 6.8.1 General

All ferrous metal parts shall be hot dip galvanized. All metal parts shall be of such materials or treated in such a way so as to avoid rust, corrosion and deterioration due to continued exposure to atmosphere and rain. Bolts, screws and pins shall be provided with standard locking device viz. Locknuts, spring washers, keys etc. and when used with current carrying parts, they shall be made of copper silicon or other high conductivity and wear resistant alloys. The switches should not need lubrication of any parts except at very long interval of five-year minimum.

The isolator shall be complete with terminal connectors, operating mechanism, control cabinets, piping, cable accessories like glands, terminal blocks, marking ferrules, lugs, galvanised support structure for isolators and control cabinet, the foundation bolts and all other accessories required for carrying out all the functions the isolator is required to perform.

### 6.8.2 Bolts, Studs, Nuts, Screws, Washers, etc

All bolts, studs, nuts, etc., shall have a standard metric threading and conform to the relevant standards as regards shape and tolerance. They shall be marked by the manufacturer's symbol and class of strength.





All bolts, studs, nuts, washers, screws, etc., above 10mm diameter, if not in stainless steel or other corrosion-resistant material, shall be hot-dip galvanised, except for bolts above Strength Class 8.8. In this case, corrosion-resistant material will be preferred. Bolts, etc., smaller than 10mm diameter shall be electrolytic zinc-coated if not provided in stainless steel or other corrosion-resistant material.

Bolts, nuts, studs and screws which require frequent tightening and unbolting during inspection or maintenance procedures shall be of stainless steel.

All bolts and nuts shall be hexagonal, either normally or of the round head socket type and secured in an approved manner against becoming loose during operation.

The Contractor shall supply the net quantities plus 5% of all permanent bolts, screws and other similar items and materials required for installation of the works at the site. Any such rivets, bolts, screws, etc., which are surplus after the installation of the equipment has been completed shall become spare parts and shall be wrapped, marked and handed over to the Purchaser.

Taper pins shall have threaded stems with nuts where dismantling of the pins is likely to be required. Bolts shall not protrude more than 10 mm beyond the nut but not less than two full threads.

### **6.8.3 Constructional Features**

The features and constructional details of isolator shall be in accordance with requirements stated hereunder - The gap between the open contacts shall be such that it can withstand at least the rated phase to phase voltage. The isolator should be able to withstand all dielectric stresses imposed on it in open condition.

### **6.8.4 Operating Mechanism and Control**

#### **General Requirements**

- (a) The operating mechanism shall be strong, rigid, not subject to rebound and shall be readily accessible for maintenance, for a man standing on ground.
- (b) A mechanical indicator shall be provided to show open and close positions of the isolator. It shall be located in a position where it will be visible to a man standing on the ground level with the mechanism housing closed.
- (c) Working parts of the mechanism shall be corrosion resistant and bearings that require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the isolator.
- (d) The Supplier shall furnish detailed operation and maintenance manual of the mechanism along with the operation manual for the isolator. The instruction manuals shall contain exploded diagrams with complete storage, handling, erection, commissioning, troubleshooting, servicing and overhauling instructions. The manual shall be written in the

English language and where it is in any other language, a complete written translation into the English language shall be provided.

#### **Control**

- (a) The close and open circuits shall be designed to permit use of momentary contact switches and push buttons.
- (b) The isolator shall normally be operated by remote electrical control. However, provisions shall be made for local electrical control. For this purpose, a local/remote selector switch and close and open control switch/push buttons shall be provided in the isolator control cabinet
- (c) Closing coil and associated circuits shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. The opening coil and associated circuits shall operate correctly under all operating conditions of the isolator for all values of supply voltage between 70% and 110% of rated voltage.
- (d) The auxiliary switch of the isolator shall be positively driven by the isolator operating rod.

#### **Support Structure**

- The structure design shall be such that during operation of the isolator, vibrations are reduced to minimum

#### **Terminal Connector Pad**

- The isolator terminal pads shall be made up of high quality electrolytic copper or aluminium. The terminal pad shall have protective covers, which shall be removed before interconnections.

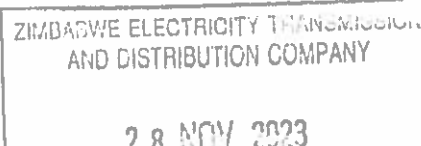
#### **Interpole Cabling**

- (a) All cables shall be armoured and shall be as per IS - 1554 (1100 Volts Grade). All cables within and between isolator and marshalling cubicle shall conform to same standard IS-1554.
- (b) Only stranded conductor shall be used. Minimum size of the conductor shall be 2.5sq. mm. (Copper).
- (c) The cables shall be with oxygen index Min-29 and temperature index as 250°C as per relevant standards

### **7. IDENTIFICATION AND MARKING:**

#### **7.1 General**

All outdoor nameplates and signs shall be made of non-corrosive weatherproof material as aluminium or stainless steel. For labels protected from solar radiation fibreglass reinforced polyester with embedded colour layers can be used. All labels shall be fixed by stainless steel screws or rivets. The Contractor shall supply all label plates and other labelling (of the screw-on type) on control boards, control desks, panels and other places where required for operational, functional and safety reasons. The labelling, size of the plates and their location shall be subject to approval by the Employer. A sample label plate indicating the material and lettering to be used shall be submitted for this purpose. The number of sizes of the various plates shall be kept to a minimum. Unless otherwise approved the isolators submitted, as a batch for a test shall bear the same marks. These marks shall be imprinted and not impressed.



### 7.2 Nameplates

All permanent equipment of the works shall be provided with a securely fixed nameplate showing the maker's name, model, serial number, year of manufacture, main characteristic data of the respective equipment and further relevant information specified in the applicable standards or necessary for the proper identification of the equipment involved. All main equipment shall have the nameplates in English. The Employer may direct special labelling or nameplates to be written in local language.

### 7.3 Warning Labels

For warning labels, yellow background with black text, black borders and red lightning symbol shall be used. Warning labels shall be mounted on all dangerous parts of the installation. This means: On low voltage distribution boards, a general warning label. On all cubicles where back voltage can appear after switches are opened, special warning labels shall be applied. Labelling, as is deemed necessary to prevent dangers arising from maloperation of equipment. Text on warning labels shall be approved by the Employer. A first aid instruction poster shall be placed inside the buildings, near the exit doors. The poster shall show steps and methods to be taken and used in case of electrical accidents where persons are hurt, i.e. first aid principles and how to proceed.

### 7.4 Labels and Plates

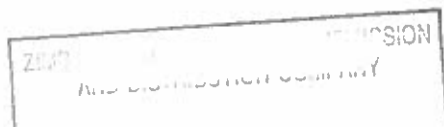
A corrosion-resistant nameplate with clearly legible writing shall be permanently attached to each assembled piece of equipment at an easily visible place. It shall provide all necessary information pertaining to the equipment, but as a minimum, the following must be included: manufacturer's name, type of equipment, serial number, year of manufacture, project identification number, weight, EDS code and other relevant information in compliance with applicable standards. Any special maintenance instructions shall also be shown at this or other suitable location. For other major components i.e., pumps, motors, etc., the following shall be added: Rated power, speed, total head, capacity, direction of rotation, and any other pertinent information.

## 8. PACKAGING:

The Contractor shall be responsible for proper storage for equipment under his responsibility. Care shall be taken to ensure adequate storage to avoid damage to equipment due to rain, dust or strong sunshine. The storage shall be in an environment similar to the installed location, i.e., indoor equipment shall be stored indoors (without heating and ventilation), and outdoor equipment shall be stored outdoors. Where required to protect against condensation and humidity, a desiccant shall be provided and its presence, with the need of periodic removal and dry-out, shall be so marked.

When electric space heaters are provided for that purpose, these should be wired to the outside of the equipment so that energising immediately upon receipt is possible without disassembly of crates, etc. This also requires that no combustible materials be left in the inside of the equipment. Items, which may be subjected to open storage for several months on site shall be suitably packed and protected from the weather. The Contractor shall provide storage and handling instructions including descriptions for periodic inspection and/or storage maintenance to ascertain that no deterioration will occur during storage. One set of these instructions shall be fastened securely to the outside of the shipping unit.

The Contractor shall provide at the Employer's request, the Contractor recommended instructions for long-term storage. When equipment is specified for export shipment, the Contractor shall include packaging adequate for export shipment, and this packaging shall be such as to obtain approval and acceptance by transportation companies. All equipment shall be shipped



from the factory completely assembled as far as practicable, subject to the limitations of length, height, depth, and weight, etc. described in the Conditions of Contract or in the Technical Data Sheets for each of the equipment under this specification.

## 9. ACCESSORIES/ DELIVERABLES

### 9.1 Fittings and Accessories

Following is a partial list of some of the major fittings and accessories to be supplied by Supplier in the Central Control cabinet.

- i) Cable glands (Double compression type), Lugs, Ferrules etc.
- ii) Local/remote changeover switch.
- iii) Control switches to cut off control power supply.
- iv) Fuses as required
- v) The number of terminals provided shall be adequate enough to wire out all contacts and control circuits plus 8 terminals spare for future use.
- vi) D.C. Supervision relays.
- vii) Rating and diagram plate in accordance with IEC incorporating year of manufacture.

### 9.2 Spare Parts and Mandatory Maintenance Equipment

- The Supplier shall include under this project spare parts and maintenance equipment as part of this Project. Calibration certificates of each maintenance equipment or component shall be supplied along with the equipment.

### 9.3 Drawings and Documents

- Bidder to submit along with the bid the drawings, diagrams, dimensions and brochures of the isolator. Drawings showing contacts in open position.

## 10. TEST REQUIREMENTS

### 10.1 Type Tests

- The isolator along with its operating mechanism should have been successfully type tested as per IEC 60129. A type test certificate or type test report shall be submitted with the bidding document.

### 10.2 Routine Tests

- Routine tests as per IEC 60129 shall be performed on all isolators.



### 10.3 Factory Acceptance tests

- Factory acceptance test shall be carried out prior to delivery and shall be at the expense of the supplier. ZETDC personnel shall witness the FATs at the manufacturer's workshop as required for this tender.

