

## **SPECIFICATIONS FOR 33 KV CONTROL PANNEL FOR (5/10 MVA) SINGLE/DOUBLE TRANSFORMER (WITHOUT DIFFERENTIAL PROTECTION).**

### **SCOPE:**

This specification covers design, manufacture. Testing, packing and delivery of 33 KV Control Panels.

### **GENERAL DESCRIPTION OF PANNELS:**

The control and relay panels should be floor mounted, freestanding cubicle type and should be vermin proof. Such control and relay panels should be complete in all respects i.e. all relays and other auxiliary instruments/equipments should be mounted on this panel only. The instruments to be mounted on the panel are given in Annexure-I.

The control panel should consist of fabricated sheet steel enclosure on the sides, front, rear and top. The rear of the panel should be in the form of lockable-hinged two-flap door. The front and rear sheet should have folded construction for providing rigidity and strength. The panel should not be made of any framework with sheets screwed or bolted to it.

The front of the panels, which accommodates most of the mounting, should be fabricated with sheet steel of thickness 10 SWG. For the rest of the sides, which does not carry weight of mounting, the sheet steel of thickness 14 SWG should be used. The height, depth and width of the panel shall be 2300x 500x600 mm approx. to accommodate all mounting properly.

The tenderer shall submit 4 complete sets of drawings (General arrangement of wiring diagram) and dimensions of both type of control panels along with tender. If required drawings submitted have to be coordinated with the breaker to be supplied. The panels shall have provisions for earthing the mountings and the panel by providing copper ground bus. The panel should be equipped with necessary links and HRC type fuses of good quality, which should be mounted on sheet steel brackets. Each fuse shall be identified with the suitably engraved plastic label. Each panel should be provided with two-pin socket and switch for a heat lamp and with internal panel lighting arrangement operated by a door switch. A space for heater rated at 100 W/230 Volt AC enclosed in a casing is also to be provided along with a ON / OFF switch. DC failure scheme along with DC fail accept and AC audible alarm shall be provided in the panel.

All relays should conform in all respect to IS-3231: 1965 and IS-8686: 1977 and subsequent revision thereof. Panels wiring should also conform to BSS: 258/1948 or equivalent Indian standards. The control panel shall be completely assembled and

following routine tests shall be conducted as per provisions of specifications and IS: 8623.

1. Insulation test.
2. High voltage test.
3. Electrical operations.
4. Checking of protective measures and the electrical continuity of the protective circuits.

### **TYPE TEST:**

Meters and all the relays should be type tested and verification of the same may be done during inspection.

### **WIRING:**

The internal wiring of the panel should be carried out with 650 Volt grade pre insulated 2.5 sq. mm copper conductor conforming to IS: 2465 and the latest amendment thereof. Both ends of wires should have numbered plastic ferrules for identification. The panel wiring should be suitably bunched, dressed and clamped to present a neat appearance. All panel wirings should withstand 2.5 KV AC 50 Hz. RMS for one minute between conductors and earth.

All panel wiring terminations for connecting external apparatus circuits should be neatly terminated on terminal blocks having links for disconnection and plugging in facility for testing purposes. The terminal block should be suitably labeled to readily identify the outgoing /incoming wires. 20% extra terminals should be provided in each panel for future use. Suitable trays for fixing of cable glands for cables should be provided. Such trays should have suitable strength and dimensions to receive the PVC multicore cable and should be mounted to form the bottom of the panels. Cable gland should be provided with rubber rings for proper sealing and holding. The bottom tray shall be provided with suitable openings covered with sheet steel blanking plates of 4mm. thickness.

All the equipments including relays and meters etc. should be flush mounted. All the mountings should be provided on the front side.

Alarm bell and buzzer should be provided on one end of the relay and control panel.

The panel should be complete with mimic diagram representing bus bars, transformers, breakers, isolators earthing switches etc. and having semaphore indicator to show breaker position.

Brilliant green colour, fully glossy as per shade No. 221 of IS-5 for 33 KV and for 11 KV black full glossy may be adopted for mimic diagram etc. the interior of panels shall be furnished with stove enamel white and the base frame shall be painted glossy black.

The outside surface of the panels should be synthetic enamel painted in light gray as per shade No. 631 of IS-5 to achieve a durable surface. Pre-treatment of all the surface of panel shall be done as follows.

### **STEPS:**

1. Degreasing (Either trichloro ethylene hot vapour or dip in alkali.)
2. Cold water rinsing (if degreased in alkali)
3. Pickling in acid to remove surface seal and/or rust.
4. Cold water rinsing to remove traces of acid.
5. Phosphatising to obtain oxidation resistant and pre storage finish.
6. Cold water rinsing to remove traces of phosphatising agent.
7. Rinsing with suitable liquid to remove any traces of salts.
8. Air-drying by blowing hot air.
9. Primer spray first coat with wet zinc chromate primer and stove at 150-160°C for 30 minutes.
10. Rub/putty – To remove minor surface flows and stove for 10-15 minutes.
11. Surface sand down (wet) with mechanical abrasive and stove for 5-10 minutes.
12. Primer spray second coat and stove at 150°C for 30 minutes.
13. Rub down dry and spray first coat of synthetic enamel point wet on wet and stove for 30 minutes.
14. Sand down (wet) or rub dry to prepare for final finish.
15. Spray second and final coat of desired colour synthetic enamel finish paint wet on wet and stove at 150°C-160°C for 30 minutes.

### **CLIMATIC CONDITIONS:**

- i) Peak ambient temperature in shade – 50°C.
- ii) Max, average temperature over a period of 24 hrs. in shade – 45°C.
- iii) Minimum ambient temperature - 0°C.
- iv) Average No. of thunder storm days per annum – 40
- v) Average no. of rainy days per annum – 40.
- vi) Average annual rainfall – 50 to 100 cm.
- vii) No. of months of tropical monsoon conditions – 4  
(Middle June to Middle of October)
- viii) Max. relative humidity – 100%.

# **COMPLETENESS OF THE CONTRACT:**

The specification has been brought out in broader sense and some minor accessories, which are essentially required for smooth functioning of the mounting / panel might have been left out. Such fittings if required shall also be provided.

## **ANNEXURE: I**

### **MOUNTINGS**

#### **THE CUBICLE SHALL BE MOUNTED WITH FOLLOWINGS**

Sl. No.	Items.	Single T/f Panels (No.)	Double T/f Panels (No.)
1	2	3	4
1.	Ammeter – Type Misc. Size 144 Sq. mm. Range 0-100/200 A.	One	Two
2.	Selector Switch –Type Rotary stay put, 4 Position (R-Y-B-OFF)	One	Two
3.	Relay Case, Type CDG-31 / ICM 21n drawout type Tripple Pole IDMT non directional having 2 O/C + 1 E/F, O/C Element 50-200% of 1A, E/F Element 10-40% of in 3-10 sec. The relay will be provided with 2 NO S/R contacts with hand-reset flag.	One Set	Two Sets
4.	Relay Case non- drawout type containing high speed tripping relays.: Type AHT-ih VAJH13/pq8chu, 24 V DC, with hand reset type operation indicator having 3NO, N/R contacts.	One	Two
5.	Circuit Breaker 'TNC' Control Switch of robust construction complete with lost motion device for autotrip indications.	One	Two
6.	CB position indication lamp, with bulbs rated 24 V DC, Red for ON, Green for OFF and Amber for Auto Trip.	Three	Six
7.	Relay Case non drawout type, Type: CV2Cj containing 5 auxiliary relay 24 V DC, with hand reset operation indicator on each element with inscription, Buchholtz Trip, Buchholtz Alarm, Oil level Low Alarm, Winding Temp. High Alarm and Trip.	One	Two
8.	Indication Lamp for Trip Circuit Healthy (Yellow).	One	Two
9.	a) Indicating Lamp of white colour to give non-trip alarm indication.	One	Two



	b) Indicating Lamp of blue colour to give CB spring charged indication.	One	Two
10.	Push Button for cancellation of audible alarm/Buzzer.	One	One
11.	Cubicle illumination lamp with door switch.	One	One
12.	Space heater with switch inside the cubicle.	One	One
13.	Two Pin Socket and switch in the cubicle.	One	One
14.	DC operated Electric Bell for trip and non-trip alarm and AC operated buzzer for DC failure.	One each	One each
15.	Cable Gland.	Three Set.	Six Set.
16.	DAV Industries or equivalent make, DC voltage operated Semaphore indicator for breaker position indicator.	One	Two
17.	Sufficient space as approved in the drawing shall be provided along with the wiring etc. for mounting of electronic energy meter in future.	One	Two
18.	Numerical differential relay Ashida/Schneider/ABB/GEC Alsthom/; along with interposing CTS proved on notified control panels only.	One	One

**Note:**

1. Mimic diagram with semaphore indicators is to be provided as per specification.
2. Meters and relays provided in the control panel should have been type tested within last five years as per relevant ISS copies of relevant Type Test certificate should be enclosed along with the tender. Tenderers shall offer panels with relays of approved make as mentioned in the technical specification.
3. All relays should conform in all respect to relevant ISS: 3231/1965 and subsequent revisions thereof. Any other authoritative standard, which ensures an equal or better quality than the said IS/IEC, shall also be acceptable.

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## **TECHNICAL SPECIFICATION FOR 1.1 KV 3.5 CORE 240 SQ. MM ARMoured LT XLPE CABLE**

### **1.0. SCOPE:**

This specification covers design, engineering, manufacture, stage testing, inspection and testing before supply and delivery at site of 1.1 kV 3.5 x 240 Sq. mm. XLPE Cables for use with effectively earthed distribution system.

- 1.1.** It is not the intent to specify completely herein all the details of the design and construction of material. However, the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble-free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

### **2.0. STANDARDS:**

- 2.1.** The materials shall conform in all respects to the relevant Indian Standard Specifications with latest amendments thereto.

Indian Standard No.	Title	Internationally Recognized standard
IS-7098 Part-I/1988	Specification for Cross Linked Polyethylene Insulated PVC Sheathed Cables for working Voltages Up to and including 1100V	IEC 502 (1983)
IS-5831/1984	PVC insulation and sheath of electric cables	IEC 502 (1983)
IS-8130/1984	Conductors for insulated electric cables and Flexible cords	IEC 228 (1978)
IS 3975/1979	Specification for armouring	
IS-10418/1982	Specification for cable drum	

Material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above, would also be acceptable. In case the Bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English Translations shall be furnished along with the offer. . In case of conflict the order of precedence shall be (i) IS, (ii) IEC, (iii) Other standards. In case of any difference between provisions of these standards and provisions of this specification, the provisions contained in this specification shall prevail.

Moderately hot and humid tropical climate, conducive to rust and fungus growth.

### **3.0. PRINCIPAL PARAMETERS :**

The material shall conform to the following specific parameters:

Sl. No.	Item	Specification
1.	Type of Installation	Outdoor

2.	System Voltage	LT 433 V (+10% -15%)
3.	System Frequency	50 Hz +/- 5%
4.	No. of Phases	Three
5.	System of earthing	Solidly grounded

#### **4.0 TECHNICAL REQUIREMENTS:**

##### **4.1 MAIN FEATURES:**

The power cables shall be of LT 1.1 kV Grade, stranded compacted, high conductivity, aluminum conductor, XLPE insulated, ST-2 type extruded PVC inner sheathed and ST type extruded P.V.C. outer sheathed, conforming to relevant standards suitable for LT AC three phase, 50 c/s, effectively earthed distribution system.

##### **4.2 MATERIALS AND CONSTRUCTION:**

###### **4.2.1 CONDUCTOR:**

The cable conductor shall be made from stranded aluminum to form compacted shaped conductor having resistance within the limits specified in IS-8130/1984

###### **4.2.2 INSULATION:**

The XLPE insulation shall be suitable for the specified system voltage. The manufacturing process shall ensure that the insulation is free from voids. The insulation shall withstand mechanical and thermal stresses under steady state as well as transient operating conditions. The extrusion method shall give smooth surface of insulation. The insulation shall be so applied that it fits closely on the conductor and it shall be easily possible to remove it without damaging the conductor.

###### **4.2.3 INNER SHEATH:-**

An extruded PVC inner sheath shall be provided over laid up cores. The sheath shall be suitable to withstand the site conditions and the desired temperature. It shall be of thickness as per the relevant standards, consistent quality and free from all defects. The binding tape (non adhesive) used over the laid up cores to give it a better round shape shall not be constructed as a part of the inner sheath.

###### **4.2.4. OUTER SHEATH:**

Extruded PVC outer sheath of "Black" colour shall be applied with suitable additives to prevent attack by rodents and termites. Outer sheathing shall be designed to offer high degree of mechanical protection and shall also be heat, oil, chemical, abrasion and weather resistant. Common acids, alkalies, saline solutions etc., shall not have adverse effects on the PVC sheathing material used.

###### **4.2.5 ARMOUR:**

Galvanized flat steel strips shall be applied as closely as possible over the inner sheath of cable for armoring conforming to IS 3975-1979 (with amendment)

###### **4.2.6 CONSTRUCTION:**

- 1) All materials used in the manufacture of cable shall be new, unused and of finest quality. All materials shall comply with the applicable provisions of the tests of the relevant Standards.

- 2) The PVC material used in the manufacture of cable shall be of reputed make. **No recycling of the PVC is permissible.** The purchaser reserves the right to ask for documentary proof of the purchase of various materials to be used for the manufacture of cable and to check that the conductor is complying with quality control.
- 3) The cable shall be suitable for laying in covered trenches and/or buried underground to meet the out door application purposes.
- 4) Cables shall have suitable fillers laid up with the conductors to provide a substantially circular cores section before the sheath is applied. Fillers shall be suitable for the operating temperature of the insulation & compatible with the insulation material

**4.2.7 Minimum guaranteed weight of aluminium conductor used in LT 3.5x240 sq mm XLPE cable shall be 2270 Kg/Km**

**4.2.8 CURRENT RATING:**

The cables shall have current ratings and derating factors as per relevant Indian Standards. The current ratings shall be based on maximum conductor temperature of 90 deg. C with ambient site condition specified for continuous operating at the rated current. The one-second short circuit current rating shall be as per table given below at maximum temperature of 250 deg C.

Nominal Area (mm <sup>2</sup> )	Short Circuit Current Rating (kA)
240	22.56

**4.2.9 OPERATION:**

Cables shall be capable of satisfactory operation, under a power supply system frequency variation of +/- 5 c/s, voltage variation of +10% or-15%. Cable shall be suitable for laying in ducts or under ground. Cables shall have heat and moisture resistance properties; these shall be of type and design with proven record on Distribution Network service.

**4.2.10 LENGTH:**

The cable shall be supplied in wooden drums and the standard drum length shall be as follows-

(a) 3.5 x 240 sq. mm	250 meters +/- 5%
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Substandard drum length of not less than 100 meters upto a maximum of 5% of the quantities ordered shall be accepted. However substandard drum length upto a maximum of 5% shall be acceptable only in a particular lot offered for inspection.

**4.2.11 IDENTIFICATION:**

For identification of individual cores, coloured strips of red, yellow and blue colours respectively shall be used on the cores to identify phase conductors as per relevant ISS.

**4.2.12 EMBOSSING:**

The cable shall be embossed through out the length with the name of the manufacturer and the letters "Property of P.V.V.N.L., Specification No., voltage grade with cable size and the month & year of manufacture". The embossing shall be done only on the outer sheath, the distance between any two consecutive embossings shall not be more than 2 Meter. The cable shall also be embossed (clearly visible) for the verification of its length at intervals of 1 Meter say 1,2,3 up to full length.

#### **4.2.13 GUARANTEED TECHNICAL PARTICULARS:**

The guaranteed technical particulars as detailed in the specification annexure-I shall be guaranteed and a statement of guaranteed technical particulars shall be furnished in the format along with the bid **without which the Bid shall be treated as Non -Responsive.**

Immediately after completion of the electrical tests (during routine/acceptance tests), the ends of the cable shall be enclosed by rubber/PVC caps of wall thickness not less than 2.5 mm and then sealed by non hygroscopic material (the cores being suitably insulated from the cap). The cap shall be of robust construction and tight fit, and it shall have the trademark of the manufacturer embossed thereon

#### **5.0. TESTS:**

##### **5.1 Type Test:**

The material offered shall be fully type tested at CPRI/ERDA by the Bidder as per the relevant standards but test reports shall not be more than five years old from the date of opening of bid. The bidder shall furnish complete set of following type test reports along with the bid. **The bids received without these type test reports shall be treated as Non-responsive.**

1. Tests on conductors
2. Test for thickness of insulation and sheath
3. Physical tests for insulation
4. Physical tests for outer sheath
5. Insulation resistance test
6. High voltage test

##### **5.2. Acceptance and Routine test:** All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in presence of purchaser's representative.

#### **6.0 INSPECTION:**

##### **6.1** The inspection shall be carried out by the purchaser's representative during manufacture and before dispatch. The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The manufacturer shall grant free access to the purchaser's representative, at a reasonable time, when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

##### **6.2** All Acceptance tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the Bidder and purchaser at the time of purchase.

The purchaser reserves the right to insist for witnessing the acceptance/ routine testing of the bought out items. The supplier shall give 15 days (for local supply)/ 30 days (incase of foreign supply) advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests. Material shall be dispatched only after getting the dispatch authorization from Inspectors representing purchaser, after successful testing.

##### **6.3** If successful type tests have been carried out on the offered design during last five years (counted from the date of tender opening), repetition of type tests is not required.

On the other hand, if the offered design is not type tested during last five years, the cable shall be subjected to all type test in accordance with IS: 1554 (Part-I)/1988 and amendment thereof at recognized test house of repute. All charges/fee/transportation etc. to conduct these tests shall be borne by Contractor.



Regular supply of the material shall commence only after successful type testing and dispatch authorization from the competent authority.

However, the purchaser reserves the right to get cable type tested at any stage during the currency of contract at his own expenses in any reputed test house. The transportation and arrangement of testing of sample to test laboratory shall be the responsibility of the contractor.

- 6.4** Routine tests report shall be sent by the manufacturers with their offer for inspection, the following acceptance tests as laid down in the referred ISS (with latest amendments) shall be carried out by the inspecting officer of the PVVNL on Samples selected at random as per Appendix 'A' in IS-1554 (Part-I) 1988:

1. Tests on conductor	Reference to I.S.S.
a) Tensile test	IS: 8130-1984
b) Conductor resistance test	IS: 8130-1984
2. Test on armoring strips:	
a) Measurement of dimension	IS: 3975 – 1979
b) Tensile test	IS: 3975 – 1979
c) Elongation test & winding test	IS: 3975 – 1979
d) Zinc coating	IS: 2633 – 1984
3. Test for thickness of insulation and sheath	IS: 5831 – 1984
4. Tensile strength and elongation at break of insulation and sheath	IS: 5831 – 1984
5. Insulation Resistance Test	IS: 5831 – 1984
6. High voltage test at room temperature	IS: 1554 (Part-I) – 1988

In addition to above, length/weight check and bending test on one drum per inspection shall also be carried out by the inspecting officers for which contractor will make all necessary arrangements and provide all necessary facilities at his own cost.

**7.0 CABLE DRUMS:**

The cables shall be supplied in non-returnable substantially lagged wooden drums of heavy construction suitable for transportation by goods train or truck and for storage at site. The wood used for construction of the drum shall be properly seasoned and sound and wood preservative shall be applied to the entire drum. All ferrous parts shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage. The drum shall also conform to specn. No. IS: 10418-1982 with latest amendment thereof.

Each drum shall have the following information marked on it with indelible ink alongwith other important information including technical data: -

1. Property of PVVNL & Specification No. – PVVNL-MT/.....
2. Designation of consignee & destination railway station.
3. Drum Number.
4. Aluminium Core Cable.
5. Cable rating eg. Voltage grade, No. of cores, sizes etc.
6. Height of empty drum.
7. Length of Cable.

- 8. Gross weight of drum with cable.
- 9. Year of manufacture.

**8.0 PACKING AND TRANSPORT:**

All the material covered under this specification shall be adequately packed for transportation by Rail/Road. A layer of waterproof paper shall be applied to the surface of the drums and over the outer cable layer. A clear space of atleast 40 mm shall be left between the cable and the laggings. The packing shall be adequate to protect the cable from damage, in transit and contractor shall be responsible for it and make good at his own expense any and all damages due to improper packing etc.

**9.0 VARIATION OF QUANTITY:**

The supplied quantity can vary within Plus/Minus 1% of the ordered quantity.

## **Technical Specification for AC Distribution Board 415 Volt and DC Distribution Board DCDB 30 Volt Indoor Floor/Wall Mounted**

### **1. SCOPE:**

This section contains the technical specification for AC Distribution Board(ACDB) 415 Volt along with 3 Phase Neutral Voltmeter, 3 Phase Ammeter, MFM & Selector Switches with one incomer and 14 nos. outgoing (1Ph & 3Ph as per drawing) with MCCB (**Moulded Case Circuit Breaker suitable for fault level 5 KA**) Switches and Distribution Board and DC Distribution Board(DCDB) 30 Volt Indoor Floor/Wall Mounted along with Voltmeter & Ammeter with one incomer and 12 nos. outgoing (as per drawing) with MCCB (**Moulded Case Circuit Breaker suitable for fault level 5 KA**) Switches and Distribution Board Indoor Floor/Wall Mounted for use at various sub-stations.

### **SCOPE OF WORK**

1. The AC/DC Distribution Board shall be made of MS Sheet having thickness of 1.5mm and whole box should adequately be reinforced with MS Angle to achieve the strength.
2. All the cable entries shall be provided with suitable size glands.
3. All the internal wiring shall be done by supplier with adequate size of copper cable. For input cable & output cable suitable connectors of required capacity shall also be provided by the supplier.
4. There should be provision of double connectors for taking output from each MCCB.
5. The AC/DC Distribution Board shall have both the arrangement either fix it on wall or may be grouted on the floor.
6. The AC/DC Distribution Board should have double earthing pad of size 50 X 25 X 5 mm for earthing the board.
7. The AC/DC Distribution Board should have arrangement of at least 4 inch ground clearance, when grouted on the floor.
8. The exterior paint color of AC/DC Distribution Board shall be metallic smoke grey from the outside and light grey from inside.
9. ACDB 415 Volt and DCDB 30 Volt should be dust proof and vermin proof.

**Standard** :- The various components being used in the AC/DC Distribution Boards like MCCBs, Ammeters, Voltmeters, Bus bars, G I Sheet 1.5 mm, LED Indicator lamp, Selector switches, CTs, wiring etc. shall complying to latest relevant IS specification and shall be of good quality.

**Type & Rating:** -

- (i) **For A.C. Distribution Board**

The Technical Details including quantities of various components of A.C. Distribution Board shall be as under-

Sr.No	PARTICULARS	MAKE	Qty (Nos.)
1	Fuse switch unit, 100 Amps T.P.N with 63A HRC Fuses	Any Standard Make	1
2	M.C.C.B 63 Amps, T.P.N for Heavy Load	do	1
3	M.C.C.B 32 Amps, T.P.N for Light Load	do	1
4	M.C.C.B 16 Amps,D.P. for Yard Light	do	2
5	M.C.C.B 16 Amps, D.P. for Control Room Light	do	1
6	M.C.C.B 16 Amps, D.P. for 33KV VCB	do	3
7	M.C.C.B 16 Amps, D.P. for 11 KV Feeder VCB	do	4
8	M.C.C.B 16 Amps, D.P. for 11 KV Capacitor VCB	do	2
9	Digital Voltmeter, Scale:(0-500) Volt, 96x96 Sqmm	do	1
10	Digital Ammeter, Scale:(0-100) AMP, CTR:100/5A, 96x96 Sqmm		1
11	Digital Multifunction meter, 96x96 Sqmm with KWH Measurement, Class-1.0		1
12	LED Indication Lamps 230 V AC RED: For I/C 100 A, 63 A TNP, 32 A DP Yellow: For I/C 100 A, 63 A TNP, 32 A TNP Blue: For I/C 100A, 63 A TNP, 32 TNP	do	15 3 3
13	V.M Selector Swwitch, 6A, Cam Type, Four Position (OFF-RY-YB-BR)	do	1
14	A.M Selector Swwitch, 6A, Cam Type, Four Position (OFF-R-Y-B)	do	1
15	Current Transformer, BPL Type Tape Wound, 100/5A, 5 VA,CL-1.0	Standard	3
16	Busbars of EC Grade 150 AMPS, Insulated By Heat Shrinkable VC Sleeve, in Standard Colour Code Mounted on DMC Material Busbar Supporters.	Standard	Set
17	Terminal Blocks, Stud Type,57 AMPS Rating	do	Set
18	HRC Fuses 2 AMPS	do	16
19	Monogram of Board and Card Frame For Marking Destination of Each Outgoing MCCB Feeder		Set
20	Internal Power Wiring and Control Wiring By Suitable Size, Colour Coded PVC Copper Wire		Set
21	Earthing Pad 50*25*5 mm Earthing pad with one hole (16mm) should be of GI material and should not be painted. The Nut bolt and washers of suitable size should also be of GI material		Set

General Arrangement Drawing of 415 V A.C. Distribution Board shall be as given in Annexure-A. Three line diagram and Bill of Material shall be as given in Annexure B.

**(ii) For D.C. Distribution Board**

Sr.No.	PARTICULARS	MAKE	Qty (Nos.)
1	M.C.C.B 32 Amps, D.P.	Any Standard Make	1
2	M.C.C.B 20 Amps, D.P. for Control Room	do	1
3	M.C.C.B 16 Amps, D.P. for Feeder	do	11
4	Digital Voltmeter, 96X96 Sqmm, (0-50) DC	do	1
5	Digital Ammeter, With External Shunt 75 mV, 96X96 Sqmm, (0-50) DC	do	1
6	LED indication Lamps 30 V DC, Red Colour (one in Each I/C and O/G Feeder)	do	10
7	Busbars of EC Grade 32 AMPS, Insulated By Heat Shrinkable VC Sleeve, in Statandard Colour Code Mounted on DMC/Epoxy material bus bar supporters.	Standard	Set
8	Terminal Blocks, Stud Type 60 AMPS Rating	do	Set
9	HRC Fuses 24 AMPS for Protection of Voltmeter and indication LED Lamp	do	10
10	Monogram of Board and Card Frame For Marking Destination of Each Outgoing MCCB Feeder		Set
11	Internal Power Wiring and Control Wiring By Suitable Size, Colour Coded PVC Copper Wire		Set
12	Earthing Pad 50*25*5 mm		Set



## **TECHNICAL SPECIFICATION FOR PG Clamps (30-50-80-100 MM2)**

1. SCOPE: This specification covers the design, manufacture, testing, supply, and delivery of Aluminium Alloy Non-Tension Parallel Grooved Clamps suitable for ACSR of size 30 mm<sup>2</sup> to 100 mm<sup>2</sup> for use in Distribution. The P.G. Clamps shall strictly comply with IS:21.
2. Raw material to be used for the manufacture of P.G. Clamps shall be Aluminium Alloy. All Ferrous metal parts shall be protected by hot dip galvanizing conforming to relevant Indian Standard Specification IS:2633 (Latest edition with amendments if any) and shall be tested according to tests laid down therein. The spring washers shall however be electro galvanized conforming to service grade-IV as specified in IS-1573 (Latest edition with amendments if any) and shall be tested accordingly. The material to be used for the manufacture of P.G. Clamps shall be such that it gives the required mechanical strength and durability in outdoor industrial environment with specified dimensions. The clamp body casting shall be having good finish, smooth, free from flaws & imperfections and other general defects.
3. ATMOSPHERIC CONDITIONS:
  - i) The climatic conditions under which this material is required to be operated
  - ii) Tests for the purpose of this standard shall preferably be carried out under conditions of temperature and humidity as specified in IS:196/1966 (that is a temp. of 27°C +2°C and relative humidity of 65+2 percent) and at the prevailing atmospheric pressure. When this is not possible, test may be carried out under conditions naturally prevailing at the time of test. The baro-metric pressure, air temperature and humidity shall be recorded for the purpose of corrections.
4. GENERAL REQUIREMENT; P.G. Clamps offered shall be of die cast Aluminium Alloy and shall be suitable for use with ACSR 30 100 mm<sup>2</sup>. The grooves in the clamps shall be smooth to give a firm & complete grip to the conductor. All ferrous metal parts shall be hot dip galvanized conforming to IS:2633 (Latest edition with amendments if any) except plain & spring washers which shall be electro galvanized. Guaranteed Technical Particulars shall be furnished by the bidders in respect of above sizes separately in the Performa given at Annexure-A.
5. SAMPLES: Samples shall be submitted by the bidder.
6. MARKING: Each clamp shall have, the following identification marks duly embossed:
  - a) Name or trade mark of the Manufacturer.
7. , on the main Aluminium Alloy body. Year of manufacture. INSPECTION & TESTS: The PVVNL shall inspect, examine & test the material through its representative or through an outside agency nominated by PVVNL at the bidder / manufacturer's works, during or after the manufacture of material prior to despatch on receipt of a clear notice of minimum two weeks in advance to be reckoned from the date of receipt by the purchaser. The bidder / manufacturer shall provide facilities for carrying out the following acceptance tests as per IS:2121 Part-4- 1991(Latest edition with amendments if any) at the manufacturer's works:
  - Visual examination.
  - Verification of dimensions.
  - Mechanical tests.
  - Galvanizing tests.Type tests certificates from a Govt. approved/ recognized Test House indicating the results of type tests conducted (before original date of opening of tender) on not less than two clamps, identical in all essential details with those to be supplied, should be enclosed with the tender.

Type test should be conducted on the tendered item manufactured only at work(s) from where material is to be.

8. PACKING: The P.G. Clamps shall be suitably packed in double gunny/plastic bags, sewn with lash/ plastic wire or in wooden boxes, which shall be tied with cross G.I. Wire. The packing shall be fit to withstand rough handling during transit & storage at destination without causing any damage to galvanizing or surface finish. Each packing shall not weight more than 50 Kg. The packing shall be done immediately after the material is cleared for despatch by Purchaser's representative after its successful testing and each packing will be sealed by the purchaser's representative. All P.G. Clamps received damaged shall be to the bidder / manufacturer's account. Since, the packings containing the inspected quantity of P.G. Clamps are required to be sealed by our Inspecting Officer after carrying out the successful testing/inspection of material as per relevant standards.

#### Annexure

##### GUARANTEED TECHNICAL PARTICULARS

a)	Name of Manufacturer.		
b)	Trade Mark of Manufacturer.		
c)	Place of Manufacture.		
d)	Standard to which the P.G. Clamps will conform.		
e)	Dimensions (w.r.t. Board's new PSP CL Drawing no. 151/R1)	A	mm
		B	mm
		C	mm
		D (Diameter of bolt)	mm
		E (Length of bolt)	mm
f)	Type/Grade of Aluminium Alloy.		
g)	Chemical Composition of Aluminium alloy used.		
h)	Weight of	i) Aluminium Alloy	gm
		ii) Steel Parts	gm
		iii) Total Weight	gm
i)	Material for	i) Bolts & nuts	
		ii) Plain washers	
		iii) Spring Washers	
j)	Withstand load for minimum one Minuteduration (Minimum 1.2KN as per IS: 2121 Part-4).		
k)	Galvanizing for Steel parts	i) Wt. of zinc/ mtr <sup>2</sup> for Bolts & nuts.	
		ii) No. of dips of one minuteduration that nuts and bolts will withstand.	
l)	Whether galvanizing conform to IS: 2633 (Latest edition with amendments if any)		
m)	Packing details.		
n)	Any other Particulars.		

## **LT Shackle Insulators Brown Glazed (size 90 mmx 75 mm)**

1. SCOPE: This specification covers the manufacture, testing, supply, and delivery of LT Shackle Insulators.

2. STANDARD All LT Shackle Insulators shall strictly comply as regards material, design, manufacture, and testing with the Indian Standard Specification IS: 1445 (With latest edition/amendments, if any). Insulators should conform to Type-I, Figure-3 of IS-1445 and shall be strictly in accordance with design laid down therein.

### **3. ATMOSPHERIC CONDITIONS**

(i) The material offered shall be suitable for operation under the climatic conditions indicated as under:

a) Maximum temperature of air in shade 50°C

b) Minimum temperature of air in shade -2°C

c) Maximum temperature of air in sun 60°C

d) Maximum humidity 100%

e) Average number of thunderstorm days 40 per annum

f) Average number of dust storm days 40 per annum

g) Maximum rain falls per annum 98 cm.

h) Average rain falls per annum 60 cm.

i) Limits of ambient temperature 19° C to 45° Cover a period of 24 hours

j) Wind Pressure 145 Kg. /Sq.M.

k) Altitude 1000 Meter. l) Whether the insulators would be used Normally polluted in normal or heavily polluted areas. Areas.

(ii) Reference atmospheric conditions at which insulator characteristics shall be expressed for the purpose of comparison are given as below: Ambient Temperature 20° C Barometric pressure 1013 millibars Absolute Humidity 11 gm of water per cubic meter corresponding to 63% relative humidity at 20° C

(iii) Tests for the purpose of this standard shall preferably be carried out under conditions of temperature and humidity specified in IS-196 (i.e. a temperature of 27° C+2° C and relative humidity of 65+2 percent) and at the prevailing atmospheric pressure. When this is not possible, tests may be carried out under conditions naturally obtainable at the time of test. The barometric pressure, air temperature and humidity shall be recorded for the purpose of correction.

### **4. GENERAL REQUIREMENTS**

i) These shall be in accordance with the details given in Clause-2 above.

ii) The insulators shall be of one-piece construction as given in IS-1445 (With latest amendments, if any).

iii) The porcelain shall be sound, free from defects, thoroughly vitrified, and smoothly glazed. The finished porcelain shall be dark brown in colour. The glaze shall be free from blemishes and cover all porcelain parts of insulators except those which serve as supports during firing or are otherwise required to be left unglazed.

iv) The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to its deterioration

v) The insulator shall be entirely free from sharp edges, ridges or points and shall not exhibit appreciable corona formation prior to flashover and when tested on High Frequency, shall flashover in air without puncturing.

5. (i) **INSULATOR CHARACTERISTICS** The Shackle Insulators shall have the electrical and mechanical characteristics given in the table below: ELECTRICAL Wet Power Frequency Withstand Voltage Withstand voltage KV (rms) 10 Mechanical Power Frequency Puncture KV (rms) 1.3 x the actual Dry Flashover Voltage.

NOTE: - The Withstand and Flashover Voltages are with reference to the atmospheric conditions.

(ii): The Shackle Insulators shall be suitable for a minimum failing load of 11.5 KN.

6. Drawing: The Tenderers shall submit with their tender, fully dimensioned elevation, cross & longitudinal sectional drawing of the Insulators. All drawings shall be to the scale and fully detailed with clear indication thereon, of the material of which each component is made.

7. **MARKING:**

Each Insulator shall legibly and indelibly mark to show the following:

a) Name or Trade Mark of the Manufacturer.

b) Month and year of Manufacture.

c) Country of Manufacture. Marking on porcelain shall be printed and shall be applied before firing. Insulators without marking are likely to be rejected. Insulators may also be marked with the ISI certification Mark, if the tenderer possess the ISI license.

8. **GUARANTEED TECHNICAL PARTICULARS**

Guaranteed technical particulars as per Annexure-A (duly filled) must accompany the tender.

9. **TESTS AND TEST CERTIFICATES** The insulators shall comply with the type test as per IS-1445 (with latest Amendments, if any). Type test certificates from any Govt. Test House giving the result of type tests conducted on not less than two insulators, identical in all essential details with those to be supplied, should be enclosed with the tender. The offer of the firm without complete type test certificates from recognized test house may be rejected. Purchaser, however, reserves the right to carry out the tests from any Govt. Test House, wherever felt necessary, at firm's cost. The Inspecting Officer, in that case may seal the samples out of the lot and witness the type tests. The material shall comply with the routine test, as per IS-1445(with latest amendments, if any) as well. The material shall be subjected to all the acceptance tests as per IS-1445(with latest amendments, if any) during pre-dispatch inspection.

10. **PACKING** The insulators shall be suitably wrapped in dry straw grass and packed in single woven plastic bags or gunny bags for safe transportation to stores of the purchaser to avoid any damage during transit or rough handling. The insulators received damaged/short shall be to the supplier's account. The bags containing the inspected material are required to be sealed by Inspecting Officer after carrying out its successful testing/inspection as per relevant standards, the lead seals & lash wire/plastic threads for this purpose shall be supplied by the supplier without any additional charges to the Board. The supplier shall, therefore, provide proper seals and lash wire/plastic threads of good quality to ensure that it give clear and legible impression of the sealing plier used by the Inspecting Officer. The supplier or their

authorized representative shall further be required to give the following certificate before our Inspecting Officer leaves their premises, to ensure that the impressions on the seals are proper & legible: "It is certified that I have checked and found impressions of the sealing plier legible on the lead seals." The quoted prices shall be deemed to include the cost of suitable packing as above, unless otherwise specified in the tender.

11. **MANUFACTURE** Place of manufacture, testing and inspection of material must be stated by the tenderer clearly.

12. **SAMPLES** Four samples of insulator quoted by the firm must accompany their tender. Samples should be duly labelled with full address of the firm with tender enquiry number and date thereon. Samples should either be handed over personally or sent by post before the due date i.e. date of opening of tenders. Samples shall not be received against RR or through GR. After finalization of the purchase proposal i.e. after the expiry of validity period, the unsuccessful bidders will collect their samples so submitted, within two months thereafter or else the department does not hold itself responsible for their safe custody.

13. **TOLERANCE** A tolerance of + 2% (two percent) of the ordered qty. subject to maximum of 250 no. insulators shall be allowed for recording completion of the order.

14. **PAST PERFORMANCE** The past performance of the firm on whom orders have been placed by this office for this material in the past, shall be taken into consideration while deciding the case. The firms with unsatisfactory performance are likely to be ignored even if otherwise found technically acceptable and fall within the zone of consideration.

#### **ANNEXURE-A**

##### **GUARANTEED AND OTHER TECHNICAL PARTICULARS:**

- A. Name of the manufacturer and country of origin.
- B. Standard to which the insulator will conform & whether ISI/PQ Marked.
- C. Dimensions (size of insulators)
- D. Hole-diameter.
- E. Colour. Dry Flash-over voltage.
- F. Wet flash-over voltage.
- G. Dry Power frequency withstand voltage.
- H. Wet power frequency withstand voltage.
- I. Power frequency puncture withstand voltage.
- J. Minimum failing load. Temperature cycle test.
- K. Porosity test.
- L. Tolerance in dimensions



**TECHNICAL SPECIFICATION FOR SINGLE CORE LT UN-ARMoured XLPE CABLE****1.0. SCOPE:**

This specification covers design, engineering, manufacture, stage testing, inspection and testing before supply and delivery at site and testing and commissioning of following sizes of Single Core XLPE Cables for use with effectively earthed distribution system.

- |     |               |     |                |     |                |
|-----|---------------|-----|----------------|-----|----------------|
| (1) | 1 x 70 Sq. mm | (2) | 1 x 120 Sq. mm | (3) | 1 x 150 Sq. mm |
| (4) | 1x240 Sq. mm  | (5) | 1x400 Sq. mm   | (6) | 1 x 630 Sq. mm |
| (7) | 1x1000 Sq. mm |     |                |     |                |

- 1.1. It is not the intent to specify completely herein all the details of the design and construction of material. However the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

**2.0. STANDARDS:**

- 2.1. The materials shall conform in all respects to the relevant Indian Standard Specifications with latest amendments thereto.

Indian Standard No.	Title	Internationally Recognized standard
IS-7098 Part-I/1988	Specification for Cross Linked Polyethylene Insulated PVC Sheathed Cables for working Voltages Up to and including 1100V	IEC 502 (1983)
IS-5831/1984	PVC insulation and sheath of electric cables	IEC 502 (1983)
IS-8130/1984	Conductors for insulated electric Cables and Flexible cords	IEC 228 (1978)
IS-10418/1982	Specification for cable drum	

Material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above, would also be acceptable. In case the Bidders who wish to offer material conforming to the other standards, salient points of difference between

the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English Translations shall be furnished along with the offer. . In case of conflict the order of precedence shall be (i) IS, (ii) IEC, (iii) Other standards. In case of any difference between provisions of these standards and provisions of this specification, the provisions contained in this specification shall prevail.

Moderately hot and humid tropical climate, conducive to rust and fungus growth.

**3.0. PRINCIPAL PARAMETERS :** The material shall conform to the following specific parameters:

Sl. No.	Item	Specification
1.	<b><u>Type of Installation</u></b>	Outdoor
2.	System Voltage	LT 433 V (+10% -15%)
3.	System Frequency	50 Hz +/- 5%
4.	No. of Phases	Three
5.	System of earthing	Solidly grounded

**4.0 TECHNICAL REQUIREMENTS:**

**4.1 MAIN FEATURES:**

The power cables shall be of LT 1.1 kV Grade, stranded compacted, high Conductivity, aluminum conductor, XLPE insulated, extruded PVC inner sheathed, extruded P.V.C. outer sheathed, conforming to relevant standards suitable for LT AC three phase, 50 c/s, effectively earthed distribution system.

**4.2 MATERIALS AND CONSTRUCTION:**

**4.2.1 CONDUCTOR:**

The cable conductor shall be made from stranded aluminum to form compacted conductor having resistance within the limits specified in IS-8130/1984. **Minimum guaranteed weight of Aluminium used in the cable shall be as given below :**

Sl. No.	Cable Size	Minimum guaranteed weight of Alu. Kg/ km
1.	1×70 mm <sup>2</sup>	189.00 Kg/KM.
2.	1×120 mm <sup>2</sup>	325.00 Kg/KM.
3.	1×150 mm <sup>2</sup>	405.45 kg / km
4.	1×240 mm <sup>2</sup>	649.00 Kg/KM
5.	1×400 mm <sup>2</sup>	1081.00 Kg/KM.
6.	1×630 mm <sup>2</sup>	1700.00 Kg/KM.
7.	1×1000 mm <sup>2</sup>	2700.00 Kg/KM.

**4.2.2 INSULATION:**

The XLPE insulation shall be suitable for the specified system voltage. The manufacturing process shall ensure that the insulation is free from voids. The insulation shall withstand mechanical and thermal stresses under steady state as well as transient operating conditions. The extrusion method shall give smooth surface of insulation. The insulation shall be so applied that it fits closely on the conductor and it shall be easily possible to remove it without damaging the conductor.

**4.2.3 INNER SHEATH: -**

An extruded PVC inner sheath shall be provided over laid up cores. The sheath shall be suitable to withstand the site conditions and the desired temperature. It shall be of thickness as per the relevant standards, consistent quality and free from all defects. The binding tape used over the laid up cores shall not be constructed as a part of the inner sheath.

**4.2.4 OUTER SHEATH:**

Extruded PVC outer sheath of Green colour shall be applied with suitable additives to prevent attack by rodents and termites. Outer sheathing shall be designed to offer high degree of mechanical protection and shall also be heat, oil, chemical, abrasion and weather resistant. Common acids, alkalies, saline solutions etc., shall not have adverse effects on the PVC sheathing material used.

**4.2.5 CONSTRUCTION:**

- 1) All materials used in the manufacture of cable shall be new, unused and of finest quality. All materials shall comply with the applicable provisions of the tests of the relevant Standards.
- 2) The PVC material used in the manufacture of cable shall be of reputed make. No recycling of the PVC is permissible. The purchaser reserves the right to ask for documentary proof of the purchase of various materials to be used for the manufacture of cable and to check that the conductor is complying with quality control.
- 3) The cable shall be suitable for laying in covered trenches and/or buried underground to meet the outdoor application purposes.

**4.2.6 CURRENT RATING:**

The cables shall have current ratings and derating factors as per relevant Indian Standards. The current ratings shall be based on maximum conductor temperature of 90 deg. C with ambient site condition specified for continuous operating at the rated current. The one-second short circuit current rating shall be as per table given below at maximum temperature of 250 deg C.

Sl. No.	Nominal Area (mm <sup>2</sup> )	Short Circuit Current Rating (KA)
1.	1×70 mm <sup>2</sup>	6.6
2.	1×120 mm <sup>2</sup>	11.28
3.	1×150 mm <sup>2</sup>	14.10
4.	1×240 mm <sup>2</sup>	22.56

5.	1×400 mm <sup>2</sup>	37.60
6.	1×630 mm <sup>2</sup>	59.22
7.	1×1000 mm <sup>2</sup>	94.00

#### **4.2.7 OPERATION:**

Cables shall be capable of satisfactory operation, under a power supply system frequency variation of  $\pm 5$  C/S, voltage variation of +10% to -15%. Cable shall be suitable for laying in ducts or under ground. Cables shall have heat and moisture resistance properties; these shall be of type and design with proven record on Distribution Network service.

#### **4.2.8 LENGTH:**

The cable shall be supplied in wooden drums and the standard drum length shall be as follows-

(1) 1 x 50 sq. mm-	500 meters +/- 5%
(2) 1 x 70 sq. mm-	500 meters +/- 5%
(3) 1 x 150 sq. mm-	500 meters +/- 5%
(4) 1 x 240 sq. mm-	500 meters +/- 5%
(5) 1 x 400 sq. mm-	500 meters +/- 5%
(6) 1 x 630 sq. mm-	500 meters +/- 5%
(7) 1 x 1000 sq. mm-	500 meters +/- 5%

#### **4.2.9 IDENTIFICATION:**

For identification of individual cores, coloured strips of red, yellow and blue colours respectively shall be used on the cores to identify phase conductors as per relevant ISS.

#### **4.2.10 EMBOSSING :**

The cable shall be embossed throughout the length with the name of the manufacturer or trade mark and the letters "Property of P.V.V.N.L.", voltage grade with cable size and the year of manufacture. The embossing shall be done only on the outer sheath, the distance between any two consecutive embossing shall not be more than 1 Meter. The cable shall be embossed for the verification of its length at intervals of 1 Meter say 1,2,3 up to full length.

#### **4.2.11 GUARANTEED TECHNICAL PARTICULARS:**

The guaranteed technical particulars of the material shall be as per Annexure enclosed herewith. In case of any inconsistency with GTP, the parameters given in Technical Specification shall prevail.

#### **5.0. TESTS:**

##### **5.1 Type Test:**

The material offered shall be fully type tested at independent test laboratories by the Bidder as per the relevant standards but test reports shall not be more than five years old from the date of opening of bid. The bidder shall furnish following type test reports

along with the bid. The bids received without these type test reports shall be treated as non responsive.

1. Tests on conductors.
2. Test for thickness of insulation and sheath.
3. Physical tests for insulation.
4. Physical tests for outer sheath.
5. Insulation resistance test.
6. High voltage test.

**5.2. Acceptance and Routine test:** All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in presence of purchaser's representative.

## **6.0 INSPECTION**

The inspection shall be carried out by the purchaser's representative during manufacture and before dispatch. The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The manufacturer shall grant free access to the purchaser's representative, at a reasonable time, when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

All Acceptance tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the Bidder and purchaser at the time of purchase.

The purchaser reserves the right to insist for witnessing the acceptance/ routine testing of the bought out items. The supplier shall give 15 days (for local supply)/ 30 days (incase of foreign supply) advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests. Material shall be dispatched only after getting the dispatch authorization from Inspectors representing purchaser, after successful testing.

## **7 VARIATION IN QUANTITY**

The supplied quantity can vary within plus/minus two percent of the ordered quantity.

The cables offered by the tenderers shall conform to the requirement of IS: 7098 (Part-II)/1985 with latest amendment thereof and as per technical particulars enclosed herewith. No other technical particulars or deviation from Technical particulars and technical specifications shall be accepted. Any deviation may result in the cancellation of order.

Further, these specifications are subject to the instructions to Tenderers, General Technical specifications, Terms and conditions mentioned in General requirement of specifications, and PVVNL Form 'B'. In case if any ambiguity of technical details given elsewhere the conditions given in technical specification shall prevail.



**Note -**

- (i) In case of any contradiction in technical specification as mentioned above the relevant IS, shall be prevail.
- (ii) In case of any contradiction in terms & conditions mentioned at more than any place, the terms & conditions to the best advantage of PVVNL will prevail.

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**TECHNICAL SPECIFICATION FOR 1.1 KV GRADE SINGLE CORE 16/35/400/630  
SOMMUN-ARMOURED XLPE CABLE**

**1.0. SCOPE:**

This specification covers design, engineering, manufacture, stage testing, inspection and testing before supply and delivery at site of 1.1 kV grade single core XLPE Cables for use with effectively earthed distribution system.

- 1.1.** It is not the intent to specify completely herein all the details of the design and construction of material. However the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

**2.0. STANDARDS:**

- 2.1.** The materials shall conform in all respects to the relevant Indian Standard Specifications with latest amendments thereto.

Indian Standard No.	Title	Internationally Recognized standard
IS-7098 Part-I/1988	Specification for Cross Linked Polyethylene Insulated PVC Sheathed Cables for working Voltages Up to and including 1100V	IEC 502 (1983)
IS-5831/1984	PVC insulation and sheath of electric cables	IEC 502 (1983)
IS-8130/1984	Conductors for insulated electric cables and Flexible cords	IEC 228 (1978)
IS-10418/1982	Specification for cable drum	

Material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above, would also be acceptable. In case the Bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English Translations shall be furnished along with the offer. In case of conflict the order of precedence shall be (i) IS, (ii) IEC, (iii) Other standards. In case of any difference between provisions of these standards and provisions of this specification, the provisions contained in this specification shall prevail.

**3.0. PRINCIPAL PARAMETERS :**

The material shall conform to the following specific parameters:

Sl. No.	Item	Specification
1.	Type of Installation	Outdoor
2.	System Voltage	433 V (+10% -15%)
3.	System Frequency	50 Hz +/- 5%
4.	No. of Phases	Three
5.	System of earthing	Solidly grounded

**4.0 TECHNICAL REQUIREMENTS:****4.1 MAIN FEATURES:**

The power cables shall be of LT 1.1 kV Grade, stranded compacted, high conductivity, aluminum conductor, XLPE insulated, ST-2 type extruded P.V.C. outer sheathed, conforming to relevant standards suitable for LT AC three phase, 50 c/s, effectively earthed distribution system.

**4.2 MATERIALS AND CONSTRUCTION:****4.2.1 CONDUCTOR:**

The cable conductor shall be made from stranded aluminum to form compacted shaped conductor having resistance within the limits specified in IS-8130/1984

**4.2.2 INSULATION:**

The XLPE insulation shall be suitable for the specified system voltage. The manufacturing process shall ensure that the insulation is free from voids. The insulation shall withstand mechanical and thermal stresses under steady state as well as transient operating conditions. The extrusion method shall give smooth surface of insulation. The insulation shall be so applied that it fits closely on the conductor and it shall be easily possible to remove it without damaging the conductor.

**4.2.3. OUTER SHEATH:**

Extruded PVC outer sheath of **black** colour shall be applied with suitable additives to prevent attack by rodents and termites. Outer sheathing shall be designed to offer high degree of mechanical protection and shall also be heat, oil, chemical, abrasion and weather resistant. Common acids, alkalies, saline solutions etc., shall not have adverse effects on the PVC sheathing material used.

**4.2.4 CONSTRUCTION:**

- 1) All materials used in the manufacture of cable shall be new, unused and of finest quality. All materials shall comply with the applicable provisions of the tests of the relevant Standards.
- 2) The PVC material used in the manufacture of cable shall be of reputed make. **No recycling of the PVC is permissible.** The purchaser reserves the right to ask for documentary proof of the purchase of various materials to be used for the

manufacture of cable and to check that the conductor is complying with quality control.

- 3) The cable shall be suitable for laying in covered trenches and/or buried underground to meet the out door application purposes.
- 4) Cables shall have suitable fillers laid up with the conductors to provide a substantially circular cores section before the sheath is applied. Fillers shall be suitable for the operating temperature of the insulation & compatible with the insulation material.

**4.2.7 Minimum guaranteed weight of aluminium conductor used in different sizes of single core cables shall be as per following table:-**

Size of Cable	Minimum Guaranteed weight of Aluminum conductor (Kg)
1x16 sq mm	43
1x35 sq mm	95
1x400 sqmm	1081
1x630 sqmm	1703

**4.2.8 CURRENT RATING:**

The cable shall have current rating and derating factor as per relevant Indian Standard. The current ratings shall be based on maximum conductor temperature of 90 deg. C with ambient site condition specified for continuous operating at the rated current.

**4.2.9 OPERATION:**

Cable shall be capable of satisfactory operation, under a power supply system frequency variation of +/- 5 c/s, voltage variation of +10% or -15%. Cable shall have heat and moisture resistance properties; these shall be of type and design with proven record on Distribution Network service.

**4.2.10 LENGTH:**

The cable shall be supplied in wooden drums and the standard drum length shall be as follows-

Size of Cable	Standard drum length
1x16 sq mm	500 meters +/-5%
1x35 sq mm	500 meters +/-5%
1x400 sqmm	250 meters +/- 5%
1x630 sqmm	250 meters +/- 5%

Substandard drum length of not less than 100 meters upto a maximum of 5% of the quantities ordered shall be accepted. However substandard drum length upto a maximum of 5% shall be acceptable only in a particular lot offered for inspection.

**4.2.11 EMBOSING:**

The cable shall be embossed through out the length with the name of the manufacturer and the letters "Property of P.V.V.N.L., Specification No., voltage grade with cable size and the year of manufacture". The embossing shall be done only on the outer sheath, the distance between any two consecutive embossings shall not be more than 2 Meter. The cable shall also be embossed (clearly visible) for the verification of its length at intervals of 1 Meter say

1,2,3 up to full length.

#### **4.2.12 GUARANTEED TECHNICAL PARTICULARS:**

The guaranteed technical particulars as detailed in the specification annexure-I shall be guaranteed and a statement of guaranteed technical particulars shall be furnished in the format along with the bid **without which the Bid shall be treated as Non -Responsive.**

Immediately after completion of the electrical tests (during routine/acceptance tests), the ends of the cable shall be enclosed by rubber/PVC caps of wall thickness not less than 2.5 mm and then sealed by non hygroscopic material (the cores being suitably insulated from the cap). The cap shall be of robust construction and tight fit, and it shall have the trademark of the manufacturer embossed thereon.

#### **5.0. TESTS:**

##### **5.1 Type Test:**

The material offered shall be fully type tested at independent test laboratories by the Bidder as per the relevant standards but test reports shall not be more than five years old from the date of opening of bid. The bidder shall furnish complete set of following type test reports along with the bid. **The bids received without these type test reports shall be treated as Non-responsive.**

1. Tests on conductors
2. Test for thickness of insulation and sheath
3. Physical tests for insulation
4. Physical tests for outer sheath
5. Insulation resistance test
6. High voltage test

##### **5.2. Acceptance and Routine test:** All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in presence of purchaser's representative.

#### **6.0 INSPECTION:**

##### **6.1** The inspection shall be carried out by the purchaser's representative during manufacture and before dispatch. The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The manufacturer shall grant free access to the purchaser's representative, at a reasonable time, when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

##### **6.2** All Acceptance tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the Bidder and purchaser at the time of purchase.

The purchaser reserves the right to insist for witnessing the acceptance/ routine testing of the bought out items. The supplier shall give 15 days (for local supply)/ 30 days (incase of foreign supply) advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests. Material shall be dispatched only after getting the dispatch authorization from Inspectors representing purchaser, after successful testing.

##### **6.3** If successful type tests have been carried out on the offered design during last five years (counted from the date of tender opening), repetition of type tests is not required.

On the other hand, if the offered design is not type tested during last five years, the cable shall be subjected to all type test in accordance with IS: 1554 (Part-I)/1988 and amendment thereof at recognized test house of repute. All charges/fee/transportation etc. to conduct these tests shall be borne by Contractor.

Regular supply of the material shall commence only after successful type testing and dispatch authorization from the competent authority.

However, the purchaser reserves the right to get cable type tested at any stage during the currency of contract at his own expenses in any reputed test house. The transportation and arrangement of testing of sample to test laboratory shall be the responsibility of the contractor.

- 6.4** Routine tests report shall be sent by the manufacturers with their offer for inspection, the following acceptance tests as laid down in the referred ISS (with latest amendments) shall be carried out by the inspecting officer of the PVVNL on Samples selected at random as per Appendix 'A' in IS-1554 (Part-I) 1988:

1. Tests on conductor	Reference to I.S.S.
a) Tensile test	IS: 8130-1984
b) Conductor resistance test	IS: 8130-1984
2. Test for thickness of insulation and sheath	IS: 5831 – 1984
3. Tensile strength and elongation at break of insulation and sheath	IS:5831 – 1984
4. Insulation Resistance Test	IS: 5831 – 1984
5. High voltage test at room temperature	IS: 1554 (Part-I) – 1988

In addition to above, length/weight check and bending test on one drum per inspection shall also be carried out by the inspecting officers for which contractor will make all necessary arrangements and provide all necessary facilities at his own cost.

**7.0 CALBE DRUMS:**

The cables shall be supplied in non-returnable substantially lagged wooden drums of heavy construction suitable for transportation by goods train or truck and for storage at site. The wood used for construction of the drum shall be properly seasoned and sound and wood preservative shall be applied to the entire drum. All ferrous parts shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage. The drum shall also conform to specn. No. IS: 10418-1982 with latest amendment thereof.

Each drum shall have the following information marked on it with indelible ink alongwith other important information including technical data: -

1. Property of PVVNL & Specification No. – PVVNL-MT/.....
2. Designation of consignee & destination railway station.
3. Drum Number.
4. Aluminium Core Cable.
5. Cable rating eg. Voltage grade, No. of cores, sizes etc.



6. Height of empty drum.
7. Length of Cable.
8. Gross weight of drum with cable.
9. Year of manufacture.

**8.0 PACKING AND TRANSPORT:**

All the material covered under this specification shall be adequately packed for transportation by Rail/Road. A layer of waterproof paper shall be applied to the surface of the drums and over the outer cable layer. A clear space of atleast 40 mm shall be left between the cable and the laggings. The packing shall be adequate to protect the cable from damage, in transit and contractor shall be responsible for it and make good at his own expense any and all damages due to improper packing etc.

**9.0 VARIATION OF QUANTITY:**

The supplied quantity can vary within Plus/Minus 1% of the ordered quantity.

## **TECHNICAL SPECIFICATION FOR JOINTING/TERMINATION KITS FOR 11 KV XLPE CABLE**

- 1.0 The instructions given hereunder are in addition to supersession of the instructions given elsewhere in the tender documents and these are to be treated as final requirement in this regard wherever any ambiguity arises.
- 1.1 **SCOPE:** The specification covers design, manufacturer, testing, packing, inspection and delivery anywhere in U.P. of cable terminations and joints employing Heat Shrinkable technology suitable for 11 KV (E) , 3 core XLPE insulated screened and armoured cables as per IS 7098 (with latest amendment), having compacted circular stranded conductor of sizes 35 mm<sup>2</sup> to 400 mm<sup>2</sup> or as per requirement.
- 1.1.2 It is not the intent to specify completely herein all details of design and construction of equipment/system. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to vendor's guarantee in a manner acceptable to the purchase who will interpret the meaning of the drawings and specification and shall have the power to reject any work or materials, which in his judgment are not in full accordance therewith.
- 1.1.3 Tenderer has to submit all relevant papers & copies of all the relevant documents. Failing to do so may amount to the bids being considered non-responsive and outright rejection. The information as asked for is to be mentioned specifically and not be narrated as 11 KV as per ISS, relevant standard, reference to other pages of tender bid etc.
- 1.2 Technical data sheet annexed has to be filled in completely and separately for indoor/outdoor terminations and straight through joints where ever asked for. Copies of the documents where asked for are to be enclosed for each requirement.
- 1.3 The tender documents have to be completely filled in and submitted even if there is repetition of the information. The offer must have a clause wise affirmation of the technical requirements. Deviations/non conformance / alternatives /equivalents must be all separately listed as deviations.
- 2.0 **APPLICABLE STANDARDS:**
- 2.1 Applicable standards for testing of heat shrink joints
  - a) VDE-0278 Power Cable Accessories with rated voltage up to 36KV.
  - b) IS-13573/1992- Including Amendment No. 1 March 1996-Joints & Terminations, for polymeric cables for working voltage 6.6 KV up to and including 33KV –Type test requirements.
  - c) ESI-09 –13-Electricity Supply industry specification-performance requirements of heat shrinkable components.
  - d) IEEE-48-Standards Test procedures and requirements for high voltage alternating current cable termination.
  - e) ASTM-D-2303-Liquid contaminant inclined plane Tracking and erosion test.
  - f) IEC-243- Recommended methods of test for electric strength of solid insulating material at power frequencies.

- g) ISO-37 Determination of testing stress strain properties of vulcanised rubbers.
- h) IS: 7098 (Part-II) for XLPE Cable, Bidders shall enclose copies of type/sequence test reports as per IS: 13573-1992 conducted and test reports for materials properties wherever asked for with fail

### **3.0 DESIGN REQUIREMENTS:**

#### **3.1 Class of Termination (No Straight through Joints)**

- 3.1.1 The heat shrinkable cable terminations (Indoor and Outdoor type) offered shall be class-I terminations as defined in IEEE standards 48, and the straight through joints must be suitable for direct burial, uncontrolled backfill, water logging, and open trays / trenches.

#### **3.2 Stress Control**

- 3.2.1 The control function at the screen cut back shall be provided by heat shrinkable tubing having volume resistivity of minimum  $10^7$  ohms-meter for both termination and joint. Also, the relative permittivity shall be minimum 15. Bidder shall furnish documentary evidence confirming adherence to these, along with his bid.
- 3.2.2 The impedance of stress control tubing shall not change over a range of temperature from 0 deg.C to 125 deg.C. The impedance shall also remain constant inspite of the difference in stress which will exist with in the sleeve due to heating effect within the conductor and the temperature of environment. Bidder must submit documentary evidence including graphs showing the effects of stress, temperature and aging on the impedance of the stress tubing along with the bid.
- 3.2.3 For straight through joints prior to the installation of the stress control tubing, a high permittivity mastic must be applied over the ferrule, overlapping the insulation by 3mm. The minimum permittivity of this mastic shall be 15.
- 3.2.4 As the steps caused by semi-conductive screen cut back, high permittivity hot melt mastic or conductive paint is to be provided to prevent discharge activity at the step. The minimum permittivity of the mastic should be 15 and restivity of paint shall be same as the restivity of semi conductive screen.
- 3.2.5 Fluorinated silicone grease shall be provided for filling up the nicks and scratches on the surface of XLPE insulation.
- 3.3 Non-tracking erosion and weather resistant protection.**
- 3.3.1 The entire surface, from the high voltage point (lug) to the armour earthing arrangement of the XLPE core/ cable (including cable crotch sealing breakout) shall be non tracking, weather and erosion resistant, and hydrophobic in nature.
- 3.3.2 A heat shrinkable flexible polymeric tubing, preferably coloured red, and possessing non-tracking erosion and weather resistant properties shall be used at an external covering for the cable cores for both indoor and outdoor terminations. Rain sheds (skirts) where ever required for providing additional creepage shall also be of the same material as the non tracking tube.
- 3.3.3 The tube material shall conform to the requirements of ASTM-D-2303, ESI-09-13 copies of test report shall be furnished.
- 3.3.4 The material of the non-tracking, erosion and weather resistant cable breakout for the cable crotch, and rain sheds shall be silicon based and shall meet the requirement of ASTM-D-2303, ESI-09-13. Copies of test report thereof to be submitted with offer.
- 3.3.5 The material used for manufacturing the non tracking tubings, breakout and rain sheds (skirts) material shall have an assessed life exceeding 40 years. Test reports pertaining to accelerated

weathering tests of at least 1600.00 Hours shall be submitted in support of this assessment. Longer duration accelerated testing wherever conducted shall be given preference. Load cycling tests alone, shall not be considered sufficient for such life assessment.

### **3.4 Environment sealing:**

3.4.1 Adhesives and sealants shall be provided in the termination and jointing kits for environmental sealing against ingress of moisture and aggressive gases. The adhesives and sealants will flow due to heating of heat shrinkable components or otherwise during installation and will fill voids and adhere to metal components and cable sheaths.

3.4.2 **For terminations:** The sealing of the strands between the lug barrel and cable termination shall be provided by:

- a) Non-tracking, erosion and weather resistant heat shrinkable tubing pre-coated with non-tracking sealant.
- b) Non-tracking sealant strips
- c) The sealants must have an indefinite shelf life.

3.4.3. **For Joints:** Heat Shrinkable flexible polymeric tubing, preferably black coloured, precoated with adhesives shall be provided for sealing the exposed metallic sheaths and sheath/earth connections.

3.4.4. Bidders shall indicate in his bid, peel strength data (minimum and typical values) between the following components:

- a. Non-tracking tubing & aluminium lug.
- b. Non-tracking tubing & PVC
- c. Non-tracking tubing & Polyethylene.
- d. Non-tracking tubing & copper.

### **3.5 Provision of additional creepage for Indoor & Outdoor terminations:**

3.5.1 Single piece, heat shrinkable weather sheds having non-tracking, erosion and weather resistant properties shall be supplied with the kits for application over non-tracking tubing. The quantity of sheds to be supplied shall depend on voltage grade and indoor/ outdoor application and shall be indicated alongwith the bid. Each shed shall give additional creepage length of at least 100mm.

### **3.6 Insulation and screen reinstatement for joints.**

3.6.1 To ensure a void-free bond between the rebuilt insulation and non metallic screen the bidder shall apply single co-extruded dual-wall tubing which enables the final insulating layer to be installed complete with a conductive polymeric screen in one step. This dual walled tubing must be co-extruded and shall be offered with joints. Bidder must confirm they are offering co-extruded dual wall tubing for straight through joints as indicated above.

3.6.2 The total installed thickness (excluding the stress control layer) of the insulation, over the ferrule, shall be at least 50% more than the cable insulation thickness.

### **3.7 Earth/Screen Continuity/Termination System.**

3.7.1. Screen continuity by being tinned copper mesh and earth continuity by using tinned copper braids of appropriate sizes, shall be provided for transfer screen/earth in straight through joints.

3.7.2. In terminations, tinned copper braids of appropriate sizes along with copper lugs at appropriate sizes shall be provided for the continuity of screen/armour along with adequate clamping arrangements.

### **3.8 Lugs / ferrules**

- 3.8.1 The requisite number and type (Aluminium) of Lugs/Ferrules for compact circular stranded conductors shall be provided for termination/joints.
- 3.8.2 Lugs and ferrules shall be of crimping type heavy duty and shall be rated for the current carrying capacity of the XLPE cable conductors and shall conform to the relevant standards.

### **3.9 Testing of the Kit**

- 3.9.1. All the components shall be sealed separately and marked clearly for the purpose of identification of each component.
- 3.9.2. Components shall be supplied in a single package as a complete kit for one termination/joint and shall bear the manufacturer's name and the cable sizes or kit sizes for which it can be used voltage grade.
- 3.9.3. Besides above identification marking on packing, following identification marking shall be made on stress control tubes, dual wall tubes, outer jacketing tubes (in straight through joints), breakouts, rain sheds, non tracking tubes,
  - a) Batch No, to co-relate with the raw materials used to manufacture the components.
  - b) Shrink ratio.
  - c) Manufacturer's name.
- 4.0 Detailed Bill of materials and installation instructions shall be provided with each kit.

### **5.0 Performance Tests:**

- 5.1 The XLPE terminations and joints of the identical type brand and type design as offered in the bids shall have been tested for all the tests covered under ISI 3573/VDE-0278 strength (with amendments to date). Type test certificate showing satisfactory results shall be furnished along with the bid from any of the following:
  - a) CPRI, Bangalore/Bhopal
  - b) Indian Institute of Technology, Kanpur/Delhi/Bombay/Kharagpur.
  - c) ERDA, Vadodra.

### **6.0 Special Requirements.**

- 6.1 The kits shall be suitable for storage without deterioration at a temperature upto 50°C and shall have unlimited shelf life.
- 6.2 The heat shrink system of the identical type brand and design as offered in the bids shall have proven performance of at least 5 years in Indian Conditions.
- 6.2.1 Documentary evidence shall be submitted with the bid against clause 6.2
- 6.3 Prices are to be quoted firm only.

### **6.4 Inspection & Testing:**

- 6.5 All acceptance tests and inspection of material shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the bidder and purchaser at the time of purchase. Relevant documents including certificate of compliance regarding import/inflow of materials/tubing, test reports under type approval and quality assurance shall be made available to the inspection team for its checking and verification.  
Further tests mentioned below shall be conducted as acceptance tests at supplier's works or any approved test laboratory preferably at place where suppliers work is situated/ which will be arranged by the supplier at his own cost:
  - a) Visual Inspection: The offered kits should be free from any visible defects.



- b) Physical verification of contents – all the contents shall be checked as per kit contents list enclosed by the supplier.
- c) Electric Strength test for insulation tubing.
- d) Elongation tests for all types of tubing.
- e) Wall thickness ratio in expended condition.
- f) Longitudinal change after full recovery.
- g) Tracking and erosion resistance test.

Test at SI No. (c), (d), (e), (f) & (g) shall be done on sample randomly selected from the offered lot.

- 6.4.2 Nigam has the right to send any kit, out of the supply made to any recognized laboratory for testing a complete make over joint or termination or both on XLPE cable in accordance with IS 13573 /VDE-0278. The cost of cable, kits transportation and testing etc, shall be borne initially by the Nigam but in case the materials are not found as per desired specification, the complete charges along with any other penalty which may be levied, will be supplier's liability. In case it is required to send the complete made joint or termination or back for the said testing. Supplier shall be intimated accordingly and he shall send his representative along with cable jointer to do the jointing work free of cost and sealing sample for sending to test lab. The firm shall also render necessary assistance to the officers of Pashchimanchal Vidyut Vitran Nigam Limited, Meerut. They shall be responsible to ensure correct supply of material at the destination both in terms of quantity as well as quality as per order.
- 6.4.3 Bidder shall submit adequate evidence of their materials being able to have minimum life of 40 years confirmed through accelerated aging test which will include (a) heat aging, (b) Atlas Weather-O-Meter testing and (c) EMMAQUA testing.

## **6.5 Guarantee:**

- 6.5.1 The materials supplied against this specification shall be backed up by manufacturer's guarantee for a period of 60 months from the date of commissioning or 66 months from the date of completion of supply, whichever is earlier, against defective design, material and manufacturing of termination and joints. In case of failure of any component of termination and joints, the tenderer shall replace such defective termination and kits free of cost within 1 month of such declaration and shall furnish an undertaking on non-judicial stamp paper of Rupees Ten along with his offer to bear the entire expense which will be incurred by Nigam towards material and labour in total for rectification/repair.

## **6 Bill of material for each kit sample.**

- 6.1 Bidder shall indicate in his bid the kit contents of the kits offered for purchaser's approval and shall submit sample (s).

## **7 Training & Free Jointing Work:**

- 7.1 Tenderer will have to give training to staff of PVVNL for installation of joints and termination supplied by them (in the event of an order being placed) free of cost in consultation with CE of Distribution zone's of PVVNL and such joints/terminations (as the case may be) shall be installed by them free of charge. However, kits and other sundry items shall be provided by Nigam.

## **8.0 Packing & Forwarding:**

- 8.1 For the purpose of identification, gloves shall be marked clearly and permanently in a prominent position with the suppliers name and reference number.



Electrically conducting components shall be marked 'conducting' clearly and permanently.

**8.2** Component shall normally be supplied in a package as a complete joint which shall be clearly with the following:-

1. PROPERTY OF PVVNL.
2. DESTINATION OF CONSIGNEE AND DESTINATION RAILWAY STATION.
3. KIT NUMBER.
4. CONTRACT/SPECIFICATION NO.
5. VOLTAGE APPLICATION AND SIZE AND TYPE OF KIT.
6. STANDARDS USED FOR MANUFACTURING THE KIT.

**8.3** The components shall normally be supplied in a package which shall be designed to protect the contents against ingress of moisture and mechanical damage.

**8.4** Components supplied with adhesive coatings shall have means to prevent coated surfaces from adhering to each other.

**8.5** Details bill of material alongwith installation instruction shall be provided with each kit.

**8.6** Whenever the material is supplied to consignee, the supplier shall prepare the following information in the form of packing slip in quadruplicate, and send the same to the consignee and obtain its acknowledgment on the same. The consignee will return to the supplier one copy of the packing slip with the remarks.

1. Purchase order No. and date.
2. Quantity allotted to the stores and rate applicable.
3. Quantity so far supplied and the rate applied.
4. Quantity now supplied and the rate applied.
5. Total quantity supplied under the P.O. with rates applied.
6. Program for supply of balance quantity to the Store.

## **GUARANTEED TECHNICAL PARTICULARS**

(As applicable for Termination/ Jointing Kits Suitable for 11KV XLPE Cable)

**Type of Jointing Kits:      Heat Shrinkable**

SL No.	Property	Assured Value
1.	Impulse Voltage Withstand	No Break-Down at 75 KV
2	High Voltage Withstand	No Break-Down at 19 KV
3	Partial Discharge at 12.7 KV	PD- 20 pC.
4	Thickness of Insulation over Ferrule	4.79 mm-Minimum
5	Corrosion Resistance	500 hrs. Min. at 120+ 3°C
6	Dimensions	
a)	Wall Thickness Ratio	0.6Min.
b)	Longitudinal change	10% Max.
7	Electric Strength	For Anti- Tracking Tube: 10MV/Meter Min. For Stress Control Tube: Not Applicable.
8	Heat Shock	No splitting cracking, dripping or flowing after 30min. at 250°C
9	Low temperature Flexibility	No cracking after 4 hours at minus 40°C max.
10	Relative Permeability	For Anti- Tracking Tube: 3 Min. to 5 max. For Stress Control Tube: 15 Minimum.
11	Thermal Ageing	500 hrs. Min. at 120+ 3°C
12	Tensile Strength	8 N/mm <sup>2</sup> Min.
13	Ultimate Strength	100% Min.
14	Tracking Resistance	For Anti- Tracking Tube: No tracking, erosion to top surface or flame failure after. 1hr. @ 2.5KV 1hr. @ 2.75KV 20mins. @ 3.0KV For Stress Control Tube: Not Applicable.
15	Volume Resistivity	10+E10 Ohm meters Min.
16	Water Absorption	0.5 max. 24 hrs. @ 25°C Imax. 24 hrs. @ 50°C
17	Water Vapour Permeability	25°C 75 RH -5g/m <sup>2</sup> /d 38°C 90RH -10g/m <sup>2</sup> /d

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**TECHNICAL SPECIFICATION OF 33 KV BUS ISOLATORS****1.0 SCOPE**

- 1.1 This specification covers design, manufacturing, assembly, testing before supply, inspection, insurance (transit & storage), packing, delivery and other basic requirements in respect of out door type 33 kV rating off load, double break centre rotating, isolators, 800 Amps, 25 KA/3 Seconds with hardware's, accessories and auxiliary equipment required for their satisfactory operation in various sub stations in western Uttar Pradesh under 'PVVNL-Meerut'.
- 1.2 The equipment offered shall be complete with all parts necessary for their effective and trouble free operation. Such parts shall be within the scope of supply irrespective of whether they are specifically indicated in the commercial order or not.
- 1.3 It is not the intent to specify, completely here in all the details of design and construction of the isolators. However, the isolators shall conform, in all respects to high standard of engineering, design and workmanship as listed in annexure I). It shall be guaranteed in a manner acceptable to the purchaser who will interpret the meaning of drawings and specification and shall have power to reject any work or material, which, in his judgment, is not in accordance therewith.
- 1.4 The isolators offered shall be complete with all components necessary for its effective and trouble free operation. Such components shall be deemed to be within the scope of supplier's supply. Irrespective of whether those are specifically brought out in this specification and/or in the commercial order.

**2.0 APPLICABLE STANDARD**

- 2.1 The isolators shall conform to the latest revisions, available at the time of placement of order of relevant standard, rules and codes listed in annexure-I.
- 2.2 Equipment meeting with the stipulations of equivalent IEC, ANSI, CSA, DIN standard, which ensure equal or better quality than the standards listed in annexure-I, shall also be acceptable. In such case the contractor should submit along with his offer, two copies of such standards in authentic English translation, if the language of the standard is other than English.

**3.0 GENERAL TECHNICAL REQUIREMENTS****3.1 Type of Disconnects**

The isolators shall be three phase gang operated horizontal double break type with rotating type moving blades and with or without gang operated vertical break each phase.

### 3.2 Current Carrying Parts

Material of blades and contacts of earthing switch shall be the same as those of main switch moving blade and contacts respectively. Cross sectional area of earthing blades and contacts shall not be less than 50% of cross sectional area of main blades and contacts. Earthing blades shall have the same short time current rating (thermal & dynamic) as that of main switch.

### 3.3 Current Density

Current density to be adopted for all the parts of isolator and terminal connector shall not exceed the following limits:

- a. Hollow tube section –Copper- 2.0 A/sqmm
- b. Flat section – Copper 1.6 A/sqmm
- c. Terminal connectors –Alum. 1.0 A/sqmm

### 3.4 Insulators

- i) The insulator shall be provided with a completely galvanized steel base design for mounting on the support. The base and mounting arrangement of the insulator shall be such that the insulator shall be rigid and self-supporting and no guying or cross bracing between phase shall be necessary.
- ii) Insulator shall be made of homogeneous and vitreous porcelain of high mechanical & dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit stresses etc. Glazing of the porcelain shall be uniform brown or dark brown colour with a smooth surface arrange to shed away rain water. Porcelain and metal parts shall be assembled in such a way that any thermal differential expansion between the metal and porcelain through the range of temperature specified in this specification shall not loosen the parts or create undue internal stresses which may affect the mechanical or electrical strength or rigidity.
- iii) Cap of the insulator shall be of high grade malleable steel casting. It shall be machine faced and hot dip galvanised as per IS 3638, IS 2623. The cap shall have four number of tapped holes spaced on a pitch circle of diameter of 76 mm. To accommodate the terminal clamps of Busbar.
- iv) The insulator unit shall be assembled in a suitable jig to ensure correct positioning of the top and bottom metal fittings relative to one another.

### 3.5 Operating Mechanism

- i. Manual operating mechanism gang operated through hand-operated lever shall be provided for main switch.
- ii. The operative mechanism shall provide quick, simple and effective operation. The design shall be such that one person shall be able to operate the isolator without undue efforts. Isolator operating mechanism should be such that it should not operate by gravity, wind, short circuit, seismic acceleration, vibration, shock, accidental touching.

- iii. The line isolator should be fitted with manually gang-operated line earthing switches. In bus isolators these earth switches are not to be provided.

### 3.6 Accessories

- i. Name plate (Complete details of the parameter)
- ii. Padlocking device

### 3.7 Earthing

- i. The frame of each disconnecter switch shall be provided with two reliable earthing terminals for connecting to earth mat. The connection shall be such that it can carry specified short circuit current.

### 3.8 Design and Construction

- i. Contractor shall have to give full details of design, manufacturing, quality control etc of the equipment offered in respect of the following items.
  - 1. Contacts material, current density etc.
  - 2. Contact support and fixing arrangement on insulator.
  - 3. Bearings, housing of bearings, bushes etc.
  - 4. Base plates
  - 5. Down pipe, guides joints
  - 6. Operating mechanism, aux switch, size and thickness of box, degree of protection, gland plate, gland etc.
  - 7. Nuts, bolt and fastenersOffers without the above information or with incomplete information may be rejected.
- ii. All live parts shall be designed to have smooth surfaces without any sharp points, edges and other corona producing surfaces so as to eliminate corona at specified extinction voltage or at 1.1x rated voltage if extinction voltage is not specified.

### 3.9 Fasteners

Nuts, bolts and washers of 5/8" and higher size shall be hot dip galvanized. The bolts used on tapped holes of insulator cap shall be galvanized by centrifuge process to avoid excess deposition of zinc on threads. Nuts, bolts and washers of less than 5/8" size shall be non-magnetic stainless steel.

### 3.10 Contacts

Contacts shall be made out of hard drawn electrolytic grade copper. Arcing contacts wherever provided shall close first and open last. The contacts shall be silver plated (10 to 15 microns).

### 3.11 Terminal Pad

It shall be made out of electrolytic copper heavily silver plated (15 microns). The terminal pads shall be suitable for connection to 40x40 mm terminal connector.

**3.12 Mounting of Contacts**

Fixed contacts shall be mounted on 6 mm thick 100x50 mm M.S. Galvanized channel welded to 10 mm thick M.S. plate with holes for fixing on insulators. Slots shall be provided for marginal adjustment of height of contacts.

**3.13 Moving Blades**

Contact surface of moving blades shall be heavily silver plated to 15 microns thick. The surface shall be wiped during closing and opening operations to remove any oxide deposition on the contacts.

**3.14 Bearings**

Rotating insulator shall be mounted on a housing with bearings. Two numbers of bearings with at least 50 mm ID and 80 mm distance between the bearings shall be provided. The bearings shall be of reputed make and lubricated for lifetime. Other parts like bushes, joints springs etc shall be so designed that no lubrication shall be required during the service.

**3.15 Tandem Pipe**

Tandem pipes shall be of at least 25 mm ID single piece and class B. One tandem pipe shall be used for phase coupling of double break isolator. Wherever unavoidable sliding clamps may be used, these clamps shall be made out of one piece of at least 6 mm thick MS plate.

**3.16 Base**

Each base of isolator shall be provided with a rigid base fabricated from steel sections. The base shall be suitable for mounting on support structures. Fabrication, welding etc shall be done by suitable jig, templates and devices used for production of the base shall be furnished with the contractor.

**3.17 Terminal Connectors**

Each isolator shall be provided with terminal connectors suitable for ACSR Panther conductor, made of EC grade of Aluminium along with suitable bimetallic plate of min. 1 mm thickness.

**3.18 Assembly**

- i. The disconnector shall be fully assembled at the works of the contractor and all operations of the fully assembled disconnector shall be checked at the manufacturers works.

**3.19 Painting, Galvanizing and Climate Proofing**

- i. All interiors and exteriors of enclosures, cabinets and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other foreign materials. After cleaning two coats of zinc oxide primer shall be



given by suitable stoving and air drying etc. Colour of the final paint shall be epoxy light gray.

- ii. Paint inside the metallic housing shall be of anti-condensation type and the paint on outer surfaces shall be suitable for out door condition.
- iii. Galvanization shall be done after completion of the fabrication and should be capable of preventing corrosion in view of severe climatic conditions.

### 3.20

#### Tests

##### Type Tests:

- i. The equipment offered should be fully type tested as per relevant standards and contractor shall furnish a set of type test reports (of **within 5 years**) along with the offer.
- ii. In order to make type test representative, all type tests must be carried out by erecting disconnector on its foundation and after fitting the actual operating mechanism of the disconnector and using normal insulators to be used in real case.

##### Routine Tests & Acceptance Test:

- i. All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier/contractor in presence of owner representative.
- ii. Mechanical operation test (Routine test) shall be conducted on the complete disconnector and earth switch.
- iii. Immediately after finalization of the program of type/acceptance/routine testing, the supplier/contractor shall give three weeks advance intimation to the purchaser, to enable him to depute his representative for witnessing the tests.

List of the relevant standards:

- a. Indian Standards: 1818, 9921, 2544, 13947, 4691, 325, 4722, 2629, 4759, 2633, 1573, 3033, 2016, 3961, 5561, 1554, 5578, 11353, 2623
- b. IEC: 129, 168,
- c. Indian Electricity Rules 1956

Only the latest versions of all these standards shall be followed.

**Technical Parameters:**

S. No.	Parameter	Unit	Requirements
1	Rated Freq.	Hz.	50
2	System Neutral Earthing		Effectively earthed
3	No. of phases (poles)	No.	3
4	Temp. Rise	Deg. C	As per standards IS/IEC
5	Safe duration of overload	Minutes	
	a) 150 % of rated current		5
	b) 120 % of rated current		30
6	Rated voltage	KV rms	33 kV
7	Type of isolator (AB)		DBCR
8	Rated normal current	Amps.	800
9	Rated short time withstand current of MS & EB for 3 second	KA rms	25
10	Rated peak current of MS & EB	KA peak	63
11	Rated short circuit make current of EB	KA peak	63
12	Derating factor		Unity
13	Basic Insulation Level		
	1) Lightning Impulse withstand voltage	KV peak	
	a) Pole to earth & between poles		170
	b) Across isolating distance		195
	2) Rated power freq. withstand voltage	KV rms	
	a) Pole to earth & between poles		70
	b) Across isolating distance		80

14	Min. creepage distance	mm	900
15	Phase to phase spacing for installation	mm	1500
16	Min. clearances	mm	
	a) Phase to earth		430
	b) Between rotating post and fixed post on one phase		485
17	Height of center line of terminal pad above ground level	mm	3885
18	Special Requirements: a) Isolator main switch (MS) shall be required to make or break the line charging current when no significant change in voltage occurs across the isolating distance on account of make or break b) The isolator required is not with "Turn and twist mechanism". It must be rotating type.		

S.No.	Description	Material	Size
1	Base Channel	MS Galvanized	100 x 50 x 6 mm
2	Base Support Channel	MS Galvanized	100 x 50 x 6 mm
3	Base for 4 <sup>th</sup> bearing	MS Galvanized	75 x 50 x 6 mm
4	Tandem pipe	GI Pipe	25 NB, class 'B' 3200 mm long
5	Down Pipe	GI Pipe	50 NB, Class 'B' 1900 mm long
6	Earthing Terminal		M16, Bolts with Nut
7	Support structure	ERW pipe	114 mm OD x 12 SWG

**GUARANTEED TECHNICAL PARTICULARS 33 KV BUS ISOLATORS**

<b>A.</b>	Name of tenderer / contractor	
<b>B.</b>	Tender specification No.	
<b>1</b>	Name of manufacturer	
<b>2</b>	Manufacturer's type	
<b>3</b>	Standards to which the equipment conforms	
<b>4</b>	Frequency (Hz.)	
<b>5</b>	Rated voltage (KV rms)	
<b>6</b>	Max. design voltage at which the isolator can operate (KV rms)	
<b>7</b>	Continuous current rating (Amp. Rms)	
<b>8</b>	Rated short time current	
	i) For 3 sec. (KA rms)	
	ii) Rated peak short time current (KA peak)	
<b>9</b>	Current density at the min. cross section of (Amp./sq. mm)	
	i) Moving blades	
	ii) Terminal pad	
	iii) Contacts	
	iv) Terminal connector	
<b>10</b>	Derating factor for specified site conditions	
<b>11</b>	Insulation levels	
	i) Dry impulse withstand voltage (KV peak)	
	a) Phase to earth	
	b) Isolating distance	

	ii) Wet power freq. Withstand voltage (KV rms)	
	a) Phase to earth	
	b) Isolating distance	
<b>12</b>	Min. clearance in air (mm)	
	i) Center to center distance between poles	
	ii) Between live parts & earth	
	iii) Between poles on one phase	
<b>13</b>	Design & Construction	
	i) No. of insulators per pole	
	ii) No. of break per pole	
	a) Main switch	
	b) Earth Switch	
	iii) Type of opening/closing mechanism	
	iv) Contacts	
	a) Material & grade	
	b) Thickness of silver plating on contact surface	
	c) Effective Cross sectional area (sq.mm.)	
	1. Main switch	
	2. Earth switch	
	d) No. of operations the isolator can make without deterioration of contacts	
	1. Main switch	
	2. Earth switch	



	v) Moving blades	
	a) Material & grade	
	b) Thickness s of silver plating on contact surface	
	c) Effective Cross sectional area (sq.mm.)	
	1. Main switch	
	2. Earth switch	
	vi) Contact support	
	a) Material & size of channel	
	b) Material & size of plate	
	vii) Rain hood & material size	
	viii) Nuts & bolts	
	a) Size, material & grade in live parts	
	b) Size, material & grade in other parts	
	ix) base plate below rotating insulator	
	a) Material	
	b) Size	
	c) Thickness	
	x) Bearing	
	a) Material of housing	
	b) Material of bearing	
	c) No. of bearing, location & size	
	d) ID of bearing	
	Distance between 2 bearing	
	Tandem pipe	

	<ul style="list-style-type: none"> <li>a) Size</li> <li>b) Length</li> <li>c) Class</li> <li>d) Numbers</li> <li>e) Size of bolt &amp; shackles</li> <li>f) No. of clamps</li> <li>g) Material of clamps</li> <li>h) Thickness of clamps</li> </ul>	
	pe of interlocks	
	own pipe <ul style="list-style-type: none"> <li>a) Size</li> <li>b) Length</li> <li>c) Class</li> </ul>	
	type of iniversal/swivel joint <ul style="list-style-type: none"> <li>a) Bearing &amp; down pipe</li> <li>b) Between down pipe &amp; operating mechanism</li> </ul>	
	erating mechanism <ul style="list-style-type: none"> <li>a) Control cabinet             <ul style="list-style-type: none"> <li>i) Material &amp; thickness</li> <li>ii) Degree of protection</li> <li>iii) Type , size &amp; no. of cable glands</li> <li>iv) Whether removable gland plate provided</li> </ul> </li> </ul> Make, type, rating & quantity of insulated wires	
	sulators <ul style="list-style-type: none"> <li>a) Type</li> <li>b) No. of units per insulator</li> <li>c) Height of each insulator stack (mm)</li> <li>d) No. of holes, size &amp; pitch circle diameter (mm)</li> <li>e) Rated voltage</li> <li>f) Dry power freq. withstand voltage (KV rms)</li> </ul>	

	<ul style="list-style-type: none"> <li>g) Wet power freq. withstand voltage (KV rms)</li> <li>h) Impulse withstand voltage (KV peak)</li> <li>i) Visual discharge voltage level (KV rms)</li> <li>j) Creepage distance (mm)</li> </ul>	
	xvii) Base Channel Material Size	
	xviii) Support structure a) Material b) Size	
	xix) Support structure a) material b) size	
	xx) Terminal connector a) Clamp body j) Material <ul style="list-style-type: none"> <li>ii) Thickness of bimetallic plate</li> <li>iii) Area of min. cross section</li> </ul> b) Material of bolts & nuts size c) Type of washers used	
	xxi) Material of braids	
	List of bought out items	

## **TECHNICAL SPECIFICATION FOR 33 KV HEAT SHRINKABLE TERMINATION/JOINTING KITS**

- 1.0 **SCOPE :** This specification covers designing, manufacturing, testing, packing, inspection & delivery any where in PVVNL of cable straight through Jointing kits, suitable for 33KV(E), 3core XLPE insulated screened and armored cable as per IS 7098 (with latest amendment), having compacted circular stranded conductor of size 70 to 400 mm<sup>2</sup> or as per requirement.
- 1.1 It is not the intent to specify completely herein all the details of the design and construction of material. However the material would be inert and capable of resisting degradation during t
- 1.2 The service life of the cable system and shall conform in all respects to high standards of engineering design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

The bidder will have to submit all relevant papers, copies of test reports as required to substantiate its claim or as required.

### **2.0 STANDARDS:**

- 2.1 The materials shall continue in all the respects to relevant 'Indian Standard Specification' with latest amendments indicated below:-

Sl. No.	Indian Standard specification with latest amendments-Title	International or internationally recognized standard with latest amendments-Title
1.(a)	IS: 13573: 1992-Joints of polymeric cable for working voltages 6.6 KV up to and including 33KV	1. VDE-0278-Power Cable Accessories with rated Voltage upto 36KV. 2. ESI-09-13- Performance Specification for High Voltage Heat-Shrinkable Components for Use With High Voltage Solid Type Cable Upto And Including 33 KV.
(b)	IS:2584-1963-Methods for test for electric strength of solid insulating materials at power frequencies.	3. IEEE-48 Standard Test Procedures And Requirement for High-Voltage Alternating Current Cable Termination. 4. ASTM-D-2303-Liquid -Contaminant, Inclined-Plane Tracking Materials. 5. IEC-332/BS-4066-Testing on electric cables under fire conditions. 6. ASTM-D- 150 -Standard test methods for AC losses characteristics and Permeability of solid electrical materials. 7. DIN-445 astmd-412- Standard test methods for rubber properties in tension. DIN-53476-Testing Plastic: Determination of water absorption.
2.	IS: 7098(Part-II) for XLPE Cable.	IEC:502(1983).

Jointing kits conforming to other internationally accepted standards, which ensure equal or higher quality than the standard mentioned above, would also be acceptable. In case the Bidder who wishes to offer material conforming to the other standards, salient points of difference

between the standards adopted and specific standards with authentic English Translation shall be furnished alongwith the offer. In case of conflicts the order of proceeds shall be (I) IS (II) IEC (III) other standards. In case of any difference between this IS and this specification provision contained in this specification shall pervade over IS.

### 3.0 SERVICE CONDITIONS:

The jointing kits type supplied against this specification shall be suitable for satisfactory and continuous operation under the following climate conditions:

(i)	Location	At various locations in the State of Uttar Pradesh.
(ii)	Max. ambient air degree Temperature (dig C)	50
(iii)	Min. ambient air temperature (dig C)	(-) 5
(iv)	Average daily ambient air tem. (dig C)	47.2
(v)	Max. Relative Humidity(%)	100
(vi)	Max. Altitude above mean sea level (m)	1450
(vii)	Average annual rainfall (mm)	1200
(viii)	Isocrautic level (days per year)	50
(ix)	Seismic level (Horizontal accn.	0.33g.

### 4.0 PRINCIPAL PARAMETERS:

Type of installation	Outdoor/indoor/underground.
System Voltage	33KV + 10% -15%
System Frequency	50 Hz + _ 5%
No. of phase	Three
System earthing	Solidly grounded

### 5.0 TECHNICAL REQUIREMENT:

- 5.1 The cable jointing kits offered shall be class-I terminations as defined in IEEE standard 48.
- 5.2 The straight through joints must be suitable for direct burial, uncontrolled backfill, water logging and open trays and trenches.
- 5.3 The joints shall be used in moderately hot and humid climate conducive to rust and fungus growth.
- 5.4 The component used in joints shall be suitable for use in high voltage cable joints and shall be suitable for indoor and outdoor applications as required.
- 5.5 joints shall be suitable for use with the XLPE cables manufactured in accordance with the IS: 7098 (Part-II).
- 5.6 Component used in joints shall not be adversely affected in any manner by contact with other materials normally used in the construction of cable joints and shall not increase the rate of corrosion of any metal with which they may come in contact.
- 5.7 The joint should have all the components to provide complete insulation of joint, providing stress grading of joint at the screen/shield end and in connector area, and should be able to withstand all thermal and dynamic stresses related to urban power distribution.
- 5.8 External leakage between conductor and ground and earthing should be completely prevented.
- 5.9 The joints should be capable of withstanding impulse voltage of 170 KV minimum for 33KV joints respectively.
- 5.10 The joints should be capable of withstanding DC voltage of 170KV minimum for 33KV joints
- 5.11 Partial discharge shall not exceed to 20 pC for test voltage of 38KV for 33KV joints.
- 5.12 Minimum thickness of insulation over ferrule should be 11.73mm for 33KV straight through joints.

- 5.13 The joints will have a device for electrical stress control at the end of insulation screen/shield.
- 5.14 Technical data sheet annexed as annexure –I has to be filled in completely and separately for straight through joints. Copies of the documents are to be enclosed for each requirement.

**6.0 DESIGN REQUIREMENTS:**

**6.1 Stress Control**

- 6.1.1 The control function at the screen cut back shall be provided by heat shrinkable tubing having volume resistivity of minimum  $10^7$  ohms-meters for joint. Also, the relative permittivity shall be minimum 15.
- 6.1.1 The impedance of stress control tubing shall not change over a range of temperature from 0 deg.C to 125 deg.C. The impedance shall also remain constant inspite of the difference in stress which will exist with in the sleeve due to heating effect within the conductor and the temperature of environment. Bidder must submit documentary evidence including graphs showing the effects of stress, temperature and aging on the impedance of the stress tubing along with the bid.
- 6.1.2 As the steps caused by semi-conductive screen cut back, high permittivity hot melt mastic or conductive paint is to be provided to prevent discharge activity at the step. The minimum permittivity of the mastic should be 15 and resistivity of paint shall be same as the resistivity of semi conductive screen.
- 6.1.3 Fluorinated silicone grease shall be provided for filling up the nicks and scratches on the surface of XLPE insulation.
- 6.1.4 The entire surface, from the high voltage point (lug) to the armour earthing arrangement of the XLPE core/ cable (including cable crotch sealing breakout) shall be non tracking, weather and erosion resistant, and hydrophobic in nature.
- 6.1.5 A heat shrinkable flexible polymeric tubing, preferably coloured red, and possessing non-tracking erosion and weather resistant properties shall be used at an external covering for the cable cores for both indoor and outdoor terminations. Rain sheds (skirts) where ever required for providing additional creepage shall also be of the same material as the non tracking tube.
- 6.1.6 The tube material shall conform to the requirements of ASTM-D-2303, ESI-09-13 copies of test report shall be furnished.
- 6.1.7 The material of the non-tracking, erosion and weather resistant cable breakout for the cable crotch, and rain sheds shall be silicon based and shall meet the requirement of ASTM-D-2303, ESI-09-13. Copies of test report thereof to be submitted with offer.
- 6.1.8 The material used for manufacturing the non tracking tubings, breakout and rain sheds (skirts) material shall have an assessed life exceeding 40 years. Test reports pertaining to accelerated weathering tests of at least 1600.00 Hours shall be submitted in support of this assessment. Longer duration accelerated testing wherever conducted shall be given preference. Load cycling tests alone, shall not be considered sufficient is for such life assessment.

**6.2 Environment sealing:**

- 6.2.1 Adhesives and sealants shall be provided in the jointing kits for environmental sealing against ingress of moisture and aggressive gases. The adhesives and sealants will flew due to heating of hear shrinkable components or otherwise during installation and will fill voids and adhere to metal components and cable sheaths.
- 6.2.2 **For Joints:** Heat Shrinkable flexible polymeric tubing, preferably block coloured, precoated with adhesives shall be provided for sealing the exposed metallic sheaths and sheath/earth connections.
- 6.3 Bidders shall indicate in his bid, peel strength data (minimum and typical values) between the following components:
- Non-tracking tubing & aluminium lug.
  - Non-tracking tubing & PVC
  - Non-tracking tubing & Polyethylene.
  - Non-tracking tubing & copper.



**6.4 Insulation and screen reinstatement for joints.**

6.4.1 To ensure a void-free bond between the rebuilt insulation and non metallic screen the bidder shall apply & single co-extruded dual-wall tubing which enables the final insulating layer to be installed complete with a conductive polymeric screen in one step. This dual walled tubing must be a co-extruded and shall be offered with joints. Bidder must confirm they are offering co-extruded dual wall tubing for straight enough joints as indicated above.

6.4.2 The total installed thickness (excluding the stress control layer) of the insulation, over the ferrule, shall be at least 50% more than the cable insulation thickness.

**6.5 Earth/Screen Continuity/Termination System.**

6.5.1 Screen continuity by being tinned copper mesh and earth continuity by using tinned copper braids of appropriate sizes, shall be provided for transfer screen/earth in straight through joints.

7.0 The components of the heat shrinkable joint such as internal insulation tube, stress control tube, anti track tube, external protective tube and other molded components shall confirm to the requirement of ESI-09-13.

**8.0 Lugs/Ferrule**

8.1 The requisite number and type of aluminum Lugs/ferrules for compact circular stranded conductor shall be provided for joints.

8.2 Lugs and ferrules shall be of crimping type heavy duty and shall be rated for the current carrying capacity of the XLPE cable conductors and shall confirm to the relevant standards.

**9.0 GUARANTEED TECHNICAL PARTICULARS:**

The guaranteed technical particulars of the conductors shall be per details given in enclosed Annexure-A

**10.0 TESTS:**

10.1 Type Test : The bidder should submit type test report alongwith the bid and it shall be strictly in accordance with IS: 13573:1992 (With latest amendments), for joints of various cable sizes and voltages specified. The test should be conducted at laboratory national/international repute where all the test facilities for conducting tests as per the specification are available.

**10.2 Routine Tests:**

The bidder should clearly indicate the routine tests carried out during manufacturing of joints. The bidder shall also mention the relevant standard used for testing.

**10.3 Acceptance Tests:**

10.3.1 Visual Inspection: the specimen shall be complete tubing or moulded components and shall be in the expanded condition.

10.3.2 The specimen shall be checked for freedom pin holes, cracks, inclusion and other defects. In colour, where applicable, shall be easily recognized as a basic colour as specified.

10.3.3 Suppliers identification and size markings, where applicable, shall be checked for legibility.

10.3.4 Products having sealant coating shall be examined for continuity, evenness and extent of coating.

10.3.5 Physical Verification of the kit content: All the kit contents shall be verified and checked as per the kit content list enclosed by the supplier.

10.3.6 Corrosion resistance test of tubing or moulded components.

10.3.7 Wall thickness ratio in the expanded condition and longitudinal change after full recovery for the moulded component.

10.3.8 Heat Shock.

10.3.9 Tracking resistance.

**11.0 Inspection:**

11.1 All acceptance tests and inspection shall be carried out at the place of manufacturer unless otherwise specially agreed upon by the Bidder and purchaser at the time of purchase. The

Bidder shall offer to inspecting official representing the purchaser, all reasonable facilities without charge, to satisfy him that the material is being furnished in accordance with this specification. The purchaser has the right to have the tests carried out at his own cost by an independent agency, wherever there is a dispute regarding the quality of supply.

## **12.0 Quality Assurance Plan:**

**12.1** The bidder shall invariably furnish following information alongwith his bid, failing which his bid shall be treated as Non-responsive. These information shall be separately given for individual type of material offered.

- i) Statement giving list of important raw materials, names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of test normally carried out on raw materials in presence of Bidder's representative, copies of test certificate.
- ii) Information and copies of test certificate as in (1) above in respect of bought out accessories.
- iii) List of manufacturing facilities available.
- iv) Level of automation achieved and list of areas where manual processing exists.
- v) List of areas in manufacturing process where stage inspection are normally carried out for quality control and details of such tests and inspections.
- vi) List of testing equipment available with the bidder for final testing of equipment and specify test limitation, if any, vis-a-vis the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviations from specified test requirements.

**12.2** The successful Bidder shall, within 30 days of placement of order, submit following information to the purchaser.

- (i) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from, furnished alongwith offer.
- (ii) All type test certificate of raw materials, bought accessories and components as per relevant standards.

## **13.0 Documentation:**

The bidder should append with the offer detailed cross section lay out drawing of the joints and should also clearly indicate, the co-relation between the dimensions in the drawing to the quantities of material supplied as per the Bill of Material for the joints, to be submitted with the offer.

## **14 Guarantee:**

**14.1** The materials supplied against this specification shall be backed up by manufacturer's guarantee for a period of 60 months from the date of commissioning or 66 months from the date of installation, whichever is earlier, against defective design, material and manufacturing of joints. In case of failure of any component of joints, the tenderer shall replace such defective kits free of cost within 1 month of such declaration and shall furnish an undertaking on non-judicial stamp paper of Rupees Ten along with his offer to bear the entire expense which will be incurred by Nigam towards material and labour in total for rectification/repair.

**15 Bill of material for each kit sample.**

- 15.1 Bidder shall indicate in his bid the kit contents of the kits offered for purchaser's approval and shall submit sample (s).

**16 Training & Free Jointing Work:**

- 16.1 Tenderer will have to give training to staff of PVVNL for installation of joints and termination supplied by them (in the event of an order being placed) free of cost in consultation with CE of Distribution zone's of PVVNL and such joints/terminations (as the case may be) shall be installed by them free of charge. However, kits and other sundry items shall be provided by Nigam.

**17.0 Packing & Forwarding:**

- 17.1 For the purpose of identification, gloves shall be marked clearly and permanently in a prominent position with the suppliers name and reference number.  
Electrically conducting components shall be marked 'conducting' clearly and permanently.
- 17.2 Component shall normally be supplied in a package as a complete joint which shall be clearly with the following:-
1. PROPERTY OF PVVNL.
  2. DESTINATION OF CONSIGNEE AND DESTINATION RAILWAY STATION.
  3. KIT NUMBER.
  4. CONTRACT/SPECIFICATION NO.
  5. VOLTAGE APPLICATION AND SIZE AND TYPE OF KIT.
  6. STANDARDS USED FOR MANUFACTURING THE KIT.
- 17.3 The components shall normally be supplied in a package which shall be designed to protect the contents against ingress of moisture and mechanical damage.
- 17.4 Components supplied with adhesive coatings shall have means to prevent coated surfaces from adhering to each other.
- 17.5 Details bill of material alongwith installation instruction shall be provided with each kit.
- 17.6 Whenever the material is supplied to consignee, the supplier shall prepare the following information in the form of packing slip in quadruplicate, and send the same to the consignee and obtain its acknowledgment on the same. The consignee will return to the supplier one copy of the packing slip with the remarks.
1. Purchase order No. and date.
  2. Quantity allotted to the stores and rate applicable.
  3. Quantity so far supplied and the rate applied.
  4. Quantity now supplied and the rate applied.
  5. Total quantity supplied under the P O. with rates applied.
  6. Program for supply of balance quantity to the Store.

### **GUARANTEED TECHNICAL PARTICULARS**

(As applicable for Jointing Kits Suitable for 33KV XLPE Cable)

**Type of Jointing Kits:      Heat Shrinkable**

<b>Sl. No.</b>	<b>Property</b>	<b>Assured Value</b>
1.	Impulse Voltage Withstand	No Break-Down at 170 KV
2	High Voltage Withstand	No Break-Down at 57 KV
3	Partial Discharge at 38.0 KV	PD- 20 pC.
4	Thickness of Insulation over Ferrule	11.73 mm-Minimum
5	Corrosion Resistance	500 hrs. Min. at 120+ 3 <sup>0</sup> C
6	Dimensions	
a)	Wall Thickness Ratio	0.6Min.
b)	Longitudinal change	10% Max.
7	Electric Strength	For Anti- Tracking Tube: 10MV/Meter Min. For Stress Control Tube: Not Applicable.
8	Heat Shock	No splitting cracking, dripping or flowing after 30min. at 250 <sup>0</sup> C
9	Low temperature Flexibility	No cracking after 4 hours at minus 40 <sup>0</sup> C max.
10	Relative Permeability	For Anti- Tracking Tube: 3 Min. to 5 max. For Stress Control Tube: 15 Minimum.
11	Thermal Ageing	500 hrs. Min. at 120+ 3 <sup>0</sup> C
12	Tensile Strength	8 N/mm <sup>2</sup> Min.
13	Ultimate Strength	100% Min.
14	Tracking Resistance	For Anti- Tracking Tube: No tracking, erosion to top surface or flame failure after. 1hr. @ 2.5KV 1hr. @ 2.75KV 20mins. @ 3.0KV For Stress Control Tube: Not Applicable.
15	Volume Resistivity	10+E10 Ohm meters Min.
16	Water Absorption	0.5 max. 24 hrs. @ 25 <sup>0</sup> C 1max. 24 hrs. @ 50 <sup>0</sup> C
17	Water Vapour Permeability	25 <sup>0</sup> C 75 RH -5g/m <sup>2</sup> /d 38 <sup>0</sup> C 90RH -10g/m <sup>2</sup> /d



## Technical Specification for Package Substation with breaker as protection on HT side

### 1.0.0 CODE & STANDARDS:

- 1.1.0 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standards. The 12KV Package Substation Design must be as per **IEC62271-202 only**.
- 1.2.0 The Package Sub-station offered shall in general comply with the latest issues including amendments of the following standards.

Title	Standards
High Voltage Low Voltage Pre-Fabricated Substation	<b>IEC:62271-202</b>
High Voltage Switches	IEC 60265
Metal Enclosed High Voltage Switchgear	IEC 60298/ IEC62271-200
High Voltage Switchgear	IEC 60694
Low Voltage Switchgear and Control gear	IEC 60439
Power Transformers	IEC 60076

**Note\* Latest Amendment of IS**

### 2.0.0 DESIGN CRITERIA

- 2.1.0 Package Sub-station consisting of **11KV non-extensible motorized SF6 Ring Main Unit with breaker as protection + Transformer + Low Voltage Switchgear** with all connection accessories, fitting & auxiliary equipment in an Enclosure to supply Low-voltage energy from high-voltage system as detailed in this specification. The complete unit shall be installed on a substation plinth (base) as **Outdoor substation** located at very congested places. 11KV Isolators controls incoming-outgoing feeder cables of the 11KV distribution system. The Vacuum Circuit Breaker shall be used to control and isolate the 11kV/433V Distribution transformer. The transformer Low Voltage side shall be connected to Low Voltage switchgear. The connection cables to consumer shall be taken out from the Low Voltage switchgear.
- 2.2.0 The prefabricated-package substation shall be designed for a) Compactness, b) fast installation, c) maintenance free operation, d) safety for worker/operator & public.
- 2.3.0 The Switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings and requirements clause without any damage or deterioration of the materials.
- 2.4.0 For continues operation at specified ratings temperature rise of the various switchgear components shall be limited to permissible values stipulated in the relevant standard and / or this specification.
- 2.5.0 The CSS should be given with FRTU, Modem etc and complete wiring to set of TBs for future use.
- 2.6.0 **Service Conditions:**

The Package substation shall be suitable for continuous operation under the basic service conditions indicated below

Ambient Temperature:	40 Deg C
Relative Humidity	upto 95%
Altitude of Installation	upto 1000m

The Enclosure of High Voltage switchgear-control gear, Low Voltage switchgear-control gear & Transformer of the package substation shall be designed to be used under **normal outdoor service condition** as mentioned. The enclosure should take minimum

space for the installation including the space required for approaching various doors & equipment inside.

### 3.0.0 SPECIFIC REQUIREMENT

3.1.0 The main components of a prefabricated- package substation are Transformer, High-voltage switchgear-control gear, Low-voltage switchgear-control gear and corresponding interconnections (cable, flexible , bus bars ) & auxiliary equipment. The components shall be enclosed, by either common enclosure or by an assembly of enclosure. All the components shall comply with their relevant IEC standards.

#### 3.1.1 Ratings:

Tender Specification	
Rated Ingress protection class of Enclosure	IP-34 for Transformer Compartment and IP:54 for LT & HT Switchgear Compartment.
LV Network	Incomer as 1600 Amps 4 Pole 50kA ACB Manual Fixed Type with Microprocessor Release
Outgoing:	5 Nos. 400Amps 36kA 3Pole MCCB with Microprocessor release
The CSS enclosure shall be made of 1.5/2.0 mm thickness Galvanized Sheet Steel tropicalised to meet Indian weather conditions including all the partition sheets & doors.	
The base of the enclosure shall be of 4.0 mm thickness Hot Dip Galvanized Sheet Steel to ensure rigidity for easy transport & installation.	
The CSS shall have 6 degrees slope to avoid waterlogging in case of rains or any other such issue.	
Interconnection between HT switchgear and transformer shall be using 1Cx3Rx95 sq.mm Aluminum un armoured XLPE cable and between transformer and LT switchgear shall be using Aluminium busbar	
11KV SF6 INDOOR, motorized NON-EXTENSIBLE, Ring Main Unit (RMU), comprising of 2 Nos 630A Load break Switches, 1No. 630 A Vacuum "T"OFF Circuit Breaker with (3 O/C & 1E/F ) Relays.	
Modular design, panel type with front cable access.	
Fixed type Vacuum breakers insulated in SF6 gas. It should be maintenance free, having stainless steel robotically welded enclosure for INDOOR RMU application. The SF6 tank should have a thickness of 2.5 mm of stainless steel	
Low gas pressure devices- 1.4 Bar pressure. RMU should have full rating with 1.2 Bar gas pressure. OR As per tested design of RMU Manufacture	
The RMU should be fixed type SF-6 insulated, Vacuum circuit breakers with O/C & E/F relay for the protection of the transformer. It should be maintenance free equipment, having stainless steel (SS 304 grade) robotically IP67 enclosure.	
CSS manufacturer should use its own make of RMU and LT Switchgear	



Description	Unit	Value
Rated Voltage / Operating Voltage	kV rms	11
Rated frequency & Number of phases	Hz & nos.	50 & 3
Rated maximum power of substation	kVA	990/1000kVA ONAN TYPE
Rated Ingress protection class of Enclosure	IP:	IP-34 for Transformer Compartment and IP:54 for LT & HT Switchgear Compartment.
Rated temp Class of Transformer Compartment		K10
<b>HV Insulation Level</b>		
Rated withstand voltage at power frequency of 50 Hz	kV rms	28
Rated Impulse withstand Voltage	kV peak	75
<b>HV Network &amp; Busbar</b>		
Rated current	Amp	630A
Rated short time withstand current	kA rms / 3 sec	21
Making capacity for switch-disconnector & earthing switches	kA peak	52.5kA
Breaking capacity of Isolators ( rated full load)	A	630A
<b>LV Network</b>		As per requirement.

## OUTDOOR ENCLOSURE

### 3.2.0 Outdoor enclosure:

- 3.2.1 The outdoor enclosure shall be made of galvanized Sheet Steel tropicalized to local weather conditions.
- 3.2.2 The CSS shall be made up of 1.5 mm thick non load bearing members and 2 mm thick load bearing members with a base frame made up of 4 mm HRCA.
- 3.2.3 The CSS shall have a 6 degrees slope to avoid waterlogging in case of rains or any other such issue.
- 3.2.4 The metal base shall ensure rigidity for easy transport & installation.
- 3.2.5 Substation will be used in outdoor application hence to prevent enclosure from rusting/corrosion, welding should be avoided.
- 3.2.6 The protection degree of the Enclosure shall be **IP54 for LT & HT switchgear compartment & IP34D for Transformer compartment**. Proper / adequate ventilation aperture shall be provided for natural ventilation by way of Louvers etc. Transformer compartment has to be designed in such away that, it meets IP class without any forced cooling arrangements.
- 3.2.7 Considering the outdoor application of the substation the doors shall be provided with proper interlocking arrangement for safety of operator and to avoid corrosion door should have stainless steel hinges.

- 3.2.8 Interconnection between HT switchgear and transformer shall be using 1Cx3Rx95 sq.mm Aluminum un armoured XLPE cable and between transformer and LT switchgear shall be using **Copper/Aluminium** busbar(as required)
- 3.2.9 **Internal Fault** : Failure within the package substation due either to a defect, an exceptional service condition or mal-operation may initiate an internal arc. Such an event may lead to the risk of injury, if persons are present. It is desirable that the highest practicable degree of protection to persons shall be provided. The Design shall be tested for **IAC AB for 21KA for 1 sec as per IEC 62271-202 in HV compartment. Type test report of arcing due to internal fault should submitted with offer.**
- 3.2.10 **Covers & Doors** : Covers & doors are part of the enclosure. When they are closed, they shall provide the degree of protection specified for the enclosure. Ventilation openings shall be so arranged or shielded that same degree of protection as specified for enclosure is obtained. All covers, doors or roof shall be provided with locking facility or it shall not be possible to open or remove them before doors used for normal operation have been opened. The doors shall open outward at an angle of at least 90° & be equipped with a device able to maintain them in an open position.
- 3.2.11 **Earthing** : All metallic components shall be earthed to a common earthing point. It shall be terminated by an adequate terminal intended for connection to the earth system of the installation, by way of flexible jumpers/strips & Lug arrangement. The continuity of the earth system shall be ensured taking into account the thermal & mechanical stresses caused by the current it may have to carry. The components to be connected to the earth system shall include :
- a) The enclosure of Package substation,
  - b) The enclosure of High voltage switchgear & control gear from the terminal provided for the purpose,
  - c) The metal screen & the high voltage cable earth conductor,
  - d) The transformer tank or metal frame of transformer,
  - e) The frame &/or enclosure of low voltage switchgear,
- 3.2.12 There shall be an arrangement for internal lighting activated by associated switch for HV , Transformer & LV compartments separately.
- 3.2.13 **Labels**: Labels for warning, manufacturer's operating instructions etc. shall be durable & clearly legible.
- 3.2.14 **Cleaning & Painting** :
- The enclosure shall be Powder coated with colour specific to Light and Dark Gray combination.**

## **TECHNICAL SPECIFICATION OF 11KV SF6 METAL ENCLOSED, INDOOR RING MAIN UNIT (RMU).**

This RMU should be complete with all components necessary for its effective and trouble free operation along with associated equipment etc. such components should be deemed to be within the scope of supplier's supply.

The RMU should be fixed type SF-6 insulated, Vacuum circuit breakers with O/C & E/F relay for the protection of the transformer. It should be maintenance free equipment, having stainless steel robotically welded or as per OEM's type test tested design with IP67 enclosure.

### **4.0 STANDARDS AND REFERENCE DOCUMENTS**

#### **4.1 Codes and Standards**

The **RING MAIN UNIT (RMU)** should be designed, manufactured and tested according to the latest version of:

IEC 60694 Common specifications for high-voltage switchgear and control gear standards.

IEC 60298/ IEC 62271-200 : A.C metal-enclosed switchgear and control gear for rated voltages above 1KV and up to and including 72KV and the IEC Codes herein referred.

IEC 60129/ IEC 62271-102: Alternating current disconnections (isolators) and earthing switches

IEC 60529 : Classification of degrees of protection provided by enclosures

IEC 60265 High-voltage switches-Part 1: Switches for rated voltages above 1kV and less than 52 kV

IEC 60056 : Circuit breakers

IEC 60420 High-voltage alternating current switch-fuse combinations

IEC 60185 Current transformers

IEC 60186 Voltage transformers

IEC 60255 Electrical relays

☐ Any other codes recognized in the country of origin of equipment might be considered provided that they fully comply with **IEC standards**.

**The design of the switchgear should be based on safety to personnel and equipment during operation and maintenance, reliability of service, ease of maintenance, mechanical protection of equipment, interchangeability of equipment and ready addition of future loads.**

#### **4.2 Salient Technical feature of "SF-6 RMU."**

11KV SF6 INDOOR, NON-EXTENSIBLE, Ring Main Unit (RMU), comprising of 2 Nos/3 Nos. 630A Load break Switches, 1No. 630 A Vacuum "T"OFF Circuit Breaker with (3 O/C & 1E/F ) Relays.

##### **(A)Load break switch (630A)**

**Load break switch should have the following**

- Manually and motor operated 12 KV, 630A Load Break switch and Earthing Switch with making capacity
- "Live Cable" LED Indicators through Capacitor Voltage Dividers mounted on the bushings.
- Mechanical ON/OFF/EARTH Indication
- Anti-reflex operating handle
- Cable testing possible without disconnection of cables.
- Cable boxes suitable for 1R X 3C x 300 sq mm XLPE Cable with right angle Cable terminal Protectors.
- Cable boxes should be Arc Proof and interlocked with respective Earthing Switches. For safety of operator it should not be possible to open the cable box unless the earth switch is ON.

#### **(B) Circuit Breaker. ( 630A)**

##### **Circuit Breaker should have the following:**

- Manually & motor operated 630 A Vacuum circuit breaker and Earthing Switch with making capacity
- Mechanical tripped on fault indicator
- Auxiliary contacts 1NO and 1NC
- Anti-reflex operating handle
- "Live Cable" LED Indicators thru Capacitor Voltage Dividers mounted on the bushings.
- 3O/C + 1E/F self powered relay with Low and High set for Over current and Earth Fault. Relay should have facility to display the maximum loaded phase current also. Relay should have facility to trip the breaker from remote commands without shunt trip coil.
- Mechanical ON/OFF/EARTH Indication

#### **INDOOR RMU**

1. Modular design, panel type with front/side cable access.
2. **RMU must be made of robotically welded stainless steel with all live parts inside stainless steel tank.**
3. Offered RMU must be Non extensible.
4. Maximum Modules can be accommodated in a single Stainless steel Tank so as to make it more compact and reliable.
5. Cable covers must be interlocked with Earth switch to have complete safety of operating person.

#### **4.3 DIELECTRIC MEDIUM**

SF6 GAS shall be used for the dielectric medium for 11KV RMU's in accordance with IEC376. It is preferable to fit an absorption material in the tank to absorb the moisture from the SF6 gas and to regenerate the SF6 gas following arc interruption. The SF6 insulating medium shall be constantly monitored via a temperature compensating gas pressure indicator offering a simple go, no-go indication.

#### **4.4 GENERAL TECHNICAL REQUIREMENTS**

- 4.4.1 Fixed-type Vacuum breakers insulated in SF6 gas. It should be maintenance free, having stainless steel robotically welded enclosure for INDOOR RMU application. **The SF6 tank should have a thickness of 2.5 mm of stainless steel.**
- 4.4.2 Low gas pressure devices- 1.4 Bar pressure. RMU should have full rating with 1.2 Bar gas pressure.
- 4.4.3 Live cable indicators- High operator safety.
- 4.4.4 Fully Rated integral earthing switch for Switches and Breakers.
- 4.4.5 Self powered Microprocessor Based 3O/C + 1E/F self powered relay with Low and High set for Overcurrent and Earth Fault - Does not require any external source of power.
- 4.4.6 Units fully SCADA compatible. Retrofitting at site possible at a later date. Line switches ( Load break switches) as well as T- OFF circuit Breaker can be operated by remote.
- 4.4.7 Cable boxes should be front/Side access and interlocked with earth switch.
- required.
- 4.4.8 Cable testing is possible without the disconnection of cables.
- 4.4.9 Compact in dimension.
- 4.4.10 Low pressure, sealed for life equipment,
- 4.4.11 Cable earthing switch on all switching device-standard, for operator safety.
- 4.4.12 All live parts should be inside a hermetically sealed Stainless Steel enclosure for indoor RMU.
- 4.4.13 Indoor unit should be classified as sealed pressure system with gas leak rate of less than 0.1% per year requiring no gas filling for 20+ years of functional life.

#### **4.5 TECHNICAL AND GUARANTEED PARTICULARS.**

The bidders shall furnish all guaranteed technical particulars as called for this specification.

#### **5.0 DESIGN CRITERIA**

### 5.1 **Service conditions**

The offered switchgear and control gear should be suitable for continuous operation under the basic service conditions indicated below. Installation should be in normal indoor conditions in accordance with IEC 60694.

Ambient temperature -10°C to +45°C

Relative humidity up to 95%

Altitude of installation up to 1000m, IEC 60120

### 5.2 **General structural and mechanical construction**

The offered RMU should be of the fully arc proof metal enclosed, free standing, floor mounting, flush fronted type, consisting of modules assembled into one or more units. Each unit is made of a cubicle sealed-for life with SF6 and contains all high voltage components sealed off from the environment. The overall design of the switchgear should be such that front access only is required. It should be possible to erect the switchboard against a substation wall, with HV and LV cables being terminated and accessible from the front.

The units should be constructed from stainless steel sheets. The design of the units should be such that no permanent or harmful distortion occurs either when being lifted by eyebolts or when moved into position by rollers.

The cubicle should have a pressure relief device. In the rare case of an internal arc, the high pressure caused by the arc will release it, and the hot gases are allowed to be exhausted out at the bottom of the cubicle. A controlled direction of flow of the hot gas should be achieved.

The switchgear should have the minimum degree of protection (in accordance with IEC 60529)

- IP 67 for the tank with high voltage components
- IP 2X for the front covers of the mechanism
- IP 3X for the cable connection covers

## 6.0 **TECHNICAL DATA**

### 6.1 **Ring Main Unit, Electrical data**

#### **Electrical data and service conditions**

##### **No Rated voltage**

	KV	<b>12KV</b>
1 Power frequency withstand voltage	KV	28
2 Impuls withstand voltage	KV	75
3 Rated frequency	Hz	50
4 Rated current busbars	A	630
5 Rated current (cable switch)	A	630
6 Rated current (T-off)	A	630

##### **Breaking capacities:**

7 active load	A	630
8 closed loop (cable switch)	A	630
9 off load cable charging (cable switch)	A	135
10 earth fault (cable switch)	A	200
11 earth fault cable charging (cable switch)	A	115
12 short circuit breaking current (T-off circuit breaker) kA		21
13 Rated making capacity	kA	50
14 Rated short time current 3 sec.	kA	20

##### **Ambient temperature:**

15 Maximum value	°C + 45
16 Maximum value of 24 hour mean	°C + 35
17 Minimum value	°C 0
18 Altitude for erection above sea level 4m ...1000	
19 Relative humidity	Max 95%



## 6.2 Ring Main Unit Technical data(11KV) INDOOR

### **General data, enclosure and dimensions**

1 Standard to which Switchgear complies	IEC
2 Type of Ring Main Unit	Metal Enclosed, Panel type, Compact Module.
3 Number of phases	3
4 Whether RMU is type tested	Yes
5 Whether facility is provided with pressure relief	Yes
6 Insulating gas	SF6
7 Nominal operating gas pressure	1.4 bar abs. 20° C
8 Gas leakage rate / annum %	0.1% per annum
9 Expected operating lifetime	30 years
10 Whether facilities provided for gas monitoring can be delivered	Yes, temperature compensated manometer
11 Material used in tank construction	Stainless steel sheet

### **No Operations, degree of protection and colours**

1 Means of switch operation	separate handle
2 Means circuit breaker operation buttons	separate handle and push
3 Rated operating sequence of Circuit Breaker	O - 3min-CO-3min-CO
4 Total opening time of Circuit Breaker	approx. . 40-50ms
5 Closing time of Circuit Breaker	approx. . 30-45ms
6 Mechanical operations of switch	CO 1000
7 Mechanical operations of CO earthing switch	1000
8 Mechanical operations of circuit breaker	CO 10000
9 Principle switch / earth switch	3position combined switch

### **Degree of protection:**

10 High Voltage live parts,	SF6 tank IP 67
11 Front cover mechanism	IP 2X for Indoor
12 Cable covers	IP 3X for Indoor

### **Colours:**

14 Front cover	7035
15 cable cover	7035

## 7.0 PANEL(MODULE) DESCRIPTION

### 7.1.1 Incoming cable module

It should consist of an SF6 cubicle housing a switch disconnector and an earthing switch. Bus bars and all electrical connections are located inside the tank. The operating shafts for the switches should be have rotary seals where they enter the SF6 cubicle. The operating mechanisms should be located outside on the front of the SF6 tank. Cable bushings should be located on the Front / Side of the SF6 cubicle in a separate cable compartment. Front covers containing the mimic diagram and having a degree of protection IP2XC close the fronts.

### 7.1.2 The T-off circuit breaker module (630 A )

The T-off circuit breaker module should be consisting of an SF6 cubicle housing a Vacuum circuit breaker unit and a disconnector- ear thing switch. An integrated relay and related CTs is used for tripping of the circuit breaker. Bus bars and all electrical connections should be located inside the tank. The operating shafts for the switches should be have rotary seals where they enter the SF6 cubicle. The operating mechanisms are located outside on the front of the SF6 tank. Cable bushings should be located on the front/Side of the SF6 cubicle in a separate cable compartment. Front covers containing the mimic diagram having a degree of protection IP2X seal off the fronts.

Off load Isolator shall be provided after the Vacuum circuit breaker for maintenance purpose.

## 7.2 CIRCUIT BREAKERS

Vacuum bottles should be use as interrupters of the currents. Make of Vacuum Interrupter shall be same as make of Ring Main Unit to ensure reliability. The circuit



breaker main circuit should be connected in series with a three-position disconnect - ear thing switch. The operation between circuit breaker and disconnect ear thing must be interlocked.

1. VCB must self tripping and has a self powered relay
2. The RMU must be non-extensible type

## **8 OTHER MAIN FEATURES**

### **8.1 Bus bars**

Comprising the 3 single phases **copper** bus bars and the connections to the switch or vacuum circuit breaker. The bus bar should be integrated in the cubicle Bus bars should be rated to withstand all dynamic and thermal stresses for the full length of the switchgear. Current density of busbar must not exceed 1.6 A/Sqmm.

### **8.2 The cable switch**

It should be a switch-disconnector and ear thing switch using SF6 gas as an arc-quenching medium. The switch positions are closed - open - earthed. In the open position the switch satisfies the disconnect requirements.

### **8.3 Earthing Switch**

Earthing switches should be rated equal to the switchgear rating.

Earthing switches should be quick make type capable of making Rated Fault Current, independent of circuit breaker. Ear thing switch should be operated from the front of the cubicle by means of a removable handle.

### **8.4 The mechanisms**

All mechanisms should be situated in the mechanism compartment behind the front covers outside the SF6-tank. The mechanism for the switch and the earthing switch is operating both switches via one common shaft. The mechanism provide independent manual operation for closing and opening of the switch, independent closing of the earthing switch and dependent opening of the earthing switch.

The mechanism for the T-off switch and earthing switch is operating both switches via one common shaft. The mechanism has stored spring energy and provide independent manual operation for closing and opening of the switch, independent closing of the ear thing switch and dependent opening of the ear thing switch. The mechanism for the vacuum circuit breaker (VCB) and disconnect- earthing switch is operating the VCB and the disconnect earthing switch via to separate shafts. The mechanism for the VCB has stored spring energy and provides Independent manual operation for closing and opening of the VCB. The mechanism has a relay with related CT's and/or remote tripping device. The mechanism for the disconnect earthing switch provide independent manual operation for closing and opening of the disconnect, independent closing of the earthing switch and dependent opening of the earthing switch. Earth switch shall have snap action or spring assisted mechanism for fast closing of earth switch independent of operator action.

### **8.5 Front covers**

The front cover contains the mimic diagram of the main circuit with the position indicators for the switching devices. The voltage indicators are situated on the front panels. Access to the cable bushings is in the lower part of each module.

### **8.6 Position indicators**

The position indicators are visible through the front cover and are directly linked to the operating shaft of the switching devices.

### **8.7 Voltage indicator**

The voltage indicators are situated on the front cover, one for each module, and indicate the voltage condition of each incoming cable. Identification of the phases is achieved with labels L1, L2 and L3 on the front of the voltage indicators. The voltage indicator satisfies the requirements of IEC61243.

### **8.8 Cable compartment**

It should be possible to terminate up to a 1x 3c x300sqmm core HV cables in each cable compartment. The access to the compartment will be possible by removing the cable cover, Hinged to the main frame only when earth switch is ON. Cable

Compartments of Indoor RMU should be Arc Proof and interlocked with respective Earth Switches.. Each module has a separate cable compartment that is segregated from each other by means of a partition wall. A partition wall should be fitted to divide the cable compartment from the rear side of the switchgear. In case of an arc inside the tank, followed by the opening of the pressure relief, the partition wall prevents the hot gases flowing out from the pressure relief to enter the cable compartments. All covers are removable. The ground continuity is achieved when the covers are in place by means of Hinged connections.

Interconnection between HT switchgear and transformer shall be using 1Cx3x95 sq.mm Al. unarmoured XLPE Cable.

#### **8.9. Power connection.**

The cables are installed in the dedicated compartment below the mimic front cover. At the bottom of the cable compartment, an earthing bar system made of copper/GI with a minimum cross section of 120 mm<sup>2</sup> should be fitted. In each compartment the earthing bar should be fitted with 4 screws M10. The earthing system is connected to the tank by a copper/GI bar, which rises up to the connecting point of the tank behind the rear partition wall on the middle of the switchgear.

#### **8.10 INTERLOCKING.**

The mechanism for the cable switch should be provide a built in interlocking system to prevent operation of the switch when the earthing switch is closed, and to prevent operation of the earthing switch when the switch is in the closed position.

The mechanism for the T-off switch should be provide a built in interlocking system to prevent operation of the switch when the earthing switch is closed, and to prevent operation of the earthing switch when the switch is in the closed position. The mechanism for the VCB and the disconnecter-earthing switch should be has a built in interlocking system to prevent operation of the disconnecter-earthing switch when the VCB is in the closed position.

Further is should not be possible to Open the Cable doors unless the Earthing Switch is Turned ON. In case the Cable door is accidentally left open a positive interlock shall prevent operation of Load Break Switch and Isolators / Breaker from any operation.

#### **8.11 Current Transformers**

All current transformers should be complying with IEC 60185.

Current transformers should be of dry type, with ratings and ratios as required. Cable current transformers used in circuit breaker modules should be maximum 100mm wide. Current transformers used in metering cubicles should be having dimensions according to DIN 42600, Narrow type.

Current transformer shall be placed in the cable covers / Bushing Mounted so that it can be easily replaced at site without removing the bushings.

#### **8.12 Auxiliaries.**

The switchgear should be prepared for options like motor operation, auxiliary contacts and short-circuit indicators. Necessary terminal blocks and wiring etc. should be placed behind the front cover of each module.

#### **8.13 Fault Passage Indicators.**

These shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply. The FPI shall be integral part of RMU to avoid thefts. The FPI shall have clear display, automatic reset facility and shall be SCADA compatible. 1 No. FPI shall be provided on 1 No. Incoming Load Break switch.

### **9 TESTING AND CERTIFICATION.**

#### **9.1 TYPE TESTS.**

Units should be type tested in accordance with IEC standards 60056, 60129, 60265, 60298, 60420, 60529 and 60694. The following type tests should perform on the HT Switchgear and report should submit with offer.

- Short time and peak withstand current test
- Temperature rise tests
- Dielectric tests
- Test of apparatus i.e. circuit breaker and earthing switch

- Arc fault test
  - Measurement of resistance of main circuit.
  - Mechanical endurance test.
  - Duty cycle test.
  - Internal arc test for 21 KA for 1 Sec for HT chamber- For both tank & cable chamber
- type test reports for above type shall be submitted with the offer.

## 9.2 ROUTINE TESTS.

Routine tests should be carried out in accordance with IEC 60298 standards. These tests should ensure the reliability of the unit.

**Below listed test should be performed as routine tests before the delivery of units;**

- Withstand voltage at power frequency
- Measurement of the resistance of the main circuit
- Withstand voltage on the auxiliary circuits
- Operation of functional locks, interlocks, signalling devices and auxiliary devices
- Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism
- Verification of wiring
- Visual inspection
- Time travel characteristics measurement facility for Breaker should be available with the manufacturer to assess the quality of RMU.

## Distribution Transformer

### 10.0 Oil filled Transformer :

- 10.1.1 Requirement:** 11000/433 Volt Oil immersed hermetically sealed, corrugated tank and without conservator type design ONAN cooled suitable for installation at outdoor in Enclosure for ground mounting.
- 10.1.2 Voltage Ratio:** No load voltage 11000/433 volts within tolerance as stipulated in IEC 76.
- 10.1.3 Rating:** The transformer shall have a continuous rating as specified at any of the specified tapping position and with the maximum temperature rise specified.
- 10.1.4 Temperature Rise:** The maximum temperature rise at the specified maximum continuous output shall not exceed 40°C by thermometer in the hottest portion of the oil or 45°C measured by resistance of winding above ambient temperature, not exceeding 40°C daily average or 50°C maximum.
- 10.1.5 Connections:** H.V. Delta and L.V Star connected with neutral brought out on the secondary side for connection to earth; Vector group DYn11.

### 10.1.6 Tapping :

Each transformer shall be provided with **sliding/rotary type tap switch** so as to provide for a voltage adjustment on H.V. from +5% to -10% of rated voltage of 11000 volts to obtain rated voltage of 433 volts on LV side

### 10.2.1 Cleaning & Painting :

- a) All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents, as required to produce a smooth surface free of scales, grease and rust.
- b) The internal surfaces in contact with insulating oil shall be painted with heat resistant insulation paint which shall not react & be soluble in the insulating liquid used.

- c) The external Surfaces, after cleaning, shall be given two coats of high quality epoxy based rust resisting primer followed by filler coats.
- d) The transformer shall be furnished with coats of weather resisting battleship gray epoxy based enamel paint specially recommended for transformer use.
- e) The paints shall be carefully selected to withstand tropical heat rain, effect of proximity to the sea etc. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.
- f) Special care shall be taken by the manufacturer to ensure against rusting of nuts, bolts and fittings during operation. All bushings and current carrying parts shall be cleaned properly after final painting.

**10.2.2** Both H.V. and L.V. bushings shall have creepage corresponding to **very heavily Polluted atmosphere.**

**10.2.3 Oil:** New transformer oil used shall be according to relevant IEC standards

**10.2.4 Phase Marking & Danger Plate:** Phase markings in fluorescent paint on small non-corrodible metallic tags shall be permanently fixed for H.V. and L.V sides. Phase markings tags shall be properly fixed with proper alignment. Danger plates shall be provided on the H.V & LV sides, mentioning the Corresponding Voltages.

### **10.3 Core and Coil :**

**10.3.1 Core :** The core shall be constructed from high grade, cold rolled, non-ageing, low loss, high permeability, grain oriented, cold-rolled grain oriented silicon steel laminations. The transformer shall be so designed as to have minimum humming noise. The percentage harmonic potentials with the maximum flux density under any conditions shall be such that capacitors connected in the system shall not be overloaded.

**10.3.2** The core and coil assembly shall be securely fixed in position so that no shifting or deformation occurs during movement of transformer. The core and coil assembly shall be capable of withstanding without injury, the thermal and mechanical effects of short circuit at the terminals of any winding.

**10.3.3 Noise:** The Contractor shall take special precautions to ensure that the noise and vibration level does not exceed which is obtained in good modern practice.

**10.3.4 Impedance Volts:** The Percentage impedance value at 75 Deg. C at any tap shall be as per IS/ IEC subject to tolerance as specified in relevant IEC standards. i.e. 4.5% upto 630kVA and 5% upto 1250kVA The value of the impedance volts at each tapping over the specified range shall be specified in the bid.

**10.3.5 Regulation:** The regulation at 75° C at full load at unity and 0.8 power factor subject to the usual tolerance as per IEC standards shall be specified in the bid.

**10.3.6 Power Freq. High Voltage & Insulation Level (Impulse voltage):** The distribution transformer shall be designed so that they are capable of withstanding high voltage & impulse voltages as given below:

- a) Impulse Voltage for 11kV winding: 75 kV (1.2/50 Microsecond wave shape).
- b) High Voltage : 28kV rms.

### **10.4.0 RATINGS (Summary) :**

	<b>Application</b>	<b>Dist. Tfr. with Corrugated Tank</b>
4.4.1	Service	Indoor Step down
4.4.2	Type	Oil immersed corrugated tank
4.4.3	Cooling system	ONAN
4.4.4	No. of Phases	3
4.4.5	No. of winding per phase	2
4.4.6	Rated output (MVA) With ONAN cooling	HV / LV
4.4.7	Rated voltage in KV (Line to Line)	HV-11 kV LV-0.433 kV
4.4.8	Rated frequency	50 Hz
4.4.9	Temperature rise above 50°C	



A	In winding by resistance	45°C or above
B	In Oil by thermometer	40°C or above
4.4.10	Guaranteed losses	990/1000 Kva
A	Maximum Losses at 50% Loading (KW)( As per IS 1180)	2790
B	Maximum Losses at 100% Loading (KW)(As per IS 1180)	7700
4.4.11	Insulation level	
A	H.V. Power Freq. KV rms	28 kV
B	H.V. (kV peak ) Impulse	75 Kv
C	L.V. (kV)	-
4.4.12	Vector Group	Dyn11
4.4.13	Type of taps provided	Off Load full capacity
A	Taps provided on	H.V. winding
B	Range of taps	+5% to -10% in steps of 2.5%

C	Method of Tap Change control	Rotary /sliding Switch
D	Manual load	Yes 'Off Circuit'
4.4.14	Percentage impedance at 75 Deg. C	As per IS 1180.
4.4.15	System earthing	
A	H.V.	Solidly earthed
B	L.V.	Solidly earthed
4.4.16	Terminal arrangement	
A	H.V.	From H.V. Bushing on Top.
B	L.V.	From L.V. Bushing on Top.
C	L.V. Neutral	From L.V. Neutral Bushing on Top.
4.4.17	Transformer-bushing voltage class a) H.V. (kV) b) L.V. (kV)	12 kV class 1.1kV class
4.4.18	System fault level a) H.V. side b) L.V. side	350 MVA (11 kV) -
4.4.19	Short circuit withstand capability duration	3 sec.

#### 10.5.0 Fittings & Accessories For Corrugated Tank Transformer :

**10.5.1** The following accessories shall be provided for 11 kV/0.433 kV, distribution transformer.

**10.5.2** Two earthing terminals. The lugs shall be provided in such a way that they shall not obstruct the movements of rollers. The earthing continuity for all the connected equipments shall be properly done.

**10.5.3** Two lifting lugs for complete transformer as well as enclosure.

**10.5.4 Rating plate and diagram plate** of durable non-corroding metal giving information as required under IEC 76. Rating plate shall also include Transformer **Actual %Z, No-Load Loss & Full-Load Loss at 75°C** along with details like Purchase Order Number, date. The name plate marking shall be done with fluorescent colour. Each equipment shall carry individual name-plate with proper instructions & affixed with screws.

**10.5.5** Skid with Haulage lugs.

**10.5.6** Instructions & affixed with screws.

**10.5.7** Skid with Haulage lugs.

## **L.T. Panel**

### **11.1 System:-**

- a) **Declared voltage** :- 3 Phase, 400V ( $\pm 6\%$ ) 50 Hz,
- b) **Neutral** :- Solidly earthed at substation.
- c) **Busbar** - Copper

### **11.2 General finish:-** Tropical, totally enclosed, metal-clad, weather-proof, vermin and dust proof.

### **11.3 LT Circuit Ways:**

OUTGOINGS:  
As per BOM

#### **As per BOM requirement**

The design of the LT panel should be type tested for the short circuit, temperature & Ingress protection test and type test report should submit with offer.

- i. All ACB & MCCB shall comply with the environmental directives like RoHS and WEEE.
- ii. The MCCBs shall be have double break type rotary contact mechanism for quick break operations.

## **11.5 GENERAL CHARACTERISTICS OF ACB**

### **11.5.1) Conformity with Standards**

The air circuit-breakers used in low voltage installations are constructed and tested in accordance with the IEC 947/IS 947 Standards and respect the following EC directives:

- "Low voltage Directive" (LVD) No. 73/23 EEC
- "Electromagnetic compatibility Directive" (EMC) No.89/336 EEC

### **11.5.2) Functional characteristics**

- The circuit-breakers must have a rated service voltage of 690 V AC and a rated insulation voltage of 1000 V.
- The circuit-breakers must have a rated impulse withstand voltage of 12 kV.
- The rated uninterrupted current must be between 800 and 6300 A with the possibility of selection of ratings from 400 A.
- Different versions shall be available with rated ultimate short circuit breaking capacity(Icu) from 50kA at 415V and shall have rated short circuit service breaking capacity(Ics) equals to Icu.
- Different versions of circuit-breakers shall be available with rated short-time withstand current (Icw -1 sec) for 50kA for 1sec in category B.
- It must be possible to supply the circuit-breakers both from the top and bottom terminals without derating their performances and without jeopardising their functionality.
- The mechanical life must be at least 12000 operations, without the need for maintenance of the contacts and arcing chambers.
- The electrical life at a voltage of 440 V AC must be and without the need for maintenance of the contacts and arcing chambers:
  - at least 9000 operations up to 2000 A
  - at least 6000 operations up to 3200 Athese values are intended to be valid only for CAT B circuit-breakers.

### **11.5.3) Environmental characteristics**



- Operating temperature: -25 °C...+70 °C (-13 °F...158 °F)
- Storage temperature: -40 °C...+70 °C (-40 °F...158 °F)
- Altitude: operation without derating up to 2000 m a.s.l. (6600 ft), and with derating up to 5000 m a.s.l. (16500 ft)
- Suitability for use in a hot-humid environment. With regard to this, the circuit-breakers must undergo a tropicalisation process which makes them suitable for use in a hot-humid environment, as established by the prescriptions of the main shipping registers and in accordance with the international IEC 60068-2-30 Standards.

#### 11.5.4) Construction characteristics

- The circuit-breaker structure must be made of steel sheet.
- There must be total segregation between power and front shield, using double insulation where suitable so as to guarantee maximum operator safety.
- Total segregation between the phases must be guaranteed for safety reasons.
- The main contacts must be separate from the arcing contacts in cat. B circuit-breakers only.
- It must be possible to inspect easily the arcing chambers easily and to check main contact wear with the circuit-breaker racked-out, by removing the arcing chambers.
- All the circuit-breakers in the range have the same height and depth with the aim of standardising the supporting structures of the switchgear and the switchgear itself as far as possible.
- The circuit-breakers must indicate the precise position of the main contacts and the condition of springs charged/discharged on the front, by means of certain and reliable signals.
- The operating mechanism must be of the stored energy type with operation by means of precharged springs fitted with antipumping device. The springs are charged manually by activating the front lever, or by means of a geared motor, supplied on request.
- The whole range of air circuit-breakers must be fitted with electronic protection releases. It must be allowed the interchangeability of protection releases from skilled personnel.
- ACBs shall have minimum watt losses in order to restrict temperature rise inside the breaker.

#### 11.5.5) RELEASES

##### 1) Release (Protection functions)

- The release must not require auxiliary power supplies since the power is taken from the current transformers.
- The signals supplied by the release must not operate with power supply supplied by internal batteries. The basic version of the release must provide:
  - protection against overload with trip with inverse long time delay (L)
  - protection against instantaneous short-circuit (I)
  - Selective short-circuit (S)
  - Earth fault (G)

##### The setting ranges shall be:

- Protection against overload (L)  
Characteristic  $t=k/I^2$   
Trip threshold  $I1=(0.4...1) \times I_n$  with timing adjustable from 3 to 144 sec. (value referred to a current equal to  $3 \times I1$ )
- Protection against selective short-circuit (S)  
Characteristics  $t=k$  and  $t=k/I^2$   
Trip threshold  $I2=(1...10) \times I_n$  with timing adjustable from 0.1 to 0.8 sec.  
(value referred to a current equal to  $10 \times I_n$  for curves at  $t=k/I^2$  and referred to currents  $>I2$  for curves at  $t=k$ )
- Protection against instantaneous short-circuit (I)  
Trip threshold  $I3=(1.5...15) \times I_n$
- Protection against earth fault (G)  
Characteristics  $t=k$  and  $t=k/I^2$

- Trip threshold  $I_4 = (0.2 \dots 1) \times I_n$  with timing adjustable from 0.1 to 0.8 sec. (value referred to a current equal to  $4 \times I_4$ )
- Neutral protection level:  
50% - 100% - 200% - excluded

All the protection functions except protection against overload must be excludable

User interface and signalling LEDs

- The release shall allow parameterisation of the trip thresholds and timing by means of dipswitches.
- alarm and trip signalling for all the protection functions by means of LEDs located on the release shall be available. No batteries or external power supplies shall be necessary for powering these indicators. The indication shall be available for not less than 48 hours after the trip, even with the circuit-breaker open
- An alarm shall indicate by means of LEDs located on the release the disconnection of opening solenoid and current transformers. A trip shall also occur, after a short time delay, when the disconnection is detected.
- It shall be possible, with the aid of external devices, to read currents, and information on last 10 trips (currents, protection tripped) occurred to the unit.

## 11.6 General aspects of MCCB with Thermal Base release

### Standards conformity

Molded case circuit-breakers (MCCB) installed in the low voltage plant must be designed, manufactured and tested according with the international standards IEC 60947-1, IEC 60947-2, IEC 60947-3, IEC 60947-4-1, IEC 61000 or with the corresponding harmonized national standards, the CE "Low Voltage Directives" (LVD) n° 73/23 EEC and "Electromagnetic Compatibility Directive" (EMC) n° 89/336 EEC.

#### 11.6.1 Molded case circuit breakers functional features

- Rated insulation voltage ( $U_i$ ) for MCCB shall be 800 V AC or more.
- Rated Impulse withstand voltage ( $U_{imp}$ ) for mccb's shall be 8kV.
- Rated service voltage ( $U_e$ ) for the moulded case circuit breaker shall be standard as 690V, however performance on short circuit level shall be consider based on system operating voltage.
- Rated uninterrupted current between varying from 160 and 800 A with trip units settings starting from 1 A
- Rated short circuit breaking capacity shall be considered as per bill of material and the rated service short circuit breaking capacity ( $I_{cs}$ ) shall be in 50-100% of rated ultimate short circuit breaking capacity ( $I_{cu}$ ).
- According to IEC 60947-2 (§ 4.4) starting from 400 A the circuit breakers must be category B, however other small rating category A shall be confirmed.
- MCCBs must be available with different ultimate short breaking capacities between 16kA and 200kA @ 380/415 V AC.
- Both line up and line down supplying must be possible without decreasing MCCBs performances or functionality
- MCCB shall confirm to current limiting type and this feature shall ensure less amount of let through energy at the time of opening on fault. The mccb shall have opening time less then 10msec for current rating upto 800A

- A test bottom for the correct functionality checking (moving contacts opening) must be place in front of the breaker.

#### 11.6.2 Ambient characteristics

- Operating temperature: -25 °C .. +70 °C (ambient temperature)
- Storage temperature: -40 °C .. +70 °C (ambient temperature)
- Reference temperature for setting the thermal element of the thermo magnetic trip unit: +40 °C
- Maximum relative humidity: 98%
- Maximum altitude: 2000 m above sea level, 5000 m above sea level with derating
- Suitability for being used in hot-humid places.

#### 11.6.3 Construction characteristics

- The range of moulded case circuit-breakers must cover a range of rated uninterrupted currents from 160 to 800 A.
- By means of the double insulation technique, moulded case circuit-breakers must guarantee complete separation between the power circuits and the auxiliary circuits.
- Moulded case circuit-breakers must have an operating lever which always indicates the exact position of the circuit-breaker contacts (positive operation), by means of safe and reliable signals (I= closed, O= open, yellow-green line= open due to trip unit).
- Moulded case circuit-breakers must be suitable for isolation in compliance with § 7.2.7 of the IEC 60947-2 Standard. This indication must be clearly and indelibly marked on the circuit-breaker (in accordance with § 5.2 of IEC 60947-2) and in a position where it is visible with the circuit-breaker installed.
- Moulded case circuit-breakers with rated uninterrupted current up to 250 A shall have a 45 mm high face which makes them suitable for installation on modular panels.
- For the front parts of the circuit-breakers the degree of protection of at least IP20 (excluding the terminals) must be guaranteed.

#### 11.6.4 Protection trip units

##### 11.6.4.1 Thermomagnetic overcurrent trip units

- Thermomagnetic trip units shall be fitted with protection threshold against overload (whose thermal element must consist of a bimetal) and with protection threshold against short circuit.
- The protection threshold against overload must be continuously adjustable starting from 0.7 times the rated current of the trip unit and up to its rated value.
- The reference temperature for setting the thermal element of the protection trip unit is 40°C. The temperature performance of the trip unit must be indicated as the temperature varies.
- The protection threshold against short-circuit can be either the fixed or adjustable type with continuity from 5 and up to 10 times the rated current of the trip unit. For current rating upto 250Amps, magnetic threshold be minimum of 10 times of rated current.

##### 11.6.4.2 Magnetic only overcurrent trip units

- The overcurrent trip units with magnetic only threshold shall be suitable for protection against short-circuit.
- The adjustable magnetic only trip units (suitable for motor protection) shall only be available in the three-pole version, whereas those with fixed threshold shall also be available in the four-pole version.

- The adjustable magnetic only trip units must be available for circuit-breakers up to 250 A with an upper magnetic threshold equal to  $I_m = 3200$

OR

## **11.6 General aspects of MCCB with microprocessor based release**

### *Standards conformity*

Molded case circuit-breakers (MCCB) installed in the low voltage plant must be designed, manufactured and tested according with the international standards IEC 60947-1, IEC 60947-2,

IEC 60947-3, IEC 60947-4-1, IEC 61000 or with the corresponding harmonized national standards, the CE "Low Voltage Directives" (LVD) n° 73/23 EEC and "Electromagnetic Compatibility Directive" (EMC) n° 89/336 EEC.

#### **11.6.1 Molded case circuit breakers functional features**

- Rated insulation voltage ( $U_i$ ) for MCCB shall be 800 VAC or more.
- Rated Impulse withstand voltage ( $U_{imp}$ ) for mccb's shall be 8kV.
- Rated service voltage( $U_e$ ) for the moulded case circuit breaker shall be standard as 690V, however performance on short circuit level shall be consider based on system operating voltage.
- Rated uninterrupted current between varying from 160 and 3200 A with trip units settings starting from 10A
- Rated short circuit breaking capacity shall be considered as per bill of material and the rated service short circuit breaking capacity ( $I_{cs}$ ) shall be in 100% of rated ultimate short circuit breaking capacity ( $I_{cu}$ ). ( $I_{cs}=I_{cu}$ )
- According to IEC 60947-2 (§ 4.4) starting from 400 A the circuit breakers must be category B, however other small rating category A shall be confirmed.
- MCCBs must be available with different ultimate short breaking capacities between 16kA and 200kA @ 380/415 V AC.
- Both line up and line down supplying must be possible without decreasing MCCBs performances or functionality
- MCCB shall confirms to current limiting type and this feature shall ensure less amount of let through energy at the time of opening on fault. The mccb shall have opening time less then 10msec for current rating upto 630A, and less them 15msec for current rating upto 1600Amps.
- A test bottom for the correct functionality checking (moving contacts opening) must be place in front of the breaker.

#### **11.6.2 Ambient characteristics**

- Operating temperature: -25 °C .. +70 °C (ambient temperature)
- Storage temperature: -40 °C .. +70 °C (ambient temperature)
- Maximum relative humidity: 98%
- Maximum altitude: 2000 m above sea level, 5000 m above sea level with derating
- Suitability for being used in hot-humid places.
- Circuit-breakers fitted with electronic trip units must comply with the prescriptions of the International Standards on electromagnetic compatibility.

#### **11.6.3 Construction characteristics**

- The range of moulded case circuit-breakers must cover a range of rated uninterrupted currents from 160 to 3200 A.



- By means of the double insulation technique, moulded case circuit-breakers must guarantee complete separation between the power circuits and the auxiliary circuits.
- Moulded case circuit-breakers must have an operating lever which always indicates the exact position of the circuit-breaker contacts (positive operation), by means of safe and reliable signals (I= closed, O= open, yellow-green line= open due to trip unit).
- Moulded case circuit-breakers must be suitable for isolation in compliance with § 7.2.7 of the IEC 60947-2 Standard. This indication must be clearly and indelibly marked on the circuit-breaker (in accordance with § 5.2 of IEC 60947-2) and in a position where it is visible with the circuit-breaker installed.
- Moulded case circuit-breakers with rated uninterrupted current up to 250 A shall have a 45 mm high face which makes them suitable for installation on modular panels.
- The same depth must be guaranteed from 320 A up to 1000 A, in order to standardize both switchboards and their supports.
- All the installation positions must be possible without jeopardizing the function of the apparatus. Starting from 630 A up to 1600 A the withdrawable version shall be mounted and operated horizontally.
- For the front parts of the circuit-breakers the degree of protection of at least IP20 (excluding the terminals) must be guaranteed.

#### **11.6.4 Protection trip units**

- From the 250 A size circuit-breakers, the trip unit must be interchangeable.

##### **Electronic overcurrent releases**

- The electronic overcurrent trip units must be self-supplied and must be able to guarantee correct operation of the protection functions even in the presence of a single phase supplied with a current value equal to 20% of the phase current.
- They must be unaffected by electromagnetic interference in compliance with the EMC directive on the matter.
- The basic version shall be fitted with protection functions against overload (function L) and against short-circuit. The latter function can either be of the instantaneous type (function I) or, alternatively, with intentional delay (function S). The function of protection against short circuit must be excludable. A basic version shall also be provided with only the protection threshold against instantaneous short-circuit which cannot be excluded.
- The minimum performances of the protection functions of the electronic protection trip unit for distribution, where present, must be:
  1. Function **L**: adjustable trip threshold  $I_1 = (0.4...1) \times I_n$ , trip curves for the basic version with times from 3 to 12 seconds – 2 different trip curves – (at 6 times the set threshold). Cannot be excluded.
  2. Function **S**: adjustable trip threshold  $I_2 = (1...10) \times I_n$ , trip curves for the basic version with times from 0.1 to 0.25 seconds – 2 different trip curves – (at 8 times the rated current of the trip unit). Can be excluded.
  3. Function **I**: adjustable trip threshold  $I_3 = (1...10) \times I_n$  for the basic version (instantaneous trip). Can be excluded.

- All the protection functions must be characterized by threshold and time tolerances according to the International Standards.
- The size of the current sensors must be a minimum of 10 A to a maximum of 3200 A so as to cover the widest possible current range.

## **12.0 Earthing:**

Earthing arrangement shall be provided for earthing each cable, PVC cable gland, neutral busbar, chassis and frame work of the cubicle with separate earthing terminals at two ends. The main earthing terminals shall be suitably marked. The earthing terminals shall be of adequate size, protected against corrosion, and readily accessible. These shall be identified by means of sign marked in a legible manner on or adjacent to terminals.

Neutral bus bar strip shall be connected to Earthing terminal with help of GI strip of suitable capacity & nut-bolt arrangement.

## **Specification For Feeder Remote Terminal Unit**

### **1.0.0 Scope of Supply & Work**

This document defines the scope of supply, including spares and scope of work of installation, testing & commissioning including interfacing/ integration with RMU & CSS and owners SCADA system for acquisition of real time status and control functions associated with the same. RMU & CSS supplier will offer the subjected FRTU & 4G Modem inside RMU & CSS and will complete all the wirings at factory before inspection & Supply.

#### **1.0.1 Scope of Supply**

The specification covers design, engineering, manufacturing, FAT, SAT, packaging and delivery of FRTU for RMU automation. The system should be completely wired up with all the required accessories to make the system capable of SCADA data acquisition and controlling of all components of RMU & CSS system. The scope of supply also covers the required spares that are to be supplied along with the system as per requirement of Engineer in Charge.

#### **1.0.2 Scope of Work**

- The specification covers engineering, installation, testing and commissioning of FRTU system, to make the system capable of SCADA data acquisition and controlling of complete accessories of RMU & CSS system at site.
- The scope also covers the interfacing/ inter-connecting of FRTU with RMU & CSS. The details are as per the clause 1.5.3. SAT is also included in the scope of work as defined in the document.
- Any firmware up-gradation meets the protocol requirement of MCC/ BCC communication protocol (IEC 60870-5-104) to be made available by the supplier engineer.
- End to end testing from MCC/ BCC to be carried out in presence of the supplier engineer. If any change is required for operation and monitoring of the RMU & CSS system to be made by the bidder without any price implication to owner.

#### **1.1.0 Applicable Standards**

FRTU shall comply with the requirements stated in the latest editions of the following recommendations, standard and specifications:

- International Electro technical Commission (IEC),
- Institute of Electrical and Electronics Engineering (IEEE),
- American National Standards Institute (ANSI),
- National Equipment Manufacturers Association (NEMA) standards

### **1.2.0 Technical Requirements**

#### **1.2.1 FRTU Functionalities:**

FRTU shall contain all the functions required for SCADA data acquisition and controlling/monitoring of the complete accessories used in RMU.

- It should be capable of handling minimum 250 DP(data point) respectively.
- FRTU shall have serial port, configurable RS485/RS232 for MODBUS serial and IEC 103 protocol communication.
- FRTU shall have TCP/IP port for Modbus TCP/IP and IEC 61850 communication.
- Ethernet ports for interfacing with IEC 60870-5-104 protocol to communicate with MCC and BCC.
- Ethernet port should be configured for IEC 60870-5-104 protocol as a slave.
- Built in optical couplers to isolate the field signals and field communication channels.



- g) FRTU shall support event storage capacity as measured events (500), system events (50), alarms (50) and normal events (250). Events should be stored on the basis of FIFO.
- h) Local viewing of all events shall be possible.
- i) FRTU DI/ DO and AI communication channel capacity should be such that it can fulfill automation of complete substation system.
- j) FRTU shall support web based monitoring from remote as well as local.
- k) All DI/ DO and AI communication channels should have individual LED indications.
- l) FRTU shall support feature of remote configuration as well as diagnosis.
- m) FRTU system shall support communication with 4 Nos. master stations simultaneously.
- n) All DI/DO/AI communication card installed in FRTU shall support HOT swap feature.
- o) As the SCADA/ DMS system will use public domain such as RF/ GPRS etc., therefore, it is mandatory to guard the data/ equipment from intrusion/ damage/ breach of security & shall have SSL VPN based security.
- p) FRTU shall support SNMP (Simple Network Management Protocol).
- q) Capability of time synchronization with GPS receiver and SCADA MCC/ BCC.
- r) FRTU system should be modular and expandable.
- s) FRTU should be capable to store the configuration program in detachable flash memory card.
- t) FRTU shall have console port with console cable.

#### 1.2.2 CPU Module:

- a) 32-bit ARM core CPU, operating @ minimum 450 MHz.
- b) Internal memory minimum 128MB and RAM 64MB, suitable for handling the RMU data acquisition and controlling the RMU, DT monitoring, ACB, LT panel and APFC used in substation.
- c) Real Time Clock (RTC)
- d) Display to show the error code and status of the processor.

#### 1.2.3 Communication Ports:

- a) FRTU shall have the following port for communications
- FRTU Warranty period: 5 years from the date of Supply.

FRTU configuration DI/ DO/AI Channel requirement is indicated in the Table given below

DIGITAL INPUT DETAILS OF FRTU	
Equipment	Signals
Each LOAD BREAK SWITCH	Disconnector Open
	Disconnector Close
	Earth Status
	FPI operated (E/F)
	FPI Operated (S/C)
	Local/Remote
	VPIS Status
Each CIRCUIT BREAKER	CB ON
	CB OFF
	Disconnector Open
	Disconnector Close
	Earth Status
	Ready to Close Signal to control centre to indicate all interlocks are OK (including spring charge and trip ckt healthy)
	Auto Trip
	Local/Remote
	SF6 Low
	VPIS Status
COMMON SIGNALS	AC Fail
	Battery Charger-1 Fail
	Command Acknowledgement
	Battery Health Monitoring Unit/Battery in Trouble
	Auxiliary Circuit Healthy (Control Ckt healthy)
Spare	Minimum 5 nos.

Digital Outputs	Signals
	LBS ON
	LBS OFF
	FPI Reset

	CB ON
	CB OFF
	FRTU Remote Reboot
	Auto Trip Reset
	Spare DO

Analog Inputs	Battery input for Battery voltage level check
	Spare

Serial Port (RS 485)	VCB Trivector meter / Energy Meter Data
	Relay and FPIs of RMU (Both relays and FPIs to be connected to FRTU through daisy chain)
	Applicable for CSS (ACB & MCCB through Modbus)

#### Specification of 5G Ethernet Modem for FRTU

1. Module: 4G Dual SIM with compatible 4G /GSM GPRS
  - a) FDD LTE: B1 (1920-1980/2110-2170) / B3 (1710-1785/1805-1880) / B8 (880-915/925-960) / B20 (800) MHz
  - b) TDD LTE: B38 (2570-2620) / B39 (1880-1920) / B40 (2300-2400) / B41(2496-2690)
  - c) HSPA / UMTS: B1 (2100) / B8 (900) /800/850/1900 MHz
  - d) GSM: 900/1800/ MHz Class 10
2. WAN Protocol: PPP/IPCP over Asynchronous HDLC with PAP/CHAP Authentication.
3. Modem shall be compatible with IPv4 & IPv6 scheme
4. Console Interface: RS232 on RJ45 connector.
5. LAN Interface: 10/100 Base-T complying to IEEE 802.3 / ANSI 8802-3 on RJ45 connector.
6. Support for SCADA Protocols in transparent pass-through mode.
7. Network Protocols: PPP, IPCP, PAP, CHAP, ARP, IP, ICMP, TCP, UDP, IPSEC, SNTP, TFTP.
8. Support for NAT and Port forwarding.
9. Management: Serial, HTTP, HTTPS, Telnet & via SMS, Port Mapping, Event Log & Upload. Firmware Upgrade
10. Modem shall have self-healing capability to recover from dead lock situation.
11. Status Monitoring: ICMP to 4 destinations for Keep Alive & Self Heal. Signal Strength & LEDs.
12. SIM Interface: External with locking provision.
13. AT Commands Interface: Supporting AT commands for dialing from FRTU through RS-232 serial port to modem.
14. Communication Interface: Remote management features like telnet & remote download facility
15. LED Indications: Power ON, Network-Signal strength, SIM availability, Ethernet link
16. Connectors: RJ45 Ethernet Port, SIM Card Holder, DC power connector, SMA Antenna connector
17. Power Supply: 24V DC (with reverse current protection) with 2 numbers Terminal Block without adapter. Modem functionality shall not affect during DC voltage supply range of 18 to 30V DC.
18. Enclosure: Metallic Extrusion
19. Mounting: DIN Rail Mounting
20. Temperature: Operating (-10 to 70 Degree Centigrade), 95% Humidity
21. Antenna: 12dB High Gain Antenna with SMA connector. 15mtr wire length to be provided with the High Gain Antenna.
22. Accessories:
  - a) 1 Meter cable for connecting to external DC power source (24 V)
  - b) 1 Meter Standard Ethernet (Straight) data cable
  - c) Standard Console cable for diagnostic port of Modem
  - d) 1 Meter serial cable for dialing modem from FRTU
23. Certification:
  - a) Conducted Immunity : IEC61000-4-6

Measure emission of the device (referenced to earth) on power mains and to compare them with specified limits to ascertain that the device will not disturb other equipments

Frequency : 0.15MHz to 80MHz

Modulation : 80% AM at 1 KHz

Test Voltage : 3V

b) Electrostatic Discharge (ESD): IEC61000-4-2

Check immunity against discharge of static electricity that may occur when a charged operator touches the device

Contact Discharge : 4KV

Air Discharge : 8KV

No of Discharge : 10 at pre-selected spots Positive & Negative Polarity

c) EN55022 CLASS B

Immunity characteristics of the device when subjected to continuous conducted noise

Conducted Emission : Frequency - 150 KHz - 30 MHz

Radiation Emission : Frequency - 30 MHz - 1000 MHz

## **ANNEXURE - 1**

### **SIGNAL LIST FOR AUTOMATION FRTU SIGNAL LIST IN RING MAIN UNIT**

A	3 Way RMU I/O List			
	Sl no	Digital Input	Qty	Remark
	1	Circuit Breaker ON	1	Hard wired
	2	Circuit Breaker OFF	1	Hard wired
	3	Earthing Switch ON	1	Hard wired
	4	Earthing Switch OFF	1	Hard wired
	5	Load Break Switch ON	1	Hard wired
	6	Load Break Switch OFF	1	Hard wired
	7	Earthing Switch ON	1	Hard wired
	8	Earthing Switch OFF	1	Hard wired
	9	Fault Passage Indication (NO)	1	Hard wired
	10	Fault Passage Indication (NC)	1	Hard wired
	11	Load Break Switch ON	1	Hard wired
	12	Load Break Switch OFF	1	Hard wired
	13	Earthing Switch ON	1	Hard wired
	14	Earthing Switch OFF	1	Hard wired
	15	Fault Passage Indication (NO)	1	Hard wired
	16	Fault Passage Indication (NC)	1	Hard wired
	Sl no	Digital Output	Qty.	Remark
	1	Circuit Breaker Remote Close	1	Hard wired
	2	Circuit Breaker Remote Open	1	Hard wired
	3	Load Break Switch Remote Close	1	Hard wired
	4	Load Break Switch Remote Open	1	Hard wired
	5	Load Break Switch Remote Close	1	Hard wired
	6	Load Break Switch Remote Open	1	Hard wired
<b>A</b>	<b>4 Way RMU I/O List</b>			
	Sl no	Digital Input	Qty.	Remark
	1	Circuit Breaker ON	1	Hard wired
	2	Circuit Breaker OFF	1	Hard wired
	3	Earthing Switch ON	1	Hard wired
	4	Earthing Switch OFF	1	Hard wired
	5	Circuit Breaker ON	1	Hard wired
	6	Circuit Breaker OFF	1	Hard wired
	7	Earthing Switch ON	1	Hard wired
	8	Earthing Switch OFF	1	Hard wired
	9	Load Break Switch ON	1	Hard wired
	10	Load Break Switch OFF	1	Hard wired
	11	Earthing Switch ON	1	Hard wired

	12	Earthing Switch OFF	1	Hard wired
	13	Fault Passage Indication (NO)	1	Hard wired
	14	Fault Passage Indication (NC)	1	Hard wired
	15	Load Break Switch ON	1	Hard wired
	16	Load Break Switch OFF	1	Hard wired
	17	Earthing Switch ON	1	Hard wired
	18	Earthing Switch OFF	1	Hard wired
	19	Fault Passage Indication (NO)	1	Hard wired
	20	Fault Passage Indication (NC)	1	Hard wired
	<i>Sl no</i>	<i>Digital Output</i>	<i>Qty.</i>	<i>Remark</i>
	1	Circuit Breaker Remote Close	1	Hard wired
	2	Circuit Breaker Remote Open	1	Hard wired
	3	Circuit Breaker Remote Close	1	Hard wired
	4	Circuit Breaker Remote Open	1	Hard wired
	5	Load Break Switch Remote Close	1	Hard wired
	6	Load Break Switch Remote Open	1	Hard wired
	7	Load Break Switch Remote Close	1	Hard wired
	8	Load Break Switch Remote Open	1	Hard wired

**Note:** Switches/ Breakers is RMU based on the type of RMU (3way & 4way) however the above is minimum indicative list of signals.

## TYPE / ROUTINE TEST ON PACKAGE SUBSTATION

### 14.0. TYPE TESTS FOR THE PACKAGE SUBSTATION:

- 14.1 The Package Substations offered must be type tested as per latest **IEC 62271-202 only**. The copy of type test summary should be submitted along with the tender. CSS manufactured at in JV consortium shall not be accepted.
- 14.2 **Routine Tests:** The routine tests shall be made on each complete prefabricated substation.
- a) Voltage tests on auxiliary circuit.
  - b) Functional test.
  - c) Verification of complete wiring.
- 14.3 **Test Witness:** Routine test shall be performed in presence of Owner's representative if so desired by the Owner. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

### 14.4 Test Certificates:

Certified reports of all the tests carried out at the works shall be furnished in three (3) copies for approval of the Owner.

### 14.5 Type Test Reports to Qualify Technical Bid :

#### Packaged Substation Enclosure:

- Tests to verify the degree of protection.
- Arcing due to internal fault 21KA/1 Sec. for IAC-AB as per latest IEC 62271-202
- Test to prove enclosure class - Temperature rise of the transformer inside the enclosure(K10).
- Short circuit test to prove the capability of the earthing circuits to be subjected to the rated peak and the rated short time withstand currents.
- Tests to verify the withstand of the enclosure of the prefabricated substation against mechanical stress.

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## **TECHNICAL SPECIFICATION FOR 1.1 KV GRADE COPPER STRANDED CONTROL CABLE**

### **1. SCOPE:**

This specification covers, design, manufacture, testing at manufacturer's works, supply and delivery, free at Destination Stores of ISI marked of 1.1KV grade PVC insulated armoured stranded heat resistant (HR) copper control cables as specified in quantity schedule to be used at sub-stations of PVVNL. Sizes of the LT control cable are:

- i. 2C x 2.5 sq. mm
- ii. 4C x 2.5 sq. mm
- iii. 7C x 2.5 sq. mm
- iv. 10C x 2.5 sq. mm

The Control Cables are required for the control, protection, instrumentation, auxiliary Power Supply. Each tender must be accompanied by full information required in the bidding schedule together with pertinent manufacturer's literatures, drawings, instruction manuals to enable the purchaser to make an appraisal of the quality and suitability of the materials offered. Failure to comply with the provision may be sufficient reason to reject the bid.

### **2. STANDARDS AND REGULATIONS:**

All materials shall comply with the applicable provisions of the latest edition of Indian Standards, Indian Electricity Rules, Indian Electricity Act and other applicable statutory provisions, rules and regulations.

The following standards would apply to the specification.

- a) IS-1554 (Part-I) – PVC insulated heavy duty.
- b) IS-8130-Conductors for PVC insulated Cables.
- c) IS-3961 (Part-II) - Recommended current ratings for Cables.
- d) IS-5831-PVC insulated and sheath of Electric Cable.
- e) Other relevant standards for screening.

### **3. CLIMATIC AND ISOCERAUNIC CONDITIONS :**

3.1. The climatic conditions at site under which the material shall operate satisfactory are as follows :

- a) Maximum ambient temperature of the air-in shade (°C): 50
- b) Minimum temperature of the air in shade (°C): 4
- c) Maximum daily average ambient temperature (°C): 45

d) Maximum Yearly average ambient temperature (°C):	30
e) Maximum relative humidity (%):	100
f) Average number of thunderstorm days per annum. :	100
g) Average annual rainfall (cm):	200
h) Maximum wind pressure (Kg/M2):	150
i) Earthquake acceleration (g):	0.04 x 2 g
j) Height above Sea Level (m):	Not exceeding 1000

**3.2** The material offered shall be suitable for continuous operation at the full rated capacity under the above conditions.

#### **4. CRITERIA FOR SELECTION OF CONTROL CABLES:**

- a) Aluminium Conductor PVC insulated armoured power cables of 1.1 KV grade shall be used for various applications in switchyard area/control room.
- b) For all control/protection/instrumentation purposes PVC insulated armoured control cables of minimum 2.5 sq.mm. size with stranded copper conductor shall be used.
- c) AC input Cable to the Battery Charger shall be of PVC insulated, armoured, stranded Copper Cable. DC output Cables from the Charger as well as from the battery shall be of PVC insulated, armoured, stranded Copper Cable.
- d) All connections for PT and D.C. Circuit to control and relay panel shall be made with not less than 2.5 sq. mm. copper stranded control cable.
- e) All connections of CT circuits to control and relay panel shall be made with not less than 4 sq. mm. copper stranded control cable.
- f) Separate cable shall be used for AC and DC.

#### **5. TECHNICAL REQUIREMENTS / DESIGN CRITERIA:**

- 5.1. The material of PVC insulated copper conductor shall be made from high conductivity copper rods complying with IS: 613**
- 5.2. Cables shall be capable of satisfactory operation under Power Supply System frequency variation of + 5% and voltage variation of + 10%.
- 5.3. Wire before stranding shall be approximately circular in cross section, smooth, uniform in quality and free from scale, spills, splits and other defects. The conductor shall be clean; reasonably uniform in size, shape and its surface shall be free from sharp edges. Manufacturer shall ensure that not more than two joints are provided in any one of the single wires forming every complete length of conductor and no joints shall be within 330 mm. of any other joints in the same layer. Joints shall be brazed, silver soldered or electric or gas welded. No joints shall be made in the conductor after it has been stranded. Each Conductor shall consist of multi strand copper wire for 2.5sq.mm cross section. Conductor wire shall be stranded. The Cable shall be laid in ground or on ladder type trays or drawn

in conduit in a hot, humid and tropical atmosphere. The trays may be over head, suspended or run in concrete trenches with removable covers. The tenderer shall indicate clearly the de-rating factor for the above conditions.

- 5.4. 1100 Volts Grade Heat Resisting (HR) Copper Cables suitable for use where the combination of ambient temperature and temperature rise due to load results in conductor temperature not exceeding 85 deg.C under normal continuous operation and 160 deg.C under short-circuit condition with stranded annealed copper conductor, HR PVC Insulated, HR extruded PVC inner sheathed, round galvanized steel wire armoured (for multi core cable only) and overall HR extruded PVC sheathed shall generally conform to latest revision of IS:1554(Part-I). The cores shall be colour coded as per IS, for easy identification.

- 5.5. Cables shall be suitable for laying in racks, ducts, trenches and underground. Cables shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating condition.

5.6. **CURRENT RATING:**

The Cables will have current rating derating factors for an ambient temperature of 45 deg. C and ground cable is required to be taken into consideration. The current ratings shall be based on the maximum temperature 85 deg. C for continuous operation at the rated current.

**6. INSULATION:**

The insulation of sheath shall consist of a compound based on one of the followings.

- (a) Polyvinyl Chloride (PVC).
- (b) Suitable co-polymers of which the major constituent shall be Polyvinyl Chloride.
- (c) The PVC insulated 1100V grade control cables shall be suitable for a maximum rated conductor temperature of 70°C. The Insulation shall be extruded PVC to Type-A of IS : 5831.
- (d) The thickness of insulation, tolerance on thickness of insulation and insulation resistance of the material shall conform to IS:1554Part-I.
- (e) The PVC material for insulation and outer sheathing shall have smooth finish. Armouring shall be of single layer of 1.6/1.4 mm. dia. G.I. Steel Wires though enough to withstand mechanical stressed during handling and shall be resistant to action of oil, acid and alkali. Single layer of 1.6/1.4 mm

**7. OUTER SHEATH:**

An outer sheath shall be provided over armoring. The outer sheath shall be applied by extrusion. The outer sheath shall be so applied that it fits closely over armoring.

The outer sheath shall be of Type STL PVC compounds conforming to IS: 5831. Outer sheath shall be Fire retardant type FR. CL. Minimum thickness of PVC outer sheath, Standard Colour and tolerance on thickness of armoured cables shall conform to Clause 14.4.2 of IS:1554 (Part-I).

**8. INNER SHEATH:**

For multi core armoured cables, the inner sheath shall be of extruded PVC. The inner sheath for common covering shall be of non-hygroscopes, fire retardant material and shall be softer than insulation. The inner sheath shall be so applied that fits closely on the laid up cores. Thickness of the inner sheath shall conform to Clause 12.3 of IS: 1554 (Part-I).

**9. ARMOURING:**

Armoring shall be applied over the inner sheath in case of multicore cables. The armour shall be galvanized round steel wires. Nominal diameter of round steel wires shall conform to Clause No.13.3 of IS:1554(Part-I).

**10. GUARANTEE :**

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, PVVNL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering along with submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

**11. DRUM LENGTH OF CABLES :**

- 11.1. The Cables shall be packed in non-returnable wooden drums. The wooden drums should be bearing distinguishing number with following information duly stencilled on the outer side of one flange.

- a. Name of the Manufacturer.
- b. Normal sectional area of the Conductor of the Cable.
- c. Number of Cores.
- d. Type of Cable & Voltage for which it is suitable.
- e. Length of Cable in this drum.
- f. Direction of rotation of Drum (an arrow)
- g. Gross Weight.
- h. Purchase Order No. & Date.
- i. Year of Manufacture.
- j. Property of PVVNL.
- k. Date of Delivery.

- 11.2 Drums shall be proofed against attack by white ant and termite, Conforming to IS-10418-1982.

- 11.3 The Cables shall be supplied in Drum lengths of 250/500m. which shall be subject to tolerance of not more than + 5% and the variation in the total quantity of cables due to tolerance in individual drum length shall be limited to + 2.5% for all types of cable. Non-standard drum length shall not be acceptable. However, before packing the cables on

drums, the successful bidders will be required to obtain *purchaser's approval* for the drum lengths.

- 11.4. Embossing on the outer sheath of the Cable with marking "Name of Employer; Name of Scheme" and length of the Cable in meters at suitable intermittent distance, preferably 1Mtr.should be done.

## **12. DRAWING DATA & MANUAL:**

The following information shall be furnished in triplicate along with the tenders:

- a) Manufacturer's leaflets giving construction details, dimensions and characteristics of different Cables.
- b) Current rating of cables including derating factor due to grouping, ambient temperature and Type of various installations.
- c) Write up sketch illustrating the manufacturer's recommendation for splitting, jointing and termination of different type of cables.
- d) List of customers to whom the cable for similar rating has been supplied.

## **13. TESTS AT MANUFACTURER'S WORKS AND TEST CERTIFICATES:**

- 13.1. Each type and size of cable shall comply with the requirements of routine test as per relevant Indian Standard.
- 13.2. All routine and Acceptance tests shall be carried out at the manufacturer's works on every lot of offered different type and sizes of cables as per relevant Indian Standards. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in quoted price of control and power cable.



#### **14. TEST REPORTS AND TYPE TESTS:**

Only type tested Control Cables are to be offered conforming to our technical specification, and relevant IS and IEC. Control Cables offered should be similar with ones on which type testing has been carried out as per relevant IS and IEC. The submitted type test report shall proof that the type test have been carried out within five years from the date of submission of bid.

Each type test report shall comply the following information with test result

- i) Complete identification, date and serial no.
- ii) Method of application, Where applied, duration and interpretation of each test

**GUARANTEED TECHNICAL PARAMETERS OF 1.1 KV GRADE COPPER STRANDED CONTROL CABLE**

Sl. No.	Item Particulars	2 Core	4 Core	7 core	10 core
1	Name of manufacturer and location of factory				
2	Standards to which conform				
3	Type and size of cables				
4	Voltage Rating				
5	Thickness of insulation (mm)				
6	No. of cores				
7	Thickness of inner sheath (mm)				
8	Material for inner sheath				
9	Thickness of outer sheath (mm)				
10	Material for outer sheath				
11	Overall dia. of cable (mm)				
12	Armour				
13	Material				
14	Shape				
15	Dimension				
16	No. of strands and wire dia.				
17	Cross-section of the conductor (sq.mm)				
18	Maximum continuous current (amps.)				
19	In ground at 32°C				
20	In duct				
21	In air/trench at 40°C				
22	Maximum short circuit current (amps.)				
23	Conductor resistance at 20°C				
24	Approx. net weight per 100 m. length (Kg)				
25	Standard drum length (m)				

## Specifications of LTCT Meter Box

### *Scope:*

- This specification covers the design, manufacture, testing and supply of anti-corrosive, dust proof, rust proof, shock proof, vermin, and water proof, U.V. stabilized and pilfer resistant meter boxes made of Glass reinforced, polyester sheet moulding compound (SMC) conforming to IS:13410:1992 (with latest amendment thereof) for installation on distribution transformers of various ratings.
- Meter boxes shall consist of two separate chambers, one suitable to accommodate LT TVM and other suitable for installation of 4 nos. single core, single ratio, ring type Current Transformers (CTs) of current ratios as per requirement in the RfP.

### *Constructional Features of Meter Box:*

- LTCT SMC Box: Meter Box shall be made of minimum 2.5 mm. thick Glass reinforced Polyester sheet moulding compound (SMC) conforming to IS:13410:1992 with latest amendments thereof.
- LT meter box shall contain two separate chambers. The upper chamber shall be suitable to house 3 phase 4 wire energy meter. The lower chamber of the box is intended for housing 04 nos. ring type LT CTs. Both the chambers of box shall be independent from each other.
- The appropriate size of cables from the secondary of distribution transformer shall pass through ring type LT CTs.
- If any portion of box is closed, it shall not be possible to approach it by opening the other portion and vice-versa. It shall be moulded in a single piece forming the body of the Meter Box and CT chamber with SMC lid/shed fitted with the base by two nos. concealed brass hinges.
- The concealed brass hinges shall be fitted with the meter Box body base and the cover rigidly in such a way that the same are neither visible nor accessible from outside, thereby making the Meter Box pilfer proof.
- The door/cover in closed position should house properly within collar of meter box/ body base, which shall also house the edges of the lid/cover so that no direct entry or access is possible. • The box should have a front door opening with a window provided with toughened glass of minimum 4.0 mm. thickness for viewing and taking meter reading.
- The meter box shall be of moulded type without any fabrication joint made by the process of hot press compression moulding.
- The body of the Meter Box shall have such construction that while installing on the grouted bolts of base-wall/ mounting bracket, the top surfaces of the box shall have little tapering shape frame centre towards both sides of the meter box so that easy flow of rainwater etc. is facilitated.
- The meter box should be anti-corrosive, rust-proof, dust-proof, vermin-proof, water-proof, UN, stabilized and pilfer resistant. The meter box becomes completely closed by providing locking arrangement in the shape of two nos. clamps.
- Clamp shall have separate holes of 1 mm. dia. each across the meter box body base as well as covers for both the chambers separately

- The meter box shall have four wall mounting bracket with proper screws to fix with the bottom base and provision for Four nos. holes each of 6 mm. dia.
- The meter box should neither melt nor become soft or distort when tested up to temperatures 2500C. ( As per IS 13360 part 6 sec 10 1992 by 'A' capillary tube method The thickness of these boxes shall not be less than 2.5 mm on all sides including floor. The box shall have 3 mm thickness on the tongue and groove area. The meter box cover shall have a groove to hold minimum of 2.5 mm Neoprene gasket.
- The tongue of the base shall ensure tongue, Groove and sealing arrangement against rainwater and dust entering inside the box. The box shall have its roof tapering down to both sides for easy flow of water.
- The boxes shall generally comply with the provision of IS: 14772:2000. The boxes shall be suitable for outdoor / indoor application. The box shall be with good workmanship. There should be a minimum of 25 mm clearance on all sides and 25 mm clearance on the front and 10 mm clearance on the back of the meter.
- Sufficient space should be available inside the meter box for making out-going connections of the leads with the terminal block of the meter.

#### ***Material Of Meter Box:***

- LTCT SMC Box: Material for construction of meter box shall be glass reinforced polyester sheet moulding compound (SMC) as per IS: 13410:1992 Grade S-1 with latest amendment thereof. Thickness of boxes shall be 2.5 mm from all sides. However, thickness of partition plate shall be 2.0 mm.
- LTCT Polycarbonate boxes: The meter box shall be weather proof, tamper proof and shall be made of Injection moulded reinforce polycarbonate material with FV0 fire retardant, self-extinguishing, UV stabilization and Anti oxidation properties. The box shall be of adequate strength , unbreakable and shall be made in two pieces(base and cover). The base shall be dark grey color whereas the cover shall be completely transparent for polycarbonate material. The material for base and cover shall be polycarbonate with minimum cover thickness of 2.5mm & base -3 mm thickness.
- The material of meter box should be anti-corrosive, rust proof, waterproof, shock proof and U.V stabilized.
- Material of meter box should not get soften on heating. (Heat distortion temperature should be above 1702 C.)
- The material of Meter box should be self-extinguishing as per IS: 4249 with latest amendment thereof.
- All MS parts of the meter boxes shall be anti-corrosive treated.

***Rating Plate:*** Manufacturers should Screen Print the following information on each meter box.

- Name of Manufacturer
- Year of manufacturing
- Type of Meter
- PO NO with Date

- Meter Box Number
- Property of Utility

The same shall be finalized during GTP approval stage.



## **TECHNICAL SPECIFICATION**

### **OF**

**LT Single Core, Two Core, Three Core, 3.5 Core and Four Core  
Cross Linked Polyethylene (XLPE) insulated, PVC sheathed (type  
ST-2), Un-armoured / Armoured Power Cables.**

**Technical Specification of LT Single Core, Two Core, Three Core, 3.5 Core and Four Core Cross Linked Polyethylene (XLPE) insulated, PVC sheathed (type ST-2), Un-armoured / Armoured Power Cables**

**1. Scope**

The specification covers design, manufacturing, testing, packing, supply & delivery on FOR destination basis of 1.1 kV grade, LT Cable, single / multiple core, Cross Linked Polyethylene (XLPE) insulated, unarmoured / armoured, PVC sheathed (type ST-2) power cables for effectively earthed systems.

**2. Standards:**

Unless otherwise specified, the cable shall conform in all respects to IS 7098 (Part- 1):1988, IS: 8130-2013, IEC: 60502, IS: 5831-1984, IS: 10810-1984, IS: 3975-1999 and IS: 10418-1982 standards with latest amendments thereof.

**3. Climatic conditions:**

1	Location	Haryana
2	Maximum ambient air temperature	50°C
3	Minimum ambient air temperature	(-)5°C
4	Average daily maximum ambient temperature	40°C
5	Max yearly weighted average ambient temperature	32°C
6	Isoceraunic level	45 days/year
7	Maximum altitude above mean sea level	1000 meters
8	Minimum relative humidity	26 %
9	Max. relative humidity	100 %
10	Average no of rainy days/ year	120
11	Basic Wind Speed	47 m/s
12	Avg. Annual rainfall	900 mm
13	Pollution	Moderate
14	Maximum wind pressure	195 kg/m <sup>2</sup>
15	Seismic Zone	Zone-IV, III, II

**Note:** Moderately hot & humid tropical climate is conducive to rust & fungus growth. The climatic conditions are also prone to wide variations in ambient conditions. Smoke is also present in the atmosphere. Heavy lightning also occurs during June to October.

**Design, construction and technical parameters: -**

**4. Conductor:**

The conductor of the cable shall be made from high conductivity, Electrolytic, H4 Grade Aluminium. The construction of the conductor shall be as follows:

Nominal cross-section	Solid/Stranded	Flexibility class (Ref IS 8130-2013)
Upto & including 10 mm <sup>2</sup>	Solid	1
16 mm <sup>2</sup> and above	Stranded	2

A protective barrier shall be applied between the conductor and insulation. Such barriers when used shall be compatible with insulating material and suitable for the operating temperature of the cable. Cables with reduced neutral conductor shall have sizes as per IS: 7098 (Part1): 1988.

The following minimum weight of Aluminium conductor shall be guaranteed by the manufacturer.

Nominal cross section area (mm <sup>2</sup> )	Minimum mass of Aluminium per km per phase of conductor	
	Solid (kg)	Stranded (kg)
10	27	-
16	42.2	43.9
25	66.2	69.5
35	91.8	96.4
50	124	131
95	249	362
120	315	331
185	485	509
240	630	669
300	800	839
400	-	1073
500	-	1353
630	-	1746

#### **5. Insulation:**

The insulation shall be suitable for LT system voltage and the insulating material shall be cross linked Poly Ethylene (XLPE) and applied by extrusion process as per IS: 7098 Part-1 along with its amendments. The insulation shall be an extrusion of thermosetting cross-linked polyethylene rated for 90°C continuous operation.

The insulating material shall have excellent electrical properties with regard to resistivity, dielectric constant and loss factor and shall have high tensile strength and resistance to abrasion. This shall not deteriorate at elevated temperatures or when immersed in water. The insulation shall be preferably fire resistant and resistant to chemicals like acids, alkalis, oils and ozone.

The insulation properties shall be stable under thermal conditions arising out of continuous operation at conductor temperature of 90°C rising momentarily to 250°C under short circuit conditions. It shall be free from any foreign material or porosity visible to the unaided eye. The insulation shall be so applied that it fits closely on the conductor and it shall be possible to remove it without damaging the conductor.

The average thickness of insulation shall not be less than the nominal value as specified in IS: 7098 (Part-1):1988 with latest amendments.

Tolerance on insulation thickness shall be as per IS-7098 (Part- 1):1988. The insulation shall withstand mechanical and thermal stress under both steady state and transient operating conditions.

#### **6. Core identification (for multiple core cables):**

Individual core of multi-core cables shall be color coded and/or numbered for proper identification in accordance with clause 10 of IS: 7098 (Part- 1):1988.

#### **7. Fillers and Laying up of cores (for multiple core cables):**

In multi core cables, the cores shall be laid up together with a suitable lay, the outermost layer shall have right-hand lay and the successive layer shall be laid with opposite lay. The interstices shall be filled with non-hygroscopic material. Further, the compounds used with fillers shall be such as to have no deleterious effect on other components of the cable and to be stable at cable temperatures.

#### **8. Inner sheath (common covering):**

The laid up cores shall be provided with inner sheath applied by extrusion process. It shall be ensured that it is as circular as possible. It shall be applied to fit closely on to the laid up cores and shall be possible to remove easily without causing any damage to the insulation. Single core cable shall have no inner sheath.

The thickness of the inner sheath shall be as per (12.3) IS: 7098 (Part- 1):1988. No tolerance on the negative side shall be acceptable.

#### **9. Armoring (for armoured cable):**

In case of Single core cable, armoring shall be applied over the insulation and shall be of Non-magnetic material conforming to IS: 3975-1999 (amended up to date). The Armoring shall be over the inner sheath in case of multi core cables. A binder tape shall be provided on the armour. The armour of cables shall consist of either galvanized round steel wires/formed steel wires (strips) as per clause 13.2 of IS: 7098 (Part I). Where the calculated diameter below armoring does not exceed 13 mm, the armour shall consist of galvanized round steel wires. Where the calculated diameter below the armoring is greater than 13 mm, the armour shall consist of either galvanized round steel wires or formed steel wires (strips).

The armoring shall be applied such that the minimum area of coverage shall be 90% and the gap between any two armour strips/ wire shall not be more than the width of strip/ diameter of armour wire. The galvanized round steel wires/formed steel wires (strips) shall comply with the requirements of IS: 3975-1999 with latest amendments.

The dimensions of the galvanized round steel wires/formed steel wires (strips) shall be as per IS: 7098 (Part-1) (Table 6, Clause 13.3) with latest amendments and armoring size & dimension shall be as per method (b), method (a) is not acceptable. Tolerance on size of armour shall be as per IS: 7098 (Part-1):1988 & IS: 3975.

The direction of lay of the armour shall be as per clause 13.1.2 of IS:7098 (Part-I) – 1988

#### **10. Outer sheath:**

The outer sheath shall be applied by extrusion. It shall be applied:

- a) over the insulation in case of unarmoured single-core cables;
- b) over the inner sheath in case of unarmoured twin and multi-core cables; and
- c) over the armoring in case of armoured cables.

The outer sheath shall be of type ST2 PVC Compound conforming to the requirements of IS: 5831-1984 (amended up to date).

The outer sheath should be so applied that it fits closely over insulation / inner sheath / armouring. It shall be possible to remove it without damaging the insulation / inner sheath.

The thickness and its tolerance of outer sheath on unarmoured / armoured cable shall be as per IS:7098 (Part-1)-1988 along with its amendments. The colour of the outer sheath shall be black. The cable must meet all the requirements of the IS: 7098 (Part- 1):1988 amended up to date and shall bear ISI mark.

#### 11. General:

All materials used in manufacturing of cable shall be new, unused and of finest quality. All materials should comply with the requirements / tests as per applicable IS / IEC specification, Indian Electricity Rules and any other statutory provision of rules & regulations.

The purchaser reserves the right to ask for documentary evidence of the purchase of various materials, (to be used for the manufacture of cable) as a part of quality control. Quality Assurance plan shall be submitted. Each of cable type and size shall be ISI certified. The manufacturer shall submit self-certified Xerox copy of valid ISI license with the offer.

#### 12. Operation:

- i) Cable shall be suitable for operation under voltage and frequency variation as per Latest Indian Electricity rule.
- ii) Cable shall be suitable for laying in air, in duct or buried underground directly or through trenchless boring.
- iii) Cable shall have heat & moisture resistance properties. These shall be of type & design with proven record on distribution network service.

#### 13. Tests:

##### A. Type tests:

All the cable types and sizes i.e. items offered should have been fully type tested as per IS: 7098 (Part-1) with amendments upto date, at any NABL accredited Laboratory / Test house. If the manufacturer's lab is accredited by NABL then it shall be acceptable for type testing. For any change between design / type of already type tested and the design / type offered against this specification, the purchaser reserves the right to demand repetition of type tests without any extra cost. For each type and size of cable, the type test shall be got carried out independently.

The Nigam also reserves the right to have tests carried out at its own cost from an independent agency, whenever there is a dispute regarding the quality of supply. The following tests shall constitute type tests:

Sr. No.	Tests	For required ref to:-	For test method ref. to part no. of IS:10810
a)	Test on conductor:		
	1. Tensile test	IS: 8130-2013	2
	2. Wrapping test	IS: 8130-2013	3
	3. Conductor resistance test	IS: 8130-2013	5
b)	Test for round steel wires/formed		



	wire (strip) armour: 1) 1. Dimensions 2) Physical Tests on round/formed wires i) Tensile strength ii) Elongation at break iv) Torsion test for round wires v) Winding test for formed wires vi) Uniformity of zinc coating of vii) vi) Mass of zinc coating viii) i) Resistivity	13.3 of IS 7098 (Pt-1) 13.6(a) of IS 7098 (Pt-1) 13.6(b) of IS 7098 (Pt-1) 13.6(c) of IS 7098 (Pt-1) 13.6(d) of IS 7098 (Pt-1) 13.6(e) of IS 7098 (Pt-1) 13.6(f) of IS 7098 (Pt-1) 13.6(g) of IS 7098 (Pt-1)	36 37 37 38 39 40 41 42
c)	Test for thickness and insulation and sheath	9, 12, 14 Table 2, 4 and 6 of IS 7098 (Part-1)-1988	6
d)	Physically tests for insulation: 1) Tension strength and elongation at break 2) 2) Ageing in air oven 3) Hot set test 4) Shrinkage test 5) Water absorption (gravimetric)	Table 1 of IS:7098 (Pt-1) Table 1 of IS:7098 (Pt-1) Table 1 of IS:7098 (Pt-1) Table 1 of IS:7098 (Pt-1) Table 1 of IS:7098 (Pt-1)	7 10 11 12 13 14
e)	Physically tests for outer sheath: 1) Tension strength and elongation at break 2) Ageing in air oven 3) Loss of mass in air oven 4) Shrinkage test 5) Hot deformation 6) Heat shock test 7) Thermal stability	IS:5831-1984 IS:5831-1984 IS:5831-1984 IS:5831-1984 IS:5831-1984 IS:5831-1984 IS:5831-1984	7 11 10 12 15 14
f)	Insulation resistance test	Table 1 of IS:7098 (Pt-1)	43
g)	High voltage test	16.2 of IS:7098 (Pt-1)	45
h)	Flammability test	16.3 of IS:7098 (Pt-1)	53

XLPE cables shall be tested as per IS: 7098 (Part-1)/IEC.

#### B. Acceptance test:

The selection of sample pieces for acceptance test shall be as per Appendix B of IS: 7098 (Part-1):1988, of each lot offered for inspection or part thereof. The minimum shall be one drum.

The following acceptance tests shall be carried as per IS: 7098 (Part- 1): 1988 out on the selected samples by the inspecting officer during inspection:

- Tensile test (for Aluminium)
- Wrapping test (for Aluminium)
- Conductor resistance test.
- Test for thickness of insulation and sheath

- v) Hot set test for insulation
- vi) Tensile strength and elongation at break test for insulation and sheath.
- vii) High voltage test.
- viii) Insulation resistance (volume resistivity) test

**C. Routine Tests:**

The Inspector shall also inspect the routine tests at the time of inspection. The following shall constitute the routine tests:

- (a) Conductor resistance test
- (b) High-voltage test for 5 minutes [as per Clause 16.2 of IS: 7098 (Part-I)].
- D. The following tests shall also be carried out at the time inspection at the firm's premises in addition to the acceptance and routine tests, on any two number samples of each size drawn from the lot offered:
  - a) Shrinkage test on XLPE insulation.
  - b) Following tests on PVC outer sheath:
    - i) Shrinkage test
    - ii) Hot deformation test Heat shock test
    - iii) Thermal stability test
    - iv) Flammability test

**14. MEASUREMENT OF WEIGHTS OF VARIOUS COMPONENTS OF CABLE**

The Inspecting Officers shall measure the weight of various components of cable from a length of 1 meter of cable from each sample and record the same in the Inspection Report.

**15. AGEING TEST, LOSS OF MASS TEST AND COLD IMPACT TEST**

The ageing test, loss of mass in air oven test and cold impact test shall be carried out from the first lot on the sample sealed by the PRT committee & sent to any NABL accredited testing lab for its testing. However, Nigam reserves its right to send sample for these three tests / any test as per IS 7098 (Part-1):1988 from any / all subsequent lots.

**16. SAMPLING PLAN**

Samples shall be taken and tested from each lot for ascertaining the conformity of the lot to the requirements of the specification as per Appendix-B of IS:7098 (Part-1)-1988 along with its amendments.

- 17. CHECK MEASUREMENT OF CABLE LENGTH:** - The manufacturer will provide necessary arrangement for checking of length at his own cost as per sampling plan at the time of inspection. Out of the total quantity of drums offered for inspection, in no case, less than two drums shall be selected for verification of length. If any of the drums is found short in length than the length specified, the whole of the lot shall be rejected.

**18. Identification mark:**

- i) Name of manufacturer
- ii) Year of manufacture

- iii) Year of manufacture
- iv) Size of cable
- v) Cable code
- vi) Name of purchaser "UHBVN" / "DHBVN"
- vii) ISI certification mark.
- viii) Successive length

**19. Packing and forwarding: -**

19.1 The cable shall be wound on non-returnable wooden drums as per IS: 10418-1972 and packed in drums suitable for vertical / horizontal transport, as the case may be and shall be suitable to withstand rough handling during transport and outer storage. The outer surface of the drum shall be painted with white Aluminium paint. Similarly, the inside surface of drum shall have the protective layer of varnish / paint.

19.2 The wooden drums shall be reinforced with steel bends and strips for better protection.

19.3 Length: The cable shall be supplied in standard drum length as per detail below: -

size (mm <sup>2</sup> )	1C (meter)	2C (meter)	3C (meter)	3.5C & 4C (meter)
Upto 16	2000	1500	1000	1000
Above 16 to 50	1500	1000	1000	1000
Above 50 to 150	1000	750	750	750
Above 150 to 300	750	500	500	500
Above 300	500	300	300	300

19.4 The ends of the cable shall be sealed by means of non-hygroscopic heat shrinkable sealing material.

19.5 Nonstandard length not less than 100 meters each shall be acceptable up to + 5% of the ordered quantity. A tolerance of + 5% is permissible on the quantity allotted to each consignee with overall + 2% tolerance on the ordered quantity for completion of order.

- i) Reference of ISAE standard.
- ii) Manufacturer's name or trademark.
- iii) Type of cable and voltage grade.
- iv) No. of cores & nominal cross sectional area of conductor
- v) Cable code.
- vi) Length of cable on the drum
- vii) Gross weight
- viii) Direction of rotation of drum (by means of an arrow)
- ix) Position of outer end of cable
- x) Nigam's technical specification number.
- xi) Year of manufacture
- xii) Reference of Tender No. /P.O. No. date
- xiii) Property of UHBVN /DHBVN
- xiv) Name of consignee and the destination
- xv) ISI Certification Mark.

19.7 The firm shall be responsible for any damage to the cables during transit due to improper and inadequate packing. Wherever necessary, proper arrangement for lifting, such as lifting hooks, shall be provided. Any cable found short inside the packing cases shall be supplied by the supplier, without any extra cost.

19.8 Each consignment shall be accompanied by a detailed packing list, containing the following information:

- (a) Name of consignee
- (b) Details of consignment
- (c) Destination
- (d) Total weight of consignment
- (e) Handling and unpacking instruction
- (f) Bill of materials, indicating contents of each package.

## **21. Warranty**

The supplier shall be made responsible to replace free of cost, with no transportation or insurance-cost to the Nigam, up to the destination, the whole or any part of the material which in normal and proper use proves defective in quality or workmanship, subject to the condition that the defect is noticed within 18 months from the date the material is received by the consignee or 12 months from the date of installation of the goods which ever period may expire earlier. The consignee or any other officer of the Nigam actually using the material will give prompt notice of each such defect to the supplier as well as the Purchasing authority and the Superintending Engineer (Store & Workshop) / Controller of Stores. The replacement shall be effected by the supplier within a reasonable time, but not, in any case, exceeding 45 days. The supplier shall also arrange to remove the defective supply within a reasonable period but not exceeding 45 days from the date of issue of the notice in respect thereof, but only after replacement of defective material. Upon the firm failing to do so, the damages/defects may be got rectified by the Nigam and the cost adjusted from the firm's pending dues and/or security deposit against this or any other contract in force and the balance left be got deposited by the supplier. The Nigam may also withhold the amount equal to cost of defective material. In case the replacement of defective material is not carried out within 45 days of our intimation of defects, the supplier shall have to pay interest @ 12% per annum of the value of defective material, beginning from the date of its receipt in store or date of intimation given by SDO(OP)/SDO(Store) whichever is later upto the date of its receipt after replacement/ repair. The warranty for 18/12 months shall be one time. In addition to above, warranty should be extended by the supplier for the period for which the service was not rendered by the material/equipment supplied by the supplier which would be allowable for one occasion only. In case of recurrence, the material/ equipment shall have to be replaced afresh or cost of the material shall be recoverable from the pending liabilities of the supplier/contractor towards Nigam. After completion of overall warranty period, if it is found that any material defective/ damaged within warranty period is still lying in the store/field/with the firm then equivalent amount of cost of material as BG shall be accepted. After receipt of fresh BG, the old BG should be released.

In case of breach of contractual obligations with reference to non-responding for repairing /replacement of defective material, notices of 15 days & 21 days shall be issued to the firm and in case of still persistence of default, the Nigam shall reserve the right to terminate the contract, encashment of BG towards recovery of damages and further initiation of action for blacklisting.

22. Technical and guaranteed particulars:

The bidder shall furnish all Guaranteed Technical Particulars, as called for, in Appendix -1 of this Specification. Particulars, which are subject to guarantee, shall be clearly identified. Offer not containing this information will not be considered for acceptance.

**GUARANTEED TECHNICAL AND OTHER PARTICULARS FOR THE SUPPLY OF SINGLE / MULTIPLE CORE LT XLPE ARMoured CABLES.**

Sr. No.	Particulars		Single / Multiple Core XLPE Armoured Cables
			Sizes
1.	Manufacturer's name and works address		
2.	Standard specification to which the material shall conform		
3.	Voltage Grade		
4.	No. of Cores		
5.	Conductor details:		
	A	Normal cross section area of :	
		1 Phase Conductor (mm <sup>2</sup> )	
		2 Neutral Conductor (mm <sup>2</sup> )	
	B	No. and size of strands (in mm) of:	
		1 Phase Conductor (mm <sup>2</sup> )	
		2 Neutral Conductor (mm <sup>2</sup> )	
	C	Shape of Conductor	
	D	Whether compacted or non-compacted	
	E	Resistance at 27°C	
		1 Phase Conductor (mm <sup>2</sup> )	
		2 Neutral Conductor (mm <sup>2</sup> )	
6.	Insulation		
	1	Type	
	2	Colour	
	3	Thickness	
	A	Phase Conductor (ohm/km)	
		1 Nominal (mm)	
		2 Minimum (mm)	
	B	Neutral Conductor (Sq.mm)	
		1 Nominal (mm)	
		2 Minimum (mm)	
7	Type of inner sheathing and colour		
8	Whether Binder Tape provided		
9	"Armoring"		
	1	Type	
	2	Dimension (mm)	
10	A	Material	
	B	Thickness	
		1 Nominal (mm)	
		2 Minimum (mm)	
	C	Standard to which it confirm	
11	A	Type and size of filler used	



	B	Min. weight of Filler in kg/km	
12		Max. overall diameter of the Cable (in mm)	
13		Nature of Packing.	

14		Drum	
	A	Tare weight of Drum	
	B	Whether Drum is wheel	
	C	Standard specification to which it conforms	
15		Minimum Weight in kg/km/phase	
	A	Aluminium	
	B	XLPE	
	C	PVC	
16		Standard Length of cable in meter & its tolerance	
17		Whether material bears BIS Certification	
18		BIS License no. & validity	
19		Embossing.	
20		Any other particulars.	

## TECHNICAL SPECIFICATION OF L.T. AIR CIRCUIT BREAKER

### 1. SCOPE

This specification covers the technical requirements of design, engineering, manufacturing, testing at manufacturer's works, packing, forwarding, supply and unloading at store/site, of LT ACB (630A, 800A, 1250A) complete with all accessories for efficient and trouble-free operation.

### 2. APPLICABLE STANDARDS

The equipment covered by this specification shall confirm to the requirements stated in latest editions of relevant Indian/ IEC Standards and shall conform to the regulations of local statutory authorities.

- a) IS 60947-1-2004/ IEC 60947-1-Edition 5.1b 2009-05 : Low voltage switchgear and control gear – Part1: General rules
- b) IS 60947-2-2003/ IEC 60947-2-Edition 4.1b : Specification for Low voltage switchgear and control gear – Circuit Breakers
- c) IS 12063-1987 IEC 60529-1989 : Degree of Protection provided by enclosures
- d) IS 8623-2-1993 IEC 60439-2-1987 : Specification for LV Switchgear and Control gear assemblies- particular requirements for bus bar trunking system (bus ways)
- e) IS 14772-2000 : General requirements for enclosures for accessories for Household and similar fixed electrical installation
- f) IEC 60664 : Insulation co-ordination within low voltage system including clearances and creepage distance for equipment.
- g) IS 2551- 1982 : danger notice plates

### 3. CLIMATIC CONDITIONS OF THE INSTALLATION

- a) Max. Ambient Temperature : 50 deg.C
- b) Max. Daily average ambient temp. : 40 deg.C
- c) Min Ambient Temp : 4 deg.C
- d) Maximum Humidity : 100%
- e) Minimum Humidity : 10%
- f) Average No. of thunderstorm days per Annum : 50
- g) Average Annual Rainfall : 750 mm
- h) Average No. of rainy days per annum : 60
- i) Rainy months : June to Oct.
- j) Altitude above MSL not exceeding : 300 meters
- k) Wind Pressure : 126 kg/sq m up to an elevation of 10M.

The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

### 4. GENERAL TECHNICAL REQUIREMENTS

S No.	DESCRIPTION	REQUIREMENT
4.1	Rating	630A, 800A, 1250A (AC)
4.2	Type of ACB	Fixed type, manually operated
4.3	Type of Release	Microprocessor based release
4.4	ACB O/L Release setting	40% to 100%
4.5	Utilization Category	B
4.6	No. of Poles	Three
4.7	Rated operational Voltage	415V
4.8	Rated Impulse withstand voltage (Uimp)	8kVP

4.9	Rated ultimate short circuit breaking capacity (Icu)	50kA rms
4.10	Rated service short circuit breaking capacity (Ics)	100% of Icu
4.11	Rated Insulation voltage (Ui)	1000V
4.12	Rated Short time withstand Capacity (Icw)	50kAP for 1 sec.
4.13	Rated Making Capacity (Icm)	105 kAP
4.14	Material of Busbar	Aluminium
4.15	Current Density of busbar	1.0 A/mm <sup>2</sup> .
4.16	Max. permissible temperature rise	80°C at terminals with an ambient temperature not exceeding 40°C
4.17	Min. Clearance b/w phases	25.4 mm
4.18	Min. Clearance b/w phase & earth	19.4 mm
4.19	Isolation	Shall be suitable
4.20	Degree of Protection	IP 65

## 5. GENERAL CONSTRUCTION

### 5.1 ENCLOSURE

The ACB shall be housed in an enclosure made of 2mm thick sheet steel. Enclosure of the ACB shall be weather proof and vermin proof. The enclosure shall be provided with taper type construction & an overall canopy to prevent accumulation of water. The enclosure shall be suitable for outdoor application with Degree of protection as IP65. The enclosure shall be provided with extended insulated Aluminium links outside & designed for use of 415V, 3-Phase 4 Wire, 50Hz supply system. The pockets of Aluminium links shall be sealed properly to avoid ingress of moisture.

The enclosure shall have single door arrangement with hinges so that it is not possible to remove the door. However a separate lifting window type arrangement should be provided on the door for operation of ACB. It shall be so designed that when the front cover is opened, there should be no accessible space. The access should only be such that the maintenance of the ACB and its protective parts can be easily carried out. The relay push trip mechanism shall be provided on the front door of the ACB so as to ensure that the tripping mechanism is accessible from outside. All parts shall be manufactured in accordance with relevant IS/IEC. In case of equipment with conductive enclosures, means shall be provided if necessary to ensure electrical continuity between exposed conductive parts of the equipment and the metal sheathing of connecting conductors. The removable parts of the enclosure shall be firmly secured to the fixed parts by a device such that they cannot be accidentally loosened or detached owing to the effects of operation of the equipment or vibrations. When an enclosure is so designed as to allow the covers to be opened without the use of tools, means shall be provided to prevent loss of the fastening devices. The circuit breaker shall have the provision to lock the operating mechanism in OFF position. One padlock at the front side shall be provided with common master key for all the circuit breakers. All the hardware used shall be hot dipped Galvanized or electro-zinc plated. ACB shall have anti-pumping, line load reversibility and shall be of Pollution degree 3. It should have microprocessor-based tripping mechanism having an in-built feature of thermal memory and sensing true RMS giving a stable, inverse time current characteristic which cannot be inadvertently adjusted. The operating characteristic shall be such that:

### 5.2 AIR CIRCUIT BREAKERS

The ACB shall be of drawout type, manually operated stored energy design. Switching ON & OFF of the ACBs shall be independent of speed of the operator. For safety of operator, the ACB shall be totally front shielded with an escutcheon cover, while maintaining the required IP65 it shall also prevent contact with live parts when the enclosure door is opened.

The ACB shall be fitted with microprocessor based release only. Overload releases shall have minimum adjustability from 40% to 100%. However the same shall be preset at 80% of the rated current while calibrating during manufacturing at 433V AC. The CTs mounted for thermal overload release shall have secondary terminals inaccessible from front including tripping mechanism of O/L to avoid tampering of CTs. Separate indications Mechanical / Electrical for overload trip and short circuit trip shall be provided. Besides this, temp. at cable terminals should not exceed 80°C at 40°C ambient on full rated current.

The time-current characteristics shall be of IDMT, normal inverse type with a pick up between 1.05 to 1.3 times the rated current settings. Magnetic short circuit release shall be of instantaneous pick-up design. The Short circuit release shall be of instantaneous pick-up design. The Short Circuit release shall have field adjustable pick-up of range 6-8 times the rated current with accuracy of ±20% maximum. The arc chutes shall be of arc resistant material and ensure that the arc is positively extinguished within the arc chutes while clearing the rated breaking current.

The actuator of the equipment shall be insulated from the live parts of the ACB. If it is made of metal, it shall be capable of being satisfactorily connected to a protective conductor unless it is provided with additional reliable insulation. If it is made of

or covered by insulating material, any internal metal part, which might become accessible in the event of insulation failure, shall also be insulated from live parts for the rated insulation voltage. The direction of movement of the actuator shall comply with the requirements of IEC-447. The open and closed positions shall be unambiguously indicated by means of position indicating devices. For equipment operated by means of two push buttons, only the push button designated for the opening operation shall be RED or marked with symbol "O". Red color shall not be used for any other push-button. The colours of other push-buttons shall be in accordance with IEC-73.

- › Circuit breakers shall be microprocessor-based release 4pole, air break, moulded case, draw out type as specified and designed to deliver performances without periodical maintenance.
- › Air circuit breakers (ACB) shall comply with standards IS/IEC 60947-1 & 2. The breakers shall be tested & certified at CPRI/ERDA.
- › Air circuit breakers shall have a rated operational voltage of 440V AC (50/60Hz).
- › The rated insulation voltage shall be 1000V AC (50/60Hz) & impulse voltage of 12 kV.
- › Circuit breakers shall be capable of carrying the full load current defined for 50 °C without any derating.
- › Circuit breaker main contacts shall be silver-plated high-grade copper with each pole encased in a reinforced polyester casing completely insulated from each other internally and offer double insulation for the operators on the breaker front face.
- › Circuit breakers from 630-1250A shall be of single frame having uniform "height x width x depth" with common door cut-outs.
- › All accessories & auxiliaries should be common for entire range of circuit breakers.
- › The operating mechanism shall be of fast opening type with opening time of breaker should be <40ms.
- › ACB should be with microprocessor based release. It should give protection against over load, short ckt & earth fault. Individual fault trip LED indications shall be available on the trip unit for easy & faster identifying the cause of fault.
- › It should be possible to change the protection settings on line and the circuit breaker need not be switched off while adjusting the setting.
- › ACB should be equipped with standard safety shutters with locking provision & ready to close contact to ensure all safety parameters are full filled.
- › Modbus communication & GPRS modem :
  - All ACB should have in built two way Modbus communication.
  - ACB release should be suitable to integrate 3rd party GPRS modem with SIM card for remote monitoring.
  - Circuit breaker trip unit shall have a display for measurement of current parameters. It shall be possible to view last 20 trip history with date and time and magnitude of fault. The release shall also store and display 100 events with date and time. All trip units provided shall have thermal memory as standard which shall be switchable.
  - The ACB display shall provide details like no. of operations, trip history, etc. the same shall be possible to be downloaded from the front of the ACB.
  - ACB should have SCADA compliant for on/off status.

### **Performances:**

- › The ACB breaking capacity performance certificates shall be available for category B according to IEC 60947-2 standard.
- › The tests shall be carried out with a breaking performance during operation ( $I_{cs}$ ) and admissible short time withstand ( $I_{cw}$ ) equal to the ultimate breaking capacity ( $I_{cu}$ ). i.e.  $I_{cu} = I_{cs} = I_{cw} = 50KA$  for 1 Sec.



- › All Air circuit breakers can be reverse fed without reduction in performance.
- › The Circuit Breaker shall have minimum Mechanical life of 15000 operations up to 1600A without maintenance.
- › The breakers shall have minimum electrical life of 6000 operations up to 1600A without maintenance.
- › The operating mechanism shall be of the Open/Closed/Open stored-energy spring type and preferably having a ready to close mechanical indication on front of ACB. The closing time shall be less than or equal to 50 milliseconds to ensure faster closing.
- › The operating mechanism shall be of fast opening type with opening time of breaker should be <30ms.
- › All 4 Pole ACBs shall have fully rated neutral equal to rating of the breaker & shall be protected against over-load & short-circuit with provisions for settings at :
  - ☐ 4P 3d - neutral unprotected,
  - ☐ 4P 3d + N/2 - neutral protection at 0.5In,
  - ☐ 4P 4d - neutral protection at In to ensure precise neutral protection.

### **Accessories & Auxiliaries:**

- › Electrical operated Circuit Breakers shall be operated with remote operation function combined with spring charging motor, closing coil & shunt trip coil having control voltage of \_\_\_\_\_. The electrical operated breaker shall also be provided with operating handle for manual closing, mechanical ON/OFF indicator, spring charged indicator, etc.,
- › Shunt trip and closing coil shall be of typical design and both should be accessible from the front of ACB after opening the cover, without disturbing any other part/release.
- › Circuit breaker shall be provided with under-voltage trip release which shall automatically trip the breaker for voltages in the range of 35% to 70% of the system voltage.
- › The ACB design shall be modular in construction that is it shall be possible to mount the coils from the front without removing the breaker from Cradle.
- › All electrical auxiliaries including the motor spring charging mechanism shall be field adaptable and should not require any calibration at site or the necessity for any tool (except a screwdriver).
- › The Circuit Breaker shall have minimum 4 changeover auxiliary contacts rated at 10 A 240/380V volts 50 Hz. There should exist facility to add one more set of 4 contacts as required.
- › Option for fixing Ready-to-close contact shall exist for indicating that all safety parameters are checked & enabling closure of breaker, ensuring at-most safety for the user.
- › All accessories & auxiliaries should be common for entire range of circuit breakers.

### **Safety:**

- › It shall be possible to connect all auxiliary wiring from the front face of the air circuit breaker. This wiring shall be taken through a set of disconnecting contacts, so that all auxiliary wiring is automatically disconnected in the isolated position.
- › There exists clear indication of the following parameters in the front panel of the circuit breakers:
  - ☐ ON - Circuit breaker closed
  - ☐ OFF - Circuit breaker open
  - ☐ Spring Charged – Ready-to-close
  - ☐ Spring discharged

- › Mechanical and electrical anti-pumping devices shall be incorporated in the circuit breakers as required.
- › The circuit breaker shall be fitted with arc chutes on each pole designed to permit rapid dispersion, cooling and extinction of the arc. Arc Chute cover should be integral part of breaker to safeguard persons from arc during extinction & it shall be removable on site.
- › The automatic shutters should be integral part of breaker & locking arrangement should be provided as per standards.
- › The with-drawable circuit breaker shall have the following three distinct and separate positions, which shall be indicated on the face of the panel.
  - ☐ "Service" -- Both main and auxiliary circuits are connected
  - ☐ "Test" -- All auxiliary circuits are connected & main circuits are disconnected
  - ☐ "Isolated" -- Both main and auxiliary circuits are disconnected
- › There should be a positive locking at these positions while racking out or racking in for clear & confirmative indications as the position is reached. A push button shall be available to release the lock.
- › The circuit breaker shall be suitable for moving out to Maintenance Position with the telescopic rails extended and with the cubicle door opened. The routine maintenance shall be capable of being carried out in this position.

### **Interlocks:**

- › It shall not be possible to with-draw the breaker from the cubicle in "ON" condition. To achieve this, suitable mechanism shall be provided to trip the breaker before the Breaker is isolated.
- › It shall not be possible to switch "ON" the breaker until it is either in the fully inserted position or for testing purposes it is in the fully isolated position.
- › It shall not be possible for the Circuit Breaker to be plugged in unless it is in the OFF position.
- › A safety catch shall be provided to ensure that the movement of the breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due to its weight.
- › A door interlock shall be provided so that it shall not be possible to open the door until the air circuit breaker moving part is in the disconnected position.
- › A mis-match interlocking shall be provided to prevent insertion of a draw-out type circuit breaker having a rating higher than the current rating of the fixed part.
- › The racking handle shall be stored on the air circuit breaker in such a manner as to be accessible without defeating the door interlocking.
- › Provision should exist for fixing key lock to have secured interlocking with the other circuit breakers.
- › The breaker shall be locked in disconnected position using key lock or padlock to avoid accidental charging of the breaker during maintenance phase.

### **Terminations:**

- › All circuit breakers shall be fully tropicalized as standard & suitable for terminating copper or aluminium bus bars.
- › Both fixed & draw-out circuit breakers shall have single pole-pitch to ensure sufficient & safer clearances between phases.
- › Provision shall exist to change the orientation of rear terminations from horizontal to vertical connection or vice-versa at installation to enable ease of bus bar/cable terminations.

### **Protections:**

- › The Circuit breaker protection shall be through microprocessor based trip units.
- › The microprocessor release should be self powered type without any auxiliary power supply during normal operation of the breaker.



- › The circuit breaker control unit shall measure the true r.m.s value of the current.
- › The protection release shall have following protections as standard.
  - ☐ Adjustable over load current (Ir) settings from 40% to 100% of rating of ACB (In).
  - ☐ Over load time setting (tr) from 0.5s, 1s, 2s, 4s.....24s as field selectable curves.
  - ☐ Short circuit setting (Isd) from 1.5 to 10 times of Ir setting
  - ☐ Short circuit time delay adjustable from 0 to 400 msec.
  - ☐ Instantaneous (Ii) protection with an adjustable pick-up and an OFF position.
  - ☐ Earth fault setting adjustable in absolute Ampere with time delay settings from 0 to 800 ms.
- › Individual fault trip LED indications shall be available on the trip unit for easy & faster identifying the cause of fault.
- › It ON / It OFF options shall be available for short-circuit & earth fault protections to enhance discrimination with downstream devices.
- › The trip unit shall have integral test facility to verify the healthiness and to avoid external calibration.
- › The release shall be self diagnostic with separate indication in case of mal functioning.
- › It shall be possible to change the protection settings on line and the circuit breaker need not be switched off while adjusting the setting.
- › Circuit breakers shall conform to Electromagnetic compatibility tests (EMC) as specified in IEC60947-2, Appendix- F.
- › The Circuit breaker control unit shall be interchangeable on site for adaptation to changes in the installation.
- › The control unit shall have thermal memory throughout the range to store temperature rise data in case of repetitive overload or earth fault for protecting the cables and loads.
- › Circuit breakers in the outgoing feeders shall be provided with micro processor based trip units offering protection against over load (Long time) & Instantaneous protection (Ii) ensuring total discrimination.
- › ACBs shall have fully rated neutral equal to rating of the breaker and shall be protected against over-load faults with provisions for settings 0%, 25%, 50%, 75%, 100%, 150% & 200% of In to ensure precise neutral protection having arrangement to connect external Neutral CT to avail neutral protection in 4P ACBs.

## Environmental requirements

- › Circuit breakers shall conform to environmental directives like ROHS & WEEE.
- › The manufacturer shall implement non polluting production processes that do not make use of chlorofluorocarbons, chlorinated hydrocarbons, ink for cardboard markings, etc...
- › The manufacturer shall provide instructions on the removal, dismantling and processing of Air circuit-breaker materials at the end of service life (material composition, weight, toxicity).

## 5.3 TERMINALS & CONNECTIONS

Current carrying parts shall have the necessary mechanical strength and current carrying capacity for their intended use. All parts of terminals which maintain contact and carry current shall be of metal having adequate mechanical strength. Standard sizes of bolts, screws, pipe and other fittings shall be used and number of sizes to be kept minimum. Terminals shall be so constructed that the conductors can be clamped between suitable surfaces without any significant damage either to conductors or terminals. Terminals shall not allow the conductors to be displaced or be displaced themselves in a manner detrimental to the operation of equipment and the insulation voltage shall not be reduced below the rated values. Terminals for connection to external conductors shall be readily accessible during installation. Phase barriers between phase bus bars shall be provided to avoid short circuit. Clamping screws and nuts shall not serve to fix any other component although they may hold the terminals in place or prevent them from turning.

All mechanism shall be made of such material as to prevent corrosion due to sticking of dust. The bolts, nuts and washers shall be of Stainless steel only to avoid corrosion and trouble free operation at the time of maintenance. All connections and contacts shall be of ample section and surfaces for carrying continuously the specified current without undue heating and shall be secured rigidly & locked in position. The manufacturer shall state the type (rigid/stranded/flexible), the minimum and the maximum cross-section of conductors for which the terminal is suitable and, if applicable, the number of conductors simultaneously connectable to the terminal.

The enclosure shall incorporate neutral link. The neutral bus bar shall be of same size as phase bus bar. Cable lugs shall be of crimping type of Aluminum suitable for Aluminum cable of size 300 sq. mm. These shall be symmetrically arranged to facilitate easy cable connections. The cable lugs shall be of long barrel type with two hole arrangement. Aluminum lugs with the provision of both wire sizes as mentioned in the below table are required to be supplied with each ACB. Sizes of incoming and outgoing cables for phases and neutral shall be as given below. The cables shall be 1100V, single core and XLPE insulated. Single core cables shall be unarmored, whereas multi core cables shall be armored.

The provision control wiring where ever shall be including spiral PVC conduits:

S No.	Rated Phase Current (A)	Size of I/C cable (sq mm) / phase	Size of O/G cable (sq mm)
1	630	1RX1CX 630	300/630 sq.mm
2	800	1RX1CX 630	300/630 sq.mm
3	1250	2RX1CX 630	300/630 sq.mm
4	Neutral Busbar	Same as of Phase size	

#### 5.4 INSULATION SUPPORT

The bidder shall use fire retardant material (not bakelite) for insulation and seal the gap near the bus-bars with sealing agent, to prevent the inrush of dust and moisture from the back side of enclosure. Phase barrier of same material shall also be provided. If, in order to prevent accidental contact between a metallic enclosure and live parts, the enclosure is partly or completely lined with insulating material, then this lining shall be securely fixed to the enclosure.

#### 5.5 PROTECTIVE MEASURES

The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance so that there is no possibility of the operator experiencing a shock during normal operation. All apparatus, connections and cabling shall be designed / arranged to minimize risks of fire and any damage which might cause in the event of fire. Bakelite impregnated / non impregnated should not be used internally or externally. All apparatus shall be so designed and constructed as to obviate the risks or short circuits of the live parts by lizards / rodents.

When the operating person is opening the door, at any circumstances he should not be able to access the live bus directly. Insulated barriers shall be provided wherever necessary so as to ensure that no accidental contact with any live parts inside is possible.

#### 5.6 PROTECTIVE EARTHING

The fixed parts of a metal enclosure shall be electrically connected to the other exposed conductive parts of the equipment and connected to a terminal which enables them to be earthed or connected to a protective conductor. The exposed conductive parts (e.g. chassis, framework and fixed parts of metal enclosures) other than those which cannot constitute a danger shall be electrically interconnected and connected to a protective earth terminal for connection to an earth electrode or to an external protective conductor. Under no circumstances shall a removable metal part of the enclosure be insulated from the part carrying the earth terminal when the removable part is in place. The ACB shall be provided with an Aluminium Earth bus suitable for the rated short circuit current of the breaker. Two nos. body earthing studs shall be provided on side of boxes for body earthing. One other stud shall be provided for neutral earthing. The earth terminal /stud shall be of suitable size to accommodate the earth conductor and shall be corrosion protected. The earth terminal shall be identified by means of earthing sign marked in legible and indelible manner on or adjacent terminals. The earthing stud shall be welded from inside so as to prevent access to theft. The protective earth terminal shall be readily accessible and so placed that the connection of the equipment to the earth electrode or to the protective conductor is maintained when the cover or any other removable part is removed.

#### 5.7 PAINTING

The paint shall be applied on clean, dry surface under suitable atmospheric conditions by seven tank process followed by powder coating. The paint shall be RAL 7032 with thickness of powder coating not less than 70 to 80 microns.

### 6 NAMEPLATE & MARKING

All the components and operating devices of the ACB shall be provided with durable and legible nameplates containing all technical parameters. The name plate on enclosure of the ACB shall be embossed with P.O no. with date, "PROPERTY OF PVVNL" & "CODE NUMBER" along with the following parameters:-

- Manufacturer's Name or trade mark

- ii) Type designation or serial no.
- iii) Reference to IEC 947-2
- iv) Utilization category
- v) Rated Operational Voltage(s) (Ue)
- vi) Value/ Range of rated frequency
- vii) Rated service short circuit breaking capacity (Ics)
- viii) Rated ultimate short circuit breaking capacity (Icu)
- ix) Line and load terminals
- x) Neutral pole terminals
- xi) Protective earth terminal
- xii) Danger Plate
- xiii) No. of the relevant standard
- xiv) Terminal Marking

## 7 TESTS

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC standards. All routine/acceptance tests shall be witnessed by the Purchaser/his authorized representative. All the components should also be type tested as per relevant standards. Following tests shall be necessarily conducted on the equipment in addition to the others specified in IS/IEC.

### 7.1 Type Tests -

- a) Temperature Rise Test
- b) Tripping Limits & Characteristics
- c) Dielectric Properties
- d) Operational Performance Capability
- e) Overload Performance (where applicable)
- f) Short Circuit breaking capacities
- g) Short Time withstand current (where applicable)
- h) Degree of Protection of enclosed equipments

### 7.2 Routine/ Sampling Tests -

- a) Mechanical Operation
- b) Calibration of Releases
- c) Dielectric withstand
- d) Verification of clearances
- e) Dimensional check

## 8 TYPE TESTS CERTIFICATES

The bidder shall furnish the type test certificates of the circuit breaker for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA as per the relevant standards. Type test should have been conducted in certified Test Laboratories during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to Purchaser.

## 9 PRE-DISPATCH INSPECTION

Equipment shall be subject to inspection by a duly authorized representative of the Purchaser. Inspection may be made at any stage of manufacturing at the discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material is liable to rejection. Supplier shall grant free access to the places of manufacture to Purchaser's representatives at all times when the work is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by Purchaser.

Following documents shall be sent along with material:

- a) Test reports
- b) MDCC issued by Purchaser
- c) GR/LR copy
- d) Invoice in duplicate
- e) Packing list
- f) Drawings & catalogue
- g) Guarantee / Warrantee card
- h) Delivery Challan



i) Other Documents (as applicable)

**10 INSPECTION AFTER RECEIPT AT STORE**

The material received at Purchaser store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department

**11 GUARANTEE**

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Company up to a period of at least 36 months from the date of commissioning or 42 months from the date of last supplies made under the contract whichever is later, (the time scale of 36/42 months could be enhanced subject to mutual agreements) Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Company, failing which the Company will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum Performance Deposit" as the case may be.

Bidder shall further be responsible for „free replacement“ for another period of THREE years from the end of the guarantee period for any „Latent Defects“ if noticed and reported by the Company.

**12 PACKING**

Bidder shall ensure that all equipment covered under this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit.

**13 TENDER SAMPLE**

Not applicable.

**14 QUALITY CONTROL**

The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's/ Consultant's engineer shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

**15 MINIMUM TESTING FACILITIES**

Bidder / Manufacturer shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

**16 MANUFACTURING ACTIVITIES**

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order

**17 SPARES, ACCESSORIES & TOOLS**

Bidder shall provide a list of recommended spares with quantity and unit prices for 3 years of operation after commissioning. The bidder shall provide a list of accessories and tools required for erection & maintenance along with the installation procedure.

**18 DRAWINGS**

Following drawings & Documents shall be prepared based on Purchaser specifications and statutory requirements and shall be submitted with the bid:

- a) Completely filled-in Technical Parameters.
- b) General description of the equipment and all components including brochures
- c) General arrangement drawings
- d) Single Line Diagram
- e) Bill of material
- f) Type Test Certificates
- g) Experience List
- h) Foundation fixing drawings.
- i) Manufacturing schedule and test schedule

After the after of the contract, four (4) copies of the drawings, drawn to scale, describing the equipment in detail shall be

forwarded for approval and shall subsequently provide four (4) complete sets of final drawings, one of which shall be auto positive suitable for reproduction, before the dispatch of the equipment. Soft copy (Compact Disk CD) of all the drawing, GTP, test certificates shall be submitted after the final approval of the same to the purchaser.

Drawings/documents to be submitted after the award of the contract:

S.No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√		√
2	General Arrangement drawings	√		√
3	Dimensional drawings	√		√
4	Bill of Material	√		
5	Foundation Plan/ Mounting details	√		√
6	Manual/Catalogues/drawings for ACB		√	√
7	Installation Instructions		√	√
8	Instruction for Use		√	√
9	Transport/ Shipping dimension drawing		√	√
10	QA & QC Plan	√	√	√
11	Test Certificates	√	√	√

All the documents & drawings shall be in English language.

**Instruction Manuals:** Supplier shall furnish two softcopies (CD) and four (4) hard copies of nicely bound manuals (In English language) covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

**Type test: Bidder must have type test report of offered items as per relevant IS/IEC and copies of test reports to be enclosed.**

**Preferred Make : Any Standard Make**

#### TECHNICAL PARTICULARS:

S.No	Description	Units	To be furnished by Bidder
1	Type of ACB		
2	No of Phase	Nos.	
3	No of poles	Nos.	
4	Rated Current	A	
5	Type of release		
6	ACB Release setting		
7	Rated Operational Voltage	V	
8	Rated Impulse withstand voltage (Uimp)	kV	
9	Rated Insulation Voltage (Ui)	V	
10	Rated Ultimate short Ckt Breaking capacity Icu (rms)	kA	
11	Rated service short Ckt breaking capacity Ics (rms)	kA	
12	Rated short circuit making capacity Icm (peak)	kA	
13	Short time withstand Capacity (Icw)		
14	Utilization Category		
15	Typical Opening Time	m sec	
16	Typical Closing time	m sec	
17	No. of Operating Cycles		
18	Material of Bus Bar		
19	Max. current Density of Bus Bar	A/mm <sup>2</sup>	
20	Max. Permissible Temp. rise		





## **TECHNICAL SPECIFICATION FOR 8.5 M. LONG WORKING LOAD PCC POLES.**

### **1.0 SCOPE:**

This specification covers pre-stressed concrete poles suitable for use in 11KV/L.T. Overhead Power lines and conforming to IS: 1678:1998(and its amendments thereof).

### **2.0 GENERAL:**

Solid sections pre-stressed cement concrete poles shall be suitable for use in overhead 11KV/L.T. Distribution lines and suitable for a working load of 180 KG. applied in transverse direction at a distance of 300 mm. below top (instead of 600 mm. specified in ISS). The Overall length of the pole shall be 8.5 M. having depth of plantation as 1.52 mt. suitable for plantation direction into ground, when used in straight-line position. The structural strength of pole in longitudinal direction shall be at least one fourth of the strength in transverse direction.

For earthing G.I wire No. 8 SWG shall be embedded with projecting length of 150 mm. at 300 mm. from top and 150 mm. at 1350 mm. from bottom as per enclosed drawing. The pole shall conform to IS: 1678-1998, IS: 1343-1960 and IS: 456-1978. (Or their latest editions/revisions thereof)

Two numbers through holes of 18-mm. dia. on the broader longitudinal side of the poles in the direction of conductor to be laid normal to and shall be provided such that the centers of these holes are at a distance of 100 mm. and 200 mm. from the top of poles.

Apart from above, necessary lifting hooks may also be provided.

### **3.0 MATERIAL:**

#### **3.1 CEMENT**

The cement used in the manufacture of prestressed concrete poles shall be any of the following: -

- a) Portland slag cement conforming to IS: 455 but with not more than 50 percent slag content.
- b) Rapid hardening Portland cement conforming to IS: 8041.
- c) 43 Grade ordinary Portland cement conforming to IS: 8112 and  
53 Grade ordinary Portland cement conforming to IS: 13269.

#### **3.2 AGGREGATES:**

Aggregates used for manufacture of prestressed concrete pole shall conform to IS: 383:1970(latest amendments thereof). If required a sample of the aggregates shall be submitted by the manufacturer to the purchaser for approval. The maximum size of the aggregate shall in no case exceed 20 mm.

#### **3.2 WATER:**

#### **3.3** The water used for concrete mixing and curing shall be clean and free from organic and inorganic matter harmful to concrete.

#### **3.4 ADMIXTURE:**

The use of admixture is not generally recommended. These may be used only with the approval of the purchaser based on evidence that with the passage of time neither the

compressive strength of concrete is reduced by more than 10% nor are other requisite qualities of concrete and/or steel impaired by the use of such admixtures. The admixture shall conform to IS: 9103.

**3.5 PRESTRESSING STEEL (High Tensile Steel):**

High tensile steel used for manufacture of prestressed concrete poles shall conform to IS: 1785 or IS: 2090 (latest amendments thereof). The Pre-stressing steel shall be free from splits, harmful scratches surface flaws, rough rust, scale and other similar deleterious matter liable to affect adversely proper tensioning or its bend with concrete. The diameter of smooth wire used for prestressing of poles shall be 4 mm. or 5-mm. dia. or a combination of two sizes and its ultimate tensile strength shall not be less than 175 Kg/mm.

**3.6 OTHER REINFORCEMENT:**

Apart from the high tensile steel provided for prestressing the poles, 6mm. dia plain round M.S Bar or 4mm. dia. H.T. Wire stirrups (as per IS: 432 or IS: 1786) shall be provided 4 Nos. at each end and 4 Nos. in the mid portion uniformly distributed.

The surface of reinforcement shall be free from loose scale, oil, grease, clay or other material that may have degenerating affect on the bond between the reinforcement and concrete.

**3.7 CONCRETE:**

Controlled concrete as defined in Para 5.32 of IS: 456:1964 and 4.05 of IS: 1343:1960 will be used in the manufacture of the poles. The design of concrete mix shall conform to the requirements laid down for controlled under Para 5.1 to 5.3 of IS: 456:1960 subject to following further conditions.

- 3.7.1** Minimum work cube strength at 28 days shall not be less than 440 Kg/Cm<sup>2</sup> in accordance with acceptability criteria given in Table V clause 5.2.2.1 and 5.4.2 of IS: 456:1960. The mix shall contain as low as possible water cement ratio as is consistent with adequate workability.
- 3.7.2** The concrete shall be compacted thoroughly by vibration, pressure, shock, or other means and shall have a density of not less than 2.4 MT/Cm<sup>3</sup>.
- 3.7.3** The cube strength of concrete at transfer of prestress shall not be less than 245 Kg/Cm<sup>2</sup>.
- 3.7.4** The supplier shall be required to maintain a register showing the test results of cubes at the age of 28 days and at the transfer of prestress. For strength test the cubes shall be taken for each days casting. The register will show the serial number and the pole cast that day for which the test will apply. The acceptability criteria will be as per columns II of table V, Para 5.2.2.1 and 5.4.2 of IS: 456. The register shall be opened for inspection with the authorized representative of the Corporation.

**4.0 DESIGN:**

- 4.1** The poles shall be so designed that they do not fail owing to failure initiated by compression in concrete. Maximum wind pressure to be assumed may be determined as specified in IS: 875. (Part-30).

- 4.2 The pole shall be 8.5 M. long and should be designed for an ultimate load of 450 Kg.
- 4.3 Acting at 300 mm. below top. The dimensions, reinforcement etc. required to be provided may be shown in the drawing.
- 4.4 The strength of the pole in longitudinal direction of the line will be at least one quarter of the strength in transverse direction.
- 4.5 The G.I Wire, no.8 SWG, which be in one continuous length, shall be embedded in the pole for earthing purpose. No joint of any kind in this wire shall be permitted. The position and details of connection to be provided at the end of earth wire have been shown in the enclosed drawing.
- 4.6 Two nos. Galvanized bolts with two nuts and 3 washers with each bolt are to be supplied by the manufacturer. The details of bolts, nut and washers are shown in the drawing.
- 4.7 The position and diameter of the holes to be provided in the poles are also shown in the enclosed drawing and shall be centrally located and will be perpendicular to the face of the pole.
- 4.8 The load factor on transfer strength shall not be less than 2.5.

The poles shall be designed to be suitable for fitting stays and clamps.

Eye hooks shall be provided for lifting of poles. The poles should be strong for lifting and erection in any direction during handling and transport. During erection poles are laid on the ground and lifted at some point near the end, similarly while loading and unloading the poles from carriers they are lifted at one end and resting on the ground and pushed on to the trucks. The poles should be able to withstand all such manual handling.

#### 5.0 **TRANSVERSE STRENGTH AT FAILURE:**

The poles shall be designed that its strength in transverse direction shall be sufficient to take the load due to wind on wires and poles, multiplied by load factor.

#### 6.0 **MANUFACTURE:**

The tensioning of prestressing tendons shall be carried out in a manner that will induce a smooth and even rate of increase of stress

- 6.1 The force induced in the pre stressing tendon shall be determined by suitable means attached to the tensioning apparatus. It is essential that the method used to determine the initial pre stress in the wire give accurate result. Each wire shall be anchored positively during casting. Pre stress in each wire shall be uniform. Care must be taken to ensure that anchorage do not yield before concrete attains the desired strength.
- 6.2 The cover of concrete measured from the outside of the pre stressing tendon shall be atleast 30 mm. or the size of the cable or bar whichever is bigger. When measuring the pre stressing force, any slip which may occur in the gripping device shall be taken into consideration.

- 6.3** The transfer of pre-stressed shall be carried out gradually by a proper device, so that the entire sets of wires are released simultaneously. In long line method, where the transfer is made on several moulds at a time, care shall be taken to ensure that pre stressing force is evenly applied on all moulds and that the transfer of prestress to concrete is uniform along with entire length of tension line by ensuring correct alignment of moulds on guide plates.

The high tensile wire shall be continuous over the entire length of the tendon. Welding shall not be allowed in any case.

**7.0 COMPACTING:**

Concrete shall be compacted by vibrating, Shocking or other suitable mechanical means. Hand compaction shall not be permitted

**8.0 CURING:**

To be done as specified in IS: 1678 (1998)

**9.0 INSPECTION / TESTING:**

- 9.1** The minimum offered number of poles for inspection/ testing should not be less than 500.

- 9.2** The respective DISCOM authorized representative shall be entitled for periodical checking and inspecting of the raw material to be used in entire production scheme and finished poles. The supplier's shall be bound to follow all written instructions found necessary to ensure quality control and conformity the product to the relevant standards.

- 9.3** The transverse strength test on the poles shall be performed in accordance with IS: 2905- 1989 (or latest amendments thereof).

- 9.4** A pole shall be deemed not to have passed the test if hair cracks appear at a stage prior to application of 50% of the ultimate Transverse load or the hair cracks if any, produced on application of 60% of the minimum ultimate Transverse load of 450 Kg. at 300 mm. from top do not close upon the removal or reduction of test load.

- 9.5** For the purpose of test, a lot shall consist of maximum of 200 Nos. of poles. 15 Nos. Of poles out of a lot shall be tested for over all length, cross section and uprightness, and 1% of the poles of the lot shall be tested till breakage amongst those 15 Nos. for transverse strength. Lot with lesser number of poles will also be tested as per above criteria.

- 9.6** The poles for test shall be selected at random out of a lot.

- 9.7** A lot shall be considered as conforming to these specifications if it satisfied the following conditions:

- 9.7.1** The number of poles which do not satisfy the requirement of overall length, cross section and uprightness shall not exceed one no. out of the 15 Nos. poles tested. If the number of such poles exceeds one then all the poles in a lot shall be tested for these requirements and those not satisfying the requirement shall be rejected.

- 9.7.2** All the poles tested for transverse strength test shall satisfy the requirement of the test. If one or more poles fail, twice the number of poles originally tested shall be taken from those



already selected, and subjected to the test. If there is no failure among these poles, the lot shall be considered to have satisfied the requirements of this test.

- 9.7.3** A pole should be deemed to have passed the transverse load test if there is no permanent set observed 10 minutes after the release of applied load 180 Kg.

**10.0 TOLERANCE:**

- 10.1** The tolerance on overall length of the pole shall be  $\pm 15$  mm.

- 10.2** The tolerance on cross sectional dimensions shall be  $\pm 5$  mm.

- 10.3** The tolerance on the uprightness or straightness of the pole shall be 0.5% (Measurement of uprightness or straightness of pole shall be done as per clause No. 4.2.1.1 of IS: 1678:1998). A tolerance of  $\pm 15$  mm is also allowed in the position of G.I Wire.

**11.0 MARKING:**

The pole shall be clearly and indelibly engraved with the following particulars during manufacture so as to easily read after erection in position.

- (a) Code No. (4 digits) (Serial No. of pole)  
at two positions (i) 400 mm, below top (ii) 3.0 meters from the bottom.
- (b) Respective DISCOM., Date, month and year of manufacturing at a place in between code numbers as given in (a).

## **TECHNICAL SPECIFICATION FOR COMPOSITE PIN INSULATORS FOR USE IN 11 KV SYSTEM**

### **1.0 SCOPE:**

This specification covers design, manufacture, testing and supply of composite Insulators for use in the 11KV overhead transmission lines and substations. The composite Insulators shall be of the following type:

### **2.0 APPLICABLE STANDARDS:**

#### **2.1 Standards:-**

Following Indian/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification, shall be referred while accessing conformity of Insulators with these specifications.

- 2.1.1 In the event of supply of Insulators conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent or better to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

SNo.	Indian Standard	Title	International Standard
1		Definition, test methods and acceptance criteria for composite Insulators for A.C. overhead lines above	IEC:61109
2	IS:2071	Methods of High Voltage Testing.	IEC:60060-1
3	IS:2486	Specification for Insulator fittings for overhead power lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements	IEC:60120 IEC:60374
4		Thermal Mechanical performance test and mechanical	IEC:60575
5		Characteristics of string Insulator units of the long rod	IEC:60433
6		Hydrophobicity Clarification Guide.	STRI guide
7		Radio interference characteristics of overhead power	CISPR18-2
8	IS:8263	Methods of RI Test of HV Insulators	IEC:60437
9		Standard for Insulators – Composite–Distribution Dead –	ANSI-C29.132-
10	IS:4759	Hot dip zinc coatings on structural steel & other allied	ISO:1459
11	IS:2629	Recommended practice for Hot Dip galvanization for	ISO:1461(E)
12	IS:6745	Determination of weight of zinc coating on zinc coated	ISO:1460
13	IS:3203	Methods of testing of local thickness of electroplated	ISO:2178

14	IS:2633	Testing of Uniformity of coating of zinc coated articles.	
15		Standard specification for glass fiber standards.	ASTM D
16		Standard specification for compositional analysis by	ASTM D
17	IS:4699	Specification for refined secondary zinc	

### 3.0 TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS::

#### 3.1 Composite Pin Insulators long rod type to support conductor for 11KV overhead power lines :-

- 3.1.1 The Insulators shall be suitable for 3  $\Phi$ , 50 Hz, effectively earthed 11KV O/H distribution system in a moderately polluted atmosphere.
- 3.1.2 Bidder must be an indigenous manufacturer and supplier of composite Insulators of rating 11kV or above OR must have developed proven in house technology and manufacturing process for composite Insulators of above rating OR possess technical collaboration/ association with a manufacturer of composite Insulators of rating 11 kV or above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the owner.
- 3.1.3 Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc, and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.
- 3.1.4 The size of Composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows:

SN	Type of composite Insulator	Nominal system voltage kV (rms)	Highest system voltage kV (rms)	Visible discharge test voltage kV(rms)	Wet power frequency withstand voltage	Impulse withstand voltage kV (peak)	Minimum creepage distance (mm)	Min. failing load KN
i.	11KV Pin Insulator	11	12	9	35	75	320	5

**Note:** Creepage distances have been considered in line with IS-13134 (which specifies 25mm/kV for moderately polluted environment).

#### 3.3 Dimensional Tolerance of Composite Insulators :-

The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with-IEC 61109:

$\pm (0,04d+1.5)$  mm when  $d < 300$  mm,

$\pm (0.025d+6)$  mm when  $d>300$  mm.

Where, d being the dimensions in millimeters for diameter, length or creepage distance as the case may be,

However, no negative tolerance shall be applicable to creepage distance.

### **3.4 Interchangeably:-**

The composite Insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.

### **3.5 Corona and RI Performance:-**

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

### **3.6 Maintenance:-**

- 3.6.1 The composite Insulators offered shall be suitable for use of hot line maintenance technique so that usual hot line operation can be carried out with ease, speed and safety.

## **4. BASIC FEATURES::**

### **4.1 Design and construction:-**

The composite Pin insulator shall have a core, housing & weather shed of insulating material and steel/aluminum alloy hardware components for attaching it to the support/conductor.

#### **4.1.1 Core:-**

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pultrusion process. The FRP rod shall be void free. For 11 KV Pin Insulator the diameter of the FRP rod should be minimum **24 mm**.

#### **4.1.2 Housing (Sheath):-**

The FRP rod shall be covered by a seamless sheath of a silicone electrometric compound or silicone alloy compound of a thickness of 3mm minimum. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing/bonding shall be free from voids.

#### **4.1.3 Weather sheds:-**

The composite polymer weather sheds made of silicone electrometric compound or silicon alloy shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free



from imperfections. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

#### 4.1.4 End Fittings:-

End fittings transmit the mechanical load to the core. They shall be made of Spheroidal Graphite Cast Iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. The gap between fitting and sheath shall be sealed by a flexible silicone electrometric compound or silicone alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof. The details of end fittings for fixing the same with V cross arms and top clamps are given below :-

S. N.	Item	Length of Stud	Minimum threaded	Dia of Stud
1	11KV	150mm	100mm	20mm

Upper end fittings shall be suitable to hold Conductor for 11KV. The size of the fitting shall be in such a way that conductor could be bound firmly so that it may not slip from the groove while in service even under the adverse condition.

#### 5.0 WORKMANSHIP:

- 5.1 All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such Insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.
- 5.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 5.3 The design of the Insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 5.4 The core shall be sound and free of cracks and voids that may adversely affect the Insulators.
- 5.5 Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.
- 5.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with out projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 5.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/Sq.m, or 87µm thickness and shall be in accordance with the requirement of IS: 4759, The zinc used for galvanizing shall be of purity 99.5% as per IS: 4699, The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

## **6. EQUIPMENT MARKING::**

6.1 Each insulator unit shall be legibly and indelibly marked with the following details as per IEC-61109:

- (a) Month & Year of manufacture
- (b) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
- (c) Manufacturer's name/Trade mark

## **7. BID DRAWINGS::**

7.1 The Bidder shall furnish full description and illustration of the material offered.

7.2 The Bidder shall furnish along with the bid the outline drawing (3 copies) of insulator unit including a cross sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information:

- (a) Long rod diameter with manufacturing tolerances
- (b) Minimum Creepage distance with positive tolerance
- (c) Protected creepage distance
- (d) Eccentricity of the long rod unit
  - (i) Axial run out
  - (ii) Radial run out
- (e) Unit mechanical and electrical characteristics
- (f) Weight of composite long rod unit.
- (g) Materials
  - (i) Identification mark
  - (ii) Manufacturer's catalogue number

7.3 At the time of placement of award the supplier shall submit three sets of full dimension manufacturing insulators drawings containing all the details to the Chief Engineer (RDSS), PVVNL, Meerut.

7.4 At the time of placement of award the Supplier shall also submit fully dimensioned insulator crate drawing for different type of Insulators for approval of the owner.

## **8. TESTS AND STANDARDS::**

Insulators offered shall be manufactured with the same configuration & raw materials as used in the Insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. The design & type test reports submitted shall not be more than 05 years old.

### **8.1 Design tests:-**

For polymeric insulators, it is essential to carryout design test as per Clause 4.1 of IEC-61109 /92-93 with latest amendments. The design tests are intended to verify the suitability of the design,

material and method of manufacture better technology. When a composite insulator is subjected to the design test the result shall be considered valid for the whole class of insulators, which are represented by the one tested and having the following characteristics: –

- Same material for the core and sets and same manufacturing method.
- Same material for the fittings, the same design, the same method of attachment.
- Same or greater layer thickness of the shed material over the core (including a sheath where used)
- Same or smaller ratio of the highest system voltage to insulation length.
- Same or smaller ratio of all mechanical loads to the smallest core diameter between fittings.
- Same or greater diameter of the core.
- the tested composite insulator shall be identified by a drawing giving all the dimensions with the manufacturing tolerances
- Manufacturer should submit test report for design test as per IEC-61109 (Clause-5) along with the bid . Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract :- + UV test: The test shall be carried out in line with clause 7.2 of ANSI C29.13

## 8.2 Type Tests:-

The tenderer shall furnish detailed type test report of the offered composite insulators as per Clause-8.2 of the technical specification at the NABL approved lab to prove that the composite insulators offered meet the requirements of the specifications. These type tests should have been carried out within 5 years prior to the date of opening of this tender. The following type tests shall be conducted on a suitable number of individual insulator units, components, materials or complete strings and the test reports should invariably be submitted with the bid :

SN	Description of type test	Test procedure/standard
1.	Dry lightning impulse withstand voltage test	As per IEC 61109 (clause 6.1)
2.	Wet power frequency test	As per IEC 61109 (clause 6.2)
3.	Mechanical load-time test	As per IEC 61109 (clause 6.4)
4.	Radio interference test	As per IEC 61109 (clause 6.4)
5.	Recovery of Hydrophobicity test	Annexure-A This test may be repeated every 3 yrs by the manufacturer
6.	Chemical composition test for silicon content	Annexure-A Or any other test method acceptable to the owner
7.	Brittle fracture resistance test	Annexure - A

NOTE :- The purchaser may like to conduct any other test(s) in addition to above at bidder's cost to establish the performance of the material as per the system requirement.

- 8.3 It shall be the option of the owner to accept the Insulators based on type test reports submitted by the manufacturer. The owner shall be free to repeat the type test & may witness the same.

**Note:** The owner, for the purpose of facilitating the type tests, may ask the bidders to quote test charges separately.

- 8.4 All the type test given in Clause No. 8.2 in addition to routine & acceptance test shall be carried out on insulator along with hardware fittings wherever required.

#### 8.5 Acceptance (sample) Tests

##### 8.5.1 For Composite Insulators

(a)	Verification of dimensions :	Clause 7.2 IEC: 61109,
(b)	Verification of the locking system (If applicable) :	Clause 7.3 IEC: 61109
(c)	Galvanizing test :	IS:2633/IS:6745
(d)	Verification of the specified mechanical load :	Clause 7.4 IEC: 61109,
(e)	Verification of tightness of the : Interface between end fitting and silicon rubber.	Clause 7.4 IEC: 61109, amendment 1 of 1995

##### 8.5.2 Routine Tests:-

sn	Description	Standard
1	Identification of marking	As per IEC: 61 109 Clause 8.1
2	Visual Inspection	As per IEC 61 109 Clause 8.2
3	Mechanical routine test	As per IEC: 61 109 Clause 8.3

#### 8.6 Tests During Manufacturing

Following tests shall also be carried out on all components as applicable

- a) Chemical analysis of zinc used for galvanizing
- b) Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
- c) Chemical analysis, hardness tests and magnetic particle inspection for forgings.

#### 8.6 Sample Batch for Type Testing

- 8.6.1 The bidder shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner, The bidder shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner,

## 8.7 Additional Tests:-

- 8.7.1 The Owner reserves the right at his own expenses, for carrying out any other test(s) of reasonable nature carried out at Supplier's premises, at site, to in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.
- 8.7.2 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test center. In case of evidence of non compliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner,

## 8.8 Co-ordination for Testing:-

- 8.8.1 The Supplier shall have to co-ordinate testing of Insulators with hardware fittings to be supplied by other Supplier and shall have to guarantee overall satisfactory performance of the Insulators with the hardware fittings.

## 8.9 Quality assurance plan:-

- 8.9.1 The successful bidder shall submit following information to the owner:
- 8.9.1.1 Test certificates of the raw materials and bought out accessories.
- 8.9.1.2 Statement giving list of important raw materials, their grades along with names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.
- 8.9.1.3 List of manufacturing facilities available.
- 8.9.1.4 Level of automation achieved and lists of areas where manual processing exists.
- 8.9.1.5 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 8.9.1.6 List of testing equipments available with the bidder for final testing of equipment along with valid calibration reports.
- 8.9.1.7 The manufacturer shall submit Manufacturing Quality Plan (MQP) for approval & the same shall be followed during manufacture and testing.
- 8.9.2 The successful bidder shall submit the routine test certificates of bought out raw materials / accessories and central excise passes for raw material at the time of inspection.

## 8.10 Guarantee:- (As per RDSS Scheme)

The Supplier of Insulators shall guarantee overall satisfactory performance of the Insulators for the period of 18 months from the date of supply.

## 9 INSPECTION::

- 9.1 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where Insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.



- 9.2. The material for final inspection shall be offered by the Supplier only under packed condition. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain Insulators manufactured in 3-4 consecutive weeks.
- 9.3 The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 9.4 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the owner in writing. In the later case also the material shall be dispatched only after satisfactory testing specified herein has been completed.
- 9.5 The acceptance of any quantity of material shall in no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.
- 10 **PACKING::**
- 10.1 All Insulators shall be packed in strong corrugated box of min, 7 ply duly palletted or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100 Kg to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
- 10.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 10.3 Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 10.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate/corrugated box shall have all the markings stenciled on it in indelible ink.
- 10.5 The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

## **Annexure-A (Tests on insulator units)**

- 1 RIV TEST (DRY):** -The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz AC voltage of 10 kV for 11 kV class insulators respectively under dry condition. The test procedure shall be in accordance with IS: 8263 / IEC: 60437/CISPR1 18-2.

**2 BRITTLE FRACTURE RESISTANCE TEST: -**

Brittle fracture test shall be carried out on naked rod along with end fittings by applying "1 n

HNO<sub>3</sub> acid" (63 g cone, HNO<sub>3</sub> added to 937 g water) to the rod. The rod should be held at

80% of SML for the duration of the test. The rod should not fail within the 96 hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

**3 RECOVERY OF HYDROPHOBICITY & CORONA TEST: -**

The test shall be carried out on 4mm thick samples of 5cm x 7cm: -

- i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification. Dry the sample surface.
- ii) The sample shall be subjected to mechanical stress by bending the sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1mm above the sample surface. The test shall be done for 100 hrs.
- iii) Immediately after the corona treatment, spray the surface with water and record the HC classification. Dry the surface and repeat the corona treatment as at clause 7 above. Note HC classification. Repeat the cycle for 1000 hrs or until an HC of 6 or 7 is obtained. Dry the sample surface.
- iv) Allow the sample to recover and repeat hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 - HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

**4 CHEMICAL COMPOSITION TEST FOR SILICON CONTENT**

The content of silicon in the composite polymer shall be evaluated by EDX (Energy Dispersion X-ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

## GUARANTEED TECHNICAL PARTICULARS OF 11 KV, 5 KN, COMPOSITE POLYMER PIN INSULATORS

Sl.	Description	11KV, 5 KN
1.	Name of Manufacturer	
2.	Address:	
	(a) registered Office	
	(b) Factory	
3.	Type of Insulators	
4.	Standard specification to which the Insulators manufactured	
5.	Name of material used in manufacture of the Insulator	
	(a) Material of core rod	
	(b) Material of Housing & weather sheds (silicon content by weight)	
	(c) Material of end fittings	
	(d) Sealing compound for end fitting	
6.	Colour of Insulator	
7.	<b>Electrical Characteristics:</b>	
	(a) Nominal system Voltage (KV rms)	
	(b) Highest System Voltage (KV rms)	
	(c) Dry power frequency withstand (KV rms)	
	(d) Wet power frequency withstand (KV rms)	
	(e) Dry flash over voltage (KV rms)	
	(f) Wet flash over voltage (KV rms)	
	(g) Dry lighting impulse withstand voltage	
	(a) Positive	
	(b) Negative	
	(h) Dry lighting impulse flashover voltage	
	(a) Positive (KV peak)	
	(b) Negative (KV peak)	
	(i) RIV at 1 MHz when energized at 10kV (rms) under dry	
	(j) Creepage distance (min) mm	
8.	<b>Mechanical Characteristics:</b>	
	Minimum failing load (KN)	
9.	<b>Dimensions of Insulator:</b>	
i.	Weight (Kg.)	
ii.	Dia of FRP rod (mm) –Dia must be 24 mm (minimum)	
iii.	Length of FRP rod (mm)	

Sl.	Description	11KV, 5 KN
iv.	Dia of weather sheds (mm)	
v.	Thickness of housing (mm)	
vi.	Dry arc distance (mm)	
10.	Dimensioned drawings of Insulator (including weight with	
11.	Method of fixing of sheds to housing specify ):- single mould or	
12.	No. of weather sheds	
13.	Type of sheds	
	(i) Aerodynamic	
	(ii) With under ribs	
14.	Packing details	
	(a) Type of packing.	
	(b) No. of Insulators in each pack	
	(c ) Gross weight of package	
15.	Any other particulars which the bidder may like to give.	

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# **TECHNICAL SPECIFICATION OF 11 KV COMPOSITE POLYMER DISC INSULATORS 45 KN (T&C TYPE)**

## **1.0. SCOPE**

This specification covers design, manufacture, testing and supply of composite Insulators for use in the 11 KV overhead transmission lines and substations. The composite Insulators shall be of the following type: -

- i) Long rod insulator for conductors in tension application at angle/cut points. The insulator shall be of Tongue & Clevis type.

## **2.0 APPLICABLE STANDARDS Standards: -**

Following Indian / International Standards, which shall mean latest revision, with amendments/ changes adopted and published, unless specifically stated otherwise in the

Specification, shall be referred while accessing conformity of Insulators with these specifications.

In the event of supply of Insulators conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent or better to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

<b>Sr. No.</b>	<b>Indian Standard</b>		<b>International</b>
1		Definition, test methods and acceptance criteria for composite	IEC:61109
2	IS:2071	Methods of High Voltage Testing	IEC:60060-1
3	IS:2486	Specification for Insulator fittings for overhead power lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements locking devices	IEC:60120
4		Thermal Mechanical performance test and mechanical performance test on string Insulators units	IEC:60575
5		Characteristics of string Insulator units of the long rod type.	IEC:60433
6		Hydrophobicity Clarification Guide.	STRI guide 1.92/1
7		Radio interference characteristics of overhead power lines and high voltage equipment.	CISPR18-2
8	IS:8263	Methods of RI Test of HV Insulators	IEC:60437
9		Standard for Insulators – Composite-Distribution Dead end	ANSI-C29.13-2000



10	IS:4759	Hot dip zinc coatings on structural steel & other allied products.	ISO:1459
11	IS:2629	Recommended practice for Hot Dip galvanization for iron and steel	ISO:1461(E)
12	IS:6745	Determination of weight of zinc coating on zinc coated iron and steel articles.	ISO:1460
13	IS:3203	Methods of testing of local thickness of electroplated coatings.	ISO:2178
14	IS:2633	Testing of Uniformity of coating of zinc coated articles.	

### **3.0 COMPOSITE INSULATORS LONG ROD TYPE FOR TENSION LOCATIONS**

- 3.1 The Insulators shall be suitable for 3 Phase , 50 Hz, effectively earthed 11 KV O/H distribution system in a moderately polluted atmosphere. Long rod Insulators shall be of Tongue & Clevis type.
- 3.2 Bidder must be an indigenous manufacturer and supplier of composite Insulators of rating 11 kV or above OR must have developed proven in house technology and manufacturing process for composite Insulators of above rating OR possess technical collaboration/ association with a manufacturer of composite Insulators of rating 11 kV or above. The Bidder shall furnish necessary evidence in support of the above along with the

bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the owner.

- 3.3. Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc, and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.
- 3.4. The size of Composite insulator, minimum creepage distance and mechanical strength alongwith hardware fittings shall be as follows: -

SN	Type of composite Insulator	Nominal system voltage kV (rms)	Highest system voltage kV (rms)	Visible discharge test voltage kV(rms)	Wet power frequency withstand voltage	Impulse withstand voltage kV (peak)	Minimum creepage distance (mm)	Min. failing load KN	Pin ball shank diameter (mm)
i.	Long Rod Disc Insulator	11	12	9	35	75	320	45	16

**Note:** Creepage distances have been considered in line with IS-13134 (which specifies 25mm/kV for moderately polluted environment).

### 3.5. DIMENSIONAL TOLERANCE OF COMPOSITE INSULATORS

The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with-IEC 61109: -

$\pm (0.04d+1.5)$  mm when  $d < 300$  mm,

$\pm (0.025d+6)$  mm when  $d > 300$  mm.

Where, d being the dimensions in millimeters for diameter, length or reepage distance as the case may be, However, no negative to f era nee shall be applicable to creepage distance.

### 3.6. INTERCHANGEABLY

The composite Insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.

### 3.7. CORONA AND RI PERFORMANCE

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so

designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

### **3.8. MAINTENANCE**

The composite Insulators offered shall be suitable for use of hot line maintenance technique so that usual hot line operation can be carried out with ease, speed and safety.

### **4.0 BASIC FEATURES**

#### **4.1 Design and construction: -**

The composite insulator shall have a core, housing & weather shed of insulating material and steel / aluminium alloy hardware components for attaching it to the support / conductor.

#### **4.2 Core: -**

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pollution process. The FRP rod shall be void free.

#### **4.3 Housing (Sheath): -**

The FRP rod shall be covered by a seamless sheath of a silicone electrometric compound or silicone alloy compound of a thickness of 3mm minimum.

It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing/bonding shall be free from voids.

#### **4.4 Weather sheds: -**

The composite polymer weather sheds made of silicone electrometric compound or silicon alloy shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

#### **4.5 End Fittings: -**

End fittings transmit the mechanical load to the core. They shall be made of spheroidal graphite cast Iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. The gap between fitting and sheath shall be sealed by a flexible silicone electrometric compound or silicone alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection.

The sealing must be moisture proof. The dimensions of end fittings of Insulators shall be in accordance with the standard dimensions stated in IS: 2486 / IEC: 60120.

## **5.0 WORKMANSHIP**

- 5.1 All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such Insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.
- 5.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 5.3 The design of the Insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 5.4 The core shall be sound and free of cracks and voids that may adversely affect the Insulators.
- 5.5 Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.
- 5.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 5.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/Sq.m, or 87 mm thickness and shall be in accordance with the requirement of IS: 4759, The zinc used for galvanizing shall be of purity 99.5% as per IS: 4699, The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one minute duration under the standard peace test. The galvanizing shall be carried out only after any machining.

## **6.0 EQUIPMENT MARKING**

- 6.1 Each insulator unit shall be legibly and indelibly marked with the following details as per IEC-61109: -
  - (a) Month & Year of manufacture
  - (b) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
  - (c) Manufacturers name/Trade mark



## **7.0 BID DRAWINGS**

7.1 The Bidder shall furnish full description and illustration of the material offered.

7.2 The Bidder shall furnish along with the bid the outline drawing (3 copies) of each insulator unit including a cross-sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information: -

- a) Long rod diameter with manufacturing tolerances
- b) Minimum Creepage distance with positive tolerance
- c) Protected Creepage distance
- d) Eccentricity of the long rod unit
  - (i) Axial run out
  - (ii) Radial run out
- e) Unit mechanical and electrical characteristics
- f) Size and weight tongue & clevis
- g) Weight of composite long rod unit.
- h) Materials
  - (i) Identification mark
  - (ii) Manufacturer's catalogue number

7.3 The bidder shall submit full dimensioned manufacturing insulator drawings containing all the details in four (4) copies along with copies of all the type tests.

7.4 At the time of placement of award, the Supplier shall also submit fully dimensioned insulator crate drawing for different type of Insulators for approval of the owner.

## **8.0 TESTS AND STANDARDS**

Insulators offered shall be manufactured with the same configuration & raw materials as used in the Insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. The design & type test reports submitted shall not be more than 05 years old.

### **8.1 Design tests: -**

Manufacturer should submit test reports for Design Tests as per IEC - 61109 (clause - 5) along with the bid. Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract: + UV test: The test shall be carried out in line with clause 7.2 of ANSI C29.13

### **8.2 Type Tests:-**

The tenderer shall furnish detailed type test report of the offered composite insulators as per Clause-8.2 of the technical specification at the NABL approved lab such as CPRI/ERDA to prove that the composite insulators offered meet the requirements of the specifications. These type test should have been carried out within 5 years prior to the date of opening of this tender. The following type tests shall be conducted on a suitable number of individual insulator units, components, materials or complete strings and the test reports should invariably be submitted with the bid :

SN	Description of type test	Test procedure/standard
1.	Dry lightning impulse withstand voltage test	As per IEC 61109 (clause 6.1)
2.	Wet power frequency test	As per IEC 61109 (clause 6.2)
3.	Mechanical load-time test	As per IEC 61109 (clause 6.4)
4.	Radio interference test	As per IEC 61109 (clause 6.4)
5.	Recovery of Hydrophobicity test	Annexure-A This test may be repeated every 3 years by the manufacturer
6.	Chemical composition test for silicon content	Annexure-A Or any other test method acceptable to the owner
7.	Brittle fracture resistance test	Annexure - A

NOTE :- The purchaser may like to conduct any other test(s) in addition to above at bidder's cost to establish the performance of the material as per the system requirement.

**8.3 It shall be the option of the owner to accept the Insulators based on type test reports submitted by the manufacturer. The owner shall be free to repeat the type test & may witness the same.**

**Note:** The owner, for the purpose of facilitating the type tests, may ask the bidders to quote test charges separately.

**8.4 All the type test given in Clause No. 8.2 in addition to routine & acceptance test shall be carried out on insulator along with hardware fittings wherever required.**

## **8.5 ACCEPTANCE (SAMPLE) TESTS**

**8.5.1 For Composite Insulators: -**

(a)	Verification of dimensions	:	Clause 7.2 IEC: 61109
(b)	Verification of the locking system (if applicable)	:	Clause 7.3 IEC: 61109
(c)	Galvanizing test	:	IS: 2633 / IS: 6745
(d)	Verification of the specified mechanical Load	:	Clause 7.4 IEC: 61109
(e)	Verification of tightness of the interface between end fitting and silicone rubber.	:	Clause 7.4 IEC: 61109 amendment 1 of 1995

## **8.5.2 ROUTINE TESTS-**

<b>Sr. No.</b>	<b>Description</b>	<b>Standard</b>
1	Identification of marking	As per IEC: 61109 Clause 8.1
2	Visual inspection	As per IEC 61109 Clause 8.2
3	Mechanical routine test	As per IEC: 61109 Clause 8.3

## **8.5.3 TESTS DURING MANUFACTURE**

Following tests shall also be carried out on all components as applicable

- a) Chemical analysis of zinc used for galvanizing
- b) Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
- c) Chemical analysis, hardness tests and magnetic particle inspection for forgings.

## **8.6. SAMPLE BATCH FOR TYPE TESTING**

The bidder shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner, the bidder shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner,

## **8.7 ADDITIONAL TESTS**

- 8.7.1 The Owner reserves the right at his own expenses, for carrying out any other test(s) of reasonable nature carried out at Supplier's premises, at site, to in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.
- 8.7.2 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test center. In case of evidence of non-compliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner,

## **8.8. CO-ORDINATION FOR TESTING**

The Supplier shall have to co-ordinate testing of Insulators with hardware fittings to be supplied by other Supplier and shall have to guarantee overall satisfactory performance of the Insulators with the hardware fittings.

## **8.9. QUALITY ASSURANCE PLAN**

8.9.1 The successful bidder shall submit following information to the owner:

8.9.1.1 Test certificates of the raw materials and bought out accessories.

8.9.1.2 Statement giving list of important raw materials, their grades along with names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.

8.9.1.3 List of manufacturing facilities available.

8.9.1.4 Level of automation achieved and lists of areas where manual processing exists.

8.9.1.5 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

8.9.1.6 List of testing equipment<sup>9s</sup> available with the bidder for final testing of equipment along with valid calibration reports.

8.9.1.7 The manufacturer shall submit Manufacturing Quality Plan (MQP) for approval & the same shall be followed during manufacture and testing.

8.9.2 The successful bidder shall submit the routine test certificates of bought out raw materials / accessories and central excise passes for raw material at the time of inspection.

## **8.10. GUARANTEE (As per RDSS Scheme)**

The Supplier of Insulators shall guarantee overall satisfactory performance ~~of the Insulators for the period of 18 months from the date of supply or 12 (twelve) calendar months from the date of installation.~~

## **9.0 TEST REPORTS**

9.1 At least three copies of type test reports shall be furnished. One copy shall be returned duly certified by the owner, only after which the commercial production of the concerned material shall start

9.2 Copies of accepts ~~nee~~ test reports shall be furnished in at least three [3] copies. One copy shall be returned duly certified by the Owner, only after which the material shall be dispatched.

9.3 Record of routine test reports shall be maintained by the Supplier at hi<sup>^</sup> works for periodic inspection by the Owner's representative.

9. 4 Test certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Owner.

## **10.0 INSPECTION**

- 10.1 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.
- 10.2 The material for final inspection shall be offered by the Supplier only under packed condition. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain Insulators manufactured in 3-4 consecutive weeks.
- 10.3 The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 10.4 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the owner in writing.

In the later case also, the material shall be dispatched only after satisfactory testing specified herein has been completed.

- 10.5 The acceptance of any quantity of material shall in no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

## **11.0 PACKING**

- 11.1 All Insulators shall be packed in strong corrugated box of min, 7 ply duly palletted or wooden crates. The gross weight of the crates along with the material should not normally exceed 30 Kg to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
- 11.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 11.3 Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 11.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate/corrugated box shall have all the markings stenciled on it in indelible ink.
- 11.5 The bidder shall provide instructions regarding handling and storage precautions to be taken at site.



## **Annexure-A (Tests on insulator units)**

- 1 **RIV TEST (DRY):** -The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz AC voltage of 10 kV & 30 KV for 11 kV & 33 KV class insulators respectively under dry condition. The test procedure shall be in accordance with IS: 8263/IEC: 60437/CISPR1 18-2.

2 **BRITTLE FRACTURE RESISTANCE TEST: -**

Brittle fracture test shall be carried out on naked rod along with end fittings by applying "1N HNO<sub>3</sub> acid" (63 g cone, HNO<sub>3</sub> added to 937 g water) to the rod. The rod should be held at 80% of SML for the duration of the test. The rod should not fail within the 96 hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

3 **RECOVERY OF HYDROPHOBICITY & CORONA TEST: -**

The test shall be carried out on 4mm thick samples of 5cm x 7cm: -

- i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification. Dry the sample surface.
- ii) The sample shall be subjected to mechanical stress by bending the sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1mm above the sample surface. The test shall be done for 100 hrs.
- iii) Immediately after the corona treatment, spray the surface with water and record the HC classification. Dry the surface and repeat the corona treatment as at clause 7 above. Note HC classification. Repeat the cycle for 1000 hrs or until an HC of 6 or 7 is obtained. Dry the sample surface.
- iv) Allow the sample to recover and repeat hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 - HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

4 **CHEMICAL COMPOSITION TEST FOR SILICON CONTENT**

The content of silicon in the composite polymer shall be evaluated by EDX (Energy Dispersion X-ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

**GUARANTEED AND OTHER TECHNICAL PARTICULARS FOR 11KV COMPOSITE POLYMER  
DISC INSULATORS 45 KN (T&C TYPE)**

Sr.No.	Description	Unit	
1	Type of insulators		
2	Standard according to which the insulators		
3	Name of material used in manufacture of the		
a)	Material of core(FRP rod) i) E-glass or ECR-glass ii) Boron content		
b)	Material of housing & weather sheds(silicon content		
c)	Material of end fittings		
d)	Sealing compound for end fittings		
4	Colour		
5	Electrical characteristics:		
a)	Nominal system voltage	KV(r ms)	
b)	Highest system voltage	KV(r ms)	
c)	Dry Power frequency withstand voltage	KV(r ms)	
d)	Wet power frequency withstand voltage	KV(r ms)	
e)	Dry flashover voltage	KV(r ms)	
f)	Wet flash over voltage	KV(r ms)	
g)	Dry lighting impulse withstand voltage a)positive b)Negative	KV(peak)	
h)	Dry lighting impulse flashover voltage a) Positive b) Negative	KV(peak)	
i)	RIV at 1 MHz when energized at 10 KV (r ms) under dry condition	Microvolt	
j)	Creepage distance(Min.)	mm	
6	Mechanical characteristics		
a)	Minimum falling load	KN	
7	Dimensions of insulator		
	i)Weight	Kg	
	ii)Dia. of FRP rod	mm	
	iii)Length of FRP rod	mm	
	iv)Dia. of weathersheds	mm	
	v)Thickness of housing	mm	
	vi)Dry arc distance	mm	
	Dimensioned drawings of insulator(including weight	Yes/No	
8	Method of fixing of sheds to housing(specify):Single mould or modular construction(injection moulding		
9	No. of weathersheds		

10	Type of sheds		
i)	Aerodynamic		
ii)	With underribs		
11	Packing details		
	a) Type of packing		
	b) No. of insulators in each pack		
	c) Gross weight of package		
12	Any other particulars which the bidder may like to		

*Note:*

1. *In case of any contradiction in Technical Specification, the relevant IS or mentioned anywhere in tender documents; the parameter whichever is better, shall prevail.*
2. *In case of any contradiction in terms & conditions mentioned at more than one place, the terms & conditions to the best advantage of PVVNL, will prevail.*

## **TECHNICAL SPECIFICATION FOR COMPOSITE PIN INSULATORS FOR USE IN 33 KV SYSTEM**

### **1.0 SCOPE::**

This specification covers design, manufacture, testing and supply of composite Insulators for use in the 33 KV overhead transmission lines and substations. The composite Insulators shall be of the following type:

### **2.0 APPLICABLE STANDARDS::**

#### **2.1 Standards:-**

Following Indian/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification, shall be referred while accessing conformity of Insulators with these specifications.

- 2.1.1 In the event of supply of Insulators conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent or better to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

SNo.	Indian Standard	Title	International Standard
1		Definition, test methods and acceptance criteria for composite Insulators for A.C. overhead lines above	IEC:61109
2	IS:2071	Methods of High Voltage Testing.	IEC:60060-1
3	IS:2486	Specification for Insulator fittings for overhead power lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements	IEC:60120 IEC:60374
4		Thermal Mechanical performance test and mechanical	IEC:60575
5		Characteristics of string Insulator units of the long rod	IEC:60433
6		Hydrophobicity Clarification Guide.	STRI guide
7		Radio interference characteristics of overhead power	CISPR18-2
8	IS:8263	Methods of RI Test of HV Insulators	IEC:60437
9		Standard for Insulators – Composite–Distribution Dead –	ANSI–C29.132–
10	IS:4759	Hot dip zinc coatings on structural steel & other allied	ISO:1459
11	IS:2629	Recommended practice for Hot Dip galvanization for	ISO:1461(E)
12	IS:6745	Determination of weight of zinc coating on zinc coated	ISO:1460
13	IS:3203	Methods of testing of local thickness of electroplated	ISO:2178
14	IS:2633	Testing of Uniformity of coating of zinc coated articles.	

15		Standard specification for glass fiber standards.	ASTM D
16		Standard specification for compositional analysis by	ASTM D
17	IS:4699	Specification for refined secondary zinc	

### 3.0 TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS::

#### 3.1 Composite Pin Insulators long rod type to support conductor for 33 KV overhead power lines :-

3.1.1 The Insulators shall be suitable for 3  $\Phi$ , 50 Hz, effectively earthed 33 KV O/H distribution system in a moderately polluted atmosphere.

3.1.2 Bidder must be an indigenous manufacturer and supplier of composite Insulators of rating 33kV or above OR must have developed proven in house technology and manufacturing process for composite Insulators of above rating OR possess technical collaboration/ association with a manufacturer of composite Insulators of rating 11 kV or above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the owner.

3.1.3 Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc, and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.

3.1.4 The size of Composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows:

SN	Type of composite Insulator	Nominal system voltage kV (rms)	Highest system voltage kV (rms)	Visible discharge test voltage kV(rms)	Wet power frequency withstand voltage	Impulse withstand voltage kV (peak)	Minimum creepage distance (mm)	Min. failing load KN
1	33KV Pin Insulator	33	36	27	75	170	980	10

#### 3.3 Dimensional Tolerance of Composite Insulators :-

The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with-IEC 61109:

$\pm \{0,04d+1.5\}$  mm when  $d < 300$  mm,

$\pm \{0.025d+6\}$  mm when  $d > 300$  mm.

Where, d being the dimensions in millimeters for diameter, length or creepage distance as the case may be,

However, no negative tolerance shall be applicable to creepage distance.

#### 3.4 Interchangeably:-



The composite Insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.

### **3.5 Corona and RI Performance:-**

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

### **3.6 Maintenance:-**

- 3.6.1 The composite Insulators offered shall be suitable for use of hot line maintenance technique so that usual hot line operation can be carried out with ease, speed and safety.

## **4. BASIC FEATURES::**

### **4.1 Design and construction:-**

The composite Pin Insulator shall have a core, housing & weather shed of insulating material and steel/aluminum alloy hardware components for attaching it to the support/conductor.

#### **4.1.1 Core:-**

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pultrusion process. The FRP rod shall be void free. For 33 KV Insulator diameter of the FRP rod should be minimum 33.5 mm.

#### **4.1.2 Housing (Sheath):-**

The FRP rod shall be covered by a seamless sheath of a silicone electrometric compound or silicone alloy compound of a thickness of 3mm minimum. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing/bonding shall be free from voids.

#### **4.1.3 Weather sheds:-**

The composite polymer weather sheds made of silicone electrometric compound or silicon alloy shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

#### **4.1.4 End Fittings:-**

End fittings transmit the mechanical load to the core. They shall be made of spheroidal graphite cast Iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. The gap between fitting and sheath shall be sealed by a flexible silicone electrometric compound or silicone alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath

and metal connection. The sealing must be moisture proof. The details of end fittings for fixing the same with V cross arms and top clamps are given below : –

S. N.	Item	Length of Stud	Minimum threaded	Dia of Stud
1	33KV	150mm	100mm	24mm

Upper end fittings shall be suitable to hold Conductor for 33 KV. The size of the fitting shall be in such a way that conductor could be bound firmly so that it may not slip from the groove while in service even under the adverse condition.

## 5.0 WORKMANSHIP:

- 5.1 All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such Insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.
- 5.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 5.3 The design of the Insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 5.4 The core shall be sound and free of cracks and voids that may adversely affect the Insulators.
- 5.5 Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.
- 5.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with out projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 5.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/Sq.m, or 87µ m thickness and shall be in accordance with the requirement of IS: 4759, The zinc used for galvanizing shall be of purity 99.5% as per IS: 4699, The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

## 6. EQUIPMENT MARKING::

- 6.1 Each insulator unit shall be legibly and indelibly marked with the following details as per IEC-61109:
  - (a) Month & Year of manufacture
  - (b) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
  - (c) Manufacturer's name/Trade mark

**7. BID DRAWINGS::**

- 7.1 The Bidder shall furnish full description and illustration of the material offered.
- 7.2 The Bidder shall furnish along with the bid the outline drawing (3 copies) of insulator unit including a cross sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information:
- (a) Long rod diameter with manufacturing tolerances
  - (b) Minimum Creepage distance with positive tolerance
  - (c) Protected Creepage distance
  - (d) Eccentricity of the long rod unit
    - (i) Axial run out
    - (ii) Radial run out
  - (e) Unit Mechanical and Electrical characteristics
  - (f) Weight of Composite long rod unit.
  - (g) Materials
    - (i) Identification mark
    - (ii) Manufacturer's catalogue number
- 7.3 At the time of placement of award the supplier shall submit three sets of full dimension manufacturing insulators drawings containing all the details to the Chief Engineer (RDSS), PVVNL, Meerut.
- 7.4 At the time of placement of award the Supplier shall also submit fully dimensioned insulator crate drawing for different type of Insulators for approval of the owner.

**8. TESTS AND STANDARDS::**

Insulators offered shall be manufactured with the same configuration & raw materials as used in the Insulators for which Design & Type Test Reports are submitted. The manufacturer shall submit a certificate for the same. The Design & Type Test Reports submitted shall not be more than 05 years old.

**8.1 Design Tests:-**

For polymeric insulators, it is essential to carry out design test as per Clause 4.1 of IEC-61109 /92-93 with latest amendments. The design tests are intended to verify the suitability of the design, material and method of manufacture better technology. When a composite insulator is subjected to the design test the result shall be considered valid for the whole class of insulators, which are represented by the one tested and having the following characteristics: -

- Same material for the core and sets and same manufacturing method.
- Same material for the fittings, the same design, the same method of attachment.

- Same or greater layer thickness of the shed material over the core (including a sheath where used)
- Same or smaller ratio of the highest system voltage to insulation length.
- Same or smaller ratio of all mechanical loads to the smallest core diameter between fittings.
- Same or greater diameter of the core.
- the tested composite insulator shall be identified by a drawing giving all the dimensions with the manufacturing tolerances
- Manufacturer should submit test report for design test as per IEC-61109 (Clause-5) along with the bid . Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract :-  
+ UV test: The test shall be carried out in line with clause 7.2 of ANSI C29.13

## 8.2 Type Tests:-

The Tenderer shall furnish detailed type test report of the offered composite insulators as per Clause-8.2 of the technical specification at the NABL approved lab to prove that the composite insulators offered meet the requirements of the specifications. These type test should have been carried out within 5 years prior to the date of opening of this tender. The following type tests shall be conducted on a suitable number of individual insulator units, components, materials or complete strings and the test reports should invariably be submitted with the bid :

SN	Description of type test	Ten procedure/standard
1.	Dry lightning impulse withstand voltage test	As per IEC 61109 (clause 6.1)
2.	Wet power frequency test	As per IEC 61 109 (clause 6.2)
3.	Mechanical load-time test	As per IEC 61 109 (clause 6.4)
4.	Radio interference test	As per IEC 61109 (clause 6.4)
5.	Recovery of Hydrophobicity test	Annexure-A This test may be repeated every 3 yrs by the manufacturer
6.	Chemical composition test for silicon content	Annexure-A Or any other test method acceptable to the owner
7.	Brittle fracture resistance test	Annexure - A

NOTE :- The purchaser may like to conduct any other test(s) in addition to above at bidder's cost to establish the performance of the material as per the system requirement.

## 8.3 It shall be the option of the owner to accept the Insulators based on type test reports submitted by the manufacturer. The owner shall be free to repeat the type test & may witness the same.

**Note:** The owner, for the purpose of facilitating the type tests, may ask the bidders to quote test charges separately.

8.4 All the type test given in Clause No. 8.2 in addition to routine & acceptance test shall be carried out on insulator along with hardware fittings wherever required.

#### 8.5 Acceptance (sample) Tests

##### 8.5.1 For Composite Insulators

(a)	Verification of dimensions :	Clause 7.2 IEC: 61109,
(b)	Verification of the locking system (if applicable) :	Clause 7.3 IEC: 61 109
(c)	Galvanizing test :	IS:2633/IS:6745
(d)	Verification of the specified mechanical load :	Clause 7.4 IEC: 611 09,
(e)	Verification of tightness of the :  interface between end fitting and silicon rubber.	Clause 7.4 IEC: 611 09,  amendment 1 of 1995

##### 8.5.2 Routine Tests:-

sn	Description	Standard
1	Identification of marking	As per IEC: 61 109 Clause 8.1
2	Visual Inspection	As per IEC 61 109 Clause 8.2
3	Mechanical routine test	As per IEC: 61 109 Clause 8.3

#### 8.6 Tests During Manufacture

Following tests shall also be carried out on all components as applicable

- a) Chemical analysis of zinc used for galvanizing
- b) Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
- c) Chemical analysis, hardness tests and magnetic particle inspection for forgings.

##### 8.6 Sample Batch for Type Testing

8.6.1 The bidder shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner, The bidder shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner,

##### 8.7 Additional Tests:-



- 8.7.1 The Owner reserves the right at his own expenses, for carrying out any other test(s) of reasonable nature carried out at Supplier's premises, at site, to in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.
- 8.7.2 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test center. In case of evidence of non compliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner,
- 8.8 Co-ordination for Testing:-**
- 8.8.1 The Supplier shall have to co-ordinate testing of Insulators with hardware fittings to be supplied by other Supplier and shall have to guarantee overall satisfactory performance of the Insulators with the hardware fittings.
- 8.9 Quality assurance plan:-**
- 8.9.1 The successful bidder shall submit following information to the owner:
- 8.9.1.1 Test certificates of the raw materials and bought out accessories.
- 8.9.1.2 Statement giving list of important raw materials, their grades along with names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.
- 8.9.1.3 List of manufacturing facilities available.
- 8.9.1.4 Level of automation achieved and lists of areas where manual processing exists.
- 8.9.1.5 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 8.9.1.6 List of testing equipments available with the bidder for final testing of equipment along with valid calibration reports.
- 8.9.1.7 The manufacturer shall submit Manufacturing Quality Plan (MQP) for approval & the same shall be followed during manufacture and testing,
- 8.9.2 The successful bidder shall submit the routine test certificates of bought out raw materials / accessories and central excise passes for raw material at the time of inspection.
- 8.10 Guarantee:- (As per RDSS Scheme)**

~~The Supplier of Insulators shall guarantee overall satisfactory performance of the Insulators for the period of 18 months from the date of supply.~~

## **9 INSPECTION::**

- 9.1 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

- 9.2. The material for final inspection shall be offered by the Supplier only under packed condition. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain Insulators manufactured in 3-4 consecutive weeks.
- 9.3. The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 9.4. No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the owner in writing. In the later case also the material shall be dispatched only after satisfactory testing specified herein has been completed.
- 9.5. The acceptance of any quantity of material shall in no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.
10. **PACKING::**
- 10.1. All Insulators shall be packed in strong corrugated box of min, 7 ply duly palletted or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100 Kg to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
- 10.2. The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 10.3. Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 10.4. All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate/corrugated box shall have all the markings stenciled on it in indelible ink.
- 10.5. The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

## **Annexure-A (Tests on insulator units)**

- 1 RIV TEST (DRY):** -The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz AC voltage of 30 KV for 33 KV class insulators respectively under dry condition. The test procedure shall be in accordance with IS: 8263 / IEC: 60437/CISPR18-2.

**2 BRITTLE FRACTURE RESISTANCE TEST: -**

Brittle fracture test shall be carried out on naked rod along with end fittings by applying "1 n HNO<sub>3</sub> acid" (63 g conc, HNO<sub>3</sub> added to 937 g water) to the rod. The rod should be held at 80% of SML for the duration of the test. The rod should not fail within the 96 hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

**3 RECOVERY OF HYDROPHOBICITY & CORONA TEST: -**

The test shall be carried out on 4mm thick samples of 5cm x 7cm: -

- i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification. Dry the sample surface.
- ii) The sample shall be subjected to mechanical stress by bending the sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1mm above the sample surface. The test shall be done for 100 hrs.
- iii) Immediately after the corona treatment, spray the surface with water and record the HC classification. Dry the surface and repeat the corona treatment as at clause 7 above. Note HC classification. Repeat the cycle for 1000 hrs or until an HC of 6 or 7 is obtained. Dry the sample surface.
- iv) Allow the sample to recover and repeat hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 - HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

**4 CHEMICAL COMPOSITION TEST FOR SILICON CONTENT**

The content of silicon in the composite polymer shall be evaluated by EDX (Energy Dispersion X-ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

# **GUARANTEED TECHNICAL PARTICULARS OF 33 KV, 10 KN COMPOSITE POLYMER PIN INSULATORS**

Sl.	Description	33KV,10 KN
1.	Name of Manufacturer	
2.	Address:	
	(a) registered Office	
	(b) Factory	
3.	Type of Insulators	
4.	Standard specification to which the Insulators manufactured	
5.	Name of material used in manufacture of the Insulator	
	(a) Material of core rod	
	(b) Material of Housing & weather sheds (silicon content by weight)	
	(c) Material of end fittings	
	(d) Sealing compound for end fitting	
6.	Colour of Insulator	
7.	<b>Electrical Characteristics:</b>	
	(a) Nominal system Voltage (KV rms)	
	(b) Highest System Voltage (KV rms)	
	(c) Dry power frequency withstand (KV rms)	
	(d) Wet power frequency withstand (KV rms)	
	(e) Dry flash over voltage (KV rms)	
	(f) Wet flash over voltage (KV rms)	
	(g) Dry lighting impulse withstand voltage	
	(a) Positive	
	(b) Negative	
	(h) Dry lighting impulse flashover voltage	
	(a) Positive (KV peak)	
	(b) Negative (KV peak)	
	(i) RIV at 1 MHz when energized at 30 kV (rms) under dry	
	(j) Creepage distance (min) mm	
8.	<b>Mechanical Characteristics:</b>	
	Minimum failing load (KN)	
9.	<b>Dimensions of Insulator:</b>	
i.	Weight (Kg.)	
ii.	Dia of FRP rod (mm) – <b>Dia must be 33.5 mm (minimum)</b>	
iii.	Length of FRP rod (mm)	
iv.	Dia of weather sheds (mm)	
v.	Thickness of housing (mm)	

Sl.	Description	33KV,10 KN
vi.	Dry arc distance (mm)	
10.	Dimensioned drawings of Insulator (including weight with	
11.	Method of fixing of sheds to housing specify ):- single mould or	
12.	No. of weather sheds	
13.	Type of sheds	
	(i) Aerodynamic	
	(ii) With under ribs	
14.	Packing details	
	(a) Type of packing.	
	(b) No. of Insulators in each pack	
	(c ) Gross weight of package	
15.	Any other particulars which the bidder may like to give.	

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# TECHNICAL SPECIFICATION OF 33 KV COMPOSITE POLYMER DISC INSULATORS 70 KN (B & S TYPE) FOR USE ON 33 KV OVERHEAD POWER LINES

## 1.0. SCOPE

This specification covers design, manufacture, testing and supply of composite Insulators for use in the 33 KV overhead transmission lines and substations. The composite Insulators shall be of the following type: –

- i) Long rod insulator for conductors in tension application at angle/cut points. The insulator shall be of Ball & Socket type.

## 2.0. APPLICABLE STANDARDS: -

Following Indian / International Standards, which shall mean latest revision, with amendments/ changes adopted and published, unless specifically stated otherwise in the Specification, shall be referred while accessing conformity of Insulators with these specifications.