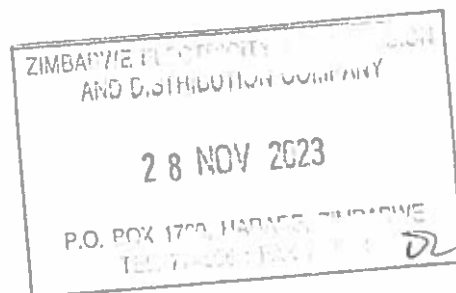
### 11. TRAINING REQUIREMENTS

The Contractor shall give thorough instruction on site concerning the operation and maintenance of all Works supplied by him to the staff appointed by the Employer. Such training shall be organised by the Contractor under the supervision of the Employer and shall be performed by qualified, English-speaking personnel. It shall take place prior to and during the Commissioning Period. The training programme shall be subject to the Employer's approval. Candidates for training selected from among the Employer's organization should have basic relevant qualifications. Their experience should be of a broad and general technical nature, including general familiarity with electronic systems and testing facilities. The supplier's costs should include training.

#### Training Objectives

The training courses shall be designed to:

- Enable staff to perform maintenance and take part in repair of the substation components and its associated equipment by teaching principle of operation trouble-shooting methods and procedures leading to the identification and replacement of faulty piece of equipment, modules, units and components, with the objective that the Employer 's personnel will become capable of carrying out repair and maintenance without outside assistance;
- Enable staff to perform routine maintenance of the substation components and its associated equipment by way of electrical and mechanical adjustments, lubrication and/or replacement of parts subject to wear or with a limited life.



## 12. TECHNICAL GUARANTEE SCHEDULE: 11KV ISOLATORS

Please complete this schedule by stating the actual tendered specification in the column labelled Guaranteed Value. and sign as indicated.

Name of Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Item	Description	Units	Required	Guaranteed Value	Reference page in technical brochure (e.g. Found on page 3, section 3.2 paragraph/line etc.)
1	Type		Double Break Center Rotating and Ganged		
2	Nominal voltage rating	kV	11		
3	Maximum voltage rating	kV	12		
4	Power Frequency	Hz	50		
5	One minute power frequency withstand voltage	kV	28		
6	Basic Insulation level	kVp	75		
7	<b>Fittings and Accessories</b> -Fasteners for stacking units along with clamp & terminal connectors.		Yes		
8	Insulator a) Type of Insulator b) Rated voltage for Insulator c) Min...Creepage distance	mm/kV	Polymeric  11 25		
9	Earth switch interlock: Yes/No		Yes		
10	Reference standard		IEC 62271-102		
11	Neutral Point Earthing		Solidly Earthed		

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12	Thermal short circuit current, 1 second not less than	kA	31.5		
13	Dynamic Peak current not less than	kA	80		
14	Continuously rated currents of Isolating Switches:	A	1 250		
	Opening time	sec	12		
16	Closing time	sec	12		
17	Bending moment at base of support insulator	kN	6		
18	Bending moment at base of support structure	kN	15		
19	Min. shear force of insulator	kN	6		
20	Min. torsional force of rotating insulator	kN	6		
21	Material of main contact system		Silver plated copper		
22	<i>Net weight of one single pole isolating switch</i>				
23	-Isolating switch without earthing switch	Kg	Specify		
24	-Isolating switch with earthing switch	Kg	Specify		
25	-Earthing switch	Kg	Specify		
26	Net weight of one separately mounted operating cabinet (if any)	Kg	Specify		

Tenderer's Signature.....

Date.....

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## 13. TECHNICAL GUARANTEE SCHEDULE: 33kV ISOLATORS

Please complete this schedule by stating the actual tendered specification in the column labelled Guaranteed Value.  
and sign as indicated.

Name of Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

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P.O. BOX 1760, HARARE, ZIMBABWE  
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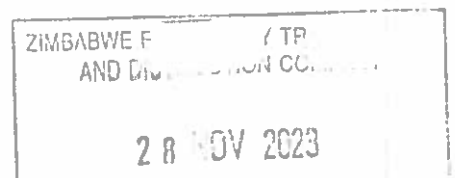
Item	Description	Units	Required	Guaranteed Value	Reference page in technical brochure (e.g. Found on page 3, section 3.2 paragraph/line etc.)
1	Type		Double Break Center Rotating and Ganged		
2	Nominal voltage rating	kV	33		
3	Maximum voltage rating	kV	36		
4	Power Frequency	Hz	50		
5	One minute power frequency withstand voltage	kV	70		
6	Basic Insulation level	kVp	170		
7	<b>Fittings and Accessories</b> -Fasteners for stacking units along with clamp & terminal connectors.		Yes		
8	Insulator d) Type of Insulator e) Rated voltage for Insulator f) Min.Creepage distance	kV mm/kV	Polymeric 33 25		
9	Earth switch interlock: Yes/No		Yes		
10	Reference standard		IEC 62271-102		
11	Neutral Point Earthing		Solidly Earthed		



12	Thermal short circuit current, 1 second not less than	kA	31.5		
13	Dynamic Peak current not less than	kA	81		
14	Continuously rated currents of Isolating Switches:	A	1 250		
15	Opening time	sec	12		
16	Closing time	sec	12		
17	Bending moment at base of support insulator	kN	6		
18	Bending moment at base of support structure	kN	15		
19	Min. shear force of insulator	kN	6		
20	Min. torsional force of rotating insulator	kN	6		
21	Material of main contact system		Silver plated copper		
22	<b>Net weight of one single pole isolating switch</b>				
23	-Isolating switch without earthing switch	Kg	Specify		
24	-Isolating switch with earthing switch	Kg	Specify		
25	-Earthing switch	Kg	Specify		
26	Net weight of one separately mounted operating cabinet (if any)	Kg	Specify		

Tenderer's Signature.....

Date.....



## 14. TECHNICAL GUARANTEE SCHEDULE: 132kV ISOLATOR

ZIMBABWE ELECT.  
AND DISTRIBUTION CORP.

28 NOV 2023

P.O. BOX 1760, HARARE, ZIMBABWE  
TEL 774503 : FAX 773 11 82

Please complete this schedule by stating the actual tendered specification and sign as indicated.

Name of Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Item	Description	Units	Required	Actual	Remarks	Corresponding reference page in spec sheet
1.	Type		Double Break Center Rotating and Ganged			
2.	Nominal voltage	kV	132			
3.	Highest system voltage as defined by IEC – 38voltage	kV	145			
4.	Rated frequency	Hz	50			
5.	Reference standard		IEC 62271-102			
6.	<b>Number of elements per insulator</b>					
	Supporting insulator		2			
	Rotating insulator		2			
7.	Neutral Point Earthing		Solidly Earthed			
8.	Thermal short circuit current, 1 second not less than	kA	31.5			
9.	Dynamic Peak current not less than	kA	80			
10.	Continuously rated currents of Isolating Switches:	A	1 250			
11.	<b>Switching capability of capacitive current</b>					
	-making	A	2			
	-breaking	A	2			
12.	<b>Rated short-time current 1 sec</b>					
	-isolating switch	kA rms	25			
	-earthing switch	kA rms	25			
13.	<b>Rated short- circuit current</b>					
	-isolating switch	kA peak	78			

	-earthing switch	kA peak	78			
14.	<b>Switching Surge withstand voltage</b>					
	- Phase to earth	kV	510			
	-Longitudinal impulse component of combined test	kV	570			
15.	<b>Lightning Impulse withstand voltage 1.2/50 micro-s</b>					
	- To earth and between phases	kVp	650			
	-Across the isolating distance of isolating switches	kVp	750			
16.	<b>One-minute power frequency withstand voltage</b>					
	-to earth	kV rms	275			
	-across the isolating distance	kV rms	325			
17.	Minimum corona starting voltage at any end position of isolating and earthing switches (voltage to earth )	kV	84			
18.	Opening time	sec	12			
19.	Closing time	sec	12			
20.	Bending moment at base of support insulator	kN	6			
21.	Bending moment at base of support structure	kN	15			
22.	Min. shear force of insulator	kN	6			
23.	Min. torsional force of rotating insulator	kN	6			
24.	Min. creepage distance (live parts to earth)	mm	1100			
25.	Min. isolating distance (clearance between open contacts)	mm	1400			

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28 NOV 2023

26.	Material of main contact system		Silver plated copper			
27.	<b>Operating devices for isolating switches</b>					
	-type of operating device		Motor drive			
	-approx. operating time					
	-three-pole isolating switch	Sec	6			
	-three-pole earthing switch	Sec	6			
28.	Max operating torque to be transmitted by rotating insulator	kN	4			
29.	<b>Auxiliary switch</b>					
	-Rupturing current at 110V	A	Specify			
	-Number of free NO contacts		10			
	-Number of free NC contacts		10			
30.	Test voltage 50 Hz, 1 min	V	2000			
31.	<b>Motor-driven operating device:</b>					
	-Driving motor					
	-Rated voltage	Vdc	110			
	-Max permissible service voltage	Vdc	121			
	- Min. service voltage	Vdc	93.5			
32.	<b>Power consumption per set</b>					
	-Motor, when starting	W	Specify			
	-Motor when running	W	Specify			

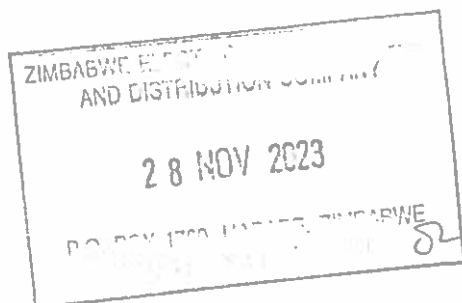
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28 NOV 2023

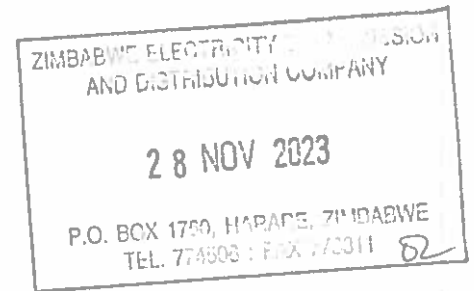
	-Electrical interlocking device	W	Specify			
	-Heaters	W	Specify			
33.	<b>Power consumption per operating cabinet</b>					
	-Motor, when starting	W	Specify			
	-Motor when running -Heaters	W	Specify			
34.	<b>Power consumption per control unit</b>					
	-control valves	W	Specify			
	-Electrical interlocking devices	W	Specify			
35.	<b>Net weight of one single pole isolating switch</b>					
	-Isolating switch without earthing switch	Kg	Specify			
	-Isolating switch with earthing switch	Kg	Specify			
	-Earthing switch	Kg	Specify			
36.	Net weight of one separately mounted operating cabinet (if any)	Kg	Specify			
37.	Minimum nominal creepage distance as defined in IEC 815, Table II	mm/kV	25			

Tenderer's Signature.....