In the event of supply of Insulators conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent or better to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

Sr. No.	Indian Standard	Title	International Standard
1		Definition, test methods and acceptance criteria for composite Insulators for AC overhead lines above 1000V.	IEC:61109
2	IS:2071	Methods of High Voltage Testing.	IEC:60060-1
3	IS:2486	Specification for Insulator fittings for overhead power lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements locking devices.	IEC:60120 IEC:60372
4		Thermal Mechanical performance test and mechanical performance test on string Insulators units.	IEC:60575
5		Characteristics of string Insulator units of the long rod type.	IEC:60433
6		Hydrophobicity Clarification Guide.	STRI guide: 1.92/1
7		Radio interference characteristics of overhead power lines and high voltage equipment.	CISPR18-2 Part 2
8	IS:8263	Methods of RI Test of HV Insulators	IEC:60437
9		Standard for Insulators – Composite-Distribution Dead end	ANSI-C29.13-2000
10	IS:4759	Hot dip zinc coatings on structural steel & other allied products.	ISO:1459
11	IS:2629	Recommended practice for Hot Dip galvanization for iron and steel	ISO:1461(E)
12	IS:6745	Determination of weight of zinc coating on zinc coated Iron and steel articles.	ISO:1460
13	IS:3203	Methods of testing of local thickness of electroplated coatings.	ISO:2178
14	IS:2633	Testing of Uniformity of coating of zinc coated articles.	
15		Standard specification for glass fiber standards.	ASTM D 578-05
16		Standard specification for compositional analysis by Thermo gravimetry.	ASTM E 1131-03
17	IS:4699	Specification for refined secondary zinc	

### 3.0. COMPOSITE INSULATORS LONG ROD TYPE FOR TENSION LOCATIONS

- 3.1 The Insulators shall be suitable for Three Phase , 50 Hz, effectively earthed 33 KV O/H distribution system in a moderately polluted atmosphere. Long rod Insulators shall be of Ball & Socket type.
- 3.2 Bidder must be an indigenous manufacturer and supplier of composite Insulators of rating 11 KV and above OR must have developed proven in- house technology and manufacturing process for composite Insulators of above rating OR possess technical collaboration/ association with a manufacturer of composite Insulators of rating 11 KV and above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the owner.
- 3.3 Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc., and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC- 60815/IS: 13134.
- 3.4 The size of Composite insulator, minimum creepage distance and mechanical strength alongwith hardware fittings shall be as follows: -

SN	Type of composite Insulator	Nominal system voltage kV (rms)	Highest system voltage kV (rms)	Visible discharge test voltage kV(rms)	Wet power frequency withstand voltage kV (rms)	Impulse withstand voltage kV (peak)	Minimum creepage distance (mm)	Min. failing load KN	Pin ball shank diameter (mm)
i.	Long Rod Disc insulator	33	36	27	75	170	900	70	16

**Note:** Creepage distances have been considered in line with IS-13134(which specifies **25mm/kV for moderately polluted environment**).

### 3.5. DIMENSIONAL TOLERANCE OF COMPOSITE INSULATORS

The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with-IEC 61109: -

- $\pm (0.04d+1.5)$  mm when  $d < 300$  mm,  
 $\pm (0.025d+6)$  mm when  $d > 300$  mm.

Where, d being the dimensions in millimeters for diameter, length or creepage distance as the case may be. However, no negative tolerance shall be applicable to creepage distance.

### 3.6. INTERCHANGEABILITY

The composite Insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.

### 3.7. CORONA AND RI PERFORMANCE

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid

local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

### **3.8. MAINTENANCE**

The composite Insulators offered shall be suitable for use of hot line maintenance technique so that usual hot line operation can be carried out with ease, speed and safety.

## **4.0 BASIC FEATURES**

### **1.1 Design and construction: -**

The composite insulator shall have a core, housing & weather shed of insulating material and steel / aluminium alloy hardware components for attaching it to the support / conductor.

### **1.2 Core: -**

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pultrusion process. The FRP rod shall be void free.

### **1.3 Housing (Sheath): -**

The FRP rod shall be covered by a seamless sheath of a silicone electrometric compound or silicon alloy compound of a thickness of 3 mm minimum.

It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing/bonding shall be free from voids.

### **1.4 Weather sheds: -**

The composite polymer weather sheds made of silicon electrometric compound or silicon alloy shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

### **1.5 End Fittings: -**

End fittings transmit the mechanical load to the core. They shall be made of spheroidal graphite cast Iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. The gap between fitting and sheath shall be sealed by a flexible silicon electrometric compound or silicon alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof. The dimensions of end fittings of Insulators shall be in accordance with the standard dimensions stated in IS: 2486 / IEC: 60120.

## **5.0 WORKMANSHIP**

- 5.1** All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such Insulators as are guaranteed by them to be satisfactory and suitable for

- continued good service in power transmission lines.
- 5.2. The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
  - 5.3. The design of the Insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
  - 5.4. The core shall be sound and free of cracks and voids that may adversely affect the Insulators.
  - 5.5. Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.
  - 5.6. End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with out projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
  - 5.7. All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/Sq.m, or 87  $\mu$ (micron) thickness and shall be in accordance with the requirement of IS: 4759, The zinc used for galvanizing shall be of purity 99.5% as per IS: 4699, The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

## **6.0 EQUIPMENT MARKING**

- 6.1 Each insulator unit shall be legibly and indelibly marked with the following details as per IEC-61109: –
  - (a) Month & Year of manufacture
  - (b) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
  - (c) Manufacturers name/Trade mark

## **7.0 BID DRAWINGS**

- 7.1 The Bidder shall furnish full description and illustration of the material offered.
- 7.2 The Bidder shall furnish along with the bid the outline drawing (3 copies) of each insulator unit including a cross sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information:–
  - a) Long rod diameter with manufacturing tolerances
  - b) Minimum Creepage distance with positive tolerance
  - c) Protected creepage distance
  - d) Eccentricity of the long rod unit
    - (i) Axial run out
    - (ii) Radial run out
  - e) Unit mechanical and electrical characteristics
  - f) Size and weight ball & socket
  - g) Weight of composite long rod unit.
  - h) Materials
  - i) Identification mark

(ii) Manufacturer's catalogue number

7.3 The bidder shall submit full dimensioned manufacturing insulator drawings containing all the details in four (4) copies along with copies of all the type tests.

7.4 At the time of placement of award the Supplier shall also submit fully dimensioned insulator crate drawing for different type of Insulators for approval of the owner.

## 8.0. TESTS AND STANDARDS

Insulators offered shall be manufactured with the same configuration & raw materials as used in the Insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. The design & type test reports submitted shall not be more than 05 years old.

### 8.1 Design tests: -

Manufacturer should submit test reports for Design Tests as per IEC – 61109 (clause – 5) along with the bid. Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract: + UV test: The test shall be carried out in line with clause 7.2 of ANSI C29.13

### 8.2 Type Tests:-

The tenderer shall furnish detailed type test report of the offered composite insulators as per Clause-8.2 of the technical specification at the NABL approved lab such as CPRI/ERDA to prove that the composite insulators offered meet the requirements of the specifications. These type test should have been carried out within 5 years prior to the date of opening of this tender. The following type tests shall be conducted on a suitable number of individual insulator units, components, materials or complete strings and the test reports should invariably be submitted with the bid :

SN	Description of type test	The procedure/standard
1.	Dry lightning impulse withstand voltage test	As per IEC 61109 (clause 6.1)
2.	Wet power frequency test	As per IEC 61 109 (clause 6.2)
3.	Mechanical load-time test	As per IEC 61 109 (clause 6.4)
4.	Radio interference test	As per IEC 61109 (clause 6.4)
5.	Recovery of Hydrophobicity test	Annexure-A This test may be repeated every 3 years by the manufacturer
6.	Chemical composition test for silicon content	Annexure-A Or any other test method acceptable to the owner
7.	Brittle fracture resistance test	Annexure - A

NOTE :- The purchaser may like to conduct any other test(s) in addition to above at bidder's cost to establish the performance of the material as per the system requirement.



- 8.3 It shall be the option of the owner to accept the Insulators based on type test reports submitted by the manufacturer. The owner shall be free to repeat the type test & may witness the same.

**Note:** The owner, for the purpose of facilitating the type tests, may ask the bidders to quote test charges separately.

- 8.4 All the type test given in Clause No. 8.2 in addition to routine & acceptance test shall be carried out on insulator along with hardware fittings wherever required.

## 8.5 ACCEPTANCE (SAMPLE) TESTS

- 8.5.1 For Composite Insulators: -

(a)	Verification of dimensions	:	Clause 7.2 IEC: 61109
(b)	Verification of the locking system (if applicable)	:	Clause 7.3 IEC: 61109
(c)	Galvanizing test	:	IS: 2633 / IS: 6745
(d)	Verification of the specified mechanical load	:	Clause 7.4 IEC: 61109
(e)	Verification of tightness of the interface between end fitting and silicon rubber.	:	Clause 7.4 IEC: 61109 amendment 1 of 1995

## 8.5.2 ROUTINE TESTS-

Sr. No.	Description	Standard
1	Identification of marking	As per IEC: 61109 Clause 8.1
2	Visual Inspection	As per IEC 61109 Clause 8.2
3	Mechanical routine test	As per IEC: 61109 Clause 8.3

## 8.5.3 TESTS DURING MANUFACTURING

Following tests shall also be carried out on all components as applicable

- Chemical analysis of zinc used for galvanizing
- Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
- Chemical analysis, hardness tests and magnetic particle inspection for forgings.

## 8.6. SAMPLE BATCH FOR TYPE TESTING

The bidder shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner, The bidder shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner,

## 8.7 ADDITIONAL TESTS

- 8.7.1 The Owner reserves the right at his own expenses, for carrying out any other test(s) of reasonable nature carried out at Supplier's premises, at site, to in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.
- 8.7.2 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test center. In case of

evidence of non compliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner,

#### **8.8. CO-ORDINATION FOR TESTING**

The Supplier shall have to co-ordinate testing of Insulators with hardware fittings to be supplied by other Supplier and shall have to guarantee overall satisfactory performance of the Insulators with the hardware fittings.

#### **8.9. QUALITY ASSURANCE PLAN**

8.9.1 The successful bidder shall submit following information to the owner:

8.9.1.1 Test certificates of the raw materials and bought out accessories.

8.9.1.2 Statement giving list of important raw materials, their grades along with names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.

8.9.1.3 List of manufacturing facilities available.

8.9.1.4 Level of automation achieved and lists of areas where manual processing exists.

8.9.1.5 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

8.9.1.6 List of testing equipments available with the bidder for final testing of equipment along with valid calibration reports.

8.9.1.7 The manufacturer shall submit Manufacturing Quality Plan (MQP) for approval & the same shall be followed during manufacture and testing.

8.9.2 The successful bidder shall submit the routine test certificates of bought out raw materials / accessories and central excise passes for raw material at the time of inspection.

#### **8.10. GUARANTEE (As per RDSS Scheme)**

The Supplier of Insulators shall guarantee overall satisfactory performance of the Insulators for the period of 18 months ~~from the date of supply or 12 (twelve) calendar months from the date of installation.~~

#### **9.0 TEST REPORTS**

9.1 At least three copies of type test reports shall be furnished. One copy shall be returned duly certified by the owner, only after which the commercial production of the concerned material shall start.

9.2 Copies of acceptance test reports shall be furnished in at least three [3] copies. One copy shall be returned duly certified by the Owner, only after which the material shall be dispatched.

9.3 Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Owner's representative.

9.4 Test certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Owner.

#### **10.0 INSPECTION**

10.1 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

- 10.2** The material for final inspection shall be offered by the Supplier only under packed condition. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain Insulators manufactured in 3-4 consecutive weeks.
- 10.3** The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 10.4** No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the owner in writing.

In the later case also the material shall be dispatched only after satisfactory testing specified herein has been completed.

- 10.5** The acceptance of any quantity of material shall in no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

## **11.0 PACKING**

- 11.1** All Insulators shall be packed in strong corrugated box of min, 7 ply duly palletted or wooden crates. The gross weight of the crates along with the material should not normally exceed 30 Kg to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
- 11.2** The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 11.3** Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 11.4** All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate/corrugated box shall have all the markings stenciled on it in indelible ink.
- 11.5** The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

## Annexure-A (Tests on insulator units)

- 1 **RIV TEST (DRY):**-The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz AC voltage of 10 kV & 30 kV for 11 KV & 33 KV class insulators respectively under dry condition. The test procedure shall be in accordance with IS: 8263/ IEC: 60437 /CISPR: 18-2.
- 2 **BRITTLE FRACTURE RESISTANCE TEST: -**  
Brittle fracture test shall be carried out on naked rod along with end fittings by applying "1n HNO<sub>3</sub> acid" (63 g cone, HNO<sub>3</sub> added to 937 g water) to the rod. The rod should be held at  
  
80% of SML for the duration of the test. The rod should not fail within the 96 hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.
- 3 **RECOVERY OF HYDROPHOBICITY & CORONA TEST: -**  
The test shall be carried out on 4mm thick samples of 5cm x 7cm: –
  - i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification. Dry the sample surface.
  - ii) The sample shall be subjected to mechanical stress by bending the sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1mm above the sample surface. The test shall be done for 100 hrs.
  - iii) Immediately after the corona treatment, spray the surface with water and record the HC classification. Dry the surface and repeat the corona treatment as at clause 7 above. Note HC classification. Repeat the cycle for 1000 hrs or until an HC of 6 or 7 is obtained. Dry the sample surface.
  - iv) Allow the sample to recover and repeat hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.
- 4 **CHEMICAL COMPOSITION TEST FOR SILICON CONTENT**  
The content of silicon in the composite polymer shall be evaluated by EDX (Energy Dispersion X-ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

**GUARANTEED AND OTHER TECHNICAL PARTICULARS FOR 33KV POLYMERIC DISC INSULATOR**  
**70 KN(B&S)TYPE**

Sr.No.	Description	Unit	
1	Name of Manufacturer		
2	Address:		
	(a)registered Office		
	(b)Factory		
3	Type of insulators		
4	Standard according to which the insulators manufactured and tested		
5	Name of material used in manufacture of the insulators with class/grade		
a)	Material of core (FRP rod) i)E-glass or ECR-glass ii)Boron content		
b)	Material of housing & weather sheds(silicon content By weight)		
c)	Material of end fittings		
d)	Sealing compound for end fittings		
6	Colour		
7	Electrical characteristics:		
a)	Nominal system voltage	KV(rms)	
b)	Highest system voltage	KV(rms)	
c)	Dry Power frequency with stand voltage	KV(rms)	
d)	Wet power frequency with stand voltage	KV(rms)	
e)	Dry lash over voltage	KV(rms)	
f)	Wet flash overvoltage	KV(rms)	
g)	Dry lighting impulse withstand voltage a)positive b)Negative	KV(peak) KV(peak)	
h)	Dry lighting impulse flash over voltage a) Positive b) Negative	KV(peak) KV(peak)	
i)	RI Vat 1 MHz when energized at 30 KV(rms) under dry condition	Microvolt	
j)	Creepage distance(Min.)	mm	
8	Mechanical characteristics		
a)	Minimum failing load	KN	
9	Dimensions of insulator		
	i)Weight	Kg	
	ii)Dia. Of FRP rod	mm	

	iii)Length of FRP rod	mm	
	iv)Dia. Of weather sheds	mm	
	v)Thickness of housing	mm	
	vi)Dry arc distance	mm	
10	Dimension eddrawings of insulator(including weight with tolerance in weight)enclosed	Yes/No	
11	Method of fixing of sheds to housing(specify):Single Mould or modular construction(injection moulding /compression moulding)		
12	No. of weather sheds		
13	Type of sheds		
i)	Aerodynamic		
ii)	With underribs		
14	Packing details		
	a) Type of packing		
	b) No. of insulators in each pack		
	c) Gross weight of package		
15	Any other particulars which the bidder may like to furnish		



## **TECHNICAL SPECIFICATION FOR 11 KV 350 MVA, 1600 AMP VCB SWITCHGEAR PANELS**

### **1.0. General**

- 1.1** The specification covers the design manufacture testing and supply of 11 KV. 3 phases 50 C/S air insulated metal clad indoor vacuum type switchgear unit with horizontal draw isolation out circuit breaker as per ISS 3118 [1991]/IEC 56 or latest or latest amendment thereof.
- 1.2** All the equipments shall be suitable for satisfactory operation in tropical climates and dry dust laden atmosphere prevailing in UP. The equipment shall be able to with stand a wide range of temperature variation in Uttar Pradesh.
- 1.3** All the plant/ apparatus/equipment supplied shall comply in all respect with the requirement of Indian Electricity Act 1910 and Indian Electricity Rule 1956/ISS and latest amendment thereof during the execution of contract where-ever applicable.

### **2.0 STANDARDS:**

- 2.1** The circuit breaker shall conform to the latest revisions with amendments available of relevant standards, rules and codes, some of which are listed herein for ready reference.

S.L.	Standard	Title
1.	IEC 56 and IS:13118:1991	Specification for alternating current circuit breakers.
2.	IS: 2705/1992	Current Transformer specification
3.	IS: 3156/1992	Voltage Transformer specification
4.	IS: 3842 IS: 3238 IS: 3231 (1987)	Application guide for electrical Relays for AC system. Specification for electrical relays for power system protection.
5.	IS: 1248	Specification for Ammeter and voltmeters
6.	IS: 375	Arrangement of Breakers Bus Bars main connection and auxiliary wiring.

### **IN CASE OF CONFLICT, THE ORDER OF PRECEDENCE SHALL BE**

- (1) IEC
- (2) Indian Standard
- (3) Other alternative standards

This list is not be considered exhaustive and reference to a particular standard or recommendation in this specification does not relieve the Bidder of the necessity of providing the goods complying with other relevant standards or recommendation.

Equipment meeting with the requirement of any other authoritative standards, which ensure equal or better quality than the standard mentioned above shall also be

acceptable. If the equipment offered by the Bidder conforms to any other standards, salient points of difference between the standard adopted and the specific standard shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English translations shall be furnished along with the bid.

### 2.2.1 **PRINCIPAL PARAMETERS:**

2.3 The 11 KV vacuum switchgear Indoor type shall conform to following specific parameters.

Sl. No.	Particulars	Incomer Panel	Outgoing Panel
3.1.1	Service	Indoor	Indoor
3.1.2	Type	Metal clad	Metal clad
3.1.3	No. of Poles/Phases	3	3
3.1.4	Rated system voltage (volts)	11000	11000
3.1.5	Rated switch gear voltage (volts)	12000	12000
3.1.6	Rated Frequency C/S	50	50
3.1.7	Rated current Amp.	1600	1250
3.1.8	Breaking capaciting K.A. (rms) for 3 sec.	18.4	18.4
3.1.9	Asymmetrical breaking capacity	46 KA	46 KA
3.1.10	Insulation level KV	75	75
3.1.11	One minute power frequency withstand voltage KV rms. a) For routine test b) For type test	28 35	28 35
	Rated operating sequence	<O-0.3 SEC – CO – 3 MIN – CO=	<O-0.3 SEC – CO – 3 MIN – CO=
3.1.12	Operating Times (i) Break Time (ii) Make Time		
3.1.13	Operating Mechanism		
3.1.14	Auxiliary supply voltage		
	(i) Accessories	24 V.D.C./ 230 V.AC	24 V.D.C./ 230 V.AC
	(ii) Illuminations & Heater circuit	230 V.AC	230 AC

### 2.4 **CURRENT TRANSFORMER FOR METERING & PROTECTION:**

(i)	Type	11 KV single phase resin cast with core double ratio secondary winding on each phase.	11 KV single phase resin cast with double core double ratio secondary winding on each phase.
(ii)	Short circuit current KA rms.	18.4	18.4

(iii)	Rated voltage KV	12	12
(iv)	CT ratio	1200-600/5-5+1A	600-300/5+5A
(A)	Secondary Core No.1 (metering) 5A		—
(i)	Class of accuracy	0.5	0.5
(ii)	Rated Burden VA	2.5	2.5
(iii)	application	Metering	Metering

(B)	Secondary core No. 2 (Protection) 5A		
(i)	Class of accuracy	5P 10	5P 10
(ii)	Rated Burden VA	15	15
(iii)	Application	Over current & earth fault Protection	Over current & earth fault Protection
(C)	Secondary core (1A) Differential Protection		
(i)	Class of accuracy	P5	
(ii)	Rated Burden VA	15	
(iii)	Application		

## 2.5 **POTENTIAL TRANSFORMER: (To be installed on 11 KV Bus side)**

(i)	Quantity	1 No.	
(ii)	No. of phases	3	
(iii)	Type	Resin cast withdraw able type with double core in Secondary	
(iv)	PT Ratio	$\frac{11000}{\sqrt{3}}$ $\frac{110}{\sqrt{3}}$ $\frac{110}{\sqrt{3}}$ $\frac{110}{\sqrt{3}}$	
(A)	Rating for secondary core No. Class of Accuracy Rated Burden VA Application	0.5 100 Metering	
(B)	Rating for secondary core No. 2 Class of Accuracy Rated Burden VA Application	3 P 100 Protection	
3.3.1	Terminal Marking Position	Circuit Side	

## 3.0 **Construction**

- 3.1 The switchgear shall be of sheet construction with MS sheets not less than 3 mm thickness for load bearing section and not less than 2 mm. thickness for non-load bearing and shall be totally dust and vermin proof. The panels shall be rigid without using any external bracings. The switch board panels should comply with relevant ISS/IEC and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, metering circuit breaker chamber, Cables and cable box Chamber should have proper access for maintenance. Proper Interlocks should be provided. All instruments shall be non-draw out type and safe



guard in every respects form damages and provided with mechanical indicator of connection and disconnection position. The Switchgear shall be completed with all necessary wiring fuses, auxiliary contacts terminal boards etc.

- 3.2. The arcing contacts and bus bar should be rated for 350 MVA for 3 sec. The bus bars shall be capable of connecting one switchgear panel to other through proper insulated arrangement, which does not decrease the insulation strength of the bus bar at the point of connection between two panels.
- 3.3 The breakers should be able to be drawn out in horizontal position at ground level (with vertical/horizontal isolation) when the breaker is drawn out in horizontal position none of the components inside the 11KV switchgear panel should be accessible. The safety shutters shall be robust and shall automatically cover the components when the breaker is drawn out. The switchgear shall have complete, should not be possible in ON position, it should not be possible to close the circuit breaker in service unless the entire auxiliary and control circuit are connected.
- 3.4 Breaker should have three distinct positions inside the cubical; i.e. service, test and isolated position.
- 3.5 All the high voltage compartments must have pressure discharge flap for the exit of gas due to internal arc to insure operator safety. All the HV compartment design ensures conformity to IEC 298 and must be type tested for internal Arc Test.

#### **4.0 Safety Shutters & interlocks:**

- 4.1 Safety shutters shall be provided one to cover the fixed plugging contacts of the circuit bus bar and second to cover the fixed pigging contacts of the circuit chamber so that when a particular equipment is withdrawn, the safety shutters move automatically and the live parts on the fixed portion are fully covered, thus eliminating the risk of accidental contact with live parts. The shutters shall be vermin and dust proof & shall operate automatically upon withdrawal or lowering of the removable equipment. Provision shall be made for operating and locking the two shutters individually. The shutters for the bus bars and circuit chamber shall be labeled clearly and painted in distinct colours.
- 4.2 Mechanism of safety interlocks shall be sturdy to enable proper locking of various parts during operation of breakers.
- 4.3 The following safety interlocks shall be provided for each pane
  - a) Movable part of each cubicle cannot be lowered/draw or unless the circuit breaker is in OFF & FREE position.
  - b) Movable part of each cubical cannot be withdrawn unless circuit breaker is fully disengaged. In this case circuit breakers can be in the open and free position.
  - c) Movable part of the cubicle can be raised/racked in only when the circuit breaker is in OPEN & FREE position.

- d) The circuit breaker can be **closed** only when the movable parts are fully engaged in it or is in the test position and circuit breaker is in locked position.
- e) Circuit breakers cannot be switched 'ON' without auxiliary contacts between fixed and moving parts of the cubicle first completing their circuit. Also breaker can be fully withdrawn only when auxiliary contacts are plugged out.
- f) Circuit breaker can be made ON in service positions only when circuit breaker panel door is closed.

## 5.0 BUS BARS AND CONNECTORS

- 5.1 Each panel shall be provided with single set of three Copper Bus Bars of suitable sections which should be able to continuously carry rated current and all other electrical connection between various components shall be made of electrolytic copper of rectangular cross sections. The bus bars section shall be ample capacity to carry the rated current of **1600** Amp continuously without excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system up to full MVA rating specified in Para 3.2 above.
- 5.2. All bus bars connections shall be firmly and rigidly mounted on suitable insulators to withstand short circuit stresses and vibrations.
- 5.3 Adequate clearance between 11KV point and earth and between phase shall be provided to ensure safety as per provision in Indian Electricity Rule 1956 and its amendment thereof and also in accordance with the relevant Indian standard specification and the same shall be capable of withstanding the specified high voltage tests as per ISS-13118/IEC-56 and amendment thereof.
- 5.4. Sharp edges and bends either in the bus bars or bus bar connections shall be avoided as far as possible. Wherever such bends or edges are un-avoidable, suitable compound or any other insulation shall be supplied to prevent local ionization and consequent flashover.
- 5.5 The bus bar height and arrangement of specification should be strictly as per enclosed drawing on page 12 to facilitate the coupling of panels of different make with this switchgear.
- 5.6 The bus bars shall be provided with each phase conductor properly insulated in air filled chambers. The insulating materials for Bus-bar insulation shall be of non-hygroscopic material and shall provide adequate insulation for the specified voltage class. All bus bar joints shall be silver-plated. Plain and spring washers shall be provided to ensure good contacts at the joints and taps. Wherever aluminium to copper connections are required, suitable bimetallic connectors of champs shall be used. Necessary arrangements shall also be provided for joining the bus bars of adjoining panels for making the bus bars electrically continuous for the entire board. Necessary materials and accessories such as band joining fish plates with nut bolts shall be supplied compound and tape shall also be



supplied. The bus section panel shall have two sets of bus bars for joining to adjoining sections of the switch board with and off-set box so that the bus bar boxes are all in a line.

## **6.0 CIRCUIT BREAKER**

- 6.1** The vacuum circuit breakers shall be draw out type suitable for installation in the switchgear cubicles. The breakers shall comply with IS-13118 (1991)/IEC-56 and latest amendment thereof. Construction of breaker shall be such that the point, which required frequent maintenance, shall be easily accessible.
- 6.2** The circuit breakers shall be spring operated, manually charged, manually released spring closing mechanism for 3 pole simultaneous operation. The speed of closing operation shall be independent of the speed of hand operating level. The indication device OPEN and CLOSE position of breaker should be visible from the front of cubical.
- 6.3** The breakers shall be capable of making and breaking the short time current in accordance with the requirement of ISS 13118 (1991)/IEC-56 and latest amendment thereof and shall have three phase rupturing capacity of 350 MVA for 3 second at 11 KV. The continuous current rating of breaker shall not be less than 1600 Amp for incomer and bus coupler and 1250 for outgoings.

The total break/make time shall be not more than 4 cycle for break and 6 cycle for make time for all breakers.

- 6.4** The vacuum circuit breakers shall ensure high speed extinctions and adequate control of pressure during breaking of current and also designed to limit excessive over voltages.
- 6.5** Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of circuit breaker from bus bar or insertion into bus bar shall only be possible when breaker in the open position.
- 6.6** Vacuum circuit breaker shall have completely sealed interrupting units for interrupting of are inside the vacuum. The vacuum bottle sealed for life shall be provided with contact wear indication.
- 6.7** Vacuum interrupter should have an expected life of 30000 operations at rated normal current and should be capable for operating more than 100 times at full short circuit current.

- 6.8 Vacuum interrupter technical data particulars provided by the manufacturer should also be enclosed.

**7.0 Essential features of Circuit Breakers:**

- 7.1 The breakers shall be triple pole with all components of adequate strength and capacity. The circuit breaker shall be of VACUUM type only. The circuit breaker shall be of the latest design and type which have proved absolutely reliable in service.
- 7.2 The design of the breaker shall be such as to allow for replacement of any component without undue difficulty or undue interruption of supply. The circuit breaker controlling feeder shall be inter changeable mechanically without difficult and electrically without disturbing different control circuits. Similar breaker of same type should have interchangeability both electrical and mechanism with breaker and of same type and rating. Circuit breaker shall comprise three (3) separate identities single pole units operated through a common shaft by the operating mechanism.
- 7.3 Vacuum circuit breaker shall be completely seated interrupting units for interruption of arc inside the vacuum.
- 7.4 The breaker shall be equipped with suitable arc control device so that circuit interruption shall be extremely rapid to give consistent and short arc duration at all values of breaking currents under all fault conditions. The details of the device incorporated in the circuit breaker for the above function and any further device to control the restriking voltage across the circuit breaker contacts shall be clearly stated.
- 7.5 The circuit breaker shall preferably be of vertical isolation/ horizontal draw-out type with fixed and moving portions and shall be provided with means for local closing and tripping by hand as well as electrically in addition to the closing and tripping by operating switch which will be mounted on the instrument panel. The circuit breaker shall have arrangement for manual closing of checking synchronizing of contacts during re-commissioning and maintenance operations.
- 7.6 The circuit breaker shall be capable of being closed at test position for testing purposed from local.
- 7.7 The circuit breaker shall be complete with all accessories including trip coils, closing coils, secondary wiring, auxiliary contact blocks, limit switches, interlock latches etc.
- 7.8 The circuit breaker mechanism shall be provided with anti pumping features.
- 7.9 There shall be „SERVICE“, „TEST“, and „FULLY WITHDRAWN“ positions for the breakers. In the „TEST“, position the circuit breaker shall be capable of being tested for operation without energizing the power circuits i.e. the control circuit shall remain turbed while the power contacts shall be disconnected. Separate limit switches each having a minimum of 4 „No“ contacts shall be provided for both „SERVICE“ and „TEST“ positions of the circuit breakers. These contacts shall be potential free and shall be rated for 10 amperes. Indicators shall be provided to indicate SERVICE/TEST POSITION of the breaker.
- 7.10 Connection of the control circuit between the fixed portion of the cubicle and the break carriage shall be by means of plug and socket arrangement. The plug and socket shall be so designed that it shall be possible to insert the plug into the socket in one position only, thereby eliminating the possibility of faulty insertion and shall be secured in position by spring clamps which need considerable force to operate. The length of the plug cord



shall be such that the plug can be inserted into the socket only when the breaker is in the 'SERVICE' and TEST positions.

- 7.11 A mechanism indicator shall be provided to show open and closed positions of the breaker. It shall be located in such a position where it will be visible to the operator standing in the front of the breaker with cubicle door closed.
- 7.12 All special tools and handles required for operation and maintenance of the circuit breaker shall be itemized and provided as per specification.

#### **8.0 Operating Mechanism:**

- 8.1 The circuit breaker operating mechanism shall be totally enclosed and self-greasing or oiling motor charged spring operated type. Main pole of the breakers shall be such that unless otherwise specified, the maximum difference between instants of contacts touching during closing shall not exceed half cycle of rated frequency.
- 8.2 Operating mechanism shall be non-pumping electrically or mechanically under every method of closing (except during manual closing of a breaker for maintenance).
- 8.3 Main pole of the breaker shall operate simultaneously. There shall be no objectionable rebound and the mechanism shall not require any critical adjustment. It shall be strong rigid, positive and fast in Operation.
- 8.4 Mechanism shall be such that failure of any auxiliary spring shall not prevent tripping and will not cause tripping or closing operation of power operated closing devices. When the circuit breaker is already closed, failure of any auxiliary spring shall not cause damage to the circuit breaker or endanger the operator.
- 8.5 The closing release shall operate correctly at all values between 85% and 110% of the rated Voltage. A shunt trip shall operate correctly under all operating conditions of the circuit breaker upto the rated breaking capacity of the circuit breaker and all values of the supply voltage between 70% and 110% of the rated voltage. The trip coils/relay shall be wired to facilitate supervision of the trip circuit.
- 8.6 Mechanism trip and close devices shall be provided for manual operation of the breaker. Access to mechanical closing device shall be only after opening the cubicle door. However, the mechanical trip device shall be brought out to the front of the breaker for manual tripping in case of emergency.
- 8.7 Working parts of the mechanism shall be of corrosion resisting material bearing which required grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned and locked to prevent loosening or changing adjustment with repeated operation of the breaker.
- 8.8 Spring Charging: The provision for manual charging of the spring charge mechanism with the help of an operating handle shall be provided.

#### **9.0 Protection Relays:**

Numerical Non Directional Feeder protection relay of Any Standard Make

The switchgear shall have numerical communicable relays designed to disconnect fault circuits with speed and Discrimination. The relay resetting should be such that resetting of the main protection relay should reset all the other auxiliary relays. All the relays

shall be communicable with suitable protocol so as to provide all the I/O signals. The relay shall be capable of detecting O/C fault, definite time O/C fault, Instantaneous O/C fault IDMT E/F Fault, Definite time and instantaneous E/F fault. Shall be as per IEC60870-5-103.

### **Protections & Features**

1. Three Phase Non directional Over Current
  2. Non directional earth fault
  3. Inrush blocking
  4. Broken conductor
  5. Negative Sequence Over current
  6. Under current
  7. Thermal Overload
  8. Circuit breaker failure protection
  9. DC supply supervision 24V.
- 9.1 Programmable Scheme Logic :** The user can customize the protection and control functions using the programmable scheme logic. The PSL is presented in a graphical format, making use of universally understood symbols. The PSL can be downloaded into the relay without requiring any compilation, and may also be saved to disc or printed out
- 9.2 Harsh environmental coating :** All printed circuit boards are routinely HEC coated which defends the boards long-term against atmospheric moisture, salt, pollutants and other potentially corrosive gases
- 9.3 Cyber security :** The Relay should have Cyber security features inbuilt, anticipating future secured environment requirements. It provides the protection of information and information systems against unauthorised disclosure, transfer, modification, or destruction, whether accidental or intentional. This complies with NERC CIP requirements and IEEE 1686. Rigorous pass-wording, and deactivation of unused communication ports are the principal compliance features
- 9.4 Event Records : 512 Events**
- Fault Records : 5 Faults (Minimum) on display
- Disturbance recording Facility
- 9.5 CT / PT : 4 / 0**
- 9.6 DI / DO : 8 / 8**
- 9.7 Communication Port : Front USB and RS485**
- 9.6 Communication Protocol : IEC103**

**9.7** Setting of Relay for Time and % of current shall be done with a help of front keypad provided on relay.

**9.8** Setting of Relay in steps of 50%, 75%, 100% and 120% for over current and 20% and 40% for over current.

## **10.0 CURRENT TRANSFORMERS**

**10.1** The requirement of ratio, VA capacity, class of accuracy, limit factor etc for resin cast CTs installed in different type of units are tabulated below:-

Sl. No.	Item	Core/CT	Ratio	VA Burden	Knee point voltage	ALF/ISF	Class of accuracy
1	Incoming Panel	Protection	1200-600/1A	15	300 at 600/1A tap	20	PS
		Protection	1200-600/5A	15	-	20	5P
		Metering	1200-600/5A	2.5	-	ISF<2.5	0.5
2	Outgoing Panel	Protecting	600-300/5A	15	-	20	5P
		Metering	600-300/5A	2.5	-	ISF<2.5	0.5

**10.2** Short time rating of CTs shall be 18.4 KV for 3 second CTs shall be double core and dual ratio Saturation factor for metering core shall not exceed 2.5

**10.3** The designed accuracy should be available even at the lowest ratios and call CTs shall withstand fault current corresponding to 350 MVA for 3 Sec.

**10.4** The secondary terminal of the current transformers shall be such that effective and firm wire terminations are possible. Shorting links of adequate capacity shall be provided at the terminal blocks for shorting of the leads from secondary terminals of current transformers. The secondary terminal of the CTs shall be earthed at one point.

**10.5** The secondary winding resistance of CTs shall be as low as possible but not greater than 0.2 Ohms per 100 turns.



- 10.6** CTs shall confirm to ISS 2705 with latest amendment, if any in all respect and will be subjected to all routine and type test specified in the ISS.
- 10.7** Cable Glands And Clamping Arrangement For Holding Suitable Cable Boxes
- 10.8** Two nos, brass-wiping glands for each incomer and one no. Brass wiping glands for each outgoing panel of adequate dimension for XLPE cable of 3 cores up to 400 sq. mm side shall be supplied along with panel. For Bus coupler no glands should be provided.
- 10.9** Suitable cable boxes as per requirement of cable shall be arranged by the purchaser at his end. The pane shall however provide a flat of size 50x6 mm with suitable clamp made of 50x6 mm flat along with Nuts, Bolts and washers for holding the cable boxes. The flat should be fitted at a suitable height with allotted arrangement for adjustment of height from 300 mm to 500 mm at site. The clamp and flat shall have suitable stud type arrangement for earthing cable and cable box.
- 10.10** All control cable/wire entries shall be by means of suitable cable glands, such glands shall be of brass and tinned.
- 11.0** **Potential Transformer:**
- 11.1** 3 phase potential transformers of ratio:  

$$\frac{11 \text{ KV}}{\sqrt{3}} / \frac{110 \text{ KV}}{\sqrt{3}} / \frac{110 \text{ KV}}{\sqrt{3}}$$
 shall be installed on 11 kV bus side of switch gears sard
- 11.2** Potential Transformer shall be star/star connected with one additional secondary. The potential transformer shall be housed in a separate chamber with HT and LT Fuses. The potential transformer shall have accuracy class and rated burden as detailed in the specification. The out-put can be lower if it is considered adequate by the tenderer for the Burden of instruments, relays etc. specified herein with sufficient spare capacity for future use. The secondary terminals should be brought to a terminal board. Necessary connections for high voltage leads shall also be provided. The PT shall be truck mounted with drawable type with the breaker. Automatic closing shutters shall be provided to protect the free opening of live parts when FT is withdrawn. The PT shall be mounted on the circuit side of the incomer breaker and bus side for capacitor panels. All PTs shall be subjected to panel discharge test as per provision of IS 11322/1985. PT bus wiring shall be done to all the breaker panel from the capacitor PT.
- 11.3** PT shall have polarity marks indelibly marked on each transformer and at the associated terminal block.
- 11.4** It shall be possible to replace the primary and secondary fuses safely when the breaker is energized.
- 11.5** The wiring shall be enclosed in a metal cover to prevent direct flash over to the wiring. One set of spare PT fuses shall be supplied as loose for every PT.
- 12.0** **Earthing:**
- 12.1** All panels shall have a special earth bus located at the bottom and extended throughout the length of the switchboard. It shall be bolted/braced to the framework of each unit and each breaker earthing contact bar.

- 12.2 The earth bus shall have sufficient cross sectional area to carry the momentary short circuit and short time fault current for 3 seconds. Without exceeding maximum allowable temperatures rise.
- 12.3 Suitable clamp type terminals at each end shall be provided to suit the size purchaser's earthing conductor.
- 12.4 All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus.
- 12.5 Bolted joints splices, taps etc. to the earth bus shall be made with at least two bolts.
- 12.6 Hinged doors shall be earthed through flexible earthing braid.
- 12.7 Positive earthing of circuit breaker frame shall be maintained when it is in the connected position and in all other positions while the auxiliary circuits are not totally disconnected.
- 12.8 The circuit breaker frame/carriage shall be earthed before the main circuit breaker contacts/control circuit contacts are plugged in the associated stationary contact.
- 12.9 Earthing terminal along with 200 Ampere copper terminals on the breaker frame suitable for connecting copper conductor shall be provided.
- 12.10 Where metal cases are used on instruments, these shall be separately connected to this bar by conductors of not less than 2.5 mm<sup>2</sup> section.
- 12.11 PT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system for other groups.
- 13.0 **L.V. Compartment (Protection Panel):**
- 13.1 L.V. Compartment (Protection Panel) shall be provided on top of every breaker panel and shall house all protective relays, indicating lamps, push buttons, meters, Trivector meter, control and selector switches, terminal blocks, auxiliary switches, associated secondary wiring and all other components which are required for local control of the circuit breaker in line with the requirement described in this specification.
- 13.2 L.V. compartment shall have facility for cable entry from both top and bottom. Necessary cutouts with detachable gland plates shall also be provided at the bottom plate of breaker cubicle with sufficient number of well supported plastic trays to run purchaser's control cable vertically along side the breaker compartment without disturbing circuit breaker movements.
- 13.3 All equipment on and in the panel shall be mounted and completely wired to the terminal blocks ready for external connection. Equipments on the front of the panel shall be flush mounted. Equipment's shall be mounted such that easily accessible without use of special tools. Terminal marking shall be clearly visible.
- 13.4 Panels shall be supplied complete with inter-connecting wiring provided between all electrical device mounted and wired in all panels and between the devices and terminal blocks for the devices to be connected outside the panels.
- 13.5 All equipment's mounted on front and rear side as well as inside the panel shall be provided with individual name plates with equipment designation engraved. Also on the top of each panel on front as well as rear side large and bold nameplates shall be provided for circuit/feeder designation. All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring. The nameplates shall be directly mounted by the side of the respective

equipment and shall not be hidden by the equipment wiring. The nameplates shall be as detailed in relevant clause of the specification.

- 13.6 Each switch, instrument, relay, lamp shall bear clear inscription identifying its function. All relays and devices shall be marked with manufacturer's name and other relevant details.
- 13.7 Each panel shall be provided with internal illumination lamp rated for 230 VAC 50 Hz. Supply plug point with ON/OFF switch.
- 13.8 Each control panel shall be supplied with necessary arrangement for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling lighting and space heating circuits. The AC circuits shall be provided with suitable MCB of appropriate capacity. Selection of main and sub circuit fuse rating shall be such as to ensure selective clearance of sub circuit faults. Potential circuit for relaying and metering shall be protected by fuses. All accessible live connection should be protected for safety & shock with fuses indicating blown fuse condition. Fuse carrier base shall have imprints of fuse rating and voltage.

#### **14.0 Spares:**

- 14.1 Mandatory spares, tools and tackles- The bidder shall quote for the mandatory spares, tools and tackles as per Annexure-II.

#### **15.0 Secondary wiring:**

- 15.1 Adequate secondary wiring shall be provided and shall be suitable for local operations of the circuit breaker in line with the requirements as detailed in the specification. The secondary wiring of the equipment shall consist of non-deteriorating fire proof superior grade standard PVC insulated stranded copper (2.5 mm<sup>2</sup>) wires CT. Wiring shall be with stranded copper (4 mm<sup>2</sup>) wires. Minimum number of strands per conductor shall be three. Following colour code shall be adopted for wiring:

DC Circuits	:	GREY
AC Circuits	:	BLACK
CT/P.T. Circuits	:	RED, YELLOW, BLUE, BLACK
Earth	:	GREEN
- 15.2 All secondary wiring shall be securely supported neatly arranged readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters and through shall be used for this purpose while terminating wiring at equipment/terminal block. The wiring shall be securely bunched so that the position of each individual connection wire does not get disturbed when disconnected from equipment terminals.
- 15.3 Auxiliary bus wiring for AC/DC supplies, P.T. circuits, annunciation circuit and other service shall be provided at appropriate place throughout the entire length of the panels.
- 15.4 Bus wiring for P.T. secondary connection shall be provided throughout the panel switchboard irrespective of type of individual breaker whether metering or non-metering type.
- 15.5 Wire termination shall be made with solder less insulated sleeve crimping type tinned copper lugs which firmly grip the conductor and insulation insulated sleeves shall be provided at all the wire ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks.



- 15.6 Wire termination shall be made with solder less insulated sleeve crimping type tinned copper lugs which firmly grip the conductor and insulation insulated sleeve shall be provided at all the wire terminations. Engraved core identification interlocking type plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends each wire Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit of breaker or device shall be distinguished by the addition of red coloured unlettered ferrule.
- 15.7 Longitudinal troughs extending throughout the full length of the panel shall be preferred for inter panel wiring. Interconnections to adjacent panel shall brought out to a separate set of terminal blocks located near the sets of holes meant for taking the interconnecting wires. Arrangements shall permit easy interconnections shall permit easy interconnections to adjacent panels at site and wires for this purposes shall be provided by bidder looped and bunched properly inside the panel. Necessary isolating device for easy testing and isolation of faults in the control and singing circuits shall also be provided inside the panels.
- 15.8 One common two pole switch and two separated sets of fuses of adequate rating for controlling 24 VDC supplies tripping and closing circuits of the breaker shall be provided.
- 15.9 The secondary wiring shall travel vertically through plastic trays covered from all sides and shall be well supported to breaker panel body so that under any circumstances, they shall not come in touch with live parts like CTs, jumpers etc. Backspace shall be kept free for fixing SCADA system instruments in future.
- 15.10 Necessary wiring from communication parts to communication equipment shall be done by the purchaser using optic fiber cables. However necessary trays, spare terminals, space nearer to top side of LV. compartment etc. shall be provided by the manufacturer in the LV. compartment.
- 15.11 Since change over to SCADA is planned in the phased manner, all the status, control and metering wires shall be brought to one terminal block (similar to remote terminal block) to be mounted on back side in the LV. compartment for carrying out wiring of control desk.

#### **16.0 Meters:**

- 16.1 Ammeters: Digital ammeter shall be provided on all circuit breakers except bus coupler panel. Ammeter shall be appropriate range to match CT ratio for obtaining reading on all the three phases shall be provided.
- 16.2 Voltmeter: Digital voltmeter shall be provided on incomer (PT Panel).
- 16.3 Energy Meters: Trivector Meter shall be provided in the pockets on all circuit breakers except bus coupler panel. These Trivector meters shall have provision of TOD facility (Any Standard Make).

#### **17.0 Terminal Blocks:**

- 17.1 All internal wiring to be connected to the external equipment shall terminated on terminal blocks. Terminal blocks shall be 650/1100 V grade and have 10 amps continuous rating. One piece moulded, nuts, lock nuts and identification strips as per standard make screw driver operated stud and nut type terminals shall be used throughout assembly of the switchboard. Separate stud shall be provided for incoming and outgoing wires. Terminal block design shall include a white fiber marking strip with clear plastic, slip on/dip on terminal covers.

- 17.2 Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. Also current transformer secondary leads shall be provided with short-circuiting and earthing facilities.
  - 17.3 At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks. All spare contacts and terminals of the panel mounted equipments and devices shall be wired to terminal blocks.
  - 17.4 Terminal block shall be fully enclosed with easily removable covers and made of non-inflammable material. The terminal blocks shall have marking strip and all terminals shall be clearly marked with identification numbers or letters to facilitate connection to the external wiring.
  - 17.5 Terminal blocks shall be suitable for connecting the conductors of Owner's cable on each side.
  - 17.6 There shall be a minimum clearance of 250 mm between the first row of terminal blocks and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be minimum of 150 mm.
  - 17.7 Arrangement of the terminal blocks assemblies and the wiring channel within the enclosure shall be such that a row terminal blocks is run parallel and in close proximity along each side of the wiring duct to provide for convenient attachment of internal panel wiring. The side of the terminal block opposite the wiring duct shall be reserved for the purchaser external cable field-wiring corridor. A steel trip shall be connected between adjacent terminal block rows at 450 mm intervals for support of incoming cables.
  - 17.8 The number & size of the owner's multi core incoming cable will be furnished to the Bidder after placement of the order, if required. All necessary cable terminating accessories such as gland plates, glands, crimp type tinned copper lugs, supporting dampers and brackets, wiring troughs and gutters etc. for owner's cable shall be included in Bidder's scope of supply.
- 18.0 Indicating Lamps:**
- 18.1 Indicating lamps shall be panel-mounting type with rear terminal connections. Lamps shall be provided with series connected resistors preferably built in the lamp assembly. Lamps shall have glass covers with holders of chrome plated metal body. The lamps cover shall be unbreakable and moulded from heat resisting material.
  - 18.2 Indicating lamps shall be LED type suitable for 24 VDC.
  - 18.3 Indicating lamps and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools if required for replacing the indicating lamps and lenses shall also be included in the scope of supply.
  - 18.4 The indicating lamps shall withstand 120% of rated voltage on a continuous basis.
  - 18.5 The colour code for lamps shall be as specified Red and Green colours shall be for ON and OFF indications. Colour code for other indicating lamps shall be selected in such a way that adjacent lamps shall have different colours.
- 19.0 Alarm:**
- 19.1 An alarm bell and hooter signaling apparatus and indicating lamp connected auto trip indication shall be provided. Common alarm accepting and resetting arrangement shall also be included. The alarm circuit should provide indication as to which particular circuit breaker has tripped off (by auto trip indication provided on each type of breaker panel). The alarm shall operate on 24 VDC supply.



- 19.2 Alarm annunciation system shall be provided by means of visual (indicating lamps) and audible alarm in order to draw the attention of the operator to the abnormal operating conditions on the operation of some protective devices. The annunciation equipment shall be suitable for operation on the voltages specified in this specification.
- 19.3 The alarm bell shall be 230 VAC and shall be used for DC supply failure. Hooter shall be 24 VDC and shall be used for trip alarm.
- 19.4 Indication and audible annunciation for the failure of DC supply shall also be provided and this annunciation shall operate on 230 Volts AC supply with separate fuses. Indications for AC supply failure and DC supply failure shall be provided on each type of breaker panel.
- 19.5 Auxiliary relay for annunciation system shall have adequate auxiliary potential free contacts for use in event logger.
- 19.6 All components of alarm circuitry including alarm bell, hooter, alarm accept and alarm reset push buttons, alarm cancellation relay, alarm circuit supervision relay etc. shall be mounted on Incomer panel. Auto trip indicator shall be provided on each type of breaker panel.
- 20.0 **Continuous healthy trip circuit supervision**  
An indicating lamp for continuous supervision of the trip circuit shall be provided on each breaker panel. The healthy trip circuit supervision lamp shall remain ON when a circuit breaker is in closed position. A push button shall be provided in the circuit to enable to check the continuity of trip circuit just before closing of the breaker.

## **1. AUXILIARY/CONTROL WIRING**

All the secondary wiring in the panel shall have quality PVC insulation and the same shall have conductor size of not less than 2.5 sq. mm. of copper. Colors of the secondary/auxiliary wiring should conform to ISS 375/1963 and latest amendment thereof any. All wiring shall be neatly run and group or wiring shall be securely fixed by clips so that wiring can be checked without necessity of removing the clamps. Wiring between fixed and moving portion of the panel shall be run in flexible tubes and the same shall be so mounted to avoid and damage to them due to mechanical movements. Ferrules with number shall be provided on both end of the wiring.

## **2 MARKING OF PARTS**

For facilitating the erection the several parts of the plant and equipment shall be suitably marked.

## **3 NAME PLATE AND DIAGRAM PLATES**

All equipment shall have weather proof and non corrosive metal plates fixed in suitable position with full particulars engraved thereon with white letters against black background.

The firm shall affix a name plate on each Switchgear panel having following information.

1. Manufacturer's name and trade mark
2. Unique No.
3. Type of Panel

4. CT Ratio
5. Rated Voltage
6. Rated Insulation Level
7. Rated Frequency
8. Rated Normal Current
9. Rated Short Circuit Breaking Current
10. Weight
11. Specification No.
12. Order No. and Date
13. Year of supply
14. Property of Madhyanchal Vidyut Vitran Nigam Limited

#### 4 PAINTING

All metallic surface {except enameled and bright parts} exposed to weather shall be give suitable primmer coat and two coats of first quality paint of approved colour. The supplier shall also supply adequate quantities of paints, Varnish etc. for use of finished cost and for use of patching up any scratches received during transport, handling, erection, testing and commissioning.

#### 5 DETAILED FITTING AND MOUNTINGS

Detailed fittings and mountings of equipments in various switchgear panel shall be as follows :-

~~Item No. 1- Incoming Panel Rating ; 1600 Amp with CT Ratio 1200-600/5-5 Amp. & 1200-600/1Amp.~~

Each unit shall have the fittings and equipments as follows:-

- 1 No. All steel, totally enclosed, fully interlocked, indoor industrial pattern, metal clad, horizontal draw out, vertical/horizontal isolation floor mounting switch unit, complete with transportation truck having integral mechanism and all necessary support each equipped as under.
- 1 No. Fabricated sheet steel housing
- 1 No. Complete set of mechanical interlocks
- 1 No. Set of isolating plugs and sockets [6 nos. rated for 1600 Amp. with automatic safety shutters and pad locking arrangements. Facilities shall be provided for proper opening of the safety shutter for cleaning, inspection and testing.
- 1 No. 1600 Amp triple pole VCB fitted with isolating sockets, spring operated, manually charged, manually released spring closing mechanism with mechanical ON/OFF indicators suitable for a rupturing capacity of not less than 350 MVA At 11 KV for 3 seconds and fitted with one set of direct acting trip coils suitable for operating with AC series trip relays.



- 1 No. Auxiliary switch with minimum four normally closed and four normally opened contacts. The contact terminals shall be brought out and terminated at Terminal Board irrespective of whether terminals are used or not.
- 3 No. 1200/600/5-5 A ratio double core resins cast current transformer of required. Accuracy, for protection and metering as per Para 7.1 of specification Alternatively single core dual ratio 5 nos. CTs [ 3 nos for protection and 2 nos for metering] shall also be acceptable.
- 1 No. 96 mm dial flush pattern moving iron spring controlled ammeter suitably scaled to suit CT ratio.
- 1 No. 3 way and off ammeter selector switch for reading the current in any phase on the above ammeter.
- 1 No. 3 phase resin cast, draw out type bus bar connected potential transformers of Ratio 11000/110 volts class 0.5 accuracy having 100 VA output per phase of operate the AC static H.T. Trivector meter, voltmeter etc. and complete with H.T. & L.T. fuse.
- 1 No. 96 mm dial round flush pattern moving iron spring controlled voltmeter suitably scaled to suit the PT ratio.
- 1 No. 3 way and off voltmeter selector switch for reading the voltage between any two phases on the voltmeter.
- 1 A.C. static H.T. Tri vector meter 2 element suitable for three phase 3 wire un-balanced load and CT, PT ratio mentioned in Para 7.1, 0.5S accuracy class with load, survey and T.O.D./Tariff and M.R.I. facility. Meter should display following parameters :

1. Phase Voltage
2. Phase current
3. Active energy
4. Reactive energy
5. Apparent energy
6. Power factor
7. Frequency
8. Max. Demand
9. Cumulative Demand
10. M.D. Reset counts. Rating of meter should be as follows:-  
Ib -5A

1 Max.- 1.2 Ib

In case of fault capable to bear 20 Ib for 0.5 sec

- 1 No. Non directional, adjustable IDMTL shunt trip O/C relay (as per clause 9.0 shall be provided) with definite minimum 3 seconds at 10 times plug setting. The relay shall be arranged for over current protection with setting from 50 to 200% of 5A on all three over current elements mounted in draw out case tropicalised with flag indicator.
- 1 No. self/hand reset type master trip relay.

- 1 No. Set of indicating pigmy lamps operating at 230 V.AC./24 V. DC. Single phase one colored RED and other GREEN to show the closed or open position of circuit breaker.
- 1 No. 80 watts [Continuously rated tubular/strip type heater with manual ON/OFF switch working on 230 V AC single phase supply.
- 1 No. Set of copper bus bars of not less than 1600 Amp Continuous rating.
- 1 No. Multiway plug box for secondary wiring between the fix and moving protection.
- 1 No. Set of independently operated automatic shutters for bus bar cable and voltage transformers orifices, which shall be clearly leveled and individually pad-locked.
- 2 No. Brass-wiping glands shall be provided [Refer clause 8.1 above]
- 1 No. Sheets instruments panel mounted on the front of the unit with hinged access doors and totally enclosed wiring terminals mounted there.
- 1 No. Complete set of self contained inter connectors, Foundation bolts, fine wiring terminals board, sundries to complete the unit.
- Auxiliary supply for relays is 24 Volt DC.

## 6 ADDITIONAL FEATURE IN 1200-600/5 Amp. INCOMING

The switchgear shall be used with 20 MVA, 132/11 KV transformer having delta in primary and star in secondary, conventionally a differential protection is primary for the transformer. On 132 KV side 3 nos. CTs of 200-100/1A connected in star configuration are available with the purchaser. For 11 KV side 3 nos. CTs of 1200-600/5A (class PS and appropriate knee point voltage) second harmonic restraint differential relay DTH and matching inter posing CTs shall be provided in this switchgear panel. The mounting inter connection and termination etc. for these additional devices/relay shall be covered in scope of supply.

**Bus-Coupler Panel:** Each unit shall have the fittings and equipment as follows :

- 1 No. All steel totally enclosed fully interlocked indoor industrial pattern, metal clad horizontal draw out, horizontal/ vertical isolation, floor mounting switch unit complete with transportation truck having integral circuit breaker mechanism and all necessary supports each equipped as under.
- 1 No. Fabricated steel mounting.
- 1 No. Complete set of mechanical interlocks.
- 1 No. Set of isolating plug and socket (6 nos. Rated for 1600 Amp.) With automatic safety shutters and pad locking arrangement. Facilities shall be provided for proper opening of the safety shutter for cleaning, inspection and testing.
- 1 No. 1600 Amp Triple pole VCB fitted with isolating sockets, spring operated manually charged, manually released spring closing mechanism with mechanical ON/OFF indicators suitable for a rupturing capacity of not less than 350 MVA at 11 KV for 3 second.
- 1 No. A set of Red and Green pigmy lamps for indicating opened and close position of breaker.



- 1 No. 3 way auxiliary switch with 4 normally closed and eight normally open contacts.
  - 1 No. 80 Watt, 230 VAC heater with 6 Amp. Rotary cam switch.
  - 1 No. Bus bar chamber with 1600 A rated copper Bus Bars.
  - 1 No. A set of self aligning horizontal/vertical isolation type auxiliary plug and sockets.
  - 1 No. sheet steel instrument panel mounted on the front of the unit with hinged across doors and totally enclosed wiring terminals mounted there.
  - The panel shall be without any metering protection CT's cable box, series trip coils and relays.
- The HT chambers (adopter chamber) will be gasketed to make it vermin proof.

## 7.0

### **Miscellaneous Accessories:**

#### **Heaters**

Each breaker cubicle shall be provided with heaters to prevent moisture condensation within the enclosure. Every breaker cubicle shall be provided with separate heater in breaker compartment and cable compartment Heater shall be fin type and shall be designed for continuous operation throughout the year. Heater shall be 230 V AC, 80 watts 660  $\Omega$ . Common thermostat of rating 230 V, 15 Amp., 0° to 60° shall also be provided.

#### **Name Plates:**

Name plates of approved design shall be furnished on each cubicle/compartment and at each instrument, device mounted on or inside the cubicle. The name plates shall be of non corrosive metals 3 mm. thick with white letters engraved against black background. The name plates shall be held by self tapping screws. Name plate size shall be minimum 20 mm x 75 mm for instruments/devices and 40 mm x 150 mm for panels. Caution notice on suitable metal plate shall be affixed at the back of each vertical panel. Firm shall affix name plate on each switchgear panel having following formation :

1. Manufacturer's name and trade mark.
2. Unique No. / Sr. No.
3. Type of panel
4. C.T. ratio
5. Rated Voltage
6. Rated insulation level
7. Rated frequency
8. Rated normal current.
9. Rated short circuit. Breaking current.
10. Weight
11. Specification No.
12. Order No. and date
13. Year of supply
14. Property of PVVNL, U.P.

#### **Sundries**

As already stated earlier all the items required for making up the complete switchboard and control desk are included in the scope of supply of this specification



whether they are specifically written or not. The panel shall be complete with all accessories, fuses, secondary colour coded wiring, terminal boards, earth wires, accessories for fixing both the components and for fixing the panels to each other, name plates, locking arrangements, tools and other materials required for erection and maintenance of the complete board.

Switch boards shall be complete with auxiliary relays, switches, contact multiplier where ever required for complete operation and control of the breakers even if same are not indicated in the specification but same required in Bidder opinion. Adequate isolation by switch fuse unit/MCB shall also be provided for internal control circuits where ever required.

#### **Corona Discharge**

The equipment shall be so designed that no corona discharge occurs under the operation condition specified earlier during monsoon season or bad and saline high humidity climatic conditions.

#### **Tropical Protection**

All equipment's accessories and wiring shall have protection involving special treatment of insulation and metal against fungus, insects and corrosion.

Screens of corrosion resistant material shall be provided on all lower and opening.

#### **Painting**

All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth clean surface free of scales grease and rust.

After cleaning the surfaces the surfaces shall be given a phosphate coating followed by two coats of high quality primer stored after each coat.

The breaker shall be finished in light Grey shade No. 631 as per standard with two coats of synthetic enamel paint. The inside of panel/panel boards shall be glossy white. Sufficient quantity of touch up paint shall be finished for application at site.

#### **Maintainability:**

The breaker cubicle shall be designed to procure easy access to various parts for maintenance, testing and wiring.

The moving contacts for the main circuit on the truck shall be so arranged that the alignment with the fixed contacts is not disturbed even if breaker poles are required to be replaced.

- a) The operating mechanism shall be easily accessible when mounted on the breaker for maintenance. It shall also be easily detachable from the breaker for replacement

### **8.0 CLARIFICATION**

The total requirement of CTs incomer of ratio 1200-600/5 A is as follows:-

- 3 CTs one for each phase of ratio 1200-600/5 A to connect to 3 nos. O/C relays.

- 3 CTs one for each phase of ratio 1200–600/1A to connect to differential relay with 3 nos. interposing CTs.
- 2 Nos. CTs one on R phase and other on B phase of ratio 1200–600/5 A for metering . It is not necessary that all the above CTs have separate entity; the contractor can comingle more than one core in one phase. This arrangement will be acceptable so long as the requisites on individual cores are met.

#### OUTGOING FEEDER PANEL WITH CT RATIO 600-300/5 A

The fittings and mountings shall be similar to item no. 1 above except the following:–

- The CT ratio will be 600–300/5 A instead of 1200–600/ 5 A.
- One no. brass wiping glands shall be supplied [refer clause 8.1]
- The voltage transformers, Voltmeter and voltmeter selector switch shall be deleted
- 3 nos. CT operated overload relays are to be provided.
- 1 Nos. **directional**/non directional triple pole adjustable IDMTL combined O/C and E/F [2 nos. O/C and 1 nos. E/F] AC series strip relay with instantaneous high set trip feature of low transient over reach not exceeding 5% with definite minimum 3 seconds at 10 times plus setting. The relay shall be arranged for over current protection with setting 50–200% of 5 Amp. And for earth fault protection with setting 20–80% mounted on a draw out case tropicalised with flag indicators High set element of O/C shall have setting range of 5 to 20 times the rated current and the E/F elements shall be 2 to 8 times of rated current.
- Clause 13.1.1 and 13.1.2 is deleted.

#### 9.0 TEST:-

##### 9.1 Type Tests:-

- The design of circuit breaker shall be proven through all the routine and type tests in accordance with IS 13118. 1991/IEC–56 and any amendment thereof. Photocopy of all the test reports must enclosed with the tender. Type test report earlier than 5 year from the date of tender opening shall not be acceptable.
- All the offered equipment, shall be fully type tested by the Bidder as per the relevant standards including the type test mentioned below:  
The type test must have been conducted from recognized test lab within 5 years prior to the dated of bid opening. The Bidder shall furnish four sets of the type test reports along with the offer. The offers received without these type test reports shall be treated as non-responsive rejected.
  - i) Basic short circuit duties T100s, T100a.
  - ii) Basic short circuit duties T60, T30 & T10.
  - iii) Short time Withstand & Peak withstand current test.
  - iv) No- load operation test.
  - v) Lightning Impulse voltage withstand test.
  - vi) Power frequency voltage withstand test.
  - vii) Mili volt drop test & temperature rise test.
  - viii) IP 5X test.
  - ix) Internal Arc fault current test on bus bar chamber, breaker and cable chamber.

- x) Single phase breaking current test.
- xi) Mechanical endurance operation test considering to M-2 class.

## 9.2 **Acceptance/Routine Tests:**

All acceptance tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of purchaser's representative as under:

- (a) Contact resistance test
- (b) Power frequency voltage withstand test
- (c) Control and auxiliary circuit test
- (d) Operation test
- (e) Speed/time test

Routine/Acceptance shall be carried out on all equipment such as circuit breakers 11KV current transformers potential transformers, relays, meter etc. as per relevant standards.

## 10.0 **Additional Test**

The Purchaser reserves the right for carrying out any other tests of a reasonable nature at the works/tests house of the supplier or at any other recognized laboratory/research institute in addition to the above mentioned acceptance and routine tests to satisfy that the material complies with the intent of this specification. The cost of such additional tests shall be borne by the purchaser.

## 11.0 **INSPECTION**

- 11.1 The equipment shall be offered for inspection by the supplier to be inspected by a duly authorized representative of the purchaser. The supplier shall give 15 days (for Indian Bidders) and 30 days advance intimation to enable the purchaser to depute his representative for witnessing routine and acceptance tests.
- 11.2 A copy of test result shall be supplied for approval before dispatch/shipment of circuit breakers, which shall be approved by the purchaser within 10 days from the receipt of test reports. After receipt of purchaser's approval, the supplier shall, within three weeks, submit 6 prints and one No. good quality reproductive of approved drawing for purchaser's use. In addition, at the time of dispatch of equipment, the supplier shall also furnish 6 sets of approved drawing to each consignee.
- 11.3 Inspection by the purchaser or his authorized representatives shall not relieve contractor his obligation of manufacturing equipment in accordance with the specifications.
- 11.4 The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for inspection.
- 11.5 The purchaser reserves the right to insist on witnessing the acceptance/routine testing of the bought out items.
- 11.6 No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

## 12.0 **DOCUMENTATION:**

- 12.1 As a part of the proposal, the bidder shall furnish relevant descriptor and illustrative literature and the following drawings (in quadruplets) for preliminary study:
  - (a) General outline drawings showing dimensions, net dispatch/shipping weight, quantity of insulating oil, air receiver capacity etc.
  - (b) Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, with lifting dimensions for maintenance.



- (c) Recommended schematic diagrams from control and supervision circuit.
- (d) General arrangement of the foundation and structure mounting.
- (e) Short circuit oscillograms and certificates for similar type tested breaker.
- (f) Descriptive details of analyzer, dummy breaker etc. all drawing and data shall be in English.

12.2 After receipt of a purchase order, the successful Bidder will be required to furnish the following drawing for approval:

- (a) General outline drawing showing front and side elevation and plan of the equipment, with detailed dimensions.
- (b) Foundation plans including weights of various components and impact loadings.
- (c) Wiring diagrams showing the control scheme of the breaker, including alarm, indicating devices, instruments, space heaters etc.

12.3 The supplier shall within 4 weeks of placement of order submit four sets of final version of all the above drawings for purchaser's approval. The purchaser shall communicate his comments/approval on the drawing to the supplier within two weeks of receipt of drawing. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for purchaser's approval within 3 weeks from the date of purchaser's comment. The purchaser shall communicate approval within two weeks of receipt of modified drawings. After receipt of purchaser's approval, the supplier shall within three weeks, submit 6 prints and one No. good quality reproducible of the approved drawing for purchaser's use. In addition, at the time of the dispatch of equipment, the supplier shall also furnish 6 sets of approved drawing to each consignee.

12.4 The supplier shall also furnish four copies of bound manuals per breaker to all consignees and four sets to engineer of contract covering erection, commissioning, operation and maintenance instruction in English Language and all relevant information and drawing pertaining to the main equipment as well as auxiliary devices. Marked erection drawings shall identify the component parts of the equipments as shipped to enable purchaser to carryout erection with his own personnel.

12.5 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the suppliers risk.

12.6 Approval of drawings by purchaser shall not relieve the supplier of any of his responsibility and liability for ensuring correctness and correct interpretation of the

drawings for meeting the requirement of the latest revision of the applicable standards, rules and code of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revision of relevant standards at the time of supply and purchaser shall have the power to reject any material which, in his judgment, is not in full accordance therewith.

### **13.0 PACKING & FORWARDING:**

- 13.1 The equipment shall be packed in crates suitable for vertical/horizontal transport as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbol. Wherever necessary, proper arrangement for lifting such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied immediately by supplier without any extra cost.
- 13.2 Each consignment shall be accompanied with a detailed packing list containing the following information:
  - (a) Name of the consignment
  - (b) Details of consignment
  - (c) Destination
  - (d) Total weight of consignment
  - (e) Handling and packing instructions
  - (f) Bill of Material indicating contents of each package
- 13.3 The supplier shall ensure that the packing list and bill of material are approved by the purchaser before dispatch.
- 13.4 The packing shall be done as per the manufacturer's standards however, he should ensure the packing is such that, the material should not get damaged during transit by Rail/Road.
- 13.5 The marking on each package shall be as per the relevant standards and shall also contain.

### **14.0 GENERAL**

#### **(A) TECHNICAL DEVIATIONS:**

"Technical deviation to section VII Technical Specification" shall be specially and clearly indicated in the Annexure-III.

#### **(B) GUARANTEED TECHNICAL PARTICULARS:**

The bidder shall provide guaranteed technical particulars as per Annexure. After with out guaranteed technical particulars shall be treated as Non-responsive.

#### **(C) MANDATORY SPARES AND TOOLS:**

Mandatory spares and tools as mentioned/applicable, shall also be supplied.



### Details of Meter Requirements

1 No.A.C. static HT Tri vector meter, 3 elements suitable for three phase, 4 wire un-balanced load and CT, PT ratio mentioned, 0.5S accuracy class with load, survey and T.O.D. /Tariff and M.R.I. facility. Meter shall be capable of displaying above parameters in the following sequence within specified limits of errors for balanced or unbalanced load at all P.F. as mentioned hereinafter:

- |      |  |              |
|------|--|--------------|
| (1)  | LCD  | :            |
| (2)  | Real Time  | :            |
| (3)  | Date   | :            |
| (4)  | Battery Status   | :            |
| (5)  | Cumulative Active Energy Import  | : KWH        |
| (6)  | Cumulative Active Energy Export  | : KWH        |
| (7)  | Cumulative Reactive Energy   | : KVARh LAG  |
| (8)  | Cumulative Reactive Energy   | : KVARh Lead |
| (9)  | Cumulative Apparent Energy Import  | : KVAH       |
| (10) | Cumulative Apparent Energy Export  | : KVAH       |
| (11) | Cumulative Active Energy of individual Time Zone during specified peak hours     | : KWH        |
| (12) | Cumulative Apparent Energy of individual time Zone during specified T.O.D. hours | : KVAH       |
| (13) | Current month maximum demand (Import.)   | : KVA        |
| (14) | Current month maximum demand (Export)  | : KVA        |
| (15) | Cumulative maximum demand  | : KVA        |
| (16) | Maximum demand reset count   | : Nos        |
| (17) | Maximum demand during specified T.O.D. hours of current month                    | : KVA        |
| (18) | Previous month maximum demand during   | : KVA        |

specified T.O.D. hours

- |      |   |          |
|------|---|----------|
| (19) | Instantaneous average power factor        | :        |
| (20) | Frequency                                 | : Hz     |
| (21) | Instantaneous voltage of all three phases | : Volts. |
| (22) | Instantaneous current of all three phases | : Amps.  |
| (23) | Type of tamper                            | :        |
| (24) | Date & Time of first occurrence of tamper | :        |
| (25) | No. of tamper count                       | :        |
| (26) | Date & Time of last restoration           | :        |

Meter should be supplied with Backlit LCD/LED display the measured value(s) shall be displayed on seven segment, seven digit liquid crystal Display (LCD)/LED display unit/register having minimum character height of 10mm. The data should be stored in non volatile memory and should retain data for a period of not less than 3 (three) years under un-powered condition battery backup memory will not be considered as NVM.

Meter shall have feature of connection check i.e. PT missing, CT reversal on meter display itself. PT missing & CT reversal shall be checked from looking on meter display.

Meter shall have the facility to lock any parameter on display screen i.e. Scroll lock facility.

Rating of meter should be as follows:

1b-5A

1Mx- 1.2 lb

In case of fault capable to bear 20lb for 0.5 sec

## Technical Specification for Armoured LT Power Cables

### 1.1 Scope:

The specification covers design, manufacturing, testing, packing, supply & delivery of 1.1 kV, multiple core, aluminium conductor, PVC insulated, PVC sheathed, armoured power cables for effectively earthed systems.

The cable shall be used for providing overhead service connections to individual consumers.

### 1.2 Standards:

The cables shall be manufactured, tested and supplied according to following standards including their latest amendments;

- IS : 1554(Part-I) : 1988 : Specification for PVC Insulated heavy duty Electric Cables for working Voltage upto & including 1100 Volt
- IS:8130-1984 : Specification for Conductors for insulated electric cables and flexible cords
- IS:5831-1984 : Specification for PVC insulation & sheath of electric cables
- IS: 3975-1970 : Specification for Low Carbon Galvanized steel wires, Formed Wires and tapes for armouring of Cables.
- IS:10810-1984 : Methods of test for Cables.
- IS: 3961(Part-II)-1967 : Recommended current rating for PVC insulated and PVC sheathed heavy duty Cables
- IS:10418-1982 : Specification for Drums for Electric Cables.

### 1.3 Service Conditions

The service conditions provided in Volume II- Part 1 shall be applicable for this specification.

### 1.4 System Parameters

The system parameters provided in Volume II- Part 1 shall be applicable for this specification.

### Rated Voltage and Cable Sizes

### 1.5 The rated voltage of the cables shall be 1100 V.

### 1.6 Following sizes of cables are required for single phase and three phase service connections respectively;

- 2C x 6 sqmm
- 4C x 4 sqmm
- 4C x 6 sqmm
- 4C x 16 sqmm

## Design, Construction and Technical Parameters

### **1.7 Conductor:**

Aluminium conductors shall be H4 grade with flexibility class 2 complying with the requirements as specified in IS-8130-1984 with latest amendments. The Conductors shall be Stranded Circular (non-compacted). The conductor shall be clean & reasonably uniform in size and shape and its surface shall be free from sharp edges.

### **1.8 Insulation:**

The Conductor shall be provided with PVC insulation applied by extrusion. Type of insulation shall be A for general purpose PVC. Maximum permissible Conductor temperature should be 70°C under normal continuous operation & should be 160°C under short circuit condition.

### **1.9 Core Identification :**

Individual cores of multi-core cables shall be colour coded and/or numbered for proper identification.

### **1.10 Laying-up of Cores :**

The cores shall be laid up together with a suitable lay, the outermost layer shall have right hand lay and the successive layer shall be laid with opposite lay.

### **1.11 Inner Sheath :**

The laid up cores shall be provided with Inner Sheath applied by extrusion. It shall be ensured that the shape of Cable is as circular as possible. Inner sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damaging the insulation. The Inner sheath shall be of type ST2 PVC Compound conforming to the requirements of IS:5831-1984 with latest amendments.

### **1.12 Armouring**

The armour wires/strips shall be applied as closely as practicable. A binder tape may be provided on the armour. The joints in armour wire or strip shall be made by brazing or welding and the surface irregularities shall be removed. A joint in any wire/strip shall be at least 300 mm from the nearest joint in any other armour wire/flat strip in the completed cable. The armouring can be of round wires where the calculated dia. below armouring does not exceed 13 mm, and above 13 mm it shall be of steel strips / round wires.

### **1.13 Outer Sheath :**

The outer sheath shall be applied by extrusion over the armouring. The colour of outer sheath is black unless otherwise specified. Thickness of outer sheath should be as per IS: 1554 (Part-I): 1988 with latest amendment. The outer sheath shall be of type ST2 PVC Compound conforming to the requirements of IS:5831-1984 with latest amendments.

## **Testing**

- 1.14** Testing of the cable shall be carried out as per general requirements provided in Volume I – Section 6 and according to details provided below;

### **1.15 Type tests:**

The offered types of cables should have been fully type tested. Type Tests should be carried out

- Within 5 years from the due date of offer or as per validity of test reports
- From CPRI/ NABL accredited testing laboratory bearing the Logo of NABL accreditation and preferably accredited to ISO/IEC 17025:2005 for carrying out specified type tests.
- As per IS: 1554(Part-1)-1988 and its latest amendment and other relevant IS.

One set of authenticated copy of type test reports should be provided. All the tests mentioned below are to be made as per details given in IS: 10810-1984.

1.16 The following shall constitute type Test:

- a) Resistance Test on Conductor
- b) Tests for armouring Wires/strips (for Armoured Cable).
- c) Test for thickness of insulation and sheath
- d) Physical tests for insulation and outer sheath
- e) Tensile strength and elongation at break
- f) Ageing in air oven
- g) Shrinkage test
- h) Hot deformation
- i) Loss of mass in air oven
- j) Heat shock test
- k) Thermal stability test
- l) Insulation resistance Test
- m) High voltage test (water immersion test)
- n) High voltage test at room temperature
- o) Flammability test

1.17 Acceptance Tests

The following shall constitute acceptance Test:

- a) Resistance Test on Conductor
- b) Test for thickness of insulation and sheath
- c) Tensile strength and elongation at break test of insulation & sheath.
- d) Insulation resistance Test



- e) High voltage test at room temperature.

#### 1.18 Routine Tests

The following shall constitute routine test:

- a) Resistance Test on Conductor
- b) High voltage test at room temperature

### Marking and Packaging

#### 1.19 Cable identification by embossing

The outer sheath of the cable shall bear following identification parameters embossed at intervals of length of one meter of cable, throughout the cable:

- Manufacturer's Name or Trade Mark
- Name of the purchaser : PVVNL / RDSS
- Voltage Grade of Cable : 1100 V
- Type of insulation, material of conductor : PVC insulated Aluminium conductor)
- Number of cores & nominal cross sectional area of conductor :
- Cable Code :
- Marking : <Electric=
- Month & Year of manufacture

Sequential length shall be marked on the outer sheath of the cable throughout the length by Printing in each meter length interval.

#### 1.20 Packing:

The cable shall be wound on non-returnable wooden drums as per IS: 10418 – 1972 and packed in drums suitable for vertical / horizontal transport, as the case may be and shall be suitable to withstand rough handling during transport and outer storage. The outer surface of the drum shall be painted with white aluminum paint. Similarly, the inside surface of drum shall have the protective layer of varnish / paint. The cable shall be supplied in standard drum length of 500 m  $\pm 5\%$ .

The ends of the cable shall be sealed with heat shrinkable caps.

#### Marking on each Drum :

The following information shall be stenciled on each drum:

- a) Reference Standard
  - b) Manufacturer's Name, brand name or Trade Mark
  - c) Type of Cable and Voltage Grade
- Ex : 1.1 KV grade PVC insulated PVC sheathed Aluminium Armoured Cable
- d) Number of cores
  - e) Nominal cross sectional area of Conductor
  - f) Cable Code
  - g) Length of Cable on the Drum
  - h) Number of length on the drum (if more than one)
  - i) Direction of rotation of Drum by means of arrow.
  - j) Approximate gross weight & tare weight
  - k) Running end of Cable
  - l) Country of Manufacture
  - m) Month & Year of manufacture
  - n) License Number
  - o) Serial number of the Drum
  - p) Name of the purchaser: UPPCL / UPPDR Project
  - q) Purchase Order No. & Date :

**Guaranteed Technical Particulars for Supply of Armoured LT Power Cables.**

	PARTICULARS	1.1 kV 2C x 6 sqmm Cable	1.1 kV 4C x16 sqmm Cable
1.0	Manufacturer's name and factory address		
2.0	Standard to which cable is manufactured :		
3.0	Voltage Grade :		
5.0	<b>Conductor details:</b>		
5.1	Material		
5.2	Shape of conductor		
5.3	Compacted / Non-compacted		
5.4	Normal cross section area (sqmm)		
5.5	No of strands:		
5.6	Diameter of strands (mm)		
5.7	Maximum DC Resistance of Conductor at 200C (Ohm/Km)		
6.0	<b>Insulation</b>		
6.1	Material		
6.2	Nominal Thickness (mm)		
6.3	Suitability with regard to temp, moisture, Acid, Oil & Alkaline Surrounding		
7.0	<b>Inner Sheath</b>		
7.1	Material		
7.2	Minimum Thickness (mm)		
8.0	<b>Armour</b>		
8.1	Armouring Material		
8.2	Nominal Dimensions (mm)		
8.3	Maximum DC resistance of Armour at 200C (Ohm/KM)		
9.0	<b>Outer Sheath</b>		
9.1	Material		

	PARTICULARS	1.1 kV 2C x 6 sqmm Cable	1.1 kV 4C x 16 sqmm Cable
9.2	Minimum Thickness (mm)		
10.0	Overall Dia of Cable (mm)		
11.0	Method of Core identification		
12.0	Maximum operating temperature of Conductor		
13.0	Maximum temperature of conductor during short circuit (°C)		
14.0	Continuous Current Carrying capacity in air at 40°C (Amps)		
15.0	Approx. Weight of cable (Kg / Km)		
16.0	Cable identification & sequential length marking as per spec.		
17.0	Sealing of cable ends		
18.0	Standard drum length of cable in meters & its Tolerance		
19.0	Marking on each drum as per spec		
16.0	BIS Certification		
17.0	BIS License No. & Validity.		
20.0	Any other particulars.		

## **TECHNICAL SPECIFICATIONS FOR GAS FILLED CYLINDRICAL LT CAPACITORS UNIT**

### **1. SCOPE:**

This specification covers supply, testing, installation and commissioning of three phase 440V, delta connected, 50Hz, self healing or explosion proof, metalized polypropylene design, Gas Filled LT Capacitors Units, Cylindrical type, suitable for outdoor use, intended for power factor improvement and to be installed on secondary side of the distribution transformers on LT lines poles of various ratings by way of suitable clamp.

Gas filled capacitor unit shall be ISI Marked along with IP65 degree protection level.

### **2. APPLICABLE STANDARDS:**

Unless otherwise stipulated in the specification, the capacitor units shall comply all testing parameters as per IS: 13340 (Part-1 & Part -2): 2012 with latest amendment for routine and type tests including IP65 and Wave Cut design type tests and also comply IS: 12672: 1989 for internal fuses and internal over pressure disconnectors.

Only ISI marked capacitor units shall be accepted. Further the equipment, from the manufacturer having ISO 14000 & above certification in addition to ISO 9000 & above certification, shall be preferred.

### **3. CLIMATIC CONDITIONS:**

Max. Ambient Temperature	55° C
Min. Ambient Temperature	-5° C
Max. Relative Humidity	100%
Min. Relative Humidity	26%
Altitude	Below 1000 meters above mean sea level.

The capacitor units shall be, suitably designed & treated for normal life and satisfactory operation under hot and hazardous tropical climatic conditions and shall be dust and vermin proof. All the parts and surface, subjected to corrosion, shall either be made of such material or provided with such protective finish so as to provide suitable protection against any injurious effect of excessive humidity.

### **4. SYSTEM DETAILS / PARTICULARS**

The distribution transformers are connected to the 11 KV network on its HT side while LT side is connected to the 440 volts LT network.

- 1) Nominal Voltage: 440 V AC/ $\pm$ 10% Volts
- 2) Over Voltages (excluding transients): As per IS: 13340 (Part 1 & 2):2012



- 3) Rated Frequency: 50Hz
- 4) No. of Phases: Three
- 5) Harmonics contents: Harmonic generating leads should be less than 15% of the total load at the trial load Intended for P.F correction.
- 6) System Operation hours: Continuous

## **5. RATING**

The stated output of capacitor units in KVAR at frequency of 50 Hz for upper limit of temperature category of 55° C, shall be as per relevant annexure of IS.

## **6. RATED VOLTAGE**

The rated voltage of capacitor units shall be 440Volts. The fluctuation in supply voltage as specified in IS: 13340 (Part 1 & 2):2012 (with latest amendments) shall not affect normal working of the equipment.

## **7. GENERAL TECHNICAL REQUIREMENT:**

- 1) The capacitor element used in unit shall have multilayer metalized polypropylene film (MPP) having low loss dielectric and impregnated with such impregnant which shall have high dielectric constant and high chemical stability.
- 2) The impregnant should be inert gas to avoid risk of fire in case of failure of capacitor. Concentric winding shall be adopted to form three phases in order to facilitate the better heat dissipation, reduce interconnections between windings and no heat concentration in the winding cores.
- 3) The PP film should be in wave cut design, so that higher current carrying capabilities can be achieved. Active binding element shall be properly heated and then vacuum dried prior to encapsulation in gas impregnation. The contact area must be carefully prepared so as to achieve high in rush current and long life. Film thickness minimum 7 micron ( +/- manufacturer tolerance )
- 4) Discharge resistance shall reduce the residual voltages to less than 75 volts within three minute as required by latest IS: 13340 (Part 1 & 2):2012. For easy identification of damaged units with naked eye, Visual Fault Indicator shall be provided.

## **8. CONSTRUCTION**

1. The capacitors should have 3 phases, cylindrical unit housed in cylindrical aluminium container. The height and diameter of the capacitor shall be as per relevant standard. At the base of capacitor unit suitable arrangement for earthing preferably in form of M-12 size stud bolt having 16 mm outer (projected) length with toothed washer hexagonal nut & two numbers spring washer shall be provided in such a way that it should also serve facility for clamping capacitor unit on LT poles. The outgoing terminals of capacitor unit should be covered by a UV resistant cap and cable gland with multi hole rubber. The capacitor & unit with the cap and cable gland should conform to IP 65 degree of protection.

2. The gas filled in capacitor units must be inert and absolutely harmless to environment. The operation and disposal of capacitor units must be environment friendly. The construction features necessary to prevent leakage and to ensure safety during operation must be adopted.
3. There should be in built protection devices / pressure sensitive in the event of any fault/ abnormal condition inside the capacitor unit. Occurrence of such condition must be indicated by display of red colour (red UV tape) indication (tape wrapped on capacitor below terminal cover) by upward movement of terminal cover cap in case of capacitor failure and should be visible from the ground to facilitate identification and replacement of the faulty unit.
4. The cable connection to terminals shall be encapsulated by resin to avoid loose connection and climatic effect (corrosion) on terminal contact area.
5. The features necessary for outdoor installation/ operation on L.T lines, without enclosures, must be incorporated

## **9. INSTALLATION**

LT Capacitors are to be installed on LT Line Poles one span ahead of common Pole (DTR) through suitable clamping arrangement. A suitable size of ISI marked with UV protection wire of reputed makes, per phase should be used for connecting the capacitors with DTR.

## **10. PERMISSIBLE OVER LOADS**

For capacitors specified in this specification, the maximum permissible over loads shall not exceed anyone of the limits given in (i) and (ii) below as conforming to IS: 13340 (Part 1 & 2):2012.

1. Voltage: The permissible overloads shall not exceed limits-set by IS: 13340 (Part 1 & 2):2012  
for self healing type capacitors. Capacitors shall be suitable for prolonged operation at RMS voltage between terminals not exceeding 1.1 times the rated voltage. Current: Capacitor units shall be suitable for continuous operation at RMS Line current 1.3 times the current occurs at rated sinusoidal voltage and rated frequency excluding transients. As per IS:13340 (Part 1 & 2):2012 for self healing type, capacitors.
2. Inrush Current: Should be 300 times the I nominal current.

## **11. CAPACITOR LOSS**

The dielectric loss shall not be more than 0.20 W/KVAR. This should be indicated in the bid. The total capacitor loss excluding discharge resistor and cable should not be more than 0.6 W/KVAR for self healing type capacitors using metalized polypropylene.

## **12. CAPACITOR LIFE**

The life of capacitor units shall not be less than 1,30,000 hours. The bidder as per the performance guarantee clause of the specification shall guarantee the capacitor units. The

failure rate should be within 3% (including the capacitors failed due to drift in accuracy).

### **13. SAFETY REQUIREMENT**

1. Capacitor unit shall be provided with directly connected discharge device metal oxide varistors (MOV) or resistors of suitable energy handling capacity and as per IS: 13340 (Part 1 & 2):2012 for self healing capacitors. It should be ensured that there must be no switch, fuse or any other isolating device between the capacitor unit and the discharge device.
2. Capacitor shall comply with the relevant general safety regulations for power installation as per Indian Electricity Rules 1956. The capacitor units shall be provided with a suitable earth terminal clearly marked so that it will be connected by the worker to the system earth.
3. The protective cap and terminal block should entirely eliminate hazards increase of accidental contact.

### **14. MONITORING FACILITY**

For easy identification of damaged units with naked eye, Visual fault indicators shall be provided.

### **15. TESTS**

#### **a. TYPE TESTS & TEST CERTIFICATES:**

The type test is mandatory and pre-requisite. Capacitor Units shall be fully type tested, as per latest version of IS. The type test certificates shall be submitted along with the bid of similar or higher ratings. Bids, without type test certificates are liable for rejection. The type test certificates shall not be more than 10 years old.

#### **b. IP 65 TEST**

Bidder should furnish IP 65 type test as per IEC 60529 for Similar or higher ratings than required capacitor.

#### **c. CONCENTRIC WINDING/WAVE CUT DESIGN TEST**

Bidder should also furnish type test for wave cut design as a proof that bidder is offering capacitor banks having wave cut PP (polypropylene) film. Type test of higher or lower rating than that required here would be acceptable for Wave cut criteria.

#### **d. ROUTINE TESTS**

The Acceptance and Routine tests shall be carried out, as per latest version of IS13340 (Part 1 & Part 2):2012 with its latest amendment.

### **19. DRAWINGS AND DOCUMENTATION**

Tender must accompany relevant catalogues and sectional drawing showing necessary details of the equipment offered and installation arrangements. One copy of the dimensional drawing and internal constructional drawing shall be furnished with the tender.

### **20. GUARANTEE**

The capacitor units shall be guaranteed for satisfactory operation for a period of 24 months from the date of supply or 18 months from the date of commissioning, whichever is later.

**21. RATING PLATE**

The name plate, containing the information as specified in IS: 13340 Part-1 & Part-2: 2012 shall be provided on each capacitor unit.

**22. BILL OF QUANTITY**

S. No.	Item Description	Quantity (Nos.)
1	LT Shunt Capacitors 440V ____KVA <sub>r</sub> 3 Phase 50 Hz, IP65 with fault indication.	____
2	LT Shunt Capacitors 440V ____KVA <sub>r</sub> 3 Phase 50 Hz, IP65 with fault indication.	____
3	LT Shunt Capacitors 440V ____KVA <sub>r</sub> 3 Phase 50 Hz, IP65 with fault indication.	____

## Guaranteed Technical Particulars

Sr. No.	Particular of Item	Required parameters	Offered by manufacturer
1.	Name of the manufacturer		
	Address of Manufacturer		
2.	No. of Phase	3 Phase, delta connected	
3.	Type of impregnation	Gas impregnated	
4.	Ingress Protection	IP 65	
5.	Type of Winding	Concentric Winding	
6.	Film Cutting technology	Wave Cut	
7.	Dielectric	Polypropylene film	
8.	Thickness of film	7 Micron $\pm 5\%$	
9.	Highest insulation strength for outdoor applications	15 KV	
10.	Harmonics	15%	
11.	Inrush current	300* In	
12.	Overloads ( voltage and current )	As per IS: 13340 (Part 1):2012	
13.	Dielectric loss	$\leq 0.2$ watts/kvar	
14.	Discharge IS 13340 ( as per latest edition 2012)	Discharge to 75 volts in 180 seconds as per IS 13340 Part-1 2012.	
15.	Rating (Output KVAR)		
16.	Rated Voltage	440 V	
17.	IR (A)		
18.	CR (mF)		
19.	Dimensions (E x L) mm		
20.	Approx Weight (Kg)		
21.	Capacitor Lifecycle	1,30,000 Hrs.	
22.	Cable (Cross Section) mm and length		



## **SPECIFICATION FOR L.T.AERIAL BUNCHED CABLES**

### **1. SCOPE :**

This specification covers the requirement of cross linked polyethylene insulated aluminium cables twisted over a central bare aluminium alloy messenger wire for use on L.T. overhead lines in electrification system.

### **RATED VOLTAGE :**

The rated voltage of the cables shall be 1100 Volts.

### **2. SERVICE CONDITIONS:**

Equipment to be supplied against the specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

2.1	Maximum ambient temperature ( Degree C )	50
2.2	Maximum temperature in shade (Degree C )....	45
2.3	Minimum temperature of Air in Shade ( Degree C )..	3.5
2.4	Relative Humidity ( Percent )	10 to 100
2.5	Maximum annual rain fall ( mm )	1450
2.6	Maximum wind pressure ( Kg/sq.mm. )	150
2.7	Maximum altitude above mean sea level ( Metres)	1000
2.8	Isoceraunic level ( day per year )	50
2.9	Siesmic level ( Horizontal Acceleration )	0.3 g
2.10	Ground Temp.	30 Degree C
2.11	Moderately hot and humid tropical climate Conducive to rust and fungus growth	

### **3. STANDARDS:**

#### **APPLICABLE STANDARDS :**

Unless otherwise specified elsewhere in this specification the rating as well as performance and testing of the L.T.A.B. cables shall conform to the IS: 14255/1995 or the latest revision available at the time of placement of order and bearing ISI mark. In addition the following Standards (or the latest version thereof ) shall be applicable :

- i) IS 8130 - 1984 cross linked polyethylene insulated aluminium cables.
- ii) IS 398 (Part - IV) - 1994 Aluminium alloy conductors.

### **4. GENERAL TECHNICAL REQUIREMENTS :-**

The insulated phase conductors (with additional street lighting conductor, if provided) shall be twisted around the bare aluminium alloy messenger wire, which shall take all the mechanical stress. The messenger wire can also serve as the earth cum neutral wire.

#### 5. PHASE/NEUTRAL CONDUCTORS :

The conductors shall be made of aluminium & shall be stranded in construction and shall be insulated with black weather resistant cross linked polyethylene suitable for 1100 Volts insulation. The insulated conductors shall generally conform to the standards (i) and (ii) quoted in clause 3 above.

The conductors shall be suitably compacted. The outer diameter shall be within the limit as specified in 5.3 below :

- 5.1 The conductors shall be provided with one, two and three ridges for quick identification.
- 5.2 The tensile strength of the aluminium wires used in the conductors shall not be less than 90 N/ sq.mm.
- 5.3 The standard size and technical characteristics of conductors shall be as shown in the following table :

Nominal Sectional Area (sq.mm)	Diameter of compacted conductor (mm)	Max.DC resistance at 20 Deg. (0hm/km)	Insulation thickness (mm)	Approx. mass (kg/km)	Minimum No. of Strands
(1)	(2)	(3)	(4)	(5)	(6)
16	4.4	1.91	1.0	42	6
35	6.8	0.868	1.0	95	6
50	7.9	0.641	1.2	127	6
70	9.6	0.443	1.4	184	12
95	11.3	0.320	1.4	254	15
120	12.7	0.253	1.6	320	15
150	14.2	0.196	2.1	382	17

NOTE :-

- (A) The resistance values given in col.3 are the max. Permissible.
- (B) Tolerance of + 5 % is allowable on diameters shown in Col. 2.

#### 6. MESSENGER WIRE :

The bare messenger wire shall be made of aluminium alloy generally conforming to IS - 398 (part - IV) - 1994 or the latest version thereof composed of 7 strands and shall be suitably compacted to have smooth round surface to avoid damage to the insulation of the phase conductors twisted around the messenger.

- 6.1 There shall be no joints in any wire of the stranded messenger conductor except those

made in the base rod of wires before final drawing.  
 6.2 The sizes and other technical characteristics of the messenger wire shall be as given in the following table :

Nominal Sectional Area (sq.mm.)	Diameter of compacted conductor (mm)	Approx Mass (kg/km)	Max.DC resistance at 20 Deg. (0hm/km)	Minimum Tensile Strength.
(1)	(2)	(3)	(4)	(5)
25	5.8	65	1.380	7.4
35	6.8	95	0.968	10.3
50	8.1	130	0.690	14.7
70	9.6	185	0.493	20.6
95	11.2	210	0.398	26.3
120	13.7	287	0.312	33.2

**Note :-**

While the limiting values in Col. 4 & 5 are to be guaranteed a tolerance of + 5 % will be permissible on values in Col. 2.

**7.0 CROSS LINKED POLYETHYLENE INSULATION :**

The polyethylene insulation shall generally conform to IS: 14255 / 1995 or the latest version thereof. The following properties shall be guaranteed by the supplier

Melt flow index	0.5 or less
Yield Stress	Not less than 8 N/sq.mm
Percentage elongation	Not less than 350
Carbon black content	Between 2 and 3
Vicat Softening Point	Not less than 85 Deg. C

**8.0 COMPOSITION AND DESIGNATION OF FINISHED CABLES:**

The composition and designation of finished cables are given in the flowing tables:

Sr.No	Designation	Complete Bunched Cables	
		Overall dia approx	Total mass approx
		(mm)	(kg/km.)
1.	3x50+16+35	32	640
2.	3x70+16+50	34	890
3.	3x95+16+70	39	1180
4.	3x120+16+95	42	1430
5.	3x150+16+120	49	1905

**Note : -**

The first part of the designation refers to the number and size of the phase conductor, the middle to the street lighting conductor (where provided) and the last to the bare messenger wire. The sizes shown are the nominal sectional areas.

## 9.0 TESTS FOR PHASE CONDUCTORS:

### 9.1 TYPE TESTS:

All the type tests are detailed below in accordance with relevant IS , amended upto date , shall be performed on cable samples drawn by the purchaser.

Type tests are required to be carried out from the first lot of supply on a sample of any one size of cable ordered. In case facilities of any of the type test is not available at the works of the supplier, then such type tests shall be carried out by the supplier at an independent recognized laboratory at the cost of supplier. Sample for the type test will be drawn by the purchaser's representative and the type tests will be witnessed by him.

Supplier, however, can claim exemption from carrying out type tests as above, provided such type tests were already conducted for the UPPCL in the past within five years and the test certificates thereof submitted to authorities may grant waiver from carrying type tests, if the type test certificates are acceptable . In case of other Government recognized laboratories / Test House valid approved Government certificate shall be enclosed along with test certificate.

### TYPE TESTS :

a)	Conductor Resistance Test	( IS : 8130 )
b)	Test for thickness of insulation	( IS : 14255 )

c)	Physical tests for polyethylene insulation	( IS : 14255 )
d)	Test for bleeding and blooming of pigment	( IS : 14255 )
e)	Insulation Resistance Test	( IS : 14255 )

f) High voltage test including water immersion test ( IS : 14255 )

## 9.2 ACCEPTANCE TESTS :

All tests as per 9.1 except ( c ) and ( d )

In addition, check of diameter values as per clause 5.5.

## 10.0 TESTS FOR MESSENGER :

### 10.1 TYPE TESTS :

- a) Breaking load test ( to be made on the finished conductors ) ( IS:398-PART-IV )
- b) Elongation test ( IS:398-PART-IV )
- c) Resistance test ( IS:398-PART-IV )

### 10.2 ACCEPTANCE TESTS:

All tests indicated in clause 10.1 above.

In addition, check of diameter values as per clause 6.3

## 11.0 BENDING TEST ON THE COMPLETE CABLE:

The test shall be performed on a sample of complete cable. The sample shall be bent around a test mandrel at room temperature for at least one complete turn. It shall then be unwound and the process shall be repeated after turning the sample around it's axis 180 Deg. The cycle of these operations shall then be repeated twice more. The diameter of the mandrel shall be

$$10 ( D + d )$$

Where D = actual diameter of the cable ( i.e. the minimum circumscribing circle diameter )  
in mm

d = actual diameter of the conductor, in mm No cracks visible to the naked eye are allowed.

## 12. PACKING AND MARKING



- 121 The cables shall be wound non-returnable wooden drums conforming to IS : 1778 / 1961 or the latest version thereof ( specification for Reels & Drums for bare wire ). The drum shall be marked with the following.
- a. Manufacturer's name.
  - b. Trade mark, if any.
  - c. Drum number or identification number.
  - d. Size of conductors.
  - e. Size of messenger
  - f. Voltage grade.
  - g. Number and lengths of pieces of cable in each drum
  - h. Gross mass of the packing.
  - i. Net mass of cable,
  - j. ISI mark.
- 122 The drums shall be of such construction as to ensure delivery of conductor in the field free from displacement and damage and should be able to withstand all stresses due to handling and the stringing operation so that cable surface is not dented, scratched or damaged in any way during transport and erection. The cable shall be properly lagged on the drum.
- 123 The cable drum should be suitable for wheel mounting.
- 124 The mass of finished cable in a drum (without mass of drum ) of various designations shall not exceed by more than 10 % of the actual values.
- 125 The normal length of each cable shall be 500 meters with plus / minus 5 % tolerance. While longer lengths shall be acceptable, shorter lengths not less than 100 meters shall be acceptable to the extent of 5 % of the ordered quantity.

#### 13.0 INSPECTION:

All tests and inspection shall be made at the place of manufacture unless otherwise especially agreed upon by the manufacture and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that the material is being furnished in accordance with this specification.

#### 14.0 QUALITY ASSURANCE PLAN :

A detailed list of bought out items which got into the manufacture of cables should be furnished indicating name of the firms from whom these items are procured. The bidder shall also give the details of quality assurance plan followed by him in respect of the raw materials, in process, final inspection, packing and marking. Company may at it's option order the verification of these plans at manufacturer's works as a pre qualification for technically accepting the bid. During verification if it is found that firm is not meeting with quality assurance plan submitted by the firm, the offer shall be liable for rejection

15 SCHEDULES:

15.1 The tenderer shall fill in the following schedules which are part and parcel of the tender specification and offer.

Schedule A' - Tenderer's Experience

15.2 The tenderer shall submit the list of orders for similar type of equipments, executed or under execution during the last three years, with full details in the schedule of Tenderer's experience (Schedule X) to enable the purchaser to evaluate the tender.

## **SCHEDULE A TENDERER'S EXPERIENCE**

Tenderer shall furnish here a list of similar orders executed/under execution by him to whom a reference may be made by Purchaser in case he considers such a reference necessary.

Sr No	Name of the client & description of order	Value of order	Period of supply and commissioning	Name & address whom reference may be made
1	2	3	4	5

## Earthing Coil

Earthing Coils shall be fabricated from soft GI Wire Hot Dip Galvanized. The Hot Dip galvanized wire shall have clean surface and shall be free from paint enamel or any other poor conducting material. The coil shall be made as per REC construction standard (Refer tender drawing No. REC-XI Plan-Gen-005). The Hot Dip galvanizing shall conform to IS:2629/1966, 2633/1972 and 4826/1969 with latest amendments. Galvanizing should be heavily coated and should stand for the following tests.

### Galvanizing Tests

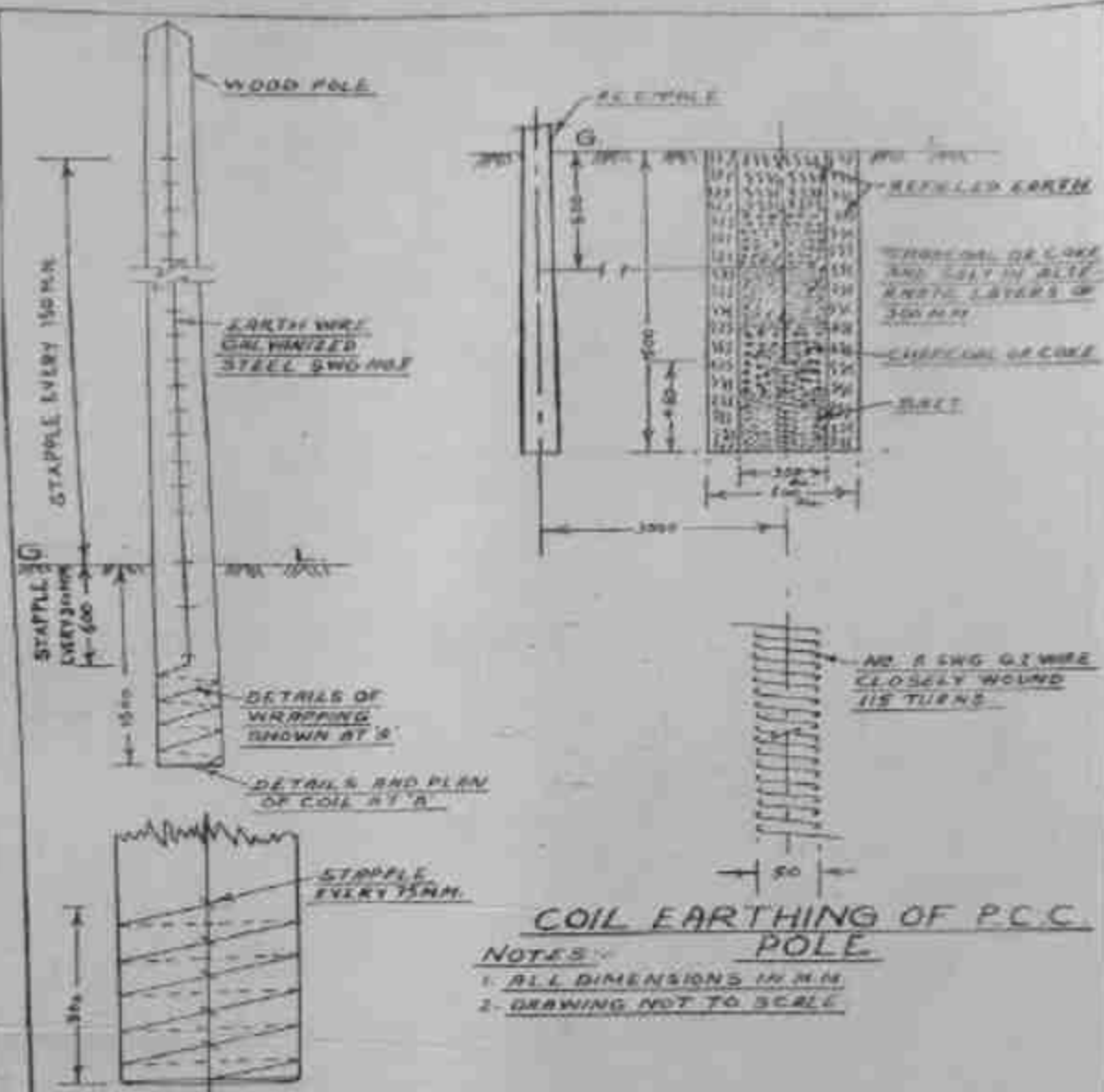
- i) Minimum Mass of Zinc
  - a) ON GI Wire used 280 gm/m<sup>2</sup>
  - b) After Coiling – 266 gm/m<sup>2</sup>. The certificate from recognized laboratory shall be submitted towards mass of zinc.
- ii) Dip Test Shall stand 3 dips of 1 minute and one dip of ½ minute before coiling and 43 dips of 1 minute after coiling as per IS : 4826/1979.

### THE DIMENSIONAL REQUIREMENT SHALL BE AS FOLLOWS

- a) Nominal dia of GI Wire 4 mm (Tolerance  $\pm 2.5\%$ )
- b) Minimum no. of turns – 115 Nos.
- c) External dia of Coil (Min) – 50 mm
- d) Length of Coil (Min) – 460 mm
- e) Free length of GI Wire at one end coil (Min.) – 2500 mm

The turns should be closely bound. Weight of one finished Earthing Coils (min.) – 1.850 Kg,

Adhesion test – As per ISS 4826 – 1979



# COIL EARTHING OF P.C.C. POLE

- NOTES:-
1. ALL DIMENSIONS IN M.M.
  2. DRAWING NOT TO SCALE



U.P. STATE ELECTRICITY BOARD  
RURAL ELECTRIFICATION & SECONDARY SYSTEM  
PLANNING ORGANISATION, LUCKNOW

COIL EARTHING OF  
WOOD/P.C.C. POLE



## TECHNICAL SPECIFICATION FOR DWC HDPE PIPES

This Specification covers design, manufacturing, testing, packing, supply of DWC HDPE Pipe.

### **1 Service Conditions:**

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

- a) Maximum ambient temperature of air: 50°C
- b) Maximum temperature of air in shade: 4°C
- c) Maximum daily average ambient temperature: 40°C
- d) Maximum yearly average ambient temperature: 30°C
- e) Relative Humidity: up to 95%
- f) Average number of thunder storm days per annum: 15
- g) Maximum annual Rainfall: 150cm
- h) Maximum Altitude above mean sea level: 1000 Meter
- i) Maximum Wind Pressure: 150 Kg/cm<sup>2</sup> (As per IS 802 latest code)
- j) Maximum soil temperature at cable depth: 30°C
- k) Maximum soil thermal resistivity.

### **2 Technical Parameters:**

- (a) DWC high density Polyethylene pipe shall have corrugation on outer wall but inner wall shall be plain conforming to IS 14930 Part I and II amended from time to time.
- (b) Terminology as defined in IS: 14930 shall be followed
- (c) DWC HDPE pipe to be supplied shall be 'ISI' marked.
- (d) Accessories like HDPE snap fit coupler with neoprene to make the joints water / damp proof.

### **3 Code & Standards:**

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS: Codes, standards, etc.) referred to herein, the former shall prevail.

- a) IS: 14930 Pt. -I: General requirements of Conduit System for Electrical and Communication installation
- b) IS: 14930 Pt. -II: Particular requirements of Conduit system for Electrical and Communication installation
- c) IS: 2530: Method for test for Polyethylene moulding material and polyethylene compounds.
- d) IS: 7328: HDPE materials for moulding and extrusion
- e) IS: 12063 : Classification of degrees of protection provided by Enclosures of electrical equipment
- f) ASTM D 1693: Test method for environmental stress Cracking of ethylene plastics
- g) ASTM D 638: Standard test method for tensile properties of plastic
- h) ASTM D 790: Test method for flexural properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials.
- i) ASTM D 2240: Standard Test method for Rubber property.
- j) ASTM D 648: Standard Test method for deflection temperature of Plastic under flexure load in the Edge Wise Position.

- k) IS:11000(Pt-2):Glow-wire Test and guidance test methods for fire /Sec-1) Hazard Testing.

#### 4 General Requirement:

##### General:

- i. The DWC HDPE pipe shall consist of two layers, the outer layer will be corrugated and the inner layer shall be plain and smooth.
- ii. DWC HDPE pipe shall be so designed and constructed that in normal use their performance is reliable and without danger to the user or surroundings.  
When assembled in accordance with manufacturer's instruction as part of a conduit system, they shall provide mechanical protection to Signaling Cables' on tainted therein. iii.
- iv. Within the conduit system there shall be no hardedge, burrs or surface projections which are likely to damage insulated conductors or cables or inflict injury to the installer or user.
- v. The protective properties of the joint between conduit and conduit fittings shall be not less than that declared for the conduit system.
- vi. The DWC HDPE pipe and fittings shall withstand the stresses likely to occur during transport, storage, recommended installation and application.
- vii. The DWC HDPE pipe shall be supplied in continuous length in coil for more straight length, suitable for shipping and handling purpose.
- viii. For conduit systems that are assembled by means other than threads, the manufacturer shall indicate whether the system can be disassembled and if, so, how this can be achieved.

##### REQUIREMENTS OF RAW MATERIALS USED FOR THE DWC HDPE PIPE

- i. The base HDPE resin used for the outer and inner layer of the DWCHDPE Pipe shall conform to any designation of IS: 7328 or to any equivalent standard meeting the requirements given in Table No.1, when tested as per the standards given therein. However, the manufacturers shall furnish the designation for the HDPE resin as per IS: 7328 as applicable.
- ii. The anti-oxidants used shall be physiologically harmless.
- iii. None of the additives shall be used separately or together in quantities as to impair long term physical and chemical properties of the duct.
- iv. Single pass rework material of the same composition produced from the manufacturer's own production may be used and it shall not exceed 10% in any case.
- v. The raw material used for extrusion shall be dried to bring the moisture content to less than 0.1%.
- vi. Suitable UV stabilizers shall be used only for manufacture of the nonblack colored HDPE duct to protect against UV degradation, when stored in open for minimum 8 months' period. The purchaser may ask for UV content test. The test result for UV Content test by FTIR method from any recognized laboratory shall be accepted and the Hindered Amine Light Stabilizer shall be minimum 0.15 %. UV Content test need not to be conducted in case of UV Stabilized raw material is used.

##### REQUIREMENT OF DWC HDPE PIPE

- i. Visual Requirement: The Pipe shall be checked visually for ensuring good workmanship that the ducts shall be free from holes, breaks and other defects. The ends shall be cleanly cut and shall be square with axis of the ducts.
- ii. Colour: The colour of the pipe viz. Green, Orange, Blue, Yellow, Brown, Violet, Grey and Red. The purchaser shall specify the colour of the duct at the time of ordering.



- iii. Dimensions: The dimensions of the DWC HDPE pipe shall be as per requirement / BOQ.
- iv. Standards Length: Duct up to 50 mm OD nominal size shall be supplied in standard length of 100 mtr.  $\pm 1\%$  or 6 mtr  $\pm 1\%$  and all other sizes will be supplied in standard length of 6 mtr.  $\pm 1\%$
- v. Compression Strength: The conduit system shall have adequate mechanical strength. Conduits when bent or compressed either during, or after, installation according to manufacturer's instructions, shall not crack and shall not be deformed to such an extent that introduction of the insulated conductors or cables becomes difficult or that the installed insulated conductors, or cables are likely to be damaged while being drawn in. Compliance may be checked with the application of force which shall be at least 450 N, when reaching the deflection of 5%.
- vi. Impact Strength: The conduit system shall have adequate mechanical strength.
- vii. Conduits when exposed to impact either during, or after, installation according to manufacturer's instructions, shall not crack and shall not be deformed to such an extent that introduction of the insulated conductors or cables becomes difficult or that the installed insulated conductors, or cables are likely to be damaged while being drawn in. Compliance may be checked by ensuring there shall be no crack allowing the ingress of light or water between the inside and outside after the test.
- viii. Bending Strength: The conduit system shall have adequate mechanical strength. Conduits when bent either during, or after, installation according to manufacturer's instructions, shall not crack and shall not be deformed to such an extent that introduction of the insulated conductors or cables becomes difficult or that the installed insulated conductors, or cables are likely to be damaged while being drawn in. During the test sample shall not flatten. Compliance shall be checked by passing a ball having a diameter equal to 95% minimum inner diameter of the sample declared by the manufacturer, through the sample whilst it is bent around the test apparatus.
- ix. Oxidation Induction Test (OIT): The OIT is a qualitative assessment of the level (or degree) of stabilization of material.
- x. Resistance to Flame Propagation: Non flame propagating ducts shall have adequate resistance to flame propagation. Samples of DWC HDPE Ducts shall be checked by applying a 1KW flame.
- xi. Anti-Rodent Properties: Safety of ducts from the direct attack of subterranean organism anti rodent material is of utmost importance. These ducts shall be evaluated for their safety against rodents before laying them in the fields.
- xii. Resistance to External Influences on DWC HDPE Duct Accessories: The accessories in Clause 11.5.4 shall be tested for external influences as per IS-12063 for ingress of dust & ingress of water. DWC Duct systems when assembled in accordance with the manufacturer's instructions shall have adequate resistance to external influences according to the classification declared by the manufacturer with a requirement of IP67.
- xiii. Marking Identification: The conduit shall be prominently marked at regular intervals along their length of preferably 1m but not longer than 3m using indelible ink with following.  
 Manufacturers name  
 Specification No.  
 Name of the duct with size  
 Lot No. of the Product  
 Date of manufacture  
 Product Length  
 Purchaser's Name/symbol

#### **DWC HDPE PIPE ACCESSORIES**

- i. The following accessories are required for jointing the ducts and shall be supplied along with the ducts against specific orders. The manufacturers shall provide complete procedure and method for installation of the accessories. The required quantities of accessories are to be mentioned by the purchasing authority in the purchase order.
- a. Plastic Coupler:  
 The coupler shall be of Push-fit type with O-ring. It is used for jointing two or more ducts. The design of this shall be simple easy to install and shall provide air tight and water tight joint between the two ducts. The coupler shall insure that the two ducts are butted smoothly without any step formation in the inner surface. The coupler may be straight, bands, T-joints type as per requirements of purchaser.

b. End Cap:

This cap made of suitable plastic material shall be fitted on the both ends of duct, coil after manufacturing the duct. This shall avoid entry of dust, mud and rain water into the duct during the transit & storage.

**Selection of pipe for different sizes Cables**

Following guide of the pipe fill shall be used for sizing the pipe Size:

- a. 1 cable in pipe - 53% full
- b. 2 cable in pipe - 31% full
- c. 3 or more cables - 43% full
- d. 4 Multiple cables - 40% full

**5 Tests**

The following tests shall be carried out in accordance with IS or the latest version thereof:

**a. TYPE TESTS**

- i) Visual.
- ii) Requirement of Colour.
- iii) Dimension
- iv) Standard Length
- v) Compression Strength
- vi) Impact Strength
- vii) Bending Strength
- viii) Oxidation Induction Test
- ix) Resistance to Flame Propagation
- x) Anti-Rodent
- xi) Resistance to External influence on DWV HDPE Pipe

**b. ACCEPTANCE TESTS**

The following tests be carried out by the manufacturer after 240 hrs of manufacture: -

- i) Visual Requirement
- ii) Requirement of Colour.
- iii) Dimension
- iv) Standard Length
- v) Compression Strength
- vi) Impact Strength
- vii) Bending Strength
- viii) Resistance to Flame Propagation

**c. ROUTINE TESTS**

The following tests be carried out by the manufacturer after 240 hrs of manufacture: -

- i) Visual Requirement
- ii) Requirement of Colour.
- iii) Dimension
- iv) Standard Length
- v) Compression Strength
- vi) Impact Strength
- vii) Bending Strength
- viii) Resistance to Flame Propagation

**6 Tests Procedure**

**a) COMPRESSION TEST**

- i. Conduits are subjected to a compression test as per IS: 14930 (Pt-II). The tests for conduits shall not be started until 240 hrs after manufacture.
- ii. Samples shall be 200 ± 5mm long.
- iii. Before the test the outside and inside diameters of the samples shall be measured as described in clause above.
- iv. The samples shall be compressed between two flat steel plates having minimum dimensions (100x200x15mm), the length 200mm being along the length of the sample. The sample shall be compressed at a rate of 15 ± 0.5mm/min and the load recorded at the vertical deflection equivalent to 5% of the average value of the original inside diameter of the sample.
- v. When reaching the deflection of 5%, the applied force shall be at least 450N
- vi. After the test there shall be no crack allowing the ingress of light or water between the inside and the outside.

- vii. The deflection is calculated with the inner dia meter but the measurement of the outside diameter may be sufficient. In case of doubt, it will be necessary to measure the inner diameter.

**b) IMPACT TEST**

- Twelve samples of the duct each  $200 \pm 5$  mm in length or fittings are subjected to an impact test as per IS: 14930 (Pt-II) by means of the apparatus shown Figure-1.
- The test apparatus shall be placed on a firm flat surface. The samples shall be conditioned in a cold chamber at a temperature of  $5 \pm 1^\circ\text{C}$  for 2h. The samples shall be removed from the cold chamber and placed on the vee block holder of the impact tester as shown in figure 1.
- The striker shall fall once on each sample. The time between removal of the sample from the cold chamber and completion of impact shall not exceed 10 seconds. The impact height and mass shall be as follows.

Nominal Size of Conduit	Mass of Striker (+1%/-0%)kg	Fall Height (+0%/-1%)(mm)	Energy Joules
Upto 60 mm	5	300	15
61 to 90 mm	5	400	20
91 to 140 mm	5	570	28
Above 140 mm	5	800	40

- The test sample shall be made on the weakest part of the Duct fittings except that it shall not be applied within 5 mm of any sample entry. Samples of ducts are tested on the center of their length
- After the test, at least in nine of the samples, there shall be no crack allowing the ingress of light or water between the inside and the outside.

**c) BENDING TEST**

- This test shall be carried out on pliable conduits.
- The test is made on six samples having an appropriate length as per IS: 14930 (Pt II). Three samples shall be tested at room temperature; the other three shall be tested at  $-5 \pm 1^\circ\text{C}$ . For the test at  $-5^\circ\text{C}$ , the sample shall be conditioned in a cold chamber for 2 hours. The test apparatus as shown in Figure-2 shall allow bending the duct with a bending radius equal to the minimum bending radius values specified by the manufacturer. One of the ends of the samples shall be fixed. The sample is then bent to approximately 90 degrees (right angle) and held.
- During the test, the sample shall not flatten. Compliance shall be checked by passing a ball having diameter equal to 95% minimum inner diameter of the sample declared by the manufacturer, through the sample whilst it is bent around the test apparatus.

**d) OXIDATION INDUCTION TEST PROCEDURE**

- A short length of completed duct (approximately 30 cm) shall be sealed at the end and placed in an oven at temperature of  $68 \pm 1^\circ\text{C}$  for 8 hours. The sample shall then be allowed to cool at room temperature for at least 16 hrs. The samples shall be clean and dry. The sample shall then be tested by means of a Differential Scanning Calorimeter (DSC) or by Differential Thermal Analyzer (DTA).
- Instrument Test Procedure:
  - ❖ Cell Cleaning: The cell shall be held at approximately  $400^\circ\text{C}$  for 10 minutes in Nitrogen. The cell shall be cleaned after standing over night and between testing of different formulations.
  - ❖ Temperature Calibration: This has to be done according to the instrument manual. The temperature scale should be adjusted until the determined melting point of pure Indium metal is  $156.6^\circ\text{C}$  at a heat rate of  $5^\circ\text{C}$  per minute or any other heat rate as indicated in the manual of the equipment is permitted.
  - ❖ Aluminum Pan Preparation: Standard aluminum DSC pans as per ASTM D 4565 are required to hold specimens during testing. A fresh pan shall be used for each test.
  - ❖ Sample preparation: Take the sample weighing about 5 mg from the duct conditioned as indicated above. Position the sample in the center of the pan.
  - ❖ Nitrogen Purge: Place the sample pan and reference pan in instrument cell. Flush for 5 minutes with cylinder of nitrogen (99.6% extra dry grade) at  $60 \pm 10$  cc per minute.
  - ❖ Oxidation Test: Rapidly increase the temperature of the sample ( $20^\circ\text{C}$  or minor greater) from  $100^\circ\text{C}$  or lower initial temperature to  $199 \pm 1^\circ\text{C}$ . After thermal equilibrium is obtained (steady recorder signal) switch to  $80 \pm 20$  cc per minute



oxygen flow and simultaneously start time-base recording. The oxygen used for the test should be equivalent to or better than 99.6% extra dry grade.

• **Induction Period:** The oxygen induction point shall be recorded as time zero, and the chart speed shall be sufficient to provide a clearly discernible loop at the start of the exothermic reaction. The test in the pure dry oxygen atmosphere shall continue until the exothermic peak is produced. The intersection of the tangent of the exothermic sloped line with the extended base line will be drawn. The time from time zero to this intersection point is read from the base line and recorded as the oxidative induction time.

**e) RESISTANCE OF LAME PROPAGATION TEST PROCEDURE**

- i. Samples of DWC HDPE Ducts shall be checked by applying 1KW flame.
- ii. A sample of length  $675 \pm 10$  mm is mounted vertically in a rectangular metal enclosure with one open face, as shown in Figure-3-2 in an area substantially free from draughts. The general arrangement is shown in Figure-3. Mounting is by means of two metal clamps approximately 25mm wide spaced  $550 \pm 10$  mm apart and approximately equal distance from the ends of the sample. A steel rod of  $16 \pm 0.1$  mm is passed through the sample. It is rigidly and independently mounted and clamped at upper end to maintain the sample in a straight and vertical position. The means of mounting is such as not to obstruct drops from falling on to the tissue paper. A suitable piece of white pine woodboard, approximately 10 mm thick, covered with single layer of white tissue paper is positioned on the lower surface of the enclosure.
- iii. The assembly of sample, rod and clamping apparatus is mounted vertically in the center of the enclosure, the upper extremity of the lower clamp being  $500 \pm 10$  mm above the internal allowed surface of the enclosure.
- iv. The burner is supported so that its axis is  $45 \pm 20^\circ$  to the vertical. The flame is applied to the samples so that the distance from the top of the burner tube to the sample measured along the axis of the flame is  $100 \pm 10$  mm and the axis of the flame intersects with the surface of the samples at a point  $100 \pm 5$  mm from the upper extremity of the lower clamp, and so that the axis of the flame intersects with the axis of the sample.
- v. The test is carried out on three samples. During the application of the flame, it shall not be moved except to remove it at the conclusion of the period of the test. After the conclusion of the test and after any burning of the sample has ceased, the surface of the sample is wiped clean by rubbing with a piece of cloth soaked with water.
- vi. All three samples shall pass the test. If the sample is not ignited by the flame, it shall be deemed to have passed the test.  
If the sample burns, or is consumed without burning, the sample shall be deemed to have passed the test if after burning has ceased, and after the sample has been wiped in accordance with 1.3 there is no evidence of burning or charring within 50mm of the lower extremity of the upper and also within 50mm of the upper extremity of the lower clamp.  
If the sample burns, it shall be deemed to have failed the test if combustion is still in progress 30 seconds after removal of the flame.  
If the tissue paper ignites, the sample shall be deemed to have failed the test. For the parts of the same below the burner, the presence of molten material on the internal or external surfaces shall not entail failure if the sample itself is not burned or charred.
- vii. Compliance of DWC HDPE Duct fittings is checked by using the glow wire test IS: 11000 (Part 2/Sec 1). The glow wire shall be applied once to each sample in the most unfavorable position of its intended use, with the surface tested in vertical position, at a temperature of  $750^\circ\text{C}$ . The sample is deemed to have passed this test if there is no visible flame or sustained glowing or inflames or glowing extinguishes within 30 seconds of removal of the glow wire.

**f) ANTI RODENT TEST PROCEDURE:**

The test against rodent may be conducted as per following procedures:

The ducts are to be laid underground in fields and also near urban or rural settlements. Therefore, they should be exposed to 3-4 most predominant rodent species inhabiting these locations. The test rodent species may include the lesser bandi cootrat, Bandi cotabengalensis, The Indian gerbils, tatera indica, the soft furred field rats, Millar diamelt ada and the house rats, Rattus rattus.

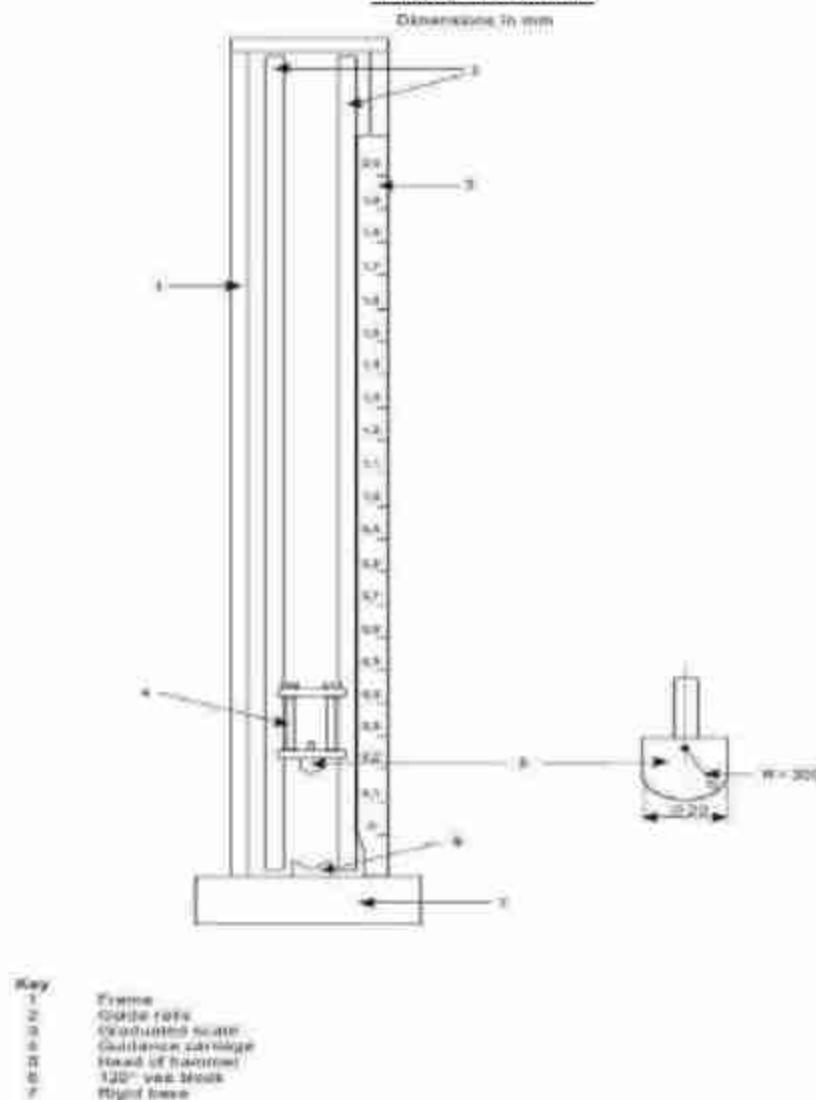
The test ducts should be exposed to the serodent species housed individually in iron mesh cages under laboratory conditions. Only freshly capture rodent are to be utilized for the study. The rodent sare first acclimatized in laboratory cages for 7-10 days and then the tests be initiated. For each trial, 3-4 rodents of uniform body weight are to be used for the trial. Two different types of testes may be under taken for all the ducts.

**Choice Tests:** In this trial the ducts of 15-30 cm length (ones ample each of treated and untreated/ control sample) are exposed to the test rodents along with food, thus the roden thada choice between the food and the test duct. This test may be run for longer periods (30-45 days). Tap water should be provided ad libitum to the rodents.

**NO Choice Test:** The rodents are exposed to the test ducts only and no food is given to the rodents during the period of trial. The test ducts (one sample each of treated and untreated/control sample) are to the exposed to the test rodents. This trail maybe run for 5-7 days depending upon the health status of starved test rodents. Tap water should be providing dad labium other rodents.

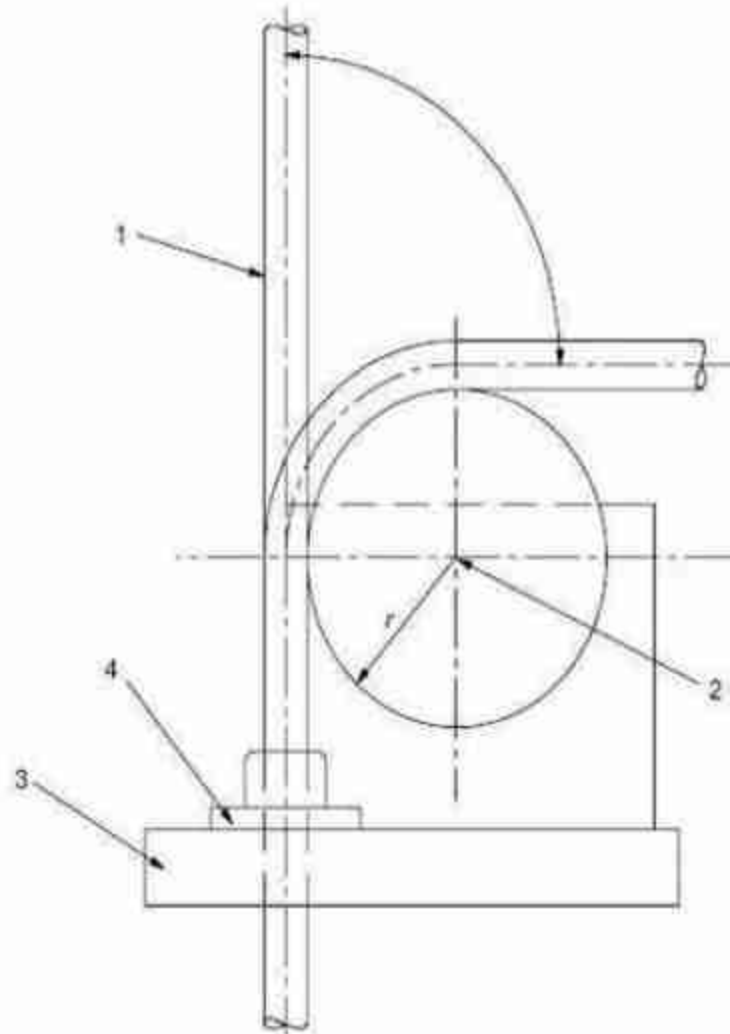
Observation on tooth marks, rodent behavior toward exposed ducts, and relative extent of damage in treated and untreated samples should be computed for both types of ducts. Health status of test animals in choice and no choice test must also be monitored for their cordanyill effect of exposure of treated/ control ducts on these animals. Number of cases and the extent of rodent bites/scratch marks in control and anti-rodent treated ducts may indicate the relative deterrent/repellent properties of the test ducts.

FIGURE-1  
IMPACT APPRATUS



NOTE: This drawing is not intended to govern design except as regards the dimensions shown.

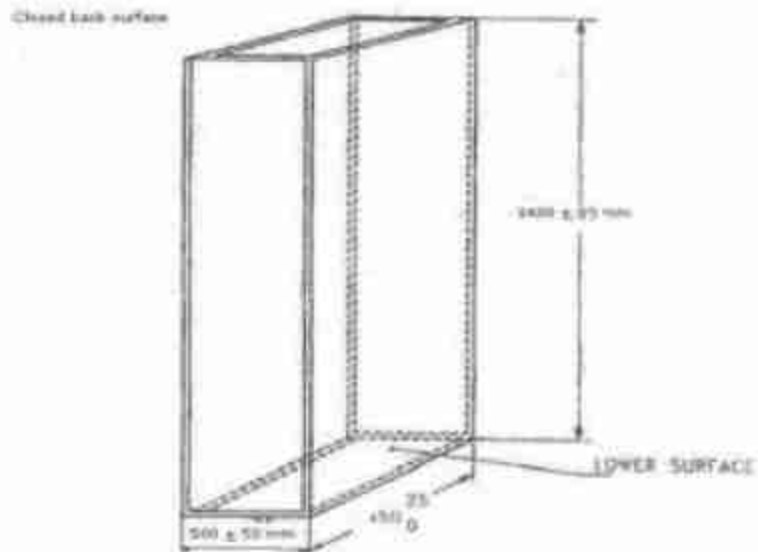
FIGURE- 2  
BENDING TEST APPARATUS



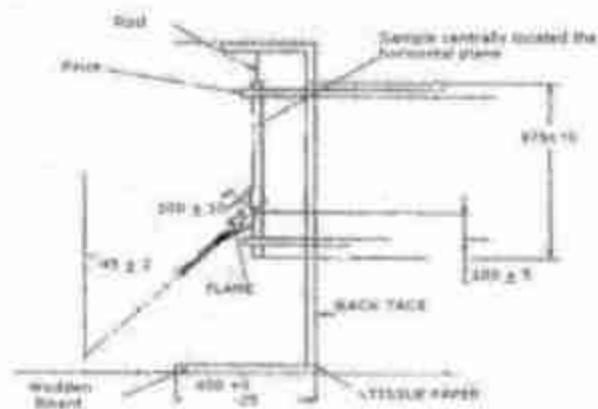
**Key**

- 1 Sample
- 2 Centre of bending cylinder
- 3 Support
- 4 Guide for conduit

## RESISTANCE TO FLAME PROPAGATION TEST APPARATUS



Note: - This drawing is not intended to govern design  
ENCLOSURE FOR BURNING TEST



Note: - This drawing is not intended to govern design except as regards the dimension shown  
ARRANGEMENT FOR BURNING TEST

### **GTP OF HDPE PIPES**

SR.	DESCRIPTION / PARAMETERS	OFFERED BY THE BIDDER
1	Make	
2	Applicable Standard	
3	Grade	
4	Pressure rating (Kg/Sqcm.)	
5	Outside Diameter (mm)	
6	Inside Diameter (mm)	
7	Recommended For (Mention Maximum Armoured cable Type and Size)	

**TECHNICAL SPECIFICATIONS FOR 1 PHASE L.T. DISTRIBUTION BOX FOR  
AERIAL BUNCHED CABLE**

**1 SCOPE:-**

- a) The Specification covers the design, manufacture and testing of Moulded Distribution Box to provide service connection to LT Line Consumers through over head ABC line.
- b) The LT Distribution Box should be suitable for Outdoor use and will be installed at the poles.
- c) The Distribution box should be anti corrosive, dust proof, rust proof, shock proof, vermin proof, U.V. stabilized and flame retardant property. Base door or other joint should not bend or soften on heating so as to ensure tamper proof construction.
- d) The Distribution box should not melt at high temperature.
- e) The body of box should be single piece moulded without any construction joint. Door will also single piece moulded in one door or double door construction as per specific requirement.

**2 MATERIAL OF DISTRIBUTION BOX:**

- a) Material of construction of distribution Box shall be THERMOSETTING PLASTIC i.e. Glass Fiber Reinforced Polyester Sheet Moulding Compound (SMC) as per IS: 13410-1992 and conforming to the requirements of this specification/GIP.
- b) Material of box should withstand temperature rise, hot spot temperature and occasional arcing bas box.
- c) All other MS part should be anti corrosive treated.

**3 CONSTRUCTION:**

- a) Distribution box shall comprise of SMC moulded base and SMC moulded door of in single piece moulded construction without fabrication joints.
- b) Concealed hinges should fix the base and cover, with hardware from inside in such a manner that it can't be manipulated from outside.
- c) The door in closed position should be overlapped on base such that direct entry of screwdriver, tool or rod is not possible.
- d) Wall mounting holes should be made.



8 **GUARANTEED TECHNICAL PARTICULARS:** Given in the enclosed Annex-II.

9 **TESTING**

One sample selected from first lot should be tested at Govt. approved independent test house for compliance of performance parameters as given in GTP including Material identification to be carried out by CIPET/IR Spectrometry. The test report should be submitted to purchaser before completion or order.

Inspection of each lot, sampling plans for test: 1 nos. selected randomly from Lot for testing at works.

Sr. No	Test requirement of Meter Box	Reference Standards
(a)	Marking	IS: 14772
(b)	Dimensions and construction	-D0-
(c)	Heat Deflection Temperature (Min. 150°C)	IS:13411/ISO 75-III
(d)	Spirit Burner Test (Self Extinguishing)	IS:4249
(e)	Melting Point (Does Not Melt Test up to 250°C)	IS:13360 part 6 Sec 10, 1992 Section 1 method 'A' Capillary Tube Method

10 **SPECIFIC REQUIREMENT:**

Thickness of SMC Box	-	3 mm (Min)
Dimension	-	390(H)x225(W)x140(D) mm.
No. of doors	-	Single door hinged type

**GUARANTEED TECHNICAL PARTICULARS FOR  
SINGLE PHASE L.T. DISTRIBUTION BOX**

ANX-II

Sl.No	Particular	Detailed Particulars	Offered
1.	Material	Thermosetting Plastic	
2.	Grade of Material	SMC IS: 13410	
3.	Thickness of Box	3 mm	
4.	<b>Properties of Material of Construction of Box</b>		
a)	Heat Deflection Temp. (Ref Standard IS: 13411/ISO 75-II)	150 °C (Minimum)	
b)	Exposure to flame (Ref. Standard IS: 4249)	Self Extinguishing	
c)	Melting Point (Test up to 250° C) IS: 13360 part 6 Sec 10, 1992 Section 1 method 'A' Capillary Tube Method	Does Not Melt	
d)	Temper Proof	Box could not be tempered thru Hot Soldering Iron	
5.	<b>Dimensions of Box</b>	Refer Drawing	
a)	Height	390 mm	
b)	Width	225 mm	
c)	Depth	140 mm	
6.	<b>Earthing Arrangement</b>		
a)	No of earth bolts	1 Nos.	
b)	Material of earthing bolt	MSZP	
c)	Dia. & length of bolts	M6 X 25	
7.	Sealing Arrangement	02 No. on door	
8.	Facility of locking	Hole for locking arrangement	
9.	Colour of box	Off white	
10.	<b>Cable Entry and Exit Arrangement</b>		
a)	Incoming	Ø 25 PVC gland at bottom 2 Nos	
b)	Outgoing	Ø 10 holes with rubber grommet 6 nos (3 Nos. on each side)	
11.	<b>Bus Bars</b>		
a)	Bus Bars MoC	Aluminium	
b)	Phase & Neutral Bus bar Size	25 x 6 mm, 235 mm long (P.N)	
c)	No. of connection on each Bus Bar	O/G 6 Nos. service connection I/C: 1 no.	
d)	Connection arrangement	As per drawing	
12.	<b>Clearances</b>		
a)	Bus Bar & Box wall	Min 50 mm on sides/wall and 50 mm from Top and Bottom	
b)	Between Bus Bars	Min 40 mm	
13.	<b>Bus Bar Mounting arrangement</b>		
a)	Arrangement	Stepped mounting	
b)	Bus Bar mounting	SMC Step mounting	
14.	<b>Pole Mounting Arrangement</b>		
	Back strips for pole/wall structure mounting	25 x 3 mm, Zinc passivated MS flats with hole for 12 mm dia bolts	



## **TECHNICAL SPECIFICATIONS FOR 3 PHASE L.T. DISTRIBUTION BOX FOR AERIAL BUNCHED CABLE**

### **1 SCOPE:-**

- a) The Specification covers the design, manufacture and testing of Moulded Distribution Box to provide service connection to LT Line Consumers through over head ABC line.
- b) The LT Distribution Box should be suitable for Outdoor use and will be installed at the poles.
- c) The Distribution box should be anti corrosive, dust proof , rust proof, shock proof, vermin proof, U.V. stabilized and flame retardant property. Base door or other joint should not bend or soften on heating so as to ensure tamper proof construction.
- d) The Distribution box should not melt at high temperature. .
- e) The body of box should be single piece moulded without any construction joint. Door will also single piece moulded in one door or double door construction as per specific requirement.

### **2 MATERIAL OF DISTRIBUTION BOX:**

- a) Material of construction of distribution Box shall be THERMOSETTING PLASTIC i.e. Glass Fiber Reinforced Polyester Sheet Moulding Compound (SMC) as per IS: 13410 –1992 and confirming to the requirements of this specification/GTP.
- b) Material of box should withstand temperature rise, hot spot temperature and occasional arcing bas box.
- c) All other MS part should be anti corrosive treated.

### **3 CONSTRUCTION:**

- a) Distribution box shall comprise of SMC moulded base and SMC moulded door of in single piece moulded construction without fabrication joints.
- b) Concealed hinges should fix the base and cover, with hardware from inside in such a manner that it can't be manipulated from outside.
- c) The door in closed position should be overlapped on base such that direct entry of screwdriver, tool or rod is not possible.
- d) Wall mounting holes should be made.
- e) Provision of wire seal should be made.

- f) Cable entry holes should be provided PVC Plug.
- g) Earthing bolt shall be provided as shown in drawing.
- h) All the corners of the meter box should be round.
- i) The box should have sealing as well as pad locking arrangement.

#### **4 DESIGN:**

a) The Distribution Box shall have 3 Phase Bus bars of EC grade Aluminium of size 25x6x300 mm long and natural bus bar shall be of size 40x6x300 mm. The Bus bars shall be provided with colour coding for identification. Each Bus bar shall be provided with facility of cable termination as under:-

- i) Incoming : 1 No lead per phase, thus 4 polymeric gland of 25 mm dia at bottom.
- ii) Outgoing : Twelve leads per phase, thus 12 nos. 10 mm dia holes with rubber gromets i.e. 6 holes on each Side wall with rubber covers.
- b) To facilitate easy working on termination on bus bar, the arrangement for termination of each lead should be have 6 mm dia holes duly fitted with M 6 x 20 screw, 1 custom designed Aluminum palm washer, 1 washer, 1 spring washer and 1 fly nut as shown in drawing.
- c) In order to restrict entry of tool from unused (cable entry) holes, partition plate should be provided between wall of the box and bus bar system. The service wire/cables will be taken from entry hole, suitably bent and taken to bus bar and finally the wire/cable shall be terminated and lightened using fly nut.
- d) The assembly of four nos. Al. Busbars shall be mounted on one SMC Step mounting arrangement. The mounting arrangement of Bus bars shall be such that minimum clearance of 50 adequate space for working as well as bending of wires . Also there should be minimum clearance of 40 mm between each bus bar so as take care of clearance and creepage distance requirements in line with IS 13947.
- e) The dimension of box shall be 450x375x200 mm. Thickness of box shall be 3 mm.

#### **5 COLOUR :**

The colour of box shall be Off White such that it does not absorb heat of solar radiation. Reprocessible plastics and of dark colour will not be acceptable.

#### **6 MAKING:**

Each Box shall be legible marked as under <MVVNL PROPERTY=

- 1. Manufacturer's name
- 2. Danger Logo

#### **7 DRAWING:** Refer to enclosed drawing (Annex-I)

#### **8 GUARANTEED TECHNICAL PARTICULARS:** Given in the enclosed Annex-II.



## 9 TESTING

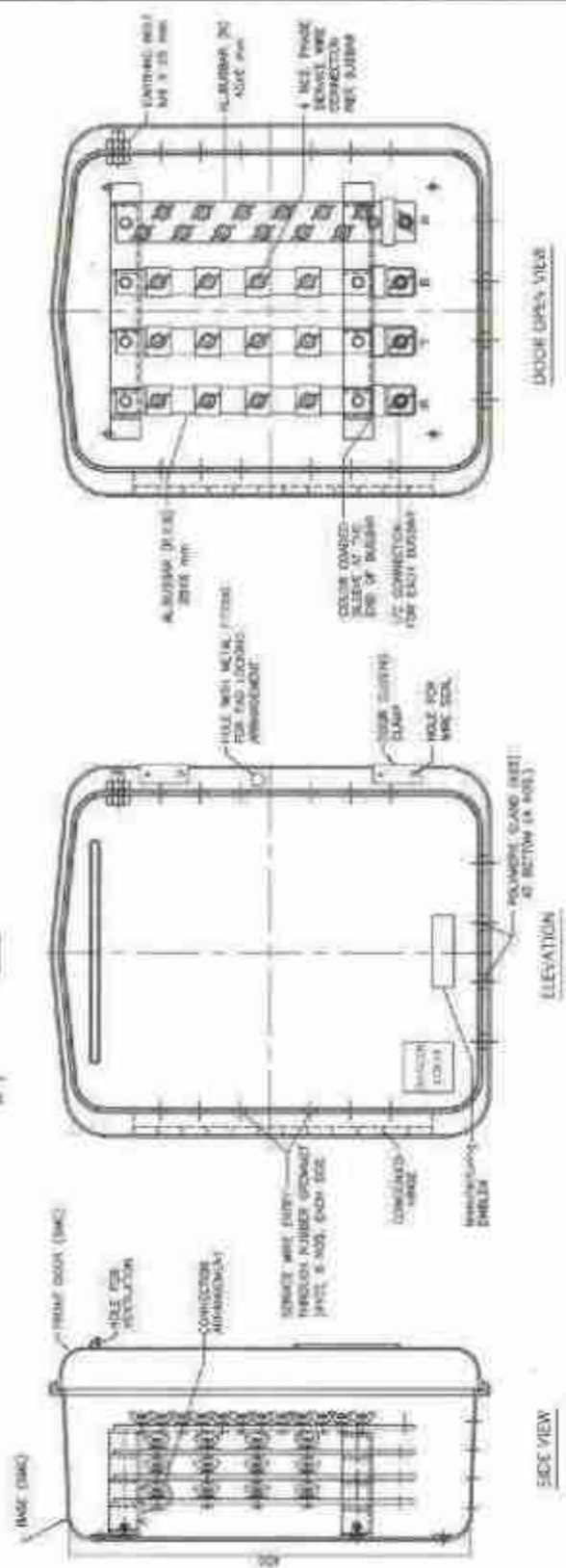
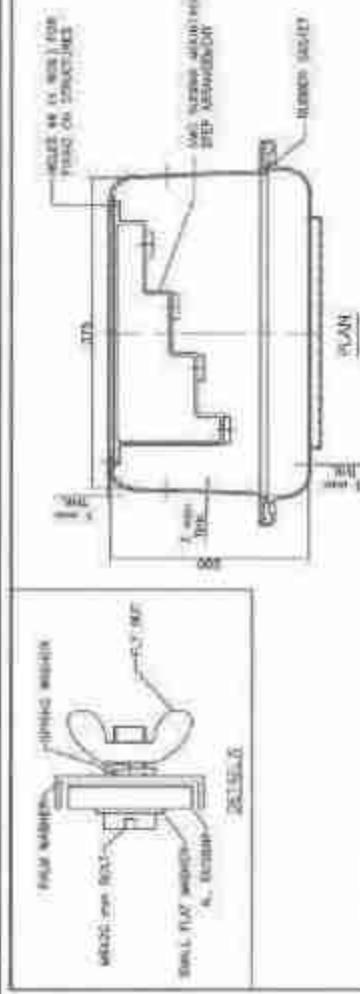
One sample selected from first lot should be tested at Govt. approved independent test house for compliance of performance parameters as given in GTP including Material identification to be carried out by CIPET/IR Spectrometry. The test report should be submitted to purchaser before completion of order. Inspection of each lot, sampling plans for test: 1 nos. selected randomly from Lot for testing at works.