Date.....



**ZETDC**



**DISTRIBUTION DEPARTMENT**

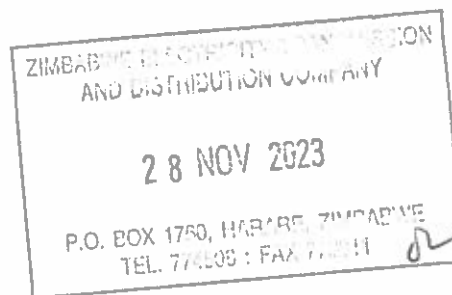
**ZETDC SPECIFICATION NO. DS14102020SGAR**

**SPECIFICATION FOR**

**11-132kV SURGE ARRESTORS**

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## ZETDC SPECIFICATION NO. DS141022020LAR

### 1 SCOPE

The specification covers the design, manufacture, laboratory testing before dispatch, supply and delivery of static class, heavy rating, gapless, metal (zinc) oxide lightning arrestors. The arrestors shall be supplied complete with clamps, complete fitting and accessories for installation on outdoor type switchgear, distribution lines and transformers up to 132kV.

Distribution electrical equipment e.g. transformers that are connected to overhead, open wire primary feeders are often subjected to severe lightning disturbances. To minimize insulation breakdown and equipment failure, surge arrestors are general applied to protect the equipment.

The Supplier shall state name, place and country of manufacture. The Supplier shall state whether or not the surge arrestors are produced under license, in which case the licence holders' name shall be stated.

Tenderers shall include a complete statement of compliance with this specification. For every clause in this specification the Tenderer shall state compliance or non-compliance and shall elaborate where appropriate.

Tenderers shall use the words "comply", "do not comply" with this specification or in the clauses of an informative nature, "noted". Where the words "do not comply" are used the Tenderer shall state whether modifications could be made and whether modifications would be undertaken. The cost implications of such modifications must be indicated in the statement of compliance as well as the pricing schedules.

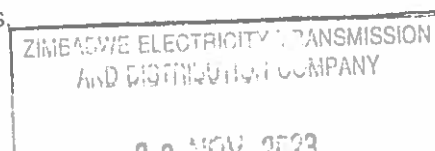
### 2. DETERMINATION OF RESPONSIVENESS

Prior to the detailed evaluation of Tenders, ZETDC will determine whether each Tender is substantially responsive to the requirements of the Tender Document.

For the purpose of this clause, a substantially responsive Tender is one which will conform to all the terms, conditions and specifications of the Tender Document without material deviations or reservations. A material deviation or reservation is one which affects in a substantial way the price, scope, quality, completion, timing or administration of the works undertaken by the Tenderer under the Contract, or which limits in a substantial way, inconsistent with the Tender Document, the **Zimbabwe Electricity Transmission and Distribution Company's rights or the Tenderer's obligations** under the Contract and the rectification of which would affect unfairly the competitive position of other Tenders who have presented substantially responsive Tenders at reasonable price.

A Tender determined to be substantially non-responsive will be rejected by the Authority and may not subsequently be made responsive by the Tenderer by correction of the non-conformity.

The Zimbabwe Electricity Transmission & Distribution Company may accept any non-material deviation or reservation provided that the acceptance thereof does not prejudice or affect the relative ranking order of any tender in the evaluation of tenders.



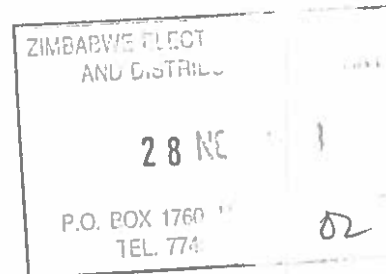


### 3. PARTICULARS OF THE ELECTRICAL SYSTEM

Unless otherwise specified in the Schedule of Requirements, it must be assumed that the electrical system in which the surge arrestors will be used in is;

- a) Three phase overhead-line construction and underground system. The maximum earth fault factor on the network is 1.5.
- b) Operated at 50 Hz, with approximately sinusoidal wave form.
- c) The highest system voltage does not normally exceed the nominal system voltage by more than 10%. The nominal system voltages are 33 kV, 11 kV and 0.4kV.
- d) The system frequency variation does not exceed plus or minus 2.5% from 50 Hz.
- e) Maximum Short circuit current of 15kA for both 33 and 11kV networks.

Designs should allow for these variations.



### 4. PARTICULARS OF THE ENVIRONMENT

Surge arrestors will operate within the tropics and will be subjected to sudden ambient air temperature changes of the order of 10 °C per hour, occurring at the onset of rain, but the barometric pressure at any given place does not vary by more than approximately 10mm Mercury. Frequent and severe lightning storms occur during summer months, with isoceraunic levels varying between 50 and 100 thunderstorm days per annum.

The surge arrestors shall be capable of operating under the following environmental conditions:

- a) **Ambient temperatures:**
  - (i) Maximum: 40 °C
  - (ii) Minimum: minus 10 °C
  - (iii) Maximum daily average: 35 °C
- b) **Altitude:**

Maximum altitude of 1 500 metres above sea level. The design shall allow for reduced cooling effect due to high altitude.
- c) **Humidity:**

Humidity of 13mg per cubic metre absolute and 65% relative before storms with vapour pressure of 17mmHg.
- d) **Lightning:**

Frequent and severe lightning storms occur during summer months, with isoceraunic levels varying between 50 and 100 thunderstorm days per annum.

**e) Dust:**

Particular attention should be paid in the design of all equipment to ensure that there is no damage to working parts or insulation through the ingress of dust, insects, vermin which are prevalent for long periods in the year.

*It is the supplier's responsibility to make himself familiar with any other climatic and physical conditions pertaining in Zimbabwe and to supply surge arrestors which meet all such conditions.*

**5. LANGUAGE, UNITS AND STANDARDS**

All tenders, correspondence, description upon drawings, illustrations or instructions shall be in unambiguous English Language. SI units of measurements shall be used throughout.

Except where modified by ZETDC's specifications, IEC recommendations (IEC 60099) or BS EN 60099-5:1997 shall apply throughout. In the case of conflict between the above stated standards and this specification, the ruling of this specification shall prevail.

**6. TECHNICAL SCHEDULES**

The Technical Schedules shall be filled in and completed by the Bidder, and submitted with the Bid. All data entered in the Schedules of Technical Guarantees are guaranteed values by the Bidder and cannot be departed from whatsoever. All data entered in the Schedules of Informative Data are also guaranteed values by the Bidder. These data may only be altered following the Engineer's written consent.

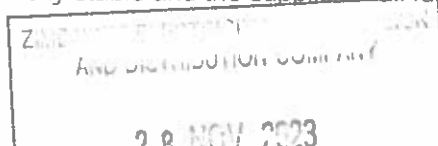
**7.0 DESIGN & CONSTRUCTION**

The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection for Distribution Transformers up to 132kV. The surge arrestor shall draw negligible current as operating voltage and at the same time offer least resistance during the flow or lightning current. The surge arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade silicon polymeric housing of specified creepage distance. The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture. The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under lightning conditions, the surge arrestor shall change over to the conducting mode.

Surge arrestors shall have a suitable pressure relief system to avoid damage to the silicon polymeric housing and providing path for flow of rated fault currents in the event of arrestor failure.

The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

The Lighting Arrestor shall be thermally stable and the supplier shall furnish a copy of thermal stability test along with the bid.



The arrester shall be capable of handling terminal energy for high lightning, external pollution and transient over voltage and have low losses at operating voltages.

The surge arrester shall be provided with line and earth terminals of suitable size. The line side terminal shall be suitable for a conductor equivalent to ACSR weasel / rabbit conductor. Surge counter, leakage detector is not required for the surge arrestors.

### 7.1 Arrester Housing

The arrester housing shall be made up of silicon polymeric housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform brown colour, free from blisters, burrs and other similar defects. Arrestors shall be complete with insulating bases fasteners for stacking units.

The housing shall be so coordinated that external flashover shall not occur due to application of any impulse of switching lighting voltage up to the maximum design value for arrester. The arrestors shall not fail due to contamination. The arrestors housing shall be designed for pressure relief class as given in Technical Parameters of the IEC 60099.

Sealed housings shall exhibit no measurable leakage.

### 7.3 Arrester Mounting

The arrestors shall be suitable for mounting on 4 pole/2 pole structure used for pole/ plinth mounted transformer and for incoming and outgoing lines.

### 7.4 Fittings & Accessories

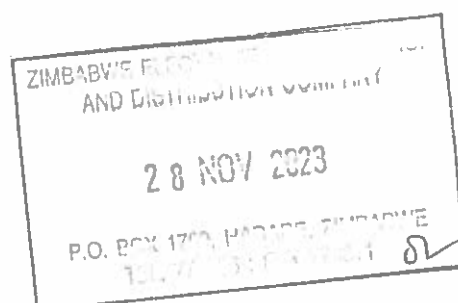
The surge arrester shall be complete with insulating bases, fasteners for stacking units along with clamp & terminal connectors and inbuilt disconnecter.

The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of lightning arrester shall be galvanized. The line terminal shall have a built in clamping device, which can be adjusted for both horizontal and vertical take off.

## 8.0 Design considerations

Surge arrestors shall withstand the voltages and the resulting currents through them with a sufficiently high reliability taking into account pollution and other site matters. In each system such voltage stresses are (see IEC 60071-1)

- operating voltage
- temporary overvoltage
- slow-front overvoltage
- fast-front overvoltage



### **8.1 Rated Voltage**

The maximum permissible r.m.s value of the power frequency voltage between the arrestor terminals, at which it is designed to operate correctly as established in the operating duty test.

### **8.2 Nominal Discharge Current**

This is the current which is required to initiate the flow of current in the operating duty test and to establish the protective level of the arrestor for surge overvoltage. This value shall be such that the arrestor provides and guarantees safety to the system it is protecting.

### **8.3 Protective Level**

The lightning impulse protective level of the surge arrestor is the maximum of the following values:

- the standard lightning impulse spark over voltage.
- the residual voltage at nominal discharge current.

These values should be as per the IEC60099-1.

### **8.4 Long duration discharge class**

A number related to the energy absorption capability of an arrestor to discharge long lines. Increasing class numbers (see table 1) indicate increasing system voltages and line length and decreasing surge impedance and overvoltage factors. Tenderers should indicate the class basing on the given table on the technical guarantee schedule.

### **8.5 Pressure release class**

A number related to the capability of an arrestor to withstand internal fault currents after a failure without violent shattering of the housing. Reference is made to clause 8.7 of IEC60099-1.

### **8.6 Polluted Housing**

Pollution on the arrestor housing may cause sparkover or temperature increase of grading components in gapped arrestors and high temperature increase of the varistors in metal oxide arrestors. To prevent arrestor failures in polluted areas, arrestors able to withstand failures in polluted areas, arrestors able to withstand the relevant polluted conditions have to be chosen. The arrestors under this specification should withstand the medium pollution stresses according to pollution level 2 of IEC 60071-2.

### **8.7 Earth Fault**

These cause over voltages which occur in a large part of the system. Guidance for the determination of temporary overvoltage amplitudes should be as per the BN EN 60099-5 1997. The duration of the overvoltage corresponds to the duration of the fault (until fault clearing). The design must withstand the 1s time duration for earthed neutral systems, and longer durations for other special conditions.

### **8.8 Load rejections**

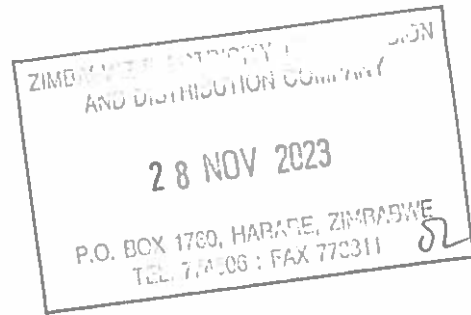
Voltage surges that occur during load disconnections should be taken into consideration during the design. The design should also look into the Ferranti effect for long lines, harmonic over voltages, resonance effects and all other aspects that bring about temporary surges.

## **9.0 Drawings and Documents**

Bidder to submit along with the bid the drawings, diagrams, dimensions and brochures of the arrestor.

**10.0 Type tests and compliance with specification.**

A type test certificate or type test results and compliance statement on a clause by clause basis shall be provided with the bidding document.



**11. TECHNICAL GUARANTEE SCHEDULE: SURGE ARRESTORS**

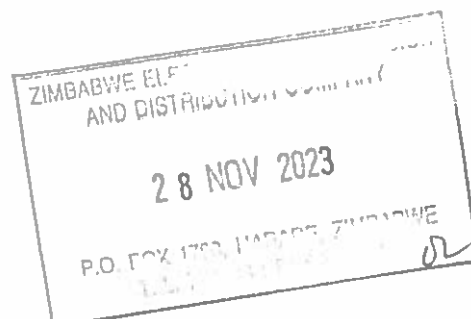
Please complete this schedule by stating the actual tendered surge arrester specification in the column labelled Guaranteed Value.

**Table 1:11kV and 33kV**

Item	Description	Units	11kV		33kV	
			Required	Guaranteed Value	Required	Guaranteed Value
1	Type		Metal Oxide,gapless		Metal Oxide,gapless	
2	Material		Polymeric		Polymeric	
3	Nominal voltage rating	kV	11		33	
4	Maximum voltage rating	kV	12		36	
5	Power Frequency	Hz	50		50	
6	One minute power frequency withstand voltage	kV	28		70	
7	Basic Insulation level	kVp	75		170	
8	Short circuit current rating	kA	At least 31.5kA for 3 seconds		At least 31.5kA for 3 seconds	
9	Specific creepage distance	mm/kV	25		25	
10	Nominal Discharge Current with 8/20 microsec wave	kA	5		10	
11	<b>Fittings and Accessories</b> -Fasteners for stacking units along with clamp & terminal connectors.		Yes		Yes	

Tenderer's Signature.....

Date.....

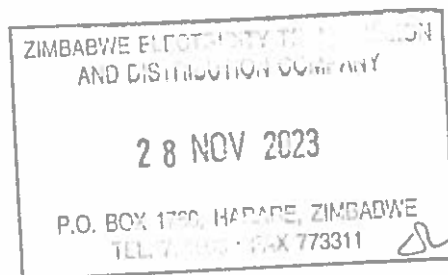


**Table 2: 132kV**

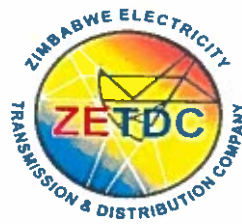
Item	Description	Units	132kV	
			Required	Guaranteed Value
1	Type		Metal Oxide,gapless	
2	Material		Polymeric	
3	Nominal voltage rating	kV	132	
4	Maximum voltage rating	kV	145	
5	Power Frequency	Hz	50	
6	One minute power frequency withstand voltage	kV	275	
7	Basic Insulation level	kVp	650	
8	Short circuit current rating		At least 31.5kA for 3 seconds	
9	Specific creepage distance	mm/kV	25	
10	Nominal Discharge Current with 8/20 microsec wave	kA	15	
11	<b>Fittings and Accessories</b> -Fasteners for stacking units along with clamp & terminal connectors.		Yes	

Tenderer's Signature.....

Date.....



ZETDC



DISTRIBUTION SERVICES DEPARTMENT

ZESA SPECIFICATION NO. DS2710202021JK

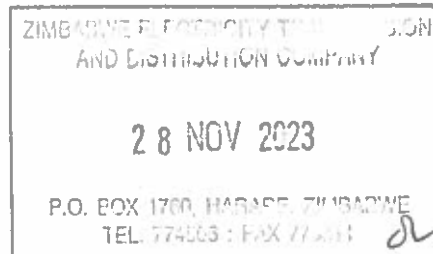
SPECIFICATION FOR

JOINTING AND TERMINATION KITS UP TO 132 kV



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## 1. SCOPE

This specification calls for supply and delivery of cable jointing kits and termination kits suitable for copper and aluminium XLPE and PILC cables up to 132 kV.

The Specification also covers transition joints for jointing PILC Cables to XLPE Cables.

Tenderers shall include a complete statement of compliance with this Specification. For every clause in this Specification the Tenderers shall state compliance or non-compliance and shall elaborate where appropriate.

Tenderers shall use the words "comply", "do not comply" with this Specification or in the clauses of an informative nature, "noted".

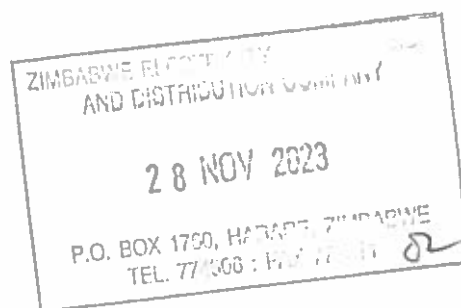
## 2. STANDARDS, LANGUAGE AND UNITS

Jointing kits, termination kits and transition jointing kits to be supplied under this specification shall conform to the following standards:

- (i) VDE 0278:
- (ii) IEC Standards
- (iii) BS where they amplify IEC Standards

All tenders, correspondence, description upon drawings, illustrations or instructions shall be in unambiguous English Language. SI Units of measurements shall be used throughout. The termination and jointing kits shall be manufactured to high quality standards.

The kits shall be sourced from manufacturers who have ISO 9001 or 9002 Certification. Evidence of the ISO certification shall be provided with the bid. The kits shall have a shelf life of at least 3 years.



### 3. PARTICULARS OF ENVIRONMENT

The kits will either be subjected to Atmospheric or Underground Environment or both.

#### 3.1 Particulars Of Atmospheric Environment

The joints and terminations shall be capable of operation under the following atmospheric conditions:

- a) At an average altitude of 1 500m above sea level.
- b) Ambient air temperatures not exceeding +45 degrees centigrade or below -10 degrees centigrade with a maximum daily average of 35°C.
- c) Humidity of 13 mg per cubic meter absolute and 65% Relative Humidity before storms with vapour pressure of 17 mm hg.
- d) Equipment will operate within the tropics and is subject to sudden ambient air temperature changes of the order of 10 degrees centigrade per hour occurring at the onset of rain, but the barometric pressure at any given place does not vary by more than ( $\pm 7\%$ )
- e) Frequent and severe lightning storms occur during summer months, with isokeraunic levels varying between 50 and 100 thunderstorm days per annum.
- f) Particular attention should be paid in the design of the equipment to prevent damage due to ingress of dust, insect and vermin which are prevalent for long periods in the year.

#### 3.2 Particulars of the Underground Environment

In addition to being exposed to the conditions under 5.1 the joints shall be capable of operation in the following ground conditions:-

- a) In soil with thermal resistivity of 1.2 K.m/W.
- b) The depth of burial from ground surface to centre of joint shall be 850mm for the 11kV joints, 1050mm for the 33kV joints and 1300mm for cables greater than 33kV.
- c) The mean ground temperature at this depth being 25 degrees centigrade with maximum value of 30 degrees centigrade.
- d) A foundation or bed of washed pit sand 150mm deep is laid in the trench first followed by a second 150mm pit sand above the cable. It is then backfilled by 450mm of earth before the yellow cable marker ribbon is laid and the trench completely closed.

#### 4. ELECTRICAL EQUIPMENT MATERIALS

All materials incorporated in the equipment shall be new and of first class commercial quality free from defects and imperfections.

The kits shall have characteristics equal to or better than the cable they are applicable for. They shall withstand the local environmental conditions stated above. The kits shall have electrical and mechanical strengths equal to or better than the cable. The kits shall consist of light and ultraviolet resistant materials which shall be non-tracking and self-cleansing.

The equipment shall withstand the impulse insulation levels and short circuit currents equal to or higher than the cable.