Sl. No.	Test Requirement of Meter Box	Reference Standards
a	Marking	IS: 14772
b	Dimensions and construction	-D0-
c	Heat Deflection Temperature (Min. 150°C)	IS:13411
d	Spirit Burner Test (Self Extinguishing) IS:4249	IS:13360 part 6 Sec 10, 1992 Section 1 method „A“ Capillary Tube Method
e	Melting Point (Does Not Melt Test up to 250°C)	

## 10 SPECIFIC REQUIREMENT:

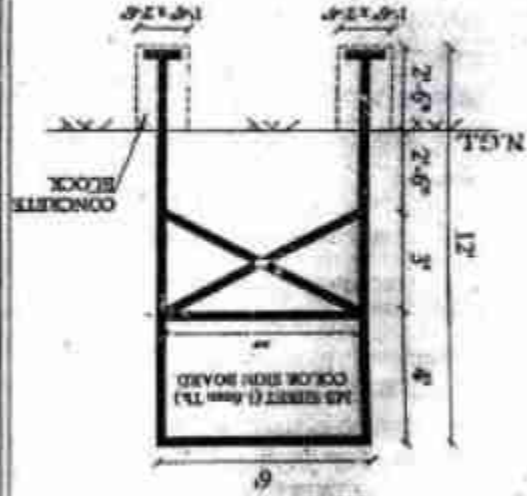
Thickness of SMC Box	-	3 mm (Min)
Dimension	-	450 (H)x375(W)x200(D) mm.
No. of doors	-	Single door hinged type

- NOTES :-
- (1) MADE OUT OF (THERMOSETTING PLASTIC) SHEET Moulding COMPOUND BY THE PROCESS OF HOT PRESS COMPRESSION Moulding conforming to IS : 13410.
  - (2) SMC BASE OR DOOR SHALL NOT SOFTEN OR BEND ON HEATING.
  - (3) DOOR FITTED TO BASE BY CONCEALED HINGES WITH DOOR CLOSING CLAMP.
  - (4) DIMENSIONS  
INCHES :- H=450mm, W=375mm, D=200mm.
  - (5) COLOUR :- OFF WHITE

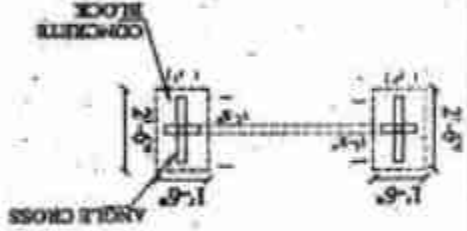


(3 of 1 = DISCREET FIRST BLOCK)

## ELEVATION OF SIGN BOARD



### PLAN OF FOUNDATION



Specification for village sign board

S.No.	Components	Desired Specification
1	Iron sheet	MS sheet 14 Gauge(1.6mm thickness)
2	Size of Iron sheet	5 Feet x 4 Feet (Length x Breadth)
4	Painting on Board	Enamel paint with red oxide base coat
5	Printing on Board	Colour printing by Screen printing method
6	Height of Board from ground level (Between ground level and bottom part of board)	6 feet
7	Support L type angle	3" X 3", 6 mm thickness
8	Length of angle to be buried in the ground	1.50 feet with 1 Feet hole pass inside

2060 / Daspo / Sambhogya / REC Corer  
dt - 24-07-18.

## 8. LT Aerial Bunched Cables

(APPLICABLE FOR LT AB CABLE WITH XLPE INSULATION ONLY)

### 1. SCOPE:

This specification covers XLPE insulated Aluminum cable twisted over a central bare Aluminum Alloy messenger wire for use of L.T. Over-Headlines in Rural Electrification System. The Aerial Bunched cable and messenger wire should be confirming to IS (as per latest amendment if any).

(Sizes: of the cable)
1X16 (Ph) + 1X25 (bare messenger cum neutral) SQ. MM.
1X16 (Ph) + 1X25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ. MM.
3X16(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
3 X 16(Ph) + 1x25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ. MM.
1X25(Ph)+1x25 (bare messenger cum neutral) SQ. MM.
1X25(Ph) + 1X25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ. MM.
3X25(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
3 X 25(Ph) + 1x25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ. MM.
1X35(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
1x35(Ph) + 1X25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ. MM.
3X35(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
3X35 (Ph) + 1x25 (bare messenger cum neutral)+ 1x16 (insulated Street lighting) SQ. MM.
3X50(Ph)+1X35 (bare messenger cum neutral) SQ. MM.
3X50 (Ph)+1x35 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ. MM.
3X95(Ph)+1X70 (bare messenger cum neutral) SQ. MM.
3X95(Ph)+1X70 (bare messenger cum neutral) SQ. MM.+1x16 (insulated Street lighting) SQ. MM.

### 2. RATED VOLTAGE:

The rated voltage of the AB cables shall be 1100 volts

### 3. APPLICABLE STANDARDS:

Unless otherwise stipulated in this specification the following Standards shall be applicable.

- IS – 14255/1995 : ABC cables 1100 volts.
- IS – 8130/1984 : Conductors for insulated cables.
- IS – 398/Pt.IV/1994: Aluminium alloy conductor.
- IS – 10418/1982 : Drums for electric cables

### 4. GENERAL:



The AB cable covered under this specification should be suitable for use on three phase, 4 wire earthed system for working voltage up to 1100 V. It should confirm the relevant standards stated above and others if applicable.

The phase conductor shall be 125 mm<sup>2</sup>, 95 mm<sup>2</sup> and 50 mm<sup>2</sup>, 35 mm, 25 mm<sup>2</sup> and 16 mm<sup>2</sup> XLPE insulated and the messenger-cum-neutral conductor of sizes 70 mm<sup>2</sup>, 35 mm<sup>2</sup> and 25 mm<sup>2</sup> shall be bare heat treated aluminium- magnesium-silicon alloy wires containing 0.5% magnesium and approximately 0.5% silicon confirming to IS: 398 (Part-IV):1979 and its latest amendment, if any.

## 5. PHASE CONDUCTORS:

5.1 The phase & street lighting conductor shall be provided cross linked poly ethylene insulation applied by extrusion. The thickness of insulation shall not be less than 1.2 mm up to 35mm<sup>2</sup> and shall not be less than 1.5 mm for above 35mm<sup>2</sup> at any point and insulation shall be so applied that it fits closely on the conductor and it shall be possible to remove it without damaging the conductor. The insulated conductors shall generally conform to the standards IS-14255:1995.

5.2 The phase conductors shall be provided with one, two & three bridges for easy identification.

5.3 The tensile strength of the aluminium wire used in the conductor shall not be less 90 N/mm<sup>2</sup>.

5.4 The standard size and technical characteristics of the phase conductors shall be as shown in the Table-1.

**TABLE-I**

Nominal Sectional area in mm <sup>2</sup>	No. of Strands	Diameter of Compacted conductor in mm	Approx. Mass Kg/KMs.	Max. DC Resistance at 20°C (Ohm/km)	Insulation Thickness in mm
1	2	3	4	5	6
16	7	4.4	42	1.91	1.2
25	7	5.6	65	1.20	1.2
35	7	6.7	95	0.868	1.2
50	7	8.0	127	0.641	1.5
95	19	11.0	266	0.320	1.5

NOTE: 1) The resistance values given in col.5 are the max. permissible.

Tolerance of + 5% is allowable on dimension.

## 6. MESSENGER-CUM-NEUTRAL WIRE:

6.1 The bare messenger wire shall be of aluminium alloy generally confirming to IS-398:Pt IV/94 composed of 7 strands and shall be suitable compacted or stranded to have smooth round surface to avoid damages to the overall insulation of phase & neutral conductor twisted around the messenger. There shall be no joint in any wire of the stranded messenger Conductor except these made in the base rod or wires before final drawing.

6.2 The sizes and other technical characteristics of the messenger wire shall be as given in the Table No 2.

**TABLE -2**

Nominal Sectional Area in mm <sup>2</sup>	No. of strands	Diameter of Compacted conductor in mm	Diameter of Stranded conductor in mm	Approx. Mass Kgs/KMs	Max. DC Resistance
1	2	3	4	5	6
25	7	5.6	6.42	65	1.380
35	7	6.7	7.56	95	0.986
70	7	9.4	10.65	196	0.492

NOTE: while limiting values in col. 3 is to be guaranteed a tolerance of + 5% will be permissible.

## 7. XLPE INSULATION:

The insulation shall generally conform to IS-14255

Sr.No.	Property	Requirement
1	Tensile Strength	12.5 N / mm <sup>2</sup> Min
2	Elongation at break	200 % Min.
3	Ageing in air over	
a	Treatment: Temperature & duration	135 ± 3°C & 7 days
b	Tensile strength variation	± 25% Max.
c4	Elongation variation Hot Set	± 25% Max.
a	Treatment temperature, Time Under load, mechanical stresses	200 ± 3°C, 15 minutes 20 N / cm <sup>2</sup> .
b	Elongation under load	175 % max.
c	Permanent elongation (set) after cooling	15 % Max
5	Shrinkage	
a	Treatment temperature duration	130 ± 3°C For 1 hour
Sr.No.	Property	Requirement
b	Shrinkage	4% Max
6	Water absorption (Gravimetric)	
a	Treatment- Temp.	85 ± 2°C
	Duration	14 days
b	Water absorbed	1 mg. / cm <sup>2</sup> max.

**8. TYPE TEST:****A. Test for Phase/Street Light Conductors**

- (iv) Tensile Test (IS-8130)
- (v) Wrapping Test (IS-8130)
- (vi) Conductor Resistance Test (IS-8130)

**B. Test for Messenger:**

- (i) Breaking load test (to be made on finished conductor) -(IS-398/ Pt.IV/ 1994 with latest revision)
- (ii) Elongation test (IS - 398 / Pt.IV/1994)
- (iii) Resistance test (IS - 398 / Pt. IV /1994)
- (iv) If insulated , the test of insulation as per relevant IS will be applicable

**C. Physical test for XLPE insulation**

- (v) Tensile strength and Elongation at break
- (vi) Ageing in air oven
- (vii) Hot set test
- (viii) Shrinkage test
- (ix) Water absorption (Gravimetric)
- (x) Carbon black 1. Content & 2. Dispersion

**D. Test for thickness of insulation****E. Insulation Resistance (Volume Resistivity ) Test****F. High Voltage Test**

Note: The Manufacturer should submit the entire above type test of Govt. of India's approved

Laboratory along with their offer.

**Optional Test:**

Bending test on the completed cable:

Bending test shall be performed on a sample of complete cable. The sample shall be bent around a test mandrel at room temperature for at least one

complete turn. It shall then be unwound and the process shall be repeated after turning the sample around its axis 180°. The cycle of this operation shall be then repeated twice.

The diameter of mandrel

shall be  $10(D+d)$ . Where

D = Actual diameter of cable (i.e. the min. circumscribing diameter in mm)

d = Actual diameter of the phase conductor in mm

No cracks visible to the naked eye are allowed.

#### 9. ACCEPTANCE TESTS:

Tests for Phase / Street Light Conductors:

- a. Tensile test (for Phase / Street light conductor)
- b. Wrapping test (for Phase / Street light conductor)
- c. Breaking load test for messenger conductor
- d. Elongation test for messenger conductor
- e. Conductor Resistance test
- f. Test for thickness of insulation
- g. Tensile strength and elongation at break test
- h. Hot set test ( For XLPE insulation)
- i. Insulation Resistance test
- j. High voltage test

#### 10. PACKING MARKING:

10.1 The LT AB cable shall be wound in nonreturnable drums conforming to IS-10418/1982 <Specification for Reels and Drums for bare wire> of the latest version thereof. The drums shall be marked with the following:

- a) Manufacturers name
- b) Trade mark if any
- c) Drum number
- d) Size of Conductor
- e) Size of Messenger

- f) Voltage grade
- g) Number of lengths of pieces of Cable in each drum
- h) Gross mass of the packing
- i) Net mass of Cable
- j) ISI mark

10.2 The drums shall be of such a construction as to assure delivery of conductor in field free from displacement and damage and should be able to withstand all stresses due to handling and the stringing operation so that cable surface not dented, scratched or damaged in any way during transport and erection. The cable shall be properly lugged on the drums

10.3 The cable drums should be suitable for wheel mounting.

#### 11. STANDARD LENGTH:

The standard length of drum will be 500 meter with  $\pm 5\%$

#### Non-standard Length:

Nonstandard length not less than 50% of the standard length shall be accepted to the extent of 10% of the ordered quantity.

#### 12. INSPECTION:

All tests and inspections shall be made at the place of manufacturer unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification.

#### 13. EXPERIENCE:

The manufacturer must have some experience of manufacturer and supply of this cable to any Electricity Board. Copy of order executed and performance report may be submitted along with the offer.

#### 14. TYPE TEST CERTIFICATES:

The duly attested copy of Type Test Certificate of the offered sizes of AB cable, as per IS: 14255/1995 with latest amendment/revision be submitted from any Govt. laboratory or from a NABL accredited laboratory along with the offer. Type Test Certificate shall not be more than Five Years Old from Date of supply.

However, if the same are not available at the time of bidding, the same may be submitted after order but before commencement of supply.

In case, the bidder is not able to submit the Type Test Certificate from any Govt. laboratory or from a NABL accredited laboratory for any size of cable,



the same shall be conducted by the bidder free of cost without any additional financial liability on utility. For this purpose, Type test Report of a phase wire or messenger wire once tested shall be accepted for all other combination. For example, if 1x16

+ 25 sq mm and 3x35 + 25 sq mm already tested then this will be valid for 3x16+25 sq mm (as phase wire of 16 sq mm and messenger wire of 25 sq mm are already tested) and for 3x35 + 25 sq mm + 16 sq mm (as phase wire of 35 & 16 sq mm and messenger wire of 25 sq mm are already tested).

#### 15. SUBMISSION OF ISI LICENSE FOR ISI4255:1995

The Manufacturer are required to submit duly attested photo copy of the valid ISI License up to the date of delivery for supply of these AB cables/wires and they should also submit GTP failing which, the offer would be ignored.

#### 16. IMPORTANT:

In absence of valid ISI License/GTP duly filled in/and copy of type test certificate of Govt. approved Laboratory, duly attested by authorized person, offer will be liable to be ignored without any further correspondence.

#### 17. ISIMARKING:

The material supplied shall be conforming to Indian Standard Specification and also with ISI marking as applicable and even after inspection of the lot, if the materials received at site is found without ISI marking, the lot shall be rejected and no further correspondence shall be entertained in this regard.

Exact details of marking/embossing, color of outer sheath etc. will be as per the detailed purchase order.

#### GUARANTEED TECHNICAL PARTICULARS (G.T.P.)

Technical information and Guaranteed Technical Particulars (G.T.P.) for LT Aerial Bunched Cable (XLPE insulated only) of sizes:

1X16 (Ph) + 1X25 (bare messenger cum neutral) SQ. MM.
1X16 (Ph) + 1X25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ.MM.
3X16(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
3 X 16(Ph)+1x25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ.MM.
1X25(Ph)+1x25 (bare messenger cum neutral) SQ. MM.
1X25(Ph) + 1X25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ.MM.
3X25(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
3 X 25(Ph)+1x25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ.MM.
1X35(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
1x35(Ph) + 1X25 (bare messenger cum neutral) + 1x16 (insulated Street lighting) SQ.MM.
3X35(Ph)+1X25 (bare messenger cum neutral) SQ. MM.
3X35 (Ph) + 1x25 (bare messenger cum neutral)+ 1x16 (insulated Street lighting) SQ.MM.
3X50(Ph)+1X35 (bare messenger cum neutral) SQ. MM.
3X50 (Ph)+1x35 (bare messenger cum neutral) +1x16 (insulated Street lighting) SQ. MM.

3X95(Ph)+1X70 (bare messenger cum neutral) SQ. MM.

3X95(Ph)+1X70 (bare messenger cum neutral) SQ. MM.+1x16 (insulated Streetlighting)SQ. MM.

**PART – A****Manufacturer has to confirm following important requirements:**

Sr. No.	Particulars	confirmation
1	AB Cable shall be manufactured and supplied Confirming to IS: 14255/1995 with latest Amendment if any	Yes
2	Cable drums/label shall bear ISI Mark	Yes
3	ISI License shall remain valid till order is Completed	Yes
4	Colour of XLPE Insulation – Black	
4a	1X16 + 1X25 SQ. MM.	Yes
4b	1X16 + 1X25 + 1x16 SQ. MM.	Yes
4c	3X16+1X25 SQ. MM.	Yes
4d	3 X 16+1x25 + 1x16 SQ. MM.	Yes
4e	1X25+1x25 SQ. MM.	Yes
4f	1X25 + 1X25 + 1x16 SQ. MM.	Yes
4g	3X25+1X25 SQ. MM.	Yes
4h	3 X 25+1x25 + 1x16 SQ. MM.	Yes
4i	1X35+1X25 SQ. MM.	Yes
4j	1x35 + 1X25 + 1x16 SQ. MM.	Yes
4k	3X35+1X25 SQ. MM.	Yes
4l	3X35 + 1x25 + 1x16 SQ. MM.	Yes
4m	3X50+1X35 SQ. MM.	Yes
4n	3X50 +1x35 +1x16 SQ. MM.	Yes
4o	3X95+1X70 SQ. MM.	Yes
4p	3X95+1X70 +1x16 SQ. MM.	Yes
5	Shape – compacted	Yes
6	Standard length in case 500 mtrs+ 5 % tolerance longer length acceptable	Yes
7	Non-Standard length 50% of Std. length up to 10% of ordered quantity	Yes
8	Packing shall contain only one Length.	Yes
9	Packing material: Wooden drums as per IS: 10418/1982 duly painted	Yes
9a	1X16 + 1X25 SQ. MM.	Yes
9b	1X16 + 1X25 + 1x16 SQ. MM.	Yes
9c	3X16+1X25 SQ. MM.	Yes

## PVVNL-RDSS

9d	3 X 16 + 1x25 + 1x16 SQ. MM.	Yes
9e	1X25+1x25 SQ. MM.	Yes
9f	1X25 + 1X25 + 1x16 SQ. MM.	Yes
9g	3X25+1X25 SQ. MM.	Yes
9h	3 X 25 + 1x25 + 1x16 SQ. MM.	Yes
9i	1X35+1X25 SQ. MM.	Yes
9j	1x35 + 1X25 + 1x16 SQ. MM.	Yes
9k	3X35+1X25 SQ. MM.	Yes
9l	3X35 + 1x25 + 1x16 SQ. MM.	Yes
9m	3X50+1X35 SQ. MM.	Yes
9n	3X50 + 1x35 + 1x16 SQ. MM.	Yes
9o	3X95+1X70 SQ. MM.	Yes
9p	3X95+1X70 + 1x16 SQ. MM.	Yes
10	Following shall be embossed on cable & Marking on drum shall be as per IS: 14255/1995	Yes
10a	Purchaser (Employee)	Yes
10b	1100 Volts	Yes
10c	IS:14255/1995	Yes
10d	Year of manufacture	Yes
10e	Trade Mark	Yes
11	Conductor –	
11a	For Phase 16 mm <sup>2</sup> , 25 mm <sup>2</sup> , 35 mm <sup>2</sup> , 50 mm <sup>2</sup> & 95 mm <sup>2</sup> Aluminium as per IS 8130/1984	Yes
11b	For Messenger wire 25 mm <sup>2</sup> , 35 mm <sup>2</sup> & 70 mm <sup>2</sup> Aluminium Alloy as per IS 398/Pt.IV/1994	Yes
12	Maximum Conductor resistance at 20°C For Phase Conductor	
12a	16 mm <sup>2</sup> Conductor – 1.91 Ohm/KM	Yes
12b	25 mm <sup>2</sup> Conductor – 1.20 Ohm/KM	Yes
12c	35 mm <sup>2</sup> Conductor – 0.868 Ohm/KM	Yes
12d	50 mm <sup>2</sup> Conductor – 0.641 Ohm/KM	Yes
12e	95 mm <sup>2</sup> Conductor – 0.320 Ohm/KM	Yes
	For messenger conductor	
12e	25 mm <sup>2</sup> Conductor – 1.380 Ohm/KM	Yes
12f	35 mm <sup>2</sup> Conductor – 0.986 Ohm/KM	Yes
12g	70 mm <sup>2</sup> Conductor – 0.492 Ohm/KM	Yes
13	Minimum average XLPE Insulation thickness for AB Cable	
13a	16 mm <sup>2</sup> – 1.2 mm	Yes
13b	25 mm <sup>2</sup> – 1.2 mm	Yes
13c	35 mm <sup>2</sup> – 1.2 mm	Yes
13d	50 mm <sup>2</sup> – 1.5 mm	Yes

PVVNL-RDSS

13f	95 mm <sup>2</sup> – 1.5 mm	Yes
14	Volume resistivity of insulation	
14a	At 27°C – $1 \times 10^{13}$ Ohm-cm. Min	Yes
14b	At 70°C – $1 \times 10^{11}$ Ohm-cm. Min	Yes
15	Tensile strength of Insulation & sheath –12.5 N/mm <sup>2</sup> Min.	Yes
16	Elongation at break of Insulation and Sheath –200% Min.	Yes
17	Overall tolerance in supply of ordered total quantity shall be + 2 % ( Plus and minus two %)	Yes

**PART-B**

Manufacturer has to furnish below details about material for information:

Sr. No.	Particulars				confirmation
1	ISI License for IS:14255/1995				Yes
1a	Number				
1b	Date of expiry				
2	Approximate weight of 1000 meters length (Weight in Kgs.)				
2a	Size of cable	Alum.	Alu. Alloy	XLPE	Total
	1X16 + 1X25 SQ. MM.				
	1X16 + 1X25 + 1X16 SQ. MM.				
	3X16+1X25 SQ. MM.				
	3 X 16 +1x25 + 1x16 SQ. MM.				
	1X25+1X25 SQ. MM.				
	1X25 + 1X25 + 1X16 SQ. MM.				
	3X25+1X25 SQ. MM.				
	3 X 25 +1x25 + 1x16 SQ. MM.				
	1X35+1X25 SQ. MM.				
	1x35 + 1X25 + 1x16 SQ. MM.				
	3X35+1X25 SQ. MM.				
	3X35 + 1x25 + 1x16 SQ. MM.				
	3X50+1X35 SQ. MM.				
	3X50 +1x35 +1x16 SQ. MM.				
	3X95+1X70 SQ. MM.				
	3X95+1X70 +1x16 SQ. MM.				
3	Cable Conductor, Circular Compacted?				Yes

**PART – C (ENCLOSURES)**

Manufacturers have to enclose following documents and has to confirm for the same

Sr. No.	Particulars	confirmation
1	ISI License	Yes
2	Proof if applied for renewal of ISI License	Yes
3	TYPE TEST CERTIFICATE: Type test certificate from Govt. of India approved Laboratory	Yes
	Size of AB Cable	
	a Name of Lab. & City Name	
	b T.R. No.	
	c Date	
4	List of plant and machinery	Yes
5	List of testing facility available	Yes
6	List of orders pending/executed	Yes
6a	with Employer	Yes
6b	with agencies other than Sr. no. 6(a)	Yes



**10. L.T. PVC ARMoured CABLE 2 Core 4 Sq.mm., 2 Core 6 Sq.mm., 4 Core 10 Sq.mm. & 4 Core 16 Sq.mm.**

**1. GENERAL INSTRUCTIONS:**

The LT PVC Insulated armoured cables shall be suitable for use on AC Single Phase or Three Phase (earthed or non- earthed) system for rated voltage up to and including 1100 volts. These cables may be used on DC system for rated voltage up to and including 1500 volts. The cable shall be suitable for use where the combination of ambient temperature and temperature rise due to load, results in a continuous temperature not exceeding 70°C.

**2. ITEM:**

Circular 2 Core 4 Sq.mm., 2 Core 6 Sq.mm., 4 Core 10 Sq.mm. & 4 Core 16 Sq.mm. armoured cable with aluminium Conductor insulated with PVC & PVC sheathed cover conforming to IS: 1554 (Part- 1):1988 with amendment, if any.

**DESCRIPTION:**

**3.1 Conductor:**

For all above items, H2 or H4 Grade Aluminium shall be used, minimum guaranteed weight of Al. / Km shall be 173 Kg. The conductor shall be solid circular in section, smooth, uniform in quality, free from scale inequalities, spills, splices and any other harmful defects. The conductor shall be compressed of Aluminium wires complying with IS: 8130/1984 with amendment thereof.

The Aluminium used shall be standard make.

**2.2 Insulation:**

The insulation shall consist of one of the material of standard make, this should have been suitably compounded and processed.

Polyvinyl Chloride (PVC).

chloride. Mixtures of (a) & (b) above.

The PVC insulation of core shall be conforming to requirement of Type- A Compound as per IS: 5831/1984 with amendment, if any. The conductor shall be provided with PVC insulation applied by extrusion.

The insulation shall be so applied that it fits closely on the conductor and it shall be easily possible to remove it without any damage to the conductor.

### **2.3 Colour Scheme for identification of core:**

Individual cores of cables shall be red, yellow, blue and Black as per IS: 1554 (Part- 1).

### **2.4 ARMOUR**

Galvanized steel wire armouring shall be provided. The dimensions of steel wire shall be as per IS: 1554 (Part- 1):1988 and its latest amendment and strip shall conform to latest provisions of IS: 3975 – 1988 and amendment thereof.

### **2.5 SHEATH:**

The composition of PVC compound of sheath shall be same as mentioned at Sl. 3.2 above. The compound shall be designed to have adequate mechanical strength. The colour of PVC Compound used for sheath shall be black. The sheath shall be of PVC conforming to requirement Type ST- I compound of IS: 5831/1981 by extrusion. It shall be applied over the laid up cores and it shall be possible to remove it without any damage to the insulation.

### **2.6 LENGTH:**

The cables shall be supplied in 1000+5% meters length. Short length shall be allowed for maximum 5% of the ordered quantity but short length cables shall not be less than 100 meters in any case. However sub standard length up to a maximum of 5% shall be acceptable in a particular lot offered for inspection.

## **3. PACKING AND MARKING:**

4.1 The cable shall be either wound on reels or supplied in coils packed and labeled.

4.2 The cables which shall be securely attached to the reels or coils shall

**have the following information:**

- (a) Property of PVVNL- RDSS**
- (b) Designation of consignee & destination railway station.**
- (c) Reference of the ISS.**
- (d) Name of manufacturers, Brand name or Trademark.**
- (e) Cable code as per clause 13.2 of IS: 694/1977.**
- (f) Nominal Cross sectional area of the conductor of the cable.**
- (g) Type of cable and voltage grade.**
- (h) Number of cores.**

- (i) **Approximate Gross weight.**
- (j) **Year of manufacture.**
- (k) **Length of the cable, contained in the coil/reel.**
- (l) **The cable may also be marked with ISI certificate mark.**

#### **4. EMBOSSING:**

**On the outermost sheathing of cable, following should be embossed at the regular interval of one- meter length of cable.**

- (i) **PROPERTY OF P V V N L.**
- (ii) **NAME OF MANUFACTURER.**
- (iii) **VOLTAGE GRADE AND SIZE.**
- (iv) **YEAR OF MANUFACTURER.**
- (v) **SPECIFICATION NO.**
- (vi) **LENGTH MARKING IN METRES.**

**The cables so embossed shall not be utilized or sold anywhere else by the supplier**

#### **6. TOLERANCE OF QUANTITIES:**

**The total permissible variation for the entire quantity ordered shall be subject to limit + 1% of ordered quantity. However, the permissible variation in case of individual consignees may be + 5% .**

#### **7. INSPECTION, TESTING AND TEST CERTIFICATES:**

- 7.1 The contractor shall furnish an authenticated electrostat copy of type test results as carried out on the same design to prove that the design has successfully passed through required tests. The type test up to a maximum of 5 years prior to date of tender opening by recognized test house of repute shall be acceptable.**
- 7.2 If successful type test have been carried out on the offered design during last five years (counted from the date of tender opening), repetition of type tests is not required.**

**On the other hand, if the offered design is not type tested during last five years, the cable shall be subjected to all type tests in accordance with IS: 694/1977 and**

amendment thereof, at recognized test house of repute. All charges/fee/transportation etc, to conduct these tests shall be borne by contractor.

Regular supply of the material shall commence only after successful type testing & dispatch authorization from competent authority.

However the purchaser reserves the right to get cable type tested at any stage during the currency of contract at his own expenses in any reputed test house. The



transportation and arrangement of testing of sample to test laboratory shall be the responsibility of the contractor.

**7.3 The following tests shall be carried out by the inspecting officers of the P V V N L on samples selected at random as per IS: 694/1977 with latest amendments.**

**1. Tests on conductor**

- |                                 |                |
|---------------------------------|----------------|
| a) Tensile test (For aluminum)  | IS: 8130- 1984 |
| b) Wrapping test (For aluminum) | IS: 8130- 1984 |
| c) Conductor resistance test    | IS: 8130- 1984 |

**2. Test for thickness of Insulation & Sheath** IS: 5831- 1970

**3. Physical test for insulation & sheath** IS: 5831- 1970

**4. Insulation resistance test** IS: 8130- 1984

**5. High voltage test (water immersion test)** IS: 694 - 1977

Length/weight check shall also be carried out on minimum 5% , reels/coils subject to minimum one reel/coil by the inspecting Officers as per their decision along with above acceptance test. The contractor will make all necessary arrangements & provide all necessary facilities at his own cost for the above tests/checks.

**8. Raw material:-**

The supplier shall themselves be responsible for timely arrangement / procurement of all the raw- materials required for the manufacturing of all ordered items and shall furnish their test certificates to the purchaser if so required.

**9. The cables offered by the supplier shall conform to the requirement of IS: 694:1977 or latest amendment if any, and as per technical particulars enclosed herewith (Annexure- III), No other technical particulars or Deviations from technical specification shall be accepted.**

Further, these specifications are subject to the technical terms and conditions mentioned in instructions to tender general requirement of specification and form 'B'. In case of any ambiguity of technical specification/Technical particulars shall prevail

## **TECHNICAL SPECIFICATION FOR 33KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER**

### **k. . SCOPE :**

This Specifications intended to cover the design, manufacture, assembly and Testing at manufacturer's works of 33 KV, 3 Ph., 50 C/S, 1250A, 25KA, Outdoor Type Porcelain Clad, Vacuum Circuit Breaker for efficient and trouble-free operation as specified hereunder.

The Circuit Breakers are required complete with structures, operating mechanism and all associated accessories and auxiliaries.

### **l. . STANDARDS :**

The Vacuum Circuit Breaker and accessories covered by this specification shall comply with the requirement of the latest edition of the following standards unless otherwise stated in this Specification.

<u>IS / IEC</u>	<u>Title</u>
IEC : 62271-100/200	: Specification for HV Switchgear and Controlgear IS :
13118	: Specification for HV AC Circuit Breaker
IS : 2099	: Specification for HV porcelain bushings.
IS : 5621	: Specification for porcelain hollow insulator.
IS : 8603	: Specification for Dimension for Porcelain Transformer Bushing for use in heavily polluted area.
IS : 3347	: Specification for Dimension for Porcelain Transformer Bushing for use in normal and lightly polluted area.
IS : 2633	: Specification for method for testing uniformity of coating On Zinc coated articles.
IS : 5561	: Specification for Electrical Power Connectors
IS : 2147	: Specification for Degree of Protection

Equipments meeting the requirement of any other authoritative standards other than ISS which ensure equal or better quality shall also be acceptable. The salient points of difference between the standard opted and the ISS standard given shall be brought out in the tender along with a copy of relevant portions of the said standard.

### **m. . DEVIATION :**

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of Equipment must be mentioned in the Deviation Schedule with reasons of such deviation. Such deviation suggested may not be accepted. Deviations not mentioned in Deviation Schedule will never be considered.

### **n. . GENERAL CLIMATIC AND ISOCERAUNIC CONDITION OF SITE :**

The climatic and isoceraunic conditions at site are given below :

k)	Max. Ambient temp	: 45 °C
l)	Minimum ambient temp.	: 4 °C
m)	Maximum relative humidity	: 100%
n)	Average number of thunderstorm day per annum.	75
o)	Max. No. of rainy days/annum	: 120 days

- |   |                        |
|---|------------------------|
| (f) Average Rainfall  | : 1000 mm. to 3000 mm. |
| (g) Max. Wind pressure/wind speed                           | : 150 Kg. Per Mtr. sq  |
| (h) Height above sea level (m )not exceeding                | 1000                   |
| (i) Earthquake acceleration horizontal seismic co-efficient | : As per IS:1893(1984) |
- For Class-III & IV Zones.

The Equipment offered shall be suitable for heavily polluted atmosphere.

The Equipment to be furnished under this Specification shall be packed for shipment so as to meet the weight and space limitations of transport facilities, specifically along with Rail, Road, right of way.

The Equipment covered by this Specification shall be complete in all respects. Any material or accessory which may not have been specifically mentioned, but is essential or necessary for satisfactory and trouble free operation and maintenance of the Equipment shall be furnished without any extra charge to the purchaser.

The Equipment shall be supplied with all accessories listed in this Specification with such modifications and alternations as to safeguard the Technical requirements.

#### **o. DESIGN CRITERIA :**

- The Equipment will be used in non effectively neutral grounded System with fault level of 20 KA at highest system voltage of 36 KV.
- Continuous current rating shall be 1250 Amp. Maximum temperature attained by any part of the Equipment at specified rating should not exceed the permissible limit as stipulate in the relevant standards. Equipment shall be designed taking 40 °C as maximum ambient temperature.
- The circuit breakers and their components shall be capable of withstanding the mechanical forces and thermal stresses of the short circuit current of the system without any damage or deterioration of material.
- The circuit breakers shall have motor wound spring charged trip free mechanism with antipumping feature, and shunt trip. In addition, facility for manual charging of spring, shall be provided.
- Each breaker shall be provided with manual close & open facility, mechanical ON-OFF indication, an operation counter and Spring charge/discharge indicator.
- For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. A visual mechanical indicating device will also be provided to show the position of the spring.
- All controls shall be suitable for 85%, to 110% for closing & 70% to 110% for tripping of 30V D.C. The A.C. supply shall be available 400 Volt +/- 10%, 50 Hz. 3 phase 4 wire system.
- The operating duty of the Breaker will be 0-0.3 sec-CO-3 min-CO.
- There shall be no radio interference when the Equipment is operated up to maximum service voltage.
- The minimum safe clearance of all live parts of the Equipment shall be as per relevant

standards. Clearances of 33 KV Low Level bus of our switchyard are :

- Phase to Phase : 1200 mm
  - Bus to ground level of supporting structure : 4000 mm
- Please note that usually our plinth height is 300 mm.

- All electrical and mechanical interlocks which are necessary for safe and satisfactory operation of the Breaker shall be furnished. The interlocking device shall be of proven quality.
- The condition of Breaker and its contacts shall be intact even under conditions of phase opposition that may arise due to faulty synchronisation or otherwise. Bidders should confirm in this regards.
- The Breaker shall be capable of smooth and rapid interruption of current under all conditions, completely suppressing the undesirable phenomenon even under the most severe and persistent rated short circuit conditions. There will be no abnormal voltage rise subsequent to the switching ON/OFF a capacitor bank within the rated capacity. The total make and break time (in m sec/cycle) for the breaker throughout the range of their operating duty shall be indicated and guaranteed.
- The breaker shall be suitable for interrupting low inductive currents without generation of abnormal over voltage.
- The breaker shall be capable of interrupting rated breaking current with recovery voltage equal to maximum line Service Voltage and at all inductive power factor of the Circuit equal to or exceeding 0.15.
- The Circuit Breaker shall be capable to withstand power frequency over Voltage 70 KV for 1 minute.
- The tenderer may indicate in his offer the methods adopted for limiting over voltage.
- The Circuit Breaker with its galvanized steel structure shall be suitable for mounting on concrete foundation. The height of the supporting structure will be such that it will be able to maintain clearance as indicated in clause 5.10 above.
- The detail of steel structure, foundation design and erection drawing shall be given. In GA/Structure drawing please indicate the location of CB., point of application of dynamic load and its amplitude, dead load etc.

p. **.0 CONSTRUCTION :**

Each vacuum Circuit breaker shall comprise of three identical poles linked together electrically and mechanically for synchronous operation.

**Vacuum Interrupter**

The vacuum interrupter, consisting of fixed contact and moving contact, shall be interchangeable among the same type interrupter. Short circuit capacity of vacuum bottle should be 25 KA and design life should be 100 nos. operation at rated short circuit level i.e. at 25 KA.

- Constructional features of the vacuum chamber along with its functional arrangements are to be shown in a drawing submitted along with tender documents.
- The gap between contacts of the Circuit Breaker inside interrupter should be capable of withstanding 1.5 time voltage to neutral at one atmospheric pressure at normal

ambient condition within Breaker in the event of vacuum pressure drop due to leakage.



## q.0 **MAIN CONTACTS :**

- In vacuum interrupter the contact configuration, contact area, contact pressure will be sufficient for carrying rated current and short time rated current, without any abnormal phenomena.
  - Complete details of main contacts shall be furnished. The material of contacts and coating of the contacts shall be suitable for vacuum Breaker technology. Evaporation of metal during arcing and deposition of the same in the inner surface of vacuum interrupter should be restricted by adopting suitable material. Tenderer shall furnish the justification of using the materials for contacts.
  - Complete details of main contacts and arc quenching device, if any with sectional drawings shall be furnished at the time of offer. Measures taken to free the contacts from vibration during closing shall be clearly explained in the drawing, support by tests results.
- The contact erosion should be limited upto 3 mm for useful life.
- The vacuum pressure within interrupter shall be adequate to interrupt the fault current. Precaution shall be taken so that there will be no flush over on outside of the vacuum interrupter inside the porcelain insulator.
- Design of the vacuum bottle and its insulator encasing should be suitable for outdoor use, taking care of required creepage distance considering possibility of moisture condensation if any, in the annular space between the vacuum bottle and insulator enclosure.
- Type test with similar bottle with similar encasing arrangement shall be done and accordingly Report shall be submitted along with tender document.

vacuum bottle with its insulator encasing chamber shall be hermetically sealed. Free passage of air in the chamber with or without provision of circulation of hot air is not accepted.

Tripping/Closing Coil burden of Equipment should not be more than 250 watts at 30 V D.C. Electrical Tripping Scheme to be designed considering two nos Trip Coil.

## r.0 **OPERATING MECHANISM :**

- The operating mechanism shall be suitable for rapid closing and tripping. The opening and closing energy shall be obtained from spring charge mechanism. The spring charging may be done by either motor operation with facility for manual charging when required or by other suitable trouble free mechanism. Local arrangement for operating breakers both electrically and mechanically shall be provided in addition to remote operation.
- The mechanism shall have anti pumping circuitry and will be trip free electrically and mechanically. The antipumping arrangement shall be initiated through normally „NO“ type, direct auxiliary contact of circuit breaker and shall be of self hold type. Plug-in type relay/Contactor for Antipumping Relay will not be acceptable.
- Spring operated mechanism will be complete with opening spring, closing spring, limit switch and all necessary accessories to make the mechanism a complete operating unit.
- Contactor used for antipumping relay shall be of reputed make.
- There shall be mechanical ON/OFF indicator, spring charge/discharge indication and operation counter for each Breaker and also provision for remote indication.
- The operating mechanism box shall be fixed at a working height from ground level. View glass shall be provided on hinged door at the front side.

- Spring charging LS shall have sufficient no. of spare contact.

S. **9.0 COMMON CONTROL CUBICLE :**

A free standing outdoor type weather proof, dust and vermin proof cubicle shall be provided to house the operating mechanism and all other accessories except those which must be located in the pole box.

- The cubicle shall be of 3.00 mm thick sheet steel and shall have hinged doors at front and rear for access to the mechanism. Doors should be of proper design for smooth opening and closing with pad locking arrangement.
- A removable gland plate of 3 mm thickness shall be provided at the bottom of the cubicles for purchaser's Cable entry. Glands of sizes suitable for entry of 1 no. 12 core, 2 nos. 8 core and 2 nos. 4 core Cables for Control etc.

9.3 Terminal blocks for AC & DC shall be kept separate. Terminals shall be suitable for at least 2X 2.5 sq.mm copper leads. All wiring shall be of 1100 V grade PVC.

9.4 Thermostat controlled heaters shall be provided to prevent condensation within cubicle. Cubicle illumination Lamp with switch and a 230 V., 15A, 3 pin socket with a Control Switch shall be provided.

All controls, alarms, indications and interlocking devices furnished with breaker shall be wired up to the terminal Block in the common control cubicle. Not more than two wires shall be connected to one terminal.

All wires shall be identified at both ends with same ferrule marking in accordance with approved wiring diagram.

Terminal blocks shall have compression type multi-way terminals with bonding screws and washers. At least 15% spare terminal shall be provided.

**Scheme diagram on a durable sticker shall be fixed on inside door of Control Cubicle.**

**10.0 INSULATORS :**

Porcelain supports, interrupter housing of adequate mechanical and dielectric strength with suitable creepage distance shall have to be used. All Support/Interrupter Housing of identical ratings shall be interchangeable. Each Interrupter-Housing shall be provided with terminal stud/pad.

The porcelain used in interrupter housing shall be made from wet process and shall be homogeneous, free from laminations, caustics and other flaws which may impair its mechanical or dielectric strength and shall be glossy, tough and impervious to moisture.

The porcelain supports, interrupter -housing insulation shall be coordinated with that of Circuit Breaker. The puncture strength of the bushings shall be greater than the dry flashover value.

When operating at rated voltage, there shall not be any electrical discharge between live terminal and earth. No Radio disturbance shall be caused by the support insulators when operating up to the maximum System Voltage. It shall also be free from corona.

**All iron parts shall be hot dip galvanised. The nuts, bolts, washers etc. shall also be hot dip galvanised steel or stainless steel.**

**Each Circuit Breaker shall be provided with Bi-metallic terminal stud/pad suitable for connection of pipe bus/ACSR Conductor.**

(vii) **AUXILIARY CONTACTS :**

- Breaker shall be provided with 6 NO & 6 NC spare auxiliary contacts in addition to the auxiliary contacts required for Breaker's own operational requirements. Contact Multipliers has to be provided if required.
- These contacts shall have continuous current rating of at least 10A. The breaking capacity shall be adequate for the circuits controlled, or at least 12A at 30 V DC with a circuit time constant of minimum 20 ms.
- All these contacts shall be wired up to terminal block in the control cubicle. Auxiliary

contacts which are to be installed on the frame of Circuit Breaker shall be suitably protected against accidental arcing from main circuit. Insulating materials of contacts shall be ceramics or other non-tracking materials.

### **12.0 GROUNDING :**

Circuit Breaker shall be provided with two grounding pads with 2 nos. tapped holes for M10 bolts and spring washers for connection of purchasers grounding conductor (50x6 mm G.I. strips).

### **13.0 PAINTING :**

External surfaces shall be given a coat of high quality red oxide or other suitable primer and shall be finished with two coats of synthetic enamel paints of shade 631 of I.S.S. Such painting should be able to withstand tropical climate as stipulated in Sl.No.4 of this Specification.

### **14.0 EQUIPMENT FOUNDATION AND STEEL STRUCTURE :**

(27) The Circuit breaker etc. shall be furnished complete with base frame, anchor/foundation bolts and hardware. Details structure assembly drawing, mentioning part no. of each member and also indicating cross sectional area of member used with supporting calculations. The point of C.B., dynamic load and its amplitude, dead load etc. shall be mentioned.

(28) To enable the purchaser to proceed with design of Equipment foundation, the successful tenderers shall furnish necessary foundation/anchor details with designed loads within 30 (thirty) days from the date of issue of letter of intent/purchase order.

(29) Similar grounding pad as mentioned against Sl.No.9 are also to be provided.

### **TENDER DRAWING, MANUALS AND TYPE TEST CERTIFICATES :**

The following drawings and manuals shall be furnished for information purpose with each copy of the tender.

General Arrangement Drawings indicating all dimensions, electrical clearness and distance of each piece of Equipment showing constructional features and dispositions of various fittings and accessories and also static dead load at point of application.

Technical leaflets/manuals on each piece of Equipment explaining the function of various parts, principle of operation and special features. Technical leaflets/manuals for offered type of vacuum bottle etc.

Type Test Certificates as per IEC/relevant IS carried out on Similar Breaker from reputed/recognised laboratory shall be furnished.

### **CONTRACT DRAWING AND CATALOGUE :**

After placement of order, six (6) copies of various drawings data and manuals as mentioned below shall be submitted to the Chief Engineer-MM, PVVNL HQ, Meerut for approval.

Dimensional General Arrangement drawing showing all dimensions and disposition of fittings and space requirement and mounting arrangements.

Sectional views of contact assembly, operating mechanism and arc extinguishing chamber.

Transport/shipping dimensions with weights.

Foundation and anchor details including dead-load and impact load with direction and also point of application.

Assembly drawing for erection at site with part numbers and schedule of materials. Electrical schematic and wiring diagram with explanatory notes, if any.

Schematic diagram for spring charged operating mechanism schematic layout drawings.

Name plate drawing and any other relevant drawing and data necessary for erection, operation and maintenance.

Outline drawings of bushings, terminals and terminal connectors.

3. After approval, the supplier shall submit Ten (10) sets of approved drawings and manuals to the Chief Engineer-MM, PVVNL, Meerut. Instruction manuals and data sheets for each rating of Equipment shall be submitted. The manuals shall clearly indicate the installation methods, checkups and tests to be carried out for testing the Equipment and maintenance procedure.
4. In all drawings, manuals etc., reference no. of purchase order no. shall be indicated.
5. Two sets complete in all respects with required bindings should be sent directly to the Chief Engineer-MM (PVVNL HQ), Meerut.

## **TEST REPORTS AND TYPE TESTS :**

The bidder shall submit complete test reports of all tests (including Type Test) as stipulated below with Complete identification, date and serial no., carried out in CPRI/ NABL accredited/ Government recognized Test House or Laboratory on tendered item/items of identical design.

COPIES OF FOLLOWING TYPE TEST REPORT AS PER LATEST IS/IEC, CARRIED OUT WITHIN FIVE (5) YEARS, FROM DUE DATE OF TENDER, FROM CPRI, NABL ACCREDITED/ GOVT. RECOGNISED TEST HOUSE OR LABORATORY SHALL BE SUBMITTED ALONG WITH TENDER DOCUMENTS AS PRE-REQUISITES. FAILING WHICH THEIR OFFER MAY NOT BE TECHNICALLY ACCEPTABLE.

### **5.2 Single capacitor bank breaking test**

### **5.3 Short time withstand and peak withstand current test**

### **5.4 Wet Power Frequency Withstand Voltage test**

#### **d) Lightning impulse voltage withstand test**

#### **e) Temperature rise Test**



**5 Mechanical Endurance Test(M2 Class)****6 Degree of Protection test of Control Cubicle SPECIFIC****LIMIT OF AUXILIARY SUPPLY VOLTAGE :**

**6.1** The auxiliary supply voltage shall be 85% to 110% of the rated 30 V in supply for closing coil and the same shall be 70% to 110% for tripping coil.

**6.2** The operating voltage for motor operated spring charged mechanism shall be 400V A.C., 3 phase, 50 Hz or 230 mV. 1-phase, 50 Hz. The motor shall operate at a voltage variation of 85% to 110% of the supply voltage.

**NAME PLATE :**

- (a) Rated voltage/Maximum voltage
- (b) Rated insulation level
- (c) Type/Model No./Sl.No./Year of manufacture.
- (d) Rated current
- (e) Rated frequency.
- (f) Rated short Circuit Breaking Current.
- (g) Rated transient recovery voltage for terminal fault.
- (h) Rated short circuit making current.
- (i) Rated operating sequence.
- (j) Rated short time current.
- (k) Rated line charging/breaking current
- (l) Rated Cable charging current.
- (m) Rated single capacitor bank charging/breaking current.
- (n) Rated small inductive breaking current.
- (o) Rated Supply Voltage of auxiliary circuits(ac & dc).
- (p) Applicable standard.

**RECOMMENDED SPARES :**

The Bidder shall quote item-wise price of recommended spares for 5 (five) years normal operation. Purchaser will decide the actual quality of spare to be procured on the basis of the List.

**ACCESSORIES :**

Each Breaker shall be furnished complete with fittings and accessories as listed below (The list is illustrative & not exhaustive).

- 10. Clamp-type terminal connectors for ACSR Conductor
- 11. Base frame and foundation/anchor bolts.
- 12. Operating mechanism, two nos trip and one no close coils.
- 13. Auxiliary Contacts and Relays/Contacts.
- 14. Local/Remote selector Switch and Close/Trip Control Switch.
- 15. Manual close and trip devices.

**16.** Mechanical ON/OFF indicators.

17. Operation counter.
18. Weatherproof Control cubicle and operating mechanism boxes, with locking arrangement.
19. Set of Switch-Fuse/MCB/MCCB units for A.C. & D.C. Supply.
20. Pippings of Inert Gas System, if any.
21. Space heaters with thermostat and switch.
22. Cubicle illumination Lamp with Switch.
23. Terminal blocks and internal wiring.
24. G.I. conduits and accessories for connection between Central Control Cubicle and operating mechanism boxes where applicable.
25. Other standard accessories which are not specified, but are necessary for efficient and trouble free operation shall be supplied.

#### TEST AT FACTORY AND TEST CERTIFICATES

All Acceptance tests shall be carried out at manufacturer's works in presence of the PVVNL's and Contractors' representatives. In addition to above, all routine tests are also to be carried on the breakers as per relevant IS. The entire cost of acceptance and routine test that to be carried out as per relevant IS" shall be treated as included in the quoted price of breakers. The contractor shall give at least 21(twenty one) days advance notice intimating the actual date of inspection and details of all tests that are to be carried out from the date when the tests will be carried out.

Routine tests on all breakers shall be carried out as per IEC-56 or IS-13118 and test reports shall be submitted along with respective inspection offer to Chief Engineer-MM, PVVNL, Meerut

Six (6) copies of test reports duly signed by the inspecting officers, shall be submitted to the Chief Engineer-MM ,PVVNL HQ Meerut.

#### **TYPE TESTS after issuance of order:**

Besides submission of Type test Report, carried out within five years as per tender specification, Type Test at the discretion of Ordering authority, shall have to be arranged by the successful contractor from any lot offered for inspection, sample chosen at random after successful routine test by our inspection team, as per relevant ISS from CPRI/ NABL accredited/ Government recognized Test House or Laboratory in presence of PVVNL'S representative.

However the necessary cost of the type test Charges will be reimbursed to the party on production of necessary supporting documents.

#### **Documents to be submitted at the time of physical delivery at consignee stores:**

The following documents to be submitted by the vendors to the consignee, Stores at the time of despatch to stores by the vendors:-

- 25.1 Copy of Purchase order.
- 25.2 Copy of Despatch Instruction.

- 25.3** Inspection Test Certificate.
- 25.4** Guarantee Certificate .
- 25.5** Proforma Invoice.
- 25.6** Calculation Sheet for Price Variation on the basis of IEEMA/ CACMAI etc., wherever applicable with base date of order.
- 25.7** Seal list and packing list.
- 25.8** Challan in triplicate.
- 25.9** Way bill, if applicable.

Mandatory particulars of 33 KV Out Door VCB

1.	<b>Vacuum Circuit Breaker</b>	
	Type	Porcelain Clad, Structure mounted Out Door VCB
	Reference Standard	IEC 62271-100, IEC 62271-200
	Arc quenching medium	Vacuum
	No. of break / phase	One
	Rated voltage	33 KV
	Highest voltage	36 KV
	Frequency	50 Hz
	Rated normal current	1250A
	Breaking Capacity	25 KA for 3 sec
	Making Capacity	62.5 KA
	STC for 3 Sec.	25 KA
	Insulation level	36 KV/70 KV/170 KV(P)
	Minimum Creepage distance	900 mm
	Temperature rise	As per IEC
	Operating duty cycle	0-0.3 sec – CO-3min-CO
	First pole to clear factor	1.5
	Single phase capacitor breaking capacity	As per IEC.
	Cable charging breaking capacity	As per IEC.
	Minimum Pole to Pole clearance	700 mm.
	Closing time	< 100 milli sec.
	Opening time	< 60 milli sec.
	Mechanical Endurance Capacity	M2 Class



	Electrical Endurance Capacity	E2 Class
	Operating mechanism	Motor wound spring charged stored energy.
	Number of Trip coil	Two
	DC Aux. voltage	30 volt.
	AC Aux. voltage	230 volt.
	No. of spare contacts Aux Switch (NO & NC)	6 NO+6NC ( As per scheme requirement )
	No. of spare contacts in Limit Switch (NO & NC)	4 NO + 4NC( As per scheme requirement )
	Contact multiplier	To be provided, if required for scheme requirement.
	Space heater	230 V AC, 80 Watt, Thermostat control.
	Illuminating lamp	230 V AC, 100 Watt
	Anti pumping Relay	To be provided rated for 30 V DC
	Breaker control switch	3 Position, 4 Ways spring return to Neutral type. Angular movement 45° – 45°.
	Local Remote switch	Two position, eight ways stay put type. Angular movement 90°, Current rating 16 Amps.
	Spring charging motor	Voltage rating 230 Volt AC
	Degree of Protection of control cubicle	IP 55
	Sheet thickness of control cubicle	3 mm.
2.	<b>Vacuum Bottle</b>	
	Make	
	Rated Voltage	33 KV
	Normal Current	1600 Amps.
	Breaking Capacity	25 KA

	Making Capacity	62.5 KA
	STC for 3 sec	25 KA
	Minimum Mechanical life in no. of operations	30000
	Minimum Electrical life in no. of operations at rated current	20000
	Minimum Electrical life in no. of operations at 25 KA	100 no.
	Dry Power Frequency withstand voltage for 1 min.	70 KV
	Impulse withstand voltage	170 KVP
	Contact Material	Copper Chromium Alloy
	Type of plating	Silver
3.	<b>Low Voltage Terminal connector</b>	
	Make	
	Type	Locking Stud
	Size	Suitable for 2.5 sq. mm control wire.
4.	<b>Primary Terminal Connector</b>	
	Material	Extruded Aluminum
	Size	Suitable for Panther ACSR.
	Continuous current rating	800 Amps
	Nuts, bolts & washers	MS hot dip galvanised.
	Reference Standard	IS 5561
	Number of connector per VCB	Six number
5.	<b>Trip &amp; Close coil</b>	
	Voltage & Wattage of Closing coil	30V DC, 200 Watt.
	Voltage & Wattage of Trip coil	30V DC, 200 Watt.

6.	<b>Control wire</b>	
	Make	
	Voltage grade	750V
	Size	2.5 sq.mm
	Colour	DC Circuit : Grey AC Circuit : Phase : Red, Neutral : Black. Earth circuit : Green.
7.	<b>Earthing Terminal</b>	
	Material	Copper
	Shape	Rectangular
	Size	50 mm x 6 mm
	Current Rating	Adequate to carry fault current.
8.	<b>Painting details</b>	
	Surface cleaning process	7 Tank process.
	Paint thickness	60-80 micron
	Paint shade	RAL 7032
9.	<b>Accessories</b>	
	Spring charging handle	1 no. per set.
	VCB operating handle	1 no per Set.
10.	<b>Name Plate details</b>	
	Manufacturer	To be provided
	Type of VCB	To be provided
	Rated voltage	33 KV
	Rated current	1250 Amps
	Rated frequency	50 Hz
	Insulation level	36 KV / 70 KV / 170 KV(p)

	Short Circuit Breaking Current	25 KA
	Short Circuit withstand Current & duration	25 KA for 3 Sec.
	Short Circuit Making Current	62.5 KA (p)
	Operating sequence	O – 0.3 Sec – CO – 3 min – CO.
	Make and Model of Vacuum Interrupter	To be provided
	Aux. DC voltage	30 Volt
	Aux. AC voltage	230 Volt
	Total weight	To be provided
	Serial number	To be provided
	Purchase Order reference	To be provided
11.	<b>Property Plate</b>	'9PROPERTY OF PVVNL-RDSS9 '9VCB SUPPLIED WITH TERMINAL CONNECTORS9 '9GUARANTEE FOR FIVE YEARS9
12.	<b>Guarantee</b>	5 years

GTP of 33 KV Out Door VCB

( To be submitted by the bidder )

1.	<b>Vacuum Circuit Breaker</b>	
	Type	
	Reference Standard	
	Arc quenching medium	
	No. of break / phase	
	Rated voltage	
	Highest voltage	
	Frequency	
	Rated normal current	
	Breaking Capacity	
	Making Capacity	
	STC for 3 Sec.	
	Insulation level	
	Minimum Creepage distance	
	Temperature rise	
	Operating duty cycle	
	First pole to clear factor	
	Single phase capacitor breaking capacity	
	Cable charging breaking capacity	
	Minimum Pole to Pole clearance	
	Clearance between lower Live part of VCB to Ground Level	
	Clearance between lower Live part of the VCB and Upper Surface of the Metallic Structure	



	Closing time	
	Opening time	
	Mechanical Endurance Capacity	
	Electrical Endurance Capacity	
	Operating mechanism	
	Number of Trip coil	
	DC Aux. voltage	
	AC Aux. voltage	
	No. of spare contacts Aux Switch (NO & NC)	
	No. of spare contacts in Limit Switch (NO & NC)	
	Contact multiplier	
	Space heater	
	Illuminating lamp	
	Anti pumping Relay	
	Breaker control switch	
	Local Remote switch	
	Spring charging motor	
	Degree of Protection of control cubicle	
	Sheet thickness of control cubicle	
2.	<b>Vacuum Bottle</b>	
	Make	
	Model No(Supporting Literature to be enclosed)	
	Rated Voltage	
	Normal Current	
	Breaking Capacity	

	Making Capacity	
	STC for 3 sec	
	Minimum Mechanical life in no. of operations	
	Minimum Electrical life in no. of operations at rated current	
	Minimum Electrical life in no. of operations at 25 KA	
	Dry Power Frequency withstand voltage for 1 min.	
	Impulse withstand voltage	
	Contact Material	
	Type of plating	
3.	<b>Low Voltage Terminal connector</b>	
	Make	
	Type	
	Size	
4.	<b>Primary Terminal Connector</b>	
	Material	
	Size	
	Continuous current rating	
	Nuts, bolts & washers	
	Reference Standard	
	Number of connector per VCB	
5.	<b>Trip &amp; Close coil</b>	
	Voltage & Wattage of Closing coil	
	Voltage & Wattage of Trip coil	

6.	<b>Control wire</b>	
	Make	
	Voltage grade	
	Size	
	Colour	
7.	<b>Earthing Terminal</b>	
	Material	
	Shape	
	Size	
	Current Rating	
8.	<b>Painting details</b>	
	Surface cleaning process	
	Paint thickness	
	Paint shade	
9.	<b>Accessories</b>	
	Spring charging handle	
	VCB operating handle	
10.	<b>Name Plate details</b>	
	Manufacturer	
	Type of VCB	
	Rated voltage	
	Rated current	
	Rated frequency	
	Insulation level	
	Short Circuit Breaking Current	

	Short Circuit withstand Current & duration	
	Short Circuit Making Current	
	Operating sequence	
	Make and Model of Vacuum Interrupter	
	Aux. DC voltage	
	Aux. AC voltage	
	Total weight	
	Serial number	
	Purchase Order reference	
11.	<b>Property Plate</b>	
12.	<b>Guarantee</b>	

Signature of Bidder : Name of

the Company : Date :

Office Seal

**TECHNICAL SPECIFICATION FOR**

**(MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESSORIES  
WITH 95pC CONTINUOUS OPERATING TEMPERATURE**

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

### 11 SCOPE :

This specification covers details of AL59 ACS Covered Conductors with continuous operating temperature 95°C for use on 33KV & 11KV Distribution system. The covered conductor insulation generally shall be as per EN 50397-1: 2020.

### 12 MANUFACTURERS QUALIFICATIONS:

The Manufacturer should have designed, manufactured & supplied at least 500 kms of any size of MVCC with offered AL59-ACS type Covered Conductor and 10% of the supplied qty. should be in satisfactory operation for at least one year in any Indian Utility, as on original date of bid submission. If, any Manufacturer is not meeting one year experience criteria, can submit its offer, provided the Qualified Manufacturer is providing Licensor-Licensee Agreement to such manufacturer.

### 13 SERVICE CONDITIONS:

The conductor to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

13.0	Maximum ambient temperature (Degree C)	50
13.1	Minimum temperature of air in shade (Degree C)	3.5
13.2	Relative Humidity (%)	10 to 100
13.3	Maximum Annual Rainfall (mm)	1415
13.4	Maximum Wind Pressure (kg/sq.m.)	150
13.5	Maximum altitude above mean sea level (meter)	3400 (MSL -2206m)
13.6	Isoceraunic level (days/ year)	50
13.7	Seismic level (Horizontal acceleration)	0.3g

### 14 CONDUCTOR SIZES:

Actual Area	Stranding wire & Dia	
	ALU.	ACS.
sq.mm.	No./mm.	No./mm.
31.60	6/2.59	1/2.59
52.88	6/3.35	1/3.35
78.82	6/4.09	1/4.09
104.98	6/4.72	1/4.72
120	26/2.44	7/1.90
160	30/2.59	7/2.59
241	30/3.20	7/3.20



## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

### 15 APPLICABLE STANDARDS:

Unless otherwise stipulated in this specification, the conductor shall conform to the following Indian/International Standards (amended upto date).

Sr. No.	Indian / International Standard	Title
1	IS : 398 (Part II) / 1996	Specification for aluminium conductors for overhead transmission purpose
2	EN 50397-1:2020	Covered Conductor Specification for voltage 1KV to 33KV.
3	IS : 10418	Reels and drums for bare conductors.
4	SS 424 08 13 & SS 424 08 14	Aluminium alloy wire for stranded conductors for overhead lines –Al 59 wire
5	IEC – 1232 : 1993-06, IEC 63248 :2022	Aluminium Clad steel wire for Electrical purpose
6	SS EN – 50182	Conductor for Overhead lines – Round wire concentric Lay stranded Conductors

### 16 PROPERTIES OF CONDUCTOR:

The properties of stranded AL59 ACS conductor of various sizes shall be as in Table 1.

TABLE – I

TABLE 1

AL59 ACS CONDUCTOR DETAIL									
Actual Area	Stranding wire & Dia.		Approx. Overall dia.	Approx. Mass	Calculated Resistance 20pC (Max.)	at	Approx. Calculated Breaking Load	Reactance per km. **	Current Rating
sq.mm.	ALU.	ACS.	mm.	Kg/km	Ohm/km		kN.	Ohms.	Amps.
	No./mm.	No./mm.							
31.60	6/2.59	1/2.59	7.77	121.35	0.890		13.51	0.362	155
52.88	6/3.35	1/3.35	10.05	203.00	0.531		22.44	0.346	215
78.82	6/4.09	1/4.09	12.27	302.62	0.356		30.95	0.333	278
104.98	6/4.72	1/4.72	14.16	403.00	0.268		39.56	0.324	335
120	26/2.44	7/1.90	15.46	467.25	0.233		51.50	0.319	383
160	30/2.59	7/2.59	18.13	681.18	0.175		79.58	0.309	445
241	30/3.20	7/3.20	22.40	1039.80	0.115		114.99	0.296	630

\*\* With Minimum clearance between phases 900 mm as per IS 5613-part1, Table 2

# TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

## 6 (a) PROPERTIES OF WIRES: Table –II

ALUMINIUM WIRE USED IN CONSTRUCTION OF ALUMINUM CONDUCTOR WITH ALUMINIUM CLAD STEEL						
Diameter of Wire			Cross-sectional area of nom. Wire dia.	Mass	Minimum breaking load after stranding	DC resistance at 20pC
Nom.	Min.	Max				
mm.	mm.	mm.	Sq.mm.	Kg./Km.	kN	Ohm/Km.
2.44	2.410	2.47	4.68	12.64	1.11	6.266
2.59	2.56	2.62	5.27	14.24	1.25	5.561
3.20	3.16	3.23	8.04	21.74	1.91	3.643
3.35	3.32	3.38	8.81	23.82	2.09	3.324
4.09	4.05	4.13	13.14	35.51	2.87	2.230
4.72	4.67	4.77	17.50	47.30	3.74	1.675

ALUMINIUM CLAD STEEL WIRE USED IN CONSTRUCTION OF ALUMINUM CONDUCTOR WITH ALUMINIUM CLAD STEEL						
Diameter of Wire			Cross-sectional area of nom. Wire dia.	Mass	Minimum breaking load after stranding	DC resistance at 20pC
Nom.	Min.	Max				
mm.	mm.	mm.	Sq.mm.	Kg./Km.	kN	Ohm/Km.
1.90	1.87	1.93	2.84	18.68	3.40	29.909
2.59	2.56	2.62	5.27	34.72	6.32	16.096
3.20	3.16	3.23	8.04	52.98	9.65	10.544
3.35	3.32	3.38	8.81	58.09	10.40	9.621
4.09	4.05	4.13	13.14	86.58	14.45	6.455
4.72	4.67	4.77	17.50	115.31	17.50	4.846

## 6 (b) TOLERANCE ON NOMINAL SIZES:

The tolerance shall be permitted on the nominal diameter aluminium wire used in the manufacture of AL59ACS COVERED CONDUCTOR. However, positive & negative tolerance in this respect shall be as provided in IS: 398 (Part IV)/1994 (amended up to date).

## 17 FREEDOM FROM DEFECTS:

The wire shall be smooth and free from all imperfections such as spills, splits, slag inclusion, dia. marks scratches, fittings, blow holes, projections, looseness, overlapping of strands, chipping of aluminium layers etc. and all such other defects which may hamper the mechanical and electrical properties of the conductor. Special care should be taken to keep away dirt, grit etc. during stranding.

## 18 JOINTS IN WIRES:

### • Conductors containing seven wires:–

There shall be no joint in any wire of a stranded conductor containing seven wires, except those made in the base rod or wire before final drawing.

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

- Conductors containing more than seven wires:-

In conductors containing more than seven wires, joints in individual wires are permitted in any layer except the outermost layer (in addition to those made in the brass rod or wire before final drawing) but no two such joints shall be less than 15 m apart in the complete stranded conductor, such joint shall be made by resistance or cold pressure butt welding. They are not required to fulfil the mechanical requirement of unjointed wires. Joints made by resistance butt welding shall, subsequent to welding, be annealed over a distance of at least 200 on each side of the joint.

### 19 STRANDING:-

15.3 The wires used in the construction of a stranded conductor shall, before Stranding satisfy all the relevant requirements of this standard.

15.4 The lay ratio of the different layers shall be within the limits given in the Table-

III. TABLE - III: LAY RATIOS FOR AL59 ACS CONDUCTORS

LAY RATIO OF ALUMINIUM CONDUCTORS, WITH ALUMINIUM CLAD STEEL REINFORCED								
Number of wires		Ratio of Aluminium wire diameter to steel wire diameter	Lay ratio of steel core		Lay ratio for Aluminium wire			
					Outer most layer		Layer immediately beneath Outermost Layer	
Aluminium	Steel		Min.	Max.	Min.	Max.	Min.	Max.
6	1	1.00	—	—	10	14	—	—
26	7	1.28	13	28	10	14	10	16
30	7	1.00	13	28	10	14	10	16

15.5 In all constructions, the successive layers shall have opposite directions of lay, the outer most layer being right handed. The wires in each layer shall be evenly and closely stranded.

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

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15.6 In aluminium alloy stranded conductors having multiple layers of wires, the lay ratio of any layer shall not be greater than the lay ratio of the layer immediately beneath it.

### 20 FILLING (WATER BLOCKING):

The Stranded Conductor shall be longitudinally water tight by means of water blocking material incorporated during the extrusion process. The use of grease/water swellable tape /water swellable powder inside or over the surface of conductor is not permitted. The water blocking material shall be stable at maximum operating conductor temperature of 95 Deg. Cent. The water blocking compound shall be compatible with the conductor material as well as the semi conducting polymer screen layer above it and not adversely affect its electrical or mechanical properties.

### 21 INSULATION:

The Insulation should be dual layered with the Inner Layer being XLPE with a nominal thickness of 1.2 mm for Voltages up to 11 KV and 2.43 mm for 33 KV and the Outer Layer of XLPE which is UV Resistant, Anti Tracking and Erosion Resistant with temperature withstand upto 95 DegC, nominal wall thickness of 1.1 mm for Voltages up to 11 KV and 1.2 mm for 33 KV. The minimum combined Insulation Thickness of both Layers should not be less than 2.0 mm for Voltages up to 11KV and 3.0 mm for Voltages upto 33 KV minimum.

The conductor manufacturing and stranding process shall incorporate the longitudinal water blocking also.

The Semi Conducting Screen, Inner Insulation and Outer Insulation should be extruded in one step i.e. triple extrusion to ensure a good, permanent bond between the three layers and also with the conductor. Chemical curing to be avoided.

It shall be possible to remove the Semi Conducting Screen, Inner and Outer Insulation Layers without damage to the conductor.

Regarding properties of XLPE insulation of 95°C continuous operating temperature refer below Table – IV

**TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS  
COVERED CONDUCTOR & ACCESORIES**

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<b>TABLE : IV</b>		
<b>PROPERTIES OF XLPE INSULATION FOR 95pC OPERATING TEMPERATURE</b>		
<b>Sr. No.</b>	<b>Properties</b>	<b>Requirements</b>
1	Tensile Strength	12.5 N/mm <sup>2</sup> , Min.
2	Elongation to break	200 percent, Min
3	Aging in air oven: a) Treatment: Temperature: Duration: b) Tensile Strength variation: c) Elongation variation:	135°C 10 days ±25 percent, Max ±25 percent, Max
4	Hot set: a) Treatment: Temperature: Time under load Mechanical stress b) Elongation under load c) Permanent elongation (set) after cooling	200±3°C 15 min 20N/cm <sup>2</sup> 175 percent, Max 10 percent, Max
5	Shrinkage: a) Treatment: Temperature Duration b) Shrinkage	150±3°C 2 hour 4 percent, Max
6	Water absorption (Gravimetric): a) Treatment: Temperature: Duration b) Water absorbed	85±2°C 14 days 1 mg/cm <sup>2</sup> , Max
7	Test of Compatibility (Ageing of complete product sample ) d) Treatment: Temperature: Duration: e) Tensile Strength variation: f) Elongation variation:	115°C +/– 2°C for 10 days ±25 percent, Max ±25 percent, Max

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

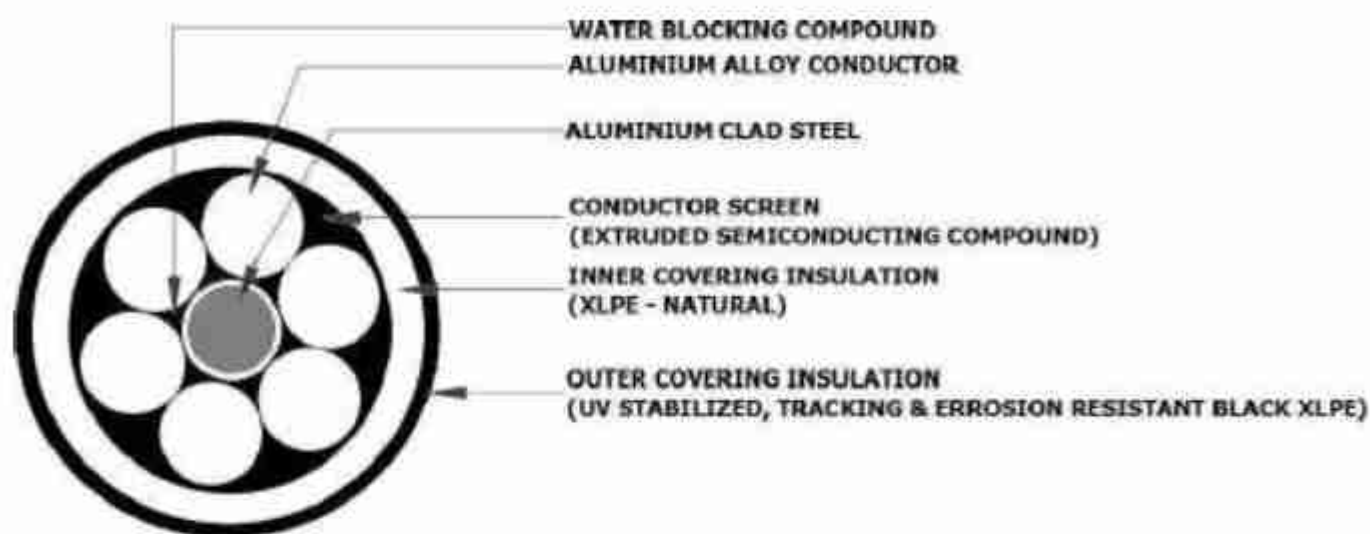


Figure 1 shows the Cross Section of AL59 ACS COVERED Conductor.

### 22 TYPE TEST:

All the following type tests certified in CPRI/ERDA in accordance with generally as per EN 50397-1: 2020 shall be performed on MVCC samples drawn by purchaser.

#### (a) Electrical tests

- Conductor resistance (T, S)

#### 12.1.2 High voltage test

- For CC without conductor screen: (T, S)

Test voltage (a.c.)	1U
Number of specimen	1
Length of specimen (minimum)	5m
Duration of immersion in water (minimum)	1h
Temperature of water	(20 ± 5) deg C
Test duration	15 min (S) 1 h (T)

- For CC with conductor screen or upon agreement between customer and Producer: (T, S)

Test voltage (a.c.)	1U
Number of specimen	1
Length of specimen (minimum)	5m
Duration of immersion in water (minimum)	1h
Temperature of water	(20 ± 5) deg C
Test duration	4 h (S) 48 h (T)



## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

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- Spark test on the covering (R)  
Test voltage: a.c. 0,7 U or dc 1 U
- Leakage current (T) Test  
voltage: a.c. 0,7 U
- Tracking resistance (T)
- Construction and dimensions (T,S,R)
- Compliance with the designs requirements (T , S , R)
- Thickness of the covering (T , S , R)
- Construction and mechanical properties of the conductor (T,S)
- Rated tensile strength (T , S )
- Construction and dimensions (T , S )
- Non-electrical tests on the covering (T)
- Mechanical properties –As per Table IV in this specification
  - before ageing of sample
  - after ageing of sample
- If Carbon black used for UV Stabilization – Carbon black content (T)
- Resistance to UV rays (If other than carbon black used) (T)
- Tests of compatibility (T) –As per Table IV in this specification
- Thermal properties of the covering –As per Table IV in this specification
- Shrinkage test (T) –As per Table IV in this specification  
Distance <L= between marks: (200± 5) mm
- Hot-set-test (T,S) –As per Table IV in this specification
- Pressure test at high temperature (For Thermo plastic Cable only)
- Further tests on the covering
- Water absorption (T) –As per Table IV in this specification
- Shore D hardness (For Thermo plastic Cable only)
- Test of the longitudinal water tightness
- With heat cycle (T)

Number of specimen	1
Length of specimen	3m
Test duration	24 h
Bending radius	20 D

- Without heat cycle (S)
- Marking
- Content, legibility (T,S, R)
- Durability (T)

Note: T – Type Test

S – Acceptance Test

R – Routine Test

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

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### 23 ROUTINE TESTS:

All the Routine tests as per EN 50397-1: 2020 amended upto date shall be carried out on each and every delivery length of MVCC . The result should be given in test report.

Number of specimen	1
Length of specimen	3m
Test duration	24 h
Bending radius	20 D

Number of specimen	1
Length of specimen	1m
Test duration	1h

The details of facility available in the manufacturer's works in this connection should be given in the bid.

### 24 ACCEPTANCE TESTS:

All Acceptance tests Generally as per EN 50397-1: 2020 as amended up to date including the Optional and should offered Anti tracking testing on selective samples in Manufacturer's work during acceptance test.

### 25 TESTING FACILITIES AND DETAILS OF EQUIPMENTS:

The supplier / tenderer shall clearly state as to what testing facilities are available in the works of manufacturer and whether the facilities are adequate to carry out type, routine and acceptance tests And Anti Tracking as mentioned in EN 50397-1 : 2020 on the MVCC. The facilities shall be provided by the bidder to purchaser's representative for witnessing the tests in the manufacturer's works. If any test cannot be carried out at manufacturer's works reason should be clearly stated in the tender.

### 26 SAMPLING PLAN:-

Samples for Acceptance Tests: Samples shall be taken 5% of the offered lot or as per relevant EN 50397-1:2020 with the latest version as the case may.

Apart from the sample selected for carrying out Acceptance Tests at the works of the firm during the inspection, one more sample from offered lot also selected under re-winding for carrying out various Acceptance Tests as per relevant IS/IEC/EN/ SS. If any of the sample so selected from each length failed in any acceptance test the entire lot under inspection is not acceptable.

### 27 END SEALING:-

Heat Shrinkable end caps with sealant shall be used for effectively sealing the end terminals of the covered conductor. The inner diameter range of cap shall be such that it shall tightly fit to the covered conductors to prevent moisture ingress.

### 28 PACKING AND MARKING:

The conductors shall be wound in reels or drums conforming to the latest versions of IS: 10418 (amended upto date), ' Specification for Drums for cables.

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

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- PACKING:

- The gross mass of packing for various conductors shall not exceed by more than 10% of the values given in the following table.

Conductor Size in sq.mm.	Gross Mass in kg (33 kV)	Gross Mass in KG (11 kV)
31.60 sq.mm (ALU 6/2.59 + ACS 1/2.59)	—	600
52.88 sq.mm. (ALU 6/3.35 + ACS 1/3.35)	—	900
78.82 sq.mm. (ALU 6/4.09 + ACS 1/4.09)	750	600
104.98 sq.mm. (ALU 6/4.72 + ACS 1/4.72)	900	800
120 sq.mm. (ALU 26/2.44 + ACS 7/1.90)	1050	850
160 sq.mm. (ALU 30/2.59 + ACS 7/2.59)	1350	1100
241 sq.mm. (ALU 30/3.20 + ACS 7/3.20)	1900	1650

- The normal length of various conductors shall be as given in the following table:

Conductor Size in sq.mm.	Normal Length in KM
31.60 sq.mm (ALU 6/2.59 + ACS 1/2.59)	2.0
52.88 sq.mm. (ALU 6/3.35 + ACS 1/3.35)	2.0
78.82 sq.mm. (ALU 6/4.09 + ACS 1/4.09)	1.0
104.98 sq.mm. (ALU 6/4.72 + ACS 1/4.72)	1.0
120 sq.mm. (ALU 26/2.44 + ACS 7/1.90)	1.0
160 sq.mm. (ALU 30/2.59 + ACS 7/2.59)	1.0
241 sq.mm. (ALU 30/3.20 + ACS 7/3.20)	1.0

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

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- LENGTHS AND VARIATION IN LENGTHS:

The standard length of AL59 ACS Covered Conductor shall be as per mentioned in clause.No 18.1.2 Tolerance of  $\pm 5\%$  (plus or minus five percent) shall be permitted in this standard length. All the lengths outside these limits of tolerances shall be treated as random length.

Random length shall not be less than 80% (eighty percent) of the standard length specified as above and the total acceptable quantity of such random lengths shall be within 7% (seven percent) quantity of the allotted quantity to each consignee of the respective size of the conductor.

- c. MARKING:

IDENTIFICATION MARKS ON COVERED CONDUCTOR:

The following particulars shall be properly legible embossed/Printing on the Covered conductor at the intervals of not exceeding one meter throughout length of the cable. The covered conductor with poor and illegible embossing or printing shall be liable for rejection

- a. Manufactures name and/or Trade name.
- b. Voltage grade.
- c. Year of manufacture.
- d. PVVNL
- e. Successive Length.
- f. Size of cable
- g. EN 50397-1: 2020 Also the following information be marked on each package:

19.INSPECTION:

All tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charges, to satisfy him that the material is being furnished in accordance with this specification.

- d. VERIFICATION OF LENGTH OF CONDUCTOR:

- i) The Company shall ascertain the length of AL59 ACS COVERED Conductor at supplier's works and at the receiving store centres by measuring the actual length by length measuring machine used for the purpose. The supplier should ensure that length measuring machine is available for measurement of the length by our inspecting officer.
- ii) Both ends of the AL59 ACS COVERED Conductor will be sealed by the supplier and seals will be contained in the drum and not exposed out of drum.
- iii) The declared length will be measured between manufacturer's seals at both ends of AL59 ACS COVERED Conductor.
- iv) The weight of AL59 ACS COVERED Conductor will also be checked for ensuring correct lay and length of AL59 ACS Covered Conductor.

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

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- v) For the verification of the length of the conductor, 5% of total lot (in Drums) should be selected at the works. The physical verification of the length of the conductor should be carried out for maximum up to 5 (five) drums. If there are any more drums left for verification, then weight of each verified drum should be carried out and average weight may be calculated.

Then the weight of each of all the remaining selected drums may be taken and if these weights are matching with the average weight, then that particular lot may be accepted otherwise rejected.

- vi) Verification of length of conductor will also be carried out at each stores centre for two drums out of each lot. If the average length is found correct or more, the lot will be accepted. If the average length is found to be less than the declared, the percentage of such short length will be applied for reduction for the entire quantity supplied in the lot at respective stores for acceptance.
- vii) In case of dispute, joint inspection along with the representative of the supplier shall be carried out after giving 10 (ten) days<sup>9</sup> notice to the supplier to remain present at stores centre for the purpose. If the representative fails to attend on stipulated date for joint inspection, the decision of the consignee shall be final and binding.

**e. REJECTION:**

While measuring the length, the sample piece from each length shall be taken for carrying out the test as per EN 50397-1:2020. All the values of each sample should not exceed the values per the relevant specification. In case of deviation, whole lot will be rejected at works.

**f. EN CERTIFICATION MARK:**

The AL59ACS COVERED Conductor with EN marking only is required by the PVVNL Against this tender specification

**g. SCHEDULES:**

The tenderer shall fill in the following schedules which form part of the tender specification and offer.

**TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS  
COVERED CONDUCTOR & ACCESORIES**

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# TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESORIES

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Schedule ' C ' ——— Schedule of Tenderer's Experience.

## SCHEDULE 8C9

### SCHEDULE OF TENDERER'S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed/under execution by him to whom a reference may be made by Purchaser in case he considers such a reference Necessary.

---

Sr.	Name of Client & Description. of order and commissioning	Value	Period of supply	Name & Address whom reference may be made	to No.
1	2	3	4	5	

---

NAME OF FIRM \_\_\_\_\_

NAME & SIGNATURE OF TENDERER \_\_\_\_\_

DESIGNATION \_\_\_\_\_

DATE \_\_\_\_\_

SEAL & SIGNATURE OF THE TENDERER

**TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS  
COVERED CONDUCTOR & ACCESORIES**

**GUARANTEED TECHNICAL PARTICULARS AL59 ACS Covered Conductor  
.....Sqmm**

SR. No	Description	Unit	To be filled by Bidder
1	Name & Address of Manufacturer		
2	Reference Standard		
3.0	Material of Covered Conductor		
3.1	Aluminium / Alloy Rods		
	a) Si	%	
	b) mg	%	
	c) fe	%	
	d) cu	%	
	e) mn	%	
	f) cr	%	
	g) zn	%	
	h) b	%	
	i) other elements (each)	%	
	j) other elements (total)	%	
	k) al	%	
3.2	Aluminium Alloy strands (Individual)	Nos	
3.3	Diameter		
	a) Nominal	mm	
	b) Maximum	mm	
3.4	Minimum Breaking load of strand		
	a) Before stranding		
	b) After stranding		
3.5	Maximum Resistance of strand at 20 deg. C	Ohm/km	
3.6	Minimum elongation of strand (200mm gauge)		
	Before and After Stranding		

## TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ACCESSORIES.

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4	<b>Complete conductor</b>	
4.1	Calculated breaking load of complete conductor	KN
4.2	Lay ration conductor (lay length/overall diameter)	
	a) 6+1 wire aluminium alloy layer	
4.3	Maximum DC Resistance of complete conductor at 20 deg. C	ohms/km
4.4	Working tension of conductor	
4.5	Modulus of elasticity of	
	a) Conductor	kg/cm <sup>2</sup>
4.6	Co-efficient of linear expansion per degc of	
	a) Conductor	per deg c
4.7	a) Overall diameter of conductor	Mm
	b) Actual area	Sq.mm
	c) Cross sectional area of individual aluminium alloy wire	Sq.mm
5	Filling	
6	Insulation	
6.1	Material	
6.2	Nominal Thickness of insulation	
6.3	outer layer of insulation	
6.4	Colour	
7	<b>Length &amp; other details of Covered conductor</b>	
7.1	Standard length of covered conductor	Mtr
7.3	Direction of lay for outermost layer	
7.4	Linear mass of the covered conductor (Approx.)	kg/km
	a) Approx. mass of individual aluminium / alloy wire	kg/km
7.5	Embossing / printing on cable	
7.6	Approximate Standard drum length	mtrs
7.7	Drum dimension in MM	mm
8	Continues AC current capacity	Amp
9	Short current rating of covered conductor KA for 1 Sec	kA

## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MCCC) ACCESSORIES

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### INDEX

Clause No.	Clause
1	SCOPE
2	SERVICE CONDITIONS
3	APPLICABLE STANDARDS
4	TYPE OF ACCESSORIES for (MVCC)
5	MARKING
	Annexure-I
	Annexure-II

## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MCCC) ACCESSORIES

### g) SCOPE:

This specification covers design, manufacture, assembly, testing and supply of Accessories for AL59 ACS Covered Conductors for use on 33 kV & 11 kV distribution systems.

### h) SERVICE CONDITIONS:

The Accessories to be supplied against this specifications shall be suitable for satisfactory continuous operation under the following tropical conditions.

- i. Maximum ambient temperature (Degree C) ----- 50
- ii. Minimum temperature of air in shade (Degree C) ----- 3.5
- iii. Relative Humidity (%) ----- 10 to 100
- iv. Maximum Annual Rainfall (mm) ----- 1450
- v. Maximum Wind Pressure (kg/sq.m.) ----- 150
- vi. Maximum altitude above mean sea level (meter) ----- 1000
- vii. Isoceraunic level (days/ year) ----- 50
- viii. Seismic level (Horizontal acceleration) ----- 0.3g

### i) APPLICABLE STANDARDS:

Unless otherwise stipulated in this specification, the accessories of conductor shall conform to the following Standards (amended upto date).

1	EN 50397-1:2006	Covered Conductor Specification- Up to 33 KV
2	EN 50397-2:2006	Covered Conductor Accessories Specification- up to 33 KV
3	NFC 33-041 (SEPTEMBER 2013)	Insulated cables and their accessories for power systems – Anchoring devices for overhead distribution with bundle assembled cores, of rated voltage 0.6/1 kV.
4	EN 50483-4 (MARCH 2009)	Test requirements for low voltage aerial bundled cable joints
5	EN 50397-2 (MARCH 2010)	Covered conductors for overhead lines and the related accessories for rated voltages above 1kV a.c. and not exceeding 36kV a.c. PART 2 : Accessories for covered conductors : tests and acceptance criteria
6	EN 50182	Conductors for overhead lines- Round wire concentric lay conductors

### j) TYPE OF MEDIUM VOLTAGE COVERED CONDUCTOR ACCESSORIES:

The Accessories of Medium Voltage Covered Conductor (MVCC) are specified below and shall consist of the following:

## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MVCC) ACCESSORIES

Sl.No.	Description	Application
1	Tension Assembly (TA)	<p>11 For fitting onto a pole for tensioning at the beginning or end of a length of MVCC, or for anchoring while a major change in direction.</p> <p>12 The Tension assembly consists of one wedge type Tension / anchoring clamp and one Tracking protection IPC.</p>
2	Insulator Clamp / Tie (IC)	<p>3. For supporting and aligning MVCC at an intermediate pole in a length, with small angle of deviation.</p> <p>4. The Insulator Clamp hold the MVCC in its position on top of the pin or post insulator.</p> <p>5. Insulator Tie consists of either an &lt;Insulated Plastic= or &lt;Metallic helical= Type for Line Alignment.</p>
3	Suspension Clamp (SC)	<p>9. For supporting a length of MVCC at an intermediate pole in a length, with large angle of deviation with a disc insulator.</p> <p>10. The suspension clamp consists of an &lt;Assembly with one locking type Suspension clamp with provision to fix in Insulators.</p>
4	Insulation Piercing Connector for <Bare to Covered interconnection= (IPC – Type 1)	<p>v) For main (Bare) to main (MVCC) networking connection.</p> <p>vi) This connector is to ensure the electrical characteristics within the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC.</p>
5	Insulation Piercing Connector for Networking / Branching / Looping (IPC – Type 2)	<p>G. For main (MVCC) to main (MVCC) networking or branching of MVCC to another MVCC or Branch Cable or Looping for transformer junctions.</p> <p>H. This connector is to ensure the electrical characteristics within the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC.</p>
6	Insulation Piercing Connector with Aluminium Ball for earthing (IPC – Type 3)	<p>(xi) For Temporary Earthing Provision from MVCC Cable for maintenance purpose.</p> <p>(xii) This connector is to ensure the electrical characteristics within the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC.</p>
7	Tension Joints (TJ)	Mid-span tension joints for jointing MVCC over a span.



## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MCCC) ACCESSORIES

- Tension / Anchoring Clamp:

Anchoring assemblies are used to firmly hold the MVCC to a concrete or steel pole and transmit the mechanical tension.

- at the end of a run
- at a major change in direction of over 20 degrees.

The clamp should consists of an Aluminium alloy corrosion resistant casted body, Rigid sling (<bail=) of stainless steel with Tracking IPC and self-adjusting plastic wedges which shall anchor/hold the cable. The following key criterion to be followed for the design of the same

- There shall be no losable part (except Tracking IPC and ball) in the process of clamping arrangement
- Locking mechanism should be wedge type self-locking. Wedges are to be made of high strength, climatic resistance Engineering Plastic with glass fibre.

The fittings shall be able to withstand the specific minimum failure load (SMFL) and shall not damage the covering. SMFL is the minimum load specified by the purchaser or declared by the supplier at which mechanical failure will not take place.

- Rigid Sling (Bail) of Anchor Assembly

- The Anchoring assembly shall be supplied with a Galvanized steel rod to connect the Tension Clamp to the Insulator clamp on the pole.
- The Rigid Bail forming part of clamp should have sufficient distance between bracket and body of clamp and shall have sufficient mechanical strength to withstand the mechanical test for the complete assembly tests in this specification.
- Flexible bail is not acceptable due to the reason to withstand the load.
- Rigid Bail should be fitted with provision to remove from the clamp to have easy installation.

- Wedge Type Tension Clamp for Anchoring Assembly

- Wedge type clamps shall be used for clamping the MVCC without damaging the insulation and shall be capable of clamping an uncut MVCC so that it can continue without break to the connecting point or next span.
- The clamp shall be of aluminium with fully insulating type of mechanical and weather resisting thermoplastic wedges.
- No tools shall be needed for fitting the MVCC into the clamp.
- Type tests as per IEC and specification shall be conducted from NABL accredited independent Lab of India/the International Laboratory Accreditation corporation,
- Mutual Recognitions Arrangement (ILAC, MRA) signatory Laboratory like COFRAC.

- Testing Requirements for an Anchoring Assembly.

The following tests are intended to establish design characteristics as per EN 50397 – 2 and NFC 33-041.

#	Test	Type test	Acceptance Test	Routine test
1	Visual examination	x	x	x

## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MVCC) ACCESSORIES

2	Dimensional verification	x	x	x
3	Mechanical tests	x		
3.1	Tensile test at ambient temperature	x	x	
3.2	Tensile test at low temperature	x		
3.3	Tensile test at high temperature	x		
3.4	Slippage test at ambient temperature	x	x	
4	Environmental tests			
4.1	Corrosion test	x		
4.2	Climate ageing test	x		
4.3	Resistance against tracking in heavy polluted areas	x		
5	Check for permanent marking	x	x	

### (viii) Insulator Clamps / Ties

The Clamps / ties shall be designed suitably to hold the MVCC in its position on top of the insulator. The Clamps is preferred to be made of Insulating Plastic materials or protected with Insulating Plastic material to ensure tracking resistance and to avoid any insulation damage to covered conductor due abrasion while mechanical or wind induce vibration.

#### • Testing Requirements for an Insulator Clamps / Tie

Tests shall meet the requirement of EN Standard 50397 – 2

Sl. No.	Test	Type test	Acceptance test	Routine test
1	Visual examination	x	x	x
2	Dimensional verification	x	x	x
3	Check for Marking	x	x	x
4	Mechanical tests	x	x	x
4.1	Failure Load Tests	x	x	x
4.2	Slip Load Tests	x	x	x
4.3	Lift / Side Load Tests	x	x	x
4.4	Thermal Tests under load	x		
4	Environmental tests			
4.1	Corrosion test	x		
4.2	Climate ageing test	x		
4.3	Resistance against tracking in heavy polluted areas	x		

### (ix) Suspension Clamps

The Suspension Clamps shall be made of Insulating Plastic to ensure tracking resistance and to avoid any insulation damage to covered conductor due abrasion while mechanical or wind induce vibration.

## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MCCC) ACCESSORIES

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- Testing Requirements for Suspension Clamps

Tests shall meet the requirement of EN Standard 50397 – 2.

### 5.5 Insulation Piercing Connectors for MVCC

- Insulation Piercing Connectors (IPC) are used for making Tee / Tap-off/ connections to an MVCC / Bare Overhead Line.
- Insulation Piercing Connectors are designed to make a connection between the uncut main conductor and a branch cable conductor without having to strip either cable to expose the conductor. Instead, the tightening action of the IPC will first pierce the insulation, then make good electrical contact between the main and branch conductor while simultaneously insulating and sealing the connection.
- The insulation piercing connectors shall be of the following type(s) depending on the applications.

#### (q) Insulation Piercing Connectors

- The connector bodies shall be made entirely of mechanical and weather resistant plastic insulation material made of weather & UV resistant reinforced polymer and no metallic part outside the housing is acceptable except for the tightening bolt or nuts.
- Any metallic part that is exposed must be free from potential during or after connector installation.
- Screws or nuts assigned for fitting with IPC (Insulating Piercing connector), must be fitted with torque limiting shear heads to prevent over tightening or under tightening.
- While the min & max torque values are to be specified by Manufacturer, these should not exceed 27 N mtr for IPC for main conductor < 95 sq mm, and 42 Nmtr for main conductor > 95, but < 240 sq mm.

Sl. No.	Test	Type Test	Acceptance Test	Routine test
1	Visual examination	x	x	x
2	Dimensional verification	x	x	x
3	Check for Marking	x	x	x
4	Mechanical tests	x	x	x
4.1	Failure Load Tests	x	x	x
4.2	Slip Load Tests	x	x	x
4.3	Lift / Side Load Tests	x	x	x
4.4	Thermal Tests under load	x		

- The IPC must perform piercing and connection on Main and Branch cables simultaneously using single bolt for tightening as multiple bolts do not ensure even tightening. The shear bolt/nut shall be suitable for tightening with a hexagonal socket of 13 mm or 17mm.



## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MCCC) ACCESSORIES

- The contact teeth or blade of the connector is made of tinned copper with equivalent cross section with respect to %IACS to suit the max branch cable size declared.
- The IPCs shall be water proof and the water tightness shall be ensured by appropriate elastomeric materials and not by grease, gel or paste alone. Grease can be applied to protect the contact blade alone and shall not be visible on the outer surface of the connector. Connector should not be dipped in grease.
- Each IPC should be provided with a cap to seal the cut end of the Branch cable. It should be of a design that once the connector is installed, it shall not be possible to remove the cap without dismantling the connector.
- All the metallic parts of the connector should be corrosion resistant and there should not be any appreciable change in contact resistance & temperature after overloads & load cycling and should conform to the long duration tests specified in this standard.

### (r) Testing Requirements for Suspension Clamps

The following tests are intended to establish design characteristics as per NFC 33-003,004, 020 and EN 600068 – 1.

Sl. No.	Test	Type test	Acceptance Test	Routine test
1	Visual examination		x	x
2	Dimensional verification		x	x
3	Mechanical tests	x	x	x
4	Voltage and Water Tightness test	x	x	x
5	Climatic Ageing Test	x		
6	Corrosion Test	x		
7	Electrical Ageing Test	x		
8	Check for marking	x	x	

### 5.6 Mid Span Insulated Jointing Sleeves

The sleeves should be Pre-Insulated type. Sleeve should be made of Aluminium, insulated with an Anti-UV black thermoplastic tube hermetically sealed two ends with 2 flexible rings. Strip length, Hexagonal crimping die reference and size to be marked on the outer surface of plastic sleeve.

Reference standard, type test and design requirements as per NFC 33 021

## TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED CONDUCTOR (MCCC) ACCESSORIES

Sl. No.	Test	Type Test	Acceptance Test	Routine Test
1	Visual examination	x	x	x
2	Dimensional verification	x	x	x
3	Check for Marking	x	x	x
4	Voltage and Water Tightness test	x	x	x
5	Climatic Ageing Test	x		
6	Corrosion Test	x		
7	Electrical Ageing Test	x		

### 4.5.1 Heat Shrinkable End Cap

The Insulated End Cap with sealant shall be suitable for effectively sealing the end terminal of the covered conductors. The inner diameter range of the Cap shall be such that it shall tightly fit to the covered conductors to prevent entry of moisture.

### 25.10 MARKING:

#### 25.11 On Covered Conductor

The covered conductors shall carry the following marking as per S0397-1

#### 5.2 On Accessories

- Manufacturer's name with designation if any.
- Batch code and Manufacturing period (MM/YY) is to be marked.

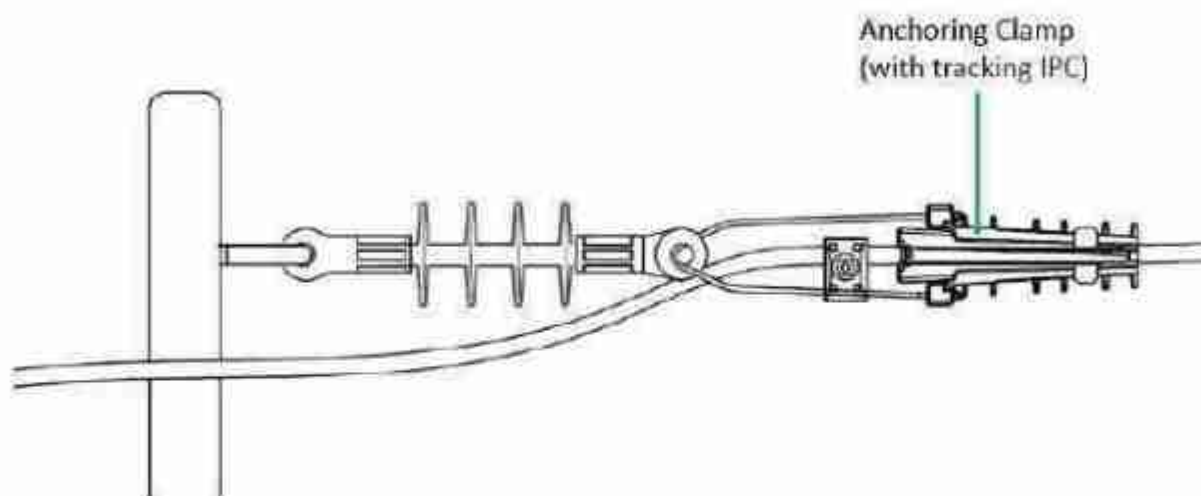
**TECHNICAL SPECIFICATION OF (MEDIUM VOLTAGE) AL59 ACS  
COVERED CONDUCTOR & ITS ACCESORIES.**

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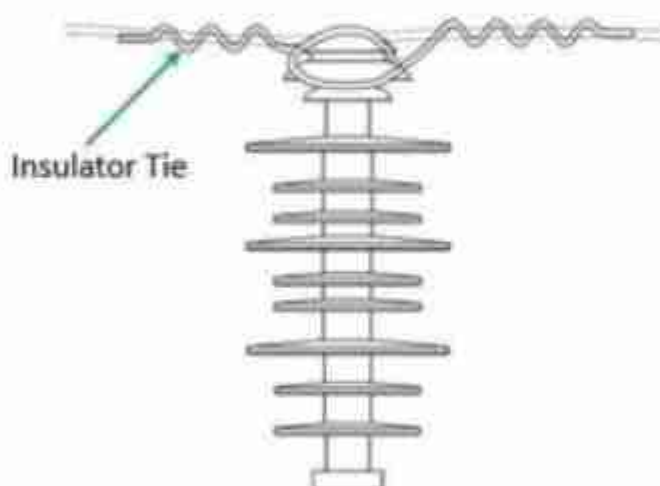
**ANNEXURE I: - TYPICAL GENERAL ARRANGEMENT DIAGRAM AND  
DRAWINGS**

- (30) Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC.

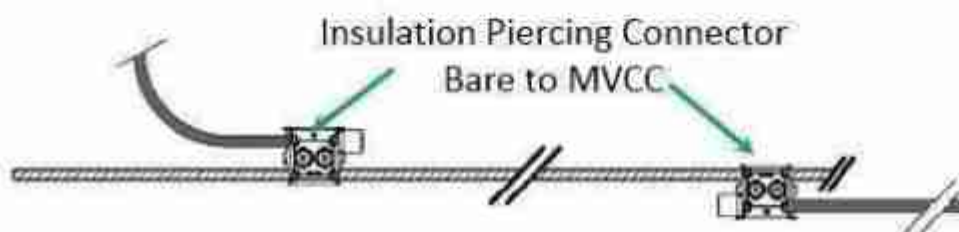
Anchoring with protection against Tracking.



- (31) Insulator Clamp / Tie (IC)



- (32) TYPE-1: Insulation Piercing Connector for Networking / Branching / Looping, TYPE -3: Insulation Piercing Connector with Aluminum Bail for earthing and Tension Joints(TJ)





## TECHNICAL SPECIFICATION OF (MEDIUM VOLTAGE) AL59 ACS COVERED CONDUCTOR & ITS ACCESORIES.

### **ANNEXURE-II - Guaranteed technical particular format**

• **GTP for Dead-End / Anchoring Assembly (Dead-End Clamp with Bracket)**

Sl. No.	Description	Particulars
1	Name of the Supplier	
2	Type of Design	
3	Weight	
4	Cable Range	Range to in line with this specification
5	Material	
6	Ultimate Tensile Strength	For conductor range of 50 – 70 sq.mm = 20 KN For conductor range of 70 – 120 sq.mm = 30 KN For conductor range of 120 – 200 sq.mm = 30 KN
7	Installation(With/Without disassembly)	Ready- to-use (Without disassembling)
8	Marking	
9	Dimensions	

• **GTP for Insulator Clamp / Tie (IC)**

Sl. No.	Description	Particulars
1	Name of the Supplier	
2	Length	
3	Weight	
4	Cable Range	Range to in line with this specification
5	Material	
7	Installation(With/Without disassembly)	Ready- to-use (Without disassembling)
8	Marking	

**TECHNICAL SPECIFICATION OF (MEDIUM VOLTAGE) AL59 ACS  
COVERED CONDUCTOR & ITS ACCESORIES.**

- GTP for Suspension Clamp

## Additional Technical Specification

Sl. No.	Description	Particulars
1	Name of the Supplier	
2	Cable Range	Range to in line with this specification
3	Material	
4	Minimum Breaking Load – Vertical	
5	Installation (With/Without disassembly)	Ready-to-use (Without disassembling)
6	Marking	
7	Dimensions	
8	Weight	

### • **GTP for INSULATION PIERCING CONNECTOR**

Sl. No.	Particulars	
1	Name of supplier	
2	Type of connection required	Bare to Covered conductor Covered conductor to Covered conductor Tapping connector
3	Are torque limiting shear heads provided to tightening bolts	
4	Range of cable sizes accommodated for Main & Branch	Range to in line with this specification
5	Tightening Torque	
6	Torque for establishing connection between main and Tap (Nm)	70% of min torque specified
7	Marking and embossing on the connector	

### • **GTP for INSULATED TENSION / MIDSPAN JOINTS**

Sl. No.	PARTICULARS	
1	Name of Supplier.	
2	Is manufacturer of Accessories an ISO 9001-2000 Company?	
3	Type No & Size Range	Range to in line with this specification
4	Is any metallic part carrying potential in operation exposed during installation	

## Additional Technical Specification

5	Installation	Crimping by Hexagonal Compression
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## Additional Technical Specification

### **1.00 GENERAL**

This specification covers the design, manufacture, assembly, testing at manufacture's works before dispatch and delivery of metal clad partitioned, SF6 gas insulated, switchboard panel conforming to IEC-62271-200. The switchboard panels for line bays, transformer bays, bus coupler/Bus-section bays, etc. shall be fitted with Vacuum circuit breakers, three position disconnecting and earthing switches, voltage transformers, current transformer, metering instruments, protection relays, cable terminal ends for incoming & outgoing cable feeders etc. as per foregoing specification.

### **REFERENCE STANDARDS**

- The metal-enclosed gas-insulated switchgear, including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be designed, manufactured, assembled and tested in accordance with the relevant standards, specification and codes of practices, referred to herein & in Section GTR, and shall be the latest editions including all applicable official amendments and revisions as on the date of opening of bid. In case of conflict between this specification and those (IS Codes, Standards etc.), the former shall prevail. In addition to relevant standards specified in Section-GTR, following standards shall also be applicable:

<b>IEC 62271-200</b>	Gas insulated metal-enclosed switchgear for rated voltage above 1kV and up to and including 52 kV
<b>IEC 62271-102</b>	A.C. disconnectors (isolators) and Earthing switches for voltages above 1000 V
<b>IEC 62271-207</b>	Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV
<b>IEC 60376</b>	New Sulphur hexafluoride
<b>IEC 62271-200</b>	High voltage metal enclosed switchgear & control gear Circuit breakers
<b>IEC 60044-1</b>	Current Transformers
<b>IEC 60044-2</b>	Voltage Transformers
<b>IEC 62271-209</b>	Cable connections for gas-insulated switchgear

- The components and devices which are not covered by the above standards shall conform to, and comply with, the applicable standards, rules, codes, and regulations of the internationally recognized standardizing bodies and professional societies as may be approved by the Employer and the manufacturer shall list all such applicable standards, codes etc.
- Equipment conforming to any other internationally accepted standards will also be considered if they ensure performance and constructional features equivalent or superior to the standards listed above.

## Additional Technical Specification

### 1. **EQUIPMENT SPECIFICATION**

#### 2. **Switchgear Panel**

- 2.1 Gas Insulated Metal clad switchgear shall be complete with all the accessories for efficient and trouble-free operation. The equipment offered shall be safe, reliable and compact to install. The workmanship shall be high order. The circuit breaker, switches and protective device etc shall be latest design so as to ensure rapid and efficient interruption of fault current low arc energy, small arcing time and freedom from fire hazards.
- 2.2 The GIS shall be designed, manufactured, and tested in accordance with the best international engineering practices under strict quality control to meet the requirement stipulated in the technical specification. Adequate safety margin with respect to thermal, mechanical, dielectric stress and insulation coordination etc. shall be maintained during design, selection of raw material, manufacturing process etc. so that the GIS provides longlife with least maintenance.
- 2.3 The workmanship shall be of the highest quality and shall conform to the latest modern practices for the manufacture of high technology machinery and electrical switchgear.
- 2.4 The switchgear panel shall be free standing, floor mounted, fully compartmentalized, metalenclosed construction complying requirements of IEC 62271-200. Each circuit shall have a separate vertical panel with required compartments for circuit breaker, cable termination, main bus bars and auxiliary control devices.
- 2.5 The SF6 gas insulated metal enclosed switchgear shall be totally safe against inadvertent touch of any of its constituent live parts.
- 2.6 The design should be such that all parts subjected to wear and tear are easily accessible for maintenance purposes. The Service Class Continuity of Switchgears shall be **LSC 2- PM** (as per IEC 62271-200).
- 2.7 All necessary equipment required for Gas handling at site (if any), shall be arranged by the supplier at their own cost.
- 2.8 All louvers (if provided) shall have very fine brass or GI mesh screen. Tight fitting gasket / gaskets are to be provided at all openings in relay compartment. Relays shall be fully flush mounted on the switchgear panels at a suitable height from operator point of view.
- 2.9 Switchgear shall have an Internal Arc Classification of IAC-A-FLR 25 KA, 1 sec. The switchgear construction shall be such that the operating personnel are not endangered by breaker operation and internal explosions, and the front of the panels shall be specially designed to withstand these. Gas Pressure relief device/Explosion Vent/Pressure relief duct shall be provided for each SF6 gas compartment, so that in case of a fault in a compartment, the gases produced are safely vented out. The pressure relief device/Explosion Vent/Pressure relief duct shall not however reduce the degree of protection of panels under normal working conditions.



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- 2.10 The switchgear shall be cooled by natural air flow.
- 2.11 Total height of the switchgear panels shall be finalized during detail engineering in line with building design. The height of switches, pushbuttons and other hand operated devices shall not exceed 1800 mm and shall not be generally less than 700 mm.
- 2.12 Suitable interlock & Indications shall be provided to prevent opening of any HT compartment doors, in case the incoming HT supply is ON.
- 2.13 Suitable base frames made out of steel / **Aluminium** channels shall be supplied along with necessary anchor bolts and other hardware, for mounting of the switchgear panels. These shall be dispatched in advance so that they may be installed and leveled when the flooring is being done, welding of base frame to the insert plates shall be in Bidder's scope. The bidder may offer panels with built in base frame ready for dispatch and suitable for installation on indoor cable trenches.
- 2.14 The switch board shall have the facility for extension on both sides.
- 2.15 SF6 gas leakage rate should not exceed 0.5% per annum.
- 2.16 A thermostatically controlled space heater with common MCB shall be provided for various compartments.

### 3. **Circuit Breakers (VCB Type)**

- a) The circuit breakers shall be of Vacuum type. It shall comprise of three single pole interrupting units or 3-pole interrupting unit, operated through a common shaft by a sturdy operating mechanism.
- b) Circuit breakers shall be re-strike free, stored energy operated and trip free type. Motor wound closing spring charging shall only be acceptable. Anti-pumping features shall be provided for each breaker. An arrangement of two breakers in parallel to meet a specified current rating shall not be acceptable.
- c) Circuit breaker shall be provided with two trip coils.
- d) Suitable indicators shall be provided on the front of panel to indicate OPEN / CLOSED conditions of the circuit breaker, and CHARGED / DISCHARGED conditions of the closing spring, SF6 gas density monitor for all gas compartments.

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- e) The rated control supply voltage shall be as mentioned elsewhere under Technical parameters. The closing coil and spring charging motor shall operate satisfactorily at all values of control supply voltage between 85–110% of the rated voltage. The trip coil shall operate satisfactorily under all operating conditions of the circuit breaker upto its rated short circuit breaking current at all values of control supply voltage between 70–110% of the rated voltage. The trip coil shall be so designed that it does not get energized when its healthiness is monitored by indicating lamps and trip coil supervision relay.
- f) The time taken for charging of closing spring shall not exceed 60 seconds. The spring charging shall take place automatically preferably after a closing operation. Breaker operation shall be independent of the spring charging motor which shall only charge the closing spring. Opening spring shall get charged automatically during closing operation. As long as power supply is available to the charging motor, a continuous sequence of closing and opening operations shall be possible. Spring charging motors shall be capable of starting and charging the closing spring twice in quick succession without exceeding acceptable winding temperature when the control supply voltage is anywhere between 85– 110% of rated voltage. The initial temperature shall be as prevalent in the switchgear panel during full load operation with 40 deg. C ambient air temperature. The motor shall be provided with Over load protection.
- j) Motor windings shall be provided with class E insulation or better. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in a hot, humid and tropical climate.

### **4. Disconnecting & Earthing Switches**

- 4.1 Each Switchgear panel shall be provided with three (3) position disconnecting–cum– earthing switch of required rating.
- 4.2 It shall be possible to control these switches from front of the panel & remotely from SCADA/SAS through IED.
- 4.3 Necessary indication shall be provided on the front of the panel for Close/Open status of the three position switches.

### **5. Control and Interlocks**

- 5.1 The circuit breaker shall normally be controlled remotely from SAS/SCADA system through closing and trip coils. However, it shall also be designed to control locally from Indoor Switchgear panel. Suitable mimic on Panel shall be provided.
- 5.2 Facilities shall be provided for mechanical tripping of the breaker in an emergency. Facility shall also be provided for manual charging of the stored energy mechanism for a complete duty cycle.

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- 5.3 Necessary mechanical & Electrical interlocks shall be provided between CB, Isolator & Earth switches for failsafe operation.
- 5.4 Each CB, Isolator & earth switch shall have 2 NO + 2 NC Auxiliary spare contacts for future use by owner.
- 5.5 Manual operation of the different switches like breaker

### 6. **Busbars and Insulators**

- 6.1 Busbar shall be of copper of adequate size and bus bar size calculation / supporting type test report shall be submitted for approval. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents.
- 6.2 Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators.
- 6.3 Bus bar cross-section shall be uniform throughout the length of switchgear board. All Indoor switchgears (GIS Type) manufacturer's Standard design i.e. bus bar (SF6/Solid core/epoxy insulated) various gas chambers, placing of various equipment's in the panel etc shall be acceptable.
- 6.4 Busbar insulators shall be of arc and track resistant, high strength, non-hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over-voltages, and short circuit current. In case of organic insulator partial discharge shall be limited to  $100 \text{ pico coulomb at rated Voltage} \times 1.1 / \sqrt{3}$ .
- 6.5 All busbars shall have suitable phase identification. Bus switching scheme shall be as per Single Line diagram attached with bidding documents.
- 6.6 The temperature of the busbars and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Standards, duly considering the specified ambient temperature (40 deg. C).

### 7. **Earthing and Earthing Devices**

- a) The grounding system for GIS shall be designed and provided as per IEEE-80-2000 and CIGRE- 44 to protect operating staff against any hazardous touch voltages and electro- magnetic interferences.
- b) A copper / galvanized steel earthing bus shall be provided at the bottom and shall extend throughout the length of each switchboard. It shall be bolted/ welded to the framework of each panel and each breaker earthing contact bar. The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth without exceeding the allowable temperature rise.
- c) Suitable arrangement shall be provided at each end of the earth bus for bolting to station earthing grid. All joint splices to the earth bus shall be made through at least two bolts

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and taps by proper lug and bolt connection.

- d) All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical continuity of the whole switchgear enclosure framework and the truck shall be maintained even after painting.
- e) All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. Insulation colour code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering shall not be acceptable. Looping of earth connections which would result in loss of earth connection to other devices, when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths of earth bus is acceptable.
- f) VT and CT secondary neutral point earthing shall be at one place only on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit may be removed without disturbing the earthing of other circuits.
- g) The panel shall have **Voltage Presence Indicator (VPI)** to warn the operator against earthing of live connections.
- h) All hinged doors shall be earthed through flexible earthing braid.

### 8. Instrument Transformers

- 8.1 All current transformers shall preferably be ring type whereas voltage transformers (PT) shall be cast resin insulated type. **PT must be metalized touch proof type without any HT HRC fuse at Primary.**
- 8.2 Instrument transformers shall be suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated load and the outside ambient temperature is 40 deg. C. The class of insulation shall be E or better.
- 8.3 All instrument transformers shall withstand the power frequency and impulse test voltage specified for the switchgear assembly. The current transformer shall further have the dynamic and short time ratings at least equal to those specified for the associated switchgear and shall safely withstand the thermal and mechanical stress produced by maximum fault currents specified when mounted inside the switchgear for circuit breaker modules.
- 8.4 The parameters of instrument transformers specified in this specification are indicative and shall be finalized by the Employer during detailed engineering, considering the actual burden of various relays and other devices finally selected. In case the Bidder finds that the specified ratings are not adequate for the relays and other devices offered by him, he shall offer instrument transformer of adequate ratings without any cost implication.



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8.5 All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block.

8.6 All voltage transformer's secondary circuits shall have suitable HRC/MCB protective devices.

### 9. **Numerical Protection Relays (IEDs)**

- Indoor switchgear panels shall have communicable numerical protection relays (IEDs) complying with IEC-61850 on all feeders which shall be networked on Ethernet to communicate with substation SAS/SCADA system on IEC-61850. These IEDs shall also be used for control & monitoring the switchgear from SAS. In addition to status of devices (CBs/Isolators/Earth Switches) and equipment alarms, Metering data shall also be made available to SAS/SCADA station from protection IEDs. Further, multifunction meters with Modbus protocol are also envisaged, which will be connected in daisy-chain-link to communicate to station SAS. Modbus to IEC 61850 converter shall be provided for integration with SAS.

The Bidder's scope shall include the followings:

- Communicable Numerical Protection Relays (with IEC 61850) in each of the feeders & Bus-section/Bus coupler
- IEDs / Numerical Relays shall have digital display, Single line diagram (SLD) display to facilitate settings, relay operations and to view measurement, event and alarm etc.
- Relays shall have built in Local/Remote Selector Switch.
- Cat5e Ethernet cable for connection of Numerical Relays (IEDs) to Ethernet switches and Optical cable between Ethernet switch (for indoor switch gear IEDs) and ring/ redundant network of Substation LAN switch shall be used.
- Required number of Ethernet switches mounted in Indoor Switchgear panels for communication with IEDs on IEC 61850 protocol.
- The SAS/SCADA system has been envisaged as part of main substation. Bidder shall facilitate in successful integration of Numerical Relays to the SAS/SCADA system through Ethernet switches.
- All Numerical relays shall be of proven design for the application satisfying requirements specified elsewhere and shall be subject to Employer's approval. Numerical Relays shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity for the intended application.
- All numerical relays shall be rated for control supply voltage as mentioned elsewhere under system parameters and shall be capable of satisfactory continuous operation between 80- 120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. Heavy duty binary output contacts of IEDs to be used for breaker close and trip commands shall be so rated as to be used directly in the closing and tripping circuits of breaker without the need of any interposing / master trip relays.

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- Threshold voltage for binary inputs shall be suitably selected to ensure avoidance of mal- operation due to stray voltages and typically shall be more than 70% of the rated control supply voltage.
- All IEDs shall have freely programmable optically isolated binary inputs (BI) and potential free binary output (BO) contacts as per approved scheme. These I/O points shall be used for wiring of status of devices (CB/Isolator/Earth switch) and equipment alarms etc.
- Failure of a control supply and de-energization of a relay shall not initiate any circuit breaker operation.
- Relays shall have event recording feature with time stamping. Event records & alarms shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data.
- All Numerical relays shall have features for electrical measurements including voltage, current, power (active & reactive), frequency, power factor etc.
- All numerical relays shall have provision of both current (CT) and voltage (VT) inputs as required for protection & measurement purposes using protection cores.
- All numerical relays shall have built-in key pad / keys to allow relay setting from relay front. Resetting of relay shall be possible from remote SCADA.
- Relays shall have suitable output contact for circuit breaker failure protection (LBB) logic.
- Relays shall have self diagnostic feature with continuous self check for power failure, program routines, memory and main CPU failures and a separate output contact for indication of any failure.
- Contractor shall submit applicable Type Test reports for Numerical relays as per IEC including report for IEC 61850 protocol from accredited lab.

### **10. Control & Protection System**

All numerical relays shall communicate to station SCADA / SAS on IEC-61850 communication protocol. It is envisaged that these protection IEDs shall be used for CB control & monitoring of bay equipments.

#### **• Numerical Transformer Protection Relay**

- The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50N) protection elements.
- The over current element should have the minimum setting adjustable between 20-200% of CT secondary rated current and high set setting 500-2000%.



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- The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5% to 80% of the CT rated current (IDMT) and high set 100–1000%.
- The relay shall have selectable directional & non-directional feature
- For transformers of rating 5MVA and above, definite time delayed Stand by earth fault protection shall be provided having a pick up setting range of 10% to 40% with a timer delay of 0.3 sec to 3 sec.
- The relay shall allow higher setting during transformer charging (inrush) and lower setting during normal operating condition.
- Transformer troubles like Buchholz, Winding temperature, Oil temperature & Pressure Relief Device trips etc. (as applicable) shall be wired independently to separate binary inputs of the relay and shall be configured to issue trip command to the breaker. Similarly alarm points shall be wired separately to binary inputs of the relay.
- Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

### **Numerical Line Protection Relay**

- The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50N) protection elements.
- The over current element should have the minimum setting adjustable between **20–200%** of CT secondary rated current.
- The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5% to 80% of the CT rated current.
- The relay shall have selectable directional & non-directional feature
- Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

### **Numerical Bus Coupler/Bus-Section Protection Relay**

- The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50N) protection elements.
- The over current element should have the minimum setting adjustable between **20–200%** of CT secondary rated current.
- The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5% to 80% of the CT rated current.
- No bus volt signal shall be configured in the relay for use in control logics and other Protections and Control functions in the Relays.
- Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

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### **Other Control and Protections features**

- Control of breakers, three position Isolators & Earth switches shall be carried out from the station HMI of SAS/SCADA system through the LAN and the numerical relays.
- The station HMI shall have a graphical dynamic Plant Key Single Line Diagram to view the complete system status. This shall include the status of the switchgears, measurement values, operation counters, graphical alarm representation, etc. Spontaneous changes of a state, typically opening of a circuit breaker from a protection, shall have a specific colour code. All the Breakers with the status shall be clearly displayed along with values of currents, voltages, frequency, active and reactive powers etc.
- Schematics requiring auxiliary relays / timers for protection function shall be part of numerical relay. Timer functions shall be configurable for on & off delays as per requirement.
- The numerical relay shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery backup for real time clock in the event of power supply failure shall be provided.
- At least 100 time tagged events / records shall be stored with time stamping. Details of at least 5 previous faults including the type of protection operated, operating time, all currents & voltages and time of fault.
- Automatic testing, power on diagnostics with continuous monitoring shall be provided in the IED to ensure high degree of reliability. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be available on the user interface
- The alarm/status of each individual protection function and trip operation including measurement values shall be communicated to the SAS/SCADA system.
- Sequence of events shall have 1ms resolution at device level.
- Measurement accuracy shall be 1%.
- It shall be possible to carry out open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.

#### 3.10 **Painting**

Painting of panels shall be as specified in Section-GTR.

### **ETHERNET SWITCH**

- Ethernet switches shall be substation hardened and shall comply with IEC61850 for communications with IEDs. The Ethernet switches shall be of managed type with two (2) No. of Fiber optic cable ports and at least Sixteen (16) Copper ports to achieve the LAN configuration. More no. of switches or higher ports switch can also be supplied to meet all IEDs & multi-function meters requirements for the LAN. The Ethernet switches shall have features to support the redundant rings. These switches shall be mounted in the

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switchgear Panels: The FO ports shall be Single mode 1000Mbps ports. Copper ports shall be 10/100Mbps ports.

- Necessary software for configuration and real-time network monitoring shall be provided along with the Ethernet switches.

### **POWER CABLE TERMINATION**

- Cable termination compartment shall receive the stranded Aluminium conductor, XLPE insulated, shielded, armored, PVC jacketed, single core / three core, unearthed / earthed grade HT power cable(s) as specified in Section –Project. **The cable bushing must be C type placed alongside the width of the panel on the Gas tank. Cable bushing alongside the depth of the panel shall not be acceptable. End termination must be done by Screen separable touch proof kit.**
- Adequate clearance shall be kept between the cable lug bottom ends and gland plates for stress cone formation for XLPE cables. Inter-phase clearance in the cable termination compartment shall be adequate to meet electrical and mechanical requirement besides facilitating easy connections and disconnection of cables. Dimensional drawing of cable connection compartment showing the location of lug, glands, gland plates etc. and the electrical clearances available shall be submitted during detail engineering.
- Cable termination compartment shall have provision for termination of power cables of sizes indicated in the bidding documents. Cable entry shall generally be from the bottom; however, this shall be finalized during detail engineering.
- Necessary cable termination plugs shall be part of Indoor switchgear panel supplier for all panels. Scope also includes Panel terminal ends jointing/connection with HT cables.

### **(x) GENERAL REQUIREMENTS FOR ERECTION**

- (xi) The contractor shall move all equipment into the respective rooms through the regular door or openings specifically provided for this purpose. No parts of structure shall be utilized to lift or erect any equipment without prior permission of the Engineer-in-charge.
- (xii) Switchgear shall be installed on finished surfaces, concrete or steel sills. Contractor shall be required to install and align any channel sills which form part of foundations. Minor modifications to foundations shall be carried out by the Contractor. Contractor shall take utmost care in handling instruments, relays and other delicate mechanisms. Wherever the instruments and relays are supplied loose along with switchgear, they shall be mounted only after the associated switchgear panels have been erected and aligned. The blocking materials, employed for safe transit of instrument and relays shall be removed after ensuring that panels have been completely installed and no further movement of the same would be necessary. Any damage shall be immediately reported to Engineer.
- (xiii) Contractor shall include all special tools required for regular operation & routine maintenance of switchgear.

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### 5.7 **CONFIGURATION OF INDOOR SWITCHGEAR PANELS (GIS TYPE)**

Sl. No.	Equipment	Unit	IP1 I/C	IP2 O/G	IP3 LT TR	IP4 B/S
1.	CB, three position Isolator & Earth Switch (3-Ph)	Set	1	1	1	1
2.	CB Spring charge indicator	No.	1	1	1	1
3.	ON/OFF Indicators for CB	Set	1	1	1	1
4.	ON/OFF Indicators for three position GIS Isolator & Earth Switch	Set	1	1	1	2
5.	ON/OFF indicators for AIS Line Isolator & Line Earth Switch	Set	-	1	-	-
6.	CT (1-Phase)	Nos.	3	3	3	3
7.	VT (1-Phase)	Nos.	-	-	-	6
8.	Multi Function Meter	No.	1	1	1	1
9.	Control switch for Circuit Breaker	No.	1	1	1	1
10.	Control Switches for Three position GIS Isolator & Earth switch (Electrical)	Set	1	1	1	2
11.	DC healthy lamp (white)		1	1	1	1
12.	Trip circuit healthy lamp		1	1	1	1
13.	SF6 Gas Density Indicator for each compartment (set)	Set	1	1	1	1
14.	Capacitive Voltage Detection system (CVD)	Set	1	1	1	-
15.	Mimic to represent SLD	Set	1	1	1	1
16.	Voltmeter with selector switch	Set	-	-	-	2
17.	Numerical protection relay (IED)	No.	1	1	1	1
18.	LAN Switches and LAN/FO Cables	Set	AS per requirement			
19.	Cable Termination arrangement including cable end Plugs	Set	AS per requirement			

Notes:

- IP1 (I/C): Panel for Transformer Incomer feeder
- IP2 (O/G): Panel for outgoing Line Feeder
- IP3 (LT TR): Panel for LT Transformer feeder
- IP4 (B/S): Panel for Bus Sectionalizer
- Location of VT (I/C or B/S Panel) shall be decided during detail engineering.
- Numerical protection relay (IED) for all type of panels shall preferably be interchangeable to optimize mandatory spares.

### 6.3 **TESTS**

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### 6.4 Type Tests

The contractor shall submit the reports for the following type tests on the equipment to be supplied under the contract:

- (a) Switchgear Panel (with Circuit Breaker installed)
  - Short circuit duty test
  - Short time and peak withstand current test.
  - Power frequency withstand test.
  - Lightning impulse withstand test.
  - Temperature rise test.
  - Internal Arc Test as per IEC 62271-200 (for 1 second)
  - Measurement of resistance of main circuit
  - Test to verify pressure relief operation of the panel **(During internal arc test)**
  - Cable charging test
  - Short circuit withstand test of earthing device.
- (b) Circuit Breaker
  - Mechanical Endurance Test
- (c) Current Transformer
  - Short time current test
  - Temperature rise test
  - Lightning Impulse voltage withstand test
- (d) Potential Transformer
  - Temperature rise test
  - Lightning Impulse voltage withstand test
- (e) Switchgear Panel
  - IP 4X test

### 6.5 Routine Tests

All acceptance and routine tests as per the specification and relevant standards IEC 62271-200& IEC 62271-100 shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The manufacturer shall furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

### 6.6 Commissioning Checks / Tests



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After installation of panels, power and Control wiring and connections, Contractor shall perform commissioning checks as listed below to verify proper operation of switchgear / panels and correctness of all equipment in all respects. In addition, the Contractor shall carry out all other checks and tests recommended by the manufacturers.

- **General**

- Check name plate details according to specification.
- Check for physical damage!
- Check tightness of all bolts, clamps and connecting terminals
- Check earth connections.
- Check cleanliness of equipment
- Check heaters are provided.
- H.V. test on complete switchboard with CT & breaker in position.
- Check all moving parts are properly lubricated.
- Check for alignment of busbars.
- Check continuity and IR value of space heater.
- Check earth continuity for the complete switchgear board.

- **Circuit Breaker**

- Check alignment.
- Check correct operation
- Check control wiring for correctness of connections, continuity and IR values.
- Manual operation of breakers completely assembled.
- Power closing / opening operation, manually and electrically
- Closing and tripping time.
- Trip free and anti-pumping operation.
- IR values, resistance and minimum pick up voltage of coils.
- Simultaneous closing of all the three phases.
- Check electrical and mechanical interlocks provided.
- Checks on spring charging motor, correct operation of limit switches and time of charging.
- All functional checks.

- **Current Transformers**

- Megger between windings and winding terminals to body.
- Polarity tests.
- Ratio identification checking of all ratios on all cores by primary injection of current.
- Magnetization characteristics & secondary winding resistance.
- Spare CT cores, if any to be shorted and earthed.

- **Voltage Transformers**



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- Insulation resistance test.
- Ratio test on all cores.
- Polarity test.
- Line connections as per connection diagram.

### **Cubicle Wiring**

- Check all switch developments.
- It should be made sure that the wiring is as per relevant drawings. All interconnections between panels shall similarly be checked.
- All the wires shall be meggered to earth.
- Functional checking of all control circuit e.g. closing, tripping interlock, supervision and alarm circuit including proper functioning of component / equipment.
- Check terminations and connections.
- Wire ducting.
- Gap sealing and cable bunching.

### **Relays**

- Check internal wiring.
- IR of all terminal body.
- IR of AC to DC terminals
- Check operating characteristics by secondary injection.
- Check operation of electrical/ mechanical targets.
- Relay settings.

## **9.00 SYSTEM PARAMETERS:**

1	Nominal System voltage	33 kV	11 kV
2	Highest System voltage	36 kV	12 kV
3	Rated Frequency	50 Hz	50 Hz
4	Number of phases/ poles	Three	Three
5	System neutral earthing	As per Vector Group of Transformers	As per Vector Group of Transformers
6	One minute power frequency withstand voltage	70	28
7	1.2/50 microsecond impulse withstand voltage	170 kV (peak)	75 kV (peak)

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8	Short time rating for bus bars, CB, CT and switchgear Assembly.	25 kA (rms) for one (1) sec.	25 kA (rms) for one (1) sec.
9	Dynamic withstand rating	62.5 kA (peak)	62.5 kA (peak)
10	IAC Rating	25 KA, 1.0 sec	25kA, 1.0 Sec
11	Control supply voltage:		
a)	Trip and closing coils	As per Station DC Supply	As per Station DC Supply
b)	Spring charging motor	As per Station DC Supply	As per Station DC Supply
12	Maximum ambient air temperature	40 deg. C	40 deg. C
13	Degree of Protection:		
a)	HV-live parts	IP65	IP65
b)	Low voltage compartments	IP4X	IP4X

<b>a) CIRCUIT BREAKERS</b>			
1.	Rated Voltage	33 kV	11 kV
2.	CB rated Current		
a)	Incomer Breaker	1250A	1250A
b)	Outgoing feeder Breaker	1250A	1250A
3.	Short circuit breaker Current:		
a)	A.C. component	25 kA	25kA
b)	D.C. component	As per IS: 13118 or IEC-62271	As per IS: 13118 or IEC-62271
4.	Short Circuit making current	62.5 kA (peak)	62.5 kA(peak)
5.	Out of phase breaking Current capacity	As per IEC	As per IEC
6.	Rated line/cable charging Interrupting current at 90° Leading power factor angle	As per IEC	As per IEC
7.	Maximum allowable switching Over voltage under any switching Condition	As per IEC	As per IEC
8.	Rated small inductive current Switching capability with over Voltage less than 2.3 pu	As per IEC	As per IEC
9.	First pole to clear factor	1.5	1.5
10	Operating Duty	<b>O-0.3 Sec-CO-3 Min-CO</b>	<b>O-0.3 Sec-CO-3 Min-CO</b>

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11.	Total break time	Not more than 4 cycles	Not more than 4 cycles
12.	Total make time	Not more than 5 cycles	Not more than 5 cycles
13.	Reclosing	3 phase auto reclosing	3 phase auto reclosing
14.	Max. difference in the instants of closing/opening contacts between poles at rated control Voltage and rated operating and quenching media pressures	As per IEC	As per IEC
15.	Auxiliary contacts	2NO+2NC for Employers future use besides scheme requirement	2NO+2NC for Employers future use besides scheme requirement
16.	Operating Mechanism	Motor wound spring charged stored energy type as per IEC-62271	Motor wound spring charged stored energy type as per IEC-62271
<b>b) CURRENT TRANSFORMER (Incomer/Bus coupler Feeder)</b>			
1.	Rated primary voltage	<b>33kV</b>	<b>11kV</b>
2.	Rated primary current	1000A	800A
3.	Type of CT	1-Phase	1-Phase
4.	Max temp rise	As per IEC:60044-1	As per IEC:60044-1
5.	Class of Insulation	Class E or better	Class E or better
6.	One minute power frequency withstand voltage between secondary terminal & earth	2kV	2kV
7.	No. of Secondary cores	3	3
<b>c) CURRENT TRANSFORMER (Line Feeder)</b>			
1.	Rated primary voltage	<b>33kV</b>	<b>11kV</b>
2.	Rated primary current	300A	300A
3.	Max temp rise	As per IEC:60044-1	As per IEC:60044-1
4.	Class of Insulation	Class E or better	Class E or better
5.	One minute power frequency withstand voltage between secondary terminal & earth	2kV	2kV
6.	Nos. of Secondary cores	2	2
<b>d) CURRENT TRANSFORMER (LT Transformer feeder)</b>			

## Additional Technical Specification

1.	Rated primary Voltage	33kV	11kV
2.	Rated primary current	40A	40A
3.	Max temp rise	As per IEC:60044-1	As per IEC:60044-1
4.	Class of Insulation	Class E or better	Class E or better
5.	One minute power frequency withstand voltage between secondary terminal & earth	2kV	2kV
6.	Nos. of Secondary cores	2	2
<b>e) VOLTAGE TRANSFORMERS</b>			
1.	Rated primary Voltage	33kV	11kV
2.	Type	1-phase	1-Phase
3.	Voltage ratio (kV)	$(33/\sqrt{3})/(0.11/\sqrt{3})$	$(11/\sqrt{3})/(0.11/\sqrt{3})$
4.	Rated Voltage Factor	1.2 continuous and 1.5 for 30 seconds	1.2 continuous and 1.5 for 30 seconds
5.	Nos. of Secondary cores	2	2
6.	Accuracy of Secondary core	Metering	Protn.
		0.5	3P
7.	Class of insulation	Class E or better	Class E or better
8.	Rated output burden (Minimum)	5VA	5VA
F	<b>Bus-Bar/ Bus-Section/Bus Coupler rating</b>		
	Current rating of Bus bars	1250A	1250A
	Current rating of Bus-Section/ Bus Coupler CB & Isolator	1250A	1250A

## Additional Technical Specification

### REQUIREMENT FOR 33KV CURRENT TRANSFORMERS

#### INCOMER / BUS COUPLER FEEDER

	<b>Metering</b>	<b>O/C &amp; E/F Protn.</b>	<b>Diff. Protn.</b>
Current ratio	1000-500/1	1000-500/1	1000-500/1
Accuracy class	0.2S class	5P20	PS
Knee point voltage (at minimum ratio)	-	-	400V
Rated burden	5VA	-	-

#### LINE FEEDER

	<b>Metering</b>	<b>O/C &amp; E/F Protn.</b>
Current ratio	300-150/1	300-150/1
Accuracy class	0.2S class	5P20
Knee point voltage (at minimum ratio)	-	-
Rated burden	5VA	-

#### LT TRANSFORMER FEEDER

	<b>Metering</b>	<b>O/C &amp; E/F Protn.</b>
Current ratio	300-150/5-5A	300-150/1
Accuracy class	0.2S class	5P20
Knee point voltage (at minimum ratio)	-	-
Rated burden	5VA	-

Notes: The ratings indicated for instrument transformers are tentative only and may be changed to meet the functional requirements.

## Additional Technical Specification

### **REQUIREMENT FOR 11KV CURRENT**

#### **TRANSFORMERS IN COMER / BUS**

##### **COUPLER FEEDER**

	<b>Metering</b>	<b>O/C &amp; E/F Protn.</b>	<b>Diff. Protn.</b>
Current ratio	800-400/1	800-400/1	800-400/1
Accuracy class	0.2S class	5P20	PS
Knee point voltage (at minimum ratio)	-	-	400V
Rated burden	5VA	-	-

##### **LINE FEEDER**

	<b>Metering</b>	<b>O/C &amp; E/F Protn.</b>
Current ratio	300-150/1	300-150/1
Accuracy class	0.2S class	5P20
Knee point voltage (at minimum ratio)	-	-
Rated burden	5VA	-

### **REQUIREMENT FOR 11KV CURRENT TRANSFORMERS** **(LT TRANSFORMER FEEDER)**

	<b>Metering</b>	<b>O/C &amp; E/F Protn.</b>
Current ratio	100/1	100/1
Accuracy class	0.2S class	5P20
Knee point voltage (at minimum ratio)	-	-
Rated burden	5VA	-

Notes: The ratings indicated for instrument transformers are tentative only and may be changed to meet the functional requirements.

#### • **INPUT SIGNAL TO SAS SYSTEM**

The following digital input of 33kV & 11kV Indoor switchgear bays shall be provided through IEDs in the SAS system:

- Status of CB, Isolator, Earth switch
- CB trouble
- CB operation/closing lockout
- Trip circuit faulty
- Bus VT FUSE Fail
- Back-up overcurrent & earth fault protection Operated
- DC source fail



## Additional Technical Specification

### **11.00 MULTIFUNCTION METER**

The Multifunction meter shall have feature to measure KV, I, MW, MVAR, PF, MWhr, MVARhr with accuracy class of 0.5. Further, multifunction meter shall have bi-directional feature to register/record MWhr values.

### **12.00 MANDATORY SPARES**

Sl.N	Equipment	Unit	Quantity	
			33kV	11kV
1.	CB Spring charge indicator	No.	1	1
2.	ON/OFF indicator for CB (Mechanical)	No.	1	1
3.	ON/OFF indicator for GIS Isolator/Earth Switch (Mechanical)	No.	1	1
4.	CT (1-Phase)	No.	1 No. of Each type	1 No. of Each type
5.	VT (1-Phase)	No.	1 No. of Each type	1 No. of Each type
6.	Multi Function Meter	No.	1	1
7.	Control switch for Breaker	Nos.	2	2
8.	Control switch for GIS Isolator	Nos.	2	2
9.	Control switch for GIS Earth Switch	Nos.	2	2
10.	DC healthy lamp (white)	Nos.	5	5
11.	Trip circuit healthy lamp	Nos.	5	5
12.	Voltmeter with selector switch	No.	1	1
13.	Numerical protection relay (IED)	No.	1 No. of Each type	1 No. of Each type
14.	Indicator for Line Isolator & Earth Switch	Nos.	5	5
15.	LAN Switch	No.	1	1
16.	Trip coil assembly	Nos.	2	2
17.	Closing coil assembly	Nos.	2	2
18.	SF6 gas density indicator	Nos.	2	2

## Additional Technical Specification

### **TECHNICAL SPECIFICATION FOR 1.98 & 3.96 MVAR, 11 KV, OUTDOOR TYPE in CRCA Cubicle .AUTOMATICALLY SWITCHED H.T. SHUNT CAPACITOR BANK ALONG WITH 11 KV CAPACITOR CONTROL PANEL**

#### **SCOPE**

This specification cover design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at various Store/Center/destination, of 1.98 & 3.96 MVAR, 11KV rates and designed for 12.65 KV, outdoor type, in CRCA Cubicle – shunt Capacitor Banks automatically switched in steps along with associated equipments and accessories that may be required for proper functioning of the capacitor Banks & to be installed on 5 MVA and 10 MVA, 33/11 KV Power Transformers. Circuit Breaker Control & Relay panels are also covered in the scope of supply.

It is not be the intent to specify completely here in all the details of design and construction of material. However the material shall conform in all respects to high standards of Engineering, design and workmanship operation in manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of bidders supply irrespective of whether these are specifically brought out in this specification and/or Purchase order or not.

In order to ascertain the highest reliability of system offered Capacitor Banks, Automatic Power Factor Controller( ACU Panel), Vacuum Contactors , series reactor and APFC Cubicle Panel shall be from manufactured by single company.

#### **8. STANDARDS**

The equipment shall conform (for performance and testing thereof) in all respects to the relevant Indian/International Standards specifications with latest amendments thereto.

#### **9. INDIAN STANDARDS**

<b><u>ISS NO.</u></b>	<b><u>Title</u></b>
13925:1998	Specification for H.T. shunt Capacitor IS
9920-2002	Vacuum Contactors/ Capacitor Switch IS
9921 -1985	Isolator
IS2705	Current Transformer
IS3070	Lighting Arrestor
IS3156	Residual Voltage Transformer.
IS5553	Series Reactor
IEC 61000	Automatic Power Factor Controller

The other components such as VCB panel & other auxiliary equipments shall comply with the latest version of latest Indian/International standards.

2.2 Equipment conforming to other internationally accepted standards which ensure equal or higher quality than the above

2.3 mentioned standards would also be acceptable. In such case bidders, who wish to offer material conforming to standards other than listed above, shall clearly bring the salient points of difference between the standards forward/adopted and specified hereinabove. Four copies of such standards with authentic English

## Additional Technical Specification

Translation shall be furnished along with the offer. In case of conflict order of preference shall be (1) ISS (2) IEC (3) other standards. In case of any difference between provisions of these standards and provision of this specification the provision contained in this specification shall prevail.

iii)

### **SERVICE CONDITIONS**

The capacitor Bank to be supplied against this specification shall be required to operate satisfactorily and continually under the following moderately hot and humid tropical climate conducive to rust and fungus growth

- (C) Location: – At various location in Uttar Pradesh
- (D) Maximum ambient air temperature (deg. C) 50
- (E) Minimum ambient temperature (deg. C) (-)5
- (F) Average daily ambient air temperature (deg/C) 40
- (G) Maximum relative Humidity (%) 100
- (H) Maximum altitude above sea level (M) 1000
- (I) Average annual rainfall (MM) 1200
- (J) Isoceraunic level (days per year) 50
- (K) Seismic level (Horizontal accn.) 0.30 g
- (L) Maximum wind pressure (kg/sqm) 195

iv)

### **PRINCIPAL PARAMETER**

The equipment covered under this specification shall conform to specific parameters given below:

### **CAPCITOR BANKS**

Sl. No.	Item	Specification
10	Nominal system voltage	11 KV
11	Rated voltage of capacitor bank	12.65 KV
	Output of capacitor bank at 12.65 KV	1980 & 3960 KVAR
29	Rated line current	90.36 & 180.73Amp.
30	Connection of capacitor bank	Single star
31	No. of phases	3
32	Rated voltage of individual capacitor unit	7.3
33	Capacity of individual capacitor unit	132 , 264 & 396 KVAR
34	Insulation level	RMS-28 KV Peak -75 KV
35	Maximum temp. rise over measured on container	10 C
36	Type of discharge	Internally though resistor provided within the Unit
37	Type of fuse	External fuse
38	Type of installation	Outdoors
39	Power loss (Tan delta)	Not to exceed 0.2 watt/KVAR subject to tolerance as per

## Additional Technical Specification

### Capacitor Bank Rating:

SLNo.	Transformer Capacity (MVA)	Rating of Capacitor Bank (MVar)	Steps configuration kVAr X No. of Steps (Switched)
1	5	1.98	396+792+792
2	10	3.96	792+792+1188+1188

**Note:** The stages may be changed during detailed engineering Residual Voltage Transformer

- **TECHNICAL REQUIREMENT**

- **CAPACITOR UNIT**

The capacitor shall be of unit type construction suitable for indoor installation having high dielectric strength. No sun protection will be provided. The capacitor bank shall be complete with mounting frames, insulators and all other components for formation of capacitor bank. The bank shall be open type complete with inter connecting aluminum bus bars and adequate clearance shall be provided between phases and phase to earth.. The capacitor should be able to withstand 10% overvoltage and 30% over current (r.m.s. value) arising due to over voltage and harmonics

- **ASSEMBLY**

Capacitor units of 132, 264 & 396 KVAR, 7.3 single phase shall be connected in parallel in each phase to form a three phase star connected capacitor bank. The bank shall be mounted on a steel frame work in suitable one/two tier formation and shall be so arranged that an individual unit of 132, 264 & 396 KVAR can be removed easily without disturbing the complete assembly/ other units.

- **CONSTRUCTION OF CAPACITOR UNIT**

16 **CONTAINER**

The container shall be built from CRCA of sufficient thickness (not less than 1.6 mm) to avoid damages to the tank in case of internal fault. It shall be of fabricated construction with all joints properly welded and designed to withstand rough handling and should be hydraulically tested before assembling the internal elements. It shall be adequately epoxy pointed. The lid of container shall be properly welded to the container.

The capacitor unit shall be hermetically sealed after the entire assembly has been dried and impregnated with suitable liquid (Dielectric.) The capacitor elements shall be thoroughly dried and impregnated with an impregnant which has been completely refined and degasified so as not to have any impurities or gas which may cause deterioration of the dielectric. The impregnant used shall have low viscosity and high chemical stability and should be non-PCB. The container shall be adequately insulated from capacitor elements. Sufficient 9Wall9 insulation shall be provided so that the capacitor units meant for use of 11 KV nominal system can be place directly on grounded steel structures. The metallic surface of capacitor units shall be epoxy painted making capacitor units suitable for installing outdoor under moist tropical climatic conditions.

17 **CAPACITOR UNIT**

The capacitor unit shall have aluminum foil as conducting layer. The dielectric used shall

## Additional Technical Specification

be polypropylene film by using layers of polypropylene film shall have the following compatibility criterion: –

17.1 Polypropylene film shall conform to standard specification with latest amendments, for plastic film for new generation.

17.2 Compatibility between oil film (after thermal aging at 115 C for 96 Hrs.)

The impregnant used shall be non PCB liquid with low be accumulating, rapid bio degradation and low toxicity. Adequate number of such elements shall be assembled and enclosed in the enclosure to form a single phase unit with terminal bushings. The air in the enclosure and moisture absorbed by the paper shall be removed under high vacuum at elevated temperature and replaced by suitable impregnating medium having high permeability, high dielectric strength and non-inflammable properties.

18 DISCHARGE DEVICE:

Suitable discharge device shall be connected across the capacitor unit in accordance with IS: 13925. The discharge device shall reduce the residual voltage from the crest value of the rated voltage to 50 V or less within 10 Minutes after the capacitor is disconnected from the source supply.

19 EARTHING CONNECTIONS:

The container of each capacitor unit shall be provided with suitable earthing terminal clearly marked with Earth symbol.

20 MARKING:

The capacitor unit shall be provided with a rating plate and terminal markings as stipulated in IS: 13925. The bidder shall submit the type test report along with the bid.

21 FUSES

Each capacitor element shall be protected by External HRC fuse of suitable rating and interruption capacity so that a faulty capacitor element shall be disconnected by fuse. The fuse shall satisfactorily operate under ambient conditions. The following requirements shall be considered while selecting the right size of fuse.

- 7 Ability to withstand the maximum discharge current from healthy capacitor element.
- 8 Capability of handling fault current so as to Blow off before the in case rupture takes place thereby avoiding damage to adjoining capacitor elements/capacitor units.

22 BUSHINGS

Bushing shall be of porcelain or polycrystalline and shall be jointed to the case by welding method (Weldable type bushing) to ensure adequate and permanent seal. Leads shall be brought out through one-piece bushing and welded to the terminal stud to make a strong and positive electrical contact. Bushing terminal shall be of stainless steel.