#### 5. CONSTRUCTION

##### 5.1 General

The kits shall have electrical and mechanical properties that are better than those of the cable to be joined or terminated. The joints and terminations shall be any of the following types:

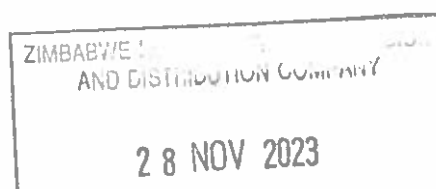
- (i) Heat shrink
- (ii) Resin filled
- (iii) Heat shrink/Resin filled
- (iv) Cold Shrink
- (v) Any other proven design, as long as adequate test reports and supply records are supplied.

All components of a kit shall have a shelf life of at least 3 years. All jointing kits shall be supplied complete with ferules. Ferules requiring use of crimping tools are not acceptable and will be rejected.

Joints and termination kits that require use of heated compounds such as Bitumen are not acceptable and will be rejected. All resin or filling compound shall be suitable for use at ambient temperatures ranging from 15 degrees Celsius to 40 degrees Celsius.

All parts and materials shall be subjected to a programme of tests to be agreed with the manufacturer.

- a) The kits shall be suitable for both aluminium and copper cables.
- b) The terminations and jointing kits shall require minimum manual preparation of the insulation e.g tapering.



- c) The method of jointing or termination shall not require special skills beyond those normally acquired by an experienced workman.
- d) Jointing kits employing tapes are not acceptable and will be rejected.
- e) Jointing kits requiring extreme hygienic conditions for preparation are not preferred.

## 5.2 Cable Joints

The joints shall be watertight, free from sharp points or ridges, thoroughly clean internally and externally and designed to retain the filling medium at all times without leakage. The sleeves shall be of sufficient diameter and length to permit colour-to-colour jointing without undue bending, handling or deformation of the cores. The joints shall be water proof. **Joints using tapes are not acceptable and will be rejected.**

## 5.3 Instructions

Detailed instructions for jointing and terminating cables shall be included in the bid. Also each kit shall be delivered with detailed instructions for jointing or terminating the cables. **ZETDC has the right to reject any bid with jointing and termination instructions which does not comply with its standard practice.**

## 5.4 Materials

A kit shall be complete with all materials contained in a box complete with Ferules or Connectors supplied. Ferules are to be specified to accommodate both copper and aluminium cables.

*Ferules that require use of a crimping tool are not acceptable and will be rejected. Each set of jointing materials shall be packed as one complete self-contained unit package for direct issue to a joiner at a work site.*

Heat shrink tubing and moulded parts shall be flexible, flame retardant, material of electrical insulating quality, and shall be obtained from an approved manufacturer. They shall be suitable for use indoors and outdoors in the conditions prevailing on site.

Each part shall bear the manufacturer's mark, part number and any other necessary markings to ensure correct identification for use on the correct size and type of cable. Each set of parts shall be packed as one unit with full and complete installation instructions and clearly marked to show the application.

The materials shall reduce to the predetermined size and shape when heated above 120°C. The components shall also be provided with an internal coating of

hot melt adhesive compound which shall not flow or exude at temperatures below 85°C.

#### 5.5 Voltage Rating

*The Cable terminations kits, jointing kits and transition joints will be used on networks with nominal voltages that is given in the schedule of requirements. The maximum continuous voltage will be 110% of the nominal voltage of the particular network. The rated one minute power frequency withstands shall be 28, 70 and 275kV for 11, 33 and 132kV kits. The basic Insulation level shall be 75, 170 and 650kV for the 11, 33 and 132kV kits.*

The Specific wet flashover voltage shall be at least 3kV/cm

#### 5.6 Tests Certificates

Test certificates from internationally recognised and unbiased Test Institute (eg. KEEMA) shall be submitted with the bid. Proof that the Test Institute is recognised by IEC shall be provided with the bid. A minimum requirement is that the Test Institute is used by international clients in testing their products. The tests shall be in accordance with the relevant IEC Standards or other relevant standards of equal standing.

#### 5.7 Supply and Delivery

Each kit shall be delivered with enclosed manuals in unambiguous English language giving detailed and illustrated step by step instructions for use as well as detailed explanation of each component's task and purpose.

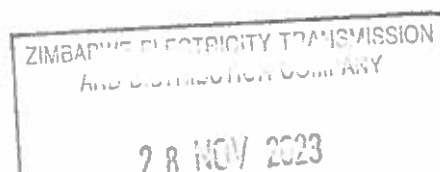
All technical literature relating to the terminations and jointing system shall be provided with the Tender.

#### 5.8 XLPE to XLPE Joints

The kit can be any of the types mentioned in clause 7.1. The kits shall be suitable for both aluminium and copper cables, armoured and unarmoured cables. The kits shall not contain components that are likely to adversely affect the XLPE cables, and shall be fully compatible with all components of an XLPE cable.

#### 5.9 PILC Cable joints

These will be required mostly for maintenance, as the procurement of PILC cables has been stopped in favour of XLPE cables. All components in a kit shall be fully compatible with components making up the PILC cable.



### 5.10 Transition Joints: XLPE to PILC Cable

Transition Joints will be used for jointing XLPE to PILC Cables as ZESA is phasing out use of PILC cables. The kits shall ensure that the oil contained in the PILC cable does not interfere with the XLPE insulation. All components in the kit shall be fully compatible with both XLPE and PILC cables. The kits shall be supplied complete with solid centre ferules, compound, jointing tube. The transition joints shall be resin filled, and shall be supplied with connectors.

### 5.11 Joints for Low Voltage Cables (Cables ratted up to 1000 volts)

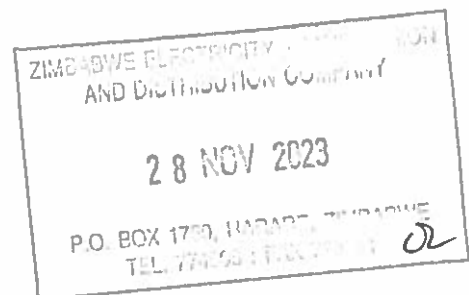
The joints shall comply with SAZS 555 Part 1 of 1997. This standard is available from Standards Association of Zimbabwe. The joints shall be supplied complete with ferrules suitable for both aluminium and copper conductor. Soldered connectors are not acceptable.

The certificate shall be submitted as per requirements of SAZ 5555.

Joints using heat shrink tubing are not acceptable.

The following type of kits are required:

- (a) PVC SWA to PVC SWA: cable
- (b) PVC SWA to PILC: cable-Transition
- (c) PVC SWA to XLPE: cable-Transition
- (d) PILC to XLPE: cable-Transition
- (e) PILC to PILC cable
- (f) XLPE to XLPE-cable



All other requirements are as per clause 1 to 7.4

### 5.12 Terminations

The terminations shall be suitable for terminating XLPE and PILC cables. Kits that incorporate Porcelain insulators or require filling with oil are not acceptable and will be rejected. The terminations shall be of any design stated in clause 7.1. They shall be suitable for either indoor or outdoor terminating, as indicated in the schedule of requirements. They shall incorporate suitable stress control and ram sheds (where applicable) for outdoor use.

Stress cones or other approved means shall be provided for grading the voltage stress on the core insulation of screened cables.

Provision shall be made for earthing all sealing end base plates, cable boxes, glands and armour clamps.

### 5.13 Termination Kits for Low voltage cables

The cable Termination kits shall consist of a bushing and an impact resistant polyethylene hood. There shall be slots inside the bushing, to enable the cores of the cable to be bent over and be pushed into these slots, before the hood is pushed over them.

### 5.14 Information to be supplied by the Supplier

The following information shall be supplied with the bid and included in each kit on delivery.

- a) the maximum voltage;
- b) the diameter of cable entries and conductor types and the sizes that are accommodated.
- c) Installation instructions that are specific to the joint;
- d) the contents;
- e) the name of the manufacturer and the reference number;
- f) Instructions on how to use the resin compound in the manner necessary to develop the properties and to reach the level of performance specified in this standard.
- g) Instructions on how to keep the resin compound before use in conditions that will comply with any relevant regulations and that will ensure that the resin compound retains its properties for one year (see.6.1.2.4)

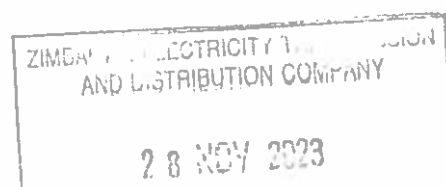
### 5.15 MARKING AND LABELLING, PACKAGING AND INFORMATION TO BE GIVEN BY THE MANUFACTURER

#### 5.15.1 Marking and Labelling

All joint shells or outer coverings shall be permanently and legibly marked with a reference that will enable the range of cables for which the joint is suitable to be identified from the manufacturer's literature.

All conductor connectors shall be permanently and legibly marked with the conductor type and size or a reference number that will enable this information to be obtained from the manufacturer's literature.

Individual resin kits shall be permanently and legibly marked with the following information:

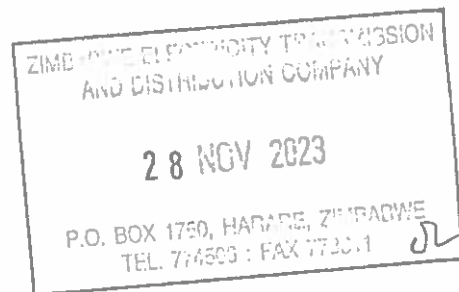




- a) the manufacturer's name;
- b) the type of cold pour resin compound (when specified).
- c) The contents;
- d) The batch number(s);
- e) The reference number;
- f) The defined storage conditions and expiry date (for resin kits)
- g) The health and safety marking and handling instructions (for resin kits)
- h) The mixing instructions (for resin kits)
- i) This SAZ standard number;

#### 5.15.2 Packaging

Packaging shall be sufficient to ensure that deterioration of the components will not happen under cover, dry storage within the stated ambient air temperatures such that the performance of these kits will not be affected.