Capacitors to be tested for cyclic Over voltage and 3 G test for mechanical shock & vibration, bidder has to clarify / confirm these points in GTP

• PHYSICAL ARRANGEMENT OF BANK

Star point of the capacitor bank shall be ungrounded. The mounting rack arrangement shall be such that one no. additional unit in each phase can be installed in future for increasing capacity.

• AUTOMATIC CONTROL UNIT



## Additional Technical Specification

l) **Switching Arrangement:**

The Automatic control unit shall be provided inside the control; room to continuously monitor total load KVAR on secondary side of the transformer and shall automatically switch ON or switch OFF the capacitor banks through the operation of 12 KV Capacitor Switch in accordance with the parameter given in table no. 4.2 Overriding provision shall also be made for electrical switching ON or OFF of the capacitor switch by the operator from the ACU control box.

m) **Time Delay:**

The switching ON operation will take place after period of 10 minutes. The switching OFF operation of relevant steps will be instantaneous.

n) **Controls:**

The Automatic control unit shall instantly switch OFF the capacitor bank in the following contingencies occurring in any of the phases.

- Voltage increased by 10% above the rated voltage of 11 KV.
- Power transformer current impedance (due to single phasing and for any other reasons) between any of the two phases exceeding 20% of the lowest, iii) Current increases in any capacitor unit by 30% above the rated current (only the relevant capacitor switch will open). Current between any of the two phases of the capacitor bank differs more than 15% of the lowest current of the 3 phases (only the relevant capacitor switch will open).

o) **Monitoring Facility:**

A suitable display should be provided to indicate the capacitor current in each phases of the complete capacitor bank on the ACU panel inside the control room. Indications shall also be provided to indicate ON & OFF status of each capacitor bank.

p) **Control Power:**

The AC control voltage for operation of the ACU shall be taken from substation battery. The required control voltage shall be 230 VAC.

q) **Temperature Variation:**

The control equipment and associate circuitry shall be suitable for operation at an ambient temperature in the range of + 5 deg C to (+) 50 deg C.

r) **Protection of ACU:**

Besides in-built protection against lines surges and transient over voltages, suitable fuses/MCB shall be provided for protection against over current. The ACU shall remain fully functional during and after line surges and transient over voltages.

s) **Control Unit Casing:**

Except for the terminals, the ACU shall be enclosed in a suitable casing so as to avoid ingress of dust.

ACU should be installed at inside of substation on Floor mounting arrangement.

## 5 6 **VACUUM CONTACTOR SWITCHES**

This specification covers 11 KV, 50 Hz, Indoor type automatic Vacuum Contactor Switch suitable for switching capacitor in steps.



## Additional Technical Specification

ix. **Applicable Standards:**

Unless otherwise stipulated in this specification the Vacuum Contactor Switch shall comply with the latest version of IS:9920 (AC Switches for voltages above 1000 V). Capacitor should be tested by International Labs as per IEC 60265-1 (1998)

x. **Rated Voltage:**

The rated voltage for the Vacuum Contactor Switch shall be 12 KV. This represents the highest system voltage corresponding to the nominal system voltage of 11 KV.

xi. **Rated Current:**

The standard rated normal current shall be 200A.

xii. **Rated Capacitive Switching Current:**

The rated capacitive switching current shall not be less than 100 A. Note: The capability of the Vacuum Contactor Switch shall also take into account the parallel switching of capacitor bank steps.

xiii. **Rated Short Time Current:**

The rated short time symmetrical current for 1 second shall be 10KA (rms AC component).

xiv. **Rated Short Circuit Making Current:**

The rated making current shall be 25 KA Peak.

xv. **Basic Impulse Level (BIL):**

The rated basic impulse level of Vacuum Contactor Switch to earth as also across the open terminals shall be 75 KV.

xvi. **Control Supply:**

The control power for closing the Vacuum Contactor Switch shall be 230 V single phase AC supply. The closing mechanism shall be suitable for a voltage variation of (+) 10% to (-) 20%.

xvii. **Design & Construction Requirement:**

Type:

- The Capacitor Switch shall be of vacuum type.
- The Vacuum Contactor Switch shall be of three phase construction and shall be suitable for remote operation.
- The Vacuum Contactor Switch shall be suitable for indoor installation and shall have sealed weather proof type construction.
- The enclosure of the Vacuum Contactor Switch shall be provided with two earthing terminals marked with the earth symbol.
- The bushings provided on the switch shall have clamp type of terminals to directly receive aluminium conductors up to 10mm dia in both horizontal and vertical directions. The terminal arrangement shall be such as to avoid bimetallic corrosion.

xviii. **Operating Mechanism:**

The operating mechanism shall be either solenoid or motor charged spring for which the control supply shall be as per clause 31.

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xix.

### **Mechanical and Electrical Endurance:**

The Vacuum Contactor Switch shall be capable of performing not less than 10,000 mechanical operations and 10,000 electrical operations at 100A capacitive current without getting damaged.

xx.

### **Marking:**

The Vacuum Contactor Switch shall be provided with a legible and indelibly marked name plate with the following:

- vii. Name of the manufacturer.
- viii. Type, designation and serial number.
- ix. Rated voltage and current.
- x. Rated frequency.
- xi. Number of poles.
- xii. Rated short time current (symmetrical).
- xiii. Rated making current.
- xiv. Rated capacitive switching current.
- xv. Date of manufacturing.
- xvi. Property of respective DISCOM

xxi.

**Testes:** The Vacuum Contactor Switch shall be subjected to the following tests in accordance with the IS:9920 (Part-IV), & Should also be tested by international labs as per IEC 60265-1(1998)

xiv.

#### **Type Tests**

- Tests to verify the insulation level, including withstand tests at power frequency voltages on auxiliary equipment.
- Tests to prove that the temperature rise of any part does not exceed the specified values.
- Making and breaking tests including tests for the rated capacitive current.
- Tests to prove the capability of the switch to carry the rated short time current.
- Tests to prove satisfactory operation and mechanical/electrical endurance.

xv.

#### **Routine Tests**

- Power frequency voltage dry tests.
- Voltage tests for auxiliary circuits.
- Measurement of the resistance of the main circuits.
- Tests to prove satisfactory operation.

d.

### **AUXILARY EQUIPMENTS**

#### **Isolator:**

- a. The Isolator shall be Outdoor type, 11 KV, 400Amp, Single throw, Double break, off load type, triple pole, Horizontal gang operated with earth switch.
- b. Tests: The Isolator shall be type tested and shall be subjected to routine and acceptance test in accordance with IS: 1818-1972.
- c. The bidder shall submit guaranteed technical particulars along with their bid.

i)

### **LIGHTNING ARRESTOR**

- The specification covers the supply, delivery, erection, testing & commissioning of 9
- KV, 10 KA, Station class heavy duty, gapless, metal (zinc) oxide surge

## Additional Technical Specification

arrestors complete along with clamps, complete fitting and accessories for installation on outdoor type 11 KV switchgear, transmission lines, transformers etc.

- Tests: The Lightning Arrestors shall be type tested and shall be subjected to routine and acceptance test in accordance with IS: 3070.
- The bidder shall submit guaranteed technical particulars along with their bid.

e. **B)** Suitable one number RC surge suppressor shall be provide per bank inside of cubicle panel.

**LA and Isolator shall be mounted on same structure and outgoing of Isolator shall be connected with CRCA capacitor panel through suitable power cable .**

f. **RESIDUAL VOLTAGE TRANSFORMERS**

The residual voltage transformers shall be in door type, dry with primary in star and secondary in star & tertiary in open delta formation. The neutral of the primary winding shall kept fully insulated and would be isolated from ground. The tertiary winding in open delta shall be used to energise the neutral unbalanced voltage withstand relay. The RVT should be suitable to discharge the capacitor bank to voltage not exceeding as per standards with latest amendments thereof. The RVT should be designed to with stand the temperature rise due to energy discharge in to it capacitors in case of tripping. All the type test as per IS including temperature rise test should be furnished.

RVT shall be mounted inside a cubicle.

g. **HRC FUSES**

Suitable indoor type 11 KV HRC fuses along with the mounting insulators etc. to provide proper protection for the capacitor unit shall form part of the equipment to be supplied.

h. **SERIES REACTORS**

0.2 % Series reactor per phase per step of capacitor rating for inrush current restriction to be connected on neutral end as per IS: 5553. The rated voltage shall be 12 KV. The reactor shall be dry type single phase reactors mounted on post insulators and designed to carry 130 % of rated current continuously without exceeding the temperature rise & shall be applicable for thermal class of insulation used. The reactor shall be mounted on structure.

- 7 Tests: The series reactor shall be type tested and shall be subjected to routine and acceptance test in accordance with IS: 5553.
- 8 The bidder shall submit guaranteed technical particulars along with their bid.

i. **CAPACITOR CUBICLE:** It shall be free standing outdoor type sheet steel enclosure fabricated from 2 mm. thick CRCA sheets. Capacitor cubical shall be mounted on mild steel channel frame and base frame shall be provided with mounting holes for fixing on concrete foundation. All doors and covers shall be designed to avoid ingress of water, moisture, dust etc. and shall be provided with suitable gaskets to achieve IP-55 degree of protection. Covers and doors shall be provided with electrical interlocks to avoid access to live parts. Viewing glasses shall be provided to view inside parts like fuses, contactors. CFL type internal panel lighting shall also be provided to have proper view in the night. Capacitor enclosure shall be duly powder coated. FRP canopy shall be provided at the top and which projects about 200 mm beyond cubicle on all sides. All LT internal wiring shall be fire retardant cable of 2.5sq.mm. All cable entries shall be from

## Additional Technical Specification

bottom through cable glands of suitable size. HT XLPE cable entry shall be through a cable entry box mounted on cubicle or fixed separately on foundation and coupled to the cubicle. Necessary Danger plate & Name plate etc shall be provided at prominent places. All other necessary fittings and accessories should be provided by manufacturer to ensure safe and smooth operation of the equipment.

**Cubicle panel shall have provision of Internal Arc prevention as per IEC 62271-200**

**Cubicle panel shall be bolted type design.**

**Cubicle panel shall be IP 55 degree of protection.**

**Cubicle panel shall be powder coated.**

### j. **BUSBARS AND INTERCONNECTION MATERIALS**

Suitable bus bar arrangement shall be provided by the supplier and requisite quantity of bus bar material shall be provided for the Bank. All bus bars shall be aluminum flats with suitable cross section. Bus bar connections between Bank and RVT. Shall also be provided.

### k. **ACCESSORIES**

Each capacitor bank cubicle panel shall be provided with the following accessories:-

1. 2 Nos. earthing terminals
2. Clamps and connectors
3. Aluminum bus bar
4. RC Surge Suppressor one no per bank
5. RVT
6. Capacitors
6. Series reactor
7. Vacuum Contactor
8. Rating plate
9. All other accessories required for erection, assembly and commissioning of the capacitor bank

ACU shall be floor mounted and kept inside of substation building near to VCB panel. LA and Isolator shall be mounted on external structure and to be kept outside.

### l. **RATING PLATE**

Each unit shall be fitted with a rating plate giving clearly the particulars specified of marking as per standards:

### m. **CLEARNCES INSTALLATION AND MAINTENANCE INSTRUCTIONS:**

The supplier shall provide 3 sets of detailed instruction manuals and drawings covering all aspects of installation and maintenance of the capacitor bank and the associated equipments.

### n. **OPERATION OF CAPACITOR BANK**

- k) The capacitors are proposed to be connected in 3 phase, 11 KV, 50 Hz system.  
The maximum symmetrical short circuit level on 11 KV systems is 18.4 kA for 3 seconds.
- l) It is to be specifically noted that 1.5 & 3 MVAR capacitors banks are intended for use at our 33/11 KV receiving substations within our distribution network.
- m) Maximum permissible over voltage shall be as per standards and latest

## Additional Technical Specification

- amendments thereof.
- n) Permissible increase in current loading due to any or all of the following shall not exceed 30% of the rated current.
  - i. Increased voltage
  - ii. Increased frequency
  - iii. Non sinusoidal voltage
- o) The capacitors shall be suitable for operating in temperature category 50° C as per standards.

a) TESTS

b) TYPES TESTS

All the offered equipment shall be fully type tested by the bidder as per relevant standards including the type tests mentioned below. Type test should have been conducted on the similar or higher capacity of equipments for 11 KV or 33 KV class of capacitor bank from recognized test laboratory preferably CPRI or other Govt. test labs within 5 years prior to date of opening of bid. The bidder shall furnish four sets of test reports as per relevant standards for each type of equipment offered, along with the bid. The offers received without type tests shall be tested as non responsive and rejected.

- i) Thermal stability
- ii) Capacitor loss tangent measurement at elevated temperature.
- iii) A.C. voltage test between terminal & container.
- iv) Lightning impulse voltage test between terminal and container.
- v) Short circuit discharge test.

c) ACCEPTING TEST

All acceptance tests stipulated in relevant standards and including those as mentioned below shall be carried out by the Supplier in presence of Purchaser's representative.

- i) Capacitance measurement test
- ii) Capacitor loss tangent measurement test.
- iii) Voltage test between terminals.
- iv) A.C. voltage test between terminal and container.
- v) Tests of internal discharges device.
- vi) Sealing test.

The method shall be subject to agreement between the Supplier and Purchaser where it is not specified in the relevant standards. The Purchaser reserves the right to carry out any other test (s) of reasonable nature, in addition to above mentioned tests, at works/test house of the Supplier or any other recognized laboratory/Research Institute to satisfy that the material complies with the intent of this specification

6. INSPECTION

The inspection shall be carried out by the Purchaser at two stages of manufacture i.e. inspection during manufacturing and final inspection and testing. The Supplier shall keep the Purchaser informed in advance of the manufacturing programme so that the arrangement can be made for inspection. The Manufacturer shall grant free access to works, for Purchaser's representative at a reasonable time. Inspection and acceptance of any equipment under this specification by the Purchaser shall not relieve the Supplier of his obligation of furnishing the equipment in accordance with this specification and shall not prevent subsequent rejection if the equipment is found to be defeat/not as per this specification.



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All acceptance tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the contractor and Purchase. The contractor shall offer to the inspecting official (s) representing the Purchase, all reasonable facilities without charge, to satisfy that the material is being furnished in accordance with this specification. The Purchase has the rights to have the tests carried out at his own cost by an independent agency wherever there is a dispute regarding the quality of the supply.

The contractor shall give not less than 15 days advance intimation to enable the purchase to depute his representative for witnessing the state/acceptance tests.

### 7. QUALITY ASSURANCE PLAN

- The bidder shall have ISO-9001/9002 or any latest, certification. The bidder shall invariably furnish the following information alongwith his bid part-I falling which his bid shall be liable for rejection. Separate information should be given be individual type of material offered.
  - Statement giving list of important raw materials, name of Suppliers for raw material, list of standards according to which the raw materials are tested and list of tests normally carried out on raw materials in presence of bidder's representative, copies of tests certificates
  - Information and copies of test certificates as in (1) above in respect of bought out items,
  - List of manufacturing facilities available
  - Level of automation and list of areas where manual processing exists.
  - List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of such test.
  - List of testing equipment available with the bidder for stage and final testing of equipment offered and test plant limitations if any, vis-a vis the type test, special acceptance and routine test specified in the relevant standards. These limitations shall be very clearly brought out in the relevant schedule of deviations as deviations from specified tests requirements.
- The successful bidder(s) shall within 30 days of placement of order submit the following Information: –
  11. List of raw material and bought out items and names of the Suppliers selected from those furnished along with the bid.
  12. Type test certificates of the raw material and bought out items.
  13. Quality assurance plan (QAP) with hold points for purchase's inspection (to be finalized after mutual discussions between the bidder and the purchaser, at latter's office.)

### HOLD POINT

A stage in the material procurement of manufacturing process beyond which work shall not proceed without the documental approval of the purchase.



## Additional Technical Specification

### NOTIFICATION POINT:

A stage in the material procurements; or manufacturing process for which advance notice of the activity is required to facilitate witness by the purchasers representatives.

- The QAP of the contractor shall consist of the following details.
  - vii) An outline of the proposed work and program sequence.
  - viii) The structure of contractor organisation for the contract.
  - ix) The duties and responsibilities assigned to the staff ensuring quality of work
  - x) Hold and Notifications points.
  - xi) Submission of engineering documents required by this specification.
  - xii) The inspection of material and components on receipt
  - xiii) Stage Inspection.
  - xiv) Final Inspection.

9.0

### **DOCUMENTATION**

All drawing shall conform to International standards organisation (ISO), 9A9 series of drawing sheets/Indian standards specification IS: 656. All dimensions shall be in SI units.

### **LIST OF DRAWINGS**

The bidder shall furnish the following alongwith the bid: –

- 26. Two sets of drawing showing clearly the general arrangement, fitting details, electrical connections etc. required for erection & commissioning
- 27. Technical leaflets (users manual) giving operating instructions.
- 28. Three copies of dimensional drawings.
- (v) The manufacturing of the equipment shall be strictly in accordance with drawings approved by purchaser and no deviation shall be permitted without the written approval of the purchase. Any manufacturing and fabrication prior to approval of the purchaser shall be at supplier risks.
- (vi) Approval of drawing/work by the purchase shall not relieve at supplier of his responsibility and liability for ensuring the correctness and correct
- (vii) Interpretation of the drawing for meeting the requirements of latest revisions of applicable standards, rules and code 6f practices. The purchase shall have power to reject any work or material which in his judgment is no in all accordance therewith.
- (viii) Three sets of drawings for purchaser's approval shall be furnished within two weeks of placement of order. The purchaser shall communicate his comments/ approval within reasonable. The supplier, shall, if necessary modify the drawings and resubmit three copies of modified drawings for a approval.
- (ix) Three sets of separating manual, drawing, technical leaflets, inspection manual etc shall be supplied to each consignee in the first instance.
- (x) One set of routine test certificate shall accompany such dispatch consignment.

10.0

### **PACKING & FORWARDING**

The equipment shall be packed in crates suitable for vertical, horizontal transport as the

## **Additional Technical Specification**

case may be and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully-packed and marked with the appropriate caution symbol. Wherever necessary proper arrangement for lifting such as fitting hooks shall be provided. Any material found short within the packing case(s) shall be supplied immediately by the supplier without any extra cost to purchaser.

Each consignment shall be accompanied with a detailed packing list containing the following information and shall be marked "PROPERTY OF respective DISCOM".

- (33) Name of the consignee
- (34) Details of consignment
- (35) Destination
- (36) Total weight
- (37) Handling and packing instructions
- (38) Bill of material indicating contents of each package.

In addition to the above the marking on each package shall per relevant standards.

- 10.1 The packing shall be done as per manufacturer's standards practice ensuring that no material is damaged during transit by Rail/Road.

### **11.0 SUPERVISION SERVICES:**

The bidders shall provide free of services of their engineers, if required during erection & commissioning of capacitor bank at various places.

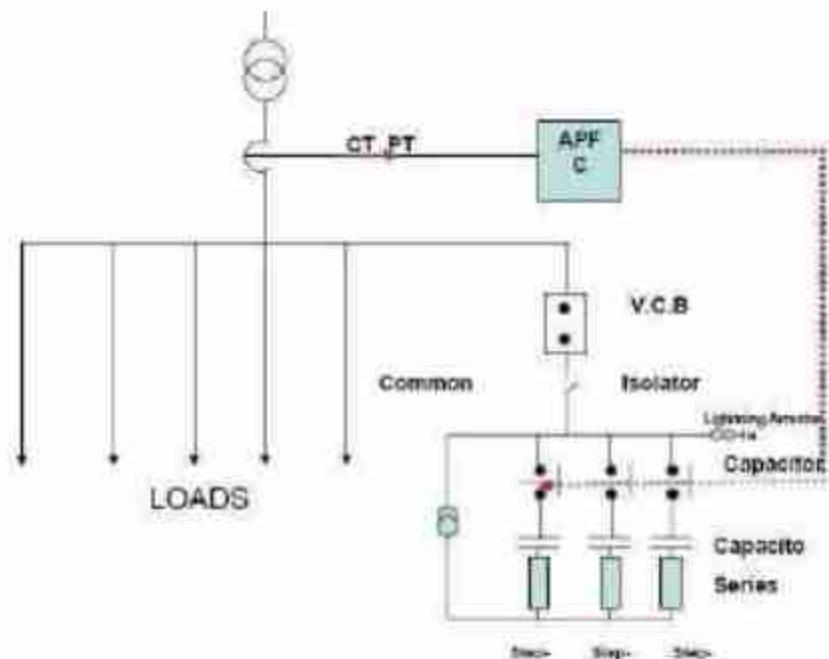
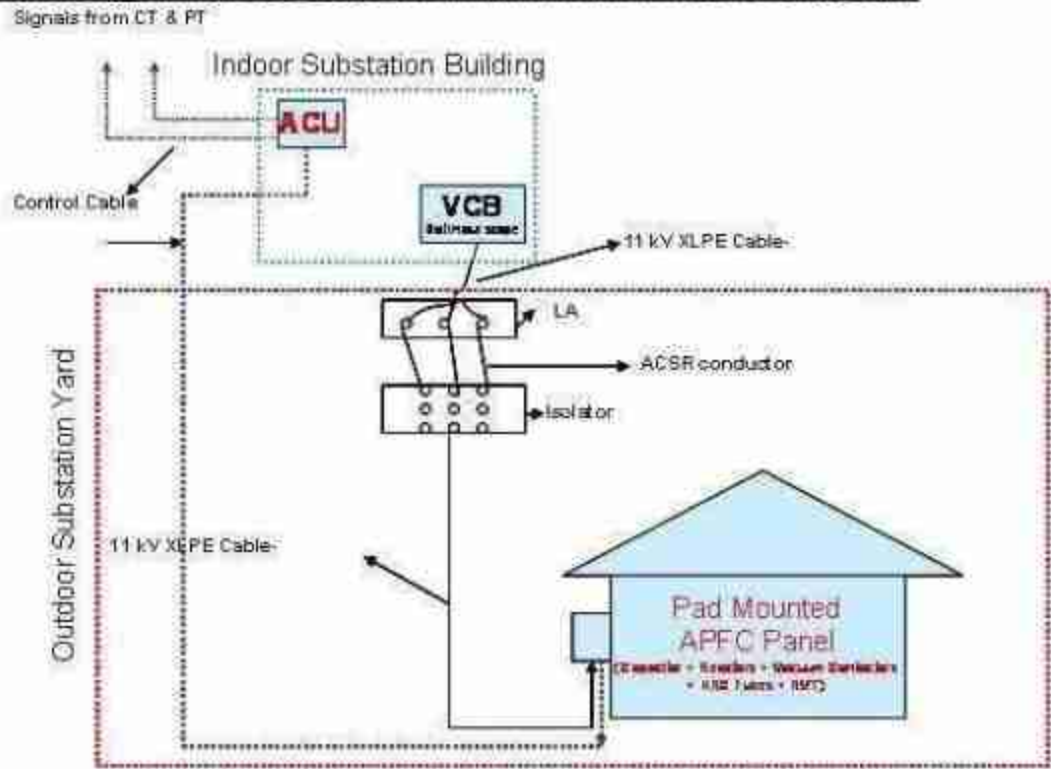
Advance notice of 15 days shall be given to the contractor to depute his engineer to various substation in state of Uttar Pradesh.

### **12. MANDATORY SPARES AND TOOLS**

The bidder shall have suitable stock to carry out O&M as and when required.

## Additional Technical Specification

### Schematic Diagram for 1.98 & 3.96 Mvar. 11 KV Automatic Capacitor Bank



RVT, RC Surge Suppressor is part of cubicle panel.

## Additional Technical Specification

### GUARANTEED TECHNICAL PARTICULARS

#### Technical Particulars of HT - APFC Capacitor Bank in CRCA Cubicle For 1.98 MVAR at 11 KV at 5 MVA

Sr	Particulars	Specifications
	Nominal System Voltage	
	Maximum Operational Voltage	
	Frequency	
	Rating of APFC Capacitor bank	
	Step configuration	
	No. of Banks	

#### CAPACITOR SUB-BANK RATINGS

Particulars	Capacitor Sub Bank		
	Sub-Bank	Unit	
Rated Voltage, KV			
Rated output, KVAR			
■ Rated Current, Amps.			
■ No. of phases			
■ Insulation Level(KV rms / KV peak)			
■ No. of Banks / Units			

#### BANKING DETAILS

■ Type of Banks			
■ Connection			
■ Terminal Arrangement			
■ Series Group per phase			
■ Units in parallel per Series group per phase			
■ Bus bar Material			
■ Overall Dimensions			

#### UNIT DETAILS

■ Dielectric and Impregnant			
■ No. of Bushings		;	

Additional Technical Specification		
■	Discharge time to Discharge to 50 Volts in less than 600 Sec.	
■	Unit Protection	
■	Allowable Overloads	■
■	Losses	
■	Finish	
■	Dimensions	

**Technical Particulars of HT - APFC Capacitor Bank in CRCA Cubicle For 3.96 MVar at 11 KV at 8 & 10 MVA**

Sl.	Particulars	Specifications
	Nominal System Voltage	
	Maximum Operational Voltage	
	Frequency	
	Rating of APFC Capacitor bank	
	Step configuration	
	No. of Banks	

**CAPACITOR SUB-BANK RATINGS**

Particulars	Capacitor Sub Bank	
	Sub-Bank	Unit
Rated Voltage, KV		
Rated output, KVar		
■ Rated Current, Amps.		
■ No. of phases		
■ Insulation Level(KV rms / KV peak)		
■ No. of Banks / Units		

**BANKING DETAILS**

■	Type of Banks	
■	Connection	
■	Terminal Arrangement	

## Additional Technical Specification

■	Series Group per phase			
■	Units in parallel per Series group per phase			
■	Bus bar Material			
■	Overall Dimensions			
<b>UNIT DETAILS</b>				
■	Dielectric and Impregnant			
■	No. of Bushings			
■	Discharge device to Discharge to 50 Volts in less than 600 Sec.			
■	Unit Protection			
■	Allowable Overloads		■	
■	Losses			
■	Finish			
■	Dimensions			



## Additional Technical Specification

General Technical Particulars of Series Reactors	
Reactor shall be suitable to be connected in Series with Capacitor Bank on the <b>Neutral</b> side for suppressing switching inrush currents. The reactor shall be dry type and shall be suitable for <b>Indoor</b> installation and shall have other particulars as mentioned below.	
<b>A</b>	Reference standard :
<b>B</b>	Type of Reactor :
<b>C</b>	Rated Voltage & Frequency :
<b>D</b>	No. Of phase :
<b>Capacitor Sub-Bank rating</b> :	
<b>E</b>	Per phase reactance, Ohms :
<b>F</b>	Per phase voltage drop, volts :
<b>G</b>	Rated output, KVAR :
<b>H</b>	Rated current, Amp :
<b>I</b>	Max. Continuous current :
<b>J</b>	Temperature rise :
<b>K</b>	Basic insulation Level :
<b>L</b>	Terminal arrangement :
<b>M</b>	Accessories for Reactors :
<b>N</b>	Testing :
<b>O</b>	Other details
	i) Class of insulation :
	ii) Rated short time symmetrical RMS Current:
	iii) Winding materials :
	iv) Type of Installation :

## Additional Technical Specification

### GENERAL TECHNICAL PARTICULARS FOR RESIDUAL VOLTAGE TRANSFORMER:

Sr. No.	Particulars	Specifications
	Reference Standard	
	Type	
	Rated primary voltage	
	Frequency	
	No. of secondary windings	
	Ratio	
	Rated burden per phase & Accuracy class	
	a) Metering Winding ( Star)	
	b) Protection Winding ( Open Delta)	
	Method of connection	
	Insulation level a) One minute power frequency withstand voltage b) Impulse with stand voltage (1.2x50 micro sec. wave, crest)	
	Voltage Factor	
	Terminal Arrangement 1) HV Side 2) LV Side	
	Make Creepage distance of bushing	

## Additional Technical Specification

### GENERAL TECHNICAL PARTICULARS FOR ISOLATOR WITH EARTH SWITCH

Sr. No.	Particulars	Specifications
	Type: Outdoor, Off load, Isolator, Double Break, with ON/OFF Indicator, mechanical interlock & padlocking	
	Reference Standard	
	Nominal System Voltage	
	Maximum permissible continuous service voltage	
	Distance between Centre of outer stack of insulator	
	Power frequency withstand test voltage for completely assembled switches	
	a) Against Ground	
	b) Across open contacts	
	c) Between Phases	
	Impulse withstand test voltage of completely assembled switches without arcing horn & with 1.2/50 micro second impulse wave	
	a) Against ground (KV Peak)	
	b) Across the open ends of the phase (KV)	
	c) Between phases (KV Peak)	
	100% impulse flash over voltage of completely assembled switch with arcing horns with 1.2/50 micro second impulse wave against ground (KV Peak)	
	Particulars of the main contacts i.e. fixed contacts & moving contacts	
	a) Type I) Fixed contacts	
	II) Moving contacts	
	b) Material I) Fixed contacts	
	II) Moving contacts	
	Continuous current rating (Amps)	
	Short time current rating	

## Additional Technical Specification

Sr. No.	Particulars	Specifications
	a) For 1 second	
	b) For 3 second	
	Rated peak short circuit current (KA peak)	
	Type of interlocking between isolator switch & earth switch	
	Number of operations which the isolator can withstand without deterioration of contacts	
	Phase to phase distance	
	Type of mounting	

## Additional Technical Specification

### TECHNICAL PARTICULARS OF VACUUM CONTACTORS

1	Applicable standard	
2	Type & Make	
3	Number of poles, nos of break/pole	
4	Model	
5	Maximum capacity	
7	Rated Voltage	
8	Rated maximum voltage	
9	Rated normal current	
10	Rated single capacitor banks current	
11	Frequency	
12	Rated short time current for one sec	
13	Rated short circuit making current	
14	Impulse with stand voltage (1.2x50 micro sec. wave, crest)	
15	One minute power frequency withstand voltage	
16	One minute power frequency withstand voltage on auxiliary circuit to earth	
19	Mechanical endurance	
20	Electrical endurance	
21	Max. Required current of Solenoid	
i	Closing solenoid	
ii	Opening solenoid	
22	Closing time	
24	Operating Mechanism	
i	Stored energy	
ii	Release	
iii	Rated voltage	
26	Inherent delay between two switching operations	
27	IP protection	
28	Whether Internationally Type tested	

## Additional Technical Specification

### GENERAL TECHNICAL PARTICULARS FOR 9 KV METAL OXIDE (GAPLESS) LIGHTNING ARRESTERS

Sr. No.	Particulars	Specifications
	Name of the manufacturer	
	Type	
	Applicable standard	
	Rated voltage (KV rsm)	
	Rated frequency (HZ)	
	No.of unit per arrester	
	Nominal discharge current (8x20 micro second wave) (KA)	
	Maximum continuous operating voltage KV (rms)	
	Insulation withstand voltage	
	a) Dry power frequency	
	c) Impulse (1.2x50 micro second)	
	Lightning impulse residual voltage (8/20 micro second wave)	
	a) 5000 A	
	b) 10000 A	
	c) 20000 A	
	Minimum clearance	
	a) Between arresters	
	b) Arrester & adjoining earthed object	



## Additional Technical Specification

### Guaranteed Technical Particulars for Power factor Controller

Sl. No.	Particulars	Proposed	Offered
1.	Feed-back Voltage:	3ph, 3wire, 110Volt (+10%/-20%).	
2.	Current input:	Selectable 1A or 5A for both load & capacitor.	
3.	Auxiliary Supply:	1Ph 415V (+10% to -20%).	
4.	Output banks control for 8 banks.	(Isolated 9NO9 contacts of rating 5Amp ac / 250Vac).	
5.	RS-232 baud rate selectable	upto 38.4kBPS.	
6.	Dedicated RS232 port on front		
7.	Facility for separate temperature probe (PT100)		
8.	Operating temperature:	0 to 50oC.	
9.	Storage temperature:	-10 to +75oC.	
10.	Humidity:	0 to 98%.	
11.	Supply frequency:	45Hz to 55Hz.	
12.	Automatic synchronization capable of giving correct results even for wrong connections at CT terminals (& also wrong		
13.	Load V,I and Cap. current THD measurement with odd harmonic coeff. upto 15 <sup>th</sup>		
14.	Mode of switching	user defined.	
15.	Standard 144 X 144 cabinet for panel door flush mounting.		
16.	Serial communication through standard		
17.	Selectable communication port	MODBUS RS485 or RS232, on rear side.	
18.	Logging of data in the form of Hourly Records, Fault Records & Daily Records	recording all electrical values.	
19.	Protections provided	All these are user settable.	
20.	Over/under Voltage		
21.	Cap. Over/under current / THD.		
22.	Over/Under frequency		
23.	Over / Under load.		
24.	Load unbalance.		
25.	Over temperature.		
26.	Out of steps (only for indication).		
27.	NV-RAM battery down.		

## Additional Technical Specification

### Guaranteed Technical Particulars for ACU ( AUTOMATIC CONTROL UNIT)

1.	Product	Control Panel
2.	Application	Automatic Switching of 11 kV Capacitor banks
3.	Installation	Indoor
4.	Ambient Temperature	
5.	No. of steps	
6.	Power Frequency Voltage	
7.	Control Mode	
8.	Control Parameter	
9.	Protection	
10.	Ingress Protection	
11.	Inputs	
12.	Output	

### Guaranteed Technical Particulars for OUTDOOR APFC CRCA CUBICLE

1.	Product	
2.	Application	Automatic Switching of 11 kV Capacitor banks
3.	Installation	OUT DOOR
4.	Whether Powder Coated	
5.	Whether provision of Internal Arc prevention	
6.	Whether IP 55 degree type tested at NABL Lab	
7.	STC Type tested for 26.2 KA RMS for 1 sec	
8.	Switching Steps	
9.	Thickness of CRCA	
10.	Whether Canopy provided	
11.	Whether Bolted type or Welded type	

## Additional Technical Specification

### **GUARANTEED TECHNICAL PARTICULARS OF 11KV VACUUM SWITCH GEAR**

#### **FOR CAPACITOR BANKS**

- Switchgear
- Type
- Nominal system voltage
- Highest system voltage
- Frequency
- Normal current rating
  - At designed ambient temp.
  - At site conditions
- Making capacity
  - Symmetrical Breaking capacity
  - Asymmetrical breaking capacity
- Short time current rating for 3 sec.
- Number of break per pole
- Total length of break per pole
- Arc Duration
  - With "No Load"
  - With 100% SC current
- a. Type and material of main contact,  
b. Material & Thickness of plating of contacts.
- Break Time
- Make Time
- Type of Arcing contacts/ or Arc control device
- a. Whether the circuit breaker fixed trip or Trip free,  
b. Whether it is lock out prevent closing.
- Number pf contacts of Auxiliary switch
  - t. Normally open
  - u. Normally closed.
- Details of operating mechanism
- Power required to close

## Additional Technical Specification

- the circuit breaker at nominal voltage
  - Nominal voltage of closing mechanism
  - Impulse withstand (1/50 micro sec wave) Test voltage KV
  - One minute power frequency with stand test voltage KV rms.
  - Minimum clearance in air
    - p) Between phases
    - q) Between the live part & earth.
  - Minimum clearance in vacuum
    - 5. Between phases
    - 6. Between the live part & earth.
  - Total weight of complete Breaker.
  - Dimension and mounting details Applicable standard
- 1.27 Details of ref. Drawing attached

### **5.8** BUS BAR

### **5.9** Bus bar material

### **5.10** Cross sectional area.

### **5.11** Insulation

### **5.12** Minimum Electrical clearance

- Phase to earth
- Between phases

# TENDER DRAWINGS

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29	Single Line Diagram of 1x3MVA (Type-B) 33/11KV Substation with Indoor 11kV Switchgear	REC RDSS/33/11kV PSS Layout/22B
30	Single Line Diagram of 1x3MVA (Type-C) 33/11KV Substation with Indoor 11kV Switchgear	REC RDSS/33/11kV PSS Layout/22C
31	Layout Section of 33/11 KV Substation	REC RDSS/33/11kV PSS Layout/23
32	Details of Girder Type "G3"	REC RDSS/33/11kV PSS Layout/24
33	Details of Girder Type "G1"	REC RDSS/33/11kV PSS Layout/25
34	Details of Girder Type "G4"	REC RDSS/33/11kV PSS Layout/26
35	33-11 KV sub-station metering arrangement	REC RDSS/33/11kV PSS Layout/27
36	33/11 KV Substation Single line diagram-SLD	REC RDSS/33/11kV PSS Layout/28
37	Structure Details of Tower Type-"T1"	REC RDSS/33/11kV PSS Layout/29
38	Structure Details of Tower Type-"T2"	REC RDSS/33/11kV PSS Layout/30A
39	Structure Details of Tower Type-"T2A"	REC RDSS/33/11kV PSS Layout/30B
40	Structure Details of Tower Type-"T3"	REC RDSS/33/11kV PSS Layout/31A
41	Structure Details of Tower Type-"T3A"	REC RDSS/33/11kV PSS Layout/31B
<b>Category: LT AB Cable</b>		
1	Stainless Steel Straps (20x0.7) & Buckles	REC RDSS/LT-ACC-ABC-01
2	Universal Pole Bracket	REC RDSS/LT-ACC-ABC-02
3	Anchoring Assembly (Cable Range 25-50 sqmm.)	REC RDSS/LT-ACC-ABC-03A
4	Anchoring Assembly (Cable Range 70-95 sqmm.)	REC RDSS/LT-ACC-ABC-03B

5	Service Clamp	REC RDSS/LT-ACC-ABC-04
6	Multiport Insulation Piercing Connector Stripping Piercing	REC RDSS/LT-ACC-ABC-05A
7	Insulation Piercing Connector	REC RDSS/LT-ACC-ABC-05B
8	Earthing Connector	REC RDSS/LT-ACC-ABC-06A
9		REC RDSS/LT-ACC-ABC-06B
10	Suspension Assembly (Cable Range 25-70 sqmm.)	REC RDSS/LT-ACC-ABC-07A
11	Suspension Assembly (Cable Range 25-50 sqmm.)	REC RDSS/LT-ACC-ABC-07B
12	Suspension Assembly (Cable Range 70-95 sqmm.)	REC RDSS/LT-ACC-ABC-07C
<b>Category: General Drawing</b>		
1	Concrete (PCC) Foundation Details for PSC Poles	REC RDSS-GEN-01
2	Foundation Details of PCC/PSC Pole	REC RDSS-GEN-02
3	Pin Insulator	REC RDSS-GEN-03
4	Pipe Type Earthing Details	REC RDSS-GEN-04
5	RCC Base PAD For PCC/PSC Pole	REC RDSS-GEN-05A
6	Stone/RCC Base Plate For Base Padding Of PCC/PSC Pole	REC RDSS-GEN-05B
7	Stone/RCC Base Plate For stay set	REC RDSS-GEN-05C
8		REC RDSS-GEN-05D
9	Service Connection Single Phase	REC RDSS-GEN-06
10	Spike Type Earthing for Normal Soil	REC RDSS-GEN-07
11	Spiral-Coil Earthing Details	REC RDSS-GEN-08
12	Stay Set Arrangement on PCC/PSC Pole	REC RDSS-GEN-09A
13	Stay Set Arrangement on PCC/PSC Pole	REC RDSS-GEN-09B
14	Strut Arrangement	REC RDSS-GEN-10
15	Cable Trench Layout 500 mm	REC RDSS-GEN-11A
16	Cable Trench Layout 750 mm	REC RDSS-GEN-11B
17	Guy end assembly (using Helically formed Fitting)	REC RDSS-GEN-12
18	Guying arrangement of single and double guy	REC RDSS-GEN-13
19	Details of MS Gate	REC RDSS-GEN-14
20	Pole pit for PCC Pole for normal Soil	REC RDSS-GEN-15
<b>Category: LT-OH Drawing</b>		
1	433V Danger Board	REC RDSS/LT-01
2	GA & Component Details of AB Cable Connections And Topping Arrangement	REC RDSS/LT-02A
3		REC RDSS/LT-02A
4	GA of LT Line Formation on Single (Dead End Arrangement) With LT AB Cable	REC RDSS/LT-03
5	GA of LT Line Formation on Single (In Line Arrangement) With LT AB Cable	REC RDSS/LT-04
6	GA of LT Line Vertical Formation on Single (At Dead End) 1Ph, 2Wire	REC RDSS/LT-05
7	GA of LT Line Vertical Formation on Single (In Angular Arrangement) 1Ph, 2Wire	REC RDSS/LT-06
8	GA of LT Line Vertical Formation on Single (In Line Arrangement) 1Ph, 2Wire	REC RDSS/LT-07A
9		REC RDSS/LT-07B
10	415/240 V lines conductor formation and clearances horizontal formation	REC RDSS/LT-08

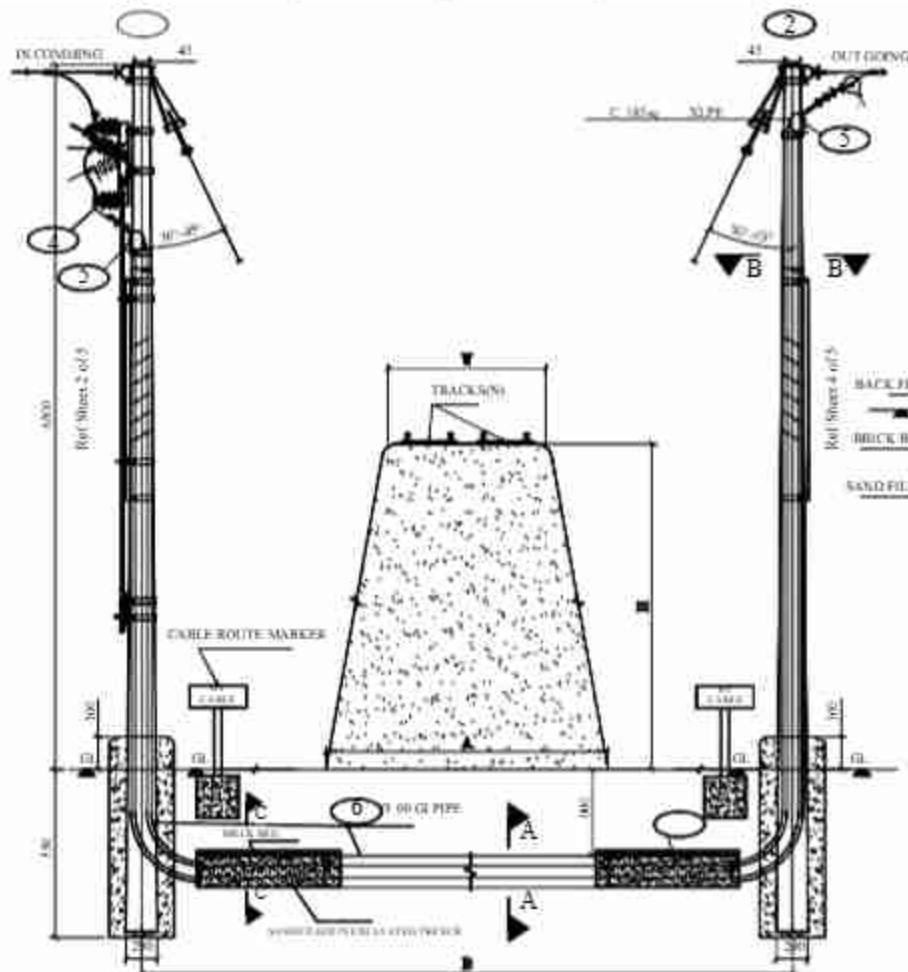


11	415/240V line supports Vertical formation	REC RDSS/LT/09
12	415/240V line supports Horizontal formation	REC RDSS/LT/10
13	Arrangement of LT conductors at angle location 415/240 volts lines (cross country) horizontal formation	REC RDSS/LT/11
14	415/240 V Lines conductor formation and clearance, 3 Ø, 4 W(horizontal formation)	REC RDSS/LT/12
15	415/240 V Lines conductor formation and clearance, 3 Ø, 4 W(vertical formation)	REC RDSS/LT/13
16	415/240 V Lines conductor formation and clearance, 3 Ø, 4 W(Vertical formation)	REC RDSS/LT/14
17	415/240 V Lines conductor formation and clearance, 1 Ø, 3 W (Vertical formation)	REC RDSS/LT/15
18	Earth Knob for L T line	REC RDSS/LT/16
19	415/240 V Lines conductor formation and arrangement of guys for 0 ° To 10 ° angle locations, (3 Ø, 4 W, Horizontal formation)	REC RDSS/LT/17
20	415/240 V Lines conductor formation and arrangement of guys for 30 ° To 60 ° angle locations, (3 Ø, 4 W, Horizontal formation)	REC RDSS/LT/18
21	415/240 V Lines conductor formation and arrangement of guys for 60 ° To 90 ° angle locations, (3 Ø, 4 W, Horizontal formation)	REC RDSS/LT/19
22	415/240 V Lines conductor formation and arrangement of guys for dead end locations, (3 Ø, 4 W, Horizontal formation)	REC RDSS/LT/20
23	415/240 V Lines conductor formation and arrangement of guys for 0 ° To 10 ° angle locations, (3 Ø, 4 W, Horizontal formation)	REC RDSS/LT/21
24	415/240 V Lines conductor formation and arrangement of guys for 10 ° To 30 ° angle locations, (3 Ø, 5 W, Horizontal formation)	REC RDSS/LT/22
25	415/240 V Lines conductor formation and arrangement of guys for 30 ° To 60 ° angle locations, (3 Ø, 5 W, Horizontal formation)	REC RDSS/LT/23
26	415/240 V Lines conductor formation and arrangement of guys for 60 ° To 90 ° angle locations, (3 Ø, 5 W, Horizontal formation)	REC RDSS/LT/24
27	415/240 V Lines conductor formation and arrangement of guys for dead end locations, (3 Ø, 5 W, Vertical formation)	REC RDSS/LT/25
28	415/240 V Lines conductor formation and arrangement of guys for dead end locations, (3 Ø, 4 W, Vertical formation)	REC RDSS/LT/26
29	415/240 V Lines conductor formation and arrangement of guys for dead end locations, (3 Ø, 4 W, Vertical formation)	REC RDSS/LT/27
30	415/240 V shackle insulator	REC RDSS/LT/28
31	415/240 V insulator and hardware fittings for type-2 shackle insulators	REC RDSS/LT/29
32	415/240 V insulator and hardware fittings for type-1 shackle insulators	REC RDSS/LT/30
33	Finished joint using service connector	REC RDSS/LT/31
34	Application of Epoxy compound on T-joint for L T service connections	REC RDSS/LT/32
35	Helical formed fittings lashing rods	REC RDSS/LT/33
36	Helical formed fittings T-connector	REC RDSS/LT/34
37	Helical formed fittings splice for ACSR joint	REC RDSS/LT/35
38	Crimp joint for L T service connection	REC RDSS/LT/36
<b>Category: Control Room</b>		
1	Proposed Double storey Control Room Layout plan of 33/11kV substation in Rural Substation	REC RDSS/Control Room/01A
2	Proposed Double storey Control Room Layout plan of 33/11kV substation in City/Town Zone	REC RDSS/Control Room/01B
3	Proposed Double storey Control Room Layout plan of 33/11kV substation in City/Town Zone	REC RDSS/Control Room/01C
<b>Category: Civil Works</b>		
1	First Floor Slab Beam & Details	REC RDSS/CIVIL/01
2	Ground Floor Slab Beam & Details	REC RDSS/CIVIL/02
3	Ground Floor Counter Aluminum Partition	REC RDSS/CIVIL/03
4	Ground Floor Toilet Layout	REC RDSS/CIVIL/04
5	Ground & First Floor Electrical Layout	REC RDSS/CIVIL/05
6	Elevation & Section-XX	REC RDSS/CIVIL/06
7	Centre Line with Column Layout & Footing Details	REC RDSS/CIVIL/07
8	Stair Detail	REC RDSS/CIVIL/08

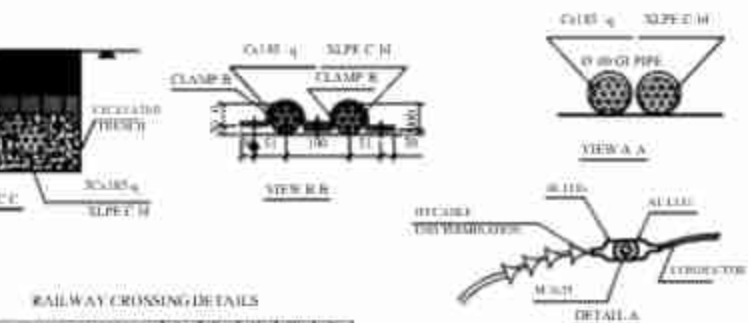
9	Ground Floor Lintel Chajja Layout & Detail	REC RDSS/CIVIL/09
10	First Floor Lintel Chajja Layout & Detail	REC RDSS/CIVIL/10
11	Ground Floor Working & Opening Detail	REC RDSS/CIVIL/11
12	Proposed Cable Trench	REC RDSS/CIVIL/12
13	First Floor Working & Opening Detail	REC RDSS/CIVIL/13
14	Ground Floor Plinth Beam Plan & Detail	REC RDSS/CIVIL/14
15	Concreting of PCC-PCC Pole	REC RDSS/CIVIL/15
16	Concreting of stay set for 11kV & LT line	REC RDSS/CIVIL/16
17	Concreting of PCC-PCC Pole for Transformer Mounting	REC RDSS/CIVIL/17







BILL OF MATERIAL			
S.NO	DESCRIPTION	QTY.	Ref Drawing No.
1	Double Pole with Sectionalizer	1 No	Sheet 2 of 5, 3 of 5
2	Double Pole Structure	1 No	Sheet 4 of 5, 5 of 5
3	11kV XLP Cable (5C x 185sqmm)	As Req.	Two Runs
4	Al Lugs Termination of Cable	6 Nos.	Cable to Conductor, Cable to Air Switch
5	XLP Termination Kit	4 Set	2 set's per DP
6	100 Dia GI Pipe	As Req.	Two Runs (As Per Track width)



RAILWAY CROSSING DETAILS

NAME OF THE BRANCH LINE	A	B	H	W	N
ATTABRA TO AMBALPUR	8.5	40	6	2.5	2
BARGAH TO ATTABRA	8.5	40	6	2.5	2
BARGAH TO BARPALI	8.5	40	6	2.5	1
BARGAH TO BARPALI	8.5	40	6	2.5	2
BARGAH ACC TO DUNGURI	14	24	3	2.5	1
BARGAH ACC TO DUNGURI	14	24	3	2.5	1

A WIDTH OF TRACK BOTTOM  
B RAILWAY BOUNDARY  
H HEIGHT OF RAIL TRACK  
W WIDTH OF RAIL TRACK TOP

FOR TENDER PURPOSE ONLY

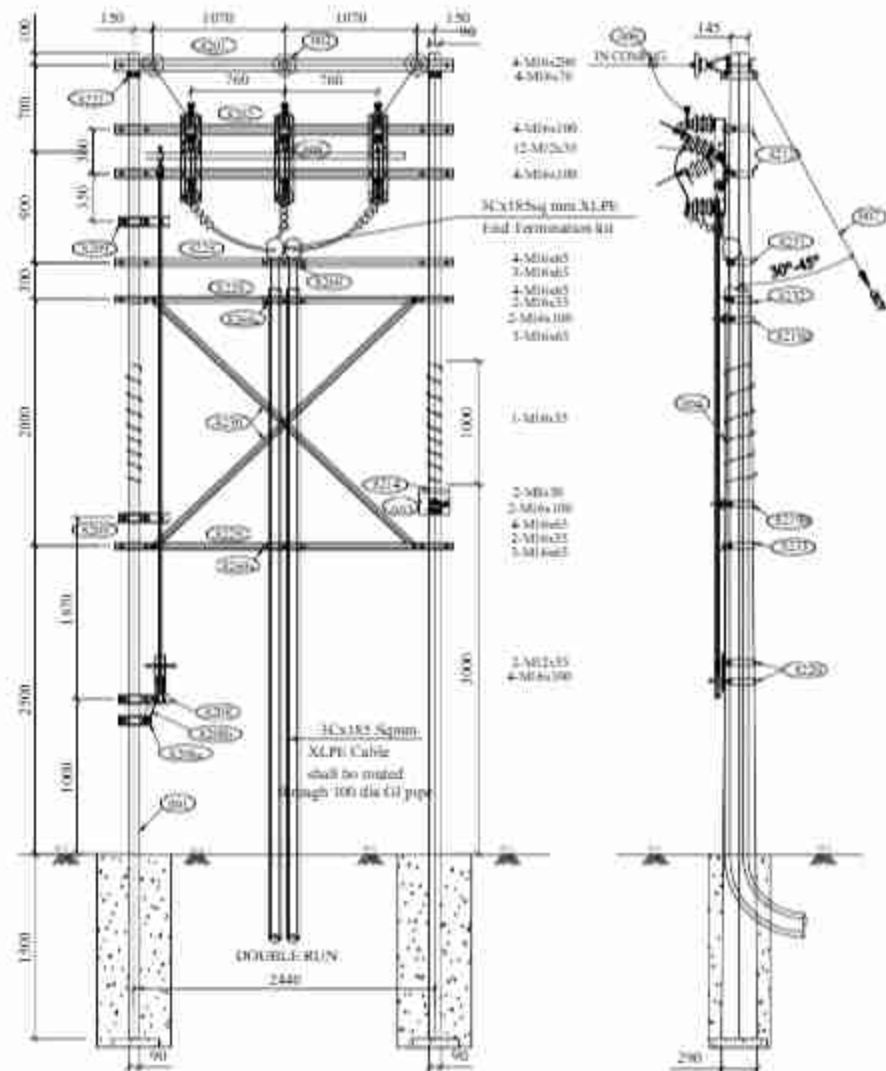
NOTES

- 1) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED
- 2) LENGTH OF GI PIPE DEPENDING ON WIDTH OF TRACK
- 3) LENGTH OF XLP CABLE DEPENDING ON SPAN BETWEEN TWO ARRANGEMENTS
- 4) GI PIPE SHALL BE LAYED UP TO BOTTOM WIDTH OF RAILWAY TRACK AND FROM ABOVE GROUND LEVEL TO TOP RAILING ANGLE ON EITHER SIDE OF CROSSING

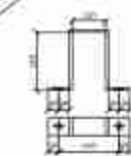
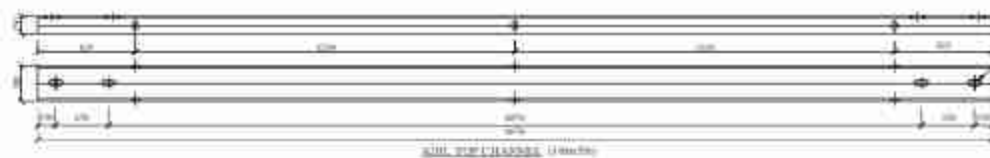


R. I. E. L. T. I. C. P. O. R. T. I. D. N. O. 1

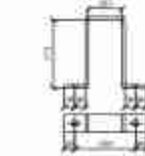
PROJECT	Railway Distribution Sector Scheme (RDS/GJY)		
TITLE	G3 OF 11KV LINE CROSSING OF RAILWAY USING 3 X 185 SQMM XLP CABLE ON DP STRUCTURE PCC/PSC POLES		
DATE	SCALE	DESIGN	REV
	NTS		R0
	A3		OF
PROJECT		RECORDS KV/02A	



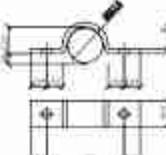
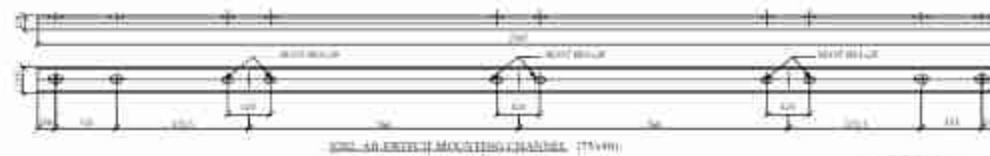
BILL OF MATERIALS						
ITEM CODE	DESCRIPTION	SECTION	LENGTH (m. mm.)	QTY. (m. Nos.)	WT. (kg. Nos.)	TOTAL WT. (kg. Nos.)
R001	Reinforcing PSC Pole			1		
R002	11KV Line Structure with Hardware			1		
R003	11KV Tower (Bolt)			1		
R004	Reinforcing Steel			1		
R005	11KV Line Structure			1		
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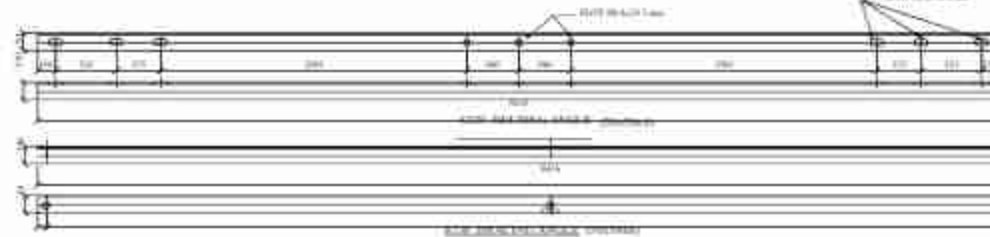
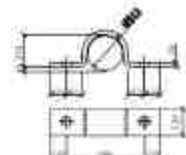
11KV/20KV CROSSARM  
DP STRUCTURE (175x40)



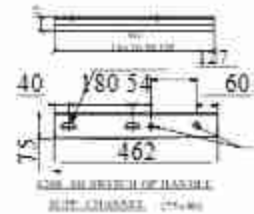
11KV/20KV CROSSARM  
DP STRUCTURE (175x40)



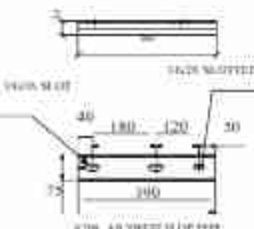
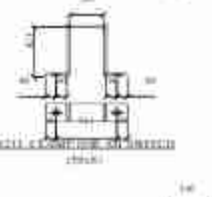
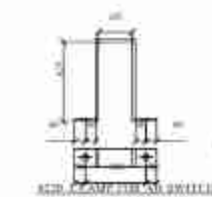
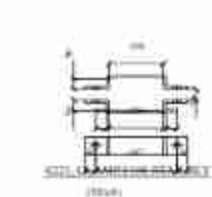
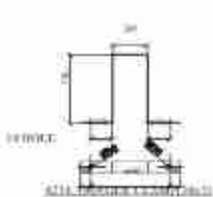
11KV/20KV MOUNTING CHANNEL



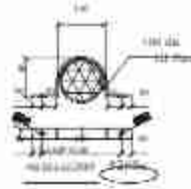
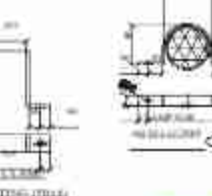
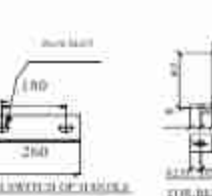
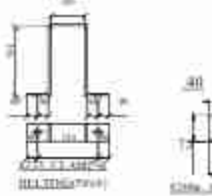
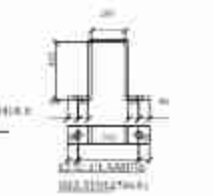
- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
  2. MATERIALS TO BE USED SHALL BE AS PER IS STANDARDS.
  3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
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11KV/20KV CROSSARM  
DP STRUCTURE (175x40)



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DP STRUCTURE (175x40)

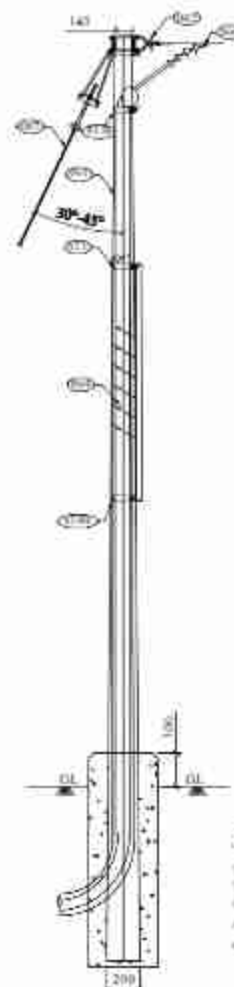


FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT	REVAMPED DISTRIBUTION SECTOR SCHEME (RDSS)		
TITLE	GA OF 11 KV LINE CROSSING OF RAILWAY USING 3c X 185 30MM XLPE CABLE ON DP STRUCTURE PCC PSC POLES		
DATE	NTS	RECORDS	RD
SCALE	A3	RECORDS	1 OF 3



BILL OF MATERIALS						
SPEC CODE	DESCRIPTION	SECTION	LENGTH (in feet)	QTY. (in feet)	Wt. Pcs (kg Pcs)	Total Wt (in kg)
001	1/2" x 2" x 1/2" Flat Plate					
002	1/2" x 2" x 1/2" x 1/2" x 1/2" x 1/2"					
003	1/2" x 2" x 1/2" x 1/2" x 1/2" x 1/2"					
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FOR TENDER PURPOSE ONLY

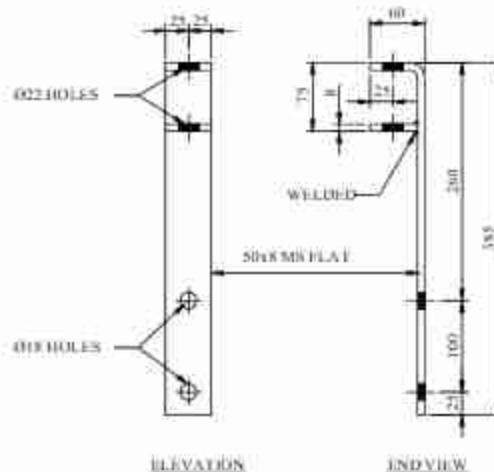


Rural Electrification Corporation Ltd.

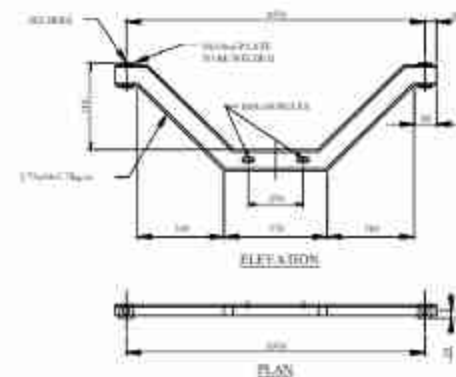
PROJECT:	Revamped Distribution Sector Scheme (RDSS)		
TITLE:	GA OF 11 KV LINE CROSSING OF RAILWAY USING 3c X 185 SQMM XLPE CABLE ON DP STRUCTURE PCC/PSC POLES		
DATE:	SCALE NTS	DRAWN BY REC/RDSS/11KV/2D	REV. NO. R0
	SCALE A3		SHEET NO. 1 OF 4



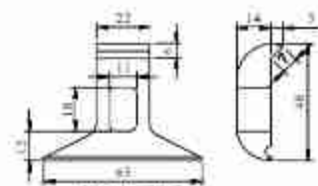
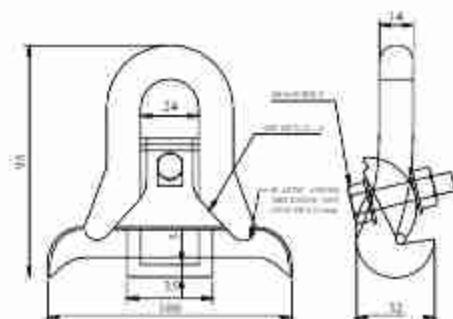
EYE HOOK REC 019  
CONSTRUCTION STANDARD  
E-35



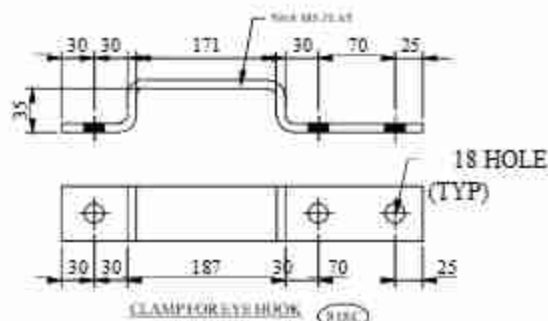
11.35.4.15 POLE TOP BRACKET (SEE  
RHC CONSTRUCTION STANDARD  
A-7)



SEE CONSTRUCTION STANDARD  
A-6



DETAIL AT A  
SUSPENSION CLAMP  
REC (027)  
CONSTRUCTION STANDARD  
E-34



## GENERAL NOTES

- 1) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED
- 2) MANUFACTURING TOLERANCE:
- |              |        |
|--------------|--------|
| UP TO 30mm   | ± 0%   |
| 31 TO 100mm  | ± 0.4% |
| 101 TO 500mm | ± 0.8% |
| ABOVE 500mm  | ± 2%   |
- 3) ALL M.S. PARTS SHALL CONFORM TO IS:2062
- 4) ALL M.S. FABRICATED ITEMS SHALL BE HOT DIP GALVANIZED  
AS PER IS:2623 & 470
- 5) ALL THE ITEMS SHALL BE MARKED WITH EJECTION CODE
- 6) WEIGHT & LENGTH MENTIONED IS FOR PACKING & FOR BEARING PURPOSE
- 7) ALL CHANNELS & ANGLES SHALL CONFORM TO IS:SP.6, PART-1  
ALL CHANNELS SHALL BE 13" C CHANNELS

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

	TIME
1	0.00
2	0.05
3	0.10
4	0.15
5	0.20
6	0.25
7	0.30
8	0.35
9	0.40
10	0.45
11	0.50
12	0.55
13	0.60
14	0.65
15	0.70
16	0.75
17	0.80
18	0.85
19	0.90
20	0.95
21	1.00
22	1.05
23	1.10
24	1.15
25	1.20
26	1.25
27	1.30
28	1.35
29	1.40
30	1.45
31	1.50
32	1.55
33	1.60
34	1.65
35	1.70
36	1.75
37	1.80
38	1.85
39	1.90
40	1.95
41	2.00
42	2.05
43	2.10
44	2.15
45	2.20
46	2.25
47	2.30
48	2.35
49	2.40
50	2.45
51	2.50
52	2.55
53	2.60
54	2.65
55	2.70
56	2.75
57	2.80
58	2.85
59	2.90
60	2.95
61	3.00
62	3.05
63	3.10
64	3.15
65	3.20
66	3.25
67	3.30
68	3.35
69	3.40
70	3.45
71	3.50
72	3.55
73	3.60
74	3.65
75	3.70
76	3.75
77	3.80
78	3.85
79	3.90
80	3.95
81	4.00
82	4.05
83	4.10
84	4.15
85	4.20
86	4.25
87	4.30
88	4.35
89	4.40
90	4.45
91	4.50
92	4.55
93	4.60
94	4.65
95	4.70
96	4.75
97	4.80
98	4.85
99	4.90
100	4.95
101	5.00
102	5.05
103	5.10
104	5.15
105	5.20
106	5.25
107	5.30
108	5.35
109	5.40
110	5.45
111	5.50
112	5.55
113	5.60
114	5.65
115	5.70
116	5.75
117	5.80
118	5.85
119	5.90
120	5.95
121	6.00
122	6.05
123	6.10
124	6.15
125	6.20
126	6.25
127	6.30
128	6.35
129	6.40
130	6.45
131	6.50
132	6.55
133	6.60
134	6.65
135	6.70
136	6.75
137	6.80
138	6.85
139	6.90
140	6.95
141	7.00
142	7.05
143	7.10
144	7.15
145	7.20
146	7.25
147	7.30
148	7.35
149	7.40
150	7.45
151	7.50
152	7.55
153	7.60
154	7.65
155	7.70
156	7.75
157	7.80
158	7.85
159	7.90
160	7.95
161	8.00
162	8.05
163	8.10
164	8.15
165	8.20
166	8.25
167	8.30
168	8.35
169	8.40
170	8.45
171	8.50
172	8.55
173	8.60
174	8.65
175	8.70
176	8.75
177	8.80
178	8.85
179	8.90
180	8.95
181	9.00
182</	

COMPONENTS FOR 11kV COMPOSITE  
LINE FORMATION ON SINGLE PSC/PCC POLE

#### LINEAR & ANGULAR LOCATIONS

SIZE	SCALE
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DRO. NO.

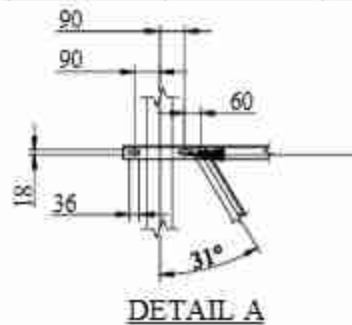
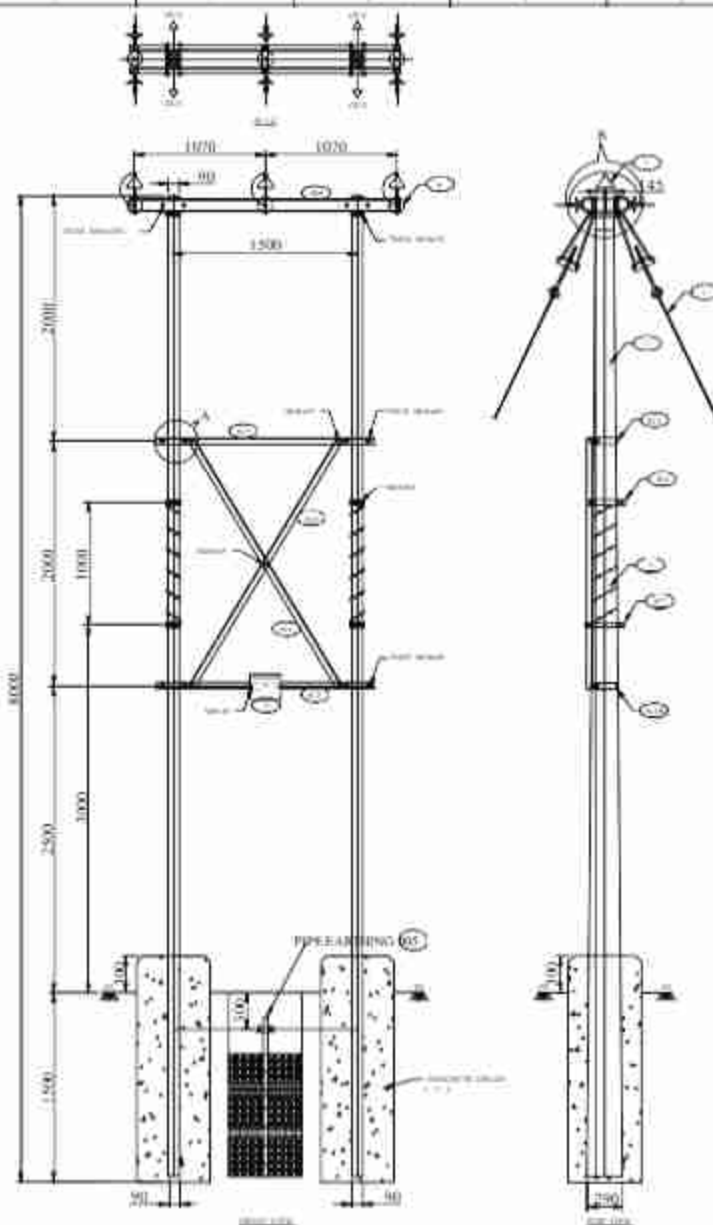
REC/RDSS/11KV/03

SHT. NO.	REV. NO.
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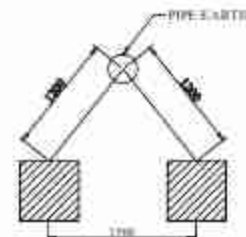
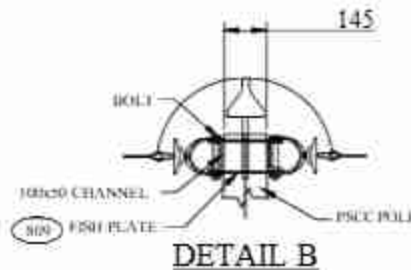
10F1

REV. NO.

10



Angle should not be cut on its one of the sides. Instead, both the sides should be bent and then drilled.



BILL OF MATERIAL			
REF. CODE	DESCRIPTION	QTY	REF. DRG. NO.
1	100x50x5 PSCC W/ 100x50x5	2.000	REC/11KV/04A
2	100x50x5 PSCC W/ 100x50x5	2.000	
3	100x50x5 PSCC W/ 100x50x5	2.000	
4	100x50x5 PSCC W/ 100x50x5	2.000	
5	100x50x5 PSCC W/ 100x50x5	2.000	
6	100x50x5 PSCC W/ 100x50x5	2.000	
7	100x50x5 PSCC W/ 100x50x5	2.000	
8	100x50x5 PSCC W/ 100x50x5	2.000	
9	100x50x5 PSCC W/ 100x50x5	2.000	
10	100x50x5 PSCC W/ 100x50x5	2.000	
11	100x50x5 PSCC W/ 100x50x5	2.000	
12	100x50x5 PSCC W/ 100x50x5	2.000	
13	100x50x5 PSCC W/ 100x50x5	2.000	
14	100x50x5 PSCC W/ 100x50x5	2.000	
15	100x50x5 PSCC W/ 100x50x5	2.000	
16	100x50x5 PSCC W/ 100x50x5	2.000	
17	100x50x5 PSCC W/ 100x50x5	2.000	
18	100x50x5 PSCC W/ 100x50x5	2.000	
19	100x50x5 PSCC W/ 100x50x5	2.000	
20	100x50x5 PSCC W/ 100x50x5	2.000	
21	100x50x5 PSCC W/ 100x50x5	2.000	
22	100x50x5 PSCC W/ 100x50x5	2.000	
23	100x50x5 PSCC W/ 100x50x5	2.000	
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25	100x50x5 PSCC W/ 100x50x5	2.000	
26	100x50x5 PSCC W/ 100x50x5	2.000	
27	100x50x5 PSCC W/ 100x50x5	2.000	
28	100x50x5 PSCC W/ 100x50x5	2.000	
29	100x50x5 PSCC W/ 100x50x5	2.000	
30	100x50x5 PSCC W/ 100x50x5	2.000	
31	100x50x5 PSCC W/ 100x50x5	2.000	
32	100x50x5 PSCC W/ 100x50x5	2.000	
33	100x50x5 PSCC W/ 100x50x5	2.000	
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35	100x50x5 PSCC W/ 100x50x5	2.000	
36	100x50x5 PSCC W/ 100x50x5	2.000	
37	100x50x5 PSCC W/ 100x50x5	2.000	
38	100x50x5 PSCC W/ 100x50x5	2.000	
39	100x50x5 PSCC W/ 100x50x5	2.000	
40	100x50x5 PSCC W/ 100x50x5	2.000	
41	100x50x5 PSCC W/ 100x50x5	2.000	
42	100x50x5 PSCC W/ 100x50x5	2.000	
43	100x50x5 PSCC W/ 100x50x5	2.000	
44	100x50x5 PSCC W/ 100x50x5	2.000	
45	100x50x5 PSCC W/ 100x50x5	2.000	
46	100x50x5 PSCC W/ 100x50x5	2.000	
47	100x50x5 PSCC W/ 100x50x5	2.000	
48	100x50x5 PSCC W/ 100x50x5	2.000	
49	100x50x5 PSCC W/ 100x50x5	2.000	
50	100x50x5 PSCC W/ 100x50x5	2.000	
51	100x50x5 PSCC W/ 100x50x5	2.000	
52	100x50x5 PSCC W/ 100x50x5	2.000	
53	100x50x5 PSCC W/ 100x50x5	2.000	
54	100x50x5 PSCC W/ 100x50x5	2.000	
55	100x50x5 PSCC W/ 100x50x5	2.000	
56	100x50x5 PSCC W/ 100x50x5	2.000	
57	100x50x5 PSCC W/ 100x50x5	2.000	
58	100x50x5 PSCC W/ 100x50x5	2.000	
59	100x50x5 PSCC W/ 100x50x5	2.000	
60	100x50x5 PSCC W/ 100x50x5	2.000	
61	100x50x5 PSCC W/ 100x50x5	2.000	
62	100x50x5 PSCC W/ 100x50x5	2.000	
63	100x50x5 PSCC W/ 100x50x5	2.000	
64	100x50x5 PSCC W/ 100x50x5	2.000	
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70	100x50x5 PSCC W/ 100x50x5	2.000	
71	100x50x5 PSCC W/ 100x50x5	2.000	
72	100x50x5 PSCC W/ 100x50x5	2.000	
73	100x50x5 PSCC W/ 100x50x5	2.000	
74	100x50x5 PSCC W/ 100x50x5	2.000	
75	100x50x5 PSCC W/ 100x50x5	2.000	
76	100x50x5 PSCC W/ 100x50x5	2.000	
77	100x50x5 PSCC W/ 100x50x5	2.000	
78	100x50x5 PSCC W/ 100x50x5	2.000	
79	100x50x5 PSCC W/ 100x50x5	2.000	
80	100x50x5 PSCC W/ 100x50x5	2.000	
81	100x50x5 PSCC W/ 100x50x5	2.000	
82	100x50x5 PSCC W/ 100x50x5	2.000	
83	100x50x5 PSCC W/ 100x50x5	2.000	
84	100x50x5 PSCC W/ 100x50x5	2.000	
85	100x50x5 PSCC W/ 100x50x5	2.000	
86	100x50x5 PSCC W/ 100x50x5	2.000	
87	100x50x5 PSCC W/ 100x50x5	2.000	
88	100x50x5 PSCC W/ 100x50x5	2.000	
89	100x50x5 PSCC W/ 100x50x5	2.000	
90	100x50x5 PSCC W/ 100x50x5	2.000	
91	100x50x5 PSCC W/ 100x50x5	2.000	
92	100x50x5 PSCC W/ 100x50x5	2.000	
93	100x50x5 PSCC W/ 100x50x5	2.000	
94	100x50x5 PSCC W/ 100x50x5	2.000	
95	100x50x5 PSCC W/ 100x50x5	2.000	
96	100x50x5 PSCC W/ 100x50x5	2.000	
97	100x50x5 PSCC W/ 100x50x5	2.000	
98	100x50x5 PSCC W/ 100x50x5	2.000	
99	100x50x5 PSCC W/ 100x50x5	2.000	
100	100x50x5 PSCC W/ 100x50x5	2.000	

#### NOTES:-

- 1) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED.
- 2) MANUFACTURING TOLERANCE:  
UP TO 30mm  $\pm 0.5\%$   
31 TO 100mm  $\pm 0.4\%$   
101 TO 300mm  $\pm 0.3\%$   
ABOVE 300mm  $\pm 0.2\%$
- 3) ALL MS PARTS SHALL CONFORM TO IS 2062
- 4) ALL MS FABRICATED ITEMS SHALL BE HOT DIP GALVANISED AS PER IS 2026/4759
- 5) ALL THF ITEMS SHALL BE MARKED WITH EJECTION CODE
- 6) WEIGHT MENTIONED IS FOR PACKING & FORWARDING PURPOSE
- 7) ALL CHANNELS & ANGLES SHALL CONFORM AS PER IS 506 PART-I
- 8) ALL CHANNELS SHALL BE DIL CHANNELS
- 9) THIS DRAWING SHALL BE USED AT TENSION LOCATION FOR SECTIONALISING AT AN INTERVAL OF 1 KM.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

GA OF 11KV LINE FORMATION AT DP ON PSC/PCC POLE WITH COMPONENTS (IN LINE ARRANGEMENT)

SIZE/SCALE:

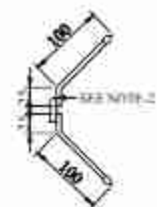
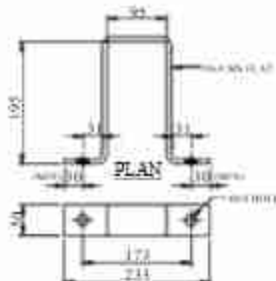
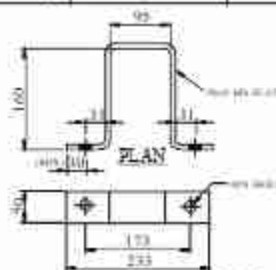
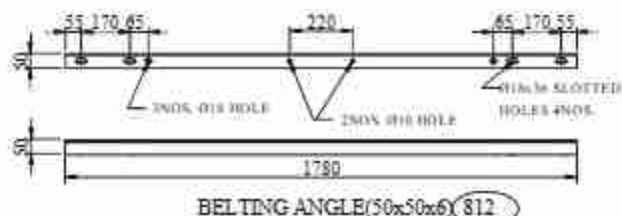
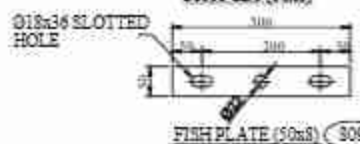
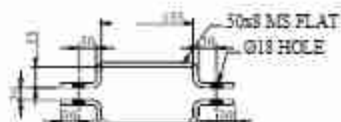
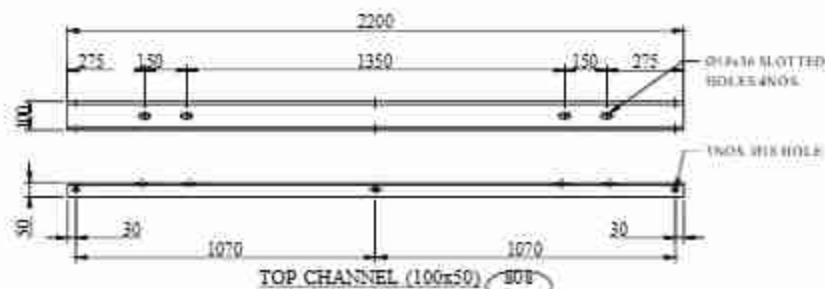
DRG. NO.

REC/RDSS/11KV/04A

SHT. NO. REV. NO.

1 OF 2 0






BILL OF MATERIAL							
ITEM NO.	DESCRIPTION	SECTION	QUANTITY	UNIT	QTY	TOTAL NO.	QTY
808	TOP CHANNEL (100x50)	808	1	NO.	1	1	1
809	FISH PLATE (50x5)	809	1	NO.	1	1	1
810	CLAMP FOR STAY SET (50x5)	810	1	NO.	1	1	1
811	BRACING ANGLE (50x50x6)	811	1	NO.	1	1	1
812	BELTING ANGLE (50x50x6)	812	1	NO.	1	1	1
813	CLAMP 'A' FOR BELTING ANGLE (50x5)	813	1	NO.	1	1	1
814B	CLAMP 'B' FOR BELTING ANGLE (50x5)	814B	1	NO.	1	1	1
815	6mm ROD SPIKE	815	1	NO.	1	1	1
TOTAL							7

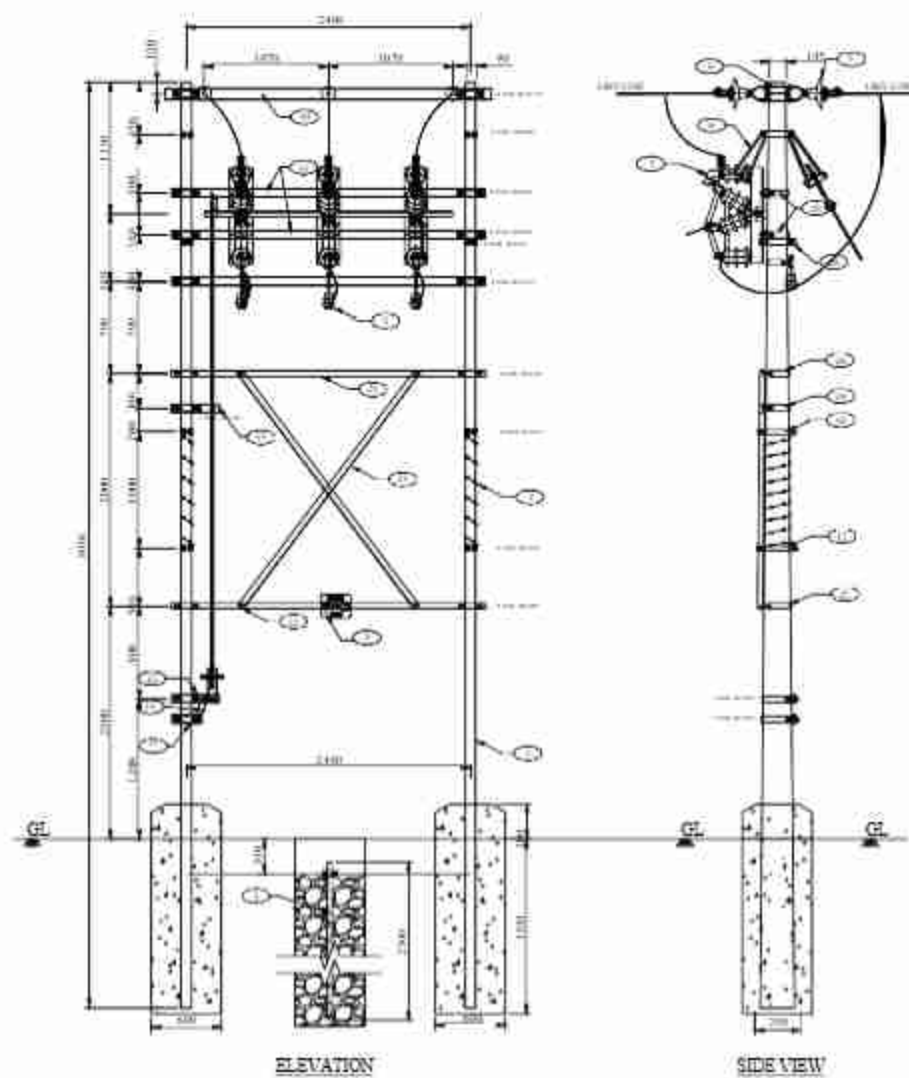
ITEM NO.	DESCRIPTION	SECTION	QUANTITY	UNIT	QTY	TOTAL NO.	QTY
808	TOP CHANNEL (100x50)	808	1	NO.	1	1	1
809	FISH PLATE (50x5)	809	1	NO.	1	1	1
810	CLAMP FOR STAY SET (50x5)	810	1	NO.	1	1	1
811	BRACING ANGLE (50x50x6)	811	1	NO.	1	1	1
812	BELTING ANGLE (50x50x6)	812	1	NO.	1	1	1
813	CLAMP 'A' FOR BELTING ANGLE (50x5)	813	1	NO.	1	1	1
814B	CLAMP 'B' FOR BELTING ANGLE (50x5)	814B	1	NO.	1	1	1
815	6mm ROD SPIKE	815	1	NO.	1	1	1
TOTAL							7

#### NOTES:-

- 1) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED
- 2) MANUFACTURING TOLERANCE  
 UP TO 50mm - ± 0.5%  
 51 TO 100mm - ± 0.4%  
 101 TO 300mm - ± 0.3%  
 ABOVE 300mm - ± 0.2%
- 3) ALL MS PARTS SHALL CONFORM TO IS 2062
- 4) ALL MS FABRICATED ITEMS SHALL BE HOT DIP GALVANIZED AS PER IS 2624 PART-1
- 5) ALL THE ITEMS SHALL BE MARKED WITH DIRECTION CODE
- 6) WEIGHT MENTIONED IS FOR PACKING & FORWARDING PURPOSE
- 7) ALL CHANNELS & ANGLES SHALL CONFORM AS PER IS-59 PART-1
- 8) ALL CHANNELS SHALL BE HSLC CHANNELS
- 9) THIS DRAWING SHALL BE USED AT DESIGN LOCATION FOR SECTIONALISING AT AN INTERVAL OF 1.6KM

FOR TENDER PURPOSE ONLY

		Rural Electrification Corporation Ltd.	
PROJECT:		Revamped Distribution Sector Scheme (RDSS)	
TITLE:		COMPONENTS FOR 11kV LINE FORMATION AT DP ON PSC/PCC POLE (IN LINE ARRANGEMENT)	
SIZE/SCALE	DRG. NO.	SHR. NO.	REV. NO.
AS HTS	REC/RDSS/11KV/04B	2 OF 2	0



BILL OF MATERIALS			
NO.	DESCRIPTION	QUANTITY	UNIT
1	Sectionalizer, 11KV	1	NO.
2	11KV PSC/PSC Pole	1	NO.
3	11KV PSC/PSC Pole	1	NO.
4	11KV PSC/PSC Pole	1	NO.
5	11KV PSC/PSC Pole	1	NO.
6	11KV PSC/PSC Pole	1	NO.
7	11KV PSC/PSC Pole	1	NO.
8	11KV PSC/PSC Pole	1	NO.
9	11KV PSC/PSC Pole	1	NO.
10	11KV PSC/PSC Pole	1	NO.
11	11KV PSC/PSC Pole	1	NO.
12	11KV PSC/PSC Pole	1	NO.
13	11KV PSC/PSC Pole	1	NO.
14	11KV PSC/PSC Pole	1	NO.
15	11KV PSC/PSC Pole	1	NO.
16	11KV PSC/PSC Pole	1	NO.
17	11KV PSC/PSC Pole	1	NO.
18	11KV PSC/PSC Pole	1	NO.
19	11KV PSC/PSC Pole	1	NO.
20	11KV PSC/PSC Pole	1	NO.
21	11KV PSC/PSC Pole	1	NO.
22	11KV PSC/PSC Pole	1	NO.
23	11KV PSC/PSC Pole	1	NO.
24	11KV PSC/PSC Pole	1	NO.
25	11KV PSC/PSC Pole	1	NO.
26	11KV PSC/PSC Pole	1	NO.
27	11KV PSC/PSC Pole	1	NO.
28	11KV PSC/PSC Pole	1	NO.
29	11KV PSC/PSC Pole	1	NO.
30	11KV PSC/PSC Pole	1	NO.
31	11KV PSC/PSC Pole	1	NO.
32	11KV PSC/PSC Pole	1	NO.
33	11KV PSC/PSC Pole	1	NO.
34	11KV PSC/PSC Pole	1	NO.
35	11KV PSC/PSC Pole	1	NO.
36	11KV PSC/PSC Pole	1	NO.
37	11KV PSC/PSC Pole	1	NO.
38	11KV PSC/PSC Pole	1	NO.
39	11KV PSC/PSC Pole	1	NO.
40	11KV PSC/PSC Pole	1	NO.
41	11KV PSC/PSC Pole	1	NO.
42	11KV PSC/PSC Pole	1	NO.
43	11KV PSC/PSC Pole	1	NO.
44	11KV PSC/PSC Pole	1	NO.
45	11KV PSC/PSC Pole	1	NO.
46	11KV PSC/PSC Pole	1	NO.
47	11KV PSC/PSC Pole	1	NO.
48	11KV PSC/PSC Pole	1	NO.
49	11KV PSC/PSC Pole	1	NO.
50	11KV PSC/PSC Pole	1	NO.
51	11KV PSC/PSC Pole	1	NO.
52	11KV PSC/PSC Pole	1	NO.
53	11KV PSC/PSC Pole	1	NO.
54	11KV PSC/PSC Pole	1	NO.
55	11KV PSC/PSC Pole	1	NO.
56	11KV PSC/PSC Pole	1	NO.
57	11KV PSC/PSC Pole	1	NO.
58	11KV PSC/PSC Pole	1	NO.
59	11KV PSC/PSC Pole	1	NO.
60	11KV PSC/PSC Pole	1	NO.
61	11KV PSC/PSC Pole	1	NO.
62	11KV PSC/PSC Pole	1	NO.
63	11KV PSC/PSC Pole	1	NO.
64	11KV PSC/PSC Pole	1	NO.
65	11KV PSC/PSC Pole	1	NO.
66	11KV PSC/PSC Pole	1	NO.
67	11KV PSC/PSC Pole	1	NO.
68	11KV PSC/PSC Pole	1	NO.
69	11KV PSC/PSC Pole	1	NO.
70	11KV PSC/PSC Pole	1	NO.
71	11KV PSC/PSC Pole	1	NO.
72	11KV PSC/PSC Pole	1	NO.
73	11KV PSC/PSC Pole	1	NO.
74	11KV PSC/PSC Pole	1	NO.
75	11KV PSC/PSC Pole	1	NO.
76	11KV PSC/PSC Pole	1	NO.
77	11KV PSC/PSC Pole	1	NO.
78	11KV PSC/PSC Pole	1	NO.
79	11KV PSC/PSC Pole	1	NO.
80	11KV PSC/PSC Pole	1	NO.
81	11KV PSC/PSC Pole	1	NO.
82	11KV PSC/PSC Pole	1	NO.
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87	11KV PSC/PSC Pole	1	NO.
88	11KV PSC/PSC Pole	1	NO.
89	11KV PSC/PSC Pole	1	NO.
90	11KV PSC/PSC Pole	1	NO.
91	11KV PSC/PSC Pole	1	NO.
92	11KV PSC/PSC Pole	1	NO.
93	11KV PSC/PSC Pole	1	NO.
94	11KV PSC/PSC Pole	1	NO.
95	11KV PSC/PSC Pole	1	NO.
96	11KV PSC/PSC Pole	1	NO.
97	11KV PSC/PSC Pole	1	NO.
98	11KV PSC/PSC Pole	1	NO.
99	11KV PSC/PSC Pole	1	NO.
100	11KV PSC/PSC Pole	1	NO.

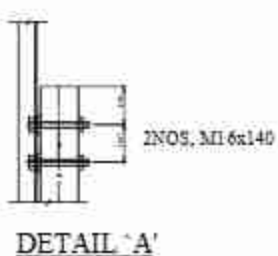
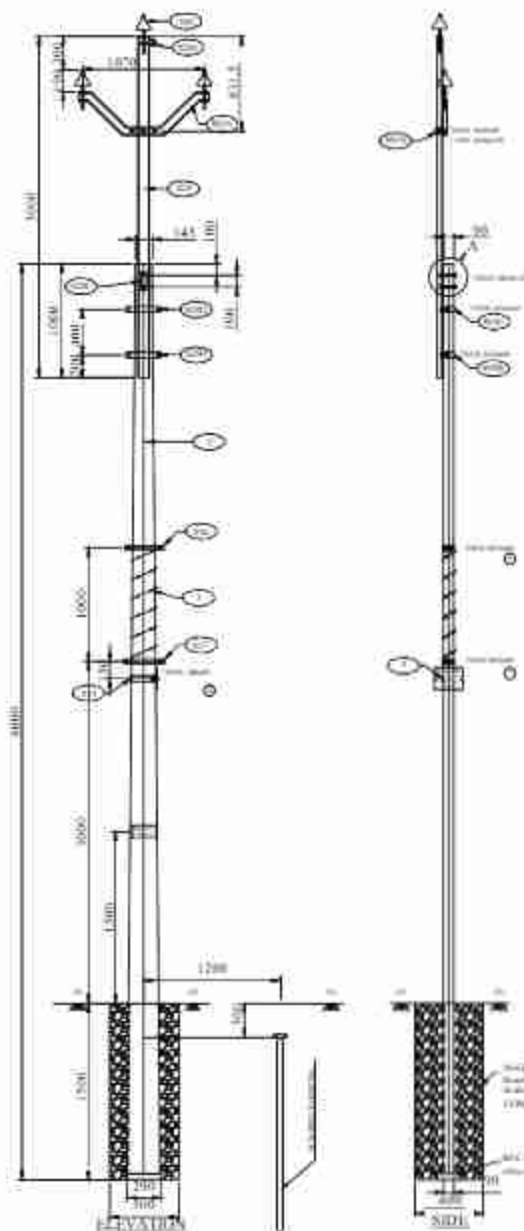
**GENERAL NOTES:**  
 1) ALL DIMENSIONS ARE IN MM (UNLESS OTHERWISE MENTIONED)  
 2) MANUFACTURING TOLERANCE  
 UP TO 50mm - ± 3%  
 51 TO 100mm - ± 4%  
 101 TO 300mm - ± 5%  
 ABOVE 300mm - ± 2%  
 3) ALL MS PARTS SHALL CONFORM TO IS 2062  
 4) ALL MS FABRICATED ITEMS SHALL BE HOT DIP GALVANIZED AS PER IS 2623 & 4750  
 5) ALL ITEMS SHALL BE MARKED WITH ERECTION CODE  
 6) WEIGHT MENTIONED IS FOR PACKING & FORWARDING PURPOSE  
 7) ALL CLAMPS AND ANCHORS SHALL CONFORM TO IS 500 PART-1  
 8) ALL CHANNELS SHALL BE FILL CHANNELS

FOR TENDER PURPOSE ONLY

**Rural Electrification Corporation Ltd.**

<b>PROJECT:</b>	Revamped Distribution Sector Scheme (RDSS)		
<b>TITLE:</b>	GA OF 11KV LINE SECTIONALIZER ON PSC/PSC POLE		
<b>DATE:</b>	<b>SCALE:</b>	<b>DRG. NO.:</b>	<b>REV. NO.:</b>
01.06.09	NT3 A3	REC RDSS 11KV/05A	R0
			NO. OF PAGES 1 OF 1





BILL OF MATERIAL			
REF. CODE	DESCRIPTION	QTY.	REF. DRG. NO.
001	40 CHANNEL PSC POLE	1 NOS.	REC/SDP/11KV/6A
002	15x75x10x5 ANGLE	2 NOS.	
003	BARBED WIRE	1000 MM	
004	10x10x5x5 CHANNEL	1 NOS.	REC/SDP/11KV/6A
005	SPRUE BUSHING	1 SET	REC/SDP/11KV/6A
006	V-CROSS ARM	2 NOS.	REC/SDP/11KV/6A
007	V-CROSS ARM SUPPORTING CHANNEL (UNDER)	1 NOS.	REC/SDP/11KV/6A
008	WELDED PLATE	2 NOS.	REC/SDP/11KV/6A
009	WELDED PLATE	2 NOS.	REC/SDP/11KV/6A
010	WELDED WARDER PLATE	1 NOS.	REC/SDP/11KV/6A
011	LOCK CLAMP FOR V-CROSS ARM	2 NOS.	REC/SDP/11KV/6A
012	CLAMP FOR CHANNEL BUSH	1 NOS.	REC/SDP/11KV/6A
013	TOP CLAMP FOR ANTI CLIMBING DEVICE	1 NOS.	REC/SDP/11KV/6A
014	BOTTOM CLAMP FOR ANTI CLIMBING DEVICE	2 NOS.	REC/SDP/11KV/6A
015	BACK CLAMP FOR V-CROSS ARM SUPPORTING CHANNEL	1 NOS.	REC/SDP/11KV/6A
016	BACK CLAMP FOR V-CROSS ARM SUPPORTING CHANNEL	2 NOS.	REC/SDP/11KV/6A
017	BACK CLAMP FOR V-CROSS ARM SUPPORTING CHANNEL	2 NOS.	REC/SDP/11KV/6A

#### GENERAL NOTES

- 1) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED
- 2) MANUFACTURING TOLERANCE  
UP TO 30mm -  $\pm 3\%$   
31 TO 100mm -  $\pm 4\%$   
101 TO 300mm -  $\pm 5\%$   
ABOVE 300mm -  $\pm 2\%$
- 3) ALL M.S. PARTS SHALL CONFORM TO IS 2062
- 4) ALL M.S. FABRICATED ITEMS SHALL BE HOT DIP GALVANIZED  
AS PER IS 2620 & 4750
- 5) ALL THE ITEMS SHALL BE MARKED WITH REFLECTION CODE
- 6) WEIGHT MENTIONED IN FOR PACKING & FORWARDING PURPOSE
- 7) ALL CHANNELS AND ANGLES SHALL CONFORM TO IS 308 PART 1  
ALL CHANNELS SHALL BE BEC CHANNELS

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

GA OF 11kV POLE EXTENSION FOR SINGLE PCC/PSC POLE

SHEET NO.

DRG. NO.

REC/RDSS/11KV/6A

SHT. NO.

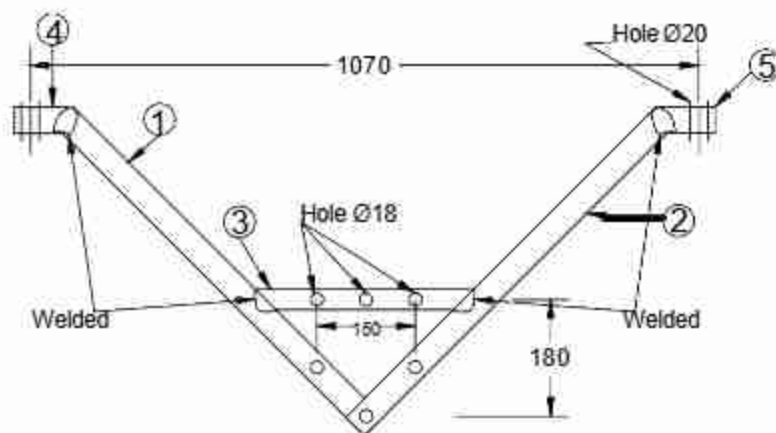
1 OF 2

REV. NO.

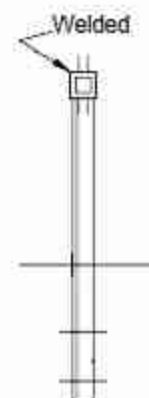
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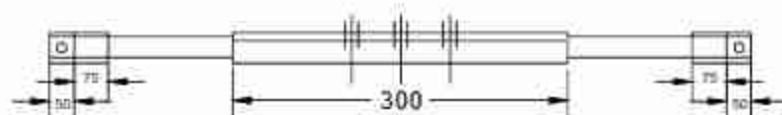




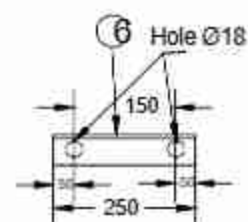
ELEVATION



END VIEW



PLAN



BACK CLEAT

11KV 'V' Cross-Arm

BILL OF MATERIAL

PART NO.	DESCRIPTION	QTY.	Weight (in Kg)
1	M. S. CHANNEL 75x40x6 = 710 LONG	1 No.	4.83
2	M. S. CHANNEL 75x40x6 = 635 LONG	1 No.	4.32
3	M. S. ANGLE 50x50x6 = 300 LONG	1 No.	1.35
4	M. S. ANGLE 85x85x6 = 125 LONG	2 Nos.	1.46
5	M. S. ANGLE 85x85x6 = 50 LONG	2 Nos.	0.58
6	M. S. CHANNEL 75x40x6 = 250 LONG	2 No.	3.4

FOR TENDER PURPOSE ONLY

All Dimensions are in mm.



Rural Electrification Corporation Ltd.

PROJECT

Revamped Distribution Sector Scheme (RDSS)

TITLE

11KV Bridling 'V' CROSS-ARM

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE  
A3

SCALE  
NTS

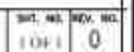
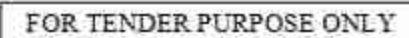
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REC/ RDSS /11KV/07

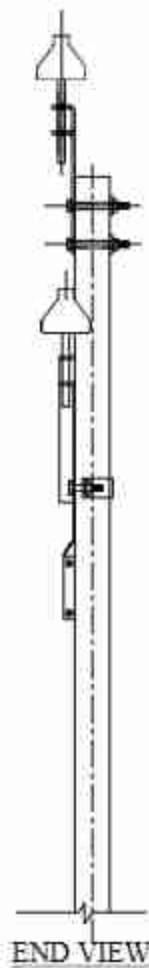
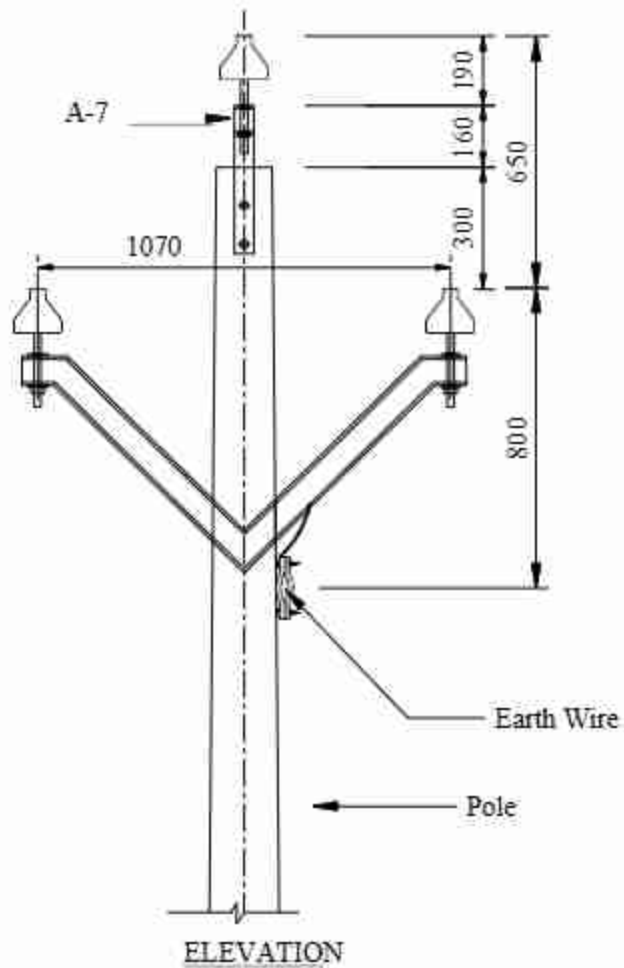
SHT. NO.  
1 OF 1

REV. NO.  
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1	2	3	4	5
6	7	8	9	10




**FOR TENDER PURPOSE ONLY**

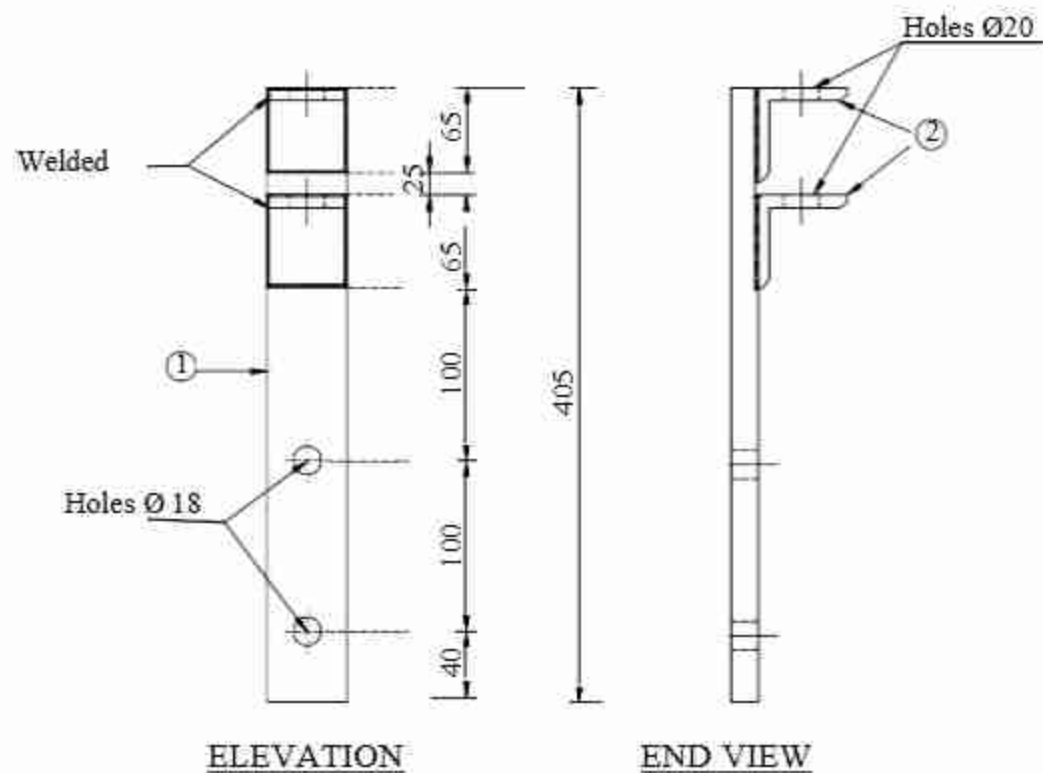
ALL DIMENSIONS ARE IN MM.

All Dimensions are in mm.

**TANGENT LOCATION**  
**MAXIMUM SPAN-107 METERS**

NOTE:- 11 KV-CONSTRUCTION WITHOUT CONTINUOUS  
EARTH WIRE VIDE A-7 IS PREFERRED

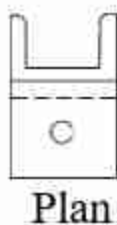
		Rural Electrification Corporation Ltd.	
PROJECT:		Revamped Distribution Sector Scheme (RDSS)	
TITLE		11 KV LINES CONDUCTOR FORMATION AND CLEARANCE WITH EARTH WIRE	
SIZE	SCALE	DRG. NO.	SHT. NO. REV. NO.
A3	NTS	REC/RDSS/11KV/09	1 OF 1 0




BILL OF MATERIAL		
Part No.	DESCRIPTION	QTY.
1	M.S Channel 75x40x6=405 Long	1 NOS.
2	M.S Angle 65x65x6=75 Long	2 NOS.

All Dimensions in mm

FOR TENDER PURPOSE ONLY

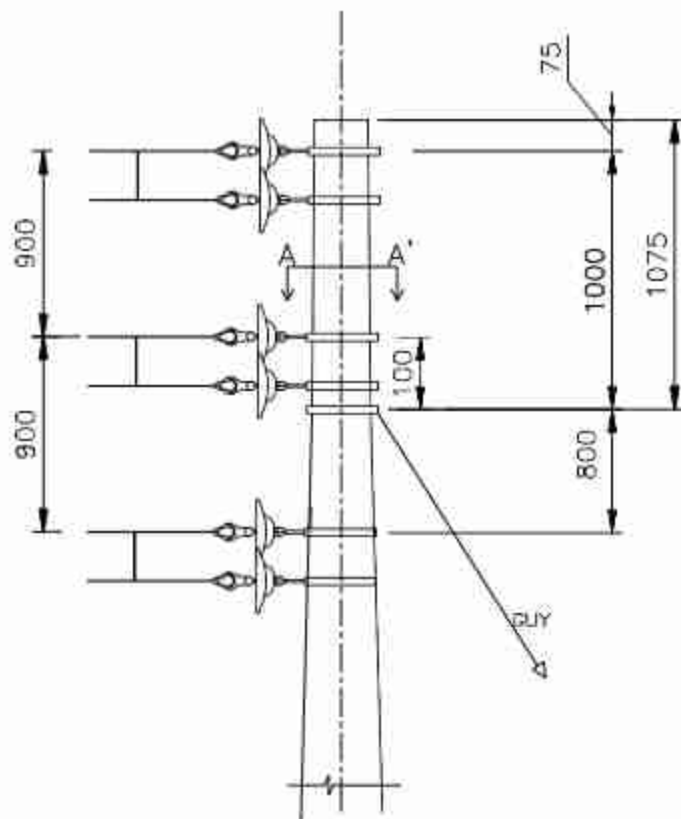


REV.	DESCRIPTION	DATE	BY	CHECKED	DATE
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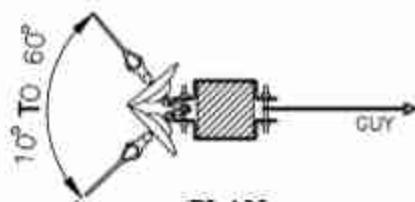
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PROJECT:		Revamped Distribution Sector Scheme (RDSS)	
TITLE:		11 KV LINE POLE TOP BRACKET	
SHEET NO.	SCALE	PROJ. NO.	SHT. NO.
AS NOTED		REC/RDSS11KV/10	1 OF 1
			REV. NO.
			0







ELEVATION



PLAN  
AT A-A'

ALL DIMENSIONS ARE IN MM.

NOTE:-

1. REFER REC CONSTRUCTION STANDARD A-23 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY CLAMP ON THE POLE. THE DIRECTION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE 30 TO 45.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)

TITLE: 11 KV LINES CONDUCTOR FORMATION AND ARRANGEMENT OF GUYS FOR 10 TO 60 ANGLE LOCATIONS (SINGLE POLE SUPPORT)

SIZE/SCALE: AS NOTED

DRG. NO.

REC/RDSS/11KV/13

SHT. NO.

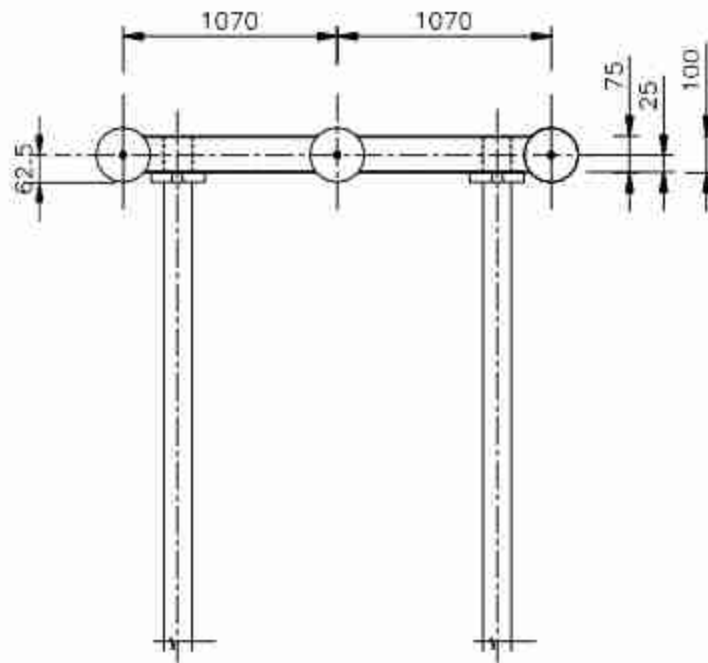
1 OF 1

REV. NO.

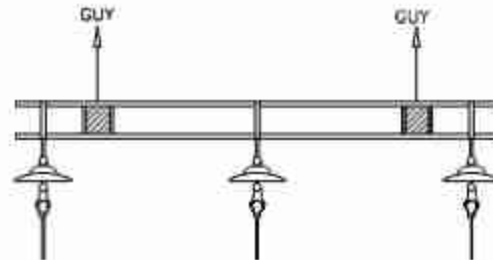
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DESIGNED BY	CHECKED BY	APPROVED BY	DATE	PROJECT NO.





ELEVATION



PLAN

NOTE:-

1. REFER REC CONSTRUCTION STANDARD A-22 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY CLAMP ON THE POLE. THE DIRECTION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE 30° TO 45°

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)

TITLE: 11 KV LINES CONDUCTOR FORMATION AND ARRANGEMENT OF GUYS FOR DEAD LOCATIONS (DOUBLE POLE SUPPORT)

SIZE SCALE  
AS NOTED

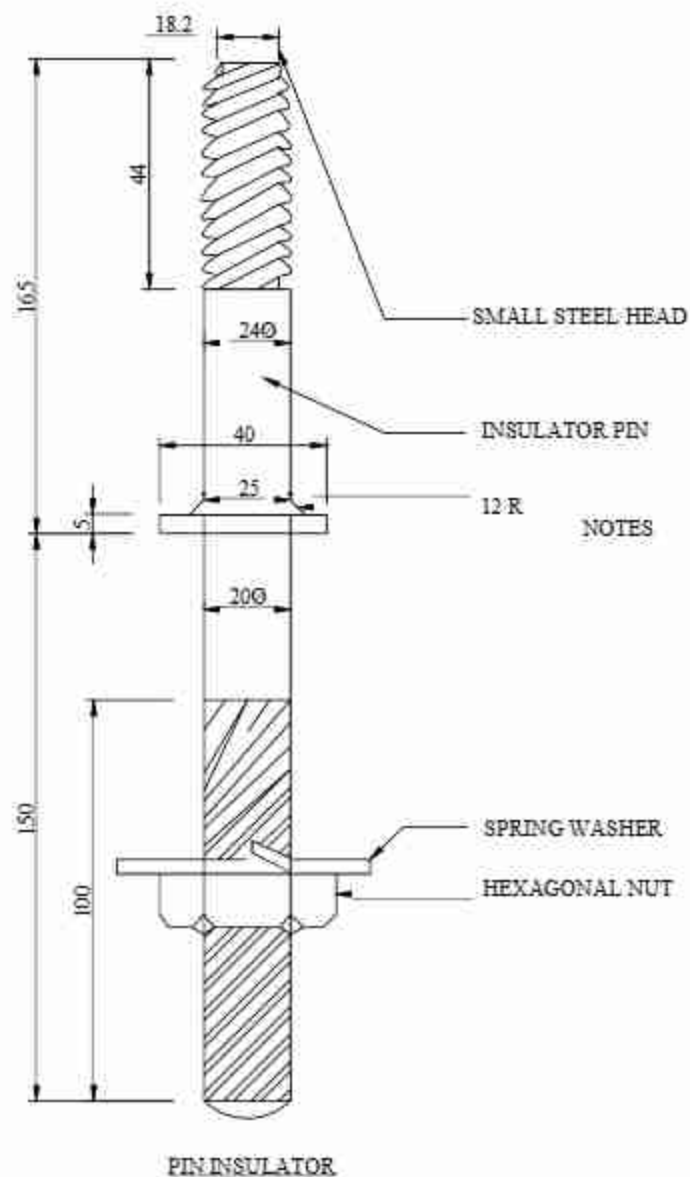
DRG. NO.

REC/RDSS/11KV/14

SHT. NO. REV. NO.

1 OF 1 0

DESIGNED	CHECKED	APPROVED	DATE	PROJECT



1. PIN AS SHOWN SUITABLE FOR METAL CROSS ARM.
2. FOR WOOD CROSS ARM INSTEAD OF SPRINGS WASHER USE TWO SQUARE WASHERS 50x50x5mm. ON THE TOP AND THE OTHER BOTTOM.

11KV INSULATORS & FITTINGS  
INSULATOR PIN NUT

SCALE: NTS

SEPT.-1972

ALL DIMENSION ARE IN mm.

FOR TENDER PURPOSE ONLY

TYPE S 165  
(S.2488 (PART-1))



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

GI PIN

SIZE

A3

SCALE

NTS

DRG. NO.

REC/RDSS /11KV/15.

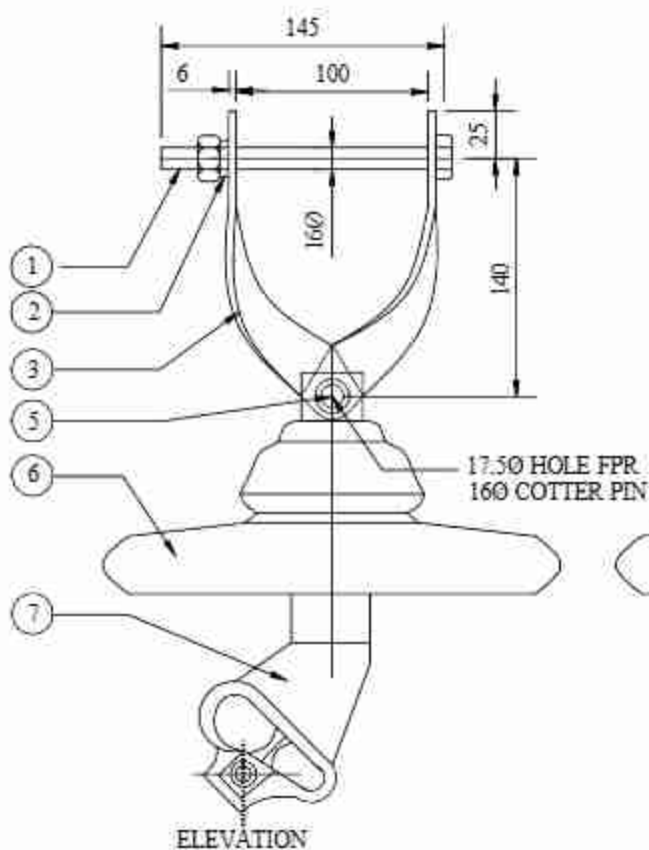
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1 OF 1

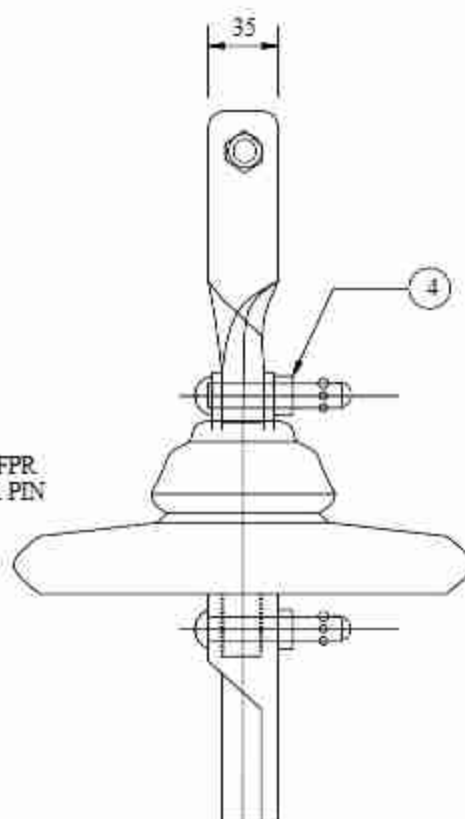
REV. NO.

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NO	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



ELEVATION



END VIEW

S.No.	BILL OF MATERIAL	QTY.
1	BOLT - NUT - 100X145	1
2	SPRING WASHER	1
3	CROSS - ARM STRAPS	2
4	WASHER	2
5	COTTER PIN	2
6	DISC INSULATOR	1
7	CLEVIS ENDED CLAMP WITH ALUMINUM LINER	1

11 KV INSULATOR &  
FITTINGS CLEVIS & TONGUE  
TYPE STRAIN INSULATOR SET

ALL DIMENSION ARE IN mm.

TENDER DRAWING

TITLE : 11 KV INSULATOR &  
FITTINGS CLEVIS & TONGUE  
TYPE STRAIN INSULATOR SET  
DRG. NO : NH / RE / INSULATOR /01

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

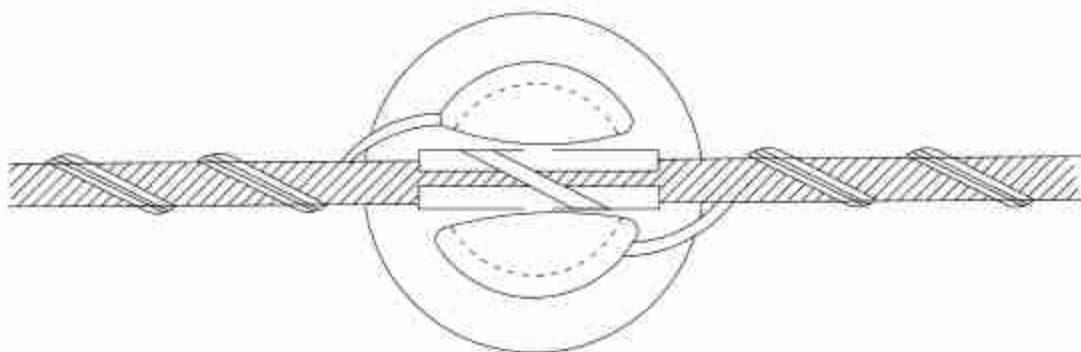
Clevis & Tongue Type Strain Insulator Set

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/ RDSS /11KV/16	1 OF 1	0



DISTRIBUTION TIE



DISTRIBUTION TIE IN POSITION ON 11KV PIN INSULATOR

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

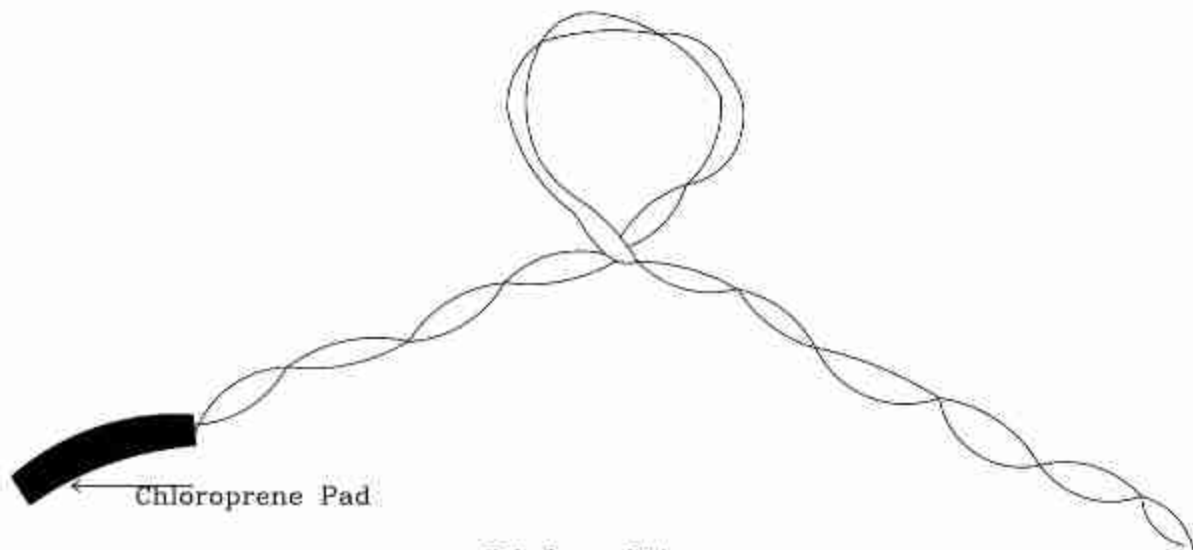
Revamped Distribution Sector Scheme (RDSS)

TITLE

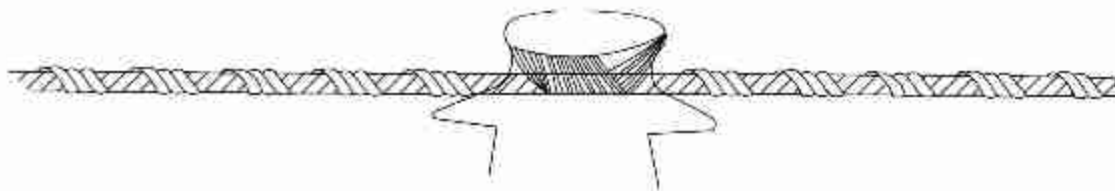
Holding of Conductor on 11 KV Pin Insulator  
Straight Run (Using Helically Formed Fitting)

RD REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DWG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/ RDSS /11KV/17	1 OF 1	0



Side Tie



Side Tie In Position On 11 KV Pin Insulator

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

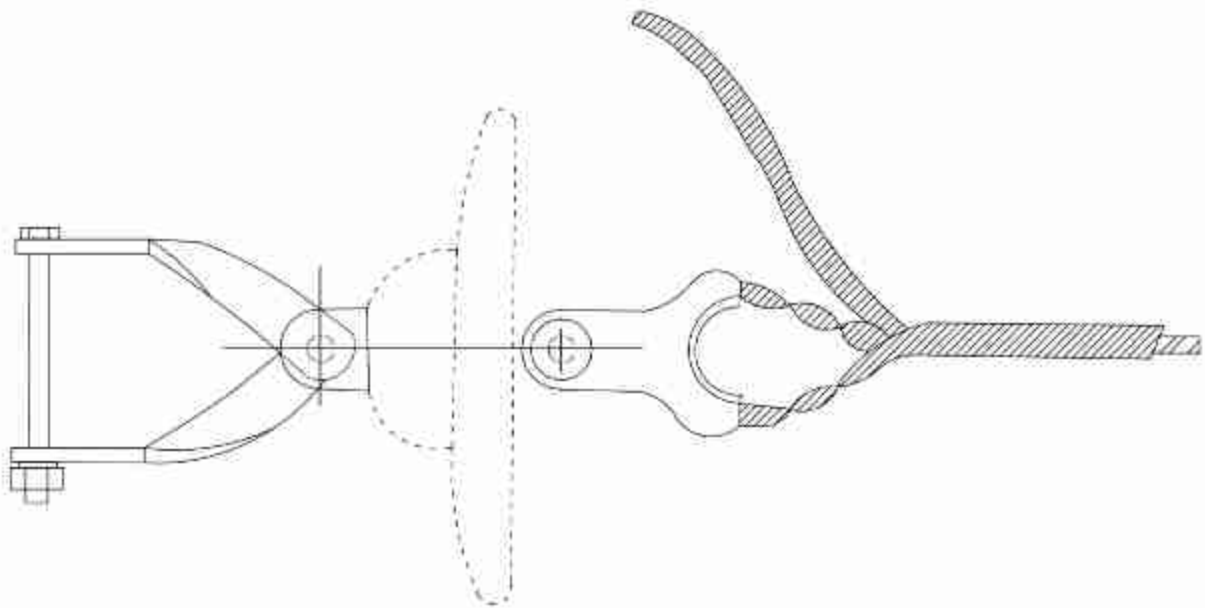
Revamped Distribution Sector Scheme (RDSS)

TITLE

Holding of Conductor on 11 KV Pin Insulator  
Angle Location(Using Helically Formed Fitting)

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/ RDSS /11KV/18	1 OF 1	0



11kV CONDUCTOR DEAD-END FITTING IN POSITION

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

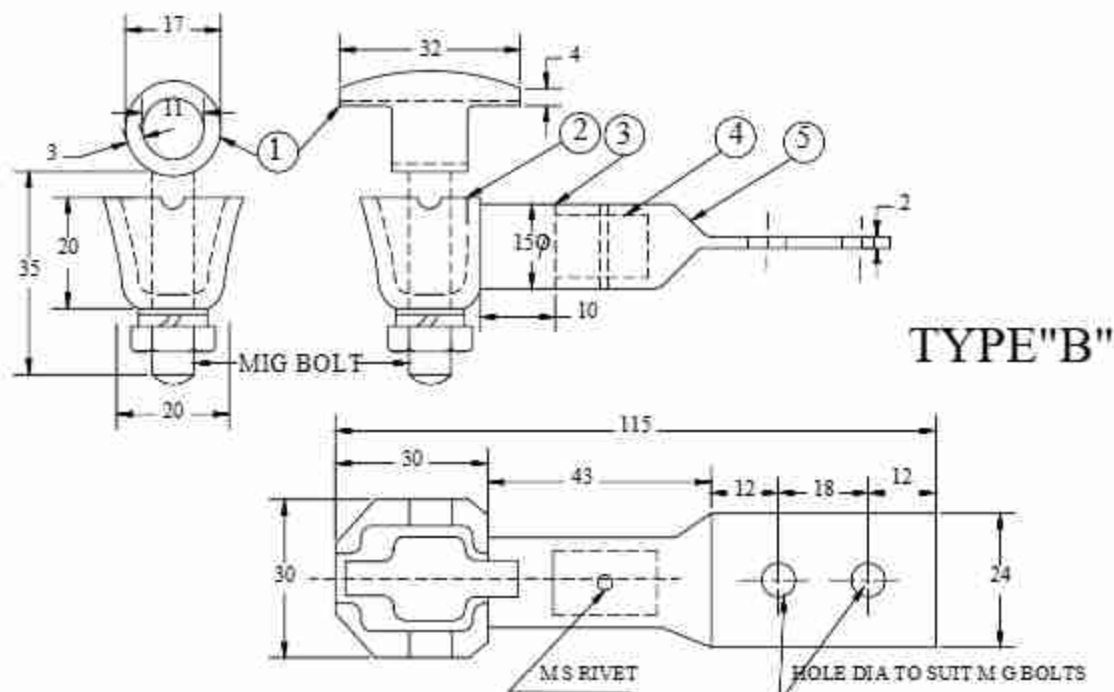
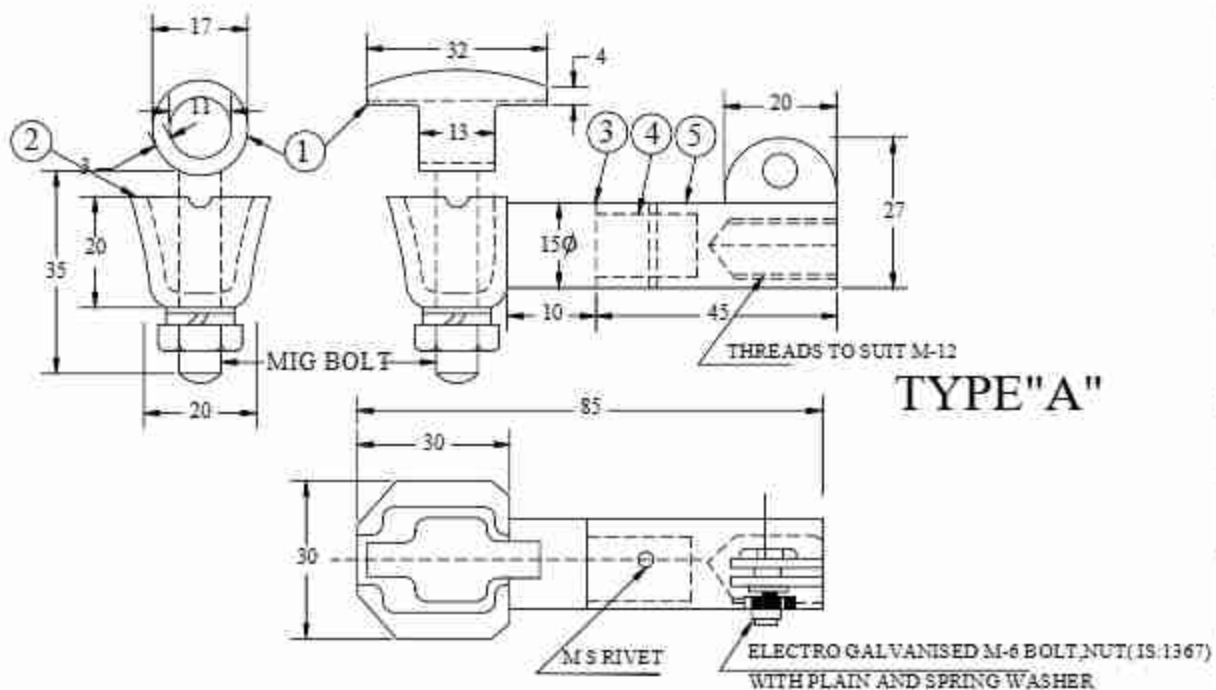
TITLE

11KV Conductor Dead-End Arrangement  
(Using Helically Formed Fitting)

RD					
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/ RDSS /11KV/19	1 OF 1	0





**NOTES:-**

1. ALUMINIUM ALLOY "A-11" CONNECTOR GRIP WITH ELECTRIC GALVANIZED M10 BOLT, NUT WITH PLAIN AND SPRING WASHERS TO GRIP THE CONDUCTOR IN HORIZONTAL AND VERTICAL DIRECTIONS.
2. ALUMINIUM ALLOY "A-11" TYPE 6061-T6 BODY.
3. EPOXY SEAL TO GUARD AGAINST ATMOSPHERIC EFFECTS.
4. HIGH PRESSURE FIT JOINT BETWEEN ALUMINIUM ALLOY AND BRONZE COMPONENTS OF THE CONNECTOR.
5. HIGH STRENGTH CORROSION RESISTANT BRONZE BODY.

ALL DIMENSIONS ARE IN MM.

FOR TENDER PURPOSE ONLY

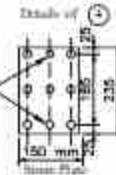
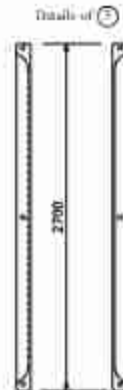
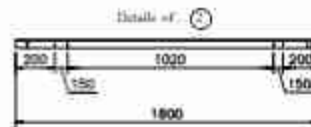
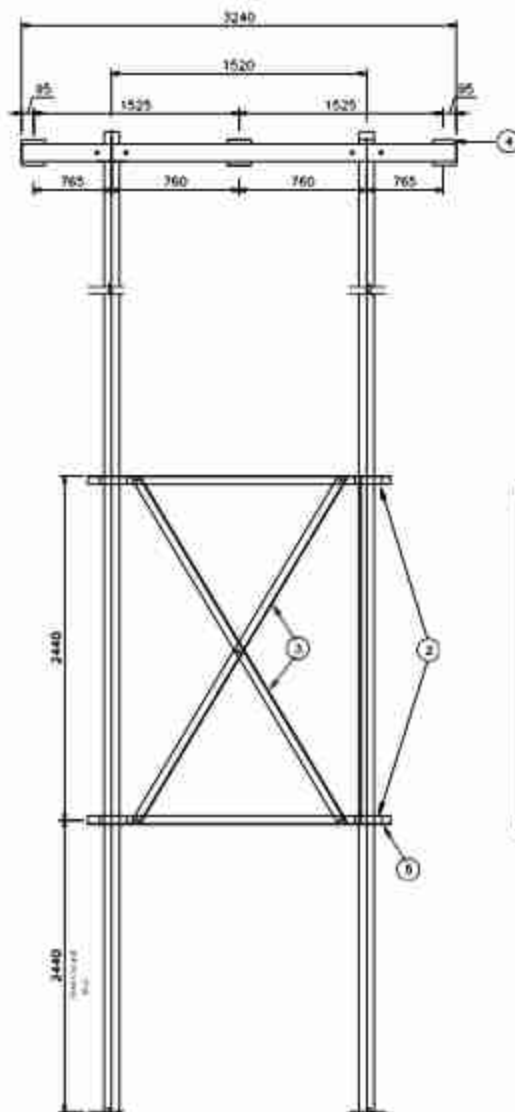


Rural Electrification Corporation Ltd.

**Revamped Distribution Sector Scheme (RDSS)**

Bimetallic Connector (H. T.) for  
11kV Distribution Transformer

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT	REV. NO.	DATE	REV. NO.	DATE	REV. NO.	DATE
A3						NTS		REC/RDSS/11KV/20		0	



1. ALL DIMENSIONS ARE IN MILLIMETERS  
2. ALL DIMENSIONS ARE IN MILLIMETERS

ALL DIMENSIONS ARE IN MILLIMETERS  
ALL DIMENSIONS ARE IN MILLIMETERS

# BILL OF MATERIAL

Item No.	Description	Qty.
1.	M.S. Channel 100x50x5 - 3240 Long	2 Nos.
2.	M.S. Angle 100x50x5 - 1520 Long	2 Nos.
3.	M.S. Angle 100x50x5 - 2700 Long	2 Nos.
4.	Steel Plate	1 Nos.
5.	M.S. Angle 100x50x5 - 235 Long	4 Nos.
6.	M.S. Channel 100x50x5	4 Nos.
7.	Fasteners	As reqd.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

General Arrangement of DC Cross-Arm and Bracing With Back Cleat for PSC/PCC Poles

SIZE/SCALE

DRG. NO.

AS NTS

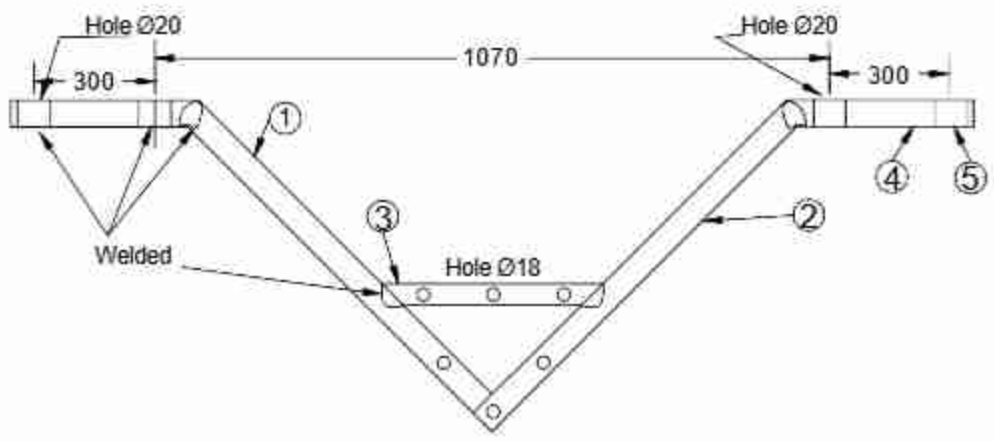
REC/RDSS/11KV/21

SHT. NO.

1 OF 1

REV. NO.

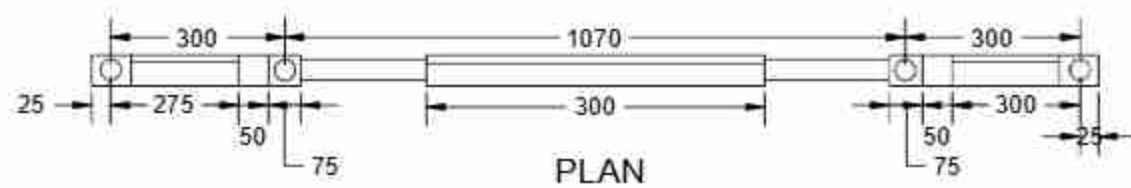
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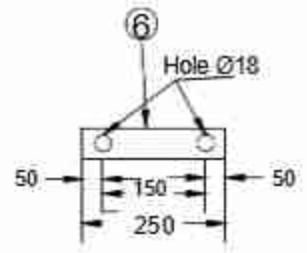
ELEVATION



END VIEW



PLAN



BACK CLEAT

FOR TENDER PURPOSE ONLY



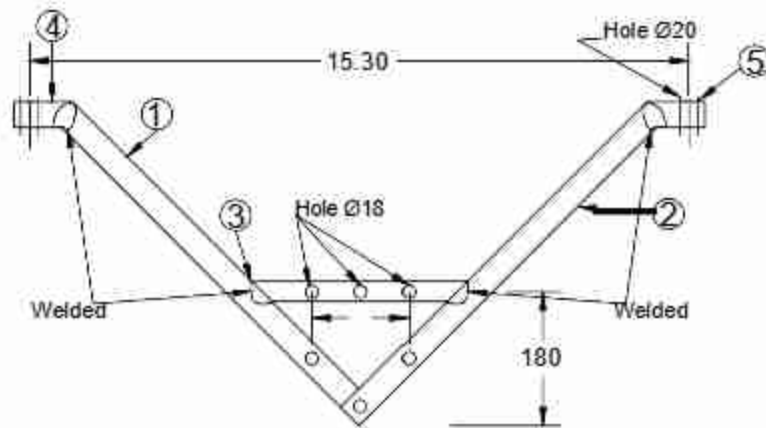
Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)

TITLE: 11KV Bridling 'V' Cross-Arm

NO	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

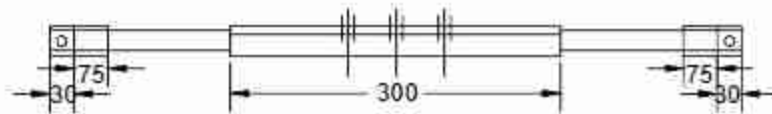
SIZE	SCALE	DWG. NO.	SHEET NO.	REV. NO.
A3	NTS	REC/RDSS /11KV/22	1 OF 1	0



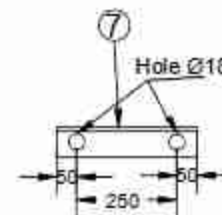
ELEVATION



END VIEW



PLAN



BACK CLEAT

FOR TENDER PURPOSE ONLY

11KV 'V' Cross-Arm



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

11KV 'V' Cross-Arm

SIZE

A3

SCALE

NTS

DRG. NO.

REC/RDSS /11KV/23

SHT. NO.

1 OF 1

REV. NO.

0

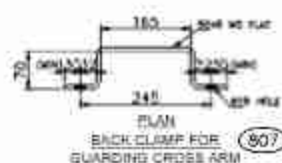
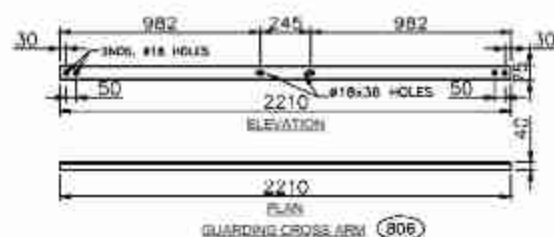
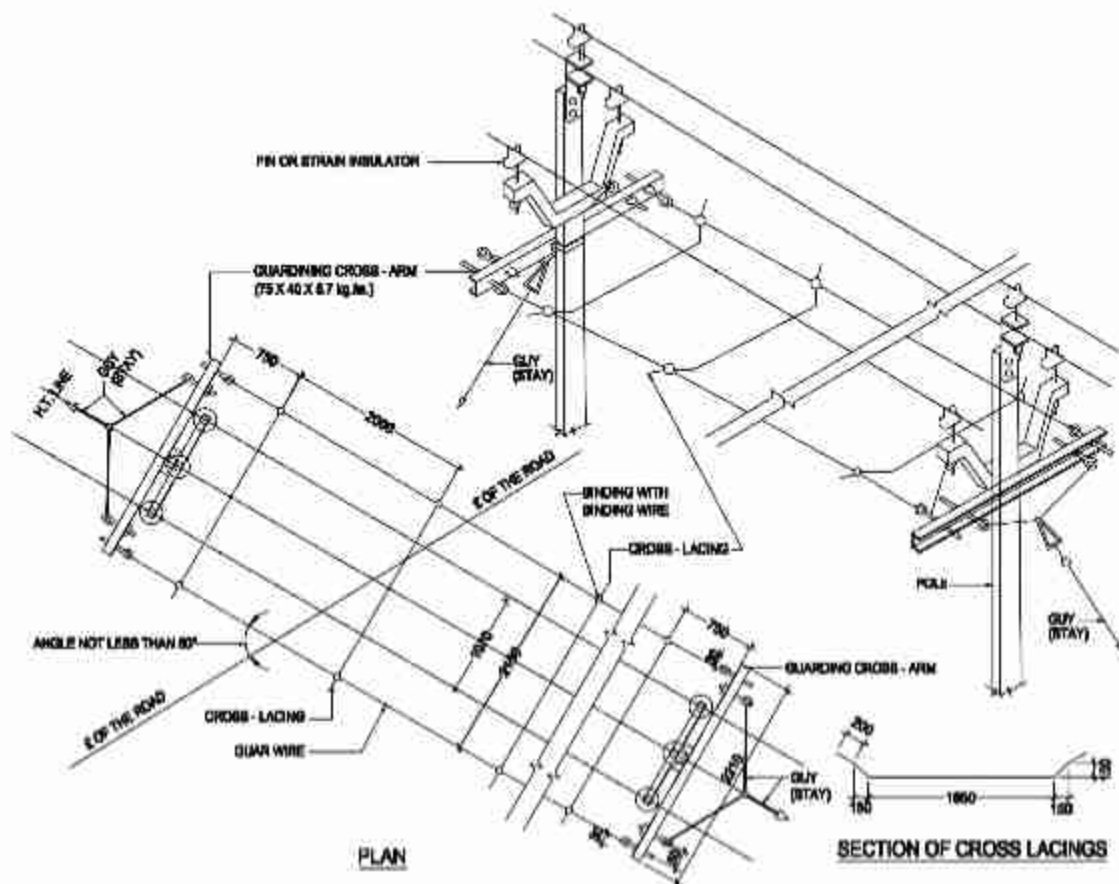
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



Revamped Distribution Sector Scheme (RDSS)

RDSS





BILL OF MATERIAL			
ITEM CODE	DESCRIPTION	QTY	REF. Dwg. NO.
806	WIRE CAPPING FOR POLES ON OTHER SIDE	2 SET	REC-111 Part-806-006
808	W - WPS (50W)	2 SET	REC-111 Part-808-007
810	GUARD WIRE	AS REQD.	
809	GUARDING CROSS - ARM	2 NOS.	REC-111 Part-1109-001
811	WIRE BOLTS - #18mm	8 NOS.	REC-111 Part-1111-001
807	BACK CLAMP FOR GUARDING CROSS ARM	2 NOS.	REC-111 Part-1107-001

BILL OF MATERIAL						
ITEM CODE	DESCRIPTION	SECTION	MATERIAL	LENGTH (mm)	QTY	TOTAL WT. (kg)
806	GUARDING CROSS ARM	75x40	MS	2210	2 NOS.	25.16
807	BACK CLAMP FOR GUARDING CROSS ARM	100x40	MS	160	2 NOS.	2.80
811	WIRE BOLT - 18mm	#18 MS	MS	50	8 NOS.	2.88

DESCRIPTION	SIZE	MATERIAL	LENGTH (mm)	QTY	TOTAL WT. (kg)
NUTS & BOLTS	M18	MS	50	8 NOS.	0.88
SPRING WASHERS	M18	MS	1.5 THK.	8 NOS.	0.08
FLAT WASHERS	M18	MS	2 THK.	8 NOS.	0.08

#### GENERAL NOTES

- 1) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED
- 2) MANUFACTURING TOLERANCE  
UP TO 50mm -  $\pm 5\%$   
51 TO 100mm -  $\pm 4\%$   
101 TO 300mm -  $\pm 3\%$   
ABOVE 300mm -  $\pm 2\%$
- 3) ALL M.S. PARTS SHALL CONFORM TO IS:2062
- 4) ALL M.S. FABRICATED BEAMS SHALL BE HOT DIP GALVANISED AS PER IS:2629 & 4759
- 5) ALL THE ITEMS SHALL BE MARKED WITH ERECTION CODE.
- 6) WEIGHT MENTIONED IS FOR PACKING & FORWARDING PURPOSE.
- 7) NO. OF CROSS LACINGS TO SUIT THE REQUIREMENTS. CROSS LACINGS BE PROVIDED FOR THE WIDTH OF THE ROAD PLUS ONE EACH NEAR THE SUPPORT.
- 8) FOR CROSS LACINGS, AAC/ACSR CONDUCTOR FROM SCRAP LENGTHS OR 3.15mm Ø WIRE CAN BE USED.
- 9) AS PER IE RULES, 88(3), THE GROUND WIRES SHOULD HAVE THE BREAKING STRENGTH NOT LESS THAN 635KG EITHER 4mm Ø WIRE OF MINIMUM STRENGTH 55KG/mm L&D QUALITY OR 5mm Ø WIRE OF MINIMUM STRENGTH 33KG/mm, SOFT QUALITY BE USED AS PER IS 280-1982.
- 10) MINIMUM CLEARANCE FROM GROUND SHALL BE 6.1 METRES AS PER IE RULES.
- 11) ALL CHANNELS AND ANGLES SHALL CONFORM TO IS: SP6 PART-1, ALL CHANNELS SHALL BE ISLC CHANNELS.

#### FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)

TITLE: 11kV LINE PROTECTIVE GUARDING ACROSS THE MINOR CROSSING LIKE VILLAGE ROAD ETC.

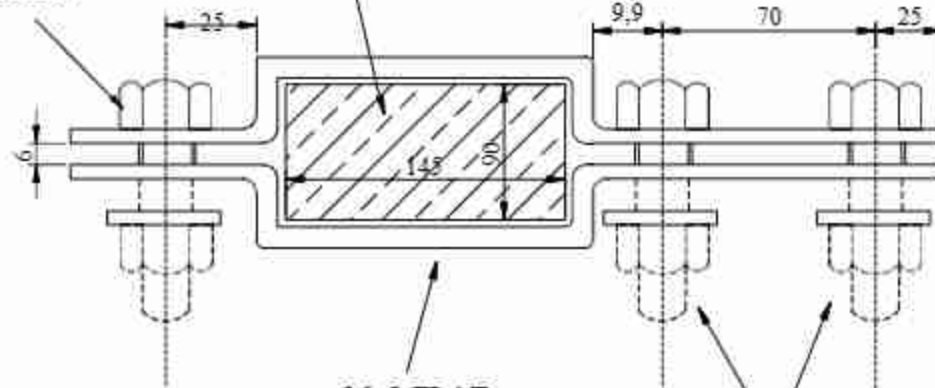
SIZE SCALE: DRG. NO. SHT. NO. REV. NO.  
AS NTS REC/RDSS /11KV/25 1 OF 1 0

REV. NO.	PREPARED BY	CHECKED BY	APPROVED BY	DATE	PROJECT
01					



M 16 OR 5/8" BSW  
M.S BOLTS WITH  
NUTS,FLAT ROUND  
&  
SPRING WASHERS

P.C.C POLE



M. S FLAT  
50X6 mm

M 16 OR 5/8" BSW  
M.S BOLTS WITH  
NUTS,FLAT ROUND  
&  
SPRING WASHERS



FRONT VIEW

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Ravamped Distribution Sector Scheme (RDSS)

TITLE:

33 kv Line Pole Bracket

REV:

SCALE:

DRG. NO.:

REV. NO.:

REV. NO.:

A3

NTS

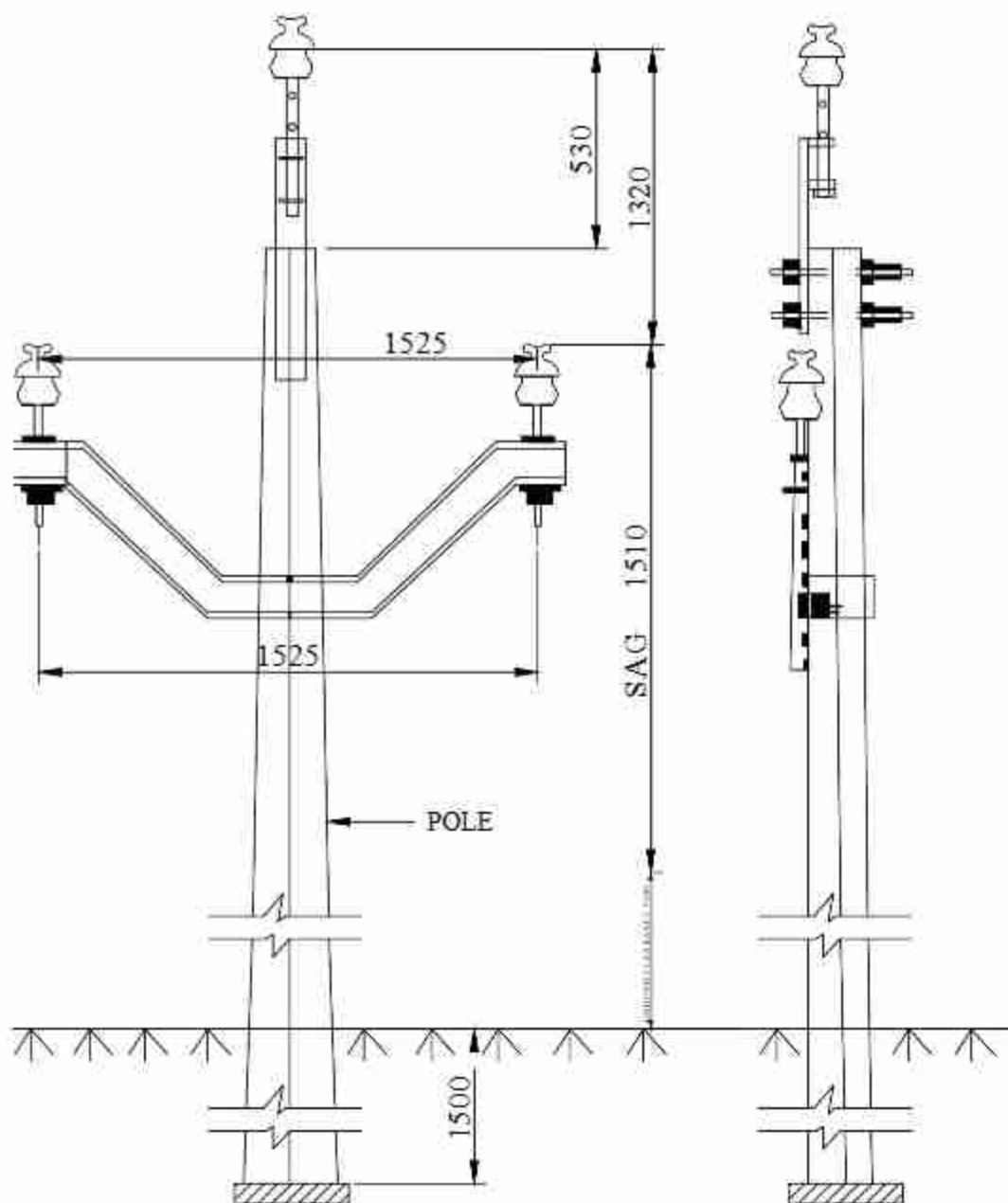
REC/RDSS/33kV/01

1 OF 1

0

NO.	REV.	PREPARED	CHECKED	APPROVED	DATE	PROJECT





FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

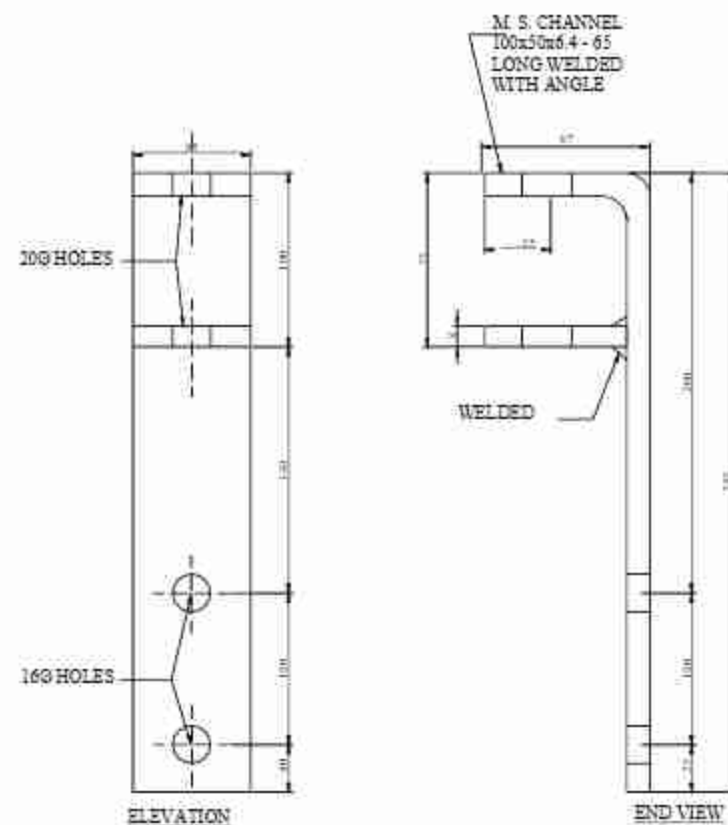
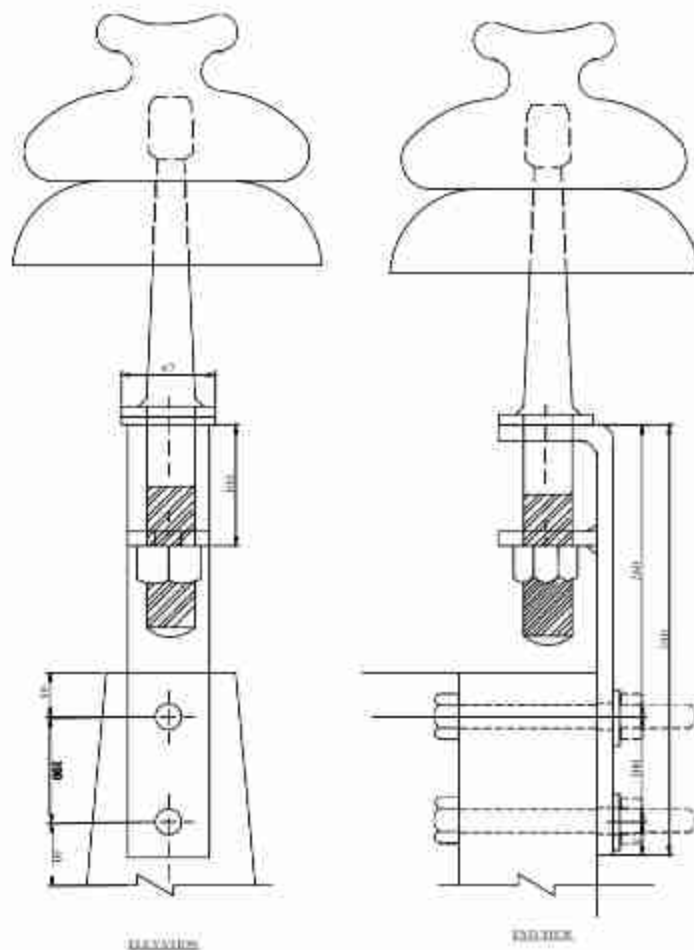
TITLE:

33kV Line Conductor Formation & Clearances

ALL DIMENSION ARE IN mm.

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/ RDSS /33kV/03	1 OF 1	0



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

33KV Line Pole Top Bracket

SIZE

SCALE

DRG. NO.

SHT. NO.

REV. NO.

A3

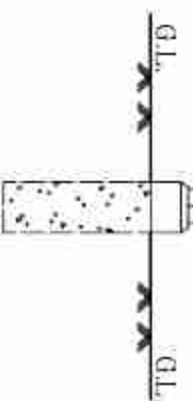
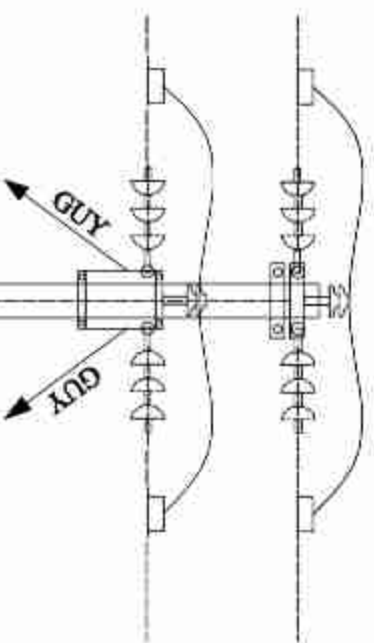
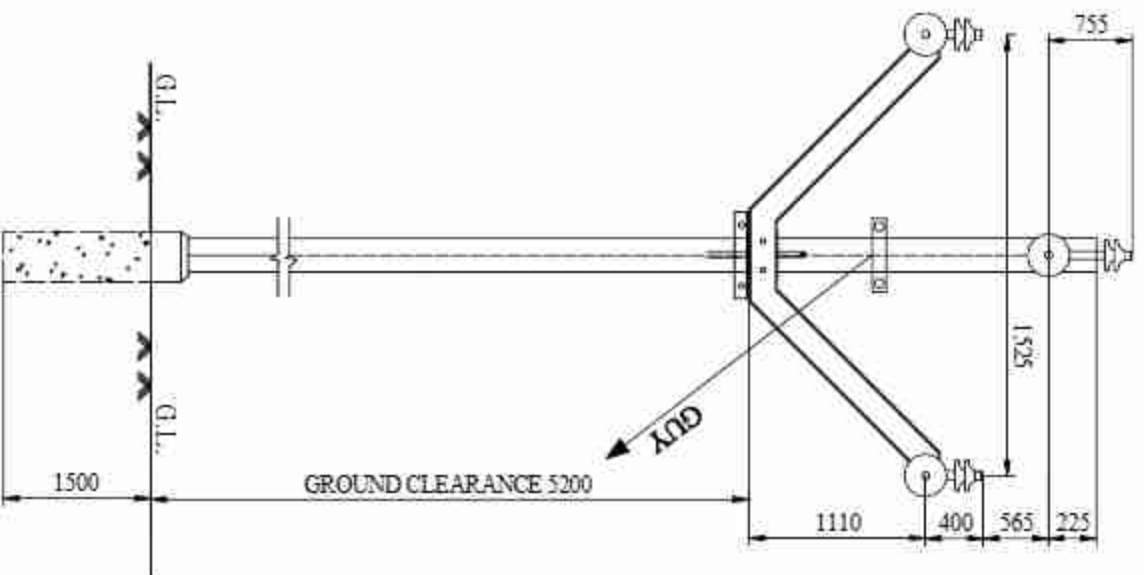
NTS

REC/RDSS /33kV/04

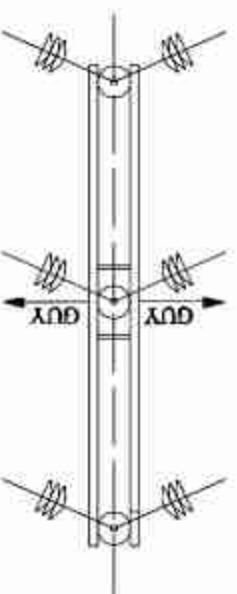
1 OF 1

0

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



SIDE VIEW



FOR TENDER PURPOSE ONLY



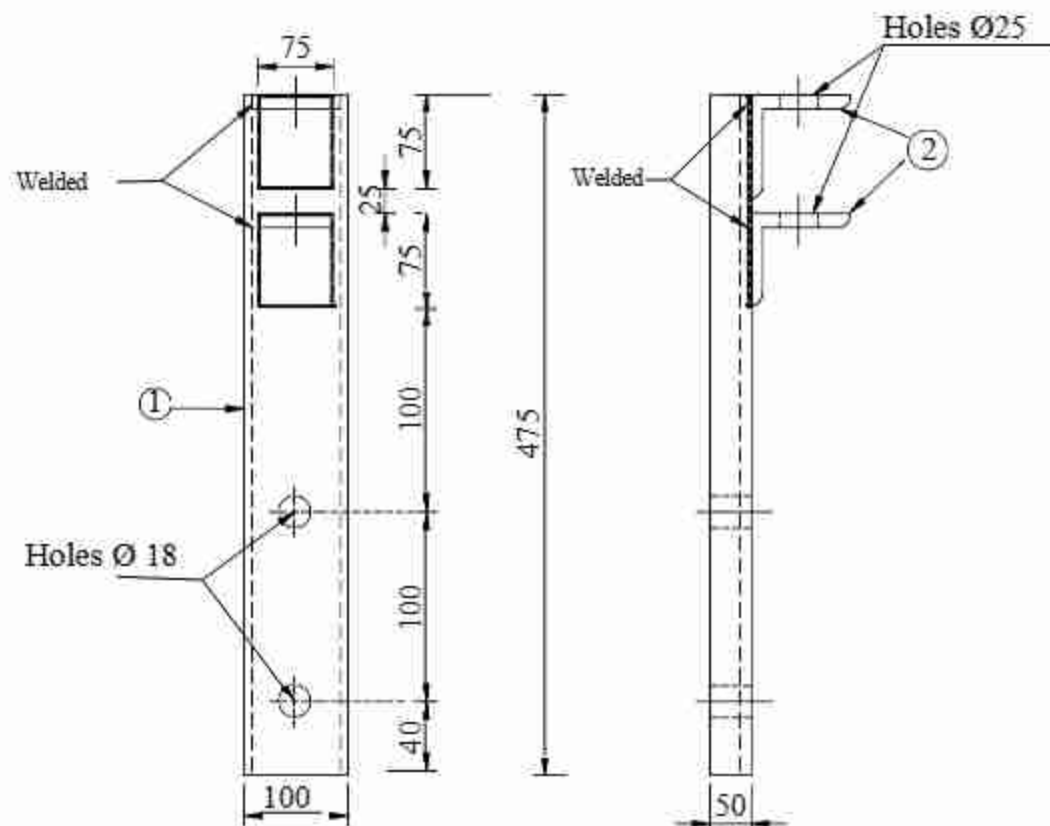
Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)

TITLE: 33kV Lines Arrangement of Conductors at Single Pole Support (0° to 10° Deviation)

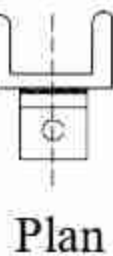
NO	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SHEET NO.	SCALE	DWG. NO.	REV. NO.
A3	NTS	REC/ RDSS /33kV/05	1 OF 1



ELEVATION

SIDE VIEW



Plan

### BILL OF MATERIAL

Part No.	DESCRIPTION	QTY.
1	Channel 100x50x6=415 Long	1 NOS.
2	Angle 75x75x6= 75 Long	2 NOS.

All Dimensions in mm

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

33 kV LINE POLE TOP BRACKET

SHEET NO.

SCALE

AS NOTED

PROJ. NO.

REC/RDSS/33kV/06

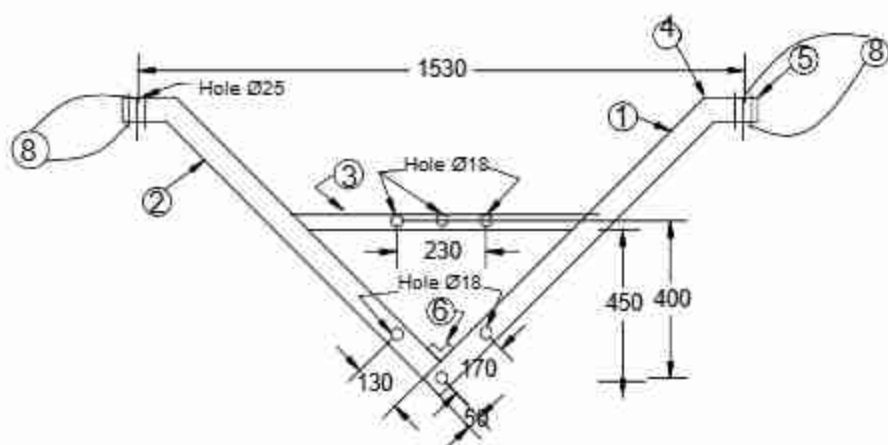
SHT. NO.

1 OF 1

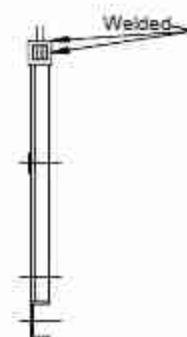
REV. NO.

0





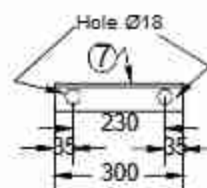
ELEVATION



END VIEW



PLAN



BACK CLEAT (2 Nos.)

33KV 'V' Cross-Arm

**BILL OF MATERIAL**

PART NO.	DESCRIPTION	QTY.
1	M. S. CHANNEL 100x50x6 = 1040 LONG	1 No.
2	M. S. CHANNEL 100x50x6 = 940 LONG	1 No.
3	M. S. ANGLE 85x85x6 = 710 LONG	1 No.
4	M. S. ANGLE 85x85x6 = 150 LONG	2 Nos.
5	M. S. ANGLE 85x85x6 = 75 LONG	2 Nos.
6	M. S. ANGLE 50x50x6 = 50 LONG	1 No.
7	M. S. CHANNEL 75x40x6 = 300 LONG	2 Nos.
8	M. S. PLATE 50x50x6	2 Nos. (Welded)

NOTE:- (1) a & b shown area for P.C.C. Poles

All Dimensions are in mm.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT-

Revamped Distribution Sector Scheme (RDSS)

TITLE

33KV 'V' CROSS-ARM

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE  
A3

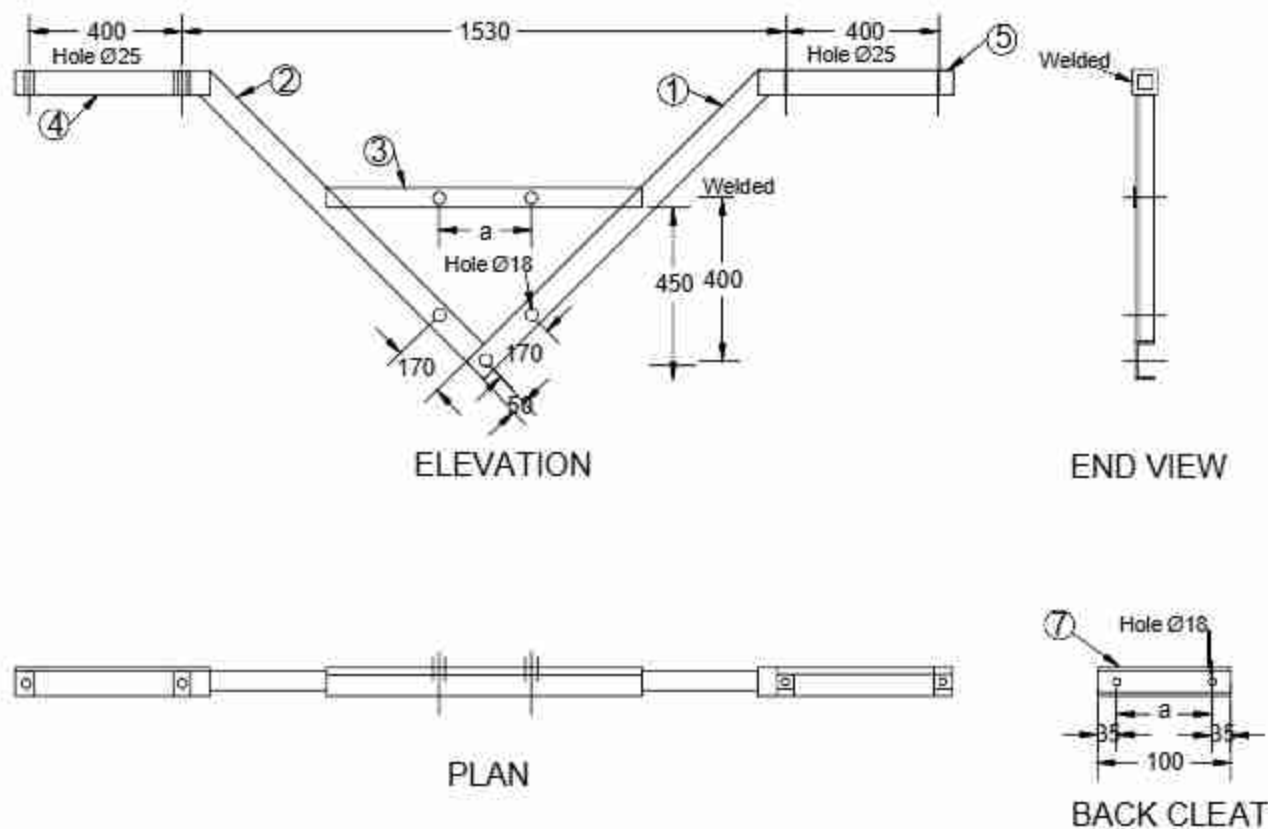
SCALE  
NTS

DWG. NO.

REC/ RDSS /33kV/07

SHT. NO.  
1 OF 1

REV. NO.  
0



**33KV Bridling 'V' Cross Arm (Road Crossing)**

BILL OF MATERIAL			
PART NO.	DESCRIPTION	QTY.	STORE CODE NO.
1	M. S. CHANNEL 100x50x8 = 1040 LONG	1 No.	F-002308
2	M. S. CHANNEL 100x50x8 = 940 LONG	1 No.	F-002308
3	M. S. ANGLE 65x65x6 = 710 LONG	1 No.	F-000324
4	M. S. ANGLE 65x65x6 = 510 LONG	2 Nos.	F-000324
5	M. S. ANGLE 65x65x6 = 75 LONG	4 Nos.	F-000324
6	M. S. ANGLE 50x50x6 = 50 LONG	1 No.	F-000263
7	M. S. CHANNEL 50x50x6 = 300 LONG	2 Nos.	F-002308

**FOR TENDER PURPOSE ONLY**

Note: For P. C. C. Plot     $a = 230\text{mm}$   
     $b = 230\text{mm}$

All Dimensions are in mm.

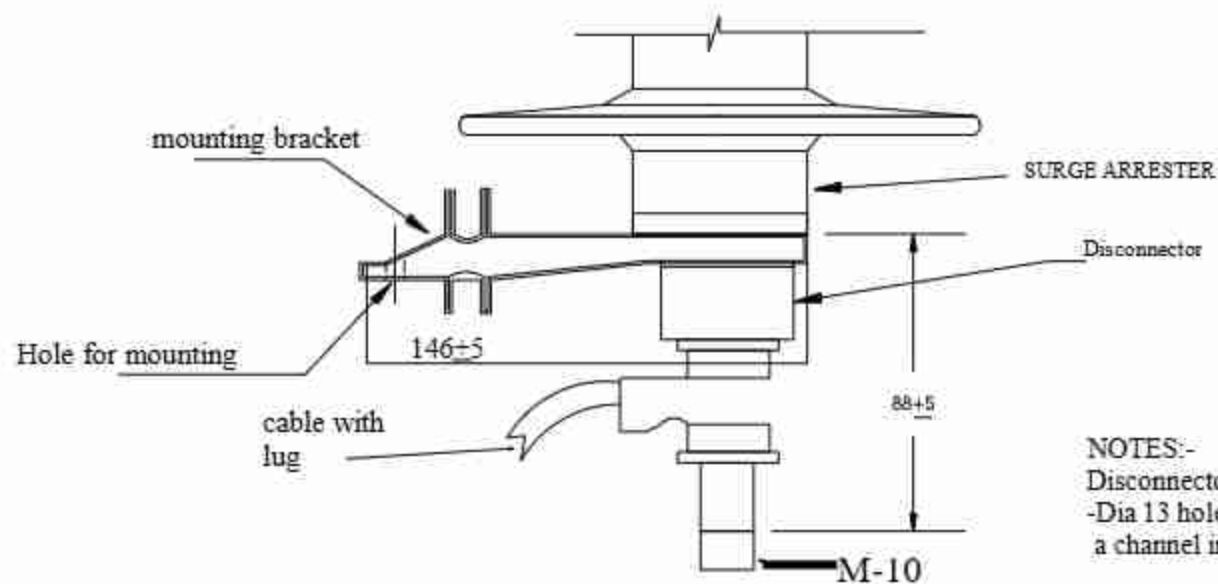
<div style="display: flex; justify-content: space-between;"> <div> <b>RD</b>            REV. NO.    PREPARED    CHECKED    APPROVED    DATE         </div> <div> <b>PROJECT</b> </div> </div>					<b>SIZE</b> A3	<b>SCALE</b> NTS	<b>DWG. NO.</b> REC/ RDSS /33kV/08	<b>SHT. NO.</b> 1 OF 1	<b>REV. NO.</b> 0
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Rural Electrification Corporation Ltd.

**PROJECT**  
 Revamped Distribution Sector Scheme (RDSS)

**TITLE**  
 33kV Bridling V-Cross Arm (Road Crossing)




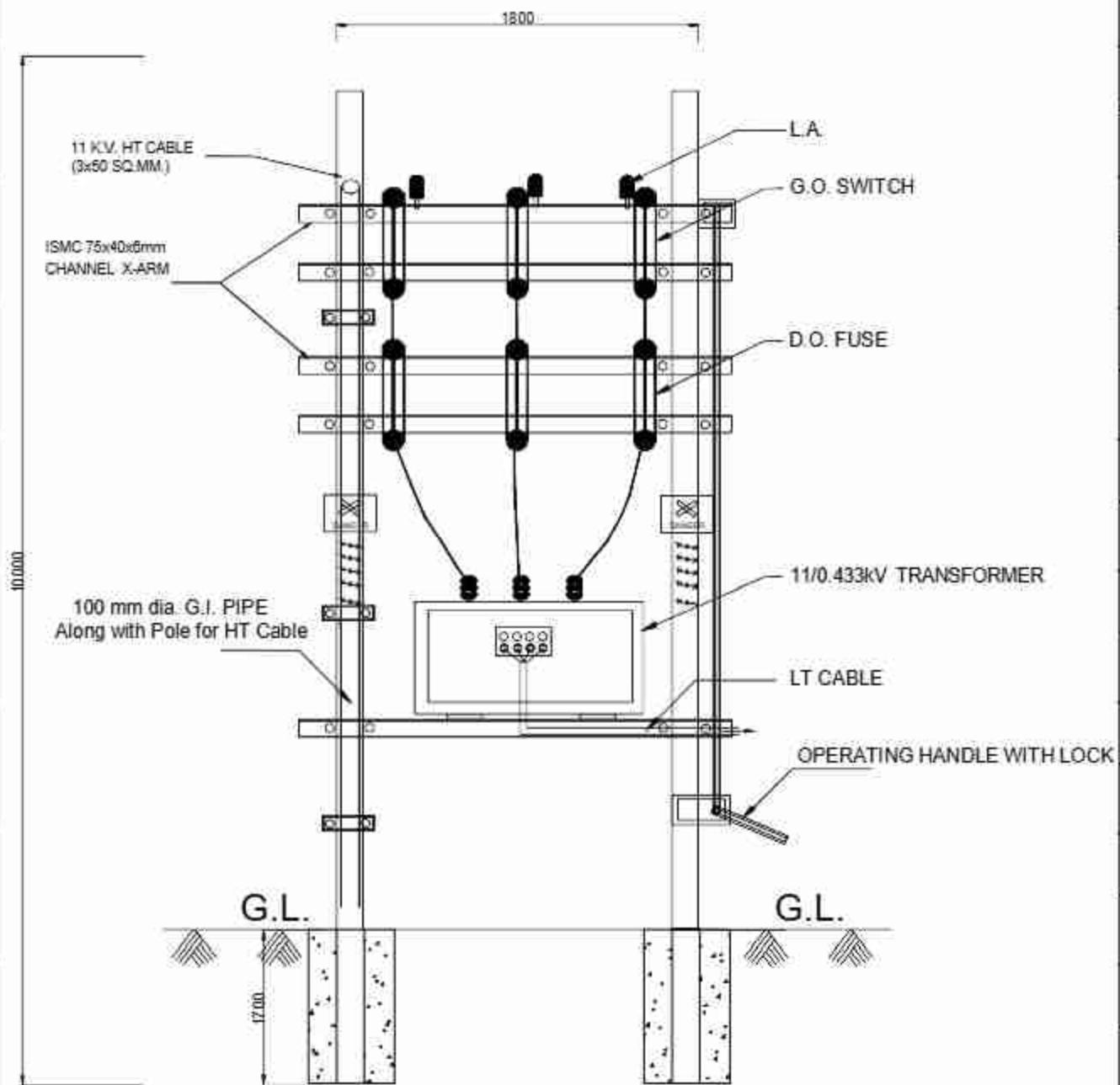
NOTES:-  
 Disconnecter integrated into bracket  
 -Dia 13 hole in bracket for mounting onto  
 a channel in the field mm

MV SURGE ARRESTER  
 TYPE:NDA  
 Mounting Bracket and Disconnecter

FOR TENDER PURPOSE ONLY

All dimensions are in mm.

		Rural Electrification Corporation Ltd.	
PROJECT: Revamped Distribution Sector Scheme (RDSS)			
TITLE: Drawing of Bracket for 11 kV LA			
SIZE/SCALE:	DRG. NO.:	SHT. NO.:	REV. NO.:
A3/NTB	REC/RDSS/DTR-SS/01	1 OF 1	0



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

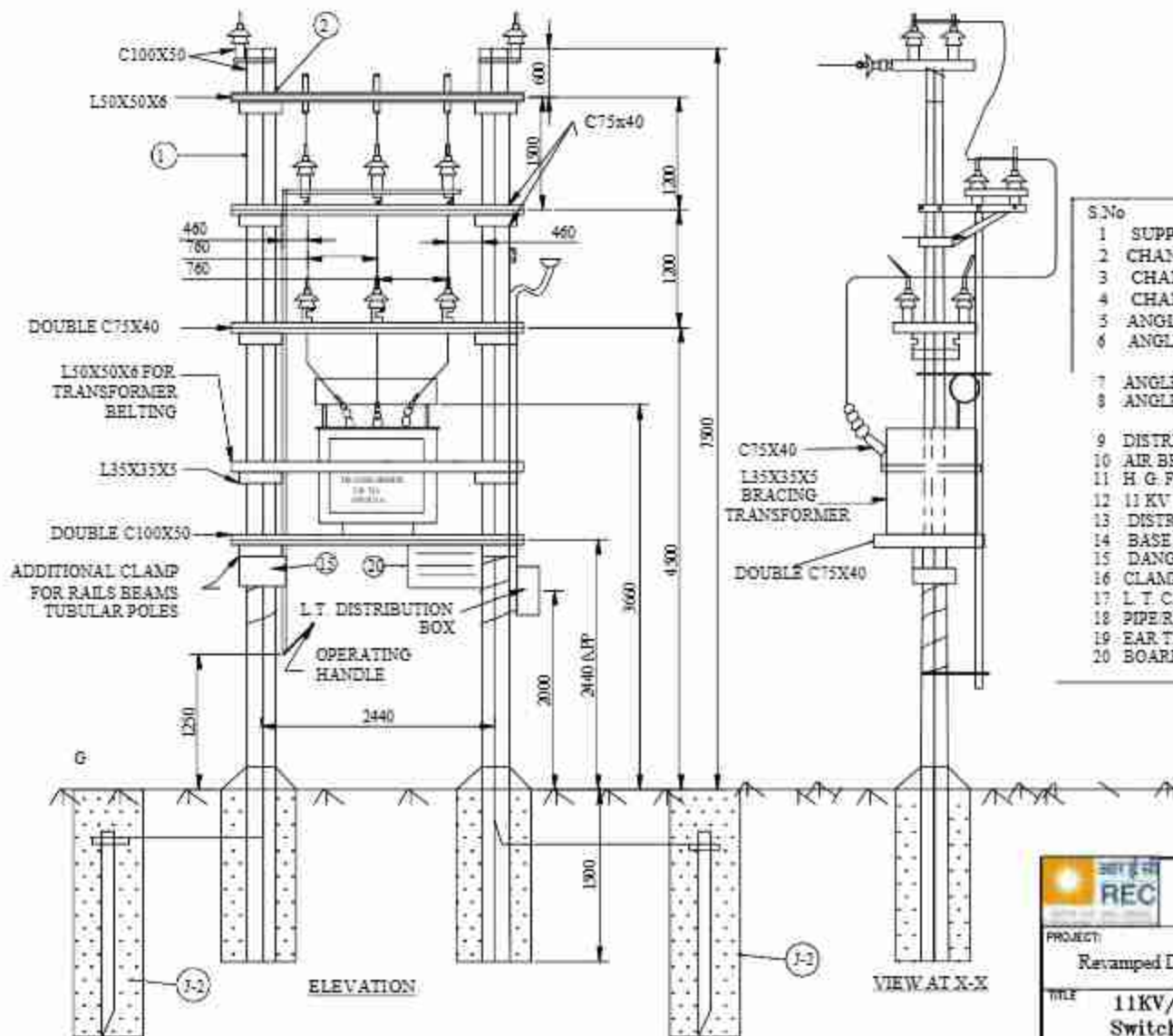
Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

TITLE

11KV/433-250V Distribution Sub-Station with  
Drop out Fuses

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/DDUGJY/DTR-SS/02	1 OF 1	0



# BILL OF MATERIAL

S.No		
1	SUPPORT - 9m	2
2	CHANNEL 100X50 - 2800 (APP.)	2
3	CHANNEL 75X40 - 1500 (APP.)	2
4	CHANNEL 75X40 - 2800 (APP.)	4
5	ANGLE 50X50X6 - 2800 (APP.)	3
6	ANGLE 35X35X5 - BREACHING FOR SUPPORTING A - B SWITCH - 1000 (APP.)	2
7	ANGLE 35X35X5 - FOR TRANSFORMER BELTING A - B SWITCH - 1000 (APP.)	2
8	ANGLE 75X40 - X- ARM FOR SUPPORTING A - B SWITCH - 1000 (APP.)	4
9	DISTRIBUTION TRANSFORMER	1
10	AIR BREAK SWITCH (HORIZONTAL TYPE)	1 SET
11	H. G. FUSE UNIT - 3 PHASE	1 SET
12	11 KV LIGHTING ARREST'S	3
13	DISTRIBUTION BOX	1
14	BASE PLATE (REFER K-1)	2
15	DANGER BOARD	1
16	CLAMPS, NUTS, BOLTS, BARBED WIRE ETC	AS REQD
17	L. T. CABLE	AS REQD
18	PIPE ROD EAR THING (REFER J-2)	AS REQD
19	EAR THING SET	AS REQD
20	BOARD	1

11 KV/433-250 V  
DISTRIBUTION SUB-STATION (16/25 KVA)  
(FOR ON LINE LINE LOCATIONS - ACROSS LINE)

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

11KV/433-250V Distribution Sub-Station with AB Switch & Horn Gap Fuses

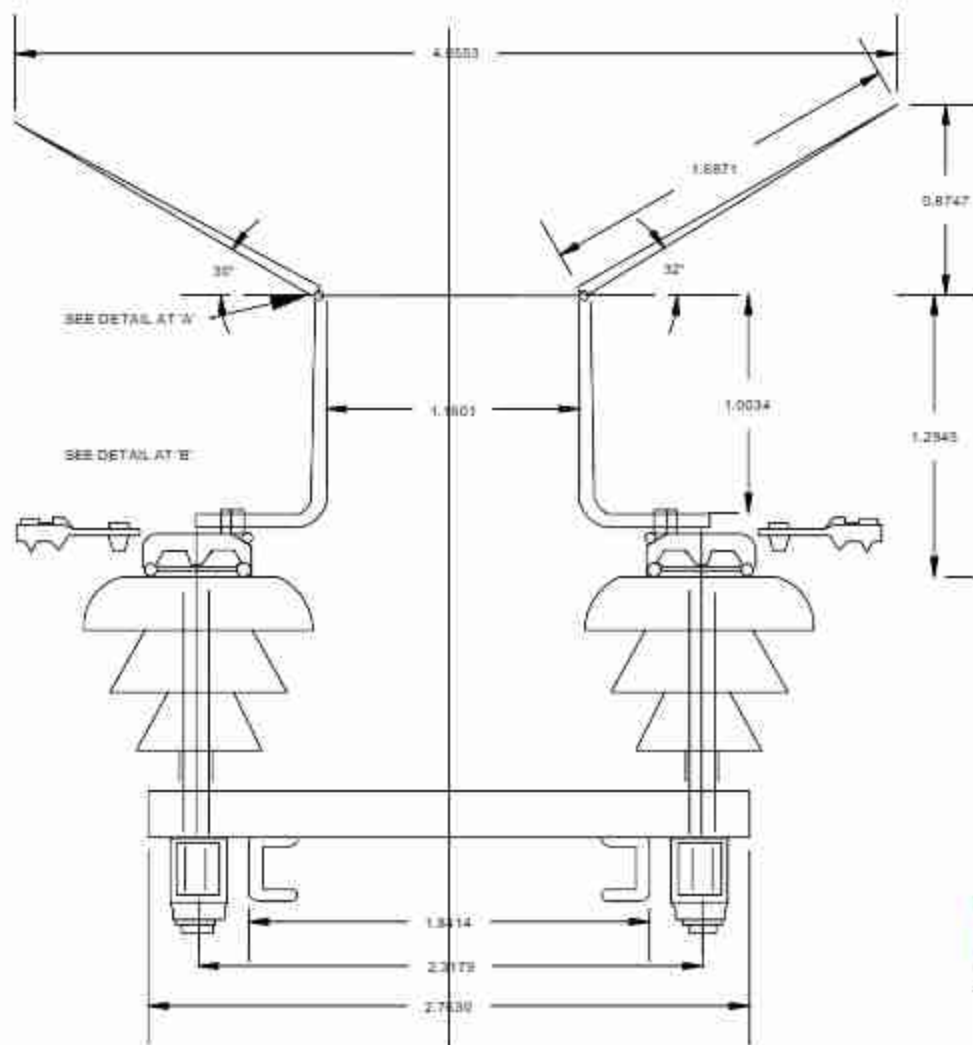
SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/RDSS /DTR-SS/03	1 OF 1	0

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT









FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

11KV Horn Gap Fuses

SIZE

SCALE

DRG. NO.

SHT. NO.

REV. NO.

A3

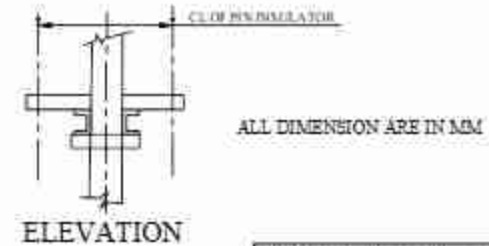
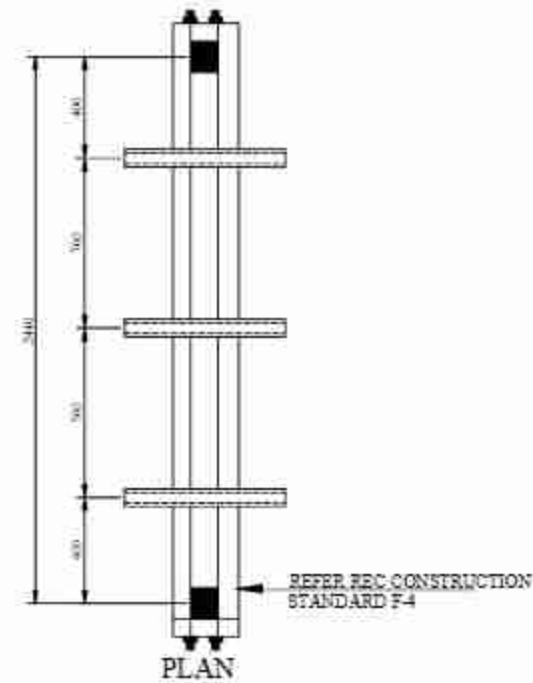
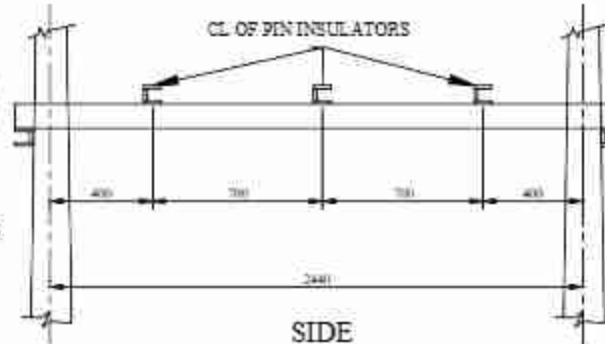
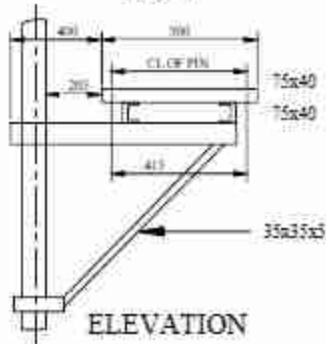
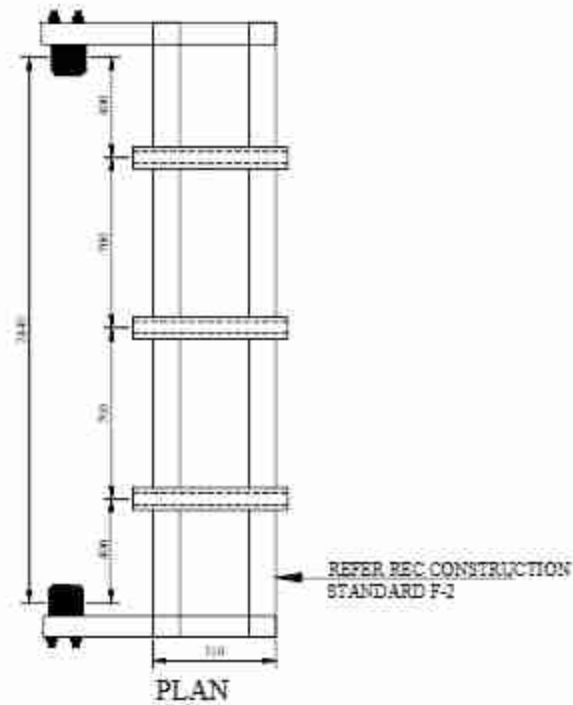
NTS

REC/ RDSS /DTR-SS/05

1 OF 1

0

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



ALL DIMENSION ARE IN MM

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

11KV Horn Gap Fuses Mounting Details

SIZE:

A3

SCALE:

NTS

DRG. NO.:

REC/ RDSS /DTR-SS/06

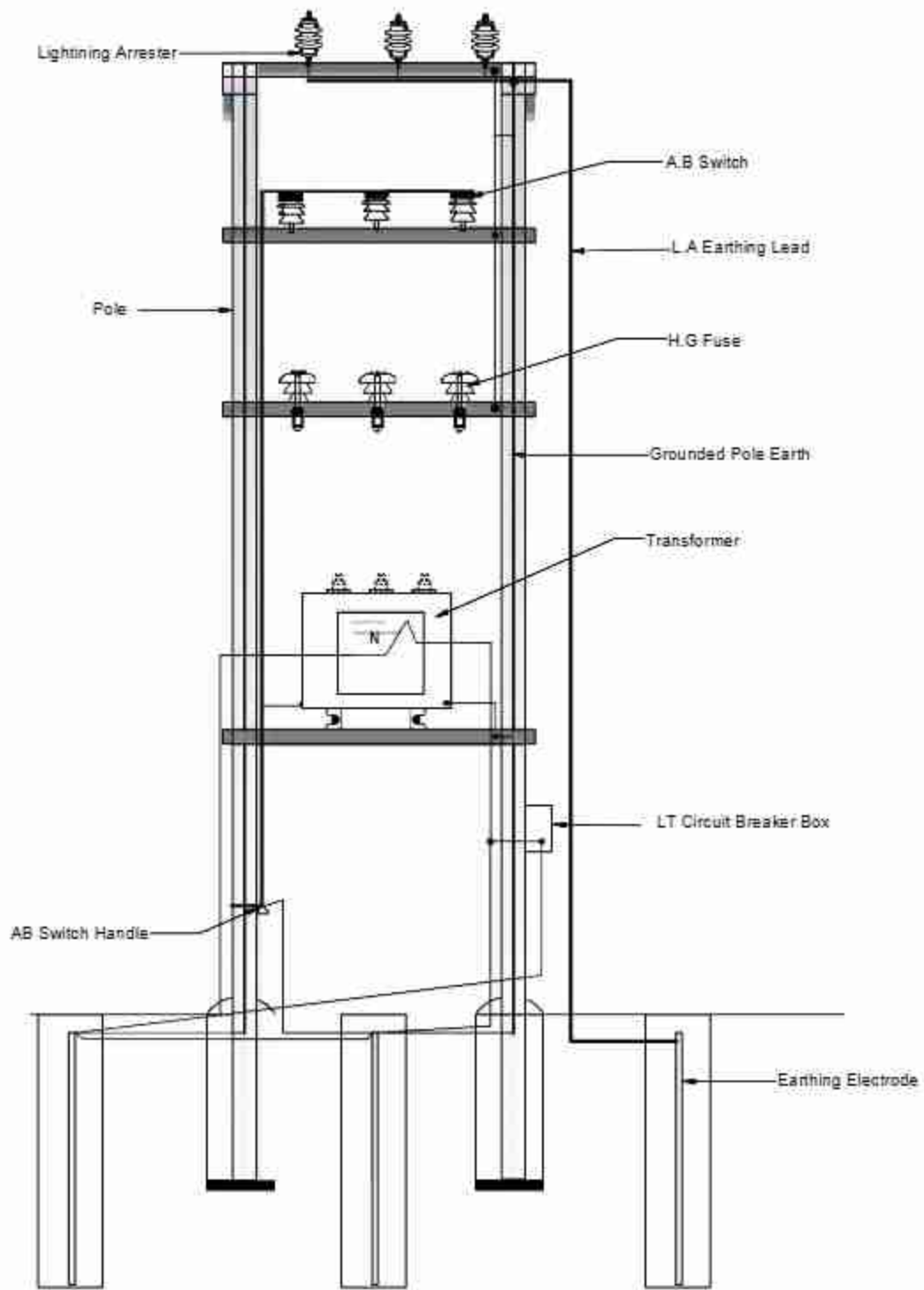
SHT. NO.:

1 OF 1

REV. NO.:

0

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



**FOR TENDER PURPOSE ONLY**



**Rural Electrification Corporation Ltd.**

PROJECT:

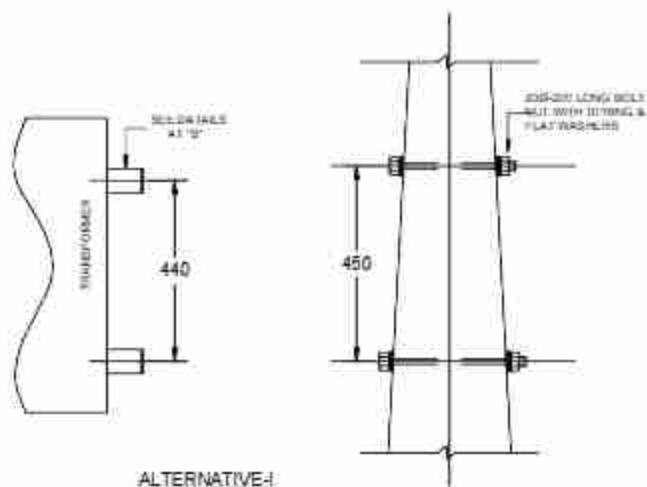
Revamped Distribution Sector Scheme (RDSS)

TITLE:

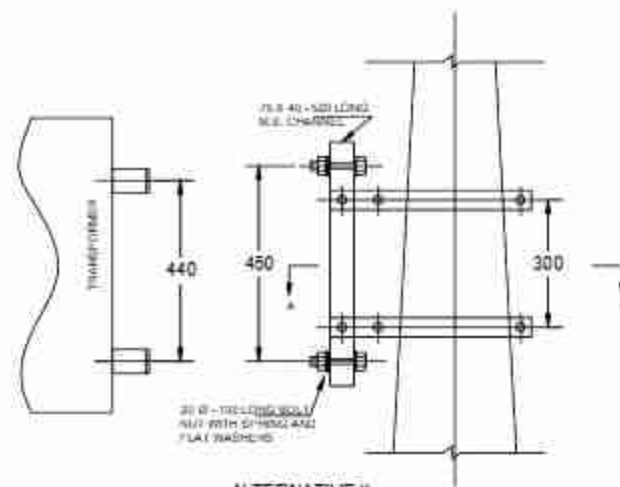
**Earthing Arrangement For Distribution Sub-Station**

NO	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

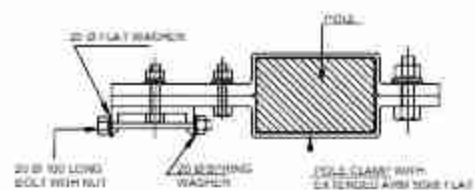
SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/ RDSS /DTR-SS/07	1 OF 1	0



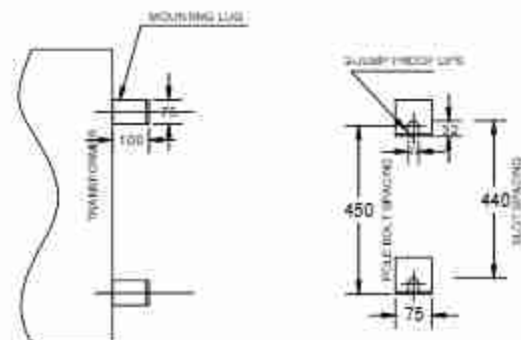
ALTERNATIVE-I



ALTERNATIVE-II



DETAIL AT AA



DETAIL AT B

ALL DIMENSIONS ARE IN MM

NOTE:

1. ALTERNATIVE-I WILL BE USED WHEN SUITABLE HOLES ARE AVAILABLE IN THE FOR THROUGH BOLTS.
2. ALTERNATIVE-II WILL BE USED WITH POLE CLAMPS.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

Single Phase Transformer Mounting Details

REV:

A3

SCALE:

NTS

DRG. NO.:

REC/RDSS/DTR-SS/08

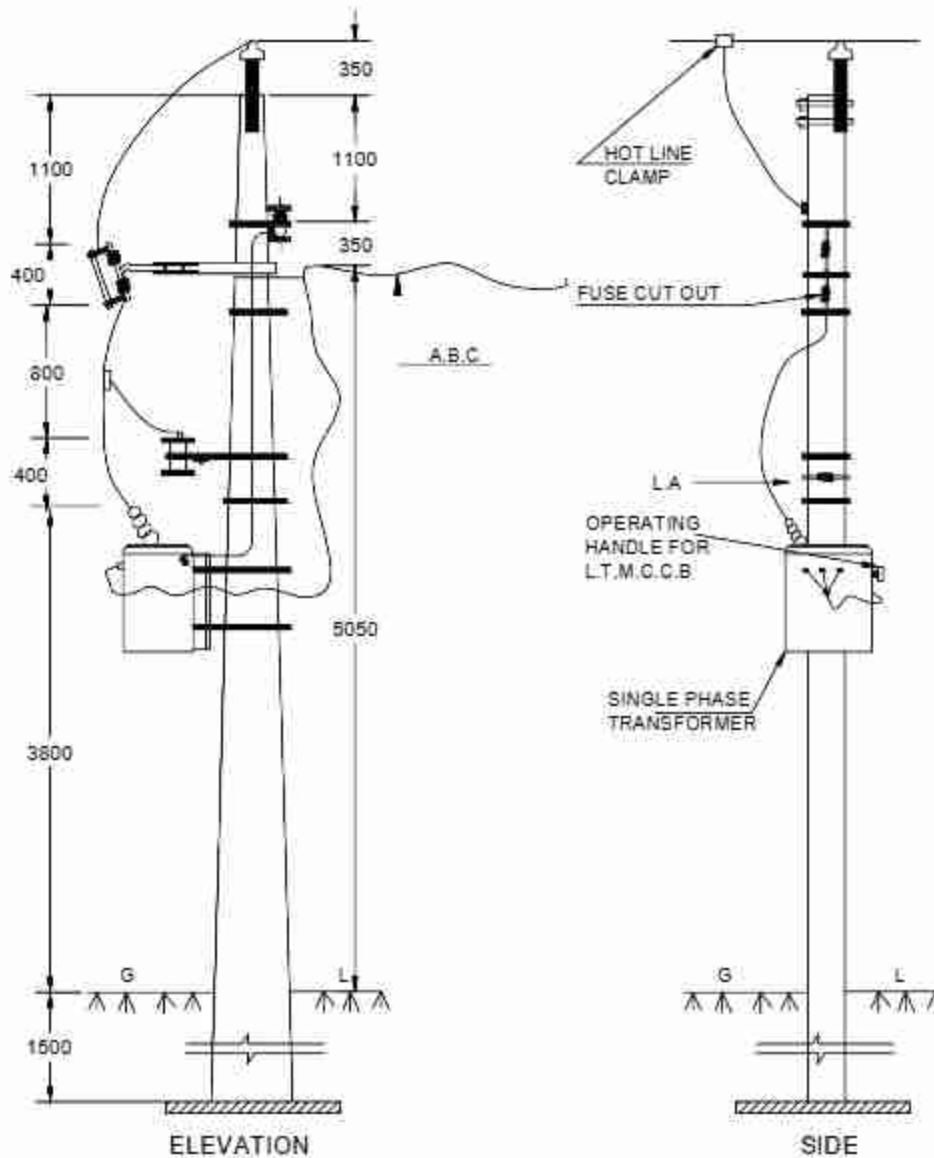
DATE:

1/10/11

REV. NO.:

0

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01					



#### BILL OF MATERIAL

P.L.C. SUPPORTS & B	1 Nos.
POLE WITH BRACKET	1 Nos.
11 KV INS. INSULATOR WITH PIN	1 Nos.
800MM INSULATOR	1 Nos.
CLAMP WITH BOLT	1 Nos.
L.A. WITH TEXTURE	1 Nos.
FUSE CUT OUT WITH TEXTURE	1 Nos.
SINGLE PHASE TRANSFORMER WITH L.T. BUCH AND TEXTURE	1 Nos.
A.B.C.	AS REQUIRED
PULL CLAMP	1 Nos.
EARTHING MATERIALS (SCOTS, BOLT CLAMPS ETC.)	AS REQUIRED
DOWN LINE CLAMP	1 Nos.
BASE PLATE	1 Nos.

NOTE:-  
THE TRANSFORMER MOUNTING DETAILS ARE GIVEN  
IN I.E.C. CONSTRUCTION STANDARD 9-14.  
ALL DIMENSIONS ARE IN MM.

FOR TENDER PURPOSE ONLY



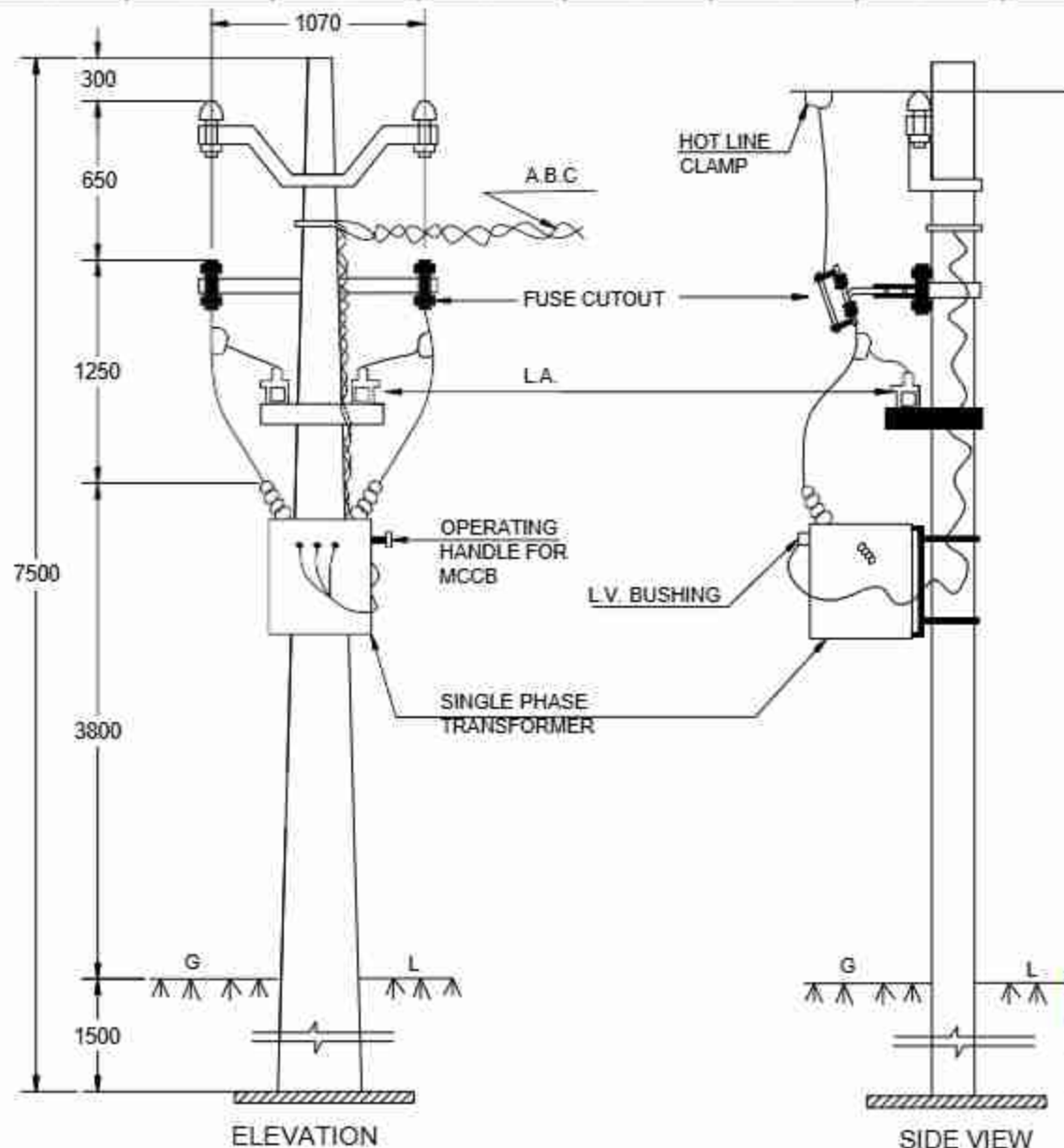
Rural Electrification Corporation Ltd.

PROJECT: Resurgent Distribution Sector Scheme (RDSS)  
Deen Dayal Chaudhary Gram Yojana (DDUGJY)

TITLE: Single Phase (Phase to Neutral)  
Distribution Sub-Station Arrangement

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
001					

REV.	SCALE	DRG. NO.	DATE	REV. NO.
A3	NTS	REC/RDSS/DTR-SS/09	(08/1)	0



# BILL OF MATERIAL

POLE 13M	1 No.
V-CRIB ARM 13M	1 No.
HORIZONTAL CROSS ARM 13M	1 No.
11 KV PIN INSULATOR WITH PIN	2 Nos.
11 KV SILICON FUSE CUTOUT	2 Nos.
11 KV L.A.	2 Nos.
11 KV SINGLE PHASE TRANSFORMER	1 No.
WIRING CHANNEL FOR L.V. FITTING	1 No.
BASE PLATE	1 No.
EARTHING MATERIAL 20 T/50/12.5/1 AMP	AS REQD.
HOT LINE CLAMP	2 Nos.
AND	AS REQD.

## NOTE:-

1. TRANSFORMER MOUNTING DETAILS ARE AS PER REC CONSTRUCTION STANDARD T-14.
2. AS AN ALTERNATIVE ARRANGEMENT TO ARC L.T. LINE SHOWN IN THE DRAWING, CABLE CONNECTION CAN BE USED TO THE FIRST POLE OF CONVENTIONAL L.T. LINE.



Rural Electrification Corporation Ltd.

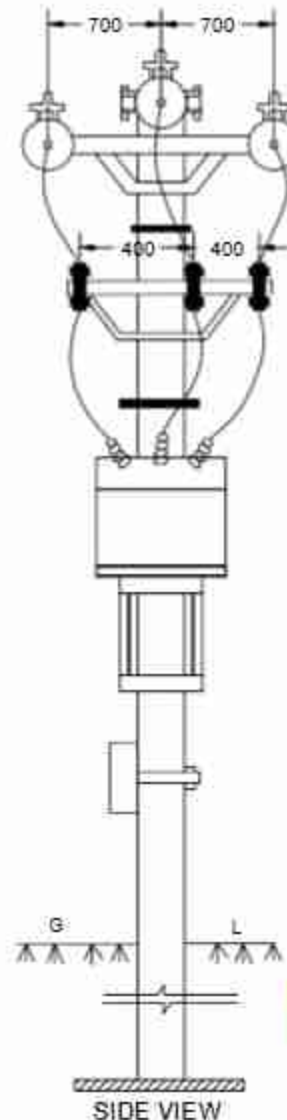
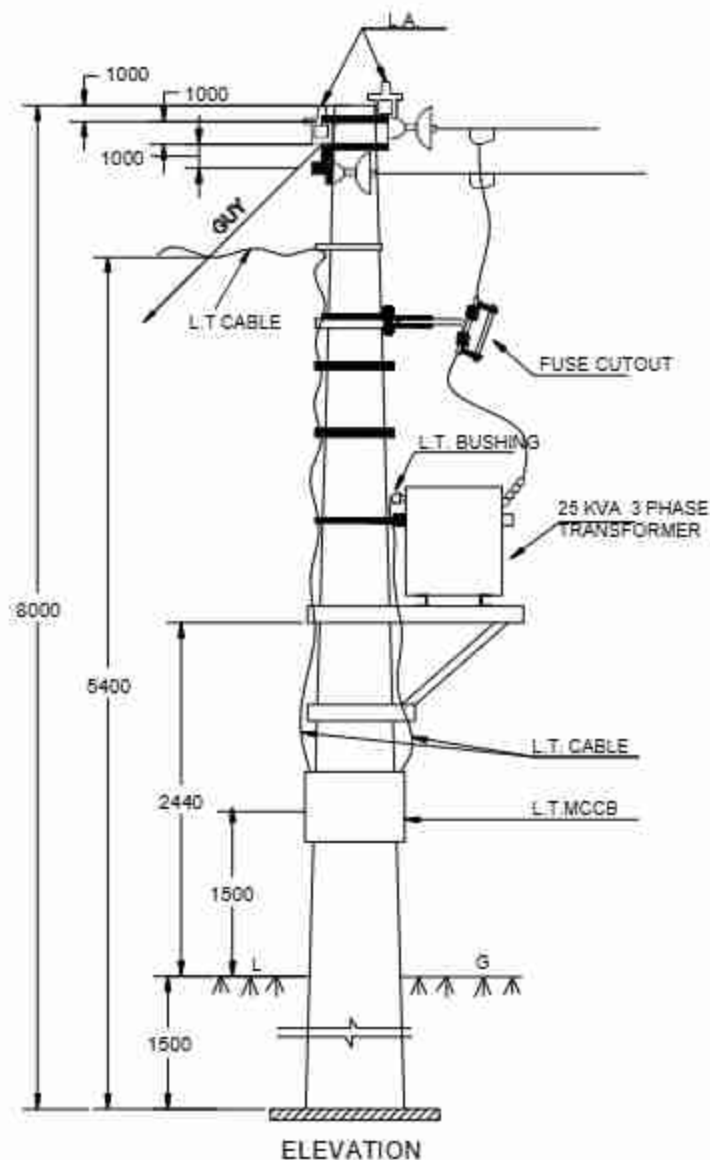
Revamped Distribution Sector Scheme (RDSS)

Single Phase (Phase to Phase)  
Distribution Sub-Station Arrangement

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

BOX	SCALE	DRW. NO.	REV. NO.	REV. NO.
A3	NTS	REC/RDSS/DTR-SS/10	1 OF 1	0





#### BILL OF MATERIALS

SUPPORTS(3 M/200 KG)
HORIZONTAL CROSS ARM
[100X50X6-150
[100X50X6-150
L.A WITH FITTINGS
D.O FUSE WITH FITTINGS
25 KVA TRANSFORMER
L.T.M.C.C.B
DISC INSULATOR WITH FITTINGS
STRUCTURE FOR TRANSMOUNTING-
[100X50X6-1000
[50X50X6-600
EARTHING MATERIAL
GUY SET
BASE PLATE
NUTS, BOLTS,POLE TOP CLAMPS
STRUCTURE FOR D.O FUSE MOUNTING:-
[100X50X6-600
[50X50X6-400

ALL DIMENSIONS ARE IN MM

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

Distribution Sub-Station Mounting  
Arrangement on Single Pole

NO.	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRAWING NO.	SHEET NO.	TOTAL SHEETS
A3	NTS	REC/RDSS/DTR-SS/11	1 OF 1	0

TO LT POLE

DTR METER  
BOX

Protection Unit

FOR TENDER PURPOSE ONLY

All dimensions are in mm.

NO.	REVISION	DATE	BY	CHKD.	DATE



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

DRAWING FOR FIXING ARRANGEMENT OF METER

SIZE/SCALE

A3/NTS

DRG. NO.

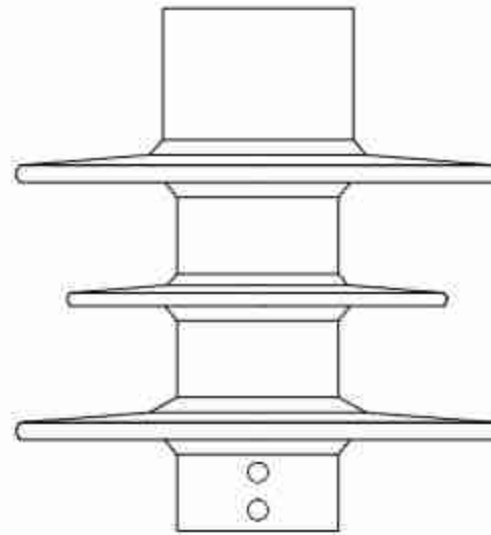
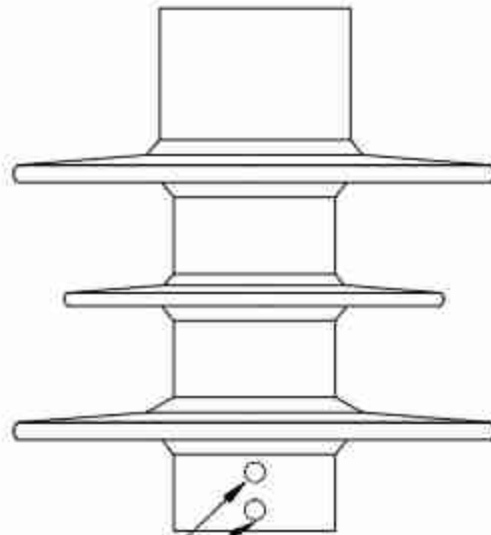
REC/RDSS/DTR-SS/12

SHT. NO.

1 OF 1

REV. NO.

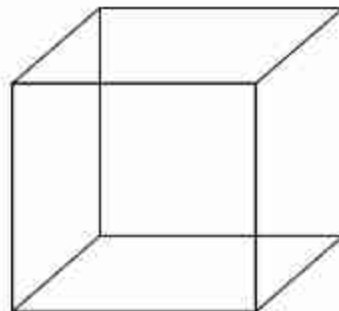
0



LOT No DATE  
CLOCKS

**NOTES:-**

All markings are obtained during moulding itself  
-Markings-Raychem, Type, Ur (Rating), Us (cov),  
In (Non discharge current), Isc(short circuit capability)  
Mfg month & year

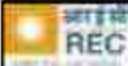


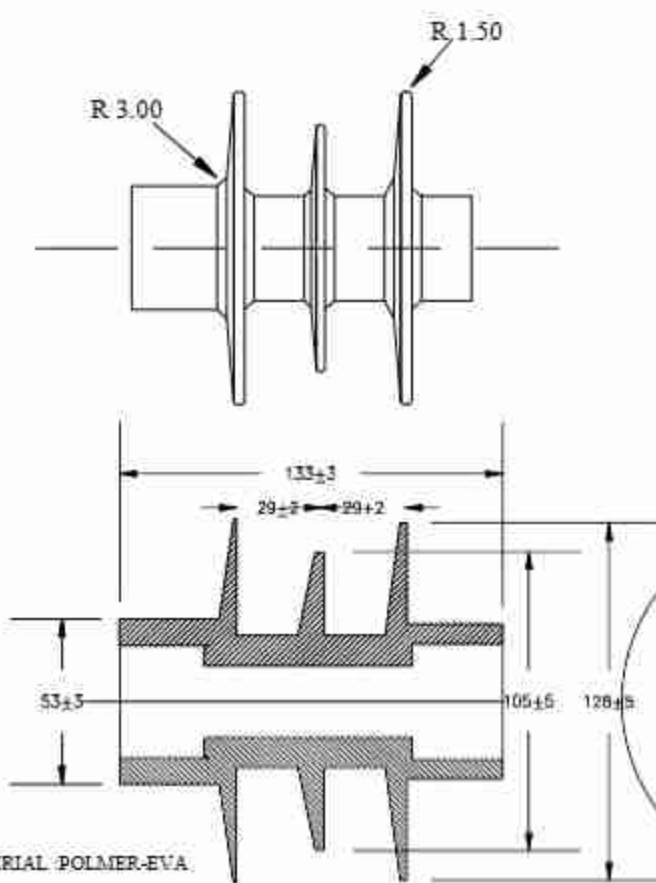
Meter Board

All dimensions are in mm.

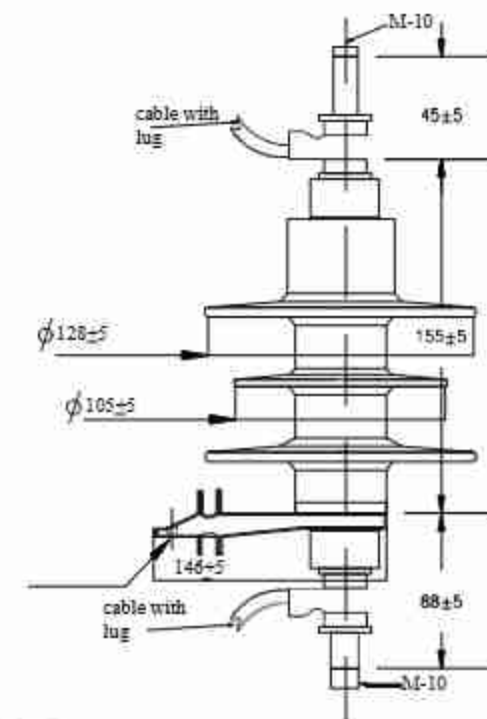
FOR TENDER PURPOSE ONLY

100	100	100	100	100	100
100	100	100	100	100	100

		Rural Electrification Corporation Ltd.	
PROJECT: Revamped Distribution Sector Scheme (RDSS)			
TITLE: Lay Out Drawing of Lighting Arrester (1)			
SIZE/SCALE	DRG. NO.	SHT. NO.	REV. NO.
AS NTS	REC/RDSS/DTR-SS/13A	1 OF 1	0



MV SURGE ARRESTER  
TYPE NDA  
HOUSING DETAILS




NOTES:-  
Nominal COV  $U_c = 8kV$   
Nominal rating  $U_c = 10kV$   
Nominal discharge current  $-5kA$   
Nominal creepage distance  $= 330mm$   
Nominal dry arcing distance  $= 163mm$

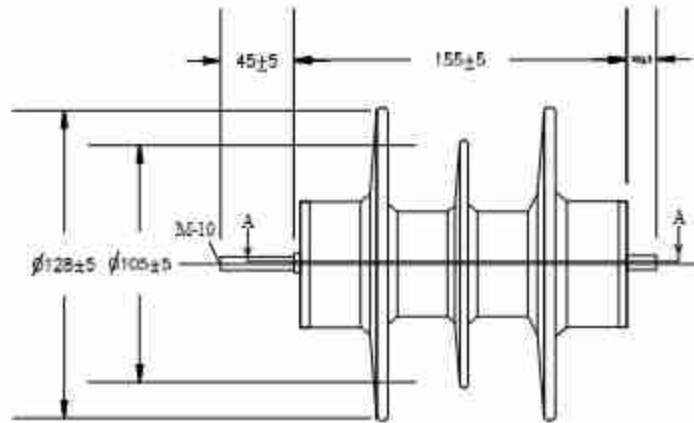
MV SURGE ARRESTER  
TYPE NDA WITH DISCONNECTOR

FOR TENDER PURPOSE ONLY

All dimensions are in mm.

REV.	NO.	DATE	BY	CHKD.	APPD.	REMARKS

		Rural Electrification Corporation Ltd.	
PROJECT		Revamped Distribution Sector Scheme (RDSS)	
TITLE		Lay Out Drawing of Lightning Arrester (2)	
SIZE/SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3 NTS	REC/RDSS/DTR-SS/13B	1 OF 1	0



**NOTES:-**

Nominal COV  $U_c = 8kV$

Nominal rating  $U_c = 10 kV$

Nominal discharge current -5kA

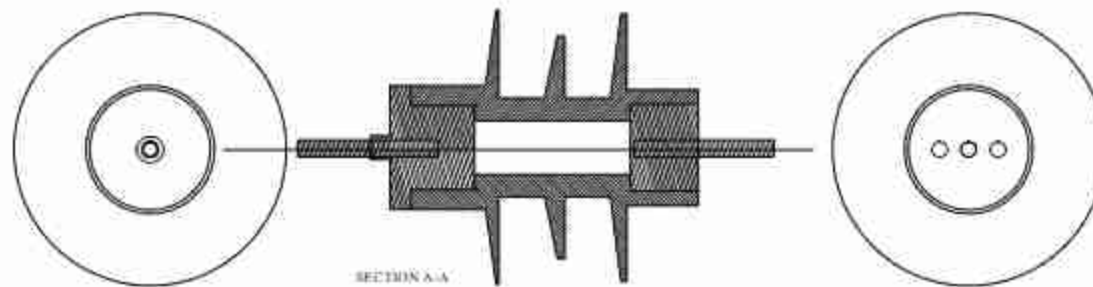
Nominal creepage distance = 330mm

Nominal dry arcing distance=163mm

**MV SURGE ARRESTER**


**TYPE:NDA**

**SECTIONAL VIEW**

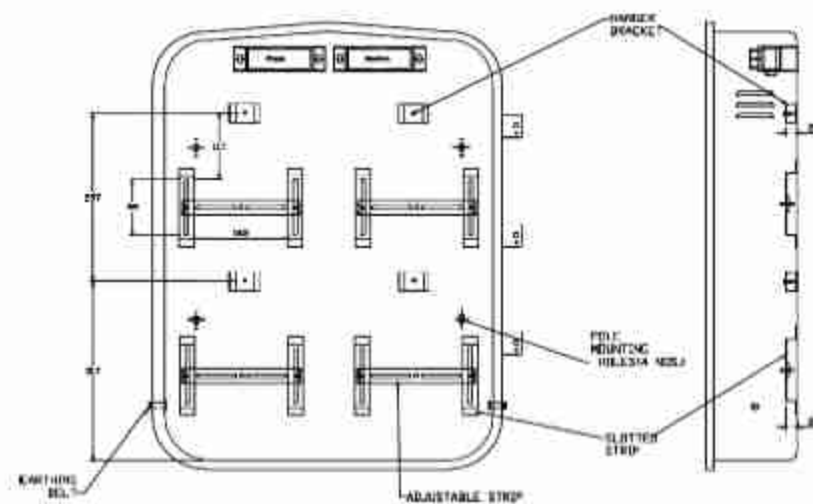
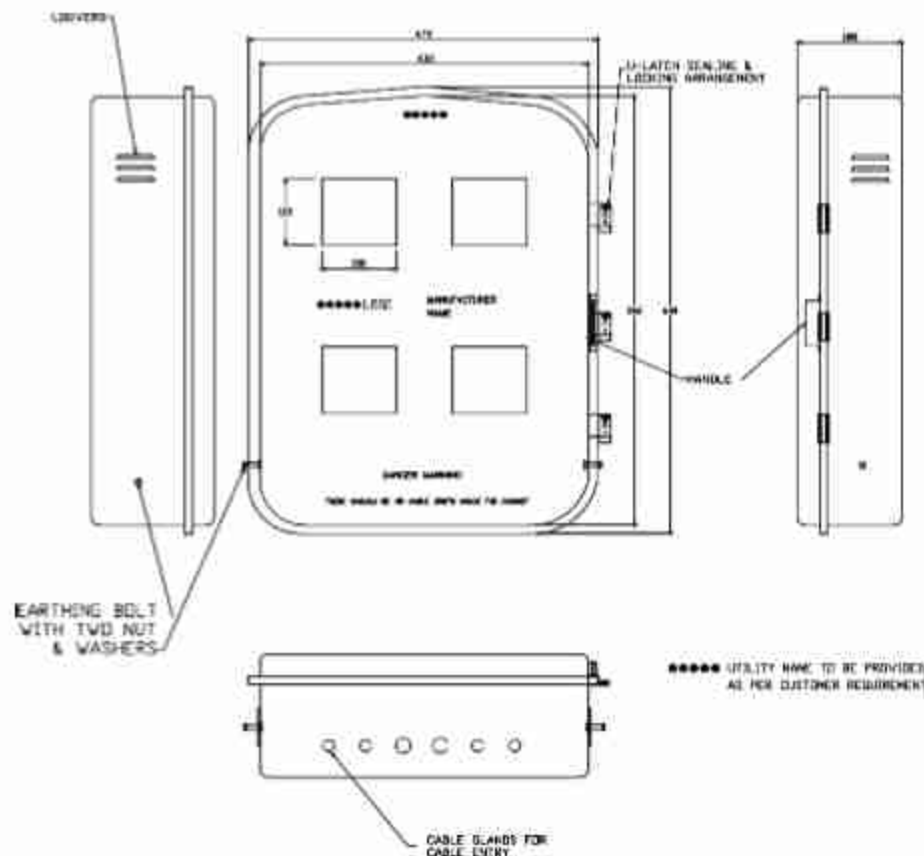


All dimensions are in mm.

**FOR TENDER PURPOSE ONLY**

		<b>Rural Electrification Corporation Ltd.</b>	
<b>PROJECT</b> Revamped Distribution Sector Scheme (RDSS)			
<b>TITLE</b> Lay Out Drawing of Lightning Arrester (3)			
<b>SIZE</b> A3	<b>SCALE</b> NTS	<b>DRG. NO.</b> REC/RDSS/DTR-SS/13C	<b>SHT. NO.</b> 1 OF 1
			<b>REV. NO.</b> 0

REV.	DESCRIPTION	DATE	BY	CHECKED	DATE



FOR TENDER PURPOSE ONLY

All dimensions are in mm.

NO.	DESCRIPTION	QUANTITY	UNIT	REMARKS
1	ENCLOSURE	1	NO.	
2	METER	1	NO.	
3	TERMINAL BLOCK	1	NO.	
4	WIRING	1	NO.	
5	ADJUSTABLE STRIP	1	NO.	
6	SLOTTER STRIP	1	NO.	
7	POLY-REINFORCING HOLES IN MOC	1	NO.	
8	METER BRACKET	1	NO.	



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

4-IN-1 MMB FOR SINGLE PHASE METER WITH MOC  
(MULTIPLE OUTGOING CONNECTOR BOX)

SHEET NO.

PRO. NO.

REC/RDSS/DTR SS/14

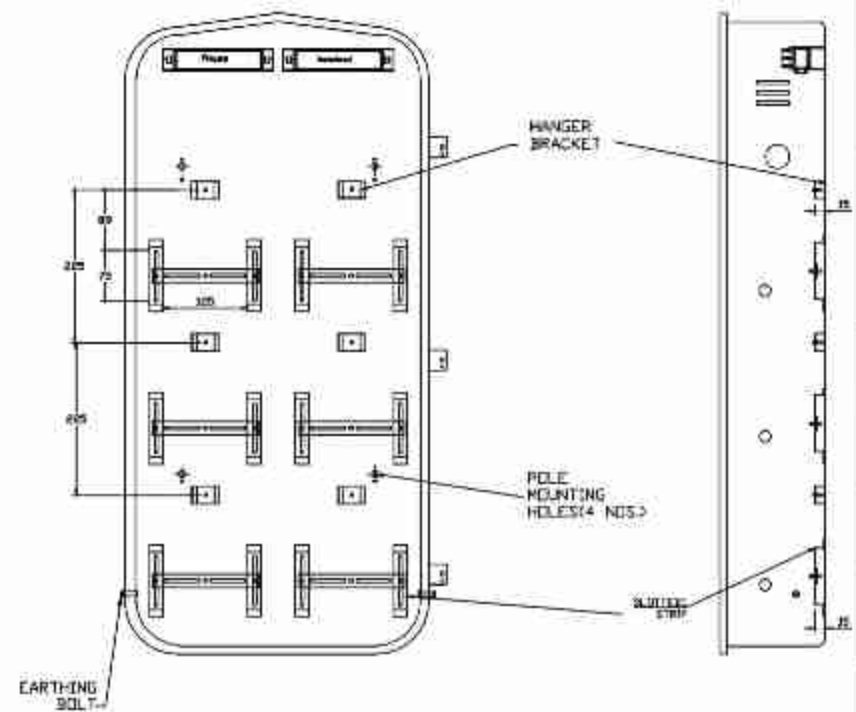
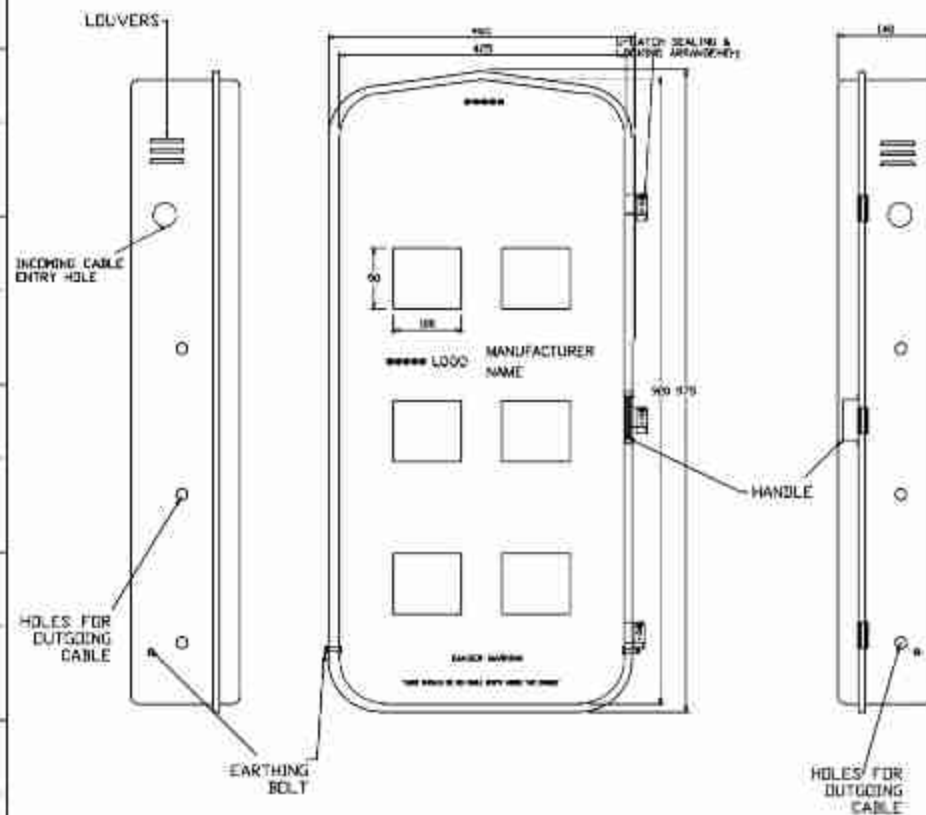
SHT. NO.

1 OF 1

REV. NO.

0





UTILITY NAME TO BE PROVIDED  
AS PER CUSTOMER REQUIREMENT

All dimensions are in mm.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

6-IN-1 MMB FOR SINGLE PHASE METER WITH MOC  
(MULTIPLE OUTGOING CONNECTOR BOX)

SHEET NO.

PRO. NO.

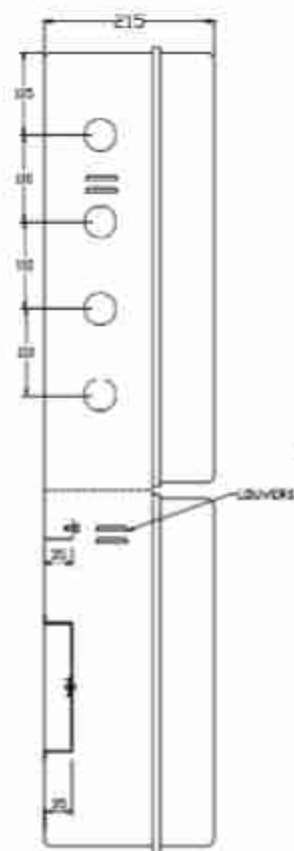
REC/RDSS/DTR SS/15

SHT. NO.

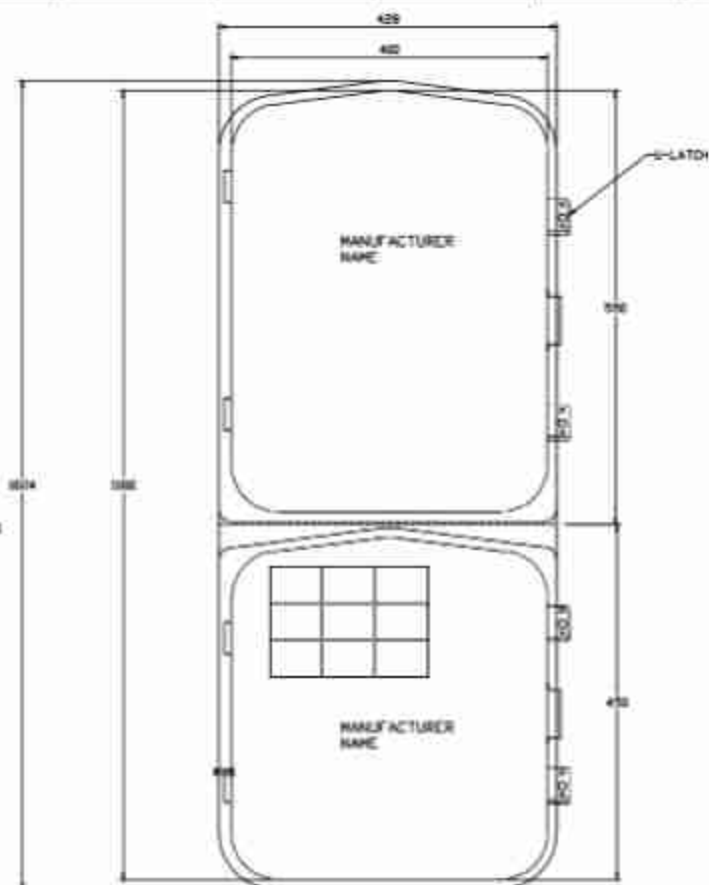
REV. NO.

1 OF 1

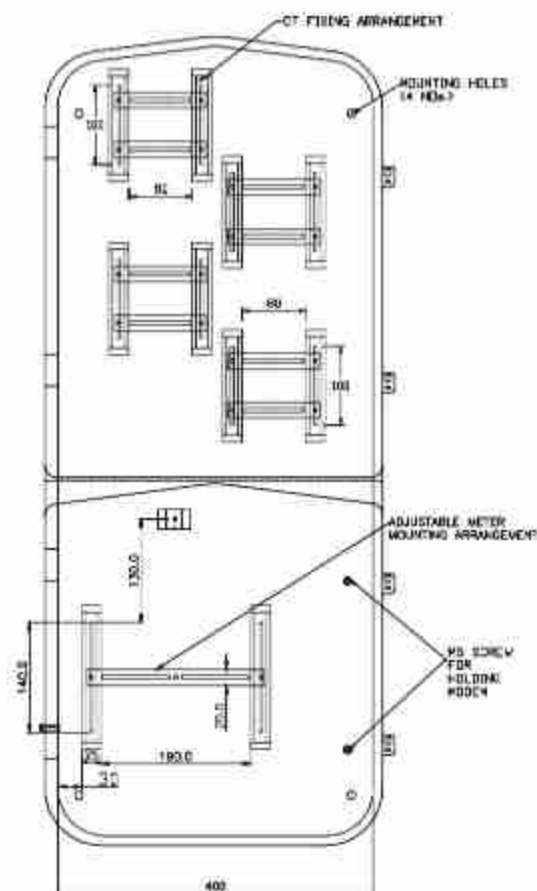
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SIDE VIEW



FRONT VIEW  
WITH COVER




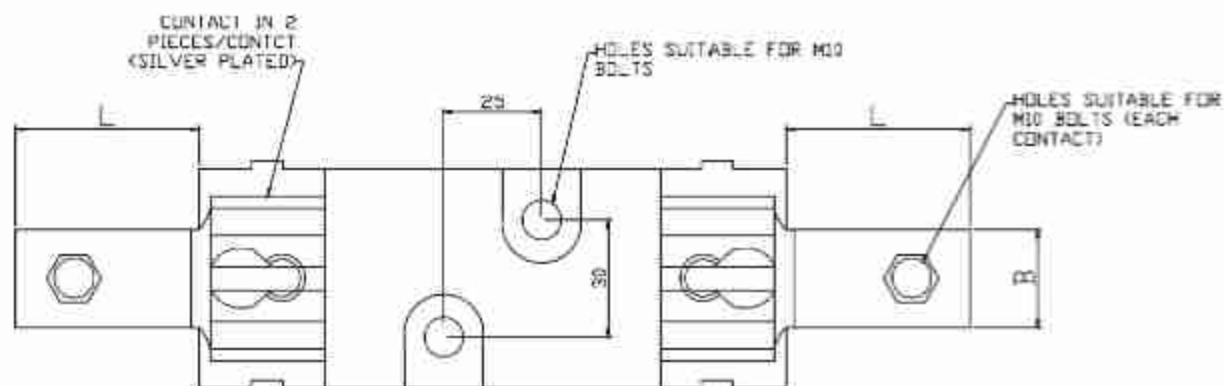
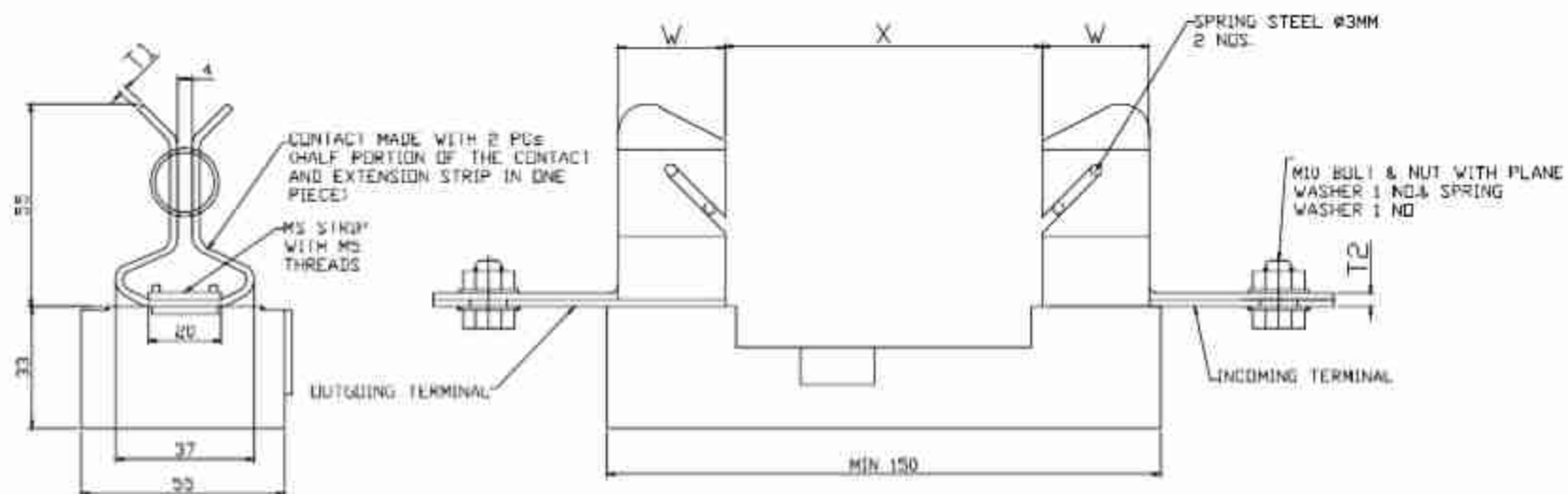
FRONT VIEW  
WITHOUT COVER

All dimensions are in mm.

FOR TENDER PURPOSE ONLY

REV.	DESCRIPTION	DATE	BY	CHKD.	PROJECT
01					

 <b>Rural Electrification Corporation Ltd.</b>		PROJECT:	
		Revamped Distribution Sector Scheme (RDSS)	
TITLE:		TAMPER PROOF DEEP DRAWN METAL METER BOX FOR HOUSING THREE PHASE METER WITH CTs & METER	
SHEET NO.	PRO. NO.	SHT. NO.	REV. NO.
AS NOTED	REC/RDSS/DTR SS/16	1 OF 1	0



All dimensions are in mm.

DESCRIPTION	63/100 KVA	200 KVA	315 KVA
FUSE BASE CURRENT RATING	200 Amps	400 Amps	630 Amps
TERMINAL THICKNESS T1	1.8 MM	3 MM	5 MM
TERMINAL THICKNESS T2	3.6 MM	6 MM	10 MM
X	86 MM	86 MM	86 MM
W	29 MM	35 MM	35 MM
L	25 MM	36 MM	36 MM
B	28 MM	34 MM	34 MM

FOR TENDER PURPOSE ONLY

Rural Electrification Corporation Ltd.

PROJECT

Revamped Distribution Sector Scheme (RDSS)

TITLE

HRC FUSE BASE FOR 63/100/200/315 KVA

SHEET NO.

SCALE

AS NOTED

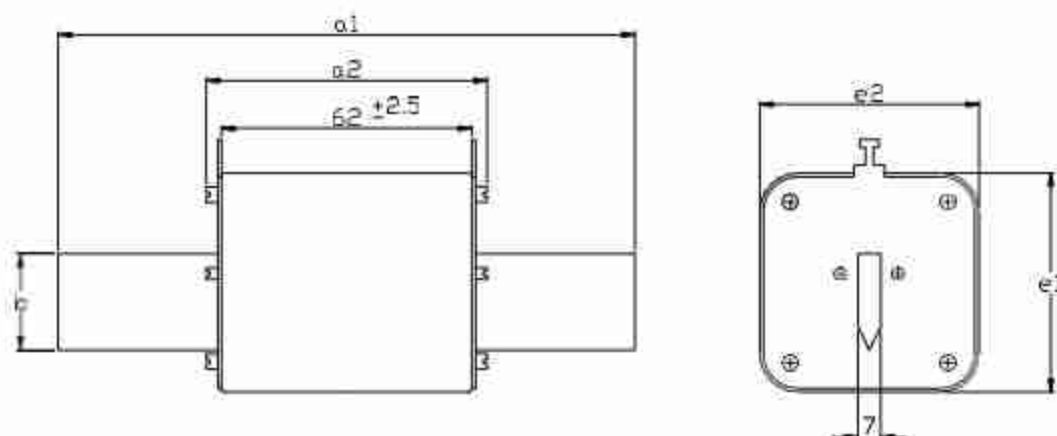
REC/RDSS/DTR SS/17

DRG. NO.

SHT. NO.

REV. NO.

1 OF 1 0




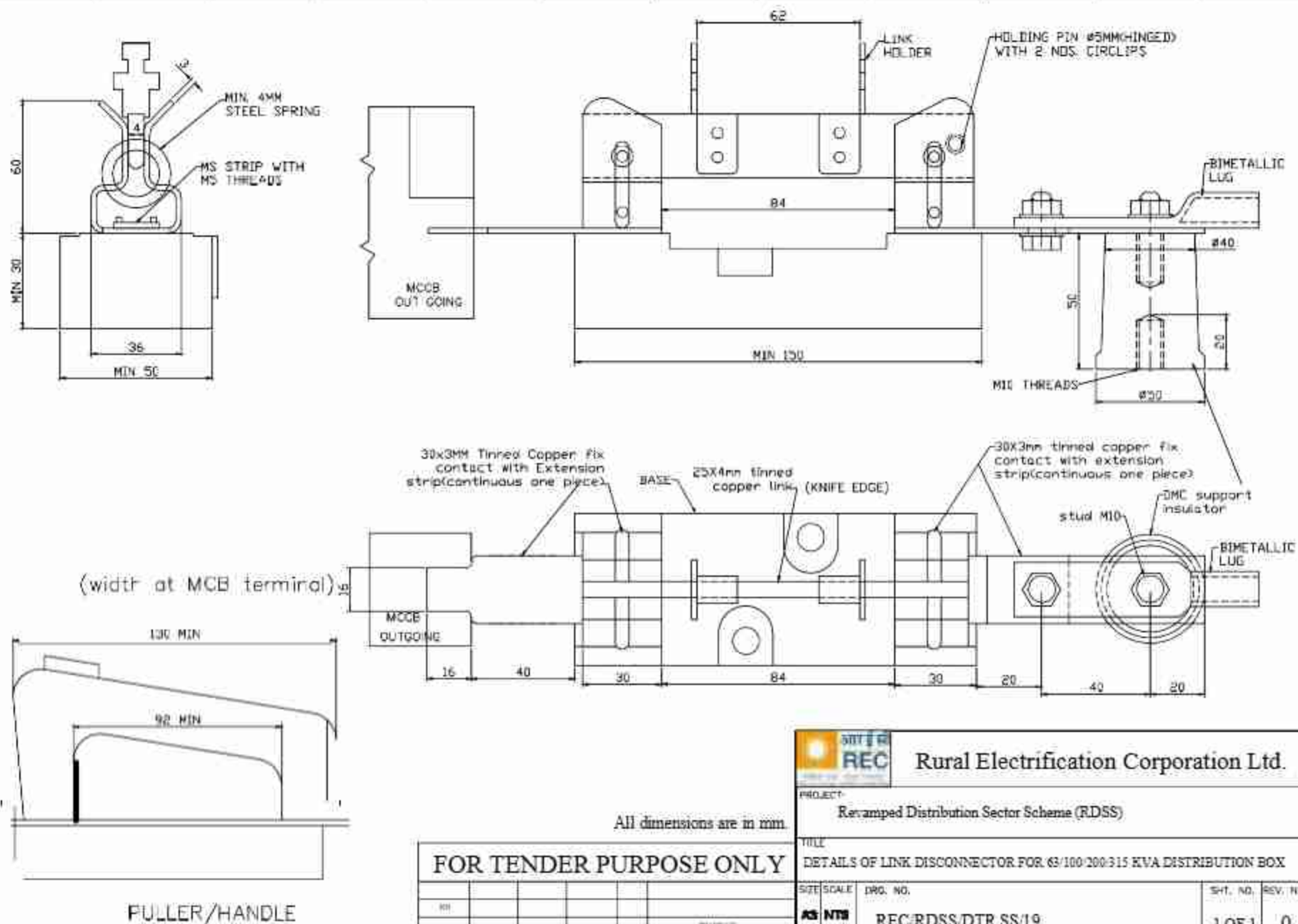
DESCRIPTION	a1	a2 (max.)	b(min)	e1(max.)	e2 (max.)
HRC LINK 100/160A	135 ±2.5	75	20	53	52
HRC LINK 315A	150 ±2.5	75	25	61	60
HRC LINK 500A	150 ±2.5	75	32	76	75

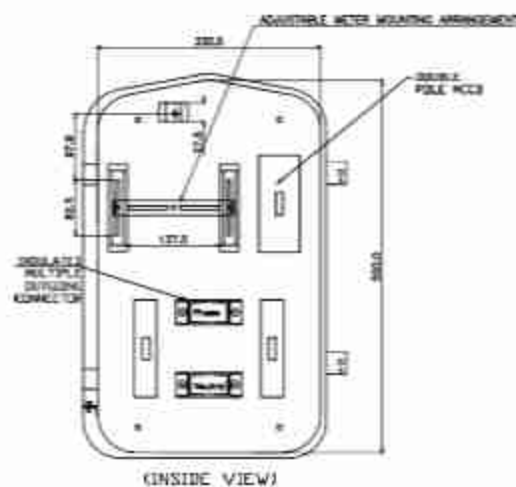
All dimensions are in mm.

FOR TENDER PURPOSE ONLY

DESIGN	CHECKED	APPROVED	DATE	PROJECT
BY: [ ]	BY: [ ]	BY: [ ]	DATE: [ ]	PROJECT: [ ]

 <b>Rural Electrification Corporation Ltd.</b>	
PROJECT: Revamped Distribution Sector Scheme (RDSS)	
TITLE: HRC FUSE LINK	
SIZE/SCALE: AS NOTED	DRG. NO.: REC/RDSS/DTR SS/19
SHT. NO.: 1 OF 1	REV. NO.: 0





FOR TENDER PURPOSE ONLY



PROJECT:

10/15/04

SIZE	SCALE
------	-------

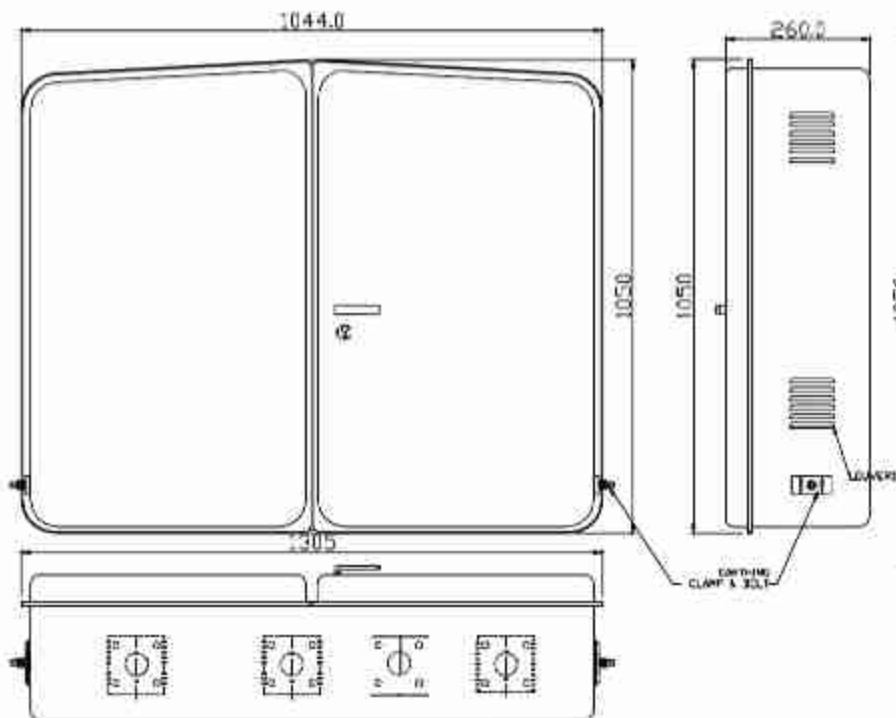
REC RDSS/DTR SS/20

SHT. NO. REV. NO.

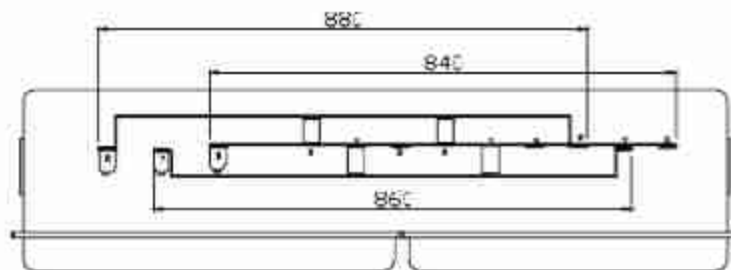
1 OF 1 0

III					
III. 1. 1	III. 1. 1. 1	III. 1. 1. 2	III. 1. 1. 3	III. 1. 1. 4	III. 1. 1. 5





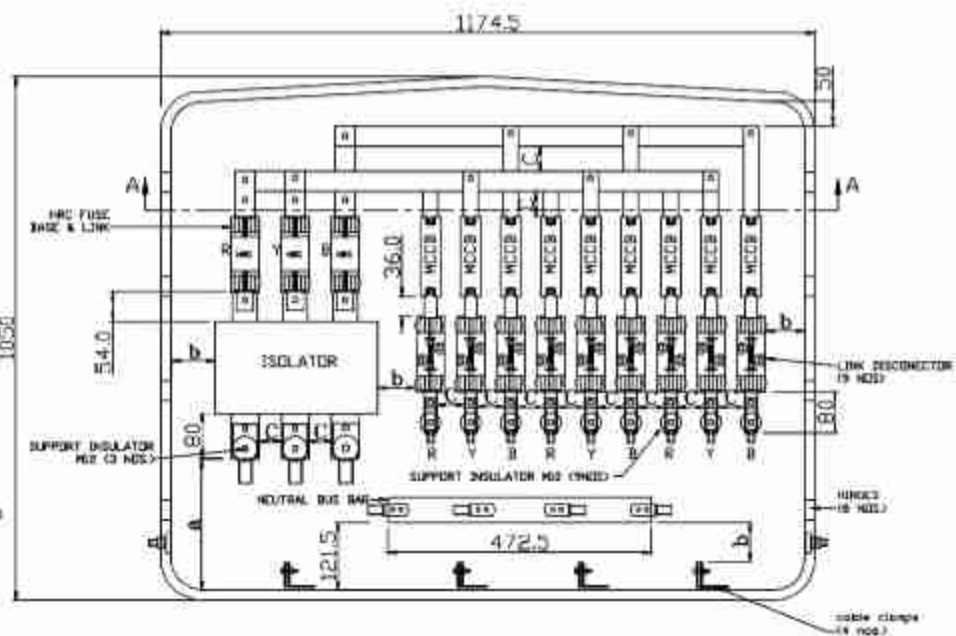
VIEW OF ENCLOSURE WITH CLOSED DOOR.



SECTION 'A-A' WITH BUS BAR ASSEMBLY DETAILS.

All dimensions are in mm.

FOR TENDER PURPOSE ONLY



DETAILS OF SUPPORT INSULATOR FOR NEUTRAL BUS BAR (2 Nos.)



DETAILS OF CABLE CLAMPS

L.T. DISTRIBUTION BOX WITH ASSY. DETAILS



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

L.T. DISTRIBUTION BOX FOR 200 KVA

SHEET NO.

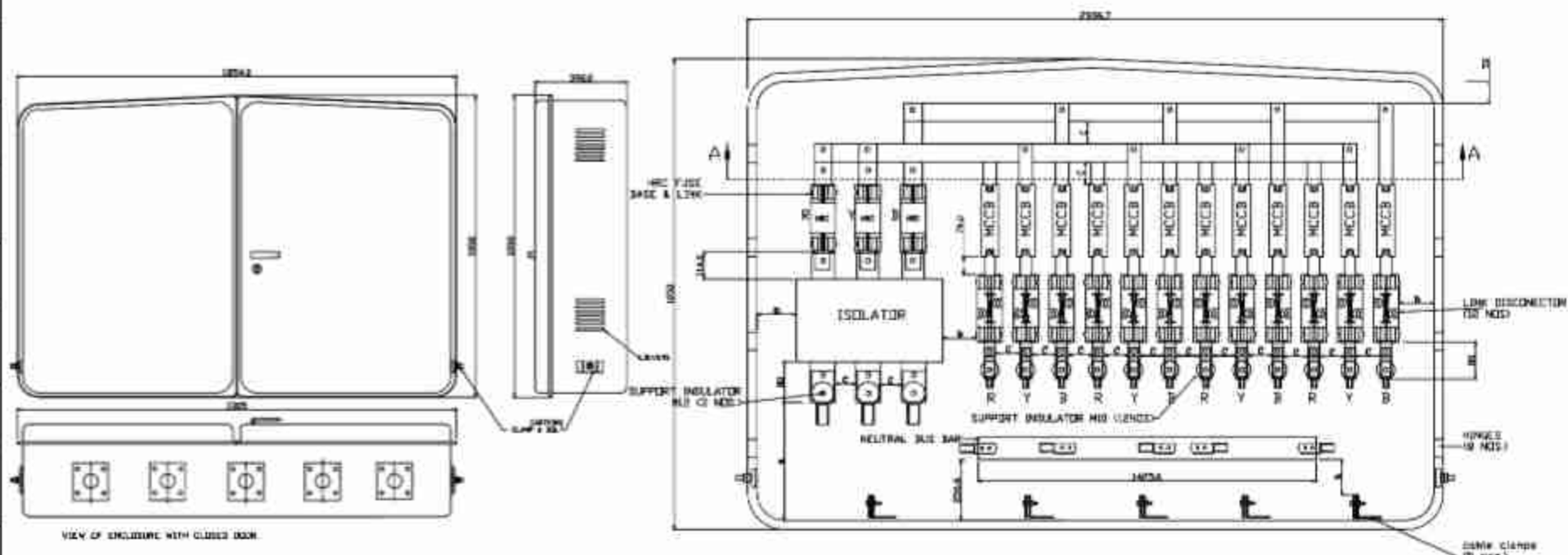
REV. NO.

AS NTS

REC/RDSS/DTR SS/21

1 OF 1

0



SECTION 'A-A' WITH BUS BAR ASSEMBLY DETAILS.

All dimensions are in mm.

FOR TENDER PURPOSE ONLY

Sl. No.	Particulars	Quantity	Unit	Remarks
1	ENCLOSURE	1	No.	
2	ISOLATOR	1	No.	
3	MCCB	10	No.	
4	SUPPORT INSULATOR	12	No.	
5	NEUTRAL BUS BAR	1	No.	
6	LINE DISCONNECTOR	1	No.	
7	CABLE CLAMPS	12	No.	
8	HINGES	12	No.	



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

L.T. DISTRIBUTION BOX WITH ASSY. DETAILS FOR 315 KVA

SHEET NO.

REV. NO.

AS NOTED

REC/RDSS/DTR SS/22

SHEET NO.

1 OF 1

REV. NO.

0



DETAILS OF SUPPORT INSULATOR  
FOR NEUTRAL BUS BAR (2 Nos.)

### MINIMUM CLEARANCE

**A = 450**

**h = 75**

● ● ●

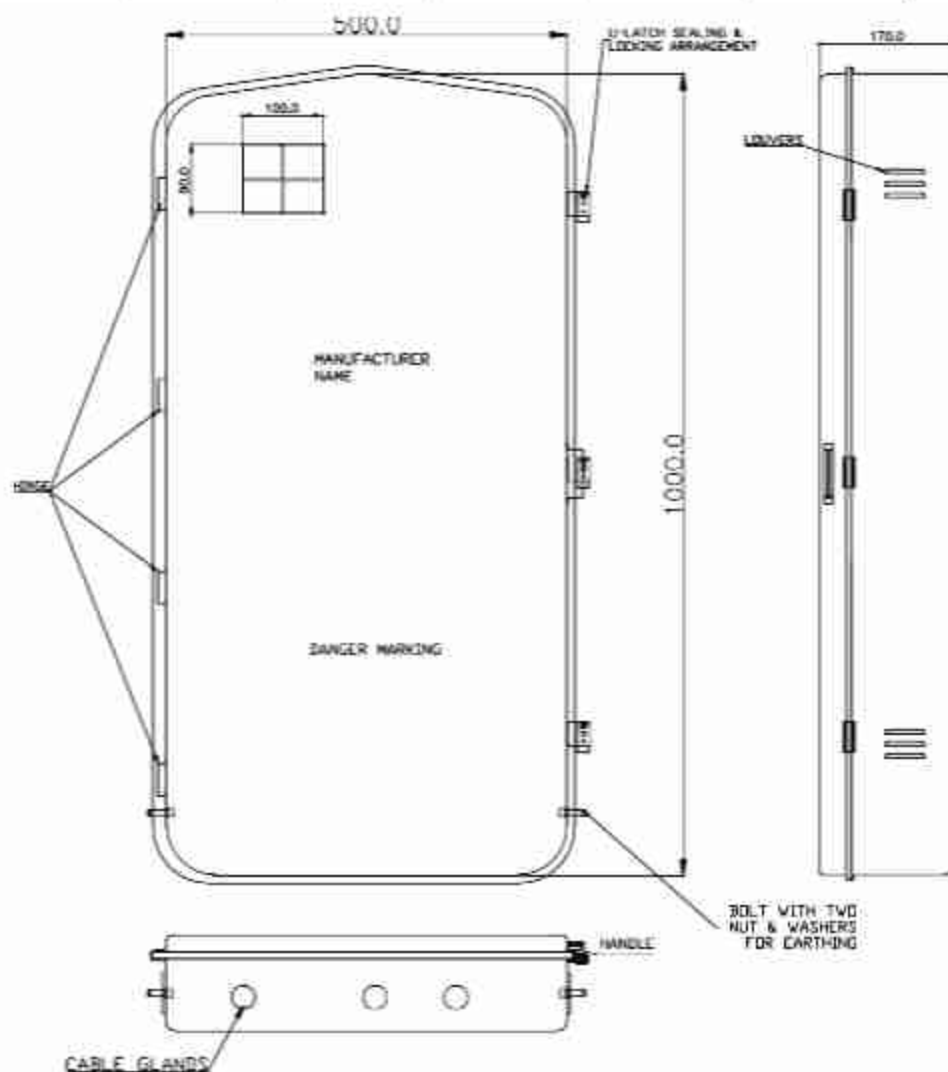


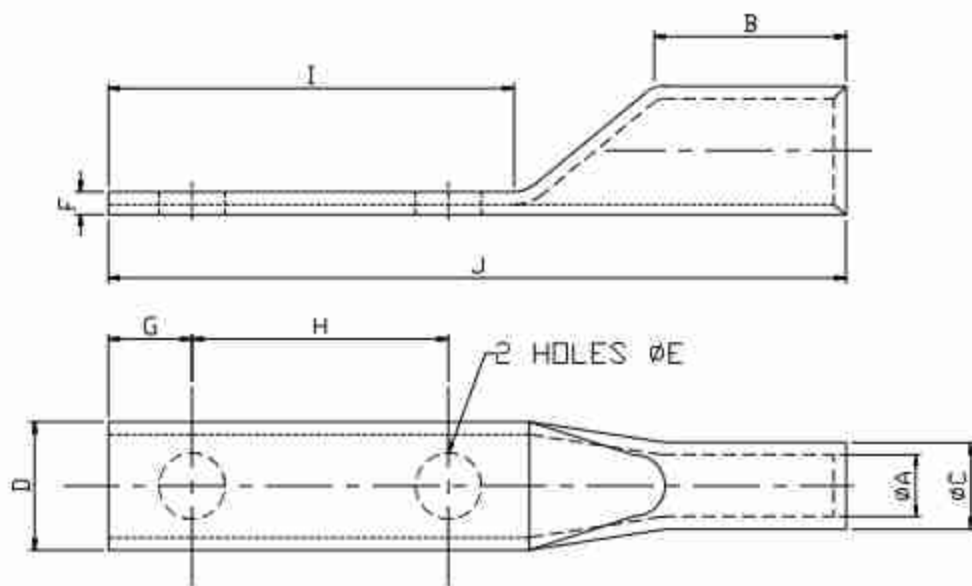
#### DETAILS OF CABLE CLAMPS

FOR TENDER PURPOSE ONLY

All dimensions are in mm.

						SIZE	SCALE	DWG. NO.	SHT. NO.	REV. NO.
REV.						AS	NTS	REC/RDSS/DTR SS/23	1 OF 1	0
REV. NO.	DESCRIPTION	DATE	BY	CHECKED	DATE	PROJECT				





SIZE NO.	$\phi A$	$\phi C$	D	F	$\phi E$	B	G	H	I	J
CABLE SIZE (50 SQ.MM)	9.6	13.5	20.0	3.5	10.3	30	13	40	65	115
CABLE SIZE (70 SQ.MM)	11.8	17.0	24.0	5.3	10.3	38	13	40	65	115
CABLE SIZE (120 SQ.MM)	15.6	21.9	30	6	13.0	50	20	40	81	145
CABLE SIZE (150 SQ.MM)	16.5	22	31.5	5.3	13.0	50	20	40	90	156
CABLE SIZE (300 SQ.MM)	24	31	45	6.8	13.0	50	20	40	90	156

All dimensions are in mm.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

BIMETALLIC LUGS

SIZE/SCALE

DRG. NO.

AS NTS

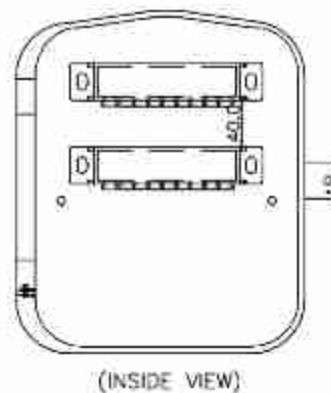
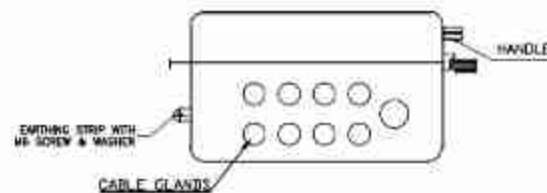
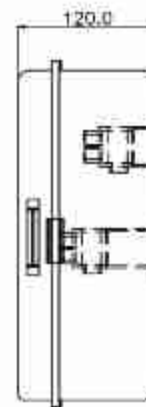
REC/RDSS/DTR SS/25

SHT. NO. REV. NO.

1 OF 1

0





All dimensions are in mm.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

LT DISTRIBUTION BOX FOR SINGLE PHASE ABC

SIZE/SCALE:

A3 NTH

ORD. NO.

REC/RDSS/DTR SS/26

SHT. NO.

1 OF 1

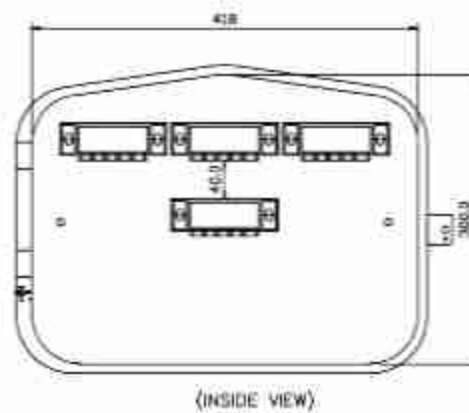
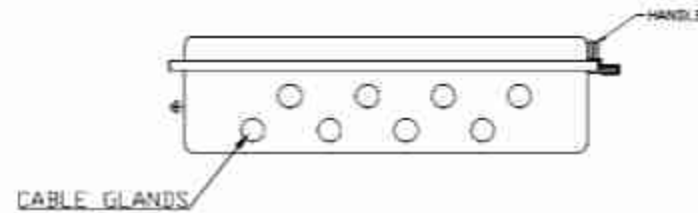
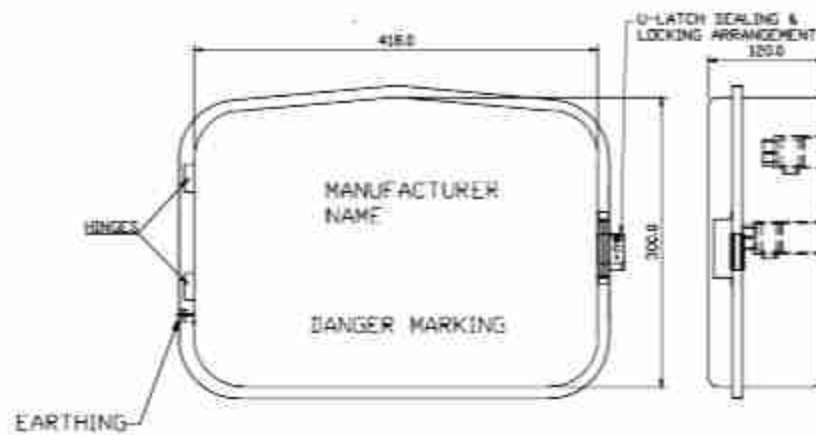
REV. NO.

0

REV.	DATE	BY	CHKD.	APPD.

NOTES:





All dimensions are in mm.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

Revamped Distribution Sector Scheme (RDSS)

TITLE

DEEP DRAWN TYPE 3 PHASE L.T. DISTRIBUTION BOX FOR AE CABLE

SIZE/SCALE

DWG. NO.

AD/NTB

REC/RDSS/DTR SS/27

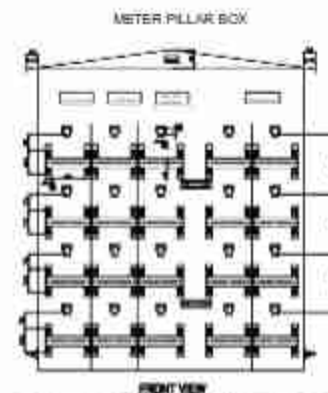
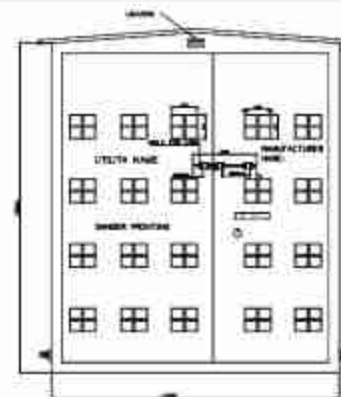
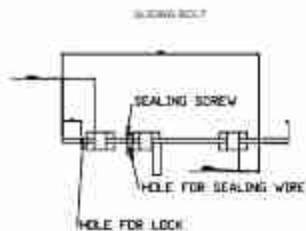
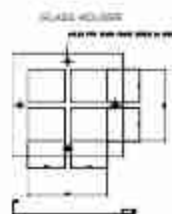
SHT. NO.

1 OF 1

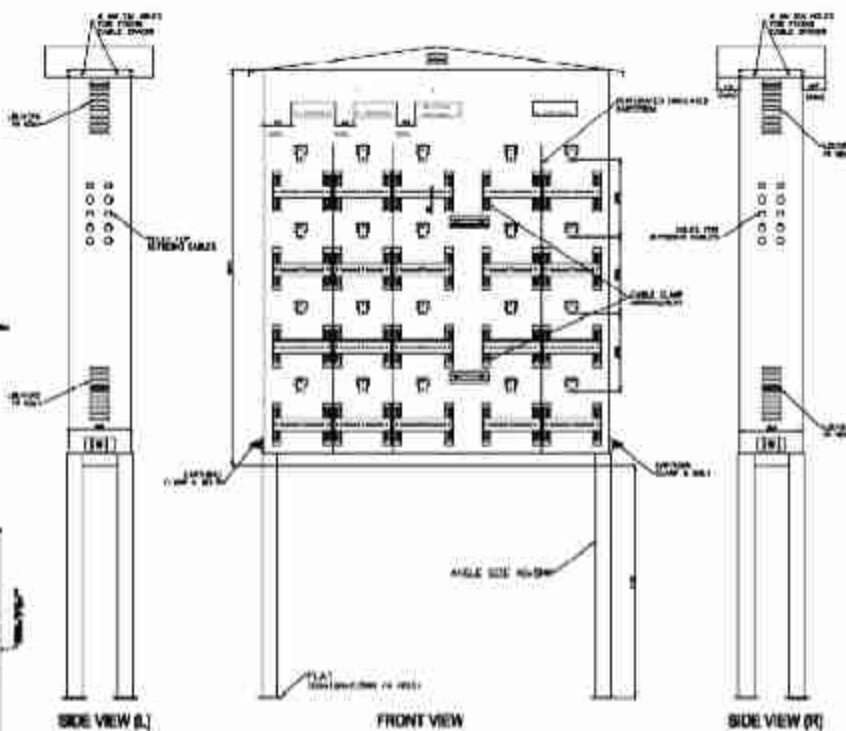
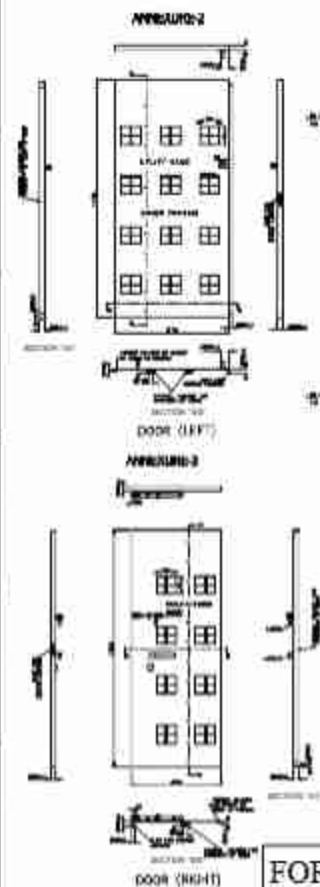
REV. NO.

0

REV.	DESCRIPTION	DATE	BY	CHKD.	APPROVED



FRONT VIEW  
Note: For arrangement shown is indicative only. Arrangement can be modified as per the local requirement. However, the minimum dimensions as per the specification of meter pillar box shall be maintained as per drawings / specifications.



Note: For arrangement shown is indicative only. Arrangement can be modified as per the local requirement. However, the minimum dimensions as per the specification of meter pillar box shall be maintained as per drawings / specifications.

All dimensions are in mm.

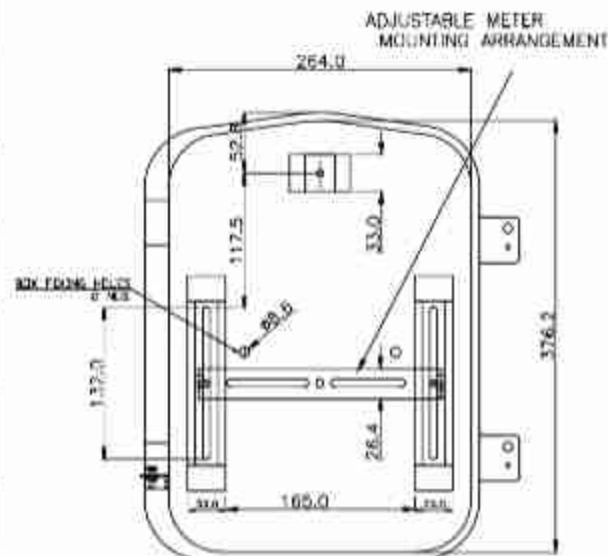
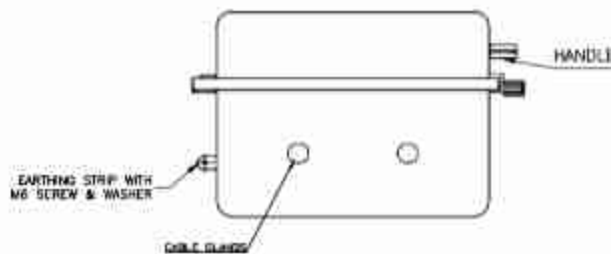
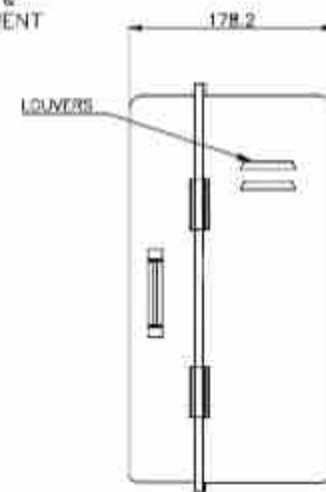
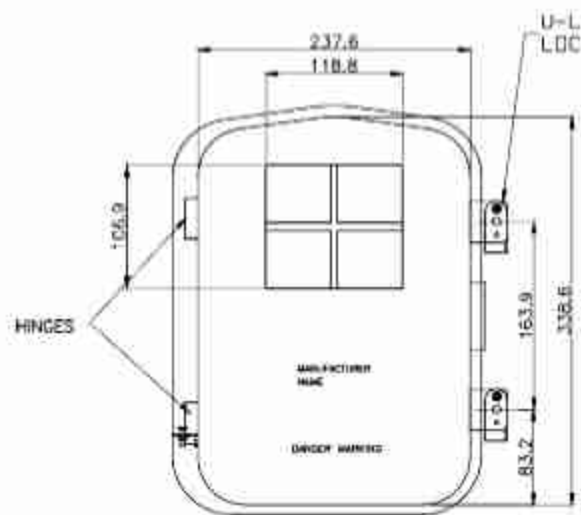
Rural Electrification Corporation Ltd.

PROJECT: Rural Electrification Corporation Ltd. (DDUGJY)

TYPE: PILLAR BOX WITH INSIDE DETAILS OF METER MOUNTING ARRANGEMENT

SIZE/SCALE	DWG. NO.	SHT. NO.	REV. NO.
AS NOTED	REC/RDSS/DTR SS/28	1 OF 1	0

FOR TENDER PURPOSE ONLY



(INSIDE VIEW)

All dimensions are in mm.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

METAL METER BOX FOR SINGLE PHASE METER (DEEP DRAWN METHOD)

SHEET NO.

PRO. NO.

REC/RDSS/DTR SS/29

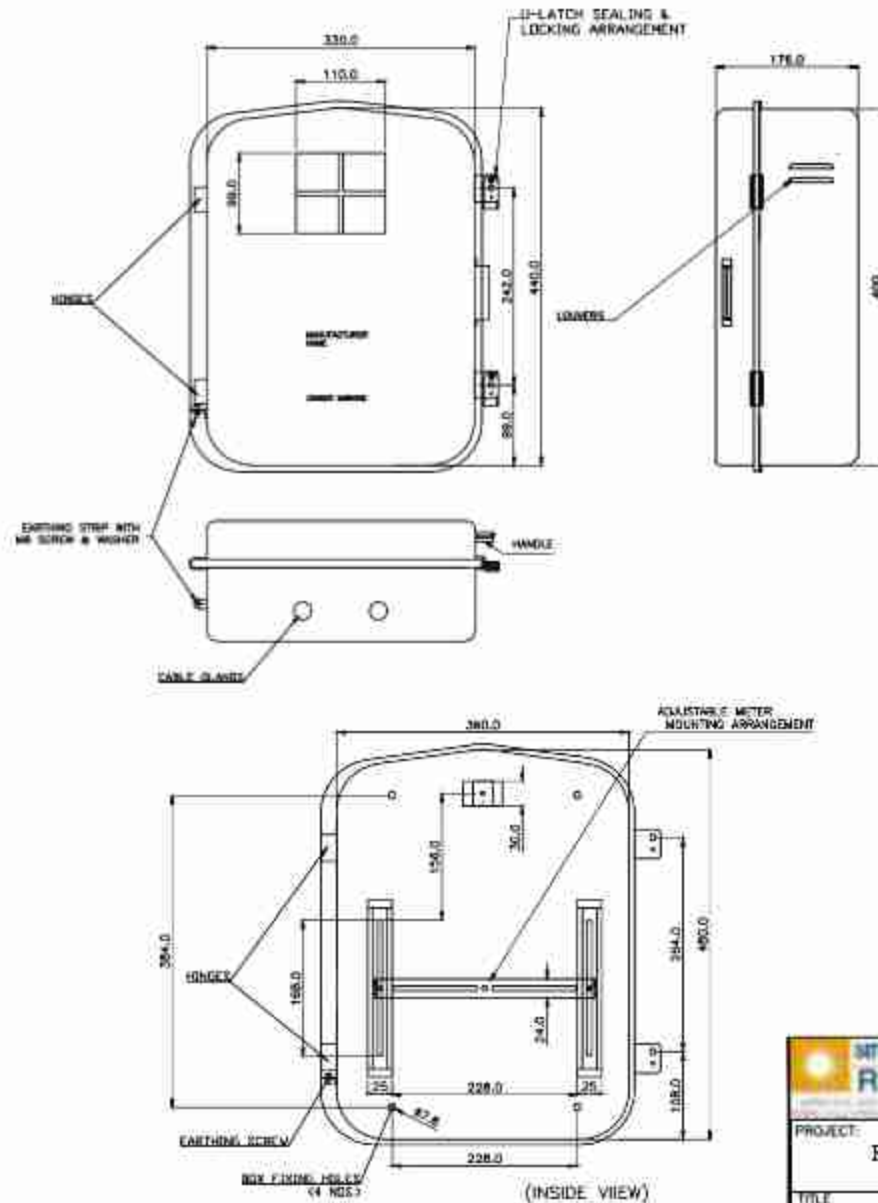
SHT. NO.

1 OF 1

REV. NO.

0

DESIGN	DESIGNED BY	CHECKED BY	APPROVED BY	DATE	PROJECT



All dimensions are in MM.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)

TITLE: METAL METER BOX FOR THREE PHASE METER (DEEP DRAWN METHOD)

SIZE/SCALE: A3/NTS  
 DRG. NO.: REC/RDSS/DTR.SS/30

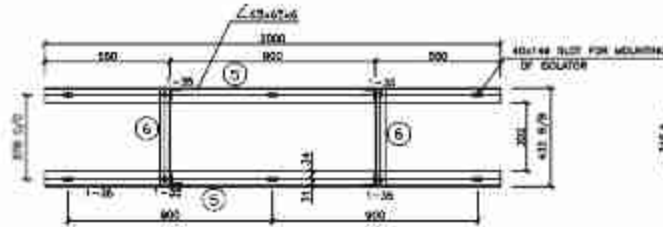
SHT. NO.: 1 OF 1  
 REV. NO.: 0

REV.	DESCRIPTION	DATE	BY	CHKD.	APPD.
01	ISSUED FOR TENDER	01/01/2020	01	02	03

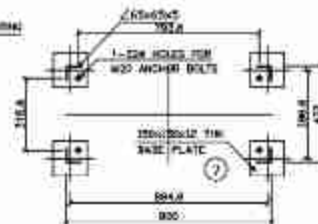


RD				
REV.	ML	PREPARED	CHECKED	APPROVED DATE

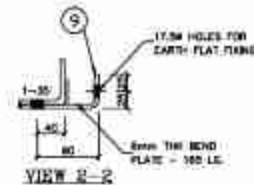




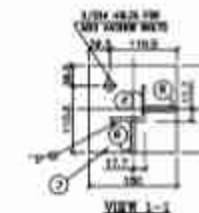
TOP PLAN  
MOUNTING ARRANGEMENT PLAN FOR ISOLATOR



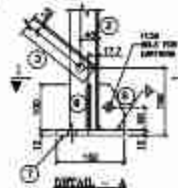
VIEW 3-3



VIEW 2-2



VIEW 1-1



DETAIL - A

BILL OF MATERIAL					
ITEM NO.	DESCRIPTION	LENGTH IN MM	QUANTITY	UNIT WT. IN KG	TOTAL WT. IN KG
1	L 100 x 50 x 6	2972	1	4.5	53.50
2	L 40 x 40 x 5	1000	4	3.4	17.00
3	L 40 x 40 x 5	1382	4	3.4	18.80
4	L 100 x 50 x 6	3000	2	5.8	22.20
5	L 40 x 40 x 5	418	2	3.4	3.84
6	12mm THK. M.S. BASE PLATE	130x130	4	94.2	6.48
7	20mm THK. M.S. ENDER PLATE	100x57	5	82.8	2.96
8	20mm THK. END PLATE	100	5	45.1	22.21
9	L 100 x 50 x 6	422	2	5.8	2.21
10	L 100 x 50 x 6	405	4	3.2	0.96
11	L 40 x 40 x 5	886	2	3.4	0.58
12	L 40 x 40 x 5	418	2	3.4	3.84
TOTAL WEIGHT OF STRUCTURAL STEEL =					187.87

	NON BELT METAL LG.	0.124	47	5.83
	NON BELT METAL LG.	-	-	-
	SPRING WASHER	0.009	47	0.423
TOTAL WEIGHT OF BOLTS & NUTS =				6.25

WEIGHT OF STRUCTURAL STEEL = 187.87kg  
WEIGHT OF BOLTS/NUTS = 6.25 kg  
WEIGHT OF THE STRUCTURE = 175.85kg

PROTO ASSEMBLY SHOULD BE MADE BEFORE MASS FABRICATION

#### NOTES

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED
- ALL WELDS ARE 10mm FOR THIN PLATES UNLESS SPECIFIED OTHERWISE
- ALL STRUCTURAL STEEL MEMBERS & BOLTS SHALL BE GALVANIZED AFTER FABRICATION AND FOR 10% AND 20% CORROSION SHALL NOT BE LESS THAN 800g/m<sup>2</sup> FOR ALL STRUCTURAL STEEL MEMBERS.
- ALL LARGEST WILL HAVE 25mm BACK MARK.
- ALL LARGEST WILL HAVE 25mm BACK MARK.
- 25mm SPRING WASHERS TO BE USED UNDER EACH NUT.
- ALL STRUCTURAL STEEL SHALL BE PRESTRESSED WITH "100"
- ALL STRUCTURAL STEEL SHALL CONFORM TO IS 2062.
- ALL WELDS SHALL BE 4mm FILLET WELD UNLESS SPECIFIED OTHERWISE.
- ALL BOLTS & NUTS SHALL BE OF PROPERTY CLASS 8.8 OF IS 1367.
- PLATE MEMBERS SHALL BE AS PER IS 2062 & SPRING WASHER SHALL BE AS PER IS 2062.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

STRUCTURAL DETAILS OF 11kV ISOLATOR

SIZE

SCALE

DRG. NO.

REC/ RDSS /33/11kV PSS/02

DATE

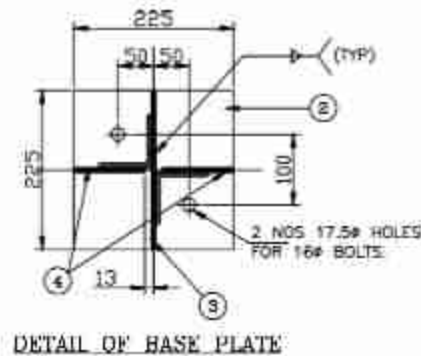
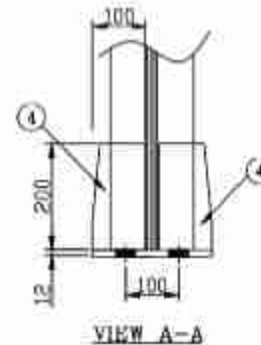
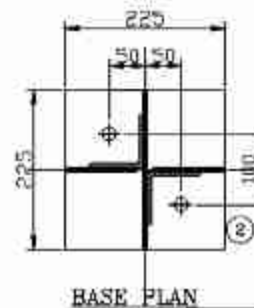
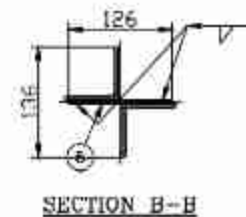
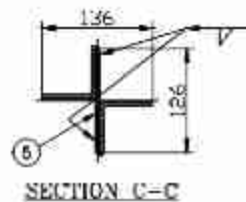
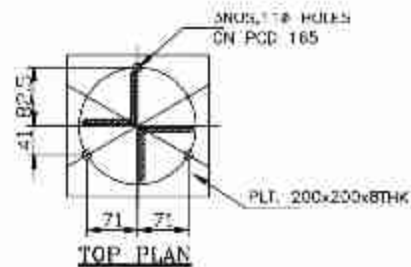
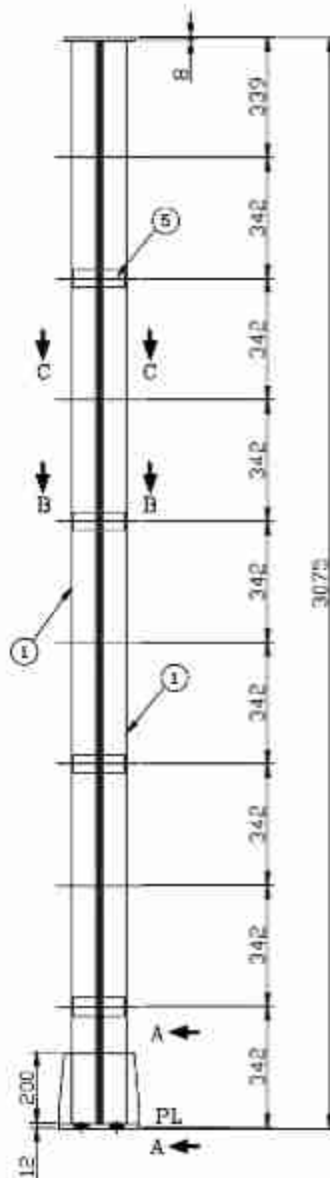
1 OF 1

REV. NO.

0

RD					
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT





BILL OF MATERIAL						
MARK NO	SECTION	QTY.	LENGTH mm	WIDTH mm	UNIT WT. Kg/m	TOTAL WT IN Kg
1	L 85x85x8	2	3085	-	5.80	35.438
2	PL 12thk	1	225	225	94.2	4.769
3	PL 8thk	1	200	225	47.10	2.120
4	PL 8thk	2	100	200	47.10	1.884
5	PL 8thk	8	50	146	47.10	2.751
6	PL 8thk	1	200	200	62.80	2.512
TOTAL WEIGHT OF STRUCTURE						49.47

WEIGHT OF THE STRUCTURE : 49.47 kg

PROTO ASSEMBLY SHOULD BE MADE BEFORE MASS FABRICATION

ACTUAL LENGTH OF MEMBER SHOULD BE DECIDED BASED ON FULL SCALE LAYOUT AT FACTORY

#### NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED
2. ALL HOLES ARE 17.5mm FOR 16mm BOLTS UNLESS SPECIFIED OTHERWISE
3. ALL STRUCTURAL STEEL MEMBERS & BOLTS SHALL BE GALVANISED AFTER FABRICATION AS PER IS: 4759 AND ZINC COATING SHALL NOT BE LESS THAN 610gm/sqm FOR ALL STRUCTURAL STEEL MEMBERS.
4. ALL L45x45x5 WILL HAVE 23mm BACK MARK.
5. ALL L50x50x5 WILL HAVE 28mm BACK MARK.
6. 3.5mm SPRING WASHERS TO BE USED UNDER EACH NUT.
7. ALL ERECTION MARK SHALL BE PREFIXED WITH "ILA".
8. ALL STRUCTURAL STEEL SHALL CONFORM TO IS: 2002.
9. ALL WELDS SHALL BE 6 mm FILLET WELD UNLESS SPECIFIED OTHERWISE.
10. ALL BOLTS & NUTS SHALL BE OF PROPERTY CLASS 5.6 OF IS: 1363 & 1367.
11. PLAIN WASHERS SHALL BE AS PER IS: 2016 & SPRING WASHER SHALL BE AS PER IS: 3043.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

STRUCTURAL DETAILS OF 11kV LA

SIZE

AS

SCALE

NTS

DRG. NO.

REC/ RDSS /33/11kV PSS/03

DRG. NO.