## 6. TECHNICAL GUARANTEE SCHEDULE

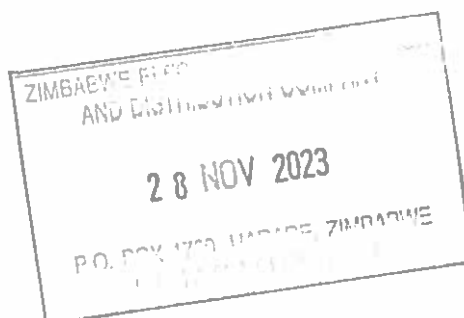
Please complete this schedule by stating the actual tendered kits specification in the column labeled Guaranteed Value.

### 6.1 TECHNICAL GUARANTEE SCHEDULE FOR XLPE-XLPE JOINTING KITS

JOINTING KITS: XLPE-XLPE				
Item	Description	Unit	Requirement	Guaranteed Value
1	Number of Cores		3	
2	Cable Type		XLPE-XLPE	
3	Voltage Rating	kV	11	
4	Conductor Size Range	mm sq.	50 -95	
5	Specific wet flashover	kV/cm	at least 3kV/cm	
6	Basic Insulation Level	kV	75	
7	Short circuit current rating	kA	At least 25kA for 3 seconds	
8	Specific creepage distance	mm/kV	25	
9	Rated one minute power frequency withstand Voltage	kV	28	
10	Ferules that require use of a crimping tool	Yes/No	No	
11	kits shall be suitable for both aluminium and copper cables	Yes/No	Yes	
12	Kit shall be complete with all materials contained in a box complete with Ferules or Connectors supplied	Yes/No	Yes	
13	Shelf life of all components Supplied		At least 3 years	
14	Depth of laying	mm (min)	850	

Tenderer's Signature.....

Date.....

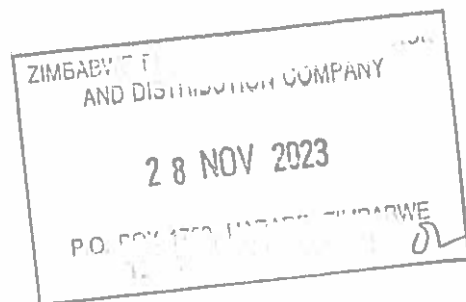


**6.2 TECHNICAL GUARANTEE SCHEDULE FOR XLPE-XLPE JOINTING KITS**

JOINTING KITS: XLPE-XLPE				
Item	Description	Unit	Requirement	Guaranteed Value
1	Number of Cores		3	
2	Cable Type		XLPE-XLPE	
3	Voltage Rating	kV	11	
4	Conductor Size Range	mm sq.	120-185	
5	Specific wet flashover	kV/cm	at least 3kV/cm	
6	Basic Insulation Level	kV	75	
7	Short circuit current rating	kA	At least 25kA for 3 seconds	
8	Specific creepage distance	mm/kV	25	
9	Rated one minute power frequency withstand Voltage	kV	28	
10	Ferules that require use of a crimping tool	Yes/No	No	
11	kits shall be suitable for both aluminium and copper cables	Yes/No	Yes	
12	Kit shall be complete with all materials contained in a box complete with Ferules or Connectors supplied	Yes/No	Yes	
13	Shelf life of all components Supplied		At least 3 years	
14	Depth of laying	mm (min)	8500	
15	Ground Temperature	°C	25	

Tenderer's Signature.....

Date.....

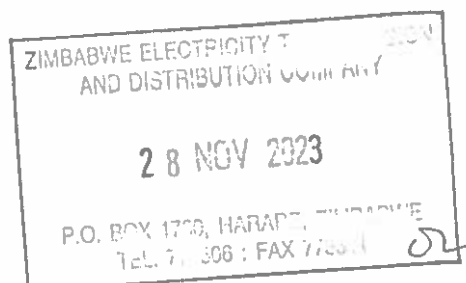


### 6.3 TECHNICAL GUARANTEE SCHEDULE FOR XLPE-XLPE JOINTING KITS

JOINTING KITS: XLPE-XLPE				
Item	Description	Unit	Requirement	Guaranteed Value
1	Number of Cores		3	
2	Cable Type		XLPE-XLPE	
3	Voltage Rating	kV	11	
4	Conductor Size Range	mm sq.	240-300	
5	Specific wet flashover	kV/cm	at least 3kV/cm	
6	Basic Insulation Level	kV	75	
7	Short circuit current rating	kA	At least 25kA for 3 seconds	
8	Specific creepage distance	mm/kV	25	
9	Rated one minute power frequency withstand Voltage	kV	28	
10	Ferules that require use of a crimping tool	Yes/No	No	
11	kits shall be suitable for both aluminium and copper cables	Yes/No	Yes	
12	Kit shall be complete with all materials contained in a box complete with Ferules or Connectors supplied	Yes/No	Yes	
13	Shelf life of all components Supplied		At least 3 years	
14	Depth of laying	mm (min)	850	
15	Ground Temperature	°C	25	

Tenderer's Signature.....

Date.....

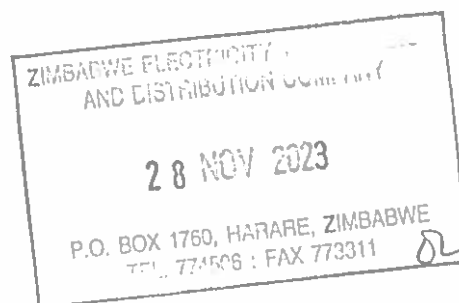


**6.4 TECHNICAL GUARANTEE SCHEDULE FOR PILC-PILC JOINTING KITS**

JOINTING KITS: PILC-PILC				
Item	Description	Unit	Requirement	Guaranteed Value
1	Number of Cores		3	
2	Cable Type		PILC-PILC	
3	Voltage Rating	kV	11	
4	Conductor Size Range	mm sq.	50-95	
5	Specific wet flashover	kV/cm	at least 3kV/cm	
6	Basic Insulation Level	kV	75	
7	Short circuit current rating	kA	At least 25kA for 3 seconds	
8	Specific creepage distance	mm/kV	25	
9	Rated one minute power frequency withstand Voltage	kV	28	
10	Ferules that require use of a crimping tool	Yes/No	No	
11	kits shall be suitable for both aluminium and copper cables	Yes/No	Yes	
12	Kit shall be complete with all materials contained in a box complete with Ferules or Connectors supplied	Yes/No	Yes	
13	Shelf life of all components Supplied		At least 3 years	
14	Depth of laying	mm (min)	850	

Tenderer's Signature.....

Date.....

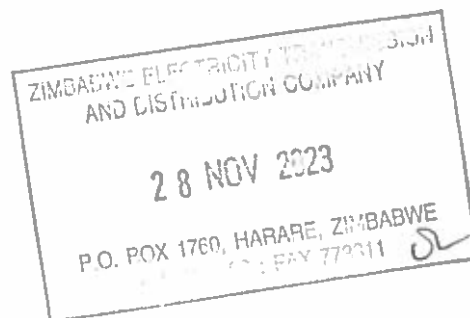


### 6.5 TECHNICAL GUARANTEE SCHEDULE FOR PILC-PILC JOINTING KITS

JOINTING KITS: PILC-PILC				
Item	Description	Unit	Requirement	Guaranteed Value
1	Number of Cores		3	
2	Cable Type		PILC-PILC	
3	Voltage Rating	kV	33	
4	Conductor Size Range	mm sq.	120-185	
5	Specific wet flashover	kV/cm	at least 3kV/cm	
6	Basic Insulation Level	kV	170	
7	Short circuit current rating	kA	At least 25kA for 3 seconds	
8	Specific creepage distance	mm/kV	25	
9	Rated one minute power frequency withstand Voltage	kV	70	
10	Ferules that require use of a crimping tool	Yes/No	No	
11	kits shall be suitable for both aluminium and copper cables	Yes/No	Yes	
12	Kit shall be complete with all materials contained in a box complete with Ferules or Connectors supplied	Yes/No	Yes	
13	Shelf life of all components Supplied		At least 3 years	
14	Depth of laying	mm (min)	1050	

Tenderer's Signature.....

Date.....



**ZETDC**

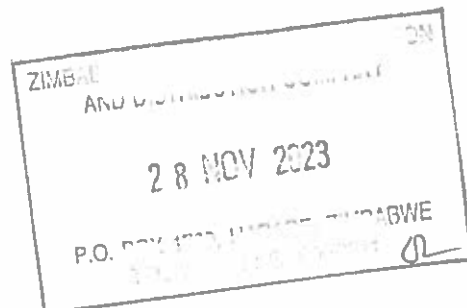


**DISTRIBUTION DEPARTMENT**

ZETDC SPECIFICATION NO. 12112015

SPECIFICATION FOR

XLPE POWER CABLES RATED UP TO 132kV



## **SPECIFICATION FOR: - XLPE POWER CABLES RATED UP TO 132KV**

### **1. Introduction**

This Specification calls for supply and delivery of XLPE Cables.

The supplier shall state name, place and country of manufacture.

The supplier shall state whether or not the cables are produced under license, in which case license holder's name shall be stated.

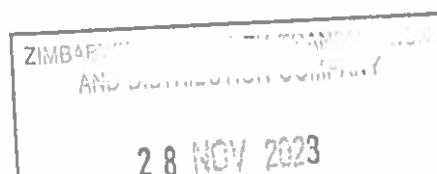
Bidders/Tenderers shall include a complete list of suitable jointing and termination kits available on the market for the cables being tendered. They should also list the recommended types of terminating and jointing kits.

The manufacture shall have a proven track record of manufacture and delivery of such goods for at least 3 years, and must indicate production for the past 2 years.

The bidder/tenderer has to complete the Technical Guarantee Schedules at the end of the specification.

Tenderers shall include a complete statement of compliance with this Specification. For every clause in this Specification the Tenderers shall state compliance or non-compliance and shall elaborate where appropriate.

Tenderers shall use the words "comply", "do not comply" with this Specification or in the clauses of an informative nature, "noted".





ZIMB  
AND DISTRIBUTION COMPANY  
28 NOV 2023  
P.O. BOX 1760, HARARE, ZIMBABWE  
TEL. 774506 : FAX 773311 *OL*

## 2. Standards, Units and Language

All cables supplied under this specification shall conform to the following standards: -

- (i) IEC 502 for cables rated up to 30kV for XLPE cables
- (ii) IEC 840 for cables rated above 30kV
- (iii) BS 6480 : 1988 Impregnated paper insulated lead or lead alloy sheathed electric cable with rated voltage up to and including 33kV.
- (iv) IEC 228 Second Edition 1978: Conductors of insulated cables.
- (v) Any other standard provided the Bidder can provide documentary evidence that the standard is equal to or better than the above standards.

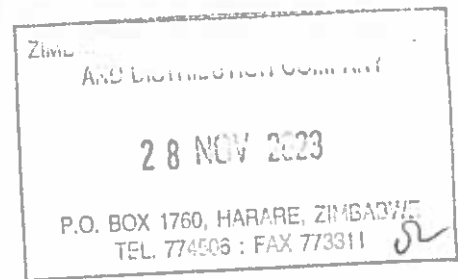
Cables not complying with the above standards will be rejected. All tenders, correspondence, and all description upon drawings, illustrations or instructions shall be in the **English language**.

**SI units of measurements** shall be used throughout. The Cables shall be manufactured to high quality standards. The companies manufacturing the cables shall have ISO Certification. Documentary proof of **ISO certification** shall be provided with the bid.

## 3. Particulars of Electrical System

The cables shall be capable of operation in the following system: -

- (a) 3 phase, underground, resistance earthed system.
- (b) Operated at 50Hz variable between plus or minus 2.5%
- (c) A highest system voltage not exceeding the normal by more than 10%.
- (d) Earthed so that the earth fault factor will be less than 1.5 at any location.
- (e) Maximum duration of earth fault not exceeding 20s.



#### 4. Particulars of Environment

The cables will either be subjected to Atmospheric or Underground Environment or both

##### 4.1 Particulars of Atmospheric Environment

The cables shall be capable of operation under the following atmospheric conditions.

- (a) At an average altitude of 1 500m above sea level.
- (b) Ambient air temperatures not exceeding +45 degrees centigrade or below - 10 degrees centigrade.
- (c) Humidity 13mg/cubic metre absolute and 65% relative before storms with vapour pressure 17mm hg.
- (d) Equipment will operate within the tropics and is subject to sudden ambient air temperature changes of the order of **10 degrees centigrade per hour** occurring at the onset of rain, but the barometric pressure at any given place does not vary by more than approximately 10mm mercury.
- (e) Frequent and severe lightning storms occur during summer months, with **isoraunic** levels varying between 50 and 100 thunderstorm days per annum.
- (f) Particular attention should be paid in the design of all equipment to ensure that there is no damage to working parts or insulation through the ingress of dust, insects, vermin which are prevalent for long periods in the year.

##### 4.2 Particulars of Underground Environment

In addition to being exposed to the conditions stated in 4.1 the cables shall be capable of operation in the following underground conditions: -

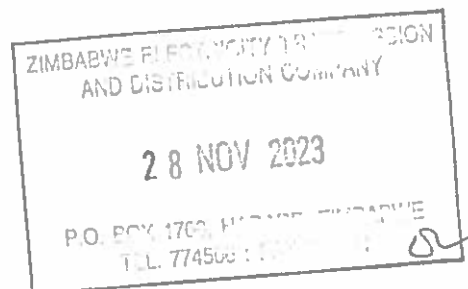
- (a) At a depth of burial from the ground surface to centre of the cable, of 850mm for 11kV cables, and 1050mm for 33kV cables and 1300mm for cables greater than 33kV.
- (b) Mean ground temperature at this depth being 25 degrees centigrade with a maximum value of 30 degrees.
- (c) In soil with a maximum resistivity of 1.2 KΩ m
- (d) With a foundation or bed of washed pit sand 150mm deep laid in the trench first, followed by a second 150mm pit sand above the cable. It is then backfilled by 450mm of earth before the yellow cable marker ribbon is laid and the trench completely closed.

**5. Electrical Equipment Materials**

All materials incorporated in the equipment supplied shall be new and of first class commercial quality, free from defects and imperfections.

**6. Cable Details**

The specification covers single-core and three core copper and Aluminium cables, which are of Crosslinked Polyethylene type, of cross-sectional area 16mm. Sq up to and including 1000mm.sq for alternating voltages of up to and including 132kV.



Zimbabwe  
AND DISTRICTS COMPANY  
28 NOV 2023  
P.O. BOX 1760, HARARE, ZIMBABWE  
TEL. 774506 : FAX 773511

**7. Cable Construction:**

**7.1 The construction of the XLPE cable shall be as follows:-**

**CONSTRUCTION OF XLPE CABLES**

- 1 Conductor-aluminium or copper
- 2 Conductor screen-extruded semiconductive layer
- 3 Insulation-XLPE
- 4 Core screen-extruded free semi-conductive layer
- 5 Semi-conductive numbered tape
- 6 Metallic earth screen-copper tape
- 7 Fillers-Preformed plastic material
- 8 Binder tape
- 9 Inner sheath -Low density Polyethylene
- 10 Armouring-steel wire or aluminium wire



**Conductor**

The Conductors shall be of compact circular stranded copper conductor or Aluminium as specified in the schedule of requirements, in accordance with IEC228, clause 2. A water absorbing powder shall be provided between the conductors and semi conductive screen. (7.2 and 7.1)

**Conductor Screen**

This shall be of non metallic material and shall consist of a layer of extruded thermoset semi-conductive compound.

**Insulation**

The XLPE shall not be steam vulcanised. It shall be **dry-vulcanised cables**, steam vulcanised XLPE insulation are not acceptable. The insulation shall consist of an extruded layer of cross-linked polyethylene (XLPE) complying

with IEC 502. A water absorbing tap or powder shall be placed between the XLPE Insulation and non-metallic insulation screen.

#### **Non-Metallic Insulation Screen**

This shall be non-metallic material and shall consist of a layer of extruded non-strippable vulcanised semi-conducting compound.

#### **Metallic Insulation Screen**

The metallic insulation screen shall consist of annealed plain copper tape, applied helically with suitable overlay. The suitable binder tape shall be applied over the metallic insulation screen with suitable overlap for single core cables only.

#### **Core Identification (for three core cables only)**

The cores of the cable shall be identified by colour strip tape, (Red, Yellow, Blue) on the non-metallic insulation screen.

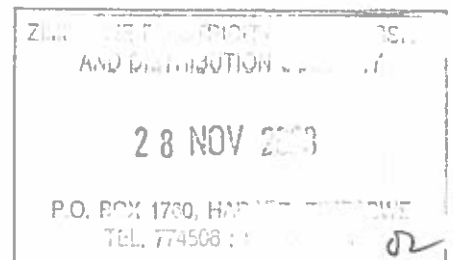
#### **Assembly of Core (For three core cable only)**

The cores shall be assembled together with fillers to form compact circular shape and wrapped with suitable binder tape with a suitable overlay.

The fillers shall be of suitable material which shall be compatible with other materials of the cable and shall be capable of operating continuously at maximum operating temperature of the cable without being adversely affected.

#### **Separation Sheath**

The separation sheath shall consist of an extruded 2mm layer of low density Polyethylene.



### **Wire Armour**

The armour shall consist of one layer of galvanised steel round wire.

Suitable binder tape may be applied over metallic armour at manufacturer's option.

### **Outer Sheath**

The outer sheath shall consist of a layer of at least 2mm low density Polyethylene.

### **Bending Radii**

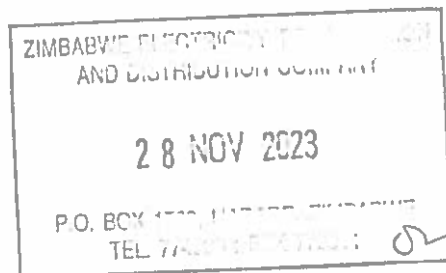
The bending radius shall be less than 15 times the diameter of the cable

### **Cable Marking**

A marking bearing voltage designation, maker's name, year of manufacture shall be marked on the PVC outer sheath at suitable intervals throughout the cable. The cable shall be marked at 1.0 m intervals to indicate the length of cable remaining on the cable drum as the cable is used.

## **8 Alternative Constructions**

The Construction stated in 7 above is the preferred construction. However Suppliers/Manufacturers can also offer other construction designs provided they can provide documentary evidence that these are an improvement to the preferred designs.



ZIMBABWE ELECTRICITY  
AND DISTRIBUTION COMPANY

28 NOV 2023

P.O. BOX 1700, HARARE, ZIMBABWE  
TEL: 02120031 FAX: 0212011

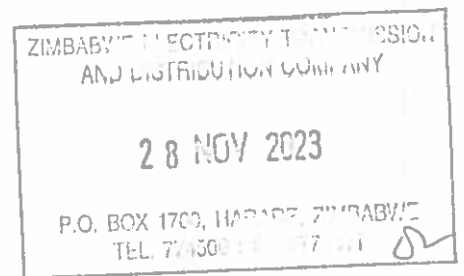
9 Tests

The following tests shall be carried out at manufacturers' factory. The Test methods shall be in accordance with IEC 502 (1983) for cables rated below 30kV and IEC 840 for cables rated above 30kV.

ITEM	CABLE TESTS	UP TO 30KV	GREATER THAN 30KV
1	Construction Test		IEC 840
2	Partial Discharge Test		IEC 885-2
3	Electrical Test on Non-metallic Sheath	IEC 502	IEC 229
4	Measurement of Electrical Resistance	IEC 502	IEC 228
5	Hot Set Test		IEC 811-2-1
6	Partial Discharge Test	IEC 502	IEC 885-2
7	Resistivity of Semi conducting layer		IEC 811-1-2
8	<b>Tests on PVC Sheaths</b>		IEC 811-1-1
8.1	Mechanical Properties		IEC 811-3-2
8.2	Loss of Mass		IEC 811-3-1
8.3	Pressure Test at High Temperature		IEC 811-3-1
8.4	Test at Low Temperature		IEC 811-1-4
8.5	Heat Shock Test		IEC 811-3-1
9	Carbon Black Content on PE Sheath		IEC 811-4-1
10	Test Under Fire Conditions		IEC 322-1
11	Water Penetration tests		IEC 840
12	Test on XLPE		
12.1	Shrinking Test		

12.2	Mechanical properties		
12.3	Hot Set Test		

For orders exceeding 15km of cable a ZESA representative will witness the tests. The manufacturer/supplier will meet the full costs for the tests including the costs for ZESA representative witnessing the tests. The Supplier has to provide type tests Certificates for tests carried on the previously manufactured cables. Bids that do not include test certificates will be rejected. The tests should have been carried out by a recognised institute (e.g. KEEMA) The Test institute should be recognised by IEC. Documentary proof that the Test Institute is recognised by IEC shall be provided with the bid.