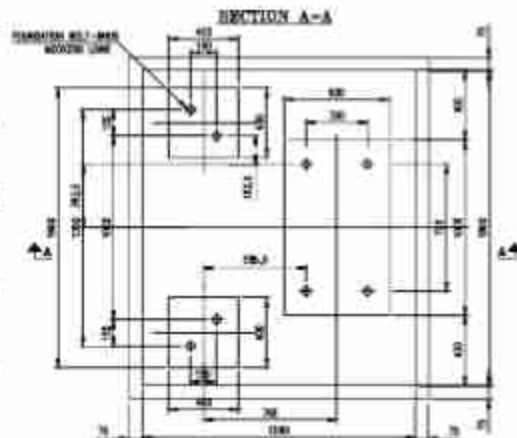
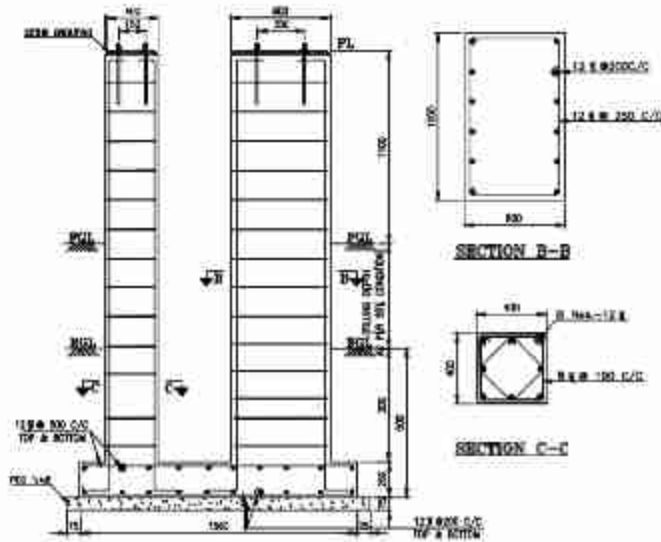
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REV. NO.

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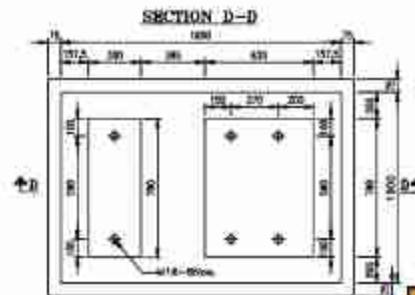
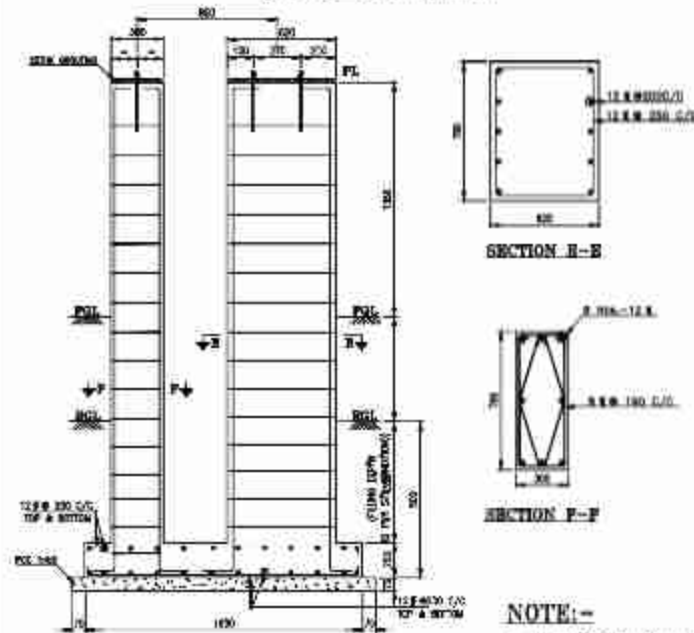
NO	REV.	ML	PREPARED	CHECKED	APPROVED	DATE	PROJECT

MAKE : OLG



FOUNDATION PLAN  
OLG MAKE COMBINED VCB/CT FOUNDATION

MAKE : SIEMENS



FOUNDATION PLAN  
SIEMENS MAKE COMBINED VCB/CT FOUNDATION

NOTE:-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED
2. ALL CONCRETE GRADE M20
3. REINFORCEMENT STEEL SHALL BE HYSD BAR
4. CLEAR COVERS TO REBARS SHALL BE AS FOLLOWS  
FOUNDATION RAFTS - 50  
PEDESTALS - 50
5. LAP LENGTH TO REBAR SHALL BE MIN. 30 DIA AND LAPS IN ALTERNATIVE BARS SHALL BE STAGGERED.
6. FOR DETAILS OF FOUNDATION BOLT  
REFER DRG NO: (3/671570-KB205-FD03, SIEMENS LTD. MAKE.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

FOUNDATION DETAILS OF 11KV VCB&CT

SIZE

AS

SCALE

NTS

DRG. NO.

REC/ RDSS /33/11kv PSS/04

DRG. NO.

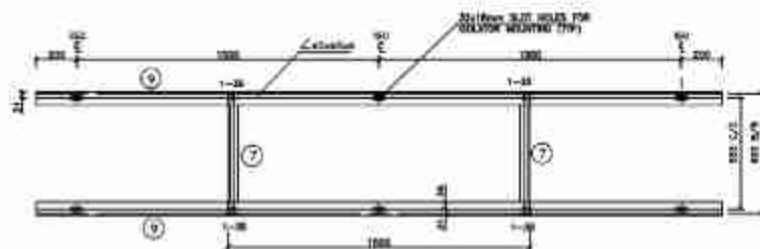
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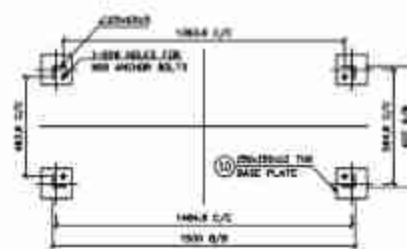
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NO	REV.	PREPARED	CHECKED	APPROVED	DATE

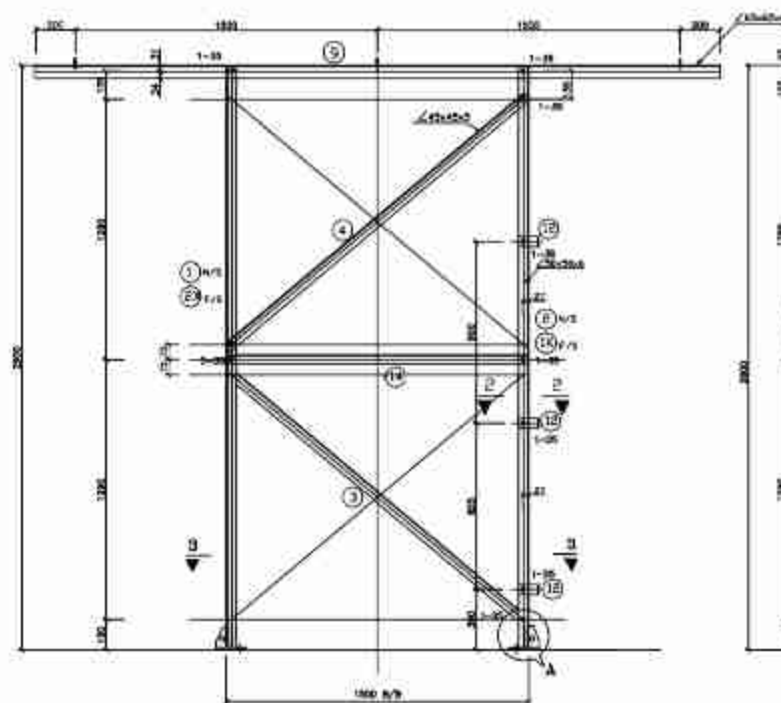
PROJECT



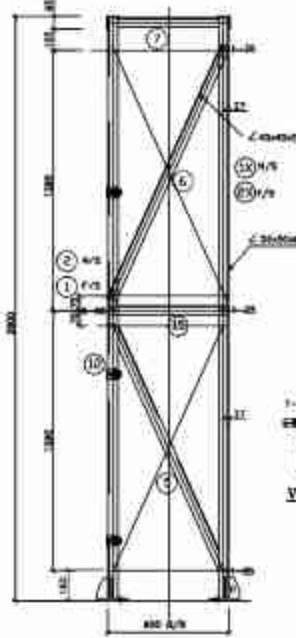
TOP PLAN  
MOUNTING ARRANGEMENT PLAN FOR HORN GAS FUSE



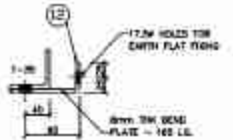
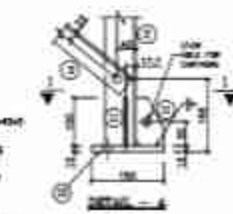
VIEW 2-2



FRONT ELEVATION



SIDE ELEVATION



VIEW 2-1

BILL OF MATERIAL				
ITEM NO.	DESCRIPTION	LENGTH IN mm	QUANTITY IN Nos.	UNIT WT. IN Kg.
1	L 50 x 50 x 5	2000	4	4.5
2	L 45 x 45 x 5	1800	2	3.4
3	L 45 x 45 x 5	1800	2	3.4
4	L 45 x 45 x 5	1800	2	3.4
5	L 45 x 45 x 5	1800	2	3.4
6	L 45 x 45 x 5	1800	2	3.4
7	L 45 x 45 x 5	1800	2	3.4
8	L 45 x 45 x 5	1800	2	3.4
9	L 45 x 45 x 5	1800	2	3.4
10	12mm THK. N/S BASE PLATE	1800x1800	4	84.2
11	8mm THK. N/S STIFFENER PLATE	1800x1800	8	82.8
12	12mm THK. END PLATE	1800	2	47.1
13	L 45 x 45 x 5	1800	2	3.4
14	L 45 x 45 x 5	1800	2	3.4
15	L 45 x 45 x 5	1800	2	3.4
TOTAL WEIGHT OF STRUCTURAL STEEL =				189.28


HIGH BOLT M16x30 L.S.	3.125	80	6.25
HIGH BOLT M16x40 L.S.	-	-	-
SPRING WASHER	0.009	80	0.45
TOTAL WEIGHT OF BOLTS & NUTS =			6.65

WEIGHT OF STRUCTURAL STEEL	189.28kg
WEIGHT OF BOLTS/NUTS	6.65 kg
WEIGHT OF THE STRUCTURE	195.93kg

PRELIMINARY SHOULD BE MADE BEFORE WELD FABRICATION

- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
  2. ALL BOLTS ARE 17.7mm FOR 18mm BOLTS UNLESS OTHERWISE SPECIFIED.
  3. ALL STRUCTURAL STEEL MEMBERS & BOLTS SHALL BE GALVANIZED AFTER FABRICATION AND PER IS: 4709 AND ZINC COATING SHALL NOT BE LESS THAN 810gm/3m<sup>2</sup> FOR ALL STRUCTURAL STEEL MEMBERS.
  4. ALL LAGBOLTS WILL HAVE 20mm BACK MARK.
  5. ALL 150mm WILL HAVE 20mm BACK MARK.
  6. 3.0mm SPRING WASHERS TO BE USED UNDER EACH NUT.
  7. ALL ERECTION MARK SHALL BE PREPARED WITH "3-40".
  8. ALL STRUCTURAL STEEL SHALL CONFORM TO IS: 2062.
  9. ALL WELDS SHALL BE 8 mm FULLY WELD UNLESS SPECIFIED OTHERWISE.
  10. ALL BOLTS & NUTS SHALL BE OF PROPERTY CLASS 5.8 OF IS: 1387.
  11. PLAIN WASHERS SHALL BE AS PER IS: 2076 & SPRING WASHER SHALL BE AS PER IS: 2063.

FOR TENDER PURPOSE ONLY

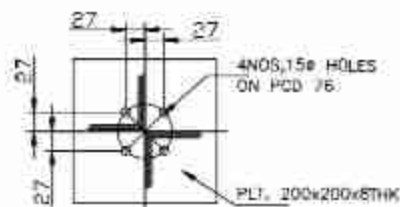
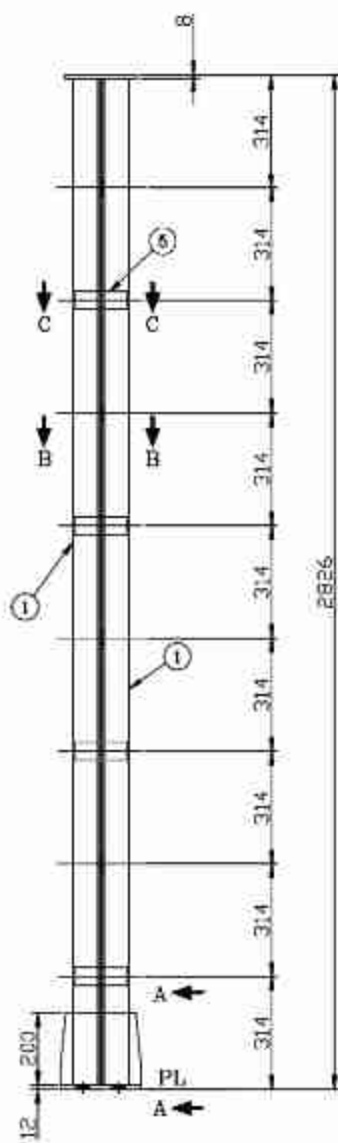
 <b>Rural Electrification Corporation Ltd.</b>	
PROJECT: Revamped Distribution Sector Scheme (RDSS)	
TITLE: STRUCTURAL DETAILS OF 33kV HG FUSE	
SIZE: AS	SCALE: NTS
DRG. NO.: REC/ RDSS /33/11kV PSS/05	DATE: 1.07.11
REV. NO.: 0	REV. NO.: 0

NO.	REV.	ML	PREPARED	CHECKED	APPROVED	DATE	PROJECT
1							

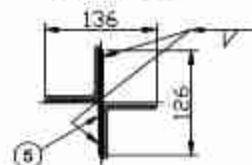




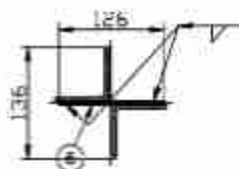




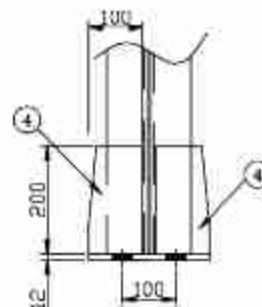
TOP PLAN



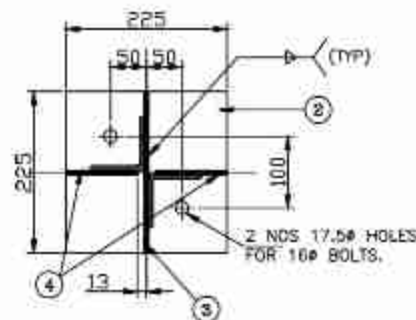
SECTION C-C



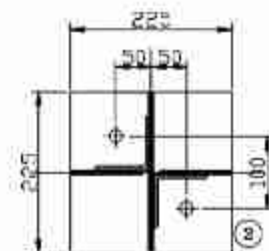
SECTION B-B



VIEW A-A



DETAIL OF BASE PLATE



BASE PLAN

BILL OF MATERIAL						
MARK NO	SECTION	QTY.	LENGTH mm	WIDTH mm	UNIT WT Kg./m	TOTAL WT IN Kg
1	L 85x85x8	2	2806	-	6.80	32.950
2	PL 12THK	1	225	225	94.3	4.769
3	PL 6THK	1	200	225	47.10	2.120
4	PL 6THK	2	100	200	47.10	1.884
5	PL 6THK	8	50	146	47.10	2.751
6	PL 8THK	1	200	200	62.80	2.512
TOTAL WEIGHT OF STRUCTURE						46.58

WEIGHT OF THE STRUCTURE : 40.58 kg

PROTO ASSEMBLY SHOULD BE MADE BEFORE MASS FABRICATION

ACTUAL LENGTH OF MEMBER SHOULD BE DECIDED BASED ON FULL SCALE LAYOUT AT FACTORY

#### NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL HOLES ARE 17.5mm FOR 16mm BOLTS UNLESS SPECIFIED OTHERWISE.
3. ALL STRUCTURAL STEEL MEMBERS & BOLTS SHALL BE GALVANISED AFTER FABRICATION AS PER IS: 4758 AND ZINC COATING SHALL NOT BE LESS THAN 800gms/sqm FOR ALL STRUCTURAL STEEL MEMBERS.
4. ALL LASHES WILL HAVE 25mm BACK MARK.
5. ALL LASHES WILL HAVE 25mm BACK MARK.
6. 3.5mm SPRING WASHERS TO BE USED UNDER EACH NUT.
7. ALL CRECTION MARK SHALL BE PRETIED WITH "3P".
8. ALL STRUCTURAL STEEL SHALL CONFORM TO IS: 3083.
9. ALL WELDS SHALL BE 6 mm FILLET WELD UNLESS SPECIFIED OTHERWISE.
10. ALL BOLTS & NUTS SHALL BE OF PROPERTY CLASS 5.8 OF IS: 1363 & 1367.
11. PLAIN WASHERS SHALL BE AS PER IS: 2016 & SPRING WASHER SHALL BE AS PER IS: 3083.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

STRUCTURAL DETAILS OF 33kV PI

SIZE

AS

SCALE

NTS

DRG. NO.

REC/ RDSS /33/11kV PSS/08

DRG. NO.

1 OF 1

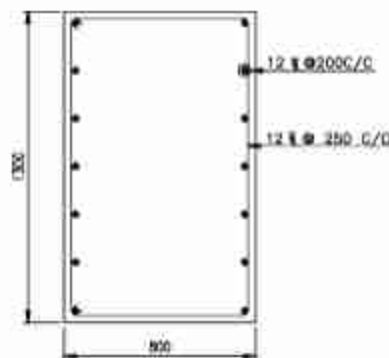
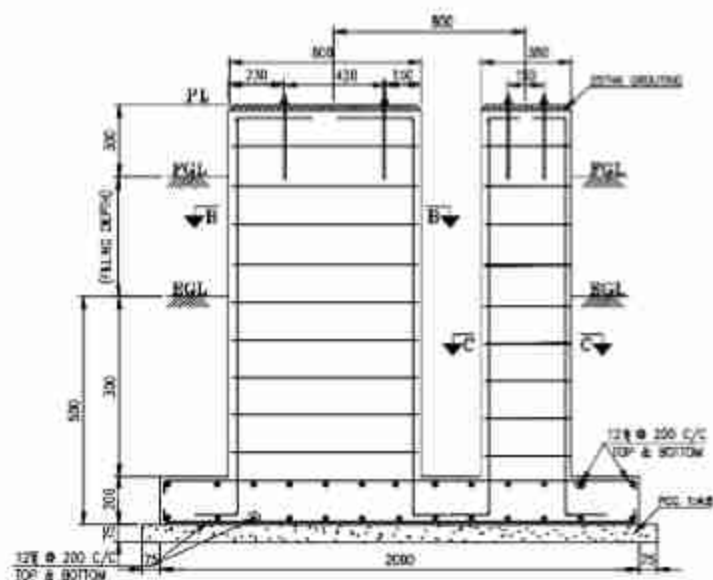
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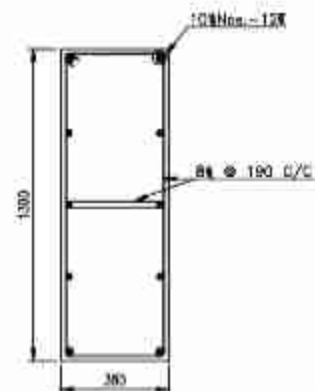
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PROJECT

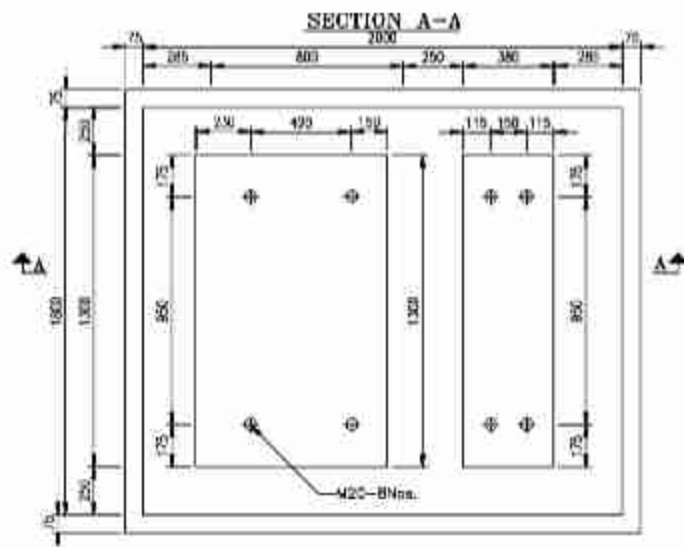




SECTION B-B



SECTION C-C



FOUNDATION PLAN

**NOTE:-**

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED
2. ALL CONCRETE GRADE M20 UNLESS OTHERWISE SPECIFIED
3. REINFORCEMENT STEEL SHALL BE HYSD BAR UNLESS OTHERWISE SPECIFIED
4. CLEAR COVERS TO REBARS SHALL BE AS FOLLOWS  
FOUNDATION RAFTS - 50  
PEDESTALS - 50
5. LAP LENGTH TO REBAR SHALL BE MIN. 50 DIA AND LAPS IN ALTERNATIVE BARS SHALL BE STAGGERED.
6. FOR DETAILS OF FOUNDATION BOLT REFER DRG NO: (4)071570-XR205-F003, SIEMENS LTD. MAKE.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

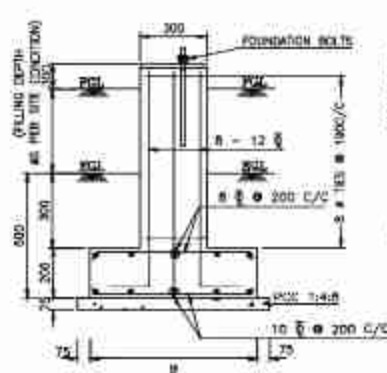
TITLE

FOUNDATION DETAILS OF 33KV VCB&CT

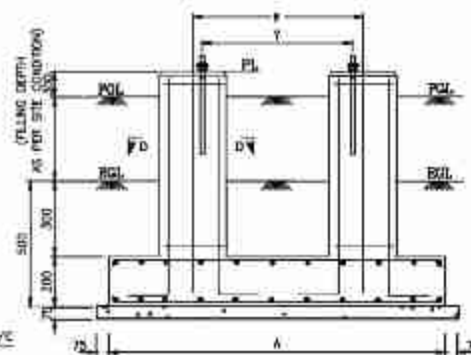
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PROJECT

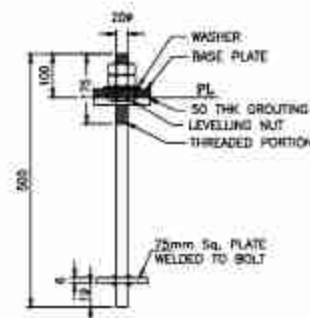
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AS	NTS	REC/ RDSS /33/11kV PSS/08	1 OF 1	0



SECTION A-A

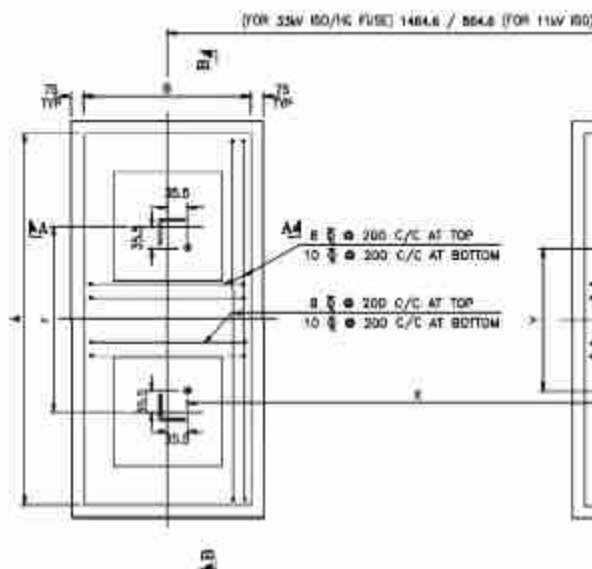


SECTION B-B

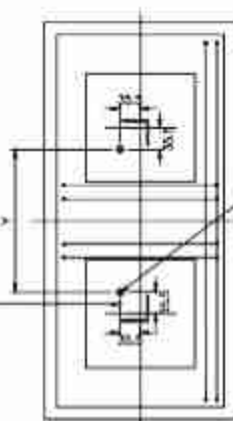


FOUNDATION BOLT DETAIL

EQUIPMENT TYPE	FOUNDATION DIMENSIONS				
	A	B	F	S	T
33KV ISO	1500	600	474.6	1383.6	403.6
33KV HGF	1300	800	564.8	1363.6	483.6
11KV ISO	1400	600	386.6	763.6	315.6



FOUNDATION PLAN



SECTION D-D

NOTES:-

1. ALL DIMENSIONS ARE IN MM, & ELEVATIONS ARE IN METRE UNLESS OTHERWISE MENTIONED.
2. ALL STRUCTURAL CONC. SHALL BE 1:1.5:3 (1 CEMENT : 1.5 COARSE SAND : 3 GRADED STONE AGGREGATE OF 20MM NOMINAL SIZE)
3. ALL LEAN CONC SHALL BE 75MM THK AND OF GRADE 1:4:8 (1 CEMENT : 4 COARSE SAND : 8 GRADED STONE AGGREGATE OF 40 MM NOMINAL SIZE)
4. ALL REINFORCEMENT STEEL BARS (DENOTED AS D) SHALL CONFORM TO IS 1786-1985 OF GRADE  $\Phi$  4/5 OR TMT BARS OF EQUIV. GRADE.
5. UNLESS NOTED OTHERWISE LAP/ANCHOR LENGTH SHALL BE 33 TIMES THE BAR SIZE.
6. CLEAR COVER TO MAIN REINF. SHALL BE 50MM.
7. FOR LOCATIONS OF EQPT FORD REFER LAYOUTS OF RESPECTIVE SUBSTATIONS.
8. ALL FOUNDATIONS SHALL REST MIN. 500 MM BELOW VIRGIN SOIL.
9. NET SBC OF SOIL = 8 T/SQM.
10. FGL DENOTES FINISHED GROUND LEVEL.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

FOUNDATION DETAILS OF 33KV ISO,HG FUSE AND 11KV ISO

SIZE

SCALE

DRG. NO.

REC/ RDSS /33/11kv PSS/10

DATE

REV. NO.

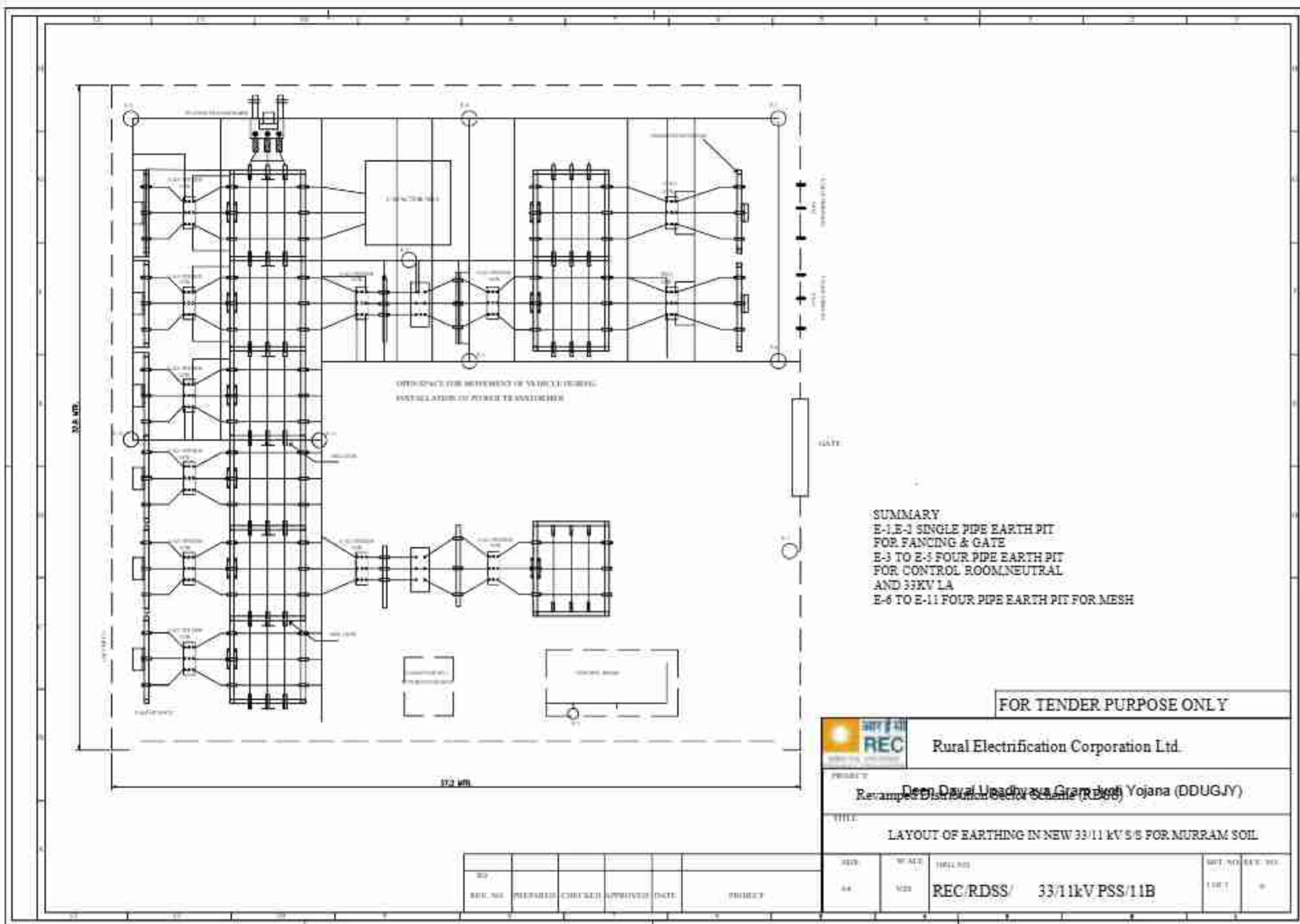
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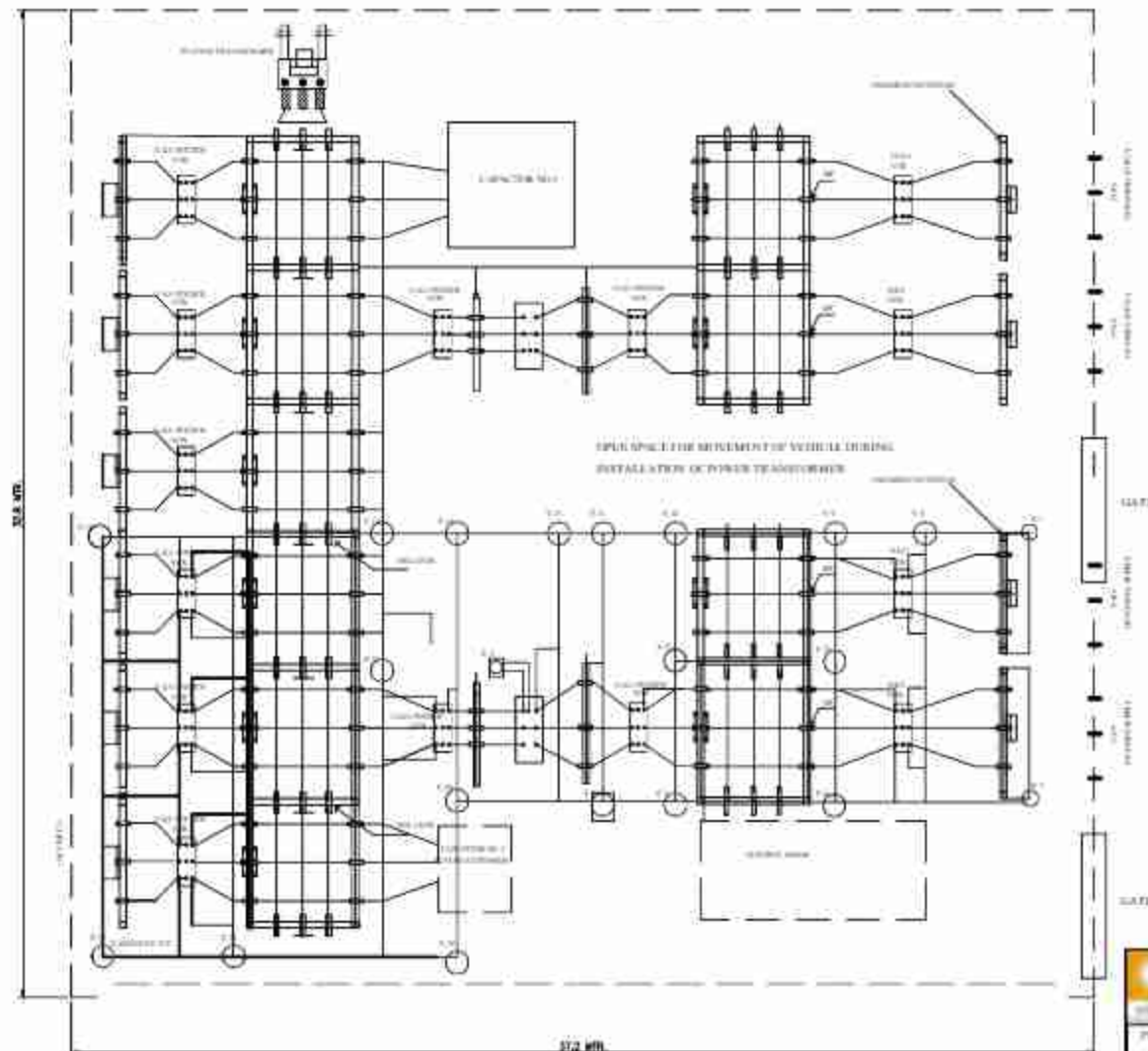
NO	REV.	NO	PREPARED	CHECKED	APPROVED	DATE

PROJECT









**SUMMARY**  
 E-1 TO E-3: 3 NOS. BORE EARTHING 60 MTR DEPTH  
 & 150 MM/GI PIPE OF B CLASS  
 (1 FOR PTR NEUTRAL, 1 FOR MESH & 1 FOR LA)  
 E-4 TO E-23: 10 NOS. CHEM ROD EARTHING FOR MESH

FOR TENDER PURPOSE ONLY



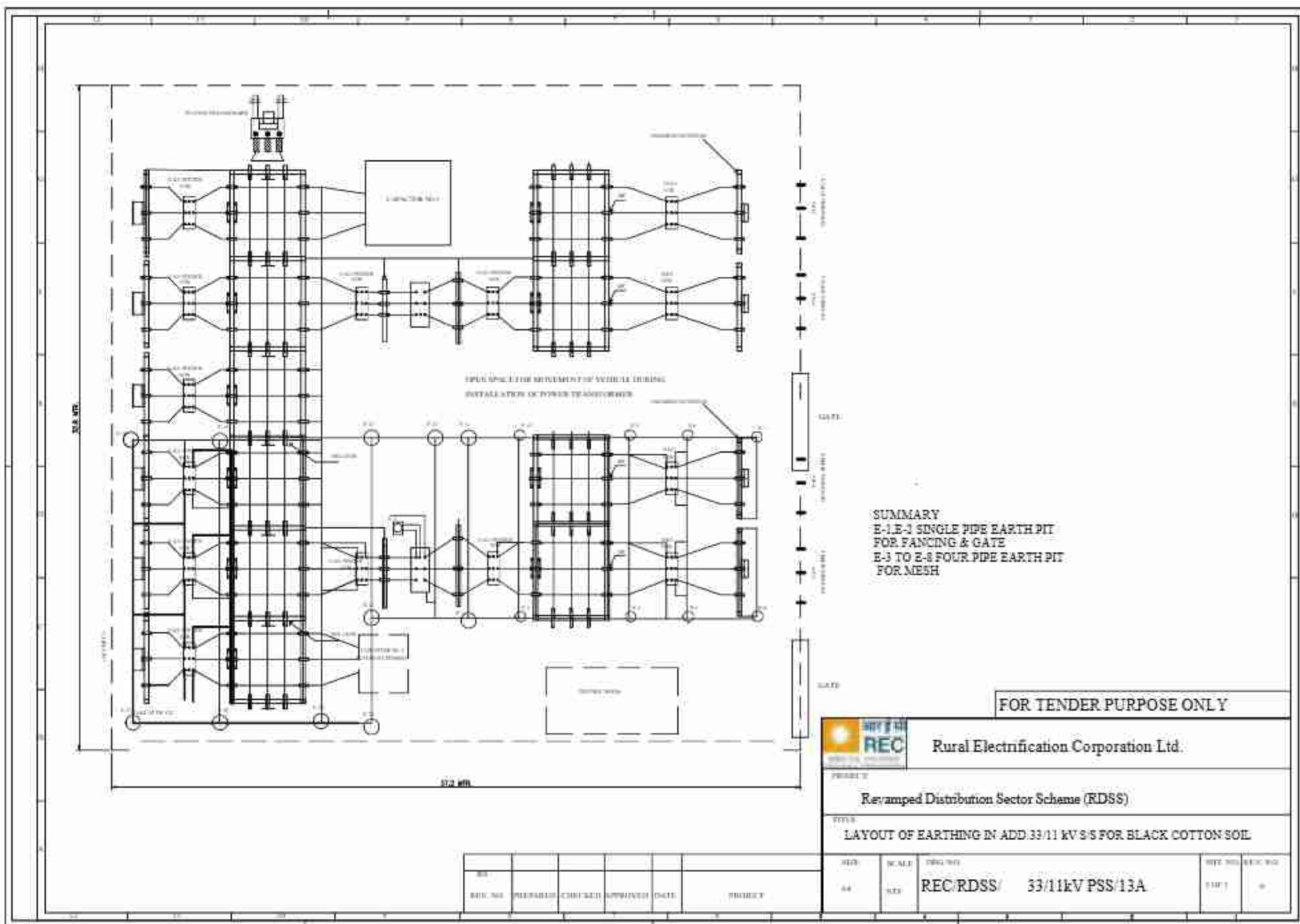
Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

LAYOUT OF EARTHING IN ADD 33/11 kV S/S FOR HARD ROCK

REV.	PREPARED BY	CHECKED BY	APPROVED BY	DATE	PROJECT
01					

REV.	DATE	DESCRIPTION	REV. NO.	REV. BY	REV. DATE
01	01/01/2023	REC RDSS / 33/11kV PSS /12A	1/1		



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

Re/amped Distribution Sector Scheme (RDSS)

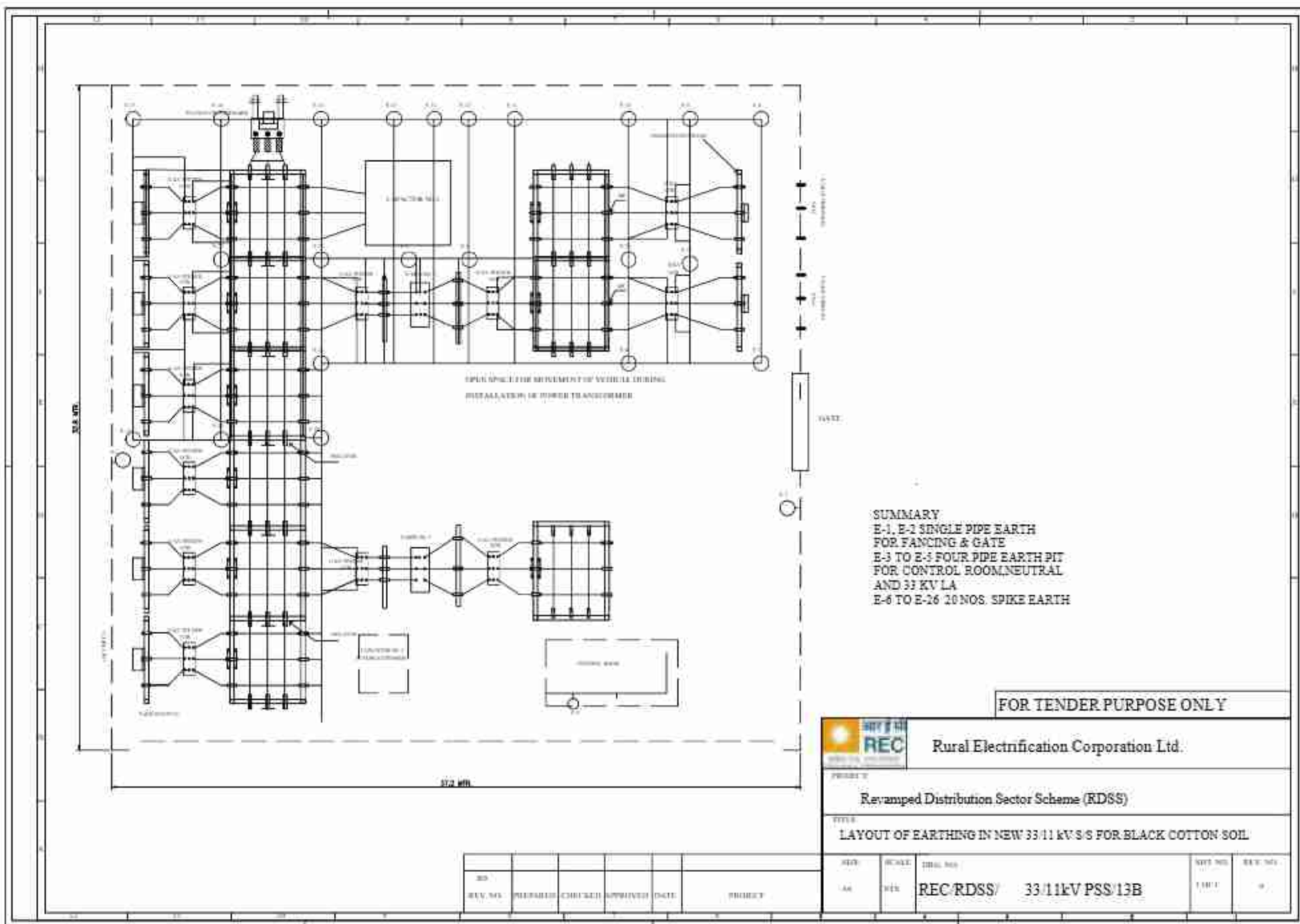
LAYOUT OF EARTHING IN ADD. 33/11 KV S/S FOR BLACK COTTON SOIL

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
001					

REV.	SCALE	DATE	BY	CHKD.	DATE	BY	CHKD.
01	1:1						

REC/RDSS/ 33/11KV PSS/13A





SUMMARY  
 E-1, E-2 SINGLE PIPE EARTH  
 FOR FENCING & GATE  
 E-3 TO E-5 FOUR PIPE EARTH PIT  
 FOR CONTROL ROOM, NEUTRAL  
 AND 33 KV LA  
 E-6 TO E-26 20 NOS. SPIKE EARTH

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

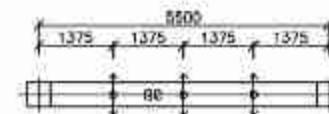
Revised Distribution Sector Scheme (RDSS)

LAYOUT OF EARTHING IN NEW 33/11 kV S/S FOR BLACK COTTON SOIL

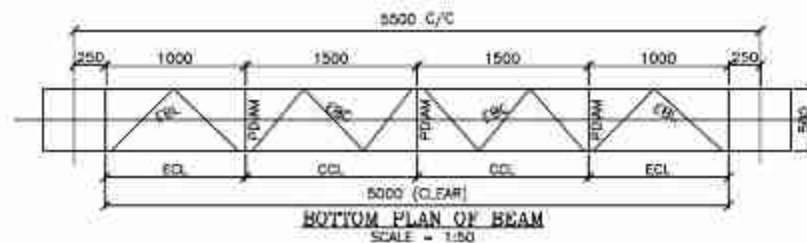
REV.	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01						

REV.	SCALE	DRAWN	DATE	REV. NO.	REV. DATE
01	1:100	REC/RDSS/	33/11kV PSS/13B	1	01/01/2017

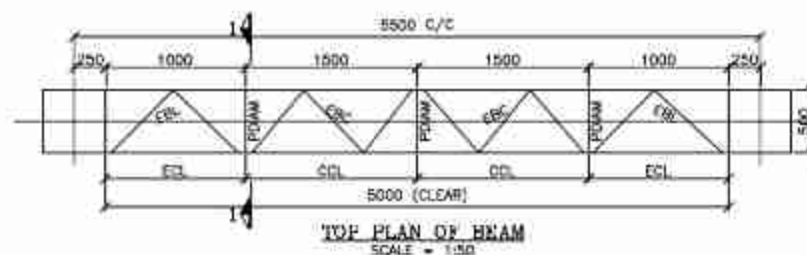
BEAM MID	ANGLE SIZE & NO. OF BOLTS	FTL	CTL	HL	FBL	VTAM	PHL	PFL	RT/PT/PRAM	DRAM/PT
Q2	ANGLE SIZE	L40X400	L40X400	L40X400	L40X400	2L40X400 RB	L40X400	L40X400	L40X400	L40X400
DRAM	NO. OF BOLTS	205-6 TH PLT	205-6 TH PLT	10	10	60	10	60	10	10



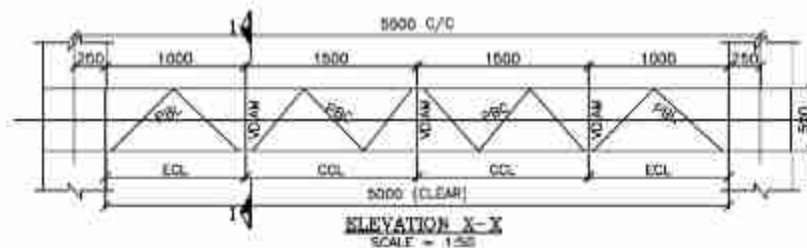
KEY PLAN



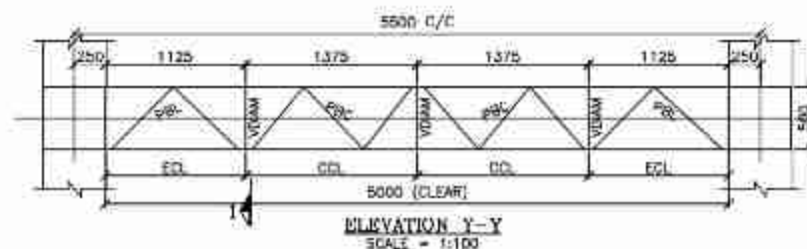
BOTTOM PLAN OF BEAM  
SCALE = 1:50



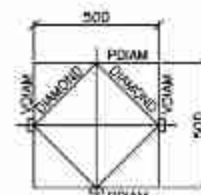
TOP PLAN OF BEAM  
SCALE = 1:50



ELEVATION X-X  
SCALE = 1:50



ELEVATION Y-Y  
SCALE = 1:100



SECTION 1-1  
SCALE = 1:25

#### NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. SPAN OF GIRDER - 5.0M (C/C)
3. SPAN OF GIRDER - 5.0M (CLEAR)
4. CROSS SECTION OF GIRDER - L40X400

#### GENERAL NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL UNNOTED NUMBER ARE IN 1:40X400.
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES.
4. ALL DIMENSIONS ARE CENTER LINE DIMENSIONS UNLESS NOTED OTHERWISE.
5. ALL CORNERS SHALL BE R400 DIA. ROLL OF CLASS 1.6.
6. ALL STEEL ITEMS, BOLTS, NUTS & WASHERS SHALL BE HOT DIP GALVANIZED.
7. THE WT. OF THE ZINC COATING SHALL BE AT LEAST 150g/m<sup>2</sup> FOR BOLTS & FOR STRUCTURAL MEMBERS.

FOR TENDER PURPOSE ONLY



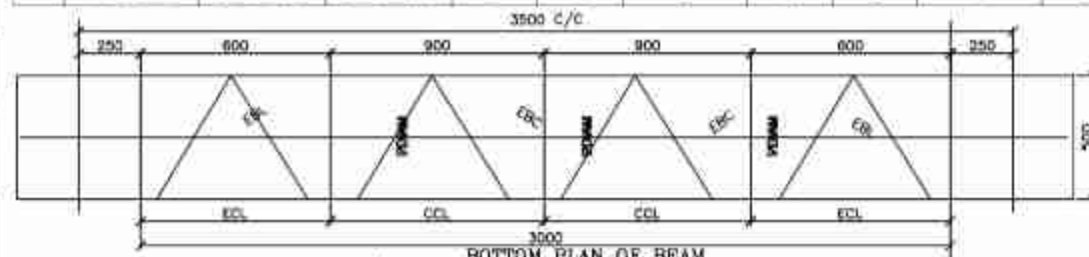
Rural Electrification Corporation Ltd.

Re-vamped Distribution Sector Scheme (RDSS)

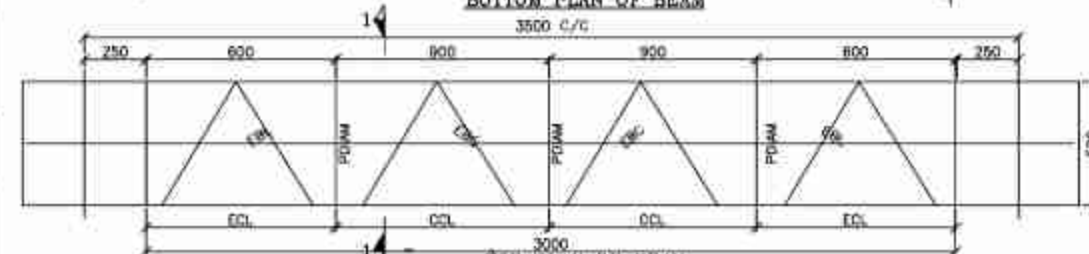
33kV BEAM STRUCTURE

REV.	REASON	DATE	BY	CHKD.
A3	NTS	REC-RDSS/33/11kV PSS/14A	1/1/1	0

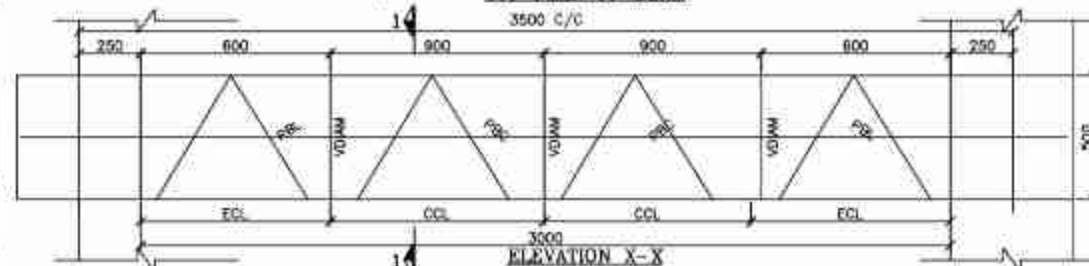
BEAM MATERIAL	ANGLE SIZE & NO. OF BOLTS	ACL	CC1	EC1	EC2	VRAM	PR1	PR2	PRAM	DIAMOND
CL	ANGLE SIZE	130X3056	130X3056	140X4037	140X4037	2140X4037 PW	140X4037	140X4037	130X3056	140X4037
ORAV	NO. OF BOLTS	205-6 TH. PLT	205-6 TH. PLT	02	02	02	02	02	02	02



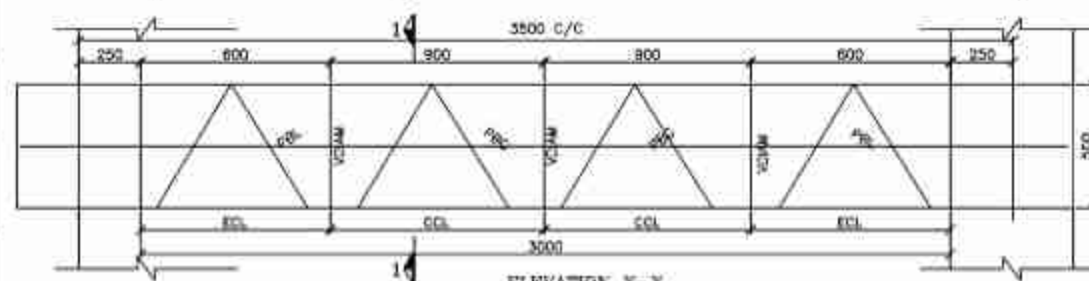
BOTTOM PLAN OF BEAM



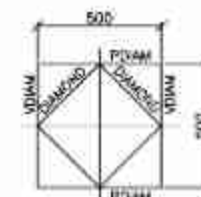
TOP PLAN OF BEAM



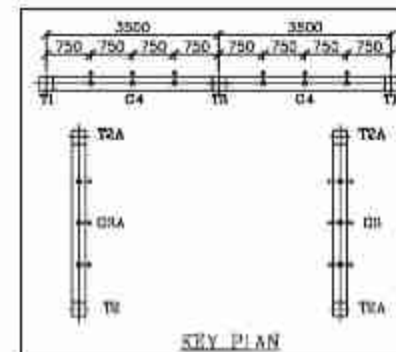
ELEVATION X-X



ELEVATION Y-Y



SECTION 1-1  
SCALE = 1:25



#### NOTES:

1. HIGHLIGHT -
2. SPAN OF GIRDER - 5.0M (C/C)
3. SPAN OF GIRDER - 5.0M (CLEAR)
4. CROSS SECTION OF GIRDER - 500X500

#### GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM (UNO)
2. ALL UNNOTED MEMBER ARE ISA 140X4037
3. ALL ANGLE SECTIONS USED ARE EQUAL ANGLES
4. ALL DIMENSIONS ARE CENTER LINE DIMENSIONS (UNO)
5. ALL CONNECTION BOLT SHALL BE 16MM DIA. BOLT OF CLASS 4.6
6. ALL STEEL (TEMB, BOLTS, NUTS & WASHERS) SHALL BE HOT DIP GALVANIZED
7. THE WT. OF THE ZINC COATING SHALL BE AT LEAST 850g/m<sup>2</sup> FOR BOLTS & FOR STRUCTURAL MEMBER

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Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

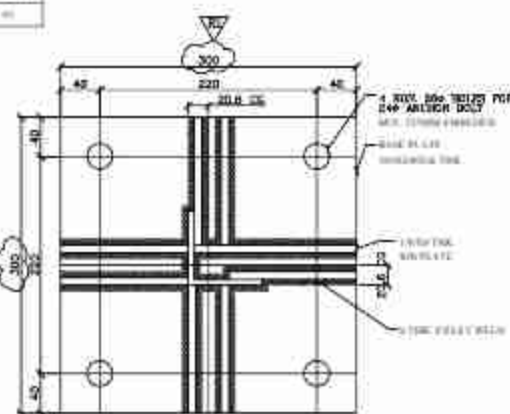
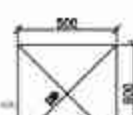
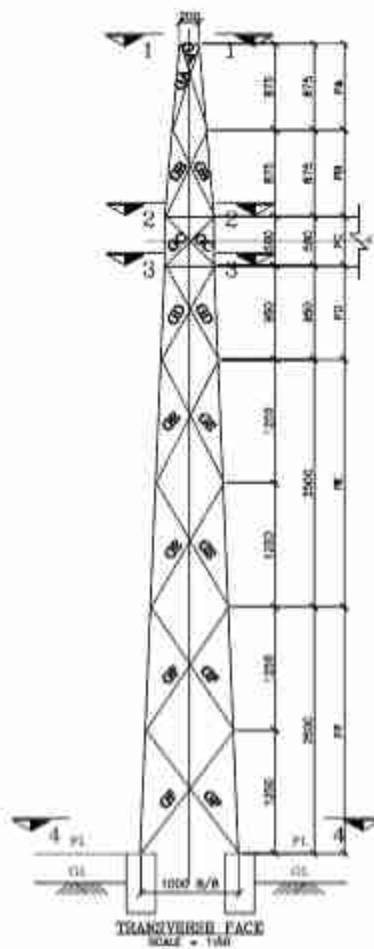
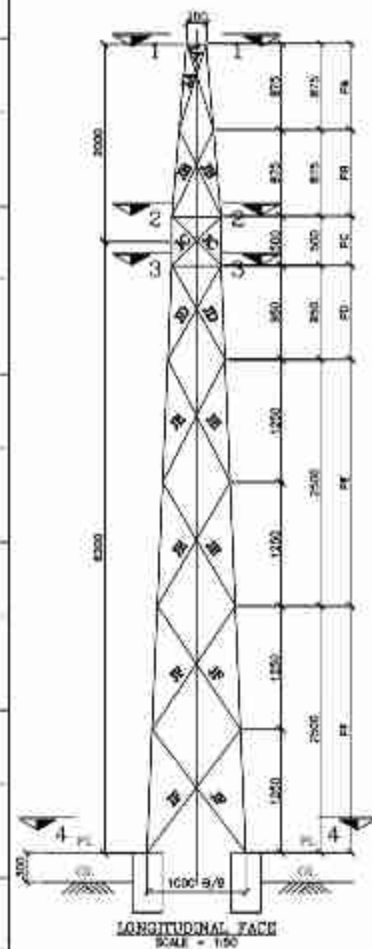
11kV BEAM STRUCTURE

SIZE	SCALE	THESE NO.	REV. NO.	REV. NO.
A3	NTS	REC/RDSS/33/11kV PSS/14B	1 OF 1	0

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
001					

FORMER MATERIAL	1. 40x40x4.0 S. RAILWAY BOLTS	2. 40x40x4.0	3. 40x40x4.0	4. 40x40x4.0	5. 40x40x4.0	6. 40x40x4.0	7. 40x40x4.0	8. 40x40x4.0	9. 40x40x4.0	10. 40x40x4.0	11. 40x40x4.0	12. 40x40x4.0
1.1	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0
2.1	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0

FORMER MATERIAL	1. 40x40x4.0 S. RAILWAY BOLTS	2. 40x40x4.0	3. 40x40x4.0	4. 40x40x4.0	5. 40x40x4.0	6. 40x40x4.0	7. 40x40x4.0	8. 40x40x4.0	9. 40x40x4.0	10. 40x40x4.0	11. 40x40x4.0	12. 40x40x4.0
1.1	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0
2.1	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0	40x40x4.0



#### LEGEND:

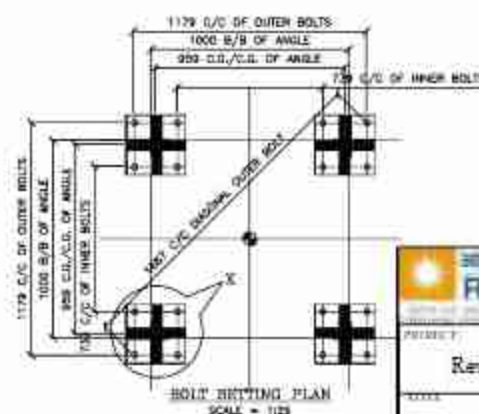
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3. 40x40x4.0 S. RAILWAY BOLTS  
4. 40x40x4.0 S. RAILWAY BOLTS  
5. 40x40x4.0 S. RAILWAY BOLTS  
6. 40x40x4.0 S. RAILWAY BOLTS  
7. 40x40x4.0 S. RAILWAY BOLTS  
8. 40x40x4.0 S. RAILWAY BOLTS  
9. 40x40x4.0 S. RAILWAY BOLTS  
10. 40x40x4.0 S. RAILWAY BOLTS  
11. 40x40x4.0 S. RAILWAY BOLTS  
12. 40x40x4.0 S. RAILWAY BOLTS

#### HIGHLIGHT:

1. 40x40x4.0 S. RAILWAY BOLTS  
2. 40x40x4.0 S. RAILWAY BOLTS  
3. 40x40x4.0 S. RAILWAY BOLTS  
4. 40x40x4.0 S. RAILWAY BOLTS  
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8. 40x40x4.0 S. RAILWAY BOLTS  
9. 40x40x4.0 S. RAILWAY BOLTS  
10. 40x40x4.0 S. RAILWAY BOLTS  
11. 40x40x4.0 S. RAILWAY BOLTS  
12. 40x40x4.0 S. RAILWAY BOLTS

#### GENERAL NOTES:

1. 40x40x4.0 S. RAILWAY BOLTS
2. 40x40x4.0 S. RAILWAY BOLTS
3. 40x40x4.0 S. RAILWAY BOLTS
4. 40x40x4.0 S. RAILWAY BOLTS
5. 40x40x4.0 S. RAILWAY BOLTS
6. 40x40x4.0 S. RAILWAY BOLTS
7. 40x40x4.0 S. RAILWAY BOLTS
8. 40x40x4.0 S. RAILWAY BOLTS
9. 40x40x4.0 S. RAILWAY BOLTS
10. 40x40x4.0 S. RAILWAY BOLTS
11. 40x40x4.0 S. RAILWAY BOLTS
12. 40x40x4.0 S. RAILWAY BOLTS



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Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

33kV TOWER STRUCTURE MARKED "T1"

NO.	REVISION	DATE	BY	CHKD	APPD
01					

NO.	REVISION	DATE	BY	CHKD	APPD
A3	NTS				

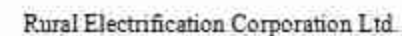






1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. CAMBER OF 1:50 SHALL BE PROVIDED.
3. EXPANSION JOINT (12mm THICK) SHALL BE PROVIDED AT EVERY 3.0M.  
EXPANSION JOINT SHALL ALSO BE PROVIDED AT CENTRE.
4. POLYTHENE SHEET OF 125 MICRONS SHALL BE PLACED BETWEEN THE PCC AND RCC SLAB.(TOP S.SAB)
5. 120mm DIA RCC HUME PIPE (NP-3) SHALL BE PLACED ACROSS THE ROAD AT EVERY 100M INTERVAL  
ALONG THE ROAD OR SUITABLY LOCATED BY ENGINEER-IN-CHARGE.
6. FINISHED TOP OF THE ROAD CREST SHALL BE 175mm ABOVE F.G.L
7. THE REQUIRED LENGTH OF DRAIN SHALL BE AS PER SITE REQUIREMENT.
8. LONGITUDINAL SLOPE SHALL BE PROVIDED 1:50

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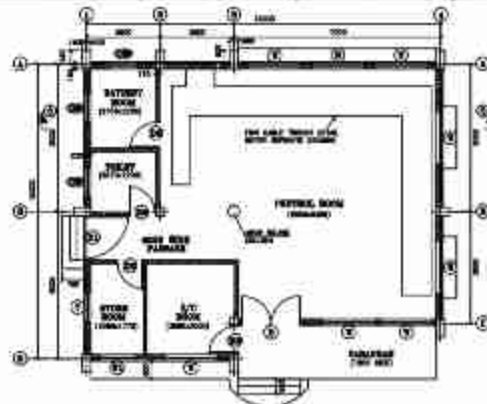


Revamped Distribution Sector Scheme (RDSS)

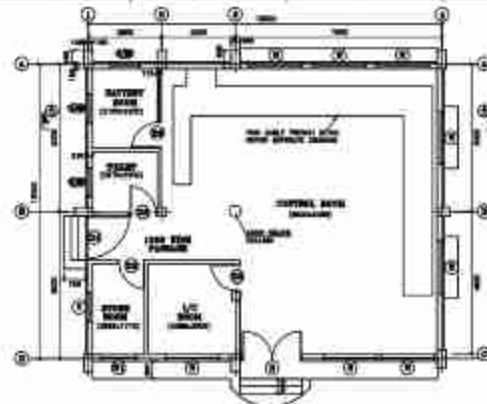
### DETAILS OF RCC ROAD AND DRAIN

III	PREPARED	CHECKED	APPROVED	DATE	PROJECT	SIZE	SCALE	DESIGN NO.	REV. NO.	REV. DATE
REC. NO.						A3	NTS	REC/ RDSS/33/11kV PSS/17	1 (26)	0

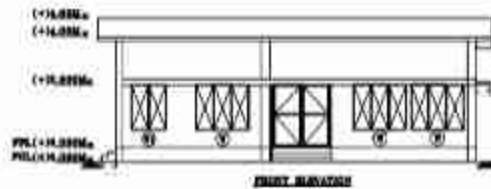




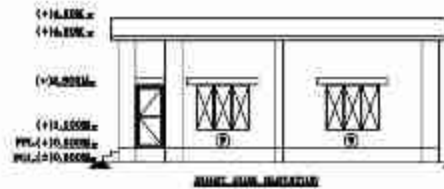
FIRST FLOOR PLAN FOR PAPER



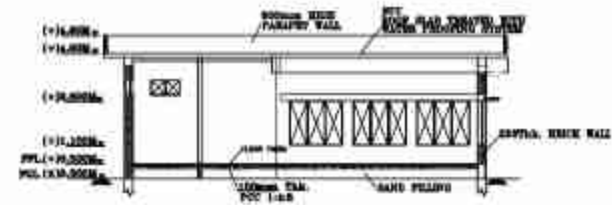
FIRST FLOOR PLAN FOR PAPER



FIRST FLOOR ELEVATION



FIRST FLOOR ELEVATION



FIRST FLOOR ELEVATION

# FINISHING SCHEDULE

## DESCRIPTION

BUILDING NAME	AREA DESCRIPTION	FLOORING		SKIRTING (150MM W.C.)		DADO		WALLS (INTERNAL)		CEILING		WALLS (EXTERNAL)	
		ITEM	QTY	ITEM	QTY	ITEM	QTY	ITEM	QTY	ITEM	QTY	ITEM	QTY
CONTROL ROOM BUILDING	1. CONTROL ROOM	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00
	2. BATTERY ROOM	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00
	3. STORAGE ROOM	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00
	4. STORE ROOM	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00
	5. TOILET	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00	CEMENT PLASTER 1:3:6	1.00

SL. NO.	ITEM	QTY	UNIT	REMARKS
1.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR CONTROL ROOM
2.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR BATTERY ROOM
3.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR STORAGE ROOM
4.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR STORE ROOM
5.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR TOILET

SL. NO.	ITEM	QTY	UNIT	REMARKS
1.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR CONTROL ROOM
2.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR BATTERY ROOM
3.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR STORAGE ROOM
4.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR STORE ROOM
5.	CEMENT PLASTER 1:3:6	1.00	M <sup>2</sup>	FOR TOILET

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Rural Electrification Corporation Ltd.

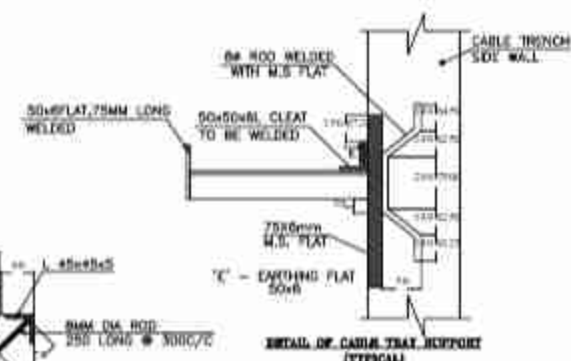
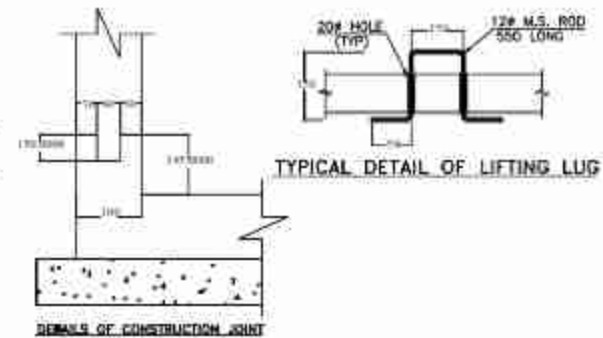
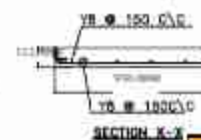
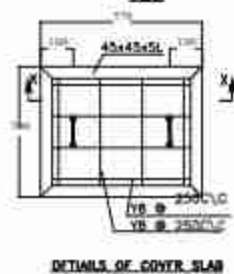
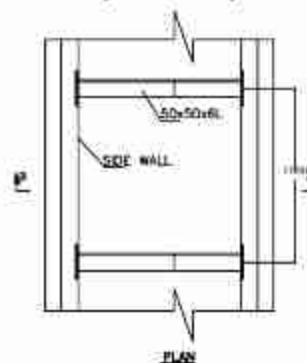
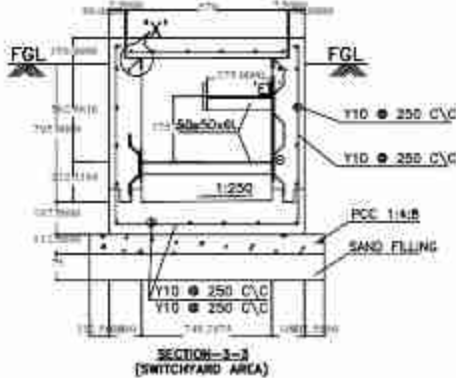
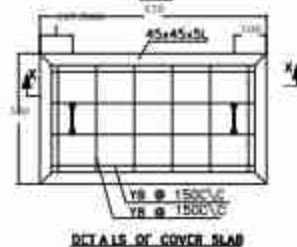
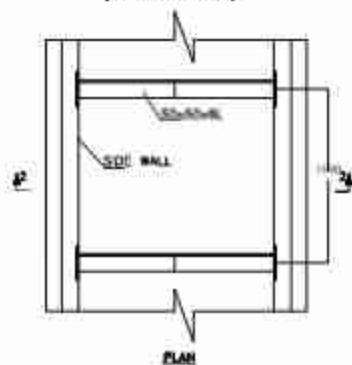
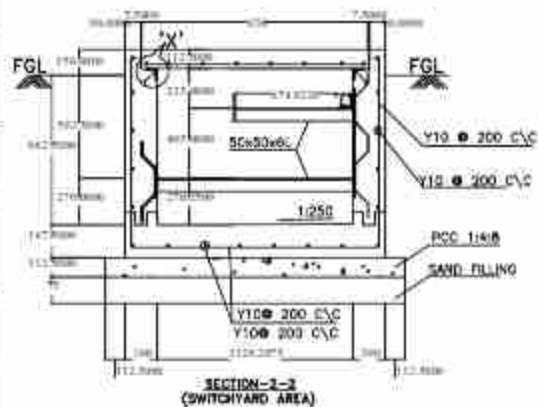
Revamped Distribution Sector Scheme (RDSS)

G.A. OF CONTROL BUILDING

NO.	REMARKS	DATE
1.	APPROVED	10/10/2018
2.	APPROVED	10/10/2018
3.	APPROVED	10/10/2018

NO.	REMARKS	DATE
1.	APPROVED	10/10/2018
2.	APPROVED	10/10/2018
3.	APPROVED	10/10/2018





- NOTES:-
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
  2. ALL REINFORCEMENT SHALL BE OF GRADE Fe415 CONFORMING TO IS 1786.
  3. CONCRETE MIX SHALL BE M20
  4. CLEAR COVER FOR REINFORCEMENT  
SIDE WALL = 50mm  
BOTTOM SLAB ON EARTH FACE = 50mm
  5. LAP/DEVELOPMENT LENGTH SHALL BE 40 TIMES THE DIA OF MAIN REINFORCEMENT.

FOR TENDER PURPOSE ONLY

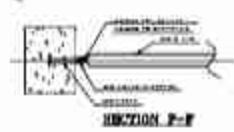
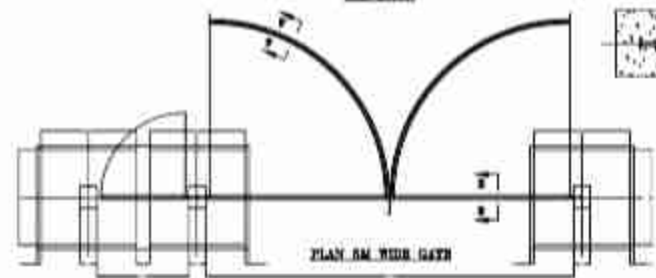
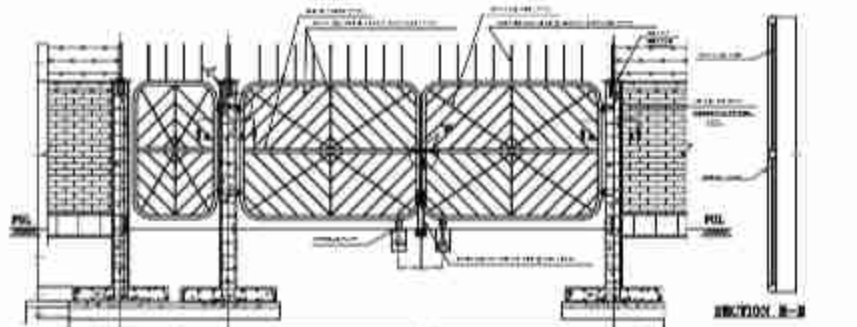
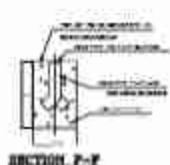
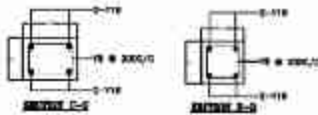
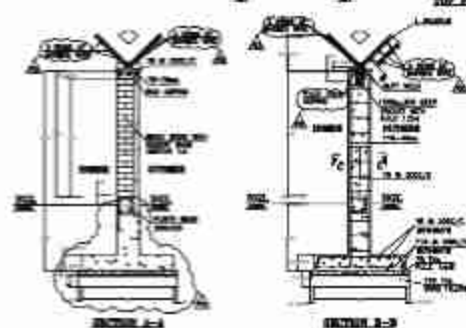
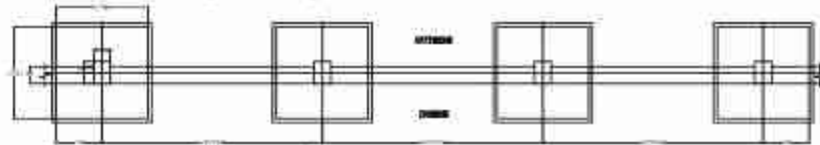
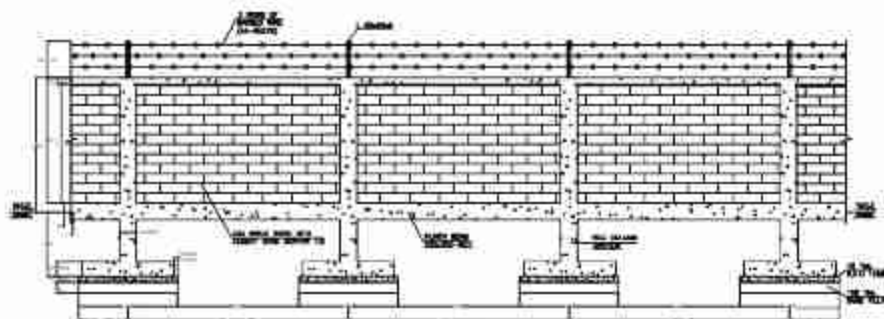


Rural Electrification Corporation Ltd.

Re-vamped Distribution Sector Scheme (RDSS)

TITLE DETAILS OF CABLE TRENCHES  
(SWITCHYARD AREA)

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT	REV.	SCALE	FILE NO.	DATE	REV.	DATE
A3	NTS							REC/RDSS/33/11kV PSS/19B	1 OF 1	0	



# **NOTES:**

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. REINFORCEMENT SHALL BE HYSD BAR AS PER IS.
3. CLEAR COVER
4. FOR COLUMN - 40mm
5. FOR PILLAR BEAM - 25mm
6. FOR FOUNDATION - 50mm
7. CEMENT MORTAR SHALL BE USED TO FINISH MASONRY WORK.
8. PLASTER SHALL BE 13mm thick inside & 15mm thick outside with coarse medium sand.
9. EXPANSION JOINT SHALL BE PROVIDED AT EVERY 10M.
10. WALL SHALL BE PAINTED WITH MINIMUM TWO COATS OF COLOUR WASH OVER A PRIME COAT OF WHITE WASH WITH LIME.
11. THE GATE FRAME SHALL BE MADE OF MEDIUM DUTY M.S. PIPE CONFORMING TO IS 1181 WITH WELDED JOINTS.
12. THE GATE FRAMES SHALL BE PAINTED WITH ONE COAT OF STEEL PRIMER AND TWO COAT OF ENAMEL CHALK PAINT.
13. ALL WELDED JOINTS SHALL BE CONFORMING TO IS 1181.

REV.	NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01						

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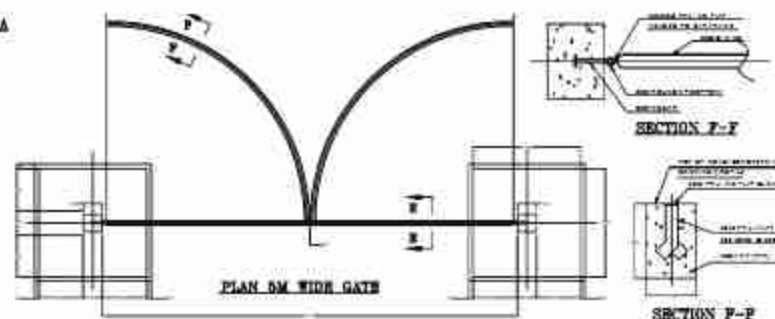
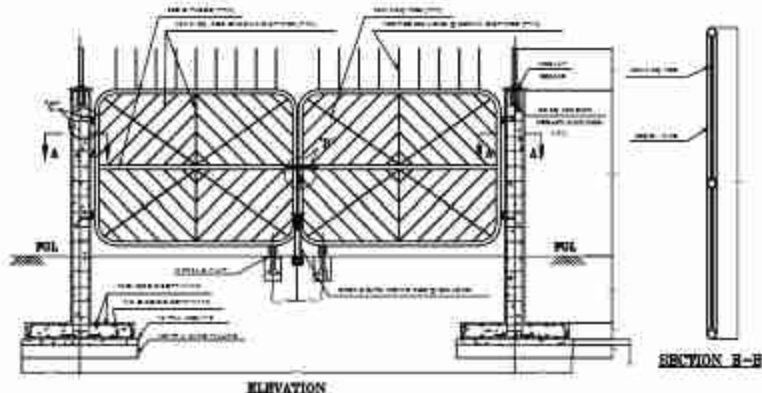
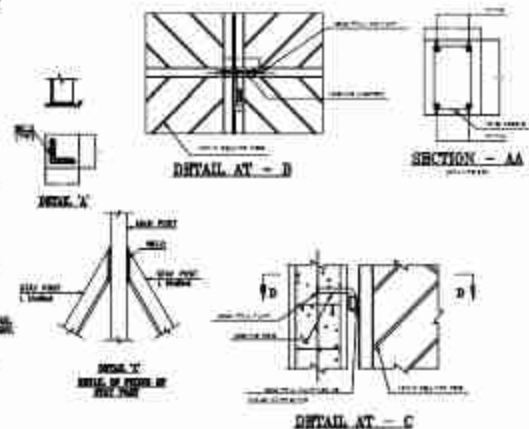
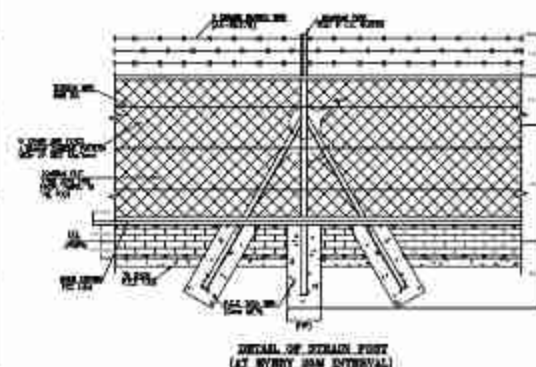
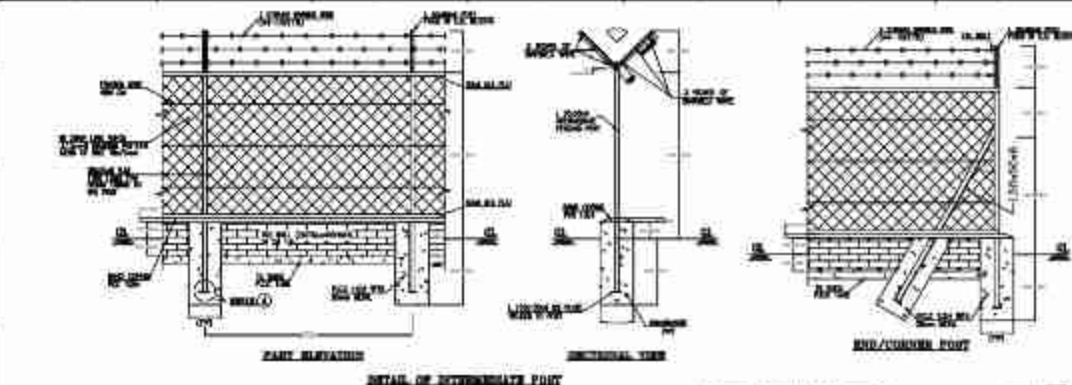
Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

DETAIL OF BOUNDARY WALL FOR SWITCHYARD WITH ENTRANCE GATE

REV.	SCALE	DRG. NO.	SHEET NO.	SHEET TOTAL
A3	NTS	REC/RDSS/33/11kV PSS/20A	1 OF 1	0





#### NOTES:-

1. ALL STRUCTURAL STEEL SHALL BE CONFORM TO IS:2062 AND SHALL BE PAINTED WITH A COAT OF STEEL PRIMER AND TWO COATS OF SYNTHETIC ENAMEL PAINT.
2. CHAIN LINK MESH SHALL BE AS PER IS:2721, MESH SIZE 75mm AND NOMINAL WIRE SIZE SHALL BE 3.15mm DIAMETER AND SHALL BE GALVANIZED.
3. BARRED WIRE SHALL BE DESIGNATED AS A-4 (IS:278) AND SHALL BE GALVANIZED.
4. FABRIC SHALL BE SECURED TO TENSION WIRES (THREE Nos. SPACED AT 500MM) WITH TIE WIRES AT 400MM INTERVAL. THE TENSION WIRE SHALL BE SINGLE STRAND HIGH TENSILE GALVANIZED STEEL WIRE AND 4mm DIAMETER. THE TIE WIRE WIRE SHALL BE GIVEN NOT LESS THAN TWO TWISTS.
5. L BOWDASH SHALL BE USED FOR INTERMEDIATE AND STAY POSTS. L BOWDASH SHALL BE USED FOR STRAINING POST.
6. INTERMEDIATE POSTS SHALL BE SPACED 25m APART MEASURED PARALLEL TO GROUND SURFACE. STRAINING POSTS SHALL BE INSTALLED AT EQUAL INTERVALS NOT EXCEEDING 25m.
7. BOTTOM AND TOP OF THE FENCE FABRIC SHALL BE FIXED WITH 80mm M.S. PLATE. FENCE FABRIC SHALL BE Laid OUT WITH BARRED EDGE ON TOP, STRETCHED TIGHTLY AND SHALL BE FASTENED TO INTERMEDIATE POST, GATE AND STRAINING POST WITH 80mm M.S. PLATE ALL THROUGH ITS LENGTH.
8. ALL EXPOSED SURFACE OF BRICK TOE WALL SHALL BE PROVIDED WITH 12 TN, 1:4 CM PLASTER AND COATED WITH TWO COATS OF COLOUR WASH WITH A BASE COAT OF WHITE WASH WITH LINE.
9. ALL WELDS ARE 4mm THK. CONTINUOUS FILLET WELDS UNLESS OTHERWISE SPECIFIED.
10. ALL CORNER POST AND EVERY TENTH POST WILL HAVE TWO STAY POST AND END POST SHALL HAVE ONE TRANSVERSE STAY POST.
11. THE GATE FRAME SHALL BE MADE OF MEDIUM DUTY M.S. PIPE CONFORMING TO IS: 1181 WITH WELDED JOINTS.
12. THE GATE FRAMES SHALL BE PAINTED WITH ONE COAT OF STEEL PRIMER AND TWO COAT OF SYNTHETIC ENAMEL PAINT.
13. ALL WELDED JOINTS SHALL BE CONFORMING TO IS:813.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

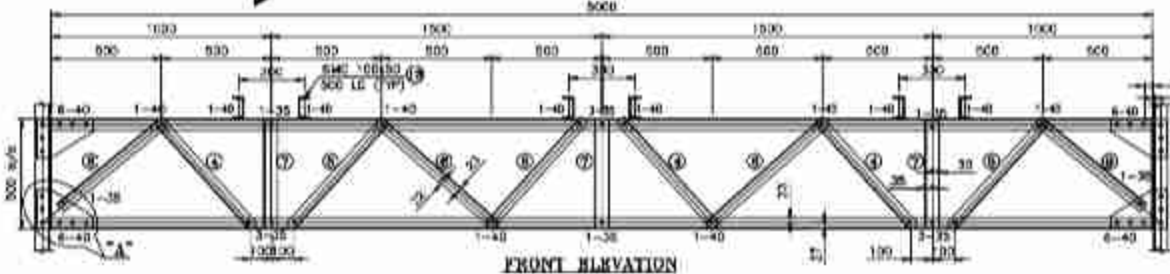
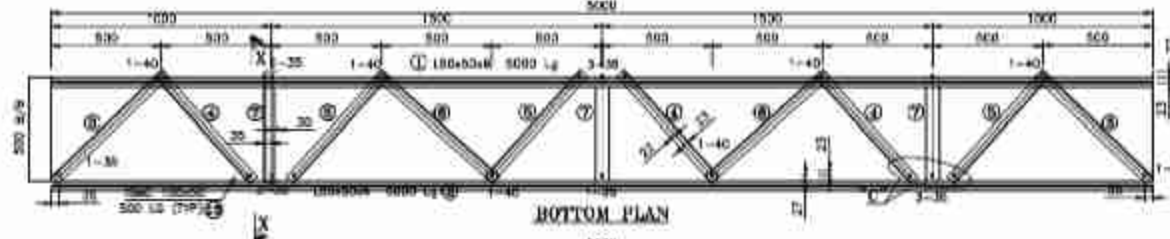
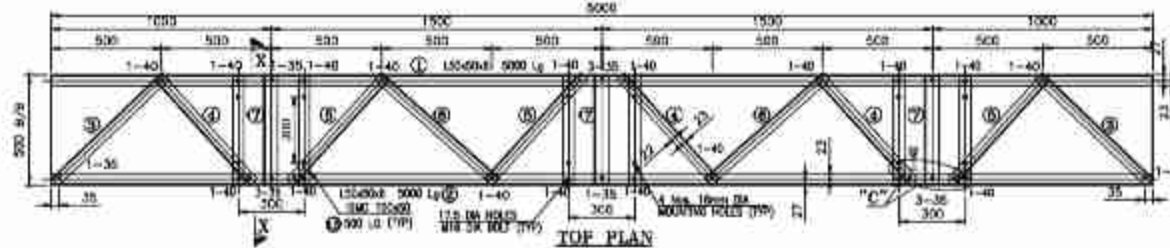
Revamped Distribution Sector Scheme (RDSS)

DETAIL OF FENCING FOR SWITCHYARD WITH GATE ARRANGEMENT

BOX	WALL	DRILL HOLE	DATE	REVISION
A3	NTS	REC/RDSS/33/11kV PSS/20B	(OF 1)	0

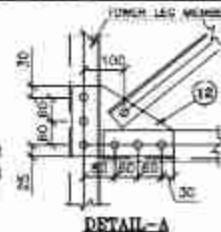
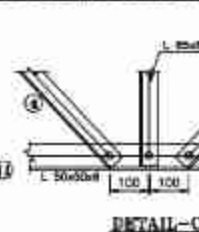
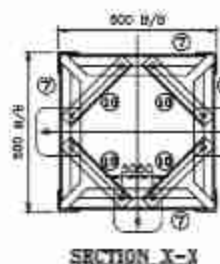
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT





PROTO ASSEMBLY SHOULD BE MADE BEFORE WELD FABRICATION

ACTUAL LENGTH OF MEMBER SHOULD BE DECIDED BASED ON FULL SCALE LAYOUT AT FACTORY



BILL OF MATERIAL						
MEMO NO	SECTION	QTY.	LENGTH mm	WTH mm	UNIT WT. Kg/20	TOTAL WT IN Kg
1	L 50x50x8Thk	3	5000	-	4.50	45.00
2	L 50x50x8Thk	2	5000	-	4.50	45.00
3	L 40x40x8Thk	4	884	-	3.40	9.44
4	L 40x40x8Thk	12	648	-	3.40	28.45
5	L 40x40x8Thk	12	648	-	3.40	26.16
6	L 40x40x8Thk	8	720	-	3.40	13.58
7	L 80x80x8Thk	12	488	-	5.80	34.53
8	L 40x40x8Thk	3	621	-	3.40	4.22
9	L 40x40x8Thk	2	621	-	3.40	4.22
10	L 40x40x8Thk	12	275	-	3.40	11.22
11	STRAN PLT. 8 TH	8	180	150	82.80	11.87
12	SPLT. 8 TH	8	255	175	62.80	22.42
13	PLATE 100x50	8	500	-	9.88	28.65
TOTAL WEIGHT						289.14
BOLTS & NUTS						
M16x45.0. BOLTS & NUTS		55			0.124	6.82
M16x45.0. BOLTS & NUTS		80			0.132	11.58
16x45.0. SPRING WASHERS		145			0.008	1.31
TOTAL WEIGHT OF BOLTS & NUTS						20.01

WEIGHT OF STRUCTURAL STEEL	=	289.14
WEIGHT OF BOLT/NUTS	=	20.01
TOTAL WEIGHT OF STRUCTURAL STEEL	=	309.15

MAKE BOLTS REQUIRED ONLY FOR = 3 Nos.

#### NOTES

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. BOLT SYMBOLS 16# C = 17.5# HOLES
3. ALL ERECTION MARKS ARE TO BE PREFIXED WITH "E1".
4. 3.5mm SPRING WASHER TO BE SUPPLIED WITH EVERY BOLT
5. ALL CONNECTION BOLTS SHALL BE OF 16mm & CONFORMING TO IS 12427 OF PROPERTY CLASS 5.8 CONFORMING TO IS 1367 (PART-6).
6. WELD STEEL SHALL CONFORM TO GRADE A572 (10) OF IS 2002
7. MINIMUM EDGE SECURITY FOR 16# BOLT SHALL BE 25mm FROM CUT EDGE
8. ALL UNNOTED MEMBERS ARE 140x45x5 WITH 23 BW
9. UNNOTED SUBSETS ARE 8mm THICK
10. PLAIN WASHERS SHALL BE AS PER IS 2018 & SPRING WASHER SHALL BE AS PER IS 3063.
11. ALL NUTS SHALL CONFORM TO IS 12427
12. GALVANISING SHALL CONFORM TO IS 2629-1955 & IS 4759-1998.
13. BRACING ANGLES SHALL BE SUITABLY CHAMFERED WHEREVER NECESSARY.
14. FABRICATOR TO DETERMINE THE REQUIREMENT OF CHAMFERING THE ENDS OF MEMBERS BY LAYING OUT THE STRUCTURE TO FULL SCALE ON THE SHOP FLOOR, BEFORE FABRICATION AND GALVANIZING.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Recamped Distribution Sector Scheme (RDSS)

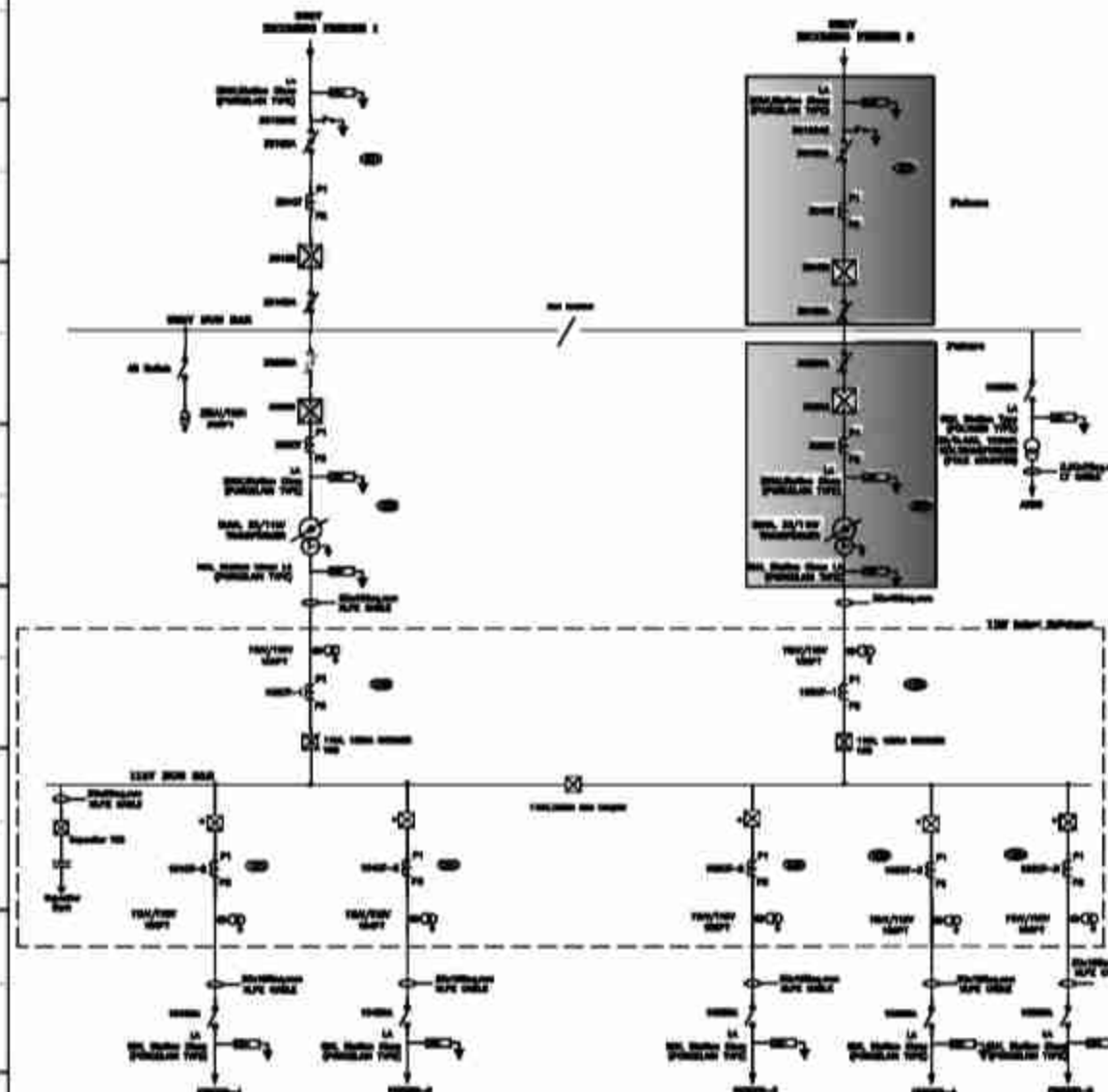
TITLE

DETAILS OF GIRDER TYPE "G2"

RD					
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHEET NO.	REV. NO.
A3	NTS	REC/ RDSS /33/11kV PSS/21	1 OF 1	0





BILL OF QUANTITY - 33KV		
SL. NO.	ITEM DESCRIPTION	QTY
1.	33KV/11KV TRANSFORMER	1 NO.
2.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.
3.	33KV/11KV, 0.4/11KV SURGE ARRESTER	1 NOS.
4.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.
5.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.
6.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.
7.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.
8.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.
9.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.
10.	33KV/11KV, 0.4/11KV SURGE ARRESTER	2 NOS.

BILL OF QUANTITY - 11KV		
SL. NO.	ITEM DESCRIPTION	QTY
1.	11KV/0.4KV TRANSFORMER	2 NOS.
2.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
3.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
4.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
5.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
6.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
7.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
8.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
9.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.
10.	11KV/0.4KV, 0.4/11KV SURGE ARRESTER	2 NOS.

# LEGEND:-

- 1. 11KV/0.4KV TRANSFORMER
- 2. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 3. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 4. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 5. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 6. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 7. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 8. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 9. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER
- 10. 11KV/0.4KV, 0.4/11KV SURGE ARRESTER

This Bill of Materials (BOM) is subject to change without notice and is not to be used for any other purpose.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:-

Deer Daul Unadhyaya Gauri Jyoti Yegana (DDUGJY)

TITLE:-

Single Line Diagram of 1x5MVA (Type-B)  
33/11KV Substation with Indoor 11kV Switchgear

NO.	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01						

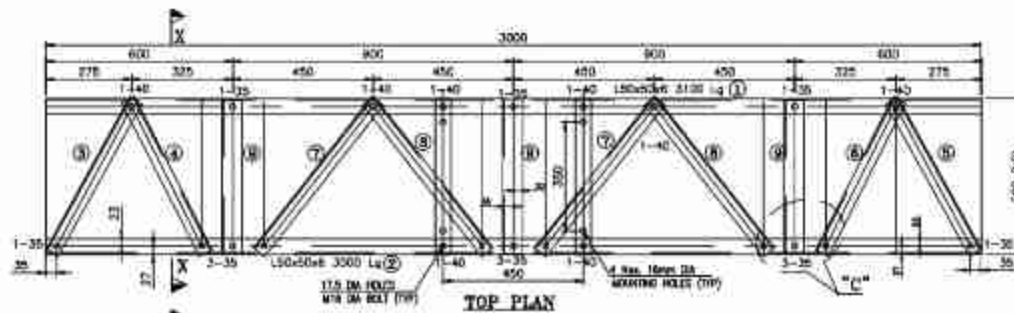
REV.	SCALE	DATE	REV. NO.	REV. DATE
A3	NTS	REC/RDSS/33/11kV PSS/22B	0	



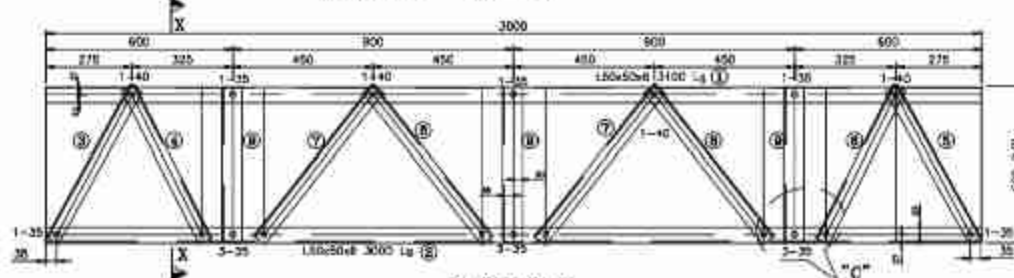




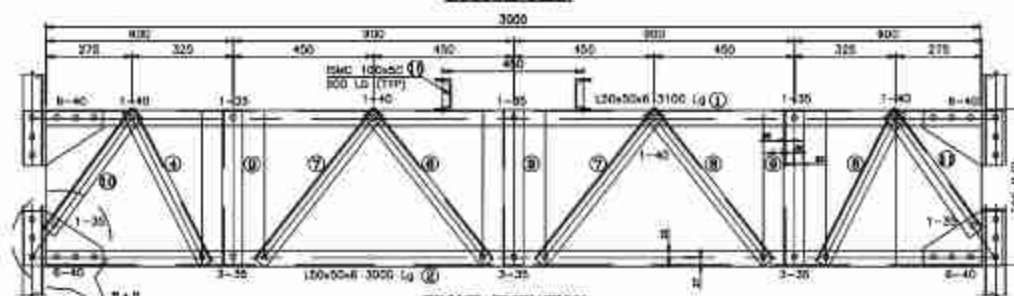




TOP PLAN



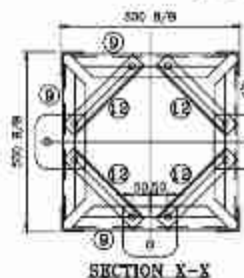
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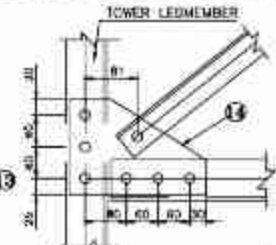
FRONT ELEVATION

PROVIDE ASSEMBLY SHOULD BE MADE BEFORE WELD FABRICATION

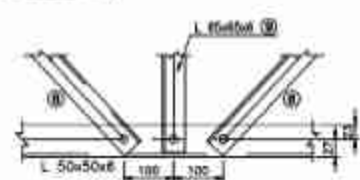
ACTUAL LENGTH OF MEMBER SHOULD BE DECIDED BASED ON FULL SCALE LAYOUT AT FACTORY



SECTION X-X



DETAIL-A



DETAIL-C


BILL OF MATERIAL					
MEM NO	SECTION	QTY	LENGTH mm	UNIT WT. Kg/m	TOTAL WT IN Kg
1	L 50x50x6	2	3000	4.50	27.00
2	L 50x50x6	2	3000	4.50	27.00
3	L 40x40x5	2	556	3.40	3.78
4	L 40x40x5	4	549	3.40	7.47
5	L 40x40x5	2	556	3.40	3.78
6	L 40x40x5	4	549	3.40	7.47
7	L 40x40x5	8	617	3.40	16.78
8	L 40x40x5	8	617	3.40	16.78
9	L 40x40x5	12	496	3.40	34.52
10	L 40x40x5	2	473	3.40	3.22
11	L 40x40x5	2	473	3.40	3.22
12	L 40x40x5	12	204	3.40	8.32
13	STRAP P.T. 8 TH	2	140	150	62.80
14	GFL. 8 TH	6	250	175	62.80
15	SHC 100x50	2	500	9.58	9.58
TOTAL WEIGHT					203.19
BOLTS & NUTS:					
MINOR BOLT & NUTS		80		0.124	7.440
MINOR BOLT & NUTS		72		0.132	9.504
BOLTS & SPRING WASHERS		120		0.018	1.215
TOTAL WEIGHT OF BOLTS & NUTS					18.159
WEIGHT OF STRUCTURAL STEEL					582.75
WEIGHT OF BOLT/NUTS					18.159
TOTAL WEIGHT OF STRUCTURAL STEEL					223.009

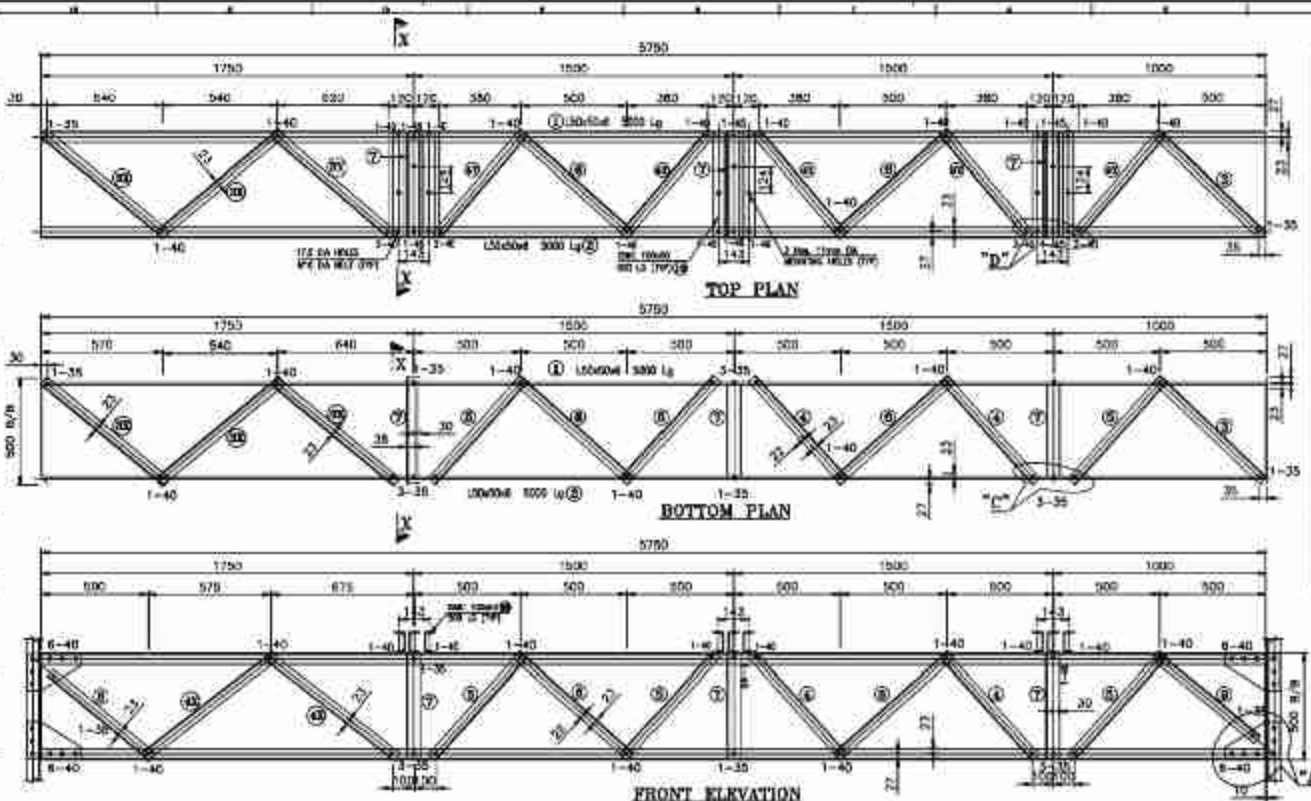
WEIGHT OF STRUCTURAL STEEL : 582.75  
 WEIGHT OF BOLT/NUTS : 18.159  
 TOTAL WEIGHT OF STRUCTURAL STEEL : 223.009  
 MAKE NO-15 REQUIRED ONLY FOR = 2 Nos.

NOTES:-

- ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
- BOLT SYMBOLS 188 (2) = 17.5 DIA HOLES
- ALL SECTION WELDS ARE TO BE PREPARED WITH "J" JOINT
- 25mm SPRING WASHERS TO BE SUPPLIED WITH EVERY BOLT
- ALL CONNECTION BOLTS SHALL BE OF 18mm & CONFORMING TO IS 12427 OF PROPERTY CLASS 5.8 CONFORMING TO IS 1367 (PART-2)
- WELD STEEL SHALL CONFORM TO GRADE A572 (10) OF 500 MPa
- MINIMUM EDGE DISTANCE FOR 18mm BOLT SHALL BE 25mm FROM CUT EDGE
- ALL UNPAINTED MEMBERS ARE 140x45x5 WITH 23 DIA
- UNPAINTED SURFACES ARE 8mm THICK
- PLAIN WASHERS SHALL BE 40 PER 50 2218 & SPRING WASHER SHALL BE 40 PER 50 3043
- ALL NUTS SHALL CONFORM TO IS 12427
- GALVANIZING SHALL CONFORM TO IS 2623-1985 & IS 4759-1986
- BRACING ANGLES SHALL BE SMOOTHLY CHAMFERED WHEREVER NECESSARY
- FABRICATOR TO DETERMINE THE REQUIREMENT OF CHAMFERING THE ENDS OF MEMBERS BY LAYING OUT THE STRUCTURE TO FULL SCALE ON THE SHOP FLOOR, BEFORE FABRICATION AND GALVANIZING.

FOR TENDER PURPOSE ONLY

		Rural Electrification Corporation Ltd.	
PROJECT: Revamped Distribution Sector Scheme (RDSS)			
TITLE: DETAILS OF GIRDER TYPE "G3"			
SIZE: AS	SCALE: NTS	DRG. NO.: REC/ RDSS /33/11kV PSS/24	DWT. NO.: 1 OF 1
REV. NO.: PREPARED CHECKED APPROVED DATE		PROJECT:	



BILL OF MATERIAL						
MARK NO	SECTION	QTY.	LENGTH mm	WGT kg	UNIT WT kg/m	TOTAL WT IN kg
1	L 50x50x6TH	2	5750	-	4.50	51.75
2	L 50x50x6TH	2	5750	-	4.50	51.75
3	L 45x45x5TH	2	894	-	3.40	4.72
3A	L 45x45x5TH	5	751	-	3.40	12.77
3B	L 45x45x5TH	1	732	-	3.40	2.50
4	L 45x45x5TH	6	848	-	3.40	13.24
4A	L 45x45x5TH	4	778	-	3.40	10.08
4B	L 45x45x5TH	5	838	-	3.40	10.81
5	L 45x45x5TH	6	848	-	3.40	18.86
6	L 45x45x5TH	8	732	-	3.40	18.58
7	L 60x60x6TH	12	498	-	5.50	24.53
8	L 45x45x5TH	2	821	-	3.40	4.22
9	L 45x45x5TH	2	821	-	3.40	4.22
10	L 45x45x5TH	12	275	-	3.40	11.22
11	STEEL PLATE 5 THK	5	140	120	62.50	11.67
12	SPR. S THK	8	235	175	62.50	22.42
13	WAS. 100x50	8	500	-	8.54	43.02
<b>TOTAL WEIGHT</b>						<b>320.06</b>
BOLTS & NUTS						
MINOR BOLT & NUT	10			0.124		8.82
MINOR BOLT & NUT	8			0.132		12.80
MINOR BOLT & NUT	6			0.139		1.11
1/2" 13.5mm SPRING WASHERS	160			0.009		1.44
<b>TOTAL WEIGHT OF BOLTS &amp; NUTS</b>						<b>22.18</b>

#### NOTES

- ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
- BOLT DIMENSIONS 16# D = 17.54 HOLER
- ALL CONNECTION MARKS ARE TO BE PREPARED WITH "01".
- 3.5mm SPRING WASHER TO BE SUPPLIED WITH EVERY BOLT
- ALL CONNECTION BOLTS SHALL BE OF 10mm & CONFORMING TO IS 12427 OF PROPERTY CLASS 8.8 CONFORMING TO IS 1387 (PART-B).
- WELD STEEL SHALL CONFORM TO GRADE A OF BS2002
- MINIMUM EDGE SECURITY FOR 16# BOLT SHALL BE 25mm FROM CUT EDGE
- ALL UNNOTED MEMBERS ARE L45x45x5 WITH 25 SW
- UNNOTED GUSSETS ARE 10mm THICK
- PLATE WASHERS SHALL BE AS PER IS 3563 & SPRING WASHER SHALL BE AS PER IS 3563.
- ALL NUTS SHALL CONFORM TO IS 12427
- GALVANIZING SHALL CONFORM TO IS 2020-1985 & IS 14750-1996
- BRACING ANGLES SHALL BE SATISFIEDLY CHAMFERED WHEREVER NECESSARY.
- FABRICATOR TO DETERMINE THE REQUIREMENT OF CHAMFERING THE ENDS OF MEMBERS BY LAYING OUT THE STRUCTURE TO FULL SCALE ON THE SHOP FLOOR, BEFORE FABRICATION AND GALVANIZING.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

DETAILS OF GIRDER TYPE "G1"

SIZE

SCALE

DRG. NO.

DATE

REV. NO.

AS

NTS

REC/ RDSS /33/11kV PSS/25

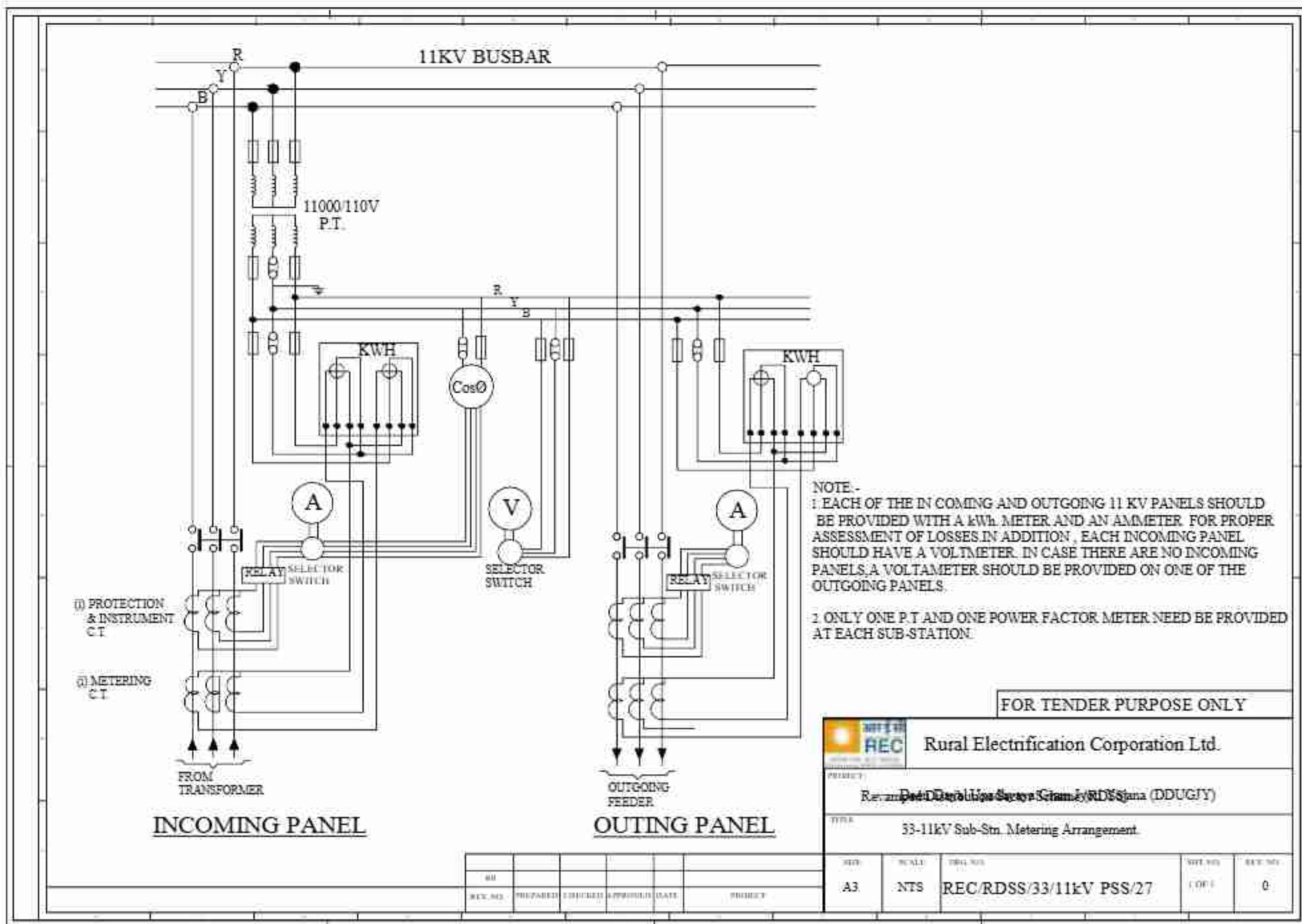
1 OF 1

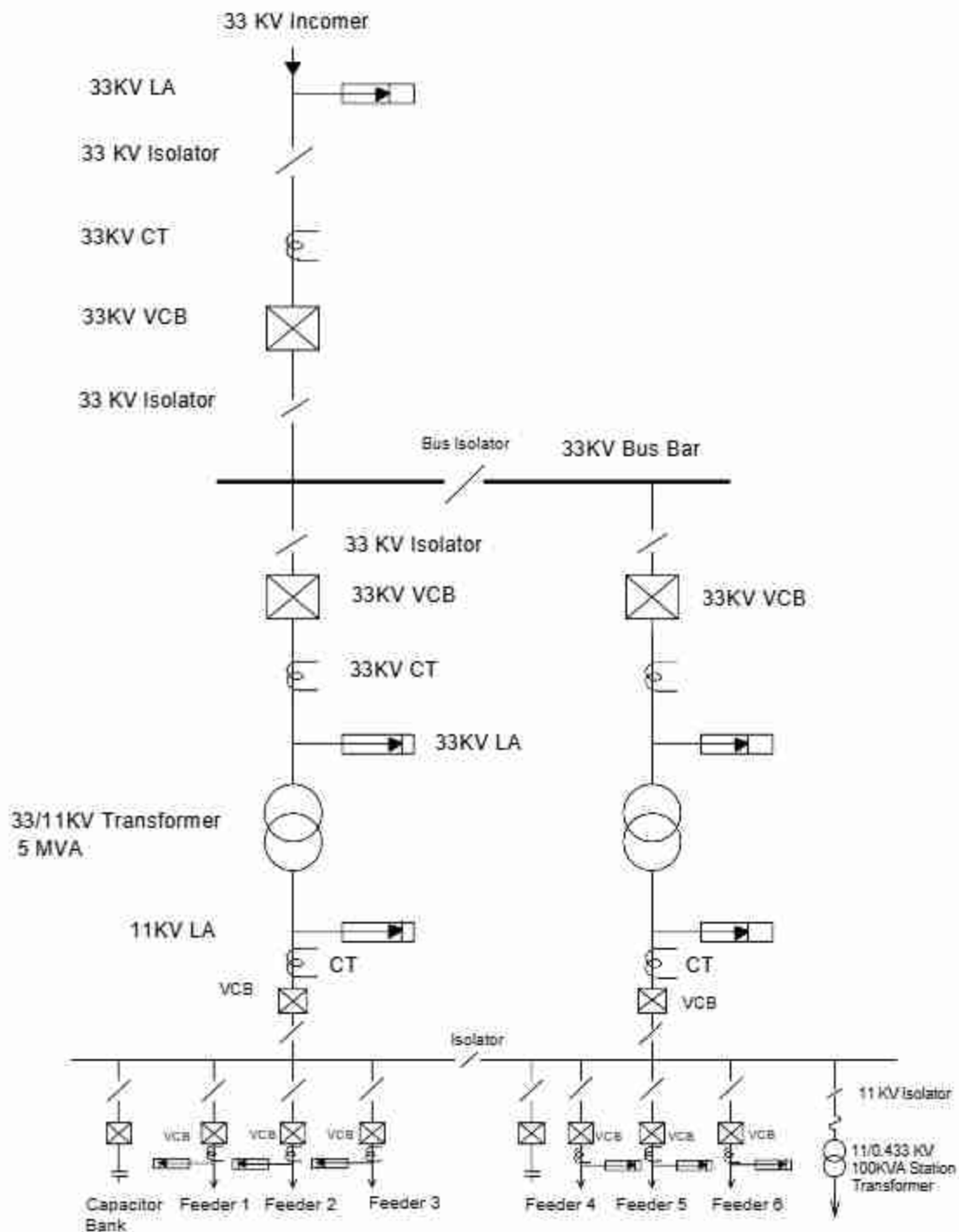
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RD	REV.	NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT









FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

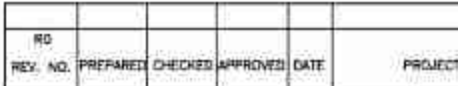
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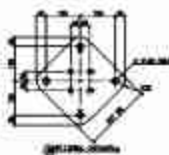
Typical SLD of 33/11KV PSS with 2 Transformer and One Incoming Line

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/RDSS /33/11kv PSS/28	1 OF 1	0



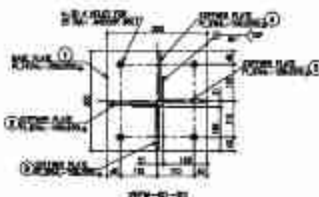


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1. ALL INFORMATION AND ANY INFORMATION OBTAINED HEREFROM;  
2. ONLY PERSONNEL WHO ARE AT LEAST POSITIVE;  
3. ALL PERSONNEL WHO ARE AT LEAST POSITIVE;  
4. ALL PERSONNEL WHO ARE AT LEAST POSITIVE;  
5. ALL PERSONNEL WHO ARE AT LEAST POSITIVE;  
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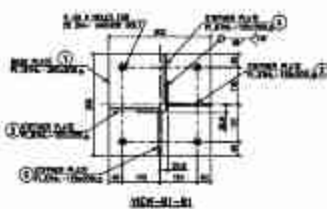
BENT & NAT MOIST				
	SIZE	QTY.	UNIT WT.	TOTAL WT.
Mt4550m	30x75 x 10/75	28	3.818	4,104
Mt4550m	30x75 x 10/75	34	3.539	8,752
Mt4550m	30x75 x 10/75	—	2.333	—
Mt4550m	30x75 x 10/75	—	0.336	—
Mt4550m	30x75 x 10/75	—	3.344	—
Mt4550m	1/2" x 3/4" x 1/2"	11	5.4	4.31
Mt4550m	PKCS MAG-48	8	0.028	0.208
Mt4550m	PKCS MAG-48	—	0.034	—
Mt4550m	PKCS MAG-48	—	0.034	—
Mt4550m	PKCS MAG-48	—	0.068	—
Mt4550m	SPRNG MAG-48	128	0.006	0.74
			10.00	18.81

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. HOLE DIMENSION 100 H4 = 100 H6 H9.
3. ALL DIMENSIONS SHOWN ARE TO BE PROVIDED WITH A TOL.
4. 2.5mm SPIRAX SAGGAS TO BE SUPPLIED WITH FORTY ONLY
5. ALL CONNECTIONS SHALL BE OF 10mm x CONFORMING TO BS 1547 OF PROPER CLASS & IS CONFORMING TO G-582 (PART-4).
6. ALL RISERS SHALL CONFORM TO GRADE 4 STRONG OF 15000
7. MINIMUM JOINT SECURITY FOR 100 MM SHALL BE 10000 FROM LEFT SIDE
8. ALL UNMATED MEMBERS ARE LATESTED WITH E3 10
9. UNKNOTTED GUSSSETS AND JOINTS SHALL
10. PLAIN MEMBERS SHALL BE AS PER IS 2078 & APPROX RADIUS SHALL BE AS PER IS 2078
11. ALL RISERS SHALL CONFORM TO IS 1547
12. DIMENSIONS SHALL CONFORM TO IS 2000-1978 & IS 1000-1978
13. BRIDGING ANGLES SHALL BE SUITABLY RATED BRIDGING MEMBER HIGHERLY
14. FABRICATION TO GUARANTEE THE REQUIREMENT OF DIMENSIONS THE EACH OF THE MEMBER OF THE BRIDGING TO BE IN THE SCALE ON THE SHOP FLOOR, BEFORE FABRICATION AND DELIVERY.

RD					
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT







BILL OF MATERIAL						
Excision Mark	Section	Length (Inch / MM)	Weight (Lb)	Unit/M Weight	Vol./Area Weight	Total Weight (Lb)
1	10MM PLATE	200x200	4	4.00	1.20	48.00
2	8MM PLATE	150x200	4	3.20	1.00	32.00
3	5MM PLATE	150x200	4	2.00	1.00	20.00
4	8MM PLATE	150x200	4	3.20	1.00	32.00
5	8MM PLATE	150x200	4	3.20	1.00	32.00
6	1/4" x 1/4" x 1/4"	30x30	1	0.1	18.44	18.44
6F	1/4" x 1/4" x 1/4"	30x30	1	0.1	18.44	18.44
7	1/4" x 1/4" x 1/4"	30x30	2	0.2	36.88	36.88
8	1/4" x 1/4" x 1/4"	37x12	1	0.8	21.63	21.63
8C	1/4" x 1/4" x 1/4"	37x12	1	0.8	21.63	21.63
9	1/4" x 1/4" x 1/4"	18x18 (T2)				
10	1/4" x 1/4" x 1/4"	18x18 (T2)				
10C	1/4" x 1/4" x 1/4"	18x18 (T2)				
11	1/4" x 1/4" x 1/4"	11x11	2	4.5	5.20	10.40
12	1/4" x 1/4" x 1/4"	11x11	4	5.4	4.50	13.40
13	1/4" x 1/4" x 1/4"	14x10	4	5.9	8.80	19.40
14	1/4" x 1/4" x 1/4"	17x16	4	5.4	4.37	17.08
15	1/4" x 1/4" x 1/4"	12x18	4	5.4	6.74	16.92
16	1/4" x 1/4" x 1/4"	11x15	4	5.4	5.03	16.08
17	1/4" x 1/4" x 1/4"	8x8	4	2.4	3.26	12.44
18	1/4" x 1/4" x 1/4"	8x8	4	3.2	2.0	11.8
19	1/4" x 1/4" x 1/4"	4x10	4	5.8	1.72	10.00
20	1/4" x 1/4" x 1/4"	8x10	4	5.4	3.20	8.00
20A	1/4" x 1/4" x 1/4"	8x10	4	5.4	2.20	8.00
21	1/4" x 1/4" x 1/4"	6x10	2	5.4	3.04	4.08
21A	1/4" x 1/4" x 1/4"	6x10	2	5.4	3.04	4.08
22	1/4" x 1/4" x 1/4"	18x18 (T2)				
23	1/4" x 1/4" x 1/4"	18x18 (T2)				
24	1/4" x 1/4" x 1/4"	30x30	2	5.8	2.00	4.13
25	8MM PLATE	200x200	4	4.1	1.00	4.10
TOTAL WEIGHT						397.63

BOL & BAL WEIGHT				
	SIZE	QTY	UNIT WT.	TOTAL WT.
MIRACRON	1/8" BOLTS & NUTS	50	0.114	5.70
MIRACRON	1/8" BOLTS & NUTS	24	0.124	2.98
MIRACRON	1/8" BOLTS & NUTS	40	0.130	5.20
MIRACRON	1/8" BOLTS & NUTS	-	0.130	-
MIRACRON	1/8" BOLTS & NUTS	-	0.144	-
MIRACRON	1/8" STEP BOLTS	11	0.41	4.51
MIRACRON	1/8" WASHERS	6	0.028	0.168
MIRACRON	1/8" WASHERS	-	0.034	-
MIRACRON	1/8" WASHERS	-	0.045	-
MIRACRON	1/8" WASHERS	-	0.060	-
MIRACRON	3/16" SPRING WASHER	136	0.009	1.22
			TOTAL	22.8

## NOTE

- [illegible]

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

**PRO.NET**

### Revamped Distribution Sector Scheme (RDSS)

TITEL

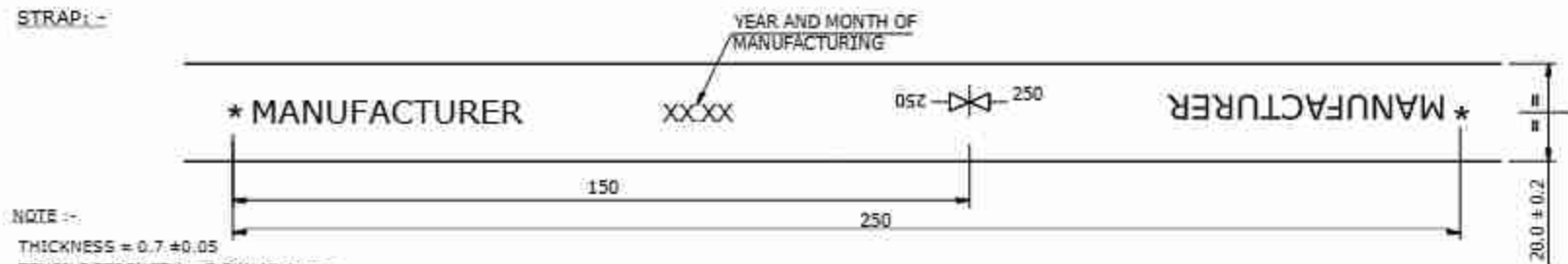
STRUCTURAL DETAILS OF TOWER TYPE - "T3A"

RD					
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/(RDSS /33/11kV PSS/31B	1 OF 1	0



# STRAP:-



## NOTE :-

THICKNESS = 0.7 ± 0.05

TENSILE STRENGTH = 7.5KN Minimum

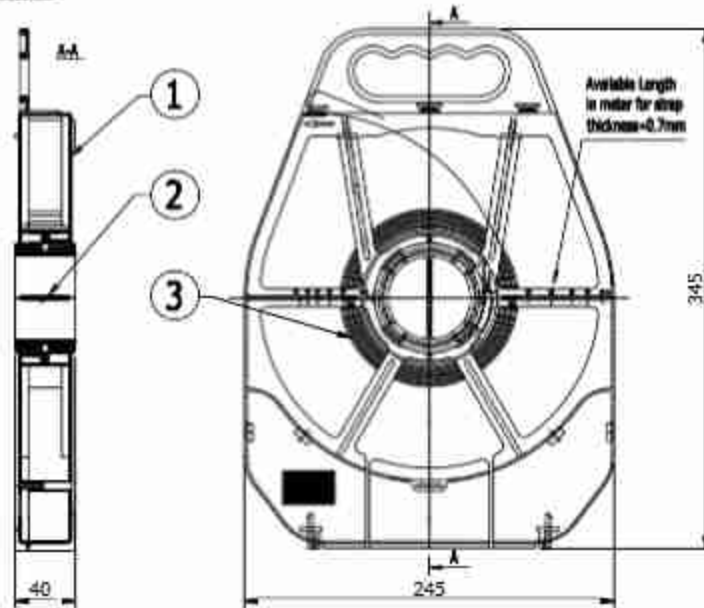
ELONGATION = 30% Min; FINISH = 2B

MATERIAL = SS 202

WEIGHT PER METER = 0.110 Kg (Min)

RAW MATERIAL (COMPOSITION) TOLERANCE = AS PER ASTM "A 480"

## STANDARD CASING:-



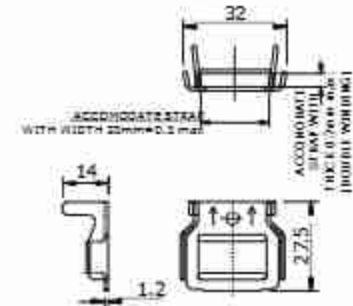
1	S.S STRAP CASING	1	Polypropylene
2	S.S STRAP BOBIN	1	Polypropylene
3	S.S STRAP	50 M	SS 202
Sl.No	Description	Qty	Material

## NOTE :-

GROSS WEIGHT PER CASING = 5.7 Kg (Approx.)  
QUANTITY PER STANDARD CARTON BOX = 5 nos.

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

## BUCKLE:-



## NOTE :-

MATERIAL = SS 304; WEIGHT PER PIECE=8 Grams.

RAW MATERIAL TOLERANCE = AS PER ASTM "A 480"

QUANTITY PER STANDARD BOX = 100 nos.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

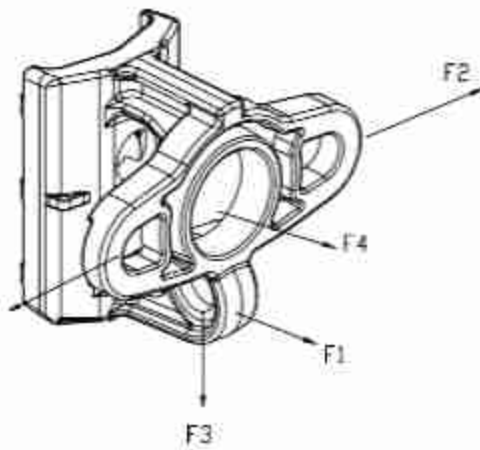
## PROJECT:

Revamped Distribution Sector Scheme (RDSS)

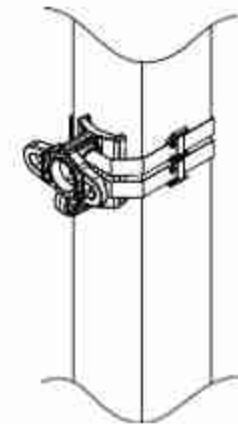
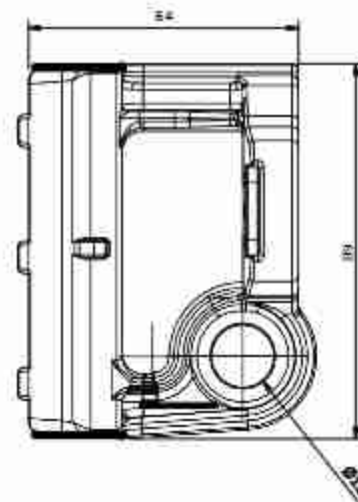
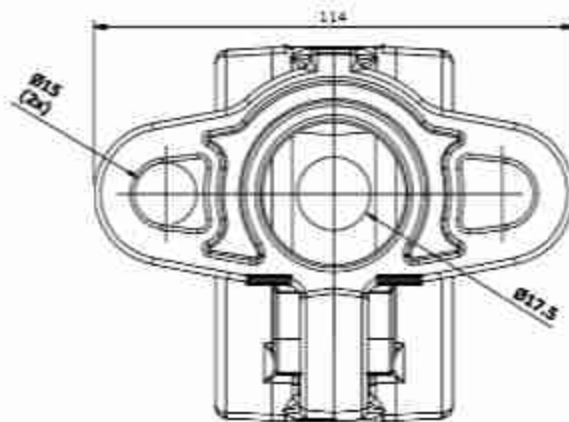
## TITLE:

STAINLESS STEEL STRAP (20 x 0.7) & BUCKLES

SIZE	SCALE	DRG. NO.	SHEET NO.	REV. NO.
A4	1:100	REC/RDSS/LT-ACC-ABC/01	1 OF 1	0



MIN BREAKING LOAD	APPLICATION
F1: 17KN	SINGLE ANCHOR
F2: 25KN	DOUBLE ANCHOR
F3: 24KN	STAY SYSTEM WITH 33
F4: 17KN	INDICATIVE



NOTE:-

MATERIAL : ALUMINIUM ALLOY

WEIGHT : \*W\* GMS(Aprox.)

STANDARD REFERENCE: SIMILAR TO NFC 33-041

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

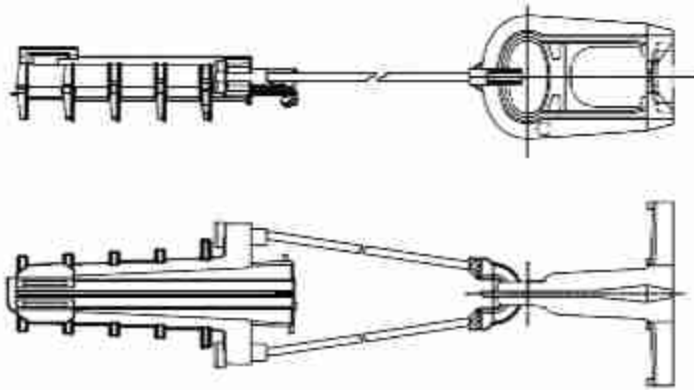
TITLE:

UNIVERSAL POLE BRACKET

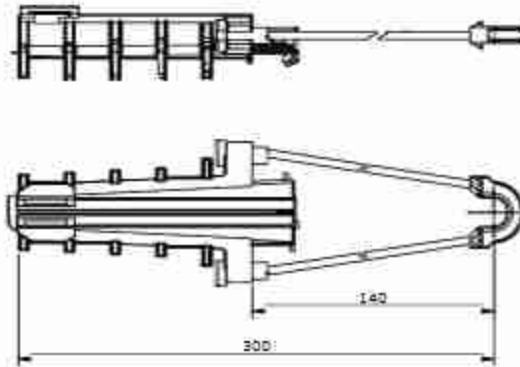
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

MTB	SCALE	DRG. NO.	SHEET NO.	REV. NO.
A4	1:100	REC/RDSS/LT-ACC-ABC/02	1 OF 1	0

# ANCHORING ASSEMBLY :-



## ANCHORING (DEAD-END) CLAMP :-



### SPECIFICATION :- AS PER NF C33-041

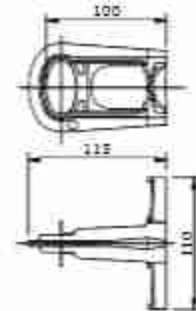
Messenger Type	Cable Range (mm <sup>2</sup> )		Minimum Breaking Load (kN)
	Min	Max	
INSULATED WIRE	25	50	10

## BRACKET :-

NOTE :-  
MATERIAL: ALUMINIUM ALLOY

SPECIFICATION :- AS PER NF C33-041

Minimum Breaking Load (kN)
15



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)  
Rural Electrification Distribution Sector Scheme (RDSS)

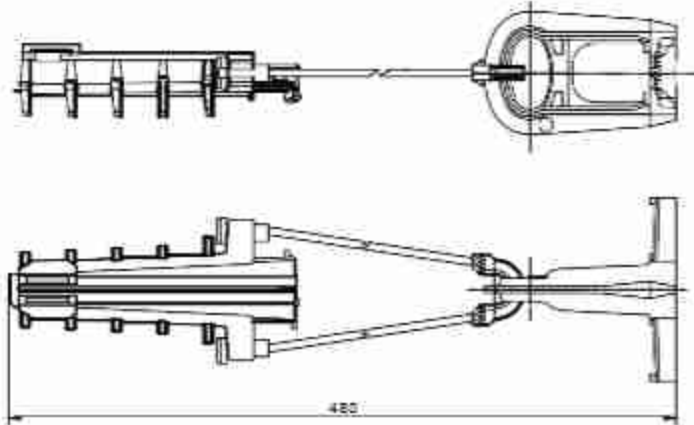
TITLE:

ANCHORING ASSEMBLY (Cable Range-25-50 sq. mm)

REV.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01					

REV.	SCALE	DRWS. NO.	SHEET NO./REV. NO.
01	1:100	REC/RDSS/LT-ACC-ABC/03A	1 OF 1

# ANCHORING ASSEMBLY :-



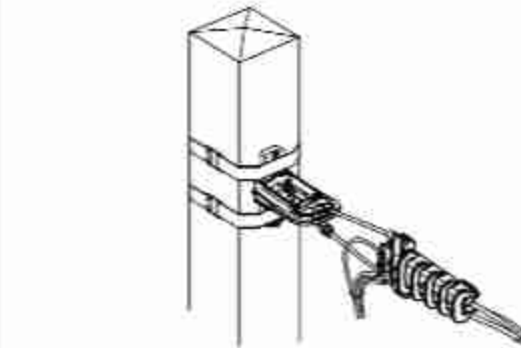
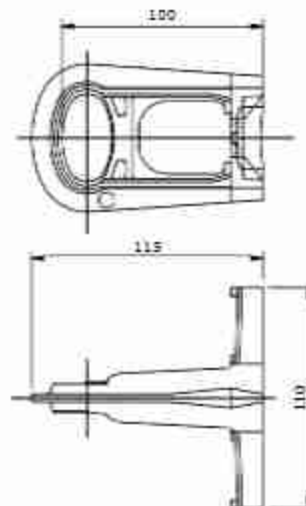
## BRACKET :-

### NOTE :-

MATERIAL: ALUMINIUM ALLOY

SPECIFICATION :- AS PER NF C33-041

Minimum Breaking Load (kN)
20



## ANCHORING (DEAD-END) CLAMP :-



SPECIFICATION :- AS PER NF C33-041

Messenger Type	Cable Range (mm)		Minimum Breaking Load (kN)
	Min	Max	
INSULATED WIRE	70	95	20

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

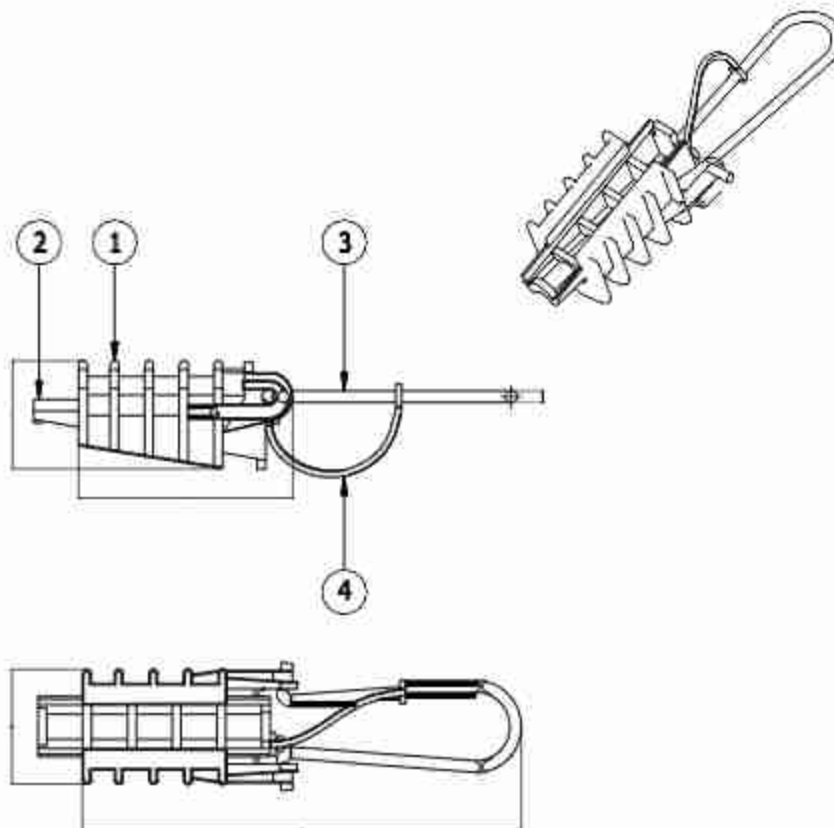
Deen Daula Upadhyaya Gram Jyotik Yojana (DDUGJY)  
Rural Electrification Corporation Ltd. (REC)

TITLE

ANCHORING ASSEMBLY (Cable Range-70-95 sq. mm)

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01					

S.D.	SCALE	DWG. NO.	SHEET NO.	REV. NO.
1/4"	1:100	REC/RDSS/LT-ACC-ABC/03B	1 OF 1	0



4	1	Wedge tie	T.P Elastomer
3	1	Ball	Stainless steel
2	1	Wedge	Thermoplastic
1	1	Body	Thermoplastic
Qty	Rep	Description	Material

FOR TENDER PURPOSE ONLY

Notes: - Cable range: Suitable for  $\varnothing$  3mm -  $\varnothing$  9mm



Rural Electrification Corporation Ltd.

PROJECT:

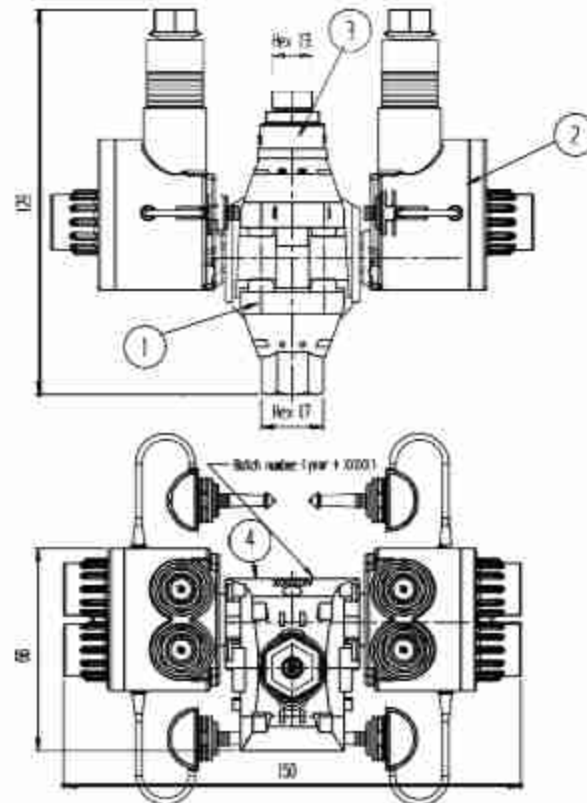
Revamped Distribution Sector Scheme (RDSS)

TITLE:

SERVICE CLAMP

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT	SIZE	SCALE	DWG. NO.	SHEET NO.	TOTAL SHEETS
						A4	1:100	REC/RDSS/LT-ACC-ABC/04	1 OF 1	1





Rep.	Qty.	Description	Material
1	1	Central part	Assembly Drawing
2	1	Plug	Assembly Drawing
3	1	Shearhead	Polycarbonate GF- natural
4	1	Making	Colour: White

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PRODUCT

TITLE

MULTI-PORT INSULATION PIERCING CONNECTOR  
STRIPPING / PIERCING

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01					

SIZE

A4

SCALE

1:100

DRG. NO.

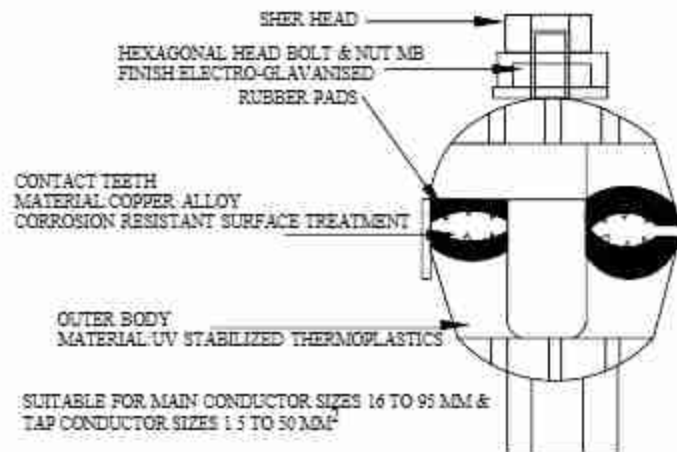
REC/RDSS/LT-ACC-ABC/05A

SHEET NO.

1 OF 1

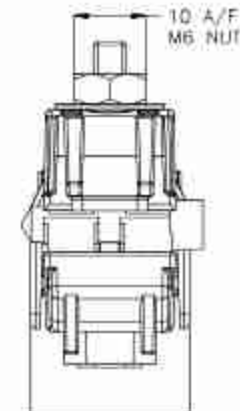
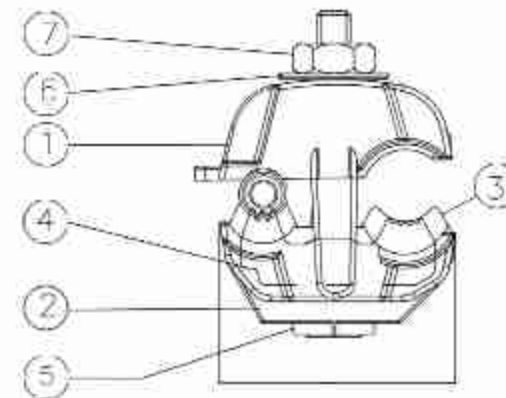
REV. NO.

01



CABLE RANGE:  
 SUITABLE FOR 10 TO 95 SQ.MM MAIN (Bare/Insulated)  
 & 1.5 TO 10 SQ.MM TAP (Bare/Insulated)  
 WEIGHT: "W" Grams (Approx)  
 RATED TIGHTENING TORQUE: "X" Nm.

Sl. No.	QTY	DESCRIPTION	MATERIAL
1	1	NUT M6	STEEL
2	1	WASHER	STEEL
3	1	SCREW	STEEL
4	2	BLADE	AL ALLOY
5	1	SEAL	T.F. ELASTOMER
6	1	LOWER BODY	THERMO PLASTIC - BLACK
7	1	UPPER BODY	THERMO PLASTIC - BLACK



All dimensions are in mm.

FOR TENDER PURPOSE ONLY

Sl. No.	QTY	DESCRIPTION	MATERIAL
1	1	NUT M6	STEEL
2	1	WASHER	STEEL
3	1	SCREW	STEEL
4	2	BLADE	AL ALLOY
5	1	SEAL	T.F. ELASTOMER
6	1	LOWER BODY	THERMO PLASTIC - BLACK
7	1	UPPER BODY	THERMO PLASTIC - BLACK



Rural Electrification Corporation Ltd.