**10 Further Information Required**

The following information is required:-

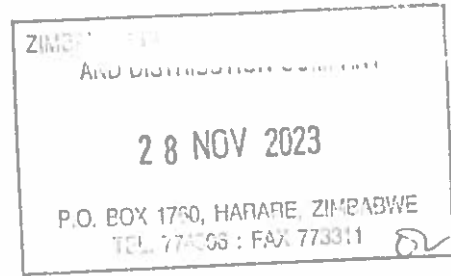
- i) The capacitive inductive reactance per kilometre.
- ii) The positive and zero phase sequence impedance per kilometre.
- iii) The maximum a.c. and d.c. resistance per kilometre
- iv) Pressure test voltage for new and old cables.

**11. Drumming Cables**

Cables are to be supplied on suitably reinforced cable drums which shall be weatherproofed for extended external outdoor unprotected storage. Each drum shall be firmly, clearly and indelibly labelled to include information on actual cable length in meters, size, type, and voltage rating of the cable, as well as rolling arrow and direction of lay of the cores where appropriate.

The drum capacities shall be utilised fully, and the drum sizes selected for minimum drum transport cost. The drum weight shall not exceed 1000kg.





## **12. Ratings**

### **12.1 Voltage rating**

The maximum continuous voltage rating shall be 10% more than the continuous voltage rating. Cables that do not meet this requirement will be rejected.

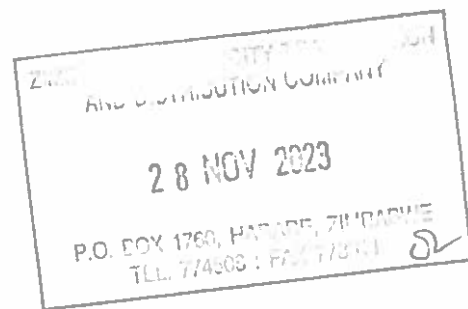
### **12.2 Current Rating**

Unless otherwise approved by the Authority, the current ratings depending on the method and environment in which the cable is laid according to the attached schedule of requirements shall conform to IEC 502 for cable rated below 30kV and IEC 840 for cables rated above 30kV. These shall correspond to conductor temperature of 90 degrees during normal operation and 250 degrees during faults. The short circuit ratings shall be according to IEC 949.

#### **NOTE:**

1. Bidders/Tenderers shall include a complete list of suitable jointing and termination kits available on the market for the cables being tendered. They should also list the recommended types of terminating and jointing kits.
2. The manufacture shall have a proven track record of manufacture and delivery of such goods for at least 5 years, and must indicate production for the past 2 years.
3. Factory Acceptance Tests shall be carried according to the IEC 502 standard. Tests to be carried out are as specified in the specification.
4. Results of Type tests carried out by an independent Technical Institute on previously manufactured items to be included in the bid. The tests should have been carried out by a recognised institute (e.g KEEMA). The institute should be recognised by IEC. Documentary proof that the Test Institute is recognised by IEC shall be provided with the bid.
5. The drum weight shall not exceed 1000kgs.

6. A marking bearing voltage designation, maker's name, year of manufacture shall be marked on the PVC outer sheath at suitable intervals throughout the cable. The cable shall be marked at 1.0 m intervals to indicate the length of cable remaining on the cable drum as the cable is used.
7. Each drum shall be firmly, clearly and indelibly labelled to include information on actual cable length in meters, size, type, and voltage rating of the cable, as well as rolling arrow and direction of lay of the cores where appropriate.



**TECHNICAL GUARRANTEE SCHEDULE FOR XLPE POWER CABLES  
 RETED UP TO 132kV**

ZIMBABWE ELECTRICITY  
 AND DISTRIBUTION COMPANY  
 28 NOV 2023  
 P.O. BOX 1760, HARARE, ZIMBABWE  
 TEL: 770051000/10311

<b>TECHNICAL GUARRANTEES (TO BE FILLED IN BY BIDDER)</b>		
<b>BIDDERS SHALL STATE WHICH STANDARD IS BEING COMPLIED TO</b>		
<b>DESCRIPTION</b>	<b>VALUE/MATERIAL</b>	<b>COMPLIANCE WITH IEC 502/IEC 840</b>
Voltage kV		
Insulating Material		
Conductor Material		
Conductor Size sq.mm		
No. Of Cores		
Thickness of Insulation mm		
Copper tape thickness mm		
Sheath thickness mm		
Nominal screen area sq.mm		
Diameter of armour wire mm		
Overall diameter mm		
Mass kg/km		
Minimum bending radius mm		
Voltage Ratings		
Peak Value of Impulse kV		
Maximum continuous permissible		
Phase to Earth Voltage		
Phase to phase Voltage		
Maximum Tensile Strength		
Electrical Characteristics		
Impedance at 90 degrees and 50 Hz ohm/km		
AC resistance at 20 degrees ohm/km		

DC resistance at 20 degrees ohm/km		
Inductance mH/km		
Reactance ohm/km		
Capacitance uF/km		
Charging Current A/km		
Short Time Current 1 second kA		
Earth fault short time 1 second kA		
Nominal Current in air A		
Nominal Current underground		


Tenderer's Signature.....

Date.....

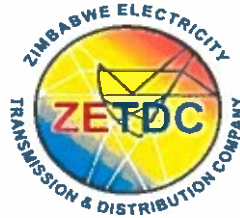
ZIMBABWE ELECTRICITY SUPPLY  
AND DISTRIBUTION COMPANY

28 NOV 2023

P.O. BOX 1760, HARARE, ZIMBABWE  
TEL. 774506 : FAX 773011



**ZETDC**



**REMOTE TERMINAL UNIT (RTU) TECHNICAL SPECIFICATIONS**  
**FOR THE GLENVILLE 88/11KV SUBSTATION**

ZIMBABWE ELECTRICITY TRANSMISSION  
AND DISTRIBUTION COMPANY  
  
28 NOV 2023  
  
P.O. BOX 1760, HARARE, ZIMBABWE  
TEL. 774506 : FAX 773811

## 1.0 Glenville RTU

**Scope:** The specification calls for the Design, Manufacture, Supply and Delivery of a Remote Terminal Unit (RTU) for an Electrical Power System at Glenville 88/11kV Substation.

There is currently no RTU at Glenville 88/11kV Substation. With coming in of the new transformer and 11kV board there shall be need for remote monitoring and control of the substation hence need for the RTU.

Tenderers shall include a complete statement of compliance with this specification. For every clause in this specification the Tenderer shall state compliance or non-compliance and shall elaborate where appropriate. Tenderers shall use the words "comply", "do not comply" with this specification or in the clauses of an informative nature, "noted".

## 2.0 RTU Solution

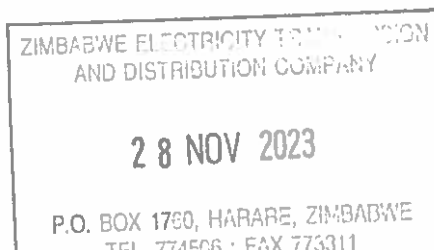
The Glenville Substation RTU data acquisition will be completely engineered by implementation of the IEC61850 standard. For communication with the control centre IEC60870-5-101 shall be used.

The required Bill of Quantities (BOQ) for the SCADA solution to be supplied for the project;

- i) 1 X RTU Panel (2200mm x 800mm x 600mm) including panel accessories and wiring
- ii) 1 X 19" Rack
- iii) 2 X RTU communications unit
- iv) 1 X (5000 Data Points, PLC License, IEC101, IEC61850, Modbus Protocol)
- v) Manageable Industrial Ethernet Switches –The contractor will provide adequate number of switches as per the approved substation data acquisition LAN (Fibre and/or Ethernet) (50VDC or 110VDC Powered)
- vi) 1 X GPS Time Server for IEDs and RTU Time synchronization (50VDC or 110VDC Powered) (Including GPS Antenna, GPS Coaxial cable, GPS In-Line Lightning Arrestor)
- vii) 2 X Power Supply Modules(24-60VDC)
- viii) 2 X Analogue Input Card
- ix) 3 X Digital Input Cards
- x) 10 X Blanking front plates
- xi) Ethernet cables (STP), optic fibre patch cables, RJ45 connectors, crimping tools and any other networking accessories that may be required to be supplied by the contractor.

## 3.0 SCADA Critical Project Tools

- i) 1 X Project Laptop for configurations, commissioning and maintenance works (Intel 4GHz Core i7, 10<sup>th</sup> Generation, 16GB RAM, 1TB HDD) - with all configuration software (RTU configuration tools, IEC 61850 configuration tools and licenses).



#### 4.0 Technical Guarantee Schedule

Please complete this schedule by stating the actual tendered specification offered in the column labelled Offered/Guaranteed Value and sign with date as required.

Item	Description	Units	Required	Offered/ Guaranteed Value
1	GPS clock	1	GPS clock	
2	RTU rack	1	19" Rack	
3	RTU communications unit	2	Specify	
4	RTU Power Supply Modules	2	Specify	
5	Analogue Input Card	2	Analogue Input Card	
6	Digital Input Cards	3	Digital Input Cards	
7	5000 data points license	1	5000 data points license	
8	PLC license	1	PLC license	
9	Licensed Protocols - IEC 61850, Modbus, IEC 101, IEC 104	1	Licensed Protocols - IEC 61850, Modbus, IEC 101, IEC 104	
10	Archive function license	1	Archive function license	
11	RTU Panel (2200mm x 800mm x 600mm)	1	RTU Panel (2200mm x 800mm x 600mm)	
12	Accessories:			
	Blanking front plates	10	Specify	
	Removal tool for process connector	1	Specify	

Tenderer's Signature.....

Date.....

ZIMBABWE ELECTRICITY TRANSMISSION  
AND DISTRIBUTION COMPANY  
  
28 NOV 2023