PROJECT:

Deep Rural Electrification Scheme (DDUGJY)  
 Retained Distribution Sector Scheme (RDSS)

TITLE

INSULATION PIERCING CONNECTOR

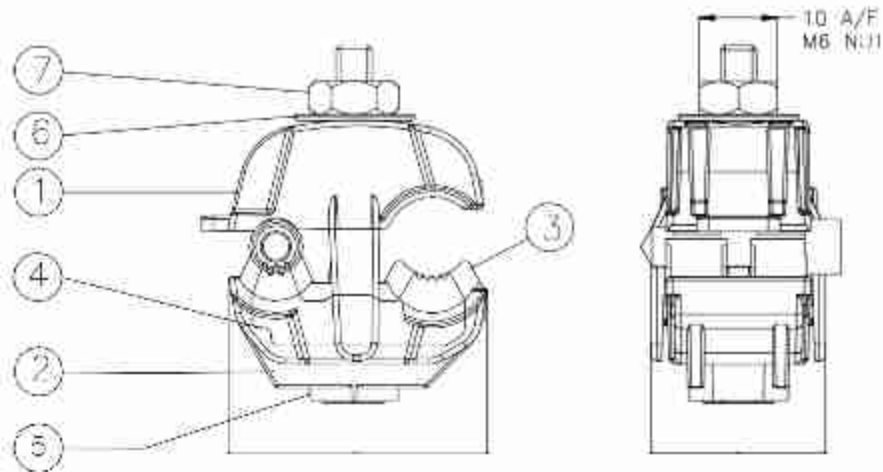
SIZE/SCALE

DRG. NO.

REC/RDSS/LT-ACC-ABC/05B

SHT. NO. REV. NO.

1 OF 1 0



CABLE RANGE:

SUITABLE FOR 10 TO 95 SQ.MM MAIN (Bare/Insulated) & 1.5 TO 10 SQ.MM TAP(Bare/Insulated)

WEIGHT: "W" Grams (Approx)

RATED TIGHTENING TORQUE: "X" Nm

7	1	NUT M6	STEEL
6	1	WASHER	STEEL
5	1	SCREW	STEEL
4	2	BLADE	AL ALLOY
3	1	SEAL	T.P.ELASTOMER
2	1	LOWER BODY	THERMO PLASTIC - BLACK
1	1	UPPER BODY	THERMO PLASTIC - BLACK
REP	QTY	DESCRIPTION	MATERIAL

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

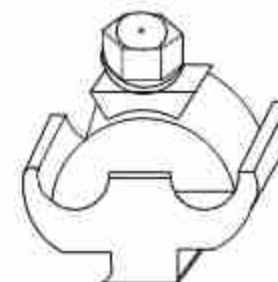
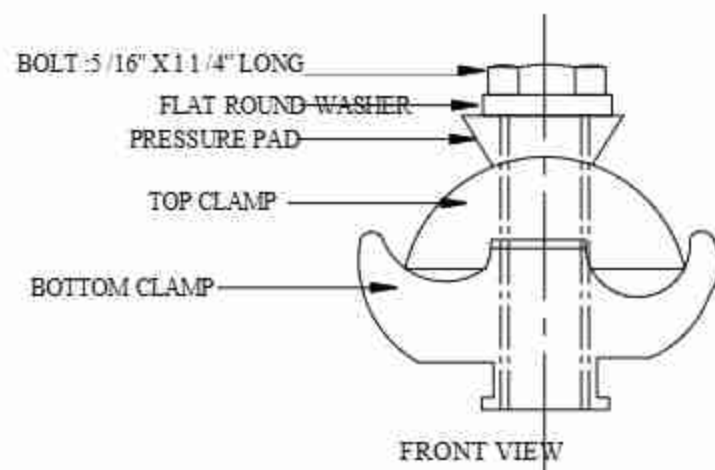
PROJECT:

**Revamped Distribution Sector Scheme (RDSS)**

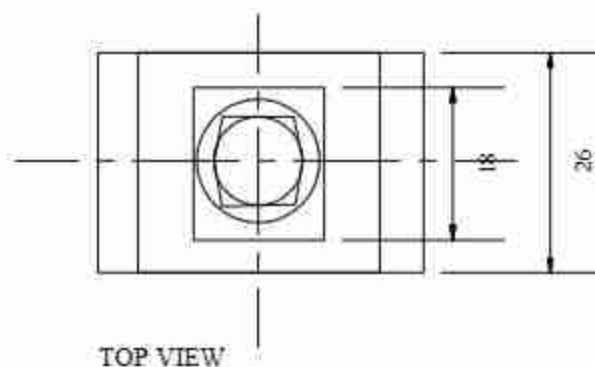
TITLE:

**EARTHING CONNECTOR**

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT	SHEET NO.	SCALE	DWG. NO.	SHEET NO.	REV. NO.
01						01	1:100	REC/RDSS/LT-ACC-ABC/06A	01	0



ISOMETRIC VIEW




SUITABLE FOR 2.5 mm TO 50 mm CONDUCTOR

material of clamp body : extruded aluminium alloy  
 finish: natural & degreased  
 material of bolt & washer : Mild steel  
 finish: electro-zinc plated  
 tolerance :  $\pm 5\%$  for all dimensions.

All dimensions are in mm.

FOR TENDER PURPOSE ONLY

		Rural Electrification Corporation Ltd.	
PROJECT		Re-vamped Distribution Sector Scheme (RDSS)	
TITLE		EARTHING CONNECTOR	
SIZE	SCALE	DRG. NO.	SHT. NO. REV. NO.
A3	NTS	REC/RDSS/LT-ACC-ABC/06B	1 OF 1 0

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION
01					ISSUED FOR TENDER

# SUSPENSION ASSEMBLY :-

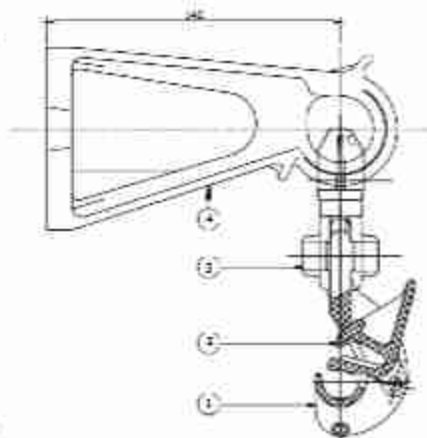
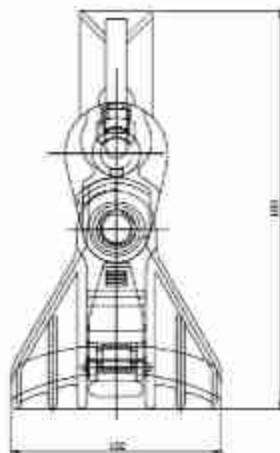
## NOTE :-

MATERIAL: SEE TABLE

WEIGHT: 380 GRAMS (Approx)

MARKING: ES 54-2

REF	QTY	DESCRIPTION	MATERIAL	COLOUR
4	1	MOUNTING BRACKET CS14	HEAT TREATED ALUMINIUM ALLOY	NA
3	2	INSULATING COVER UP34 / LW 1522	THERMO PLASTIC	BLACK
2	1	COVER PG 3-14	THERMO PLASTIC	BLACK
1	1	BODY PG 34 / PG 1522	THERMO PLASTIC	BLACK



SUSPENSION ASSEMBLY :-

SPECIFICATION :- AS PER NF C33-040

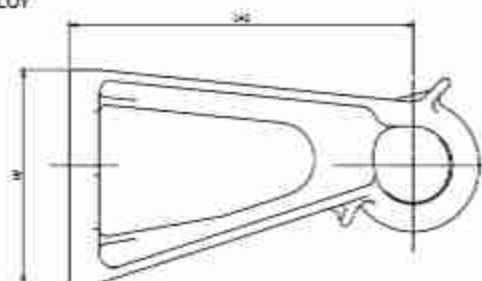
# BRACKET :- CS 14

## NOTE :-

MATERIAL: HEAT TREATED ALUMINIUM ALLOY

MARKING: CS 14

SPECIFICATION :- AS PER NF C33040



Product Reference	Messenger Type	Cable Range (mm <sup>2</sup> )		Dia (mm)	
		MIN	MAX	MIN	MAX
ES 54 14-2	INSULATED	25	70	8	14

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)  
Revamped Distribution Sector Scheme (RDSS)

TITLE

**SUSPENSION ASSEMBLY**  
**(Cable Range 25-70 sq. mm)**

NO.	SCALE	DWG. NO.	SPEC. NO.	REV. NO.
NA	1:100	REC/RDSS/LT-ACC-ABC/07A	1 OF 1	1

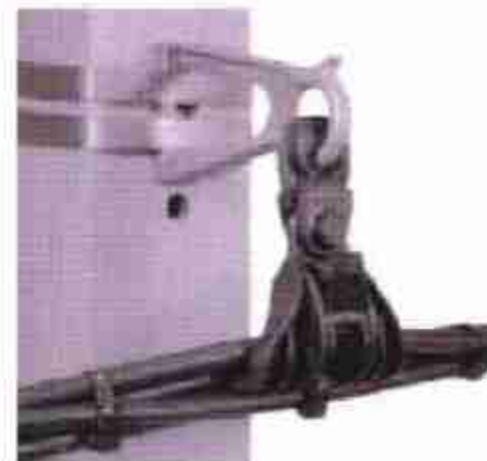
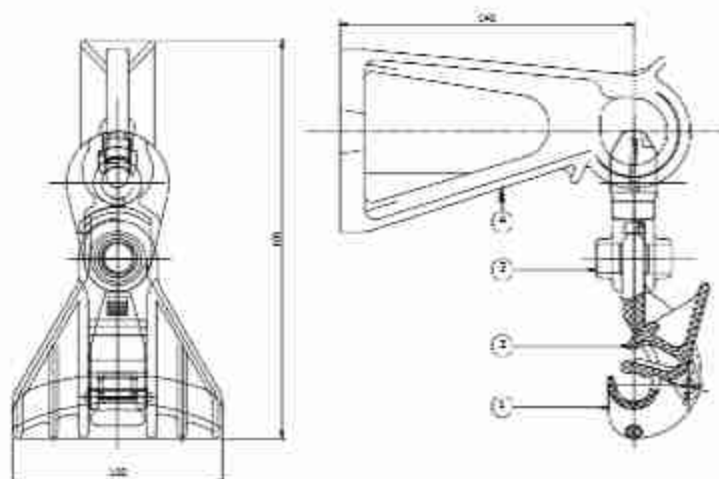
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



# **SUSPENSION ASSEMBLY :-**

**NOTE :-**

**MATERIAL: SEE TABLE**



## **SUSPENSION ASSEMBLY :-**

**SPECIFICATION :- AS PER NF C33-040**

Messenger/ Type	Cable Range (mm)		Load kg
	Min	Max	
INSULATED WIRE	25	50	12

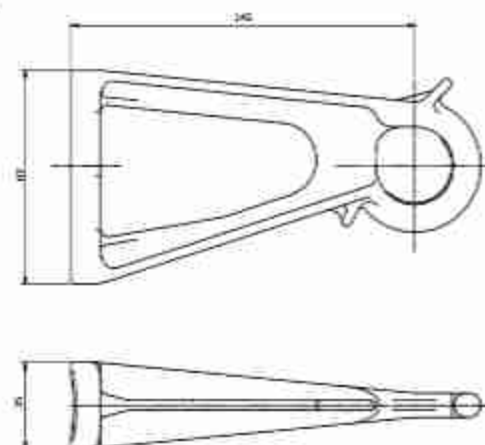
REF	QTY	DESCRIPTION	MATERIAL	COLOR
1	1	MOUNTING BRACKET	HEAT TREATED ALUMINIUM ALLOY	RA
2	2	MOVABLE LINK	THERMO PLASTIC	BLACK
3	1	LEVER	THERMO PLASTIC	BLACK
4	1	BODY	THERMO PLASTIC	BLACK

## **BRACKET :-**

**NOTE :-**

**MATERIAL: HEAT TREATED ALUMINIUM ALLOY**

**SPECIFICATION :- AS PER NF C33040**



**FOR TENDER PURPOSE ONLY**



**Rural Electrification Corporation Ltd.**

**PROJECT**

**Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)**

**TITLE**

**SUSPENSION ASSEMBLY  
(Cable Range 25-50 sq. mm)**

SUB	SCALE	DWG. NO.	AUT. NO.	REV. NO.
1/4	1:100	REC/RDSS/LT-ACC-ABC/07B	1 OF 1	0

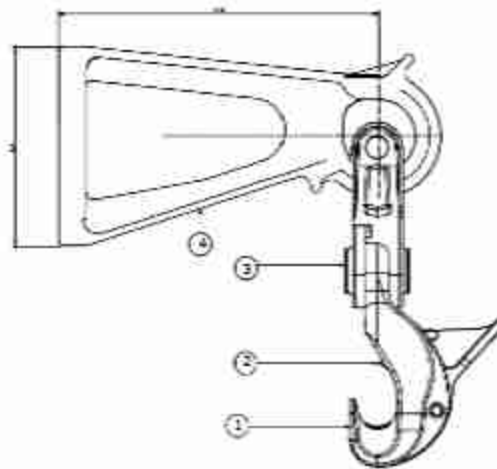
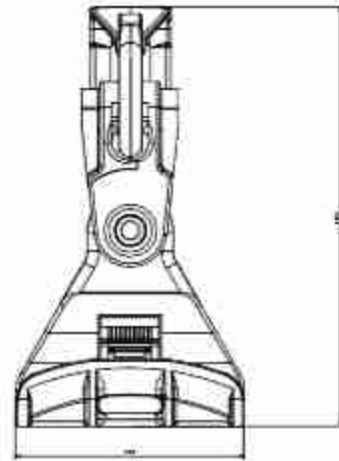
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

# SUSPENSION ASSEMBLY :-

NOTE :-

MATERIAL: SEE TABLE

Sl. No.	QTY	DESCRIPTION	MATERIAL	COLOUR
1	1	MOUNTING BRACKET	HEAT TREATED ALUMINIUM ALLOY	NA
2	1	INSULATING LINK	THERMO PLASTIC	BLACK
3	1	LEVER PB	THERMO PLASTIC	BLACK
4	1	BODY	THERMO PLASTIC	BLACK

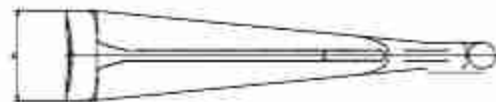
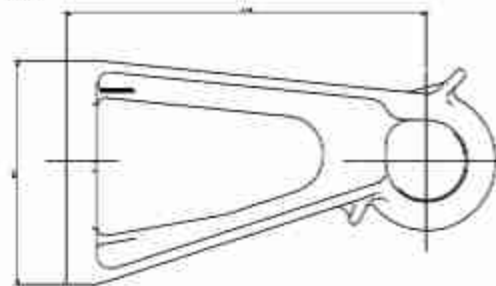


## BRACKET :-

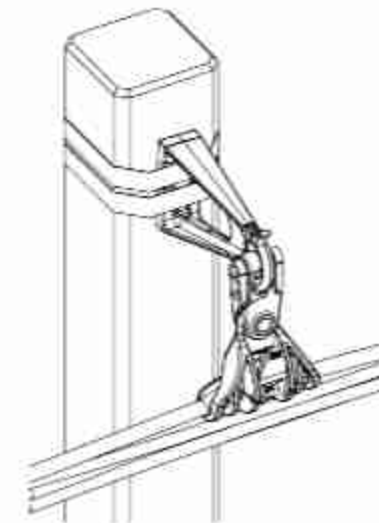
NOTE :-

MATERIAL: HEAT TREATED ALUMINIUM ALLOY

SPECIFICATION :- AS PER NFC33040



GENERAL TOLERANCE ON DIMENSIONS: ±0.5%



## SUSPENSION ASSEMBLY :-

SPECIFICATION :- AS PER NF C33-040

Insulator Type	Cable Range (mm <sup>2</sup> )	Load
INSULATED WIRE	70 95	KN

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Been Dahi Unadhyaya Gram, Jodhpur Yojana (DDUGJY)

TITLE:

SUSPENSION ASSEMBLY  
(Cable Range 70-95 sq. mm)

MTR.

SCALE

DRG. NO.

REV. NO.

A4

1:100

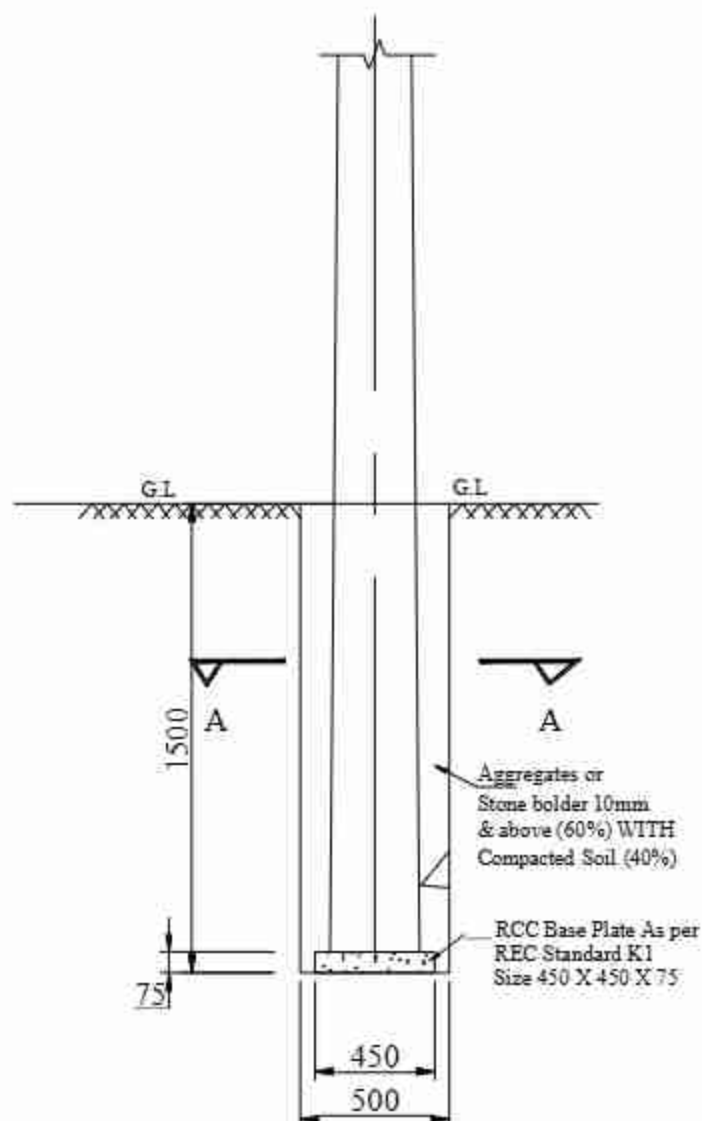
REC/RDSS/LT-ACC-ABC/07C

1 OF 1

4

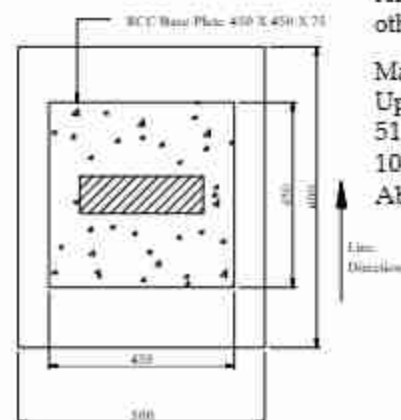


Revamped Distribution Sector Scheme (RDSS)



Plain Foundation for PSC Pole

S.No.	Description	Vol. in m <sup>3</sup>
1	Excavation (0.5x0.6x1.5M)	0.45
2	RCC Base Plate Size (0.45X0.45X0.075 M)	0.015



All Dimensions are in mm unless otherwise mentioned

Manufacturing Tolerance as Follows


Upto 50mm	: ± 5%
51 to 100mm	: ± 4%
101 to 500mm	: ± 5%
Above 500mm	: ± 2%

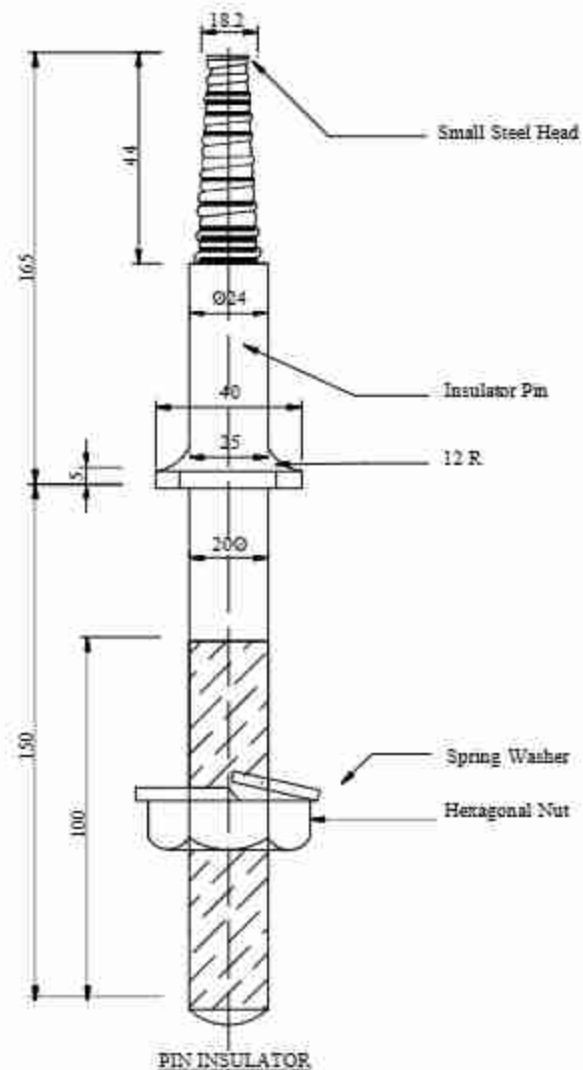
Line  
Direction

#### NOTES:-

1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MM.
2. AGGREGATES OF SIZE <30 MM (LARGE SIZE AS PER TABLE-3 OF IS 383)

FOR TENDER PURPOSE ONLY

 <b>Rural Electrification Corporation Ltd.</b>	
PROJECT:	Ravamped Distribution Sector Scheme (RDSS)
TITLE:	FOUNDATION DETAILS OF PSC/PCC Pole FILLING WITH EXCAVATED SOIL, BRICKBATTING & COMPACTION
SIZE/SCALE:	AS NOTED
DRG. NO.	REC/RDSS/GEN/02
SHT. NO.	1 OF 1
REV. NO.	0



### NOTES:-

- 1) PIN AS SHOWN SUITABLE FOR METAL CROSS ARM.
- 2) FOR WOOD CROSS ARM INSTEAD OF SPRING WASHER.  
USE TWO SQUARE WASHERS 50X50X5 MM. ONE ON TOP  
AND THE OTHER AT BOTTOM.
- 3) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED.
- 4) MANUFACTURING TOLERANCE AS FOLLOWS

UP TO 50mm	: ±5%
51 TO 100mm	: ±4%
101 TO 300mm	: ±3%
ABOVE 300mm	: ±2%

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

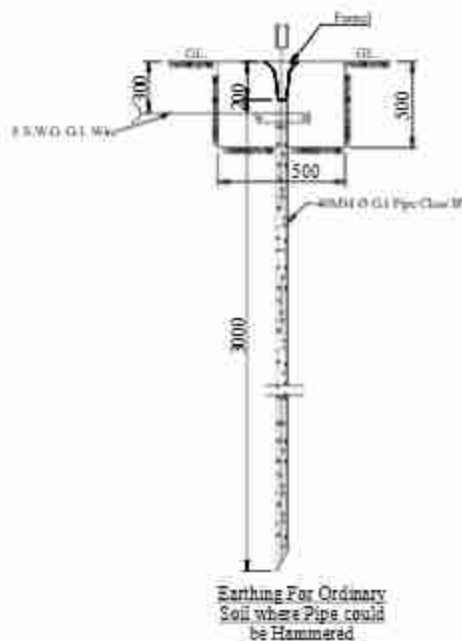
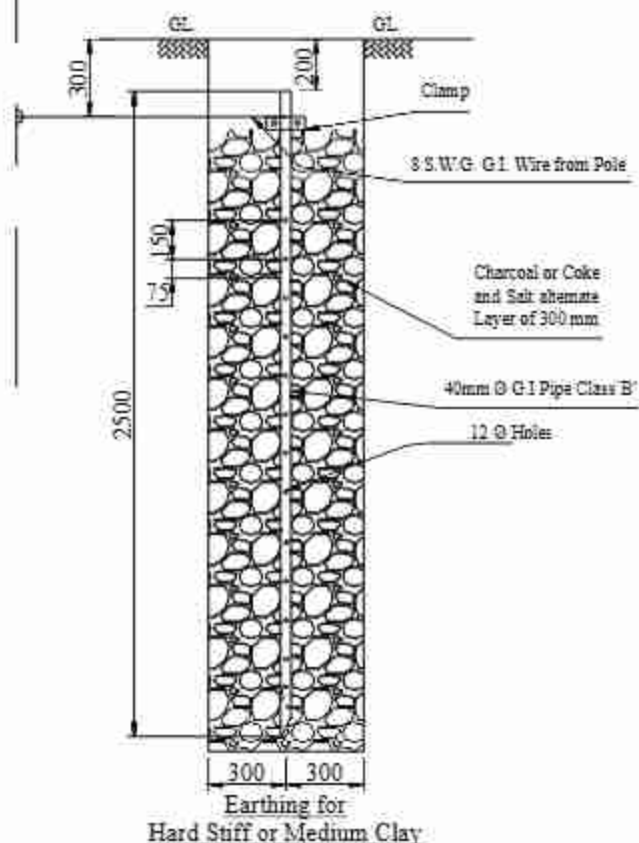
Revamped Distribution Sector Scheme (RDSS)

PIN INSULATOR

REV. NO.	REV. DATE	REV. BY	REV. DATE	REV. BY	REV. DATE
A3	NTS	REC/RDSS/GEN/03	1 OF 1	G	

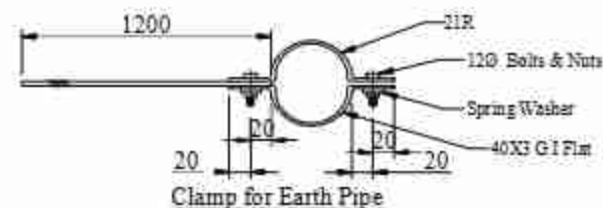


☉ of Pole



# BILL OF MATERIAL

S.NO.	DESCRIPTION	ERECTION MARK	SECTION	LENGTH in MM	Wt/Mtr Kg/M	QTY	TOTAL Wt Kg
1	Clamp for Earth Pipe		GI Flat 40x3	146	0.942	2 Nos	0.275
2	Bolts & Nuts		M12	30	0.057	2 Nos	0.114
3	Spring Washer		M12	3.5mm Thk	0.006	2 Nos	0.012
TOTAL WT.							0.401



## NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. EARTH TERMINAL OF GI STRIP 40x3 WITH 2 NOS. 120 STUDS.
3. MANUFACTURING TOLERANCE  
UP TO 50mm - ± 5%  
51 TO 100mm - ± 4%  
101 TO 300mm - ± 3%  
ABOVE 300mm - ± 2%
4. MS PARTS SHALL CONFIRM TO IS 2062
5. ALL MS PARTS TO BE HOT DIP GALVANISED AS PER IS 2629 & 4759.
6. WEIGHT MENTIONED IS FOR PACKING & FORWARDING PURPOSE ONLY

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE

PIPE TYPE EARTHING

SHEET/SCALE

DRG. NO.

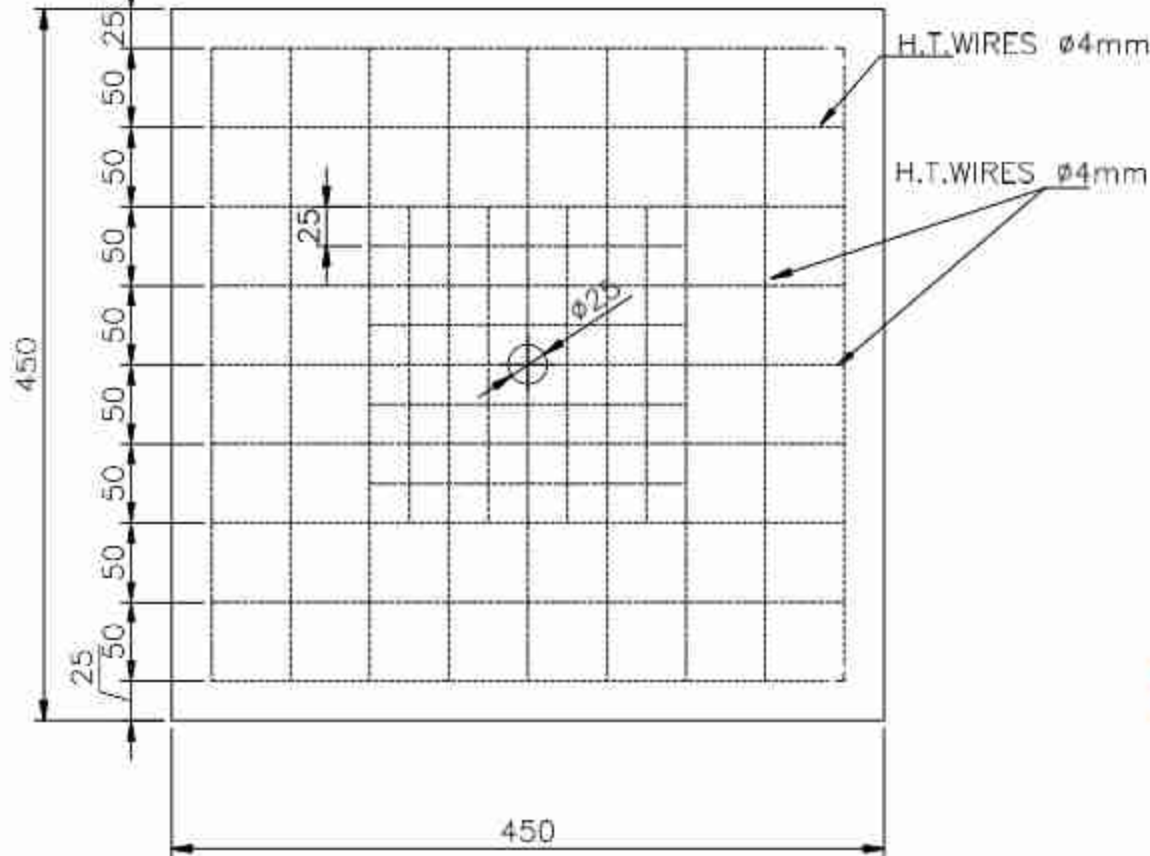
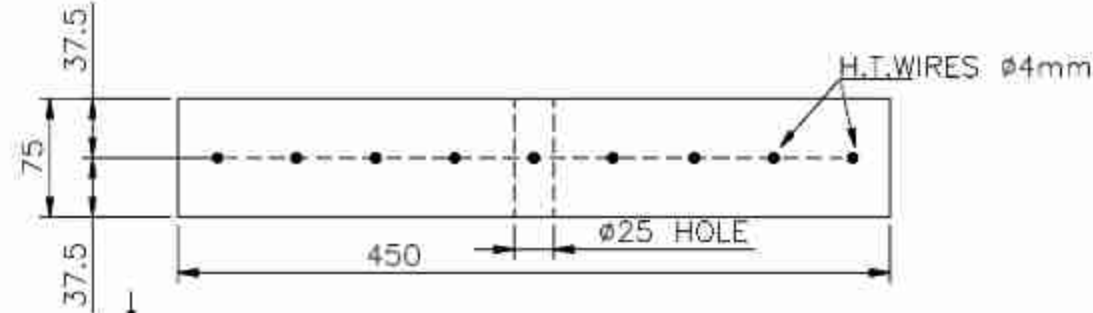
AS NTS

REC/RDSS/GEN/04

SHT. NO. REV. NO.

1 OF 1

0



#### NOTES:-

- 1) THE CONCRETE MIX SHALL BE OF M15 GRADE
- 2) BASE PLATE IS NOT NECESSARY FOR CONCRETE LOCATIONS
- 3) EQUIVALENT SIZE OF STONE PAD CAN BE USED AS BASE PLATE WHEREVER AVAILABLE ECONOMICALLY
- 4) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED

FOR TENDER PURPOSE ONLY

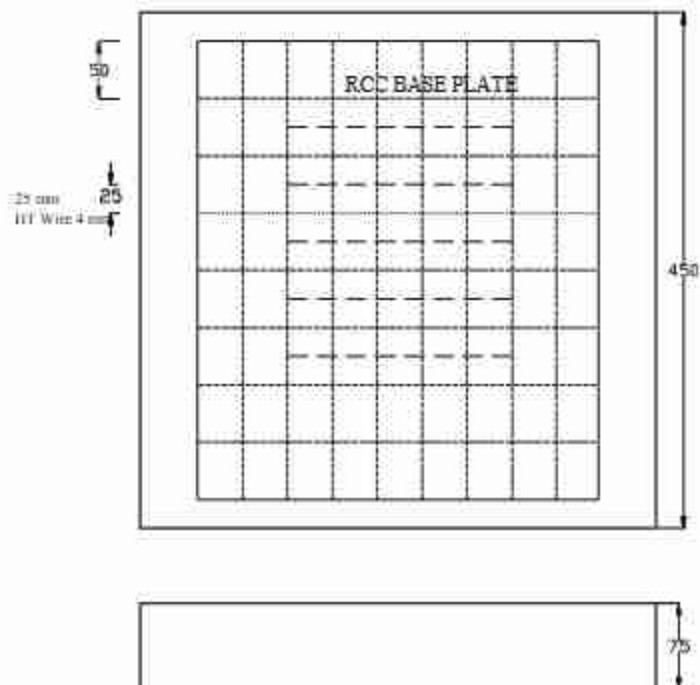
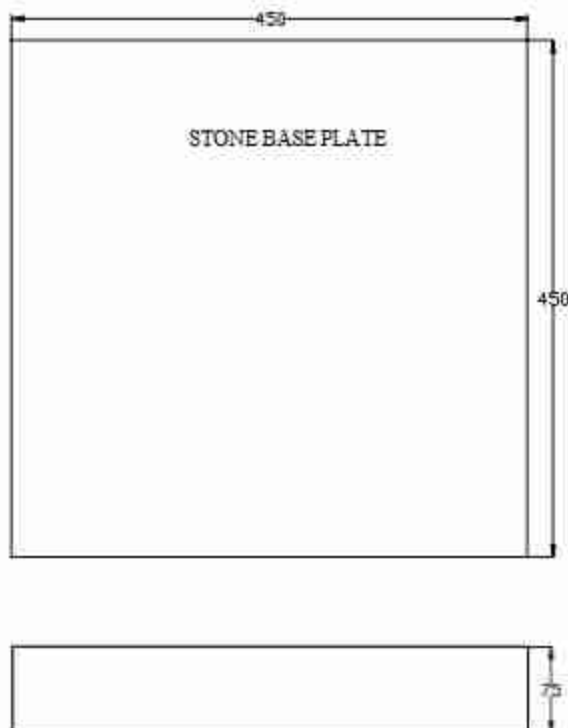


Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

RCC BASE PAD FOR PCC POLE

SIZE	SCALE	THICKNESS	REV. NO.	REV. NO.
A3	NTS	REC/RDSS/GEN/05A	1 of 1	0



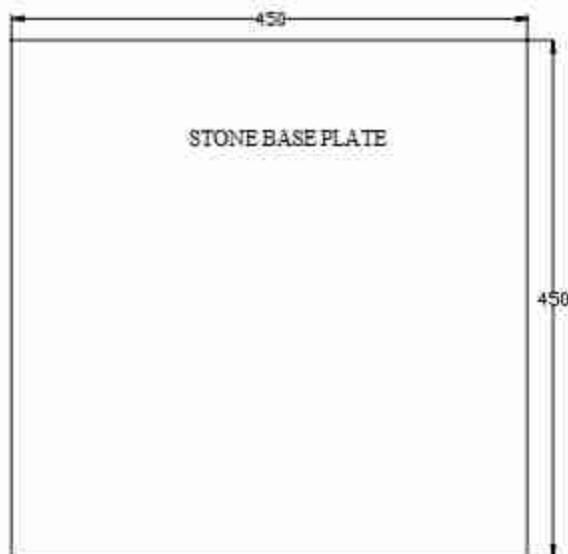
All dimensions are in mm.

FOR TENDER PURPOSE ONLY

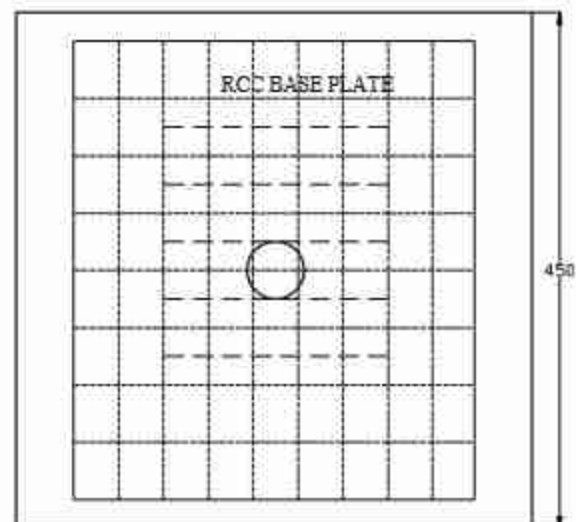


Rural Electrification Corporation Ltd.

PROJECT				Revamped Distribution Sector Scheme (RDSS)			
TITLE				DRAWING FOR STONE/RCC BASE PLATE FOR STAY SET			
DATE	SCALE	CWL NO.		SHEET NO.	REV. NO.		
20/01/2018	AS PER	REC RDSS GEN/05B		1 OF 1	0		



150  
250  
25 mm  
HT Wire 4 mm



All dimensions are in mm.

FOR TENDER PURPOSE ONLY

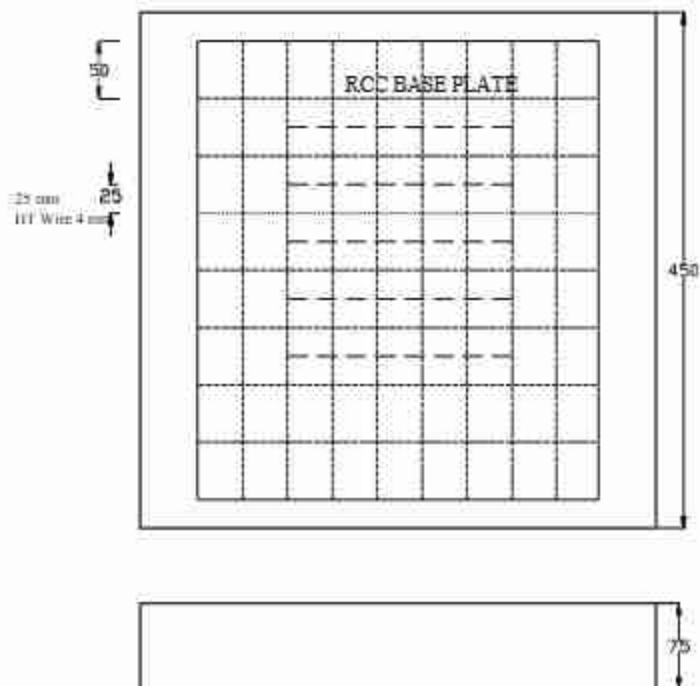
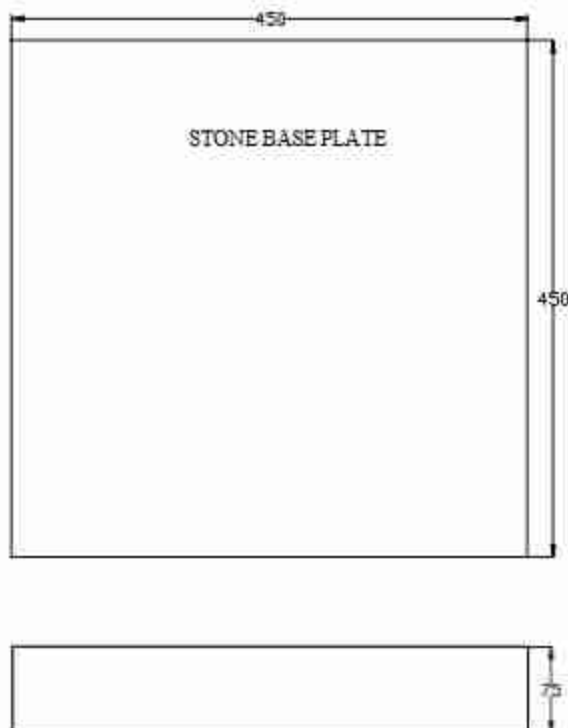


Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)

TITLE: DRILLING FOR STAY/ANCHOR BASE PLATE  
FOR STAY SET.

DATE	SCALE	QNL. NO.	SHT. NO.	REV. NO.
APR 2018		REC/RDSS/GEN-2C	1 OF 1	0



All dimensions are in mm.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

Revamped Distribution Sector Scheme (RDSS)

TITLE

DRAWING FOR STONE/RCC BASE PLATE  
FOR STAY SET

DATE

SCALE

AS PER

REQD. NO.

REC/RDSS/GEN/50

SHEET NO.

1 OF 1

REV. NO.

0





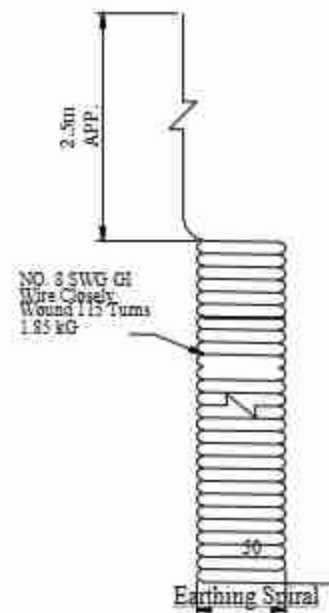
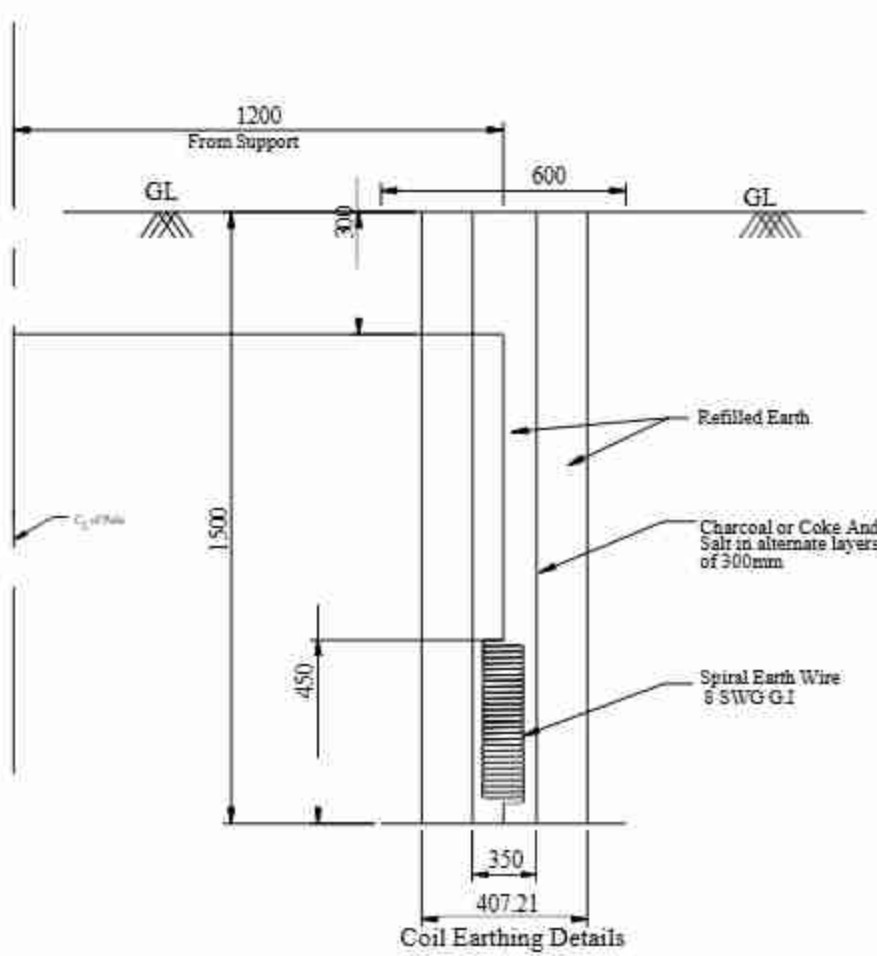
Revamped Distribution Sector Scheme (RDSS)

SWEDH



Revamped Distribution Sector Scheme (RDSS)

RDSS



#### NOTES:-

- 1) All dimensions are in mm unless otherwise mentioned.
- 2) Manufacturing Tolerance:  
a) Dia of GI wire  $\pm 2.5\%$
- 3) MS wire shall conform to IS 280
- 4) All MS parts shall be hot dip galvanised as per IS 2629 and IS 4759.
- 5) In rocky areas where digging upto 1500 mm is not possible, earthing arrangement in horizontal configuration buried at a depth not less than 500 mm shall be used.
- 6) Weight mentioned is for packing and forwarding purpose only.

FOR TENDER PURPOSE ONLY

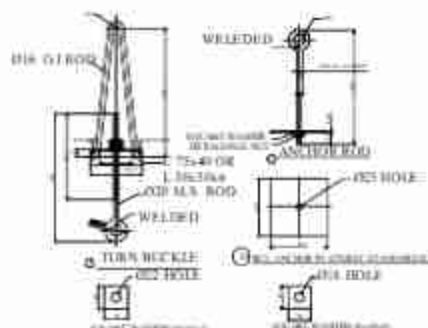
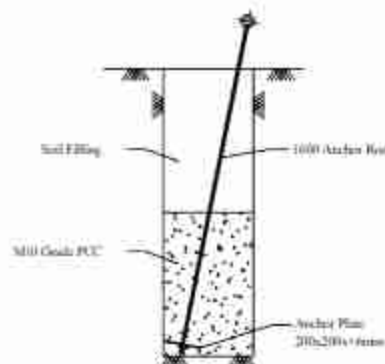
Rural Electrification Corporation Ltd.

PROJECT: **Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)**  
Revised Distribution Schedule, 2011-12

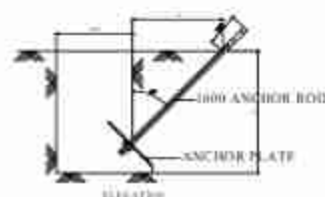
TITLE				
SPIRAL EARTHING DETAILS				
DATE	SCALE	SHEET NO.	TOTAL SHEETS	REV. NO.
AS	NTS	REC-RDS-GEN/08	1	0

REVISIONS					
NO.	DESCRIPTION	DATE	BY	CHKD.	APPD.

All Dimensions are in mm unless otherwise mentioned  
Manufacturing Tolerance as Follows  
Upto 50mm :  $\pm 5\%$   
51 to 100mm :  $\pm 4\%$   
101 to 300mm :  $\pm 3\%$   
Above 300mm :  $\pm 2\%$



Stay Set Arrangement



Stay Set Arrangement

# BILL OF MATERIAL

ITEM NO.	DESCRIPTION	SECTION	MATERIAL	LENGTH MM	QTY.
1	STEEL GUY WIRE ASSEMBLY		GL		1.00
2	TURN BUCKLE	100mm	GL	750	1.00
3	SUPPORTING ANGLE	100x100x6	GL	100	1.00
4	END PLATE	100mm	GL	1000	1.00
5	WASHER	40mm	GL	40000	1.00
6	NUT	40mm	GL		2.00
7	ANCHOR ROD & ANCHOR PLATE		GL		1.00
8	ANCHOR ROD	100mm	GL	1000	1.00
9	ANCHOR PLATE (STANDARD 6-1)	75x75x10	GL	475000	1.00
10	WELDED WASHER	80mm	GL	40000	1.00
11	NUT	40mm	GL		1.00
12	GUY INSULATOR				1.00
13	GUY WIRE	7.25mm	GL		
14	TURNBuckle		GL		2.00

Concrete 0.2cu

## NOTES:-

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED.
- ALL M.S. ITEM SHALL BE HOT DIP GALVANISED AS PER IS 2629&4759
- MANUFACTURING TOLERANCE  
UPTO 50mm -  $\pm 5\%$   
51 TO 100mm -  $\pm 4\%$   
101 TO 300mm -  $\pm 3\%$   
ABOVE 300mm -  $\pm 2\%$
- M.S. MATERIAL SHALL CONFIRM TO IS 1062
- GUY INSULATORS TO BE UTILISED AS PER SPECIFICATION FOR HT & LT LINES RESPECTIVELY
- FOR FIRM SOILS, ONLY SOIL FILLING WITH COMPACTION TO BE DONE

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

STAY SET ARRANGEMENT FOR 11KV/LT LINE

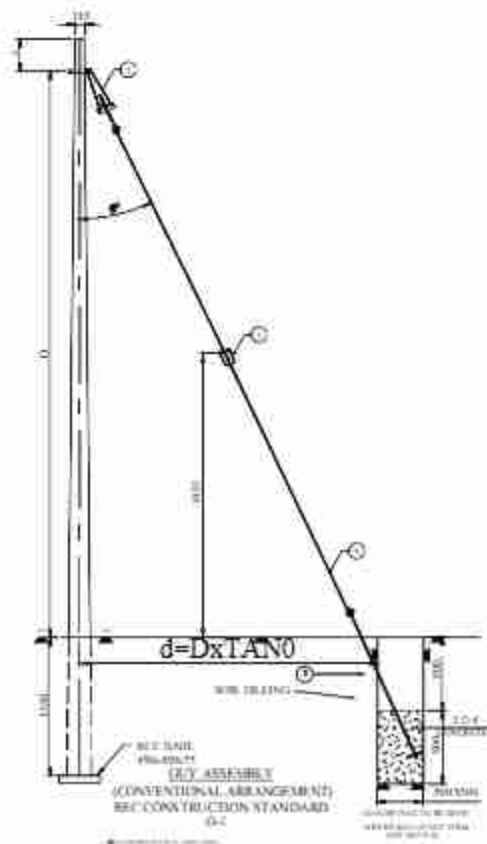
SIZE SCALE: DRG. NO.

AS NTS

REC/RDSS/GEN/09A

SHT. NO. REV. NO.

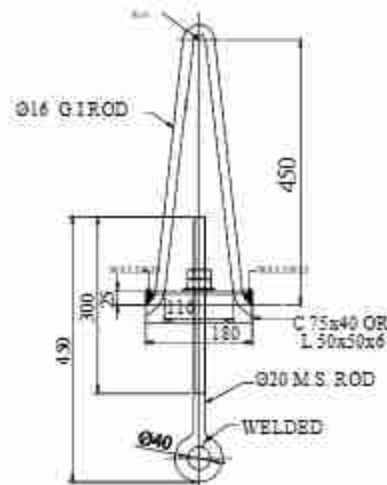
1 OF 1 0



STAY INSULATOR MAKE-OFF



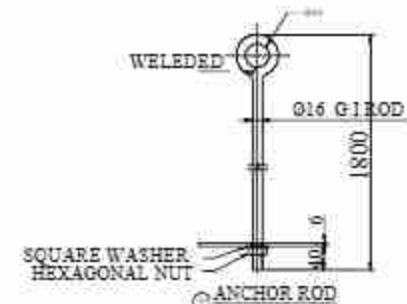
END MAKING OF GUY WIRE



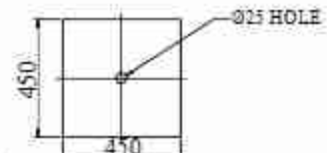
TURNBUCKLE

Ø22 HOLE

SQUARE WASHER (40x40x4)



ANCHOR ROD



RCC ANCHOR PLATE (REC STANDARD XI)

Ø18 HOLE

SQUARE WASHER (40x40x4)

# NOTES:-

- 1) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED
- 2) ALL M.S. ITEMS SHALL BE HOT DIP GALVANIZED AS PER IS 2625:1979
- 3) MANUFACTURING TOLERANCE:  
UP TO 50mm - ± 3%  
51 TO 100mm - ± 4%  
101 TO 500mm - ± 5%  
ABOVE 500mm - ± 2%
- 4) M.S. MATERIAL SHALL CONFORM TO IS 2062
- 5) GUY INSULATORS TO BE UTILIZED AS PER SPECIFICATION FOR HT & LT LINES RESPECTIVELY.
- 6) FOR FIRM SOILS, ONLY SOIL FILLING WITH COMPACTION TO BE DONE

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

STAY SET ARRANGEMENT ON 140KG PCC POLE

SIZE/SCALE:

A3/NTS

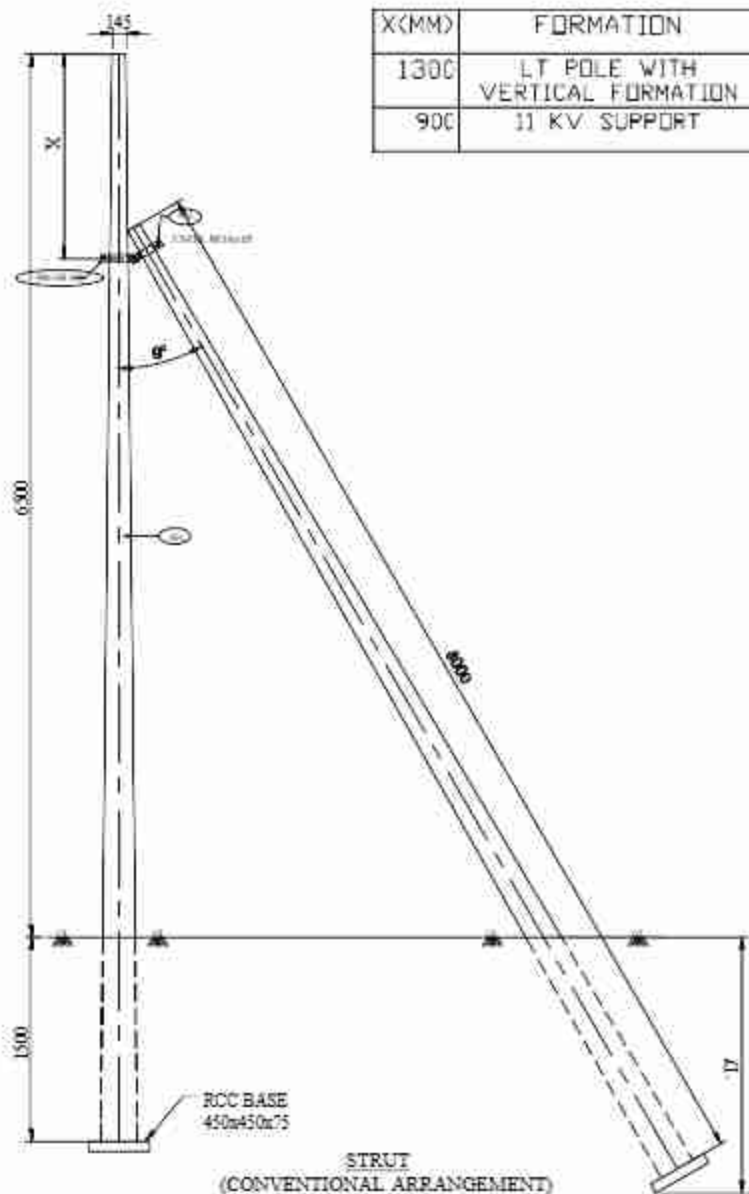
DWG. NO.:

REC/RDSS/GEN/09B

SHT. NO. / REV. NO.:

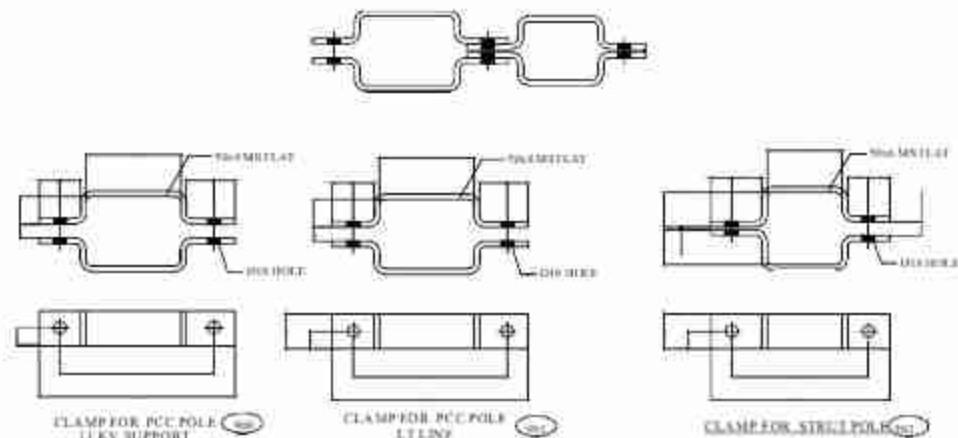
1 OF 1 / 0





X(MM)	FORMATION
1300	LT POLE WITH VERTICAL FORMATION
900	11 KV SUPPORT

BILL OF MATERIAL							
ITEM NO.	DESCRIPTION	SIZE	MATERIAL	LENGTH MM	QUANTITY	QTY.	TOTAL WT. KG.
001	No.200x40 PCC POLE				2.0000		
002	CLAMP FOR PCC POLE (DIAGONAL SUPPORT)	50x50	MS	175	1.10	2.0000	2.275
003	CLAMP FOR PCC POLE (VERTICAL)	50x50	MS	200	1.10	2.0000	2.400
004	CLAMP FOR STRUT POLE	50x50	MS	100	1.10	2.0000	2.200
005	WATER & SOIL	50x50		60	0.5000	1.0000	0.800
006	SPRING WASHER	50x50		1.0000	0.0000	1.0000	0.000
007	PLATE WASHER	50x50		1.0000	0.0000	1.0000	0.000
TOTAL							7.675



#### GENERAL NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED

2. TOLERANCE ACCORDING TO IS 1592

0 TO 10mm  $\pm 0.25$

11 TO 100mm  $\pm 0.40$

101 TO 1000mm  $\pm 0.75$

ABOVE 1000mm  $\pm 1.25$

3. ALL M.S. PARTS SHALL CORROSION RESISTANT

4. ALL M.S. CORRUGATED PARTS SHALL BE HOT DIP GALVANIZED

AS PER IS 2624 & 4779

5. ALL THE FITTINGS SHALL BE MARKED WITH IDENTIFICATION

6. WEIGHT INDICATED IS FOR PACKING & TRANSPORTATION PURPOSE ONLY

7. ALL CLAMP AND ANGLE SHALL REFER TO IS 1592 PART 1

8. ALL DIMENSIONS SHALL BE IN MM UNLESS OTHERWISE SPECIFIED

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

Revamped Distribution Sector Scheme (RDSS)

TITLE

STRUT ARRANGEMENT

REV.

DATE

BY

NO.

REV.

NO.

REV.

NO.

REV.

NO.

A3

NTS

REC/RDSS/GEN/10

1 OF 1

0

### DETAILS OF CABLE TRANCH SECTION

## PLAN

TYPICAL DETAILS OF  
SLAB SUPPORT

### DETAILS OF CONSTRUCTION

SECTION A-A

L → A  
PLAN  
 DETAILS OF COVER SLAB

TYP. DETAIL OF  
ANCHORING 75x6 MS  
FLAT

VIEW 2-2

VIEW H-H

TYP. CABLE SUPPORT

## NOTES 179

- 1) ALL DIMENSIONS ARE IN MM.
- 2) M20 GRADE CONCRETE SHALL BE USED.
- 3) STEEL FE 415 GRADE SHALL BE USED.
- 4) CLEAR COVER TO THE MAIN REINFORCEMENT SHALL BE 25 MM
- 5) SLOPE IN TRENCH ALONG THE RUN OF TRENCH SHALL BE IN 1:500

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

**PUC/FED**

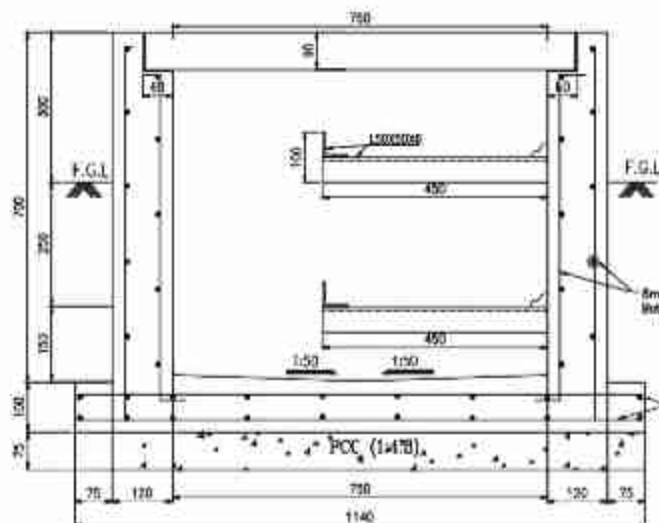
Revamped Distribution Sector Scheme (RDSS)

**TABLE 1**

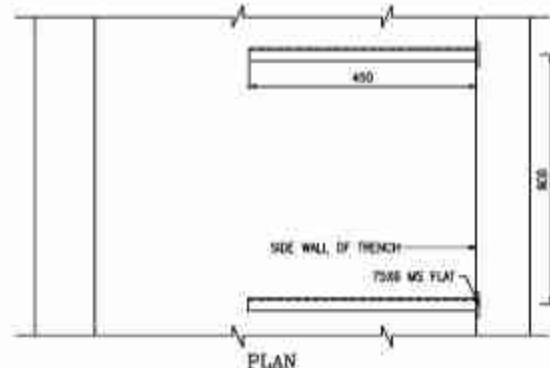
### DETAILS OF 500MM WIDE CABLE TRENCH

SA					
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

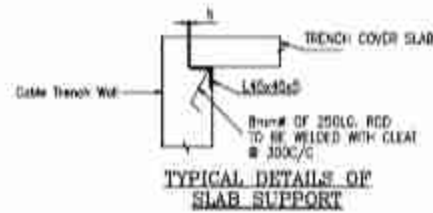
SZTS	SZALZ	DEG. NO.	MIT. NO.	RFE. NO.
A4	1-300	REC/ RDSS */GEN/11A	( 0 )	0



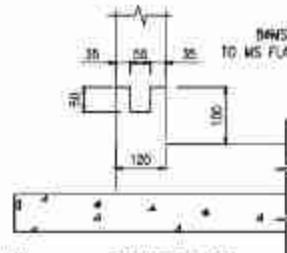
**DETAILS OF CABLE TRENCH SECTION**



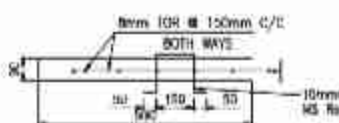
**PLAN**



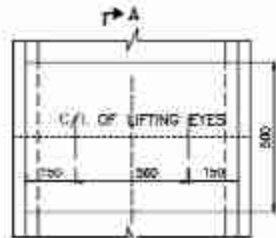
**TYPICAL DETAILS OF SLAB SUPPORT**



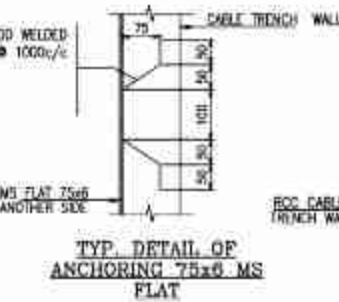
**DETAILS OF CONSTRUCTION JOINT**



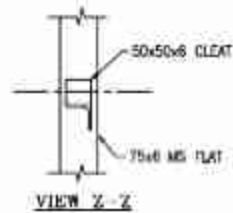
**SECTION A-A**



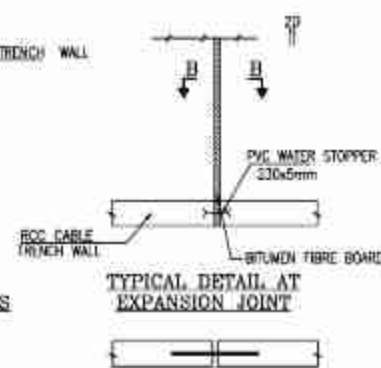
**PLAN**  
**DETAILS OF COVER SLAB**



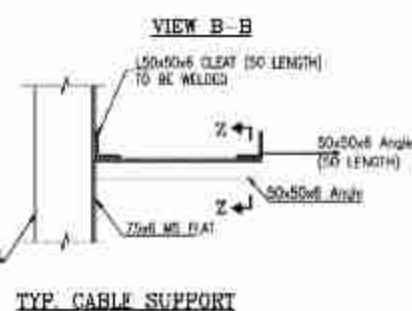
**TYP. DETAIL OF ANCHORING 75x8 MS PLAT**



**VIEW Z-Z**



**TYPICAL DETAIL AT EXPANSION JOINT**




**TYP. CABLE SUPPORT**

**NOTES 1:-**

- 1) ALL DIMENSIONS ARE IN MM.
- 2) M20 GRADE CONCRETE SHALL BE USED.
- 3) STEEL FE 415 GRADE SHALL BE USED.
- 4) CLEAR COVER TO THE MAIN REINFORCEMENT SHALL BE 25 MM.
- 5) SLOPE IN TRENCH ALONG THE RUN OF TRENCH SHALL BE IN 1:500.

**FOR TENDER PURPOSE ONLY**

		<b>Rural Electrification Corporation Ltd.</b>	
<b>PROJECT:</b> Revamped Distribution Sector Scheme (RDSS)			
<b>TITLE:</b> <b>DETAILS OF 750MM WIDE CABLE TRENCH</b>			
S.D. NO. 44	SCALE 1:100	DRG. NO. <b>REC/ RDSS /GEN/118</b>	SHEET NO. 1 OF 1
REV. NO. PREPARED CHECKED APPROVED DATE	PROJECT	REV. NO. 1	REV. NO. 1

G. I. Stay Wire

Hellically Formed End Fitting

Thimble

Stay Rod

NOTE: FOR DETAILS OF HELLICALLY FORMED GUY GRIPS REFER REC SPECIFICATION NO. 25/1983

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

Guy -End Assembly  
(Using Hellically Formed Fitting)

REV.

SCALE

ORIG. NO.

DATE REC.

REV. NO.

A3

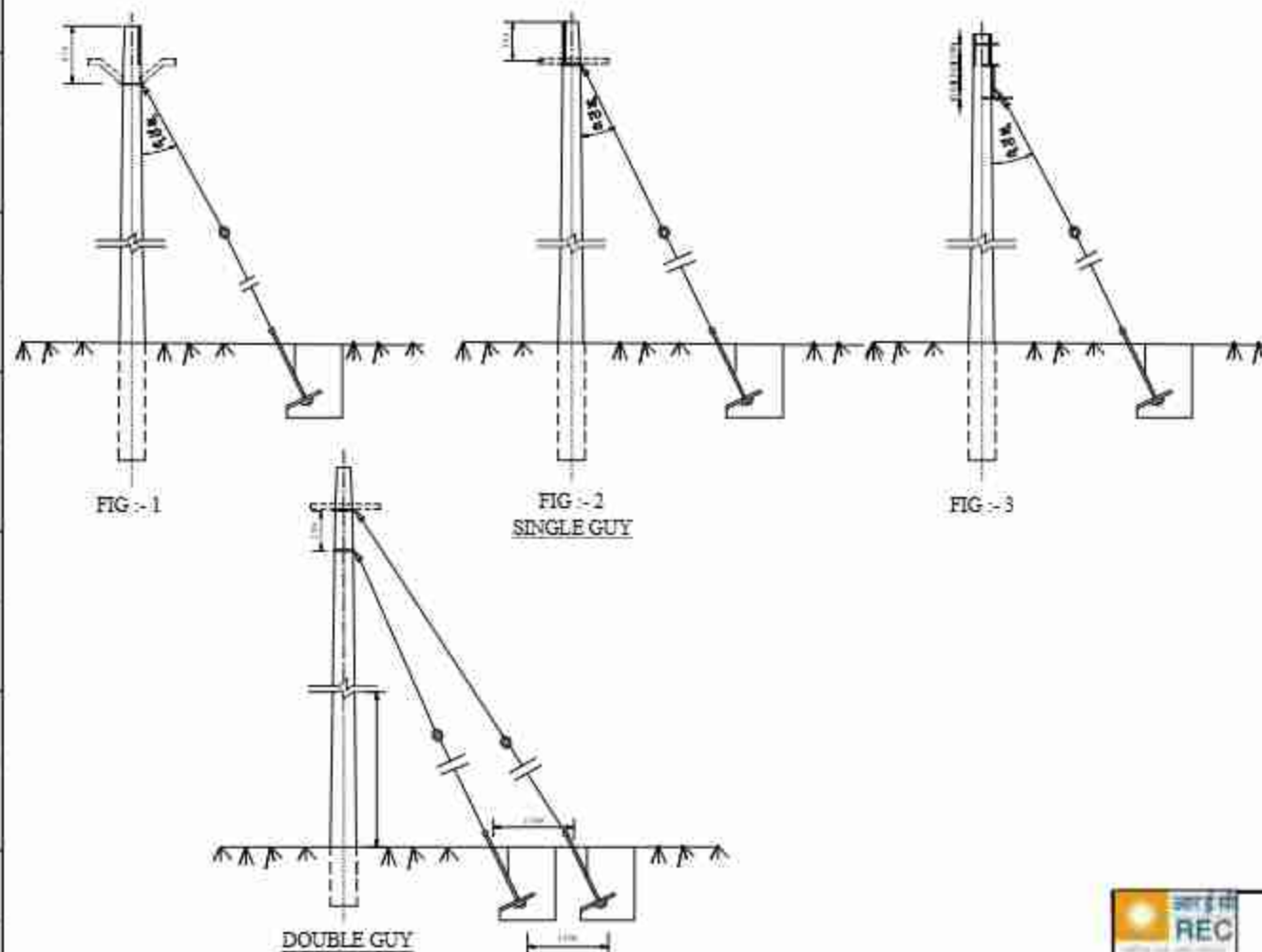
NTS

REC/RDSS/GEN/12

1 OF 1

0

REV.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



#### NOTES :-

1. SINGLE GUY ARRANGEMENT AS PER FIGURE 1, 2 & 3 CAN BE USED WHEN TOTAL TENSION TO BE TAKEN ON THE GUY DOES NOT EXCEED THE FOLLOWING LIMITS
2. IN THE DURABLE GUY ARRANGEMENT THE FOUNDATION OF THE GUYS SHOULD BE SO PLACED THAT ONE DOES NOT REDUCE THE STRENGTH OF THE OTHER. IN OTHER WORDS, THE SOIL WHICH RESISTS THE UP - LIFT SHOULD NOT BE DISTURBED WHILE DIGGING THE FOUNDATION FOR THE OTHER STAY.
3. FOR DETAILS OF COMPONENTS OF GUY ASSEMBLY, REFER, G - 1.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT :

Revamped Distribution Sector Scheme (RDSS)

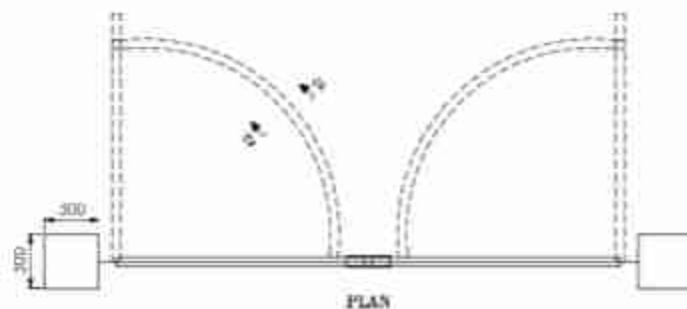
WORK :

Guying Arrangement Single & Double Guy

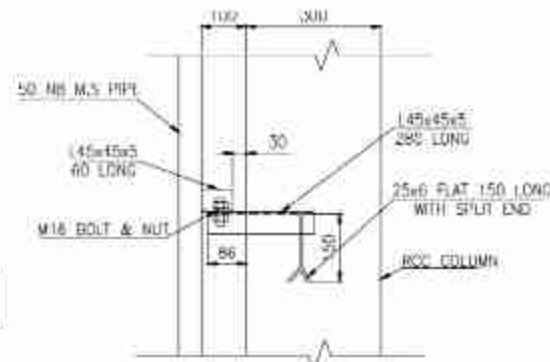
NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01					

REV.	REASON	DATE	BY	DATE
A3	NTS	REC/RDSS/GEN/13	1/10/1	6



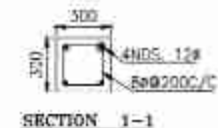


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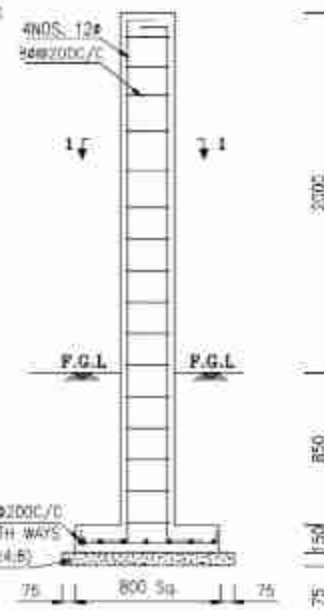


DETAIL - X

SCALE : 1:10

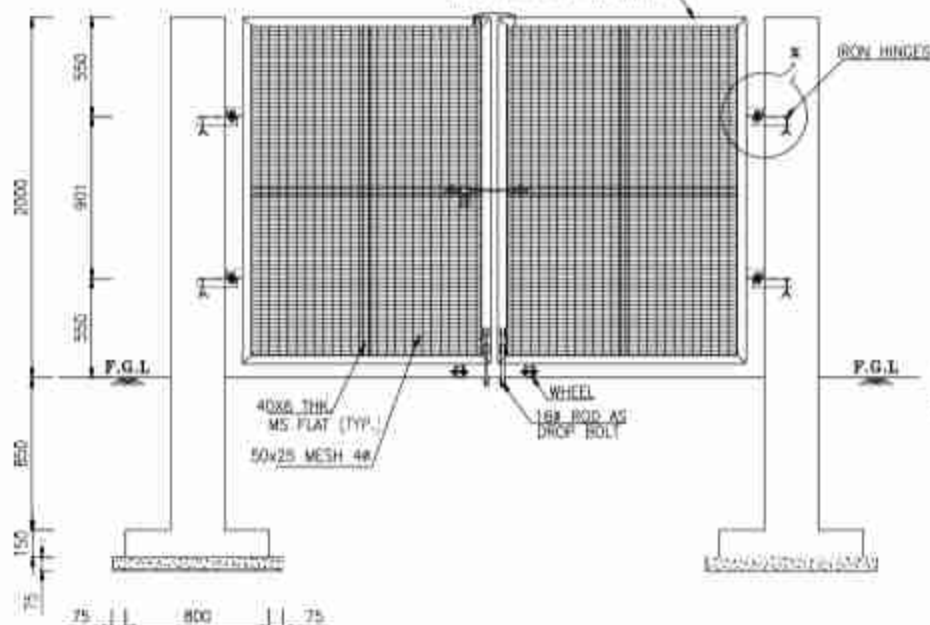


SECTION 1-1



COLUMN DETAILS

50 NB M.S. PIPE MEDIUM DUTY  
WELD TO RIGID CONNECTIONS



DETAILS OF M.S. GATE



SECTION 2-2

SCALE : 1:10

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. GATE FITTING SHALL BE AS PER I.S.
3. M20 GRADE CONCRETE SHALL BE USED.
4. Fe 415 GRADE STEEL SHALL BE USED.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

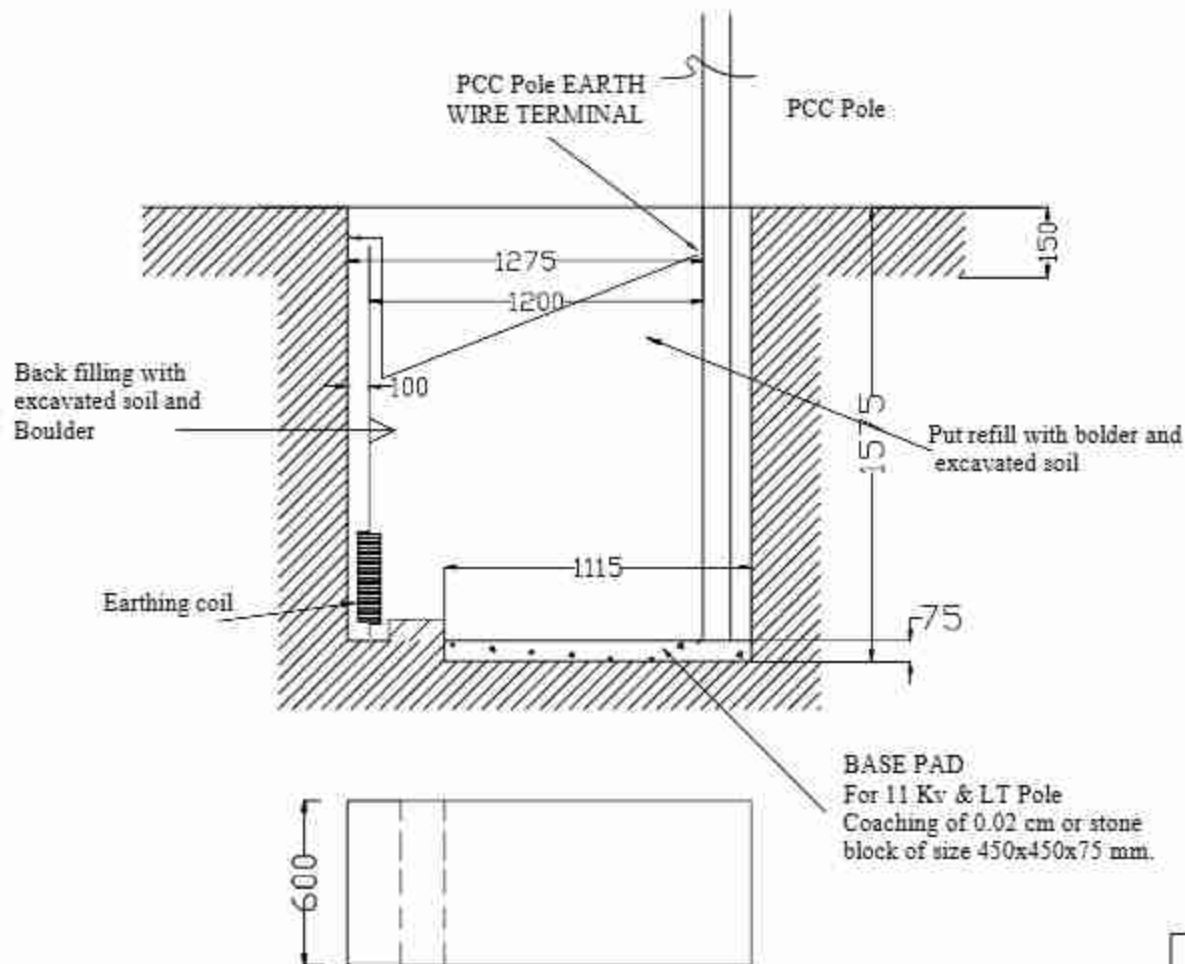
Revamped Distribution Sector Scheme (RDSS)

TITLE:

DETAILS OF M.S. GATE

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

MTS	SCALE	DRG. NO.	MTS. NOS	REV. NOS
A4	1:10	REC/RDSS/GEN/14	1 OF 1	0



FOR TENDER PURPOSE ONLY

All dimensions are in mm.

NO.	REVISION	DATE	BY	CHKD.	APPD.
1					



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

DRAWING FOR POLE PIT FOR PCC POLE FOR NORMAL SOIL

SIZE/SCALE:

AS NOTED

DRG. NO.

REC/RDSS/GEN/15

SHT. NO.

1 OF 1

REV. NO.

0



Revamped Distribution Sector Scheme (RDSS)



Revamped Distribution Sector Scheme (RDSS)



Revamped Distribution Sector Scheme (RDSS)





Revamped Distribution Sector Scheme (RDSS)

RDSS



Revamped Distribution Sector Scheme (RDSS)

10/10/2010



Revamped Distribution Sector Scheme (RDSS)



Revamped Distribution Sector Scheme (RDSS)

ENR 11



Revamped Distribution Sector Scheme (RDSS)

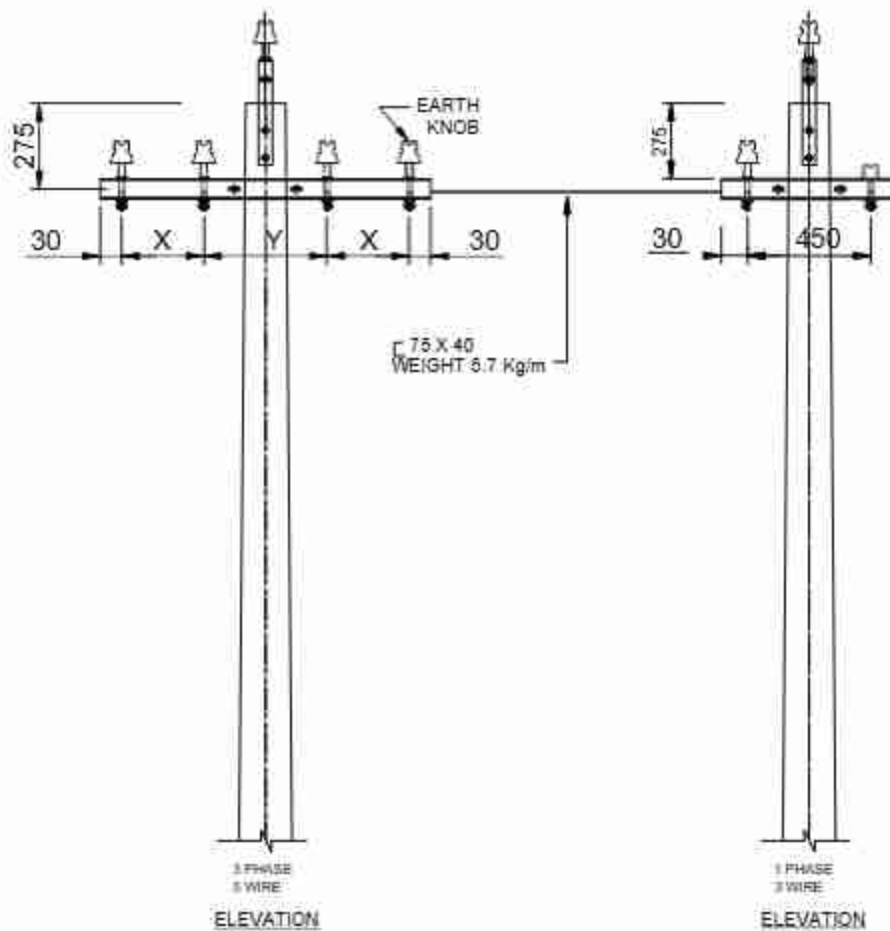
ENR 2014





Revamped Distribution Sector Scheme (RDSS)

ENR 11



SAGS	HORIZONTAL SPACING	
	X	Y
UP TO 750	300	450
750 TO 1200	450	450



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:  
Revamped Distribution Sector Scheme (RDSS)

TITLE:  
415/240V Conductor Formation and Clearance Horizontal Formation

NO.	REVISION	DATE	BY	CHKD	PRJCT
01					

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/RDSS/LT-OH/08	1 OF 1	0

REGISTRATION INFORMATION



Ph: 011-26101000

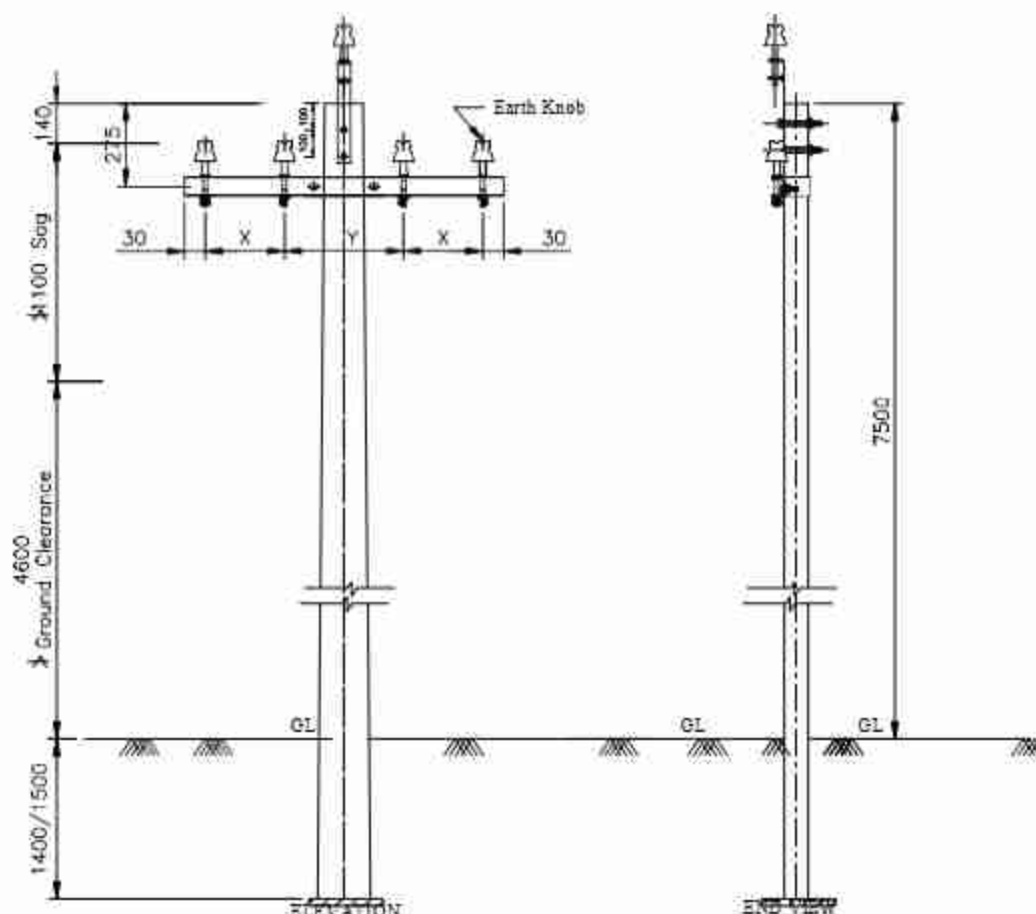
011-26101000

Revamped Distribution Sector Scheme (RDSS)

1000 1000

1000 1000

RDSS



Bill of Material

Supports 7.5 M	1 No.
V-Cross Arm	1 No.
Black Clamp	1 No.
Pole Top Bracket	1 No.
L T Pin Insulators	4 Nos.
L T Pin	4 No.
Earth Knob	1 No.
Bolt 10 Ø	4 No.

Sags	Horizontal Spacing	
	X	Y
UP TO 750	300	450
750 TO 1200	450	450

FOR TENDER PURPOSE ONLY

Tangent Location  
Maximum Span-67 Mtr.

Note: - All Dimension are in mm.

NO.	REVISION	DATE	BY	CHKD	APPD
1					



Rural Electrification Corporation Ltd.

Revised Design of 415/240V Line Support Horizontal Formation

415/240V Line Supports Horizontal Formation

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	MTS	REC/RDSS/LT-OH/10	1 of 1	0

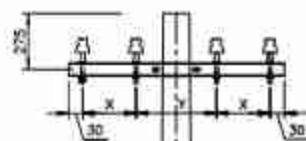


Diagram  
 1.0P 70.6 for 7.2-11 mm & 7.0.5N AC30  
 1.0P 70.6 for 7.2-11 mm AC30

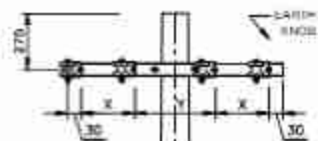


Diagram  
 1.0P 70.6 for 7.2-11 mm & 7.0.5N AC30  
 1.0P 70.6 for 7.2-11 mm AC30

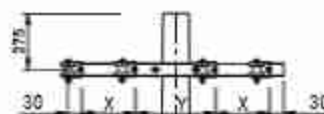


Diagram  
 1.0P 70.6 for 7.2-11 mm & 7.0.5N AC30  
 1.0P 70.6 for 7.2-11 mm AC30

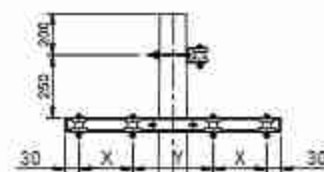


Diagram  
 1.0P 70.6 for 7.2-11 mm & 7.0.5N AC30  
 1.0P 70.6 for 7.2-11 mm AC30

Horizontal Spacing	
X	Y
300	450

All Dimension are in mm.

FOR TENDER PURPOSE ONLY

		Rural Electrification Corporation Ltd.	
PROJECT: Revamped Distribution Sector Scheme (RDSS)			
TITLE: Arrangement of Conductors at Angle Location 415/240 Volta Lines (Cross Country) Horizontal Formation			
SIZE	SCALE	DRG. NO.	SHT. NO. REV. NO.
A3	MTS	REC/RDSS/LT-OH/11	1 OF 1 0

DATE	REVISION	REVISION	REVISION	REVISION
01/01/2011	01/01/2011	01/01/2011	01/01/2011	01/01/2011



# Bill of Material

Supports 7.5 M	1 No.
Cross Arm	1 No.
Black Clamp	1 No.
L.T Pin Insulators	3 Nos.
L.T Pin	3 Nos.
Earth Knob	1 No.
Bolt 16 Ø with Nuts	2 No.

Sags	Horizontal Spacing	
	X	Y
UP TO 750	300	450
750 TO 1200	450	450

FOR TENDER PURPOSE ONLY

Rural Electrification Corporation Ltd.



PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

415/240V Line Conductor Formation And Clearances  
(Horizontal Formation)

SIZE SCALE

DRG. NO.

AS HTS

REC/RDSS/LT-OH/12

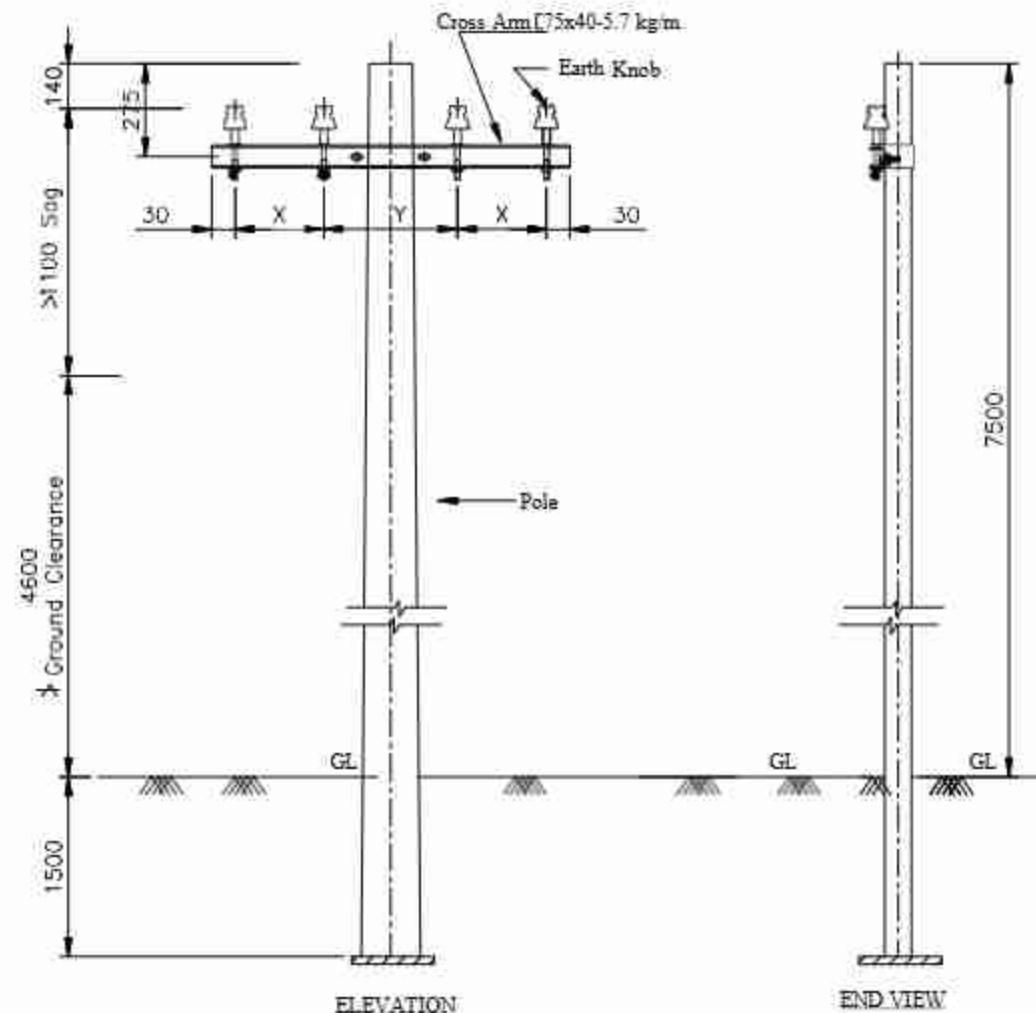
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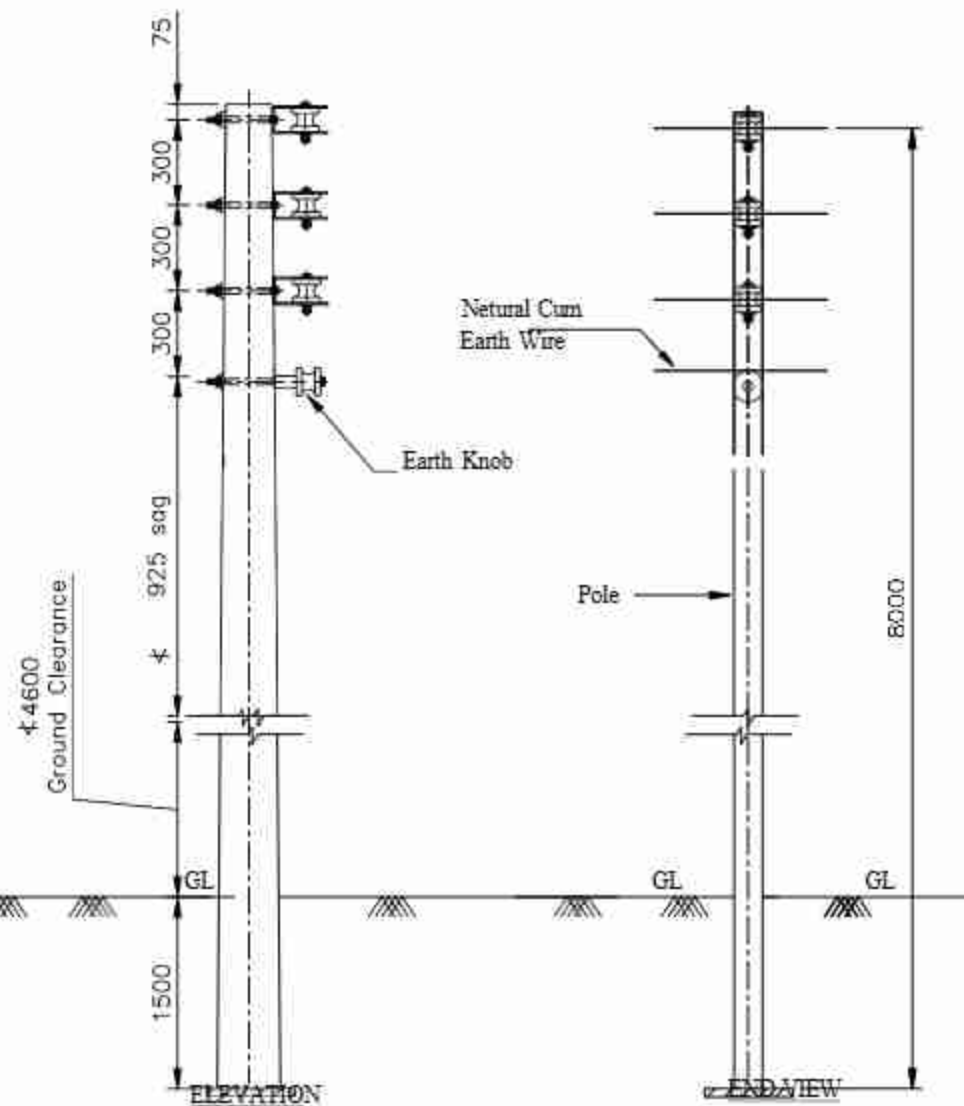
1 OF 1

0

Note:- All Dimension are in mm.

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION





### Bill of Material

8 M Supports	1 No.
U- Clamp	3 Nos.
Shackle Insulators	3 Nos.
Earth Knob	1 No.
Bolt 16 $\phi$ with Nuts	4 No.

FOR TENDER PURPOSE ONLY

Rural Electrification Corporation Ltd



Revamped District (Special) Scheme (RDSS) Yojana (DDUGJY)

PROJECT:

415/240V Line Conductor Formation And Clearances  
10.4W (Vertical Formation)

TITLE:

/

SIZE/SCALE  
AS NOTED

DRG. NO.

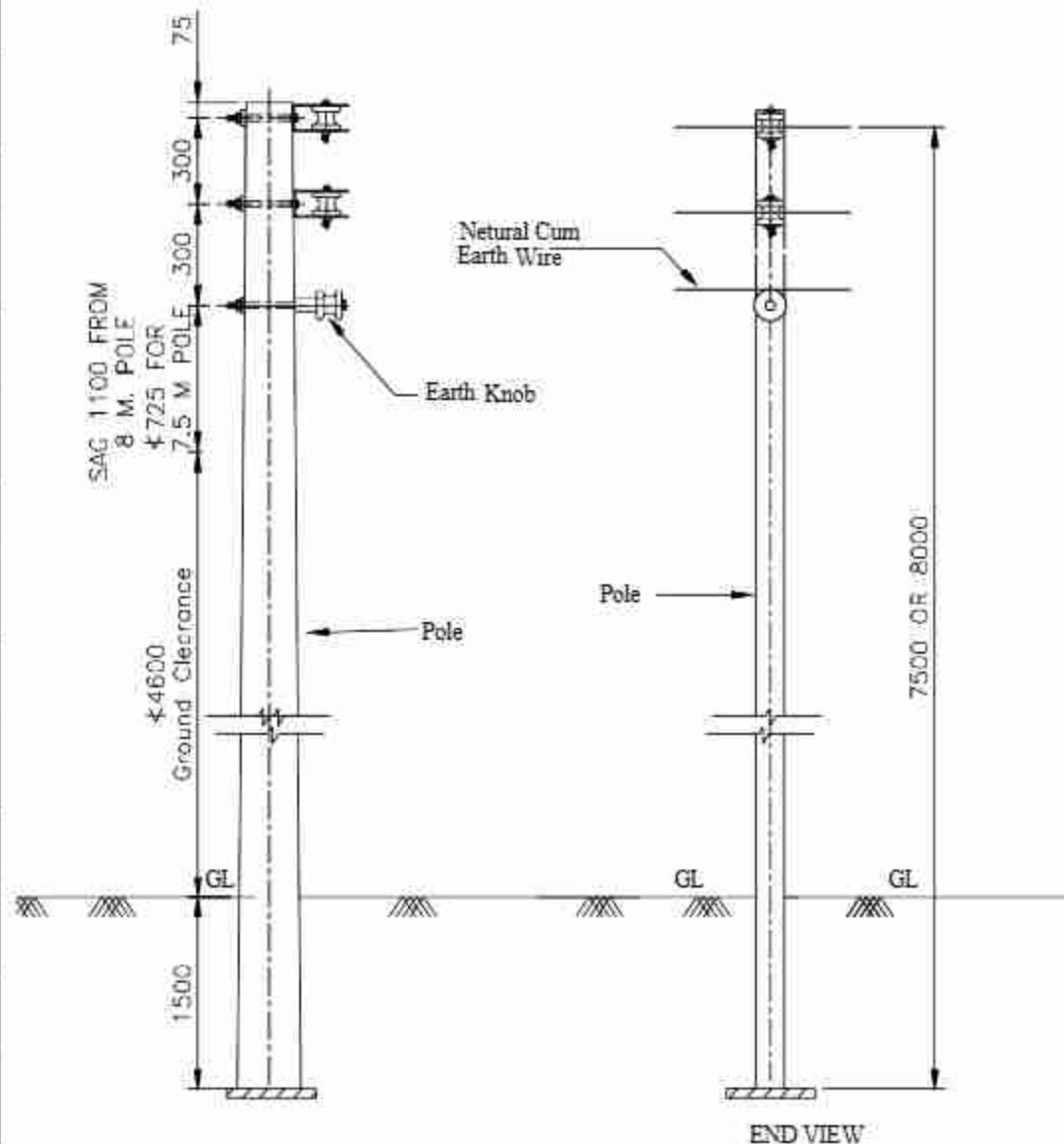
REC/KDSS/LT-OH/13

skd

REV. NO.

Note - All Dimension are in mm.

DATE	REVISION	REVISION	REVISION	REVISION	REVISION



Bill of Material

8 M Supports	1 No.
U- Clamp	2 Nos.
Shackle Insulators	2 Nos.
Earth Knob	1 No.
Bolt 16 $\phi$ with Nuts	3 No.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

415/240V Line Conductor Formation And Clearances  
 (V.V.F) (Vertical Formation)

SHEET NO.

PRO. NO.

REC/RDSS/LT-OH/14

SHT. NO.

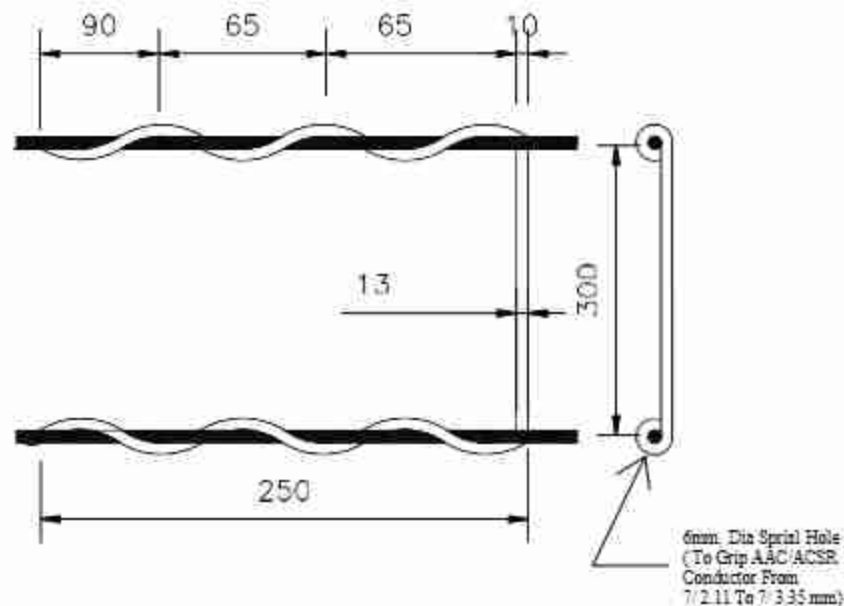
1 OF 1

REV. NO.

0

Note:- All Dimension are in mm.

NO.	REVISION	DATE	BY	CHKD.
1				
2				
3				
4				
5				



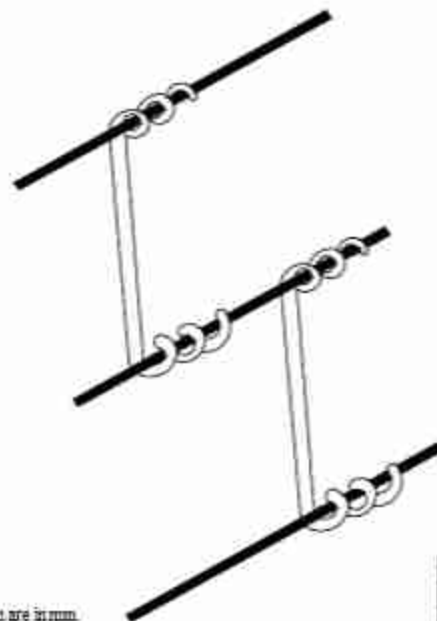
#### Tests:-

The Spaces shall comply with the following Test Requirements:-

1. Dry Power Frequency Withstand Voltage 23KV.
2. Wet Power Frequency Withstand Voltage 10KV.
3. Three Specification Shall be Maintained At A Temp. of 70\_2C For Period of 24 Hours After This Treatment, The Specimens shall Not Show Any Deformity And After Cooling, shall Have A Minimum Tensile Strength of 375 Kg/Cm (500 Kg For 13mm Dia Spacer)

#### NOTE:-

While 1 And 2 Will Be Treated AS Type Tests. The Third Test Will Be Carried Out On Each Batch of 5000 Nos.




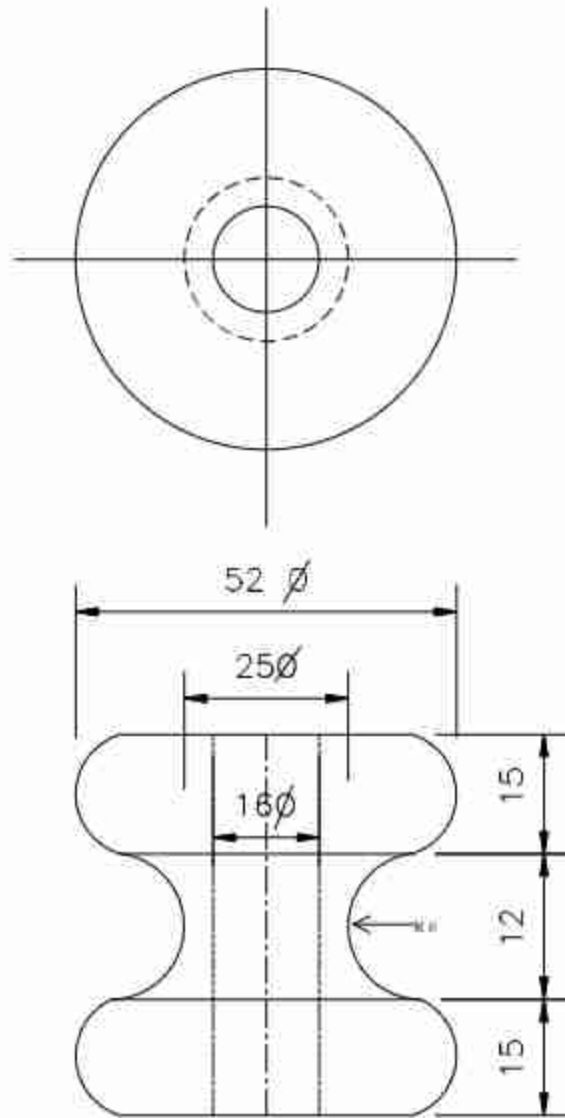
A View of the PVC Spacers on the L.T Line

Note:- All Dimension are in mm.

FOR TENDER PURPOSE ONLY

NO.	DESCRIPTION	QUANTITY	UNIT	REMARKS
1	PVC SPACER	5000	NO.	

		Rural Electrification Corporation Ltd.	
PROJECT: Revamped Distribution Sector Scheme (RDSS)			
TITLE: L.T Lines PVC Spacer			
SIZE/SCALE	DRG. NO.	SHT. NO.	REV. NO.
AS NOTED	REC/RDSS/LT-OH/15	1 OF 1	0



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

Earth Knob For L.T. Line

SIZE:

AS NTS

SCALE:

DRG. NO.

REC/RDSS/LT-OH/16

SHT. NO.

1 OF 1

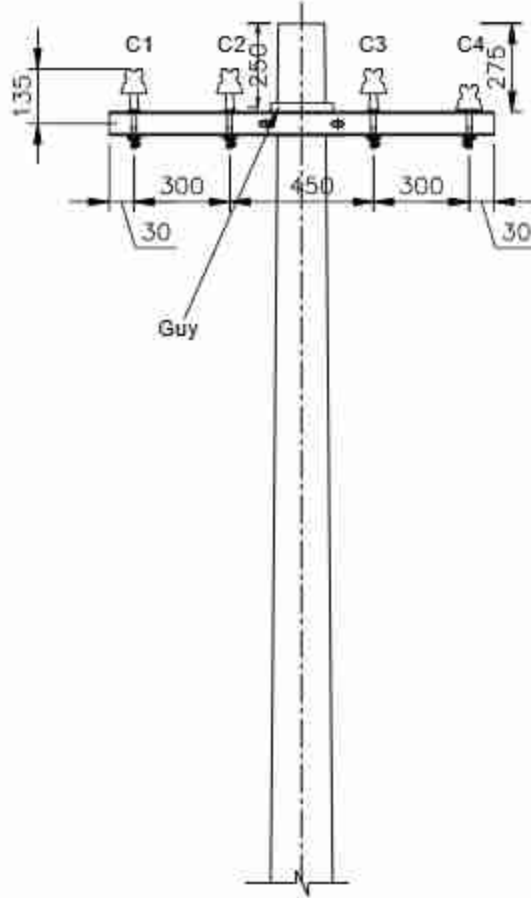
REV. NO.

0

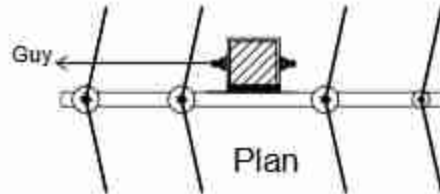
Note - All Dimension are in mm.

NO.	REVISION	DATE	BY	CHKD.	APPD.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					





Elevation



Plan

Note: - All Dimensions are in mm.

#### NOTES:-

1. FOR 7/2.11 mm AND 7/2.59 mm ACSR THE ANGLE OF DEVIATION MAY BE TAKEN UP TO 10.
2. FOR 7/3.35 mm ACSR THE ANGLE OF DEVIATION MAY BE TAKEN UP TO 5.
3. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.
4. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
5. GUY ANGLE SHALL BE 30° TO 45°.

#### NOTATIONS:-

- C1, C2, C3 \_\_\_\_\_ PHASE CONDUCTORS  
C4 \_\_\_\_\_ EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

#### PROJECT:

Revamped Distribution Sector Scheme (RDSS)

#### TITLE:

415V/240V Lines Conductor Formation And Arrangement of Guys For 0° TO 10° Angle Locations (3-Phase, 4 Wire, Horizontal Formation)

#### SIZE/SCALE

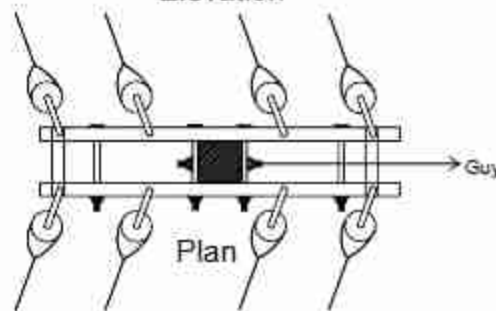
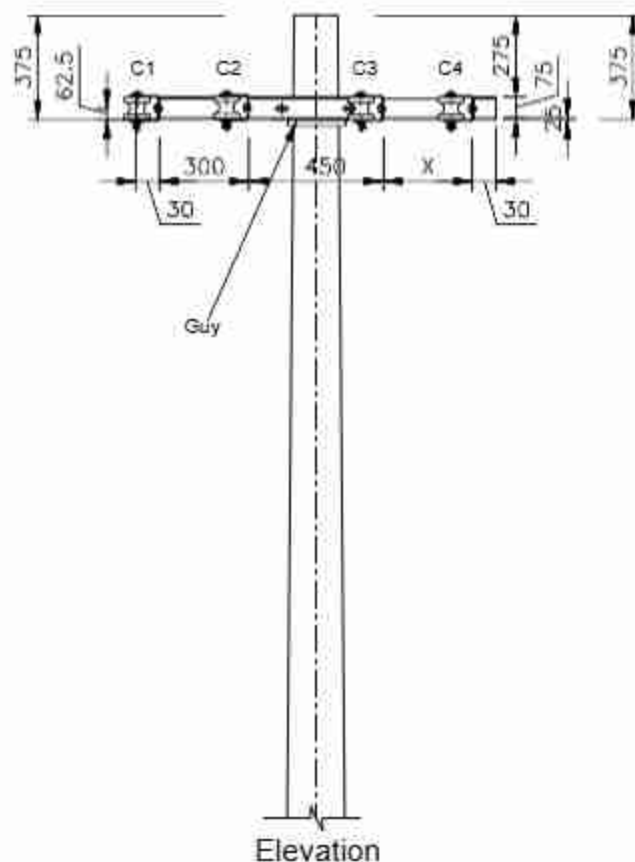
#### DRG. NO.

AS HTS

REC/RDSS/LT-OH/17

#### SHT. NO. REV. NO.

1 OF 1 0



NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE  $30^\circ$  TO  $45^\circ$


NOTATIONS:-

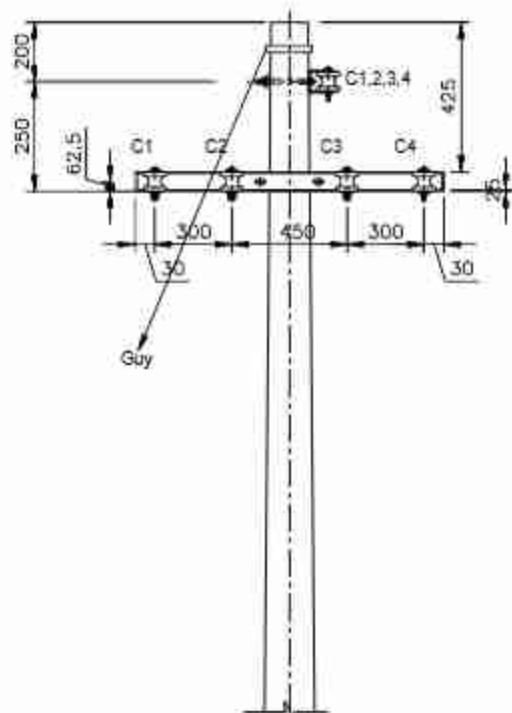
C1,C2,C3 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY

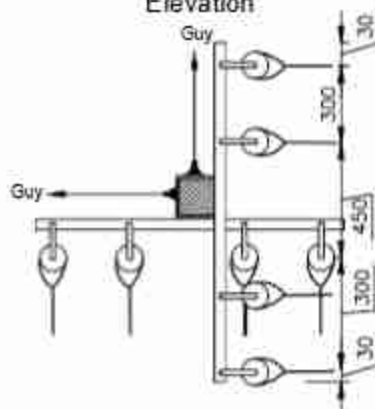
Note - All Dimension are in mm.

REV	DATE	BY	CHKD	APPD	REMARKS

		Rural Electrification Corporation Ltd.	
PROJECT: Revamped Distribution Sector Scheme (RDSS)			
TITLE: 415V/240V Lines Conductor Formation And Arrangement of Guys For 30° TO 60° Angle Locations(3-Phase, 4 Wire, Horizontal Formation)			
SIZE	SCALE	DRG. NO.	SHT. NO. REV. NO.
A3	NTS	REC/RDSS/LT-OH/18	1 OF 1 0



Elevation



Plan

#### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.

2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.

3. GUY ANGLE SHALL BE  $30^\circ$  TO  $45^\circ$ .

#### NOTATIONS:-

C1, C2, C3 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

#### PROJECT:

Revamped Distribution Sector Scheme (RDSS)

#### TITLE:

415V/240V Lines Conductor Formation And Arrangement of  
Guys For  $60^\circ$  TO  $90^\circ$  Angle Locations (3-Phase, 4 Wire, Horizontal Formation)

#### SIZE/SCALE

#### DRG. NO.

AS HTS

REC/RDSS/LT-OH/19

#### SHT. NO.

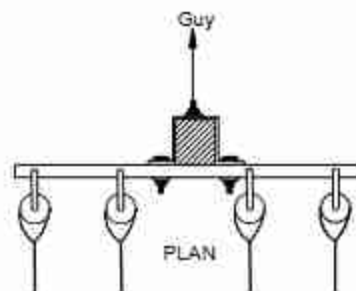
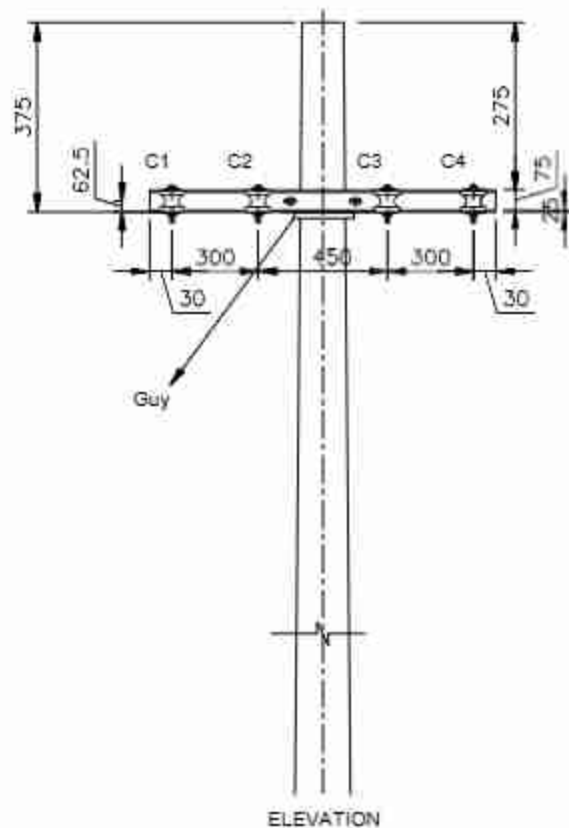
1 OF 1

#### REV. NO.

0

Note:- All Dimensions are in mm.

NO.	REVISION	DATE	BY	CHKD.	APPD.



#### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE  $30^{\circ}$  TO  $45^{\circ}$ .

#### NOTATIONS:-

C1, C2, C3 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY

Rural Electrification Corporation Ltd.

#### PROJECT:

Revamped Distribution Sector Scheme (RDSS)

#### TITLE:

415V/240V Lines Conductor Formation And Arrangement of  
Guys For Dead End Locations (3-Phase, 4 Wire, Horizontal Formation)

#### SIZE/SCALE

A3: HTS

#### DRG. NO.

REC-RDSS/LT-OH/20

#### SHT. NO.

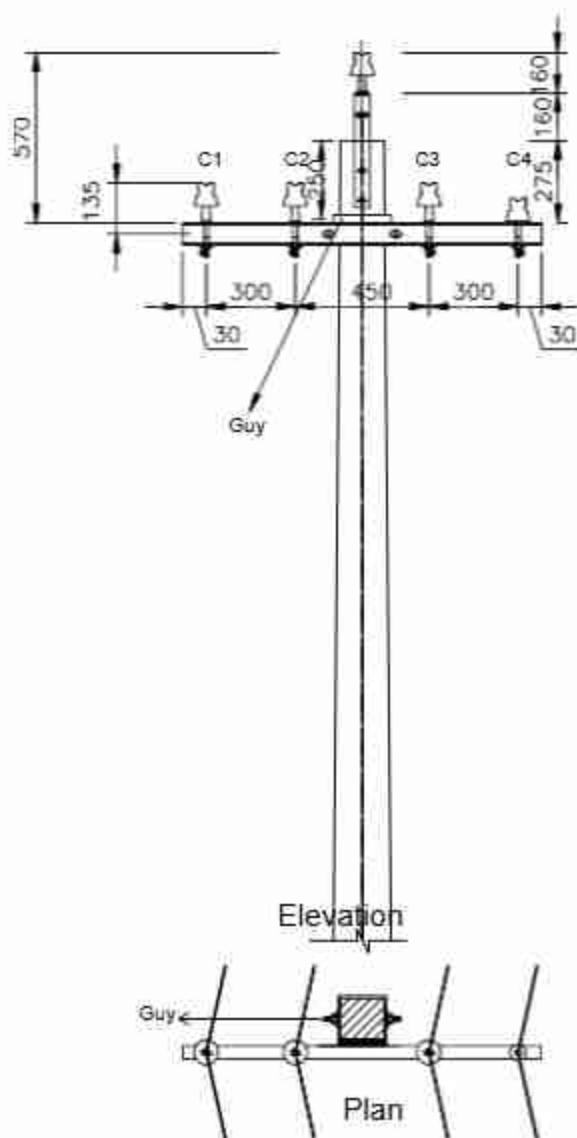
1 OF 1

#### REV. NO.

0

Note - All Dimension are in mm.

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION



### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE  $30^\circ$  TO  $45^\circ$ .

### NOTATIONS:-

C1, C2, C3 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY

Note - All Dimension are in mm.

NO.	REVISION	DATE	BY	CHKD.	APPD.
1					
2					
3					
4					
5					



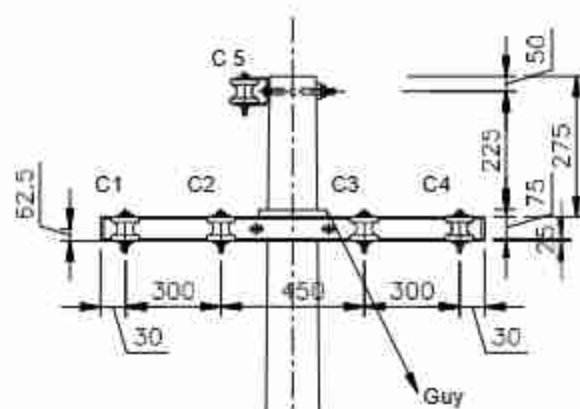
Rural Electrification Corporation Ltd.

State of Gujarat - Dava Unashvaya Gram Jyoti Yojana (DDUGJY)  
Programmed Distribution Sector Scheme (RDSS)

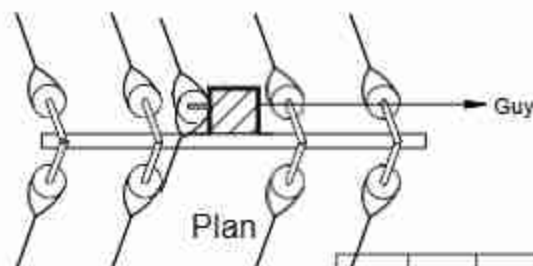
415V/240V Lines Conductor Formation And Arrangement of  
Guys For 0 TO 10 Angle Locations (3-Phase, 4 Wire, Horizontal Formation)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	MTS	REC/RDSS/LT-OH/21	1 of 1





Elevation



Plan

Note:- All Dimension are in mm.

### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE  $30^\circ$  TO  $45^\circ$ .

### NOTATIONS:-

C1, C2, C3, C5 \_\_\_\_\_ PHASE CONDUCTORS  
C4 \_\_\_\_\_ EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

415V/240V Lines Conductor Formation And Arrangement of Guys For  $10^\circ$  TO  $30^\circ$  Angle Locations (3-Phase, 5 Wire, Horizontal Formation)

SIZE/SCALE

DRG. NO.

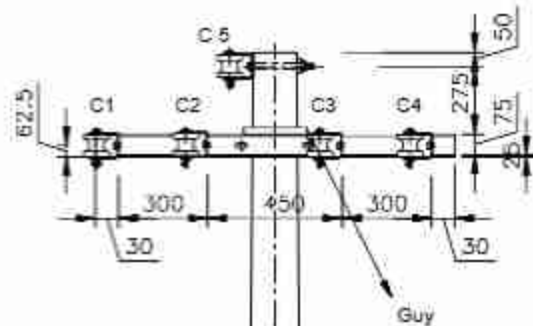
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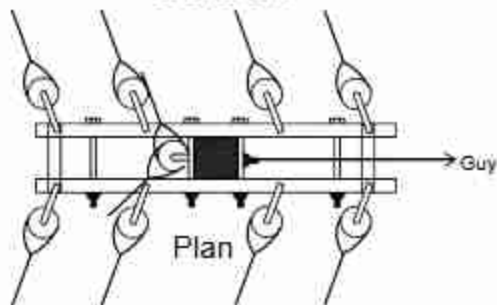
REC/RDSS/LT-OH/22

1 OF 1

0



Elevation



Plan

### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19. FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE  $30^{\circ}$  TO  $45^{\circ}$ .

### NOTATIONS:-

C1, C2, C3, C5 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY

Note - All Dimensions are in mm.

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION



Rural Electrification Corporation Ltd.

#### PROJECT:

Revamped Distribution Sector Scheme (RDSS)

#### TITLE:

415V/240V Lines Conductor Formation And Arrangement of Guys For  $30^{\circ}$  TO  $60^{\circ}$  Angle Locations (3-Phase, 5 Wire, Horizontal Formation)

#### SIZE/SCALE

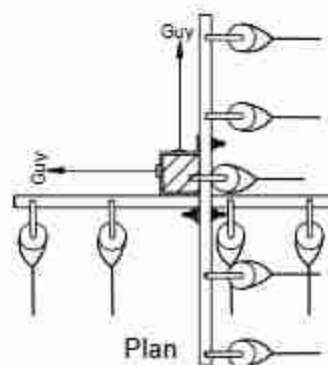
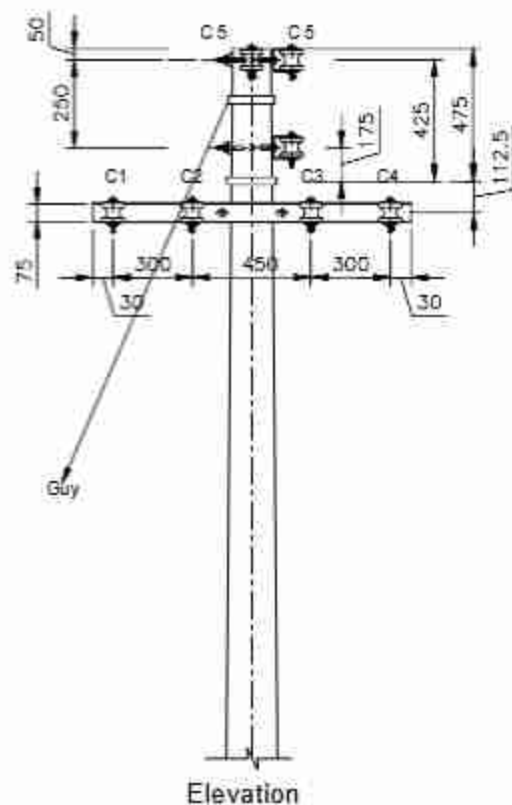
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#### DRG. NO.

REC/RDSS/LT-OH/23

#### SHT. NO. REV. NO.

1 OF 1 0



#### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE  $30^{\circ}$  TO  $45^{\circ}$ .

#### NOTATIONS:-

C1, C2, C3, C5 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

#### PROJECT:

Revamped Distribution Sector Scheme (RDSS)

#### TITLE:

415V/240V Lines Conductor Formation And Arrangement of  
Guys For 60° TO 90° Angle Locations (3-Phase, 5 Wire, Horizontal Formation)

#### SIZE/SCALE

#### DRG. NO.

AS HTS

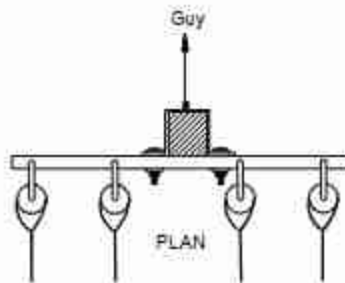
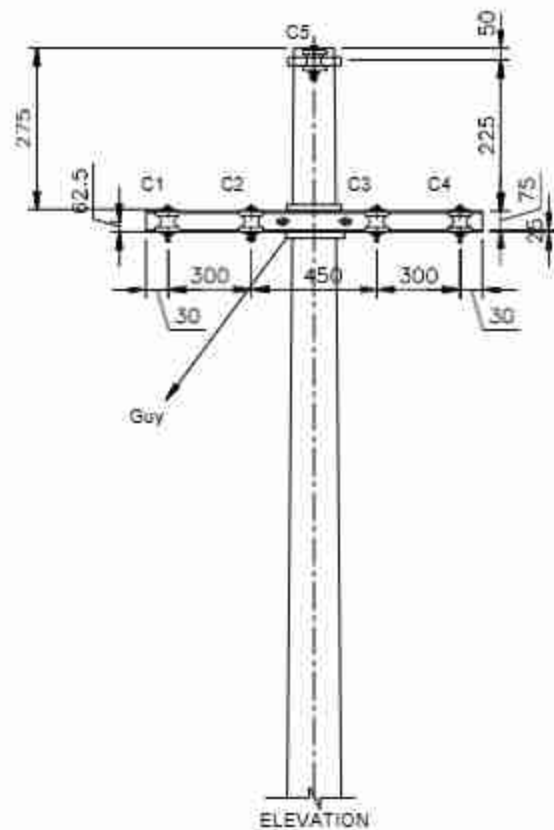
REC/RDSS/LT-OH/24

#### SHT. NO. REV. NO.

1 OF 1 0

Note - All Dimensions are in mm.

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION
01					ISSUED FOR TENDER



Note: - All Dimensions are in mm.

#### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.
2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.
3. GUY ANGLE SHALL BE  $30^{\circ}$  TO  $45^{\circ}$ .

#### NOTATIONS:-

C1, C2, C3, C5 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:-

Revamped Distribution Sector Scheme (RDSS)

TITLE:-

415V/240V Lines Conductor Formation And Arrangement of Guys For Dead End Locations(3-Phase, 5Wire, Horizontal Formation)

SIZE/SCALE

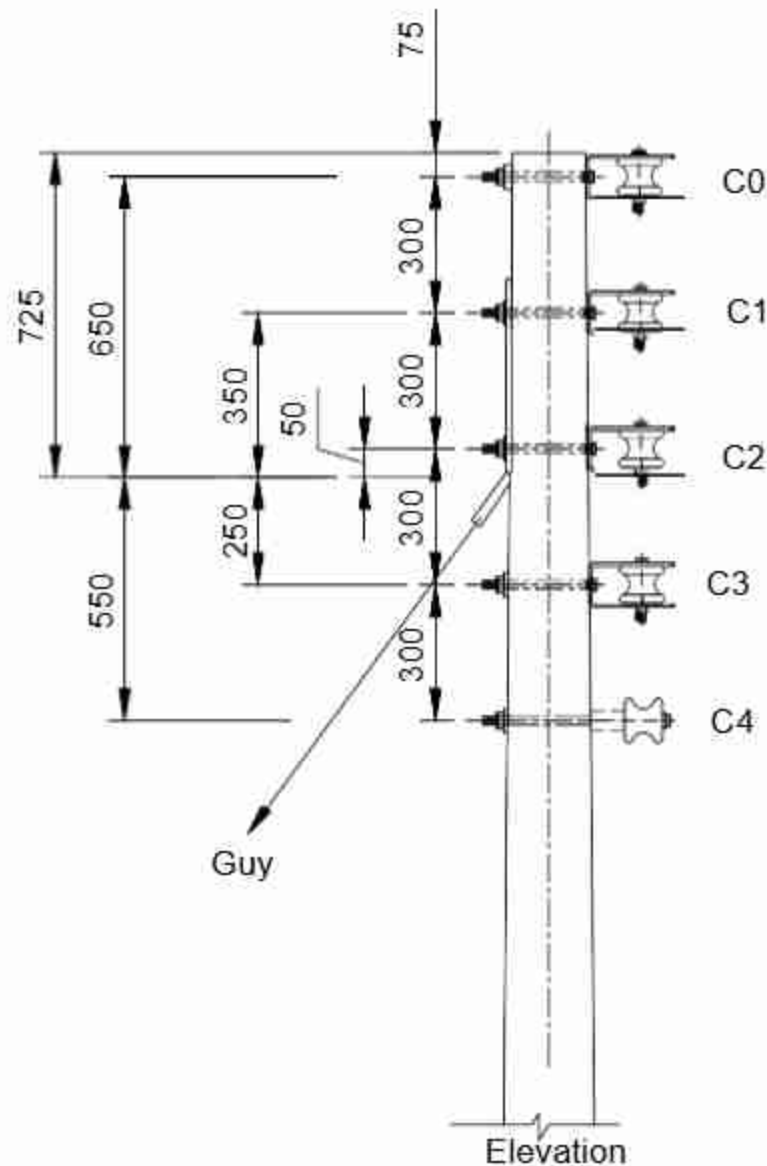
DRG. NO.

AS HTS

REC/RDSS/LT-OH/25

SHT. NO. REV. NO.

1 OF 1 0



### NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.

2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.

3. GUY ANGLE SHALL BE  $30^{\circ}$  TO  $45^{\circ}$ .

### NOTATIONS:-

C0, C1, C2, C3 ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY

Note - All Dimensions are in mm.

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION



Rural Electrification Corporation Ltd.

PROJECT:

Recamped Distribution Sector Scheme (RDSS)

TITLE:

415V/240V Lines Conductor Formation And Arrangement of Guys For Dead End Locations (3-Phase, 5 Wire, Vertical Formation)

SIZE/SCALE

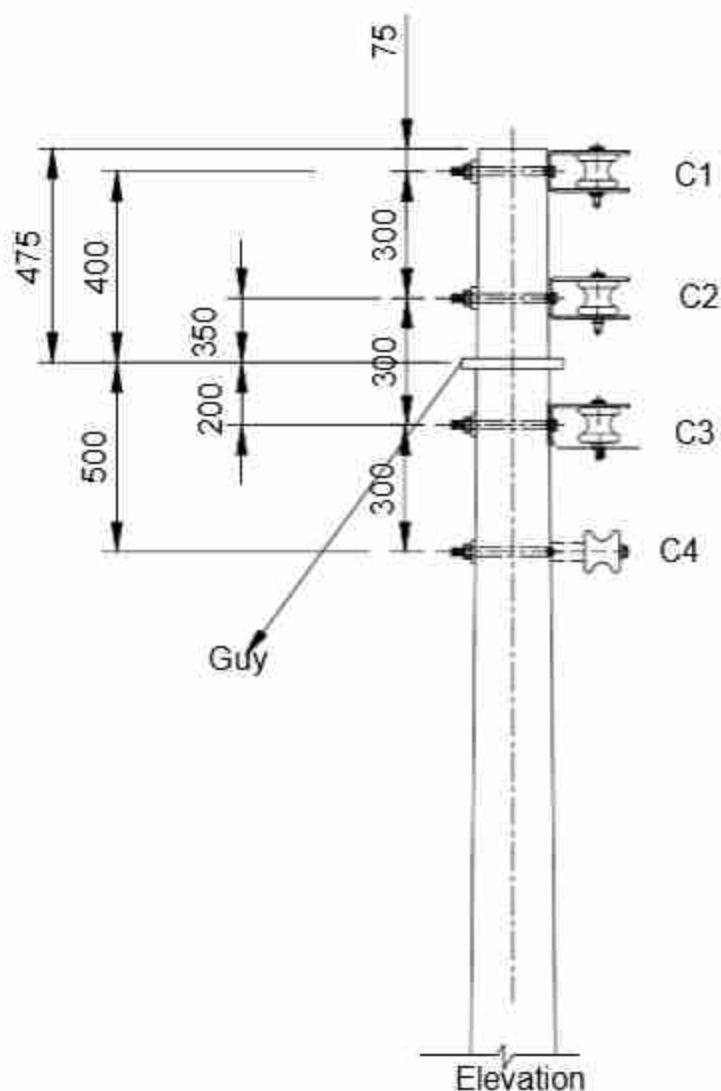
DRG. NO.

REC/RDSS/LT-OH/26

SHEET NO. REV. NO.

1 OF 1 0





# NOTES:-

1. REFER REC CONSTRUCTION STANDARD B-19 FOR TYPE OF POLE TO BE USED.

2. THE DRAWING INDICATES THE POSITION OF GUY WIRE SHALL BE SUCH AS TO COUNTERACT THE RESULTANT TENSION OF THE CONDUCTORS.

3. GUY ANGLE SHALL BE 30° TO 45°.

## NOTATIONS:-

C1, C2, C3, ——— PHASE CONDUCTORS  
C4 ——— EARTH CUM NEUTRAL

FOR TENDER PURPOSE ONLY

Note - All Dimensions are in mm.

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

415V/240V Lines Conductor Formation And Arrangement of  
Guys For Dead End Locations (3-Phase, 4 Wire, Vertical Formation)

SIZE/SCALE

DWG. NO.

AS HTS

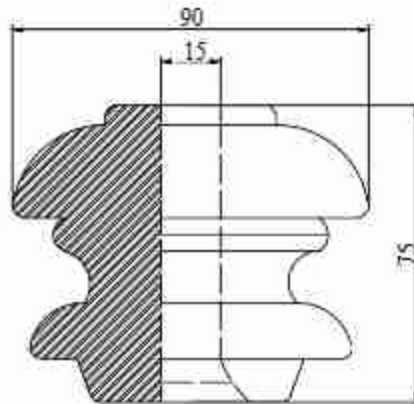
REC/RDSS/LI-OH/27

SHEET NO.

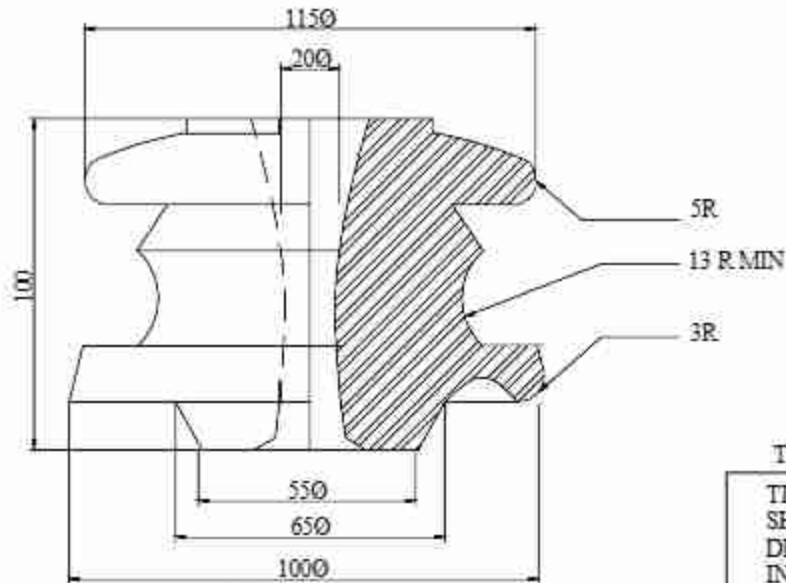
1 OF 1

REV. NO.

0



**TYPE-1**



**TYPE-2**

TENDER DRAWING

TITLE : 415/ 240 VOLTS  
SHACKLE INSULATOR  
DRG. NO : NH / RE /  
INSULATOR / 02

415/ 240 VOLTS  
SHACKLE INSULATOR  
ALL DIMENSION ARE IN mm.

NOTE : THE ENCLOSED DIMENSIONS ARE MANDATORY.  
OTHER DIMENSIONS AND THE PROFILES ARE  
GIVEN FOR GUIDANCE

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

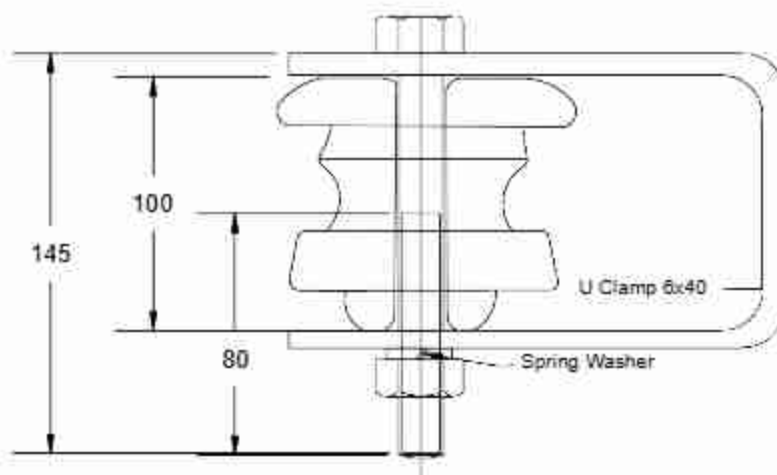
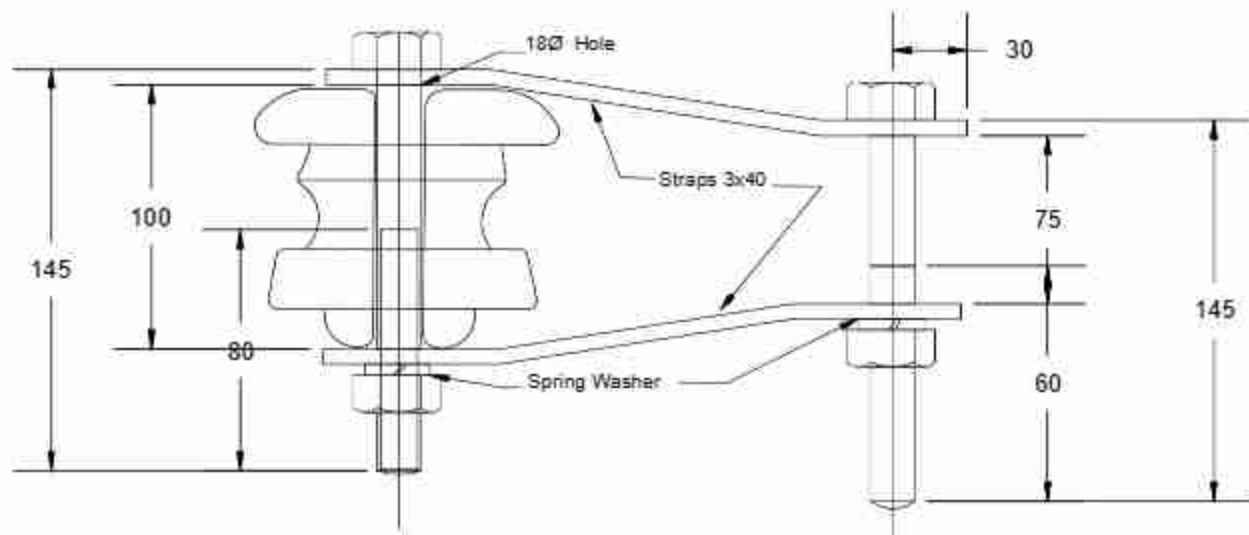
Revamped Distribution Sector Scheme (RDSS)

TITLE

415/240 V Shackle Insulators

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/RDSS /LT-OH/28	1 OF 1	0



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

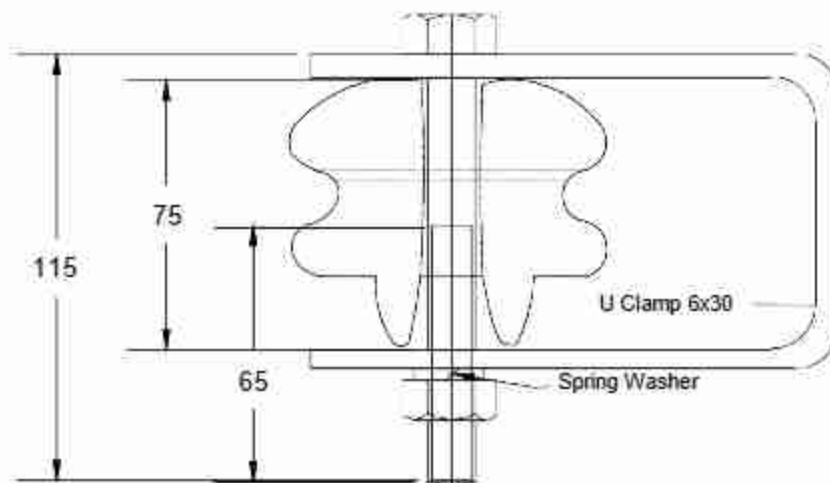
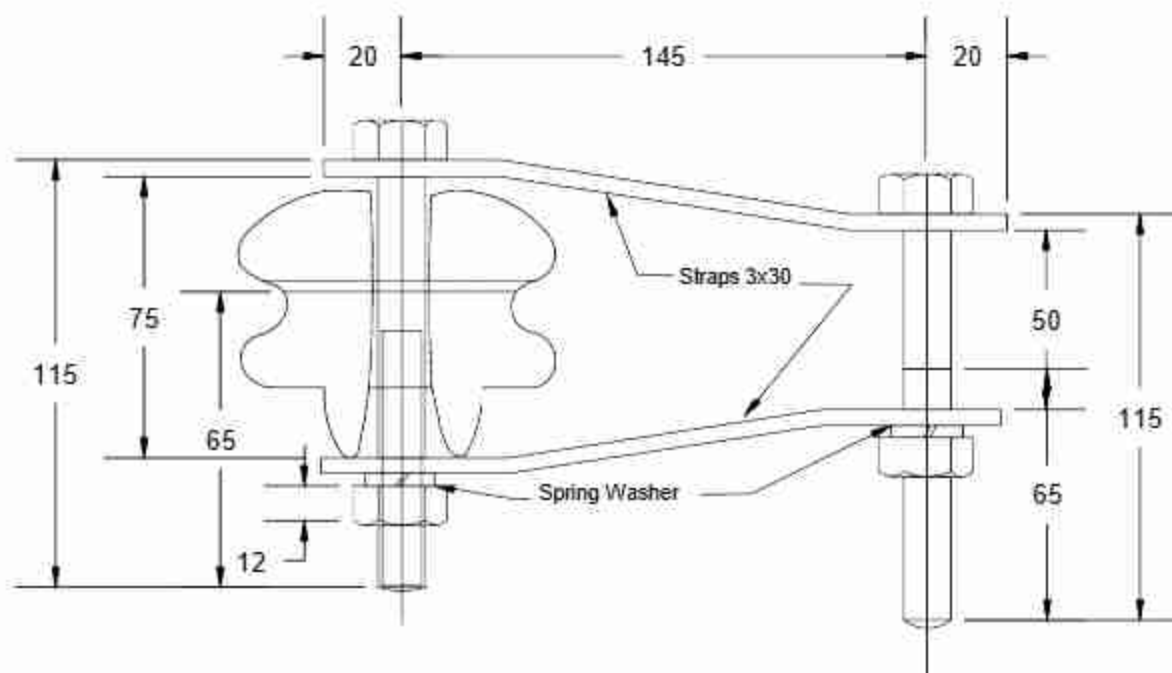
Revamped Distribution Sector Scheme (RDSS)

TITLE

415/240V Insulators and Hardware  
Fitting For Type-2 Shackle Insulators

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/ RDSS /LT-OH/29	1 OF 1	0



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

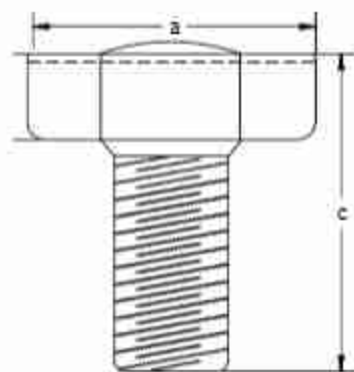
Revamped Distribution Sector Scheme (RDSS)

TITLE

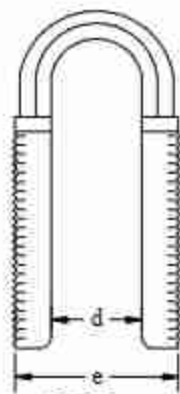
415/240V Insulators & Hardware Fitting  
For Type-I Shackle Insulator

RD					
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

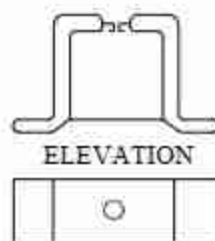
SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/RDSS /LT-OH/30	1 OF 1	0



ELEVATION

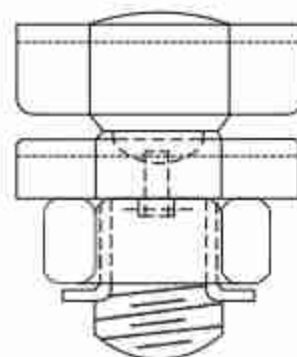


SIDE

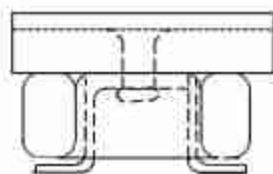


ELEVATION

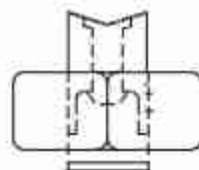
PLAN  
DETAIL 'A'



CONNECTOR ASSEMBLY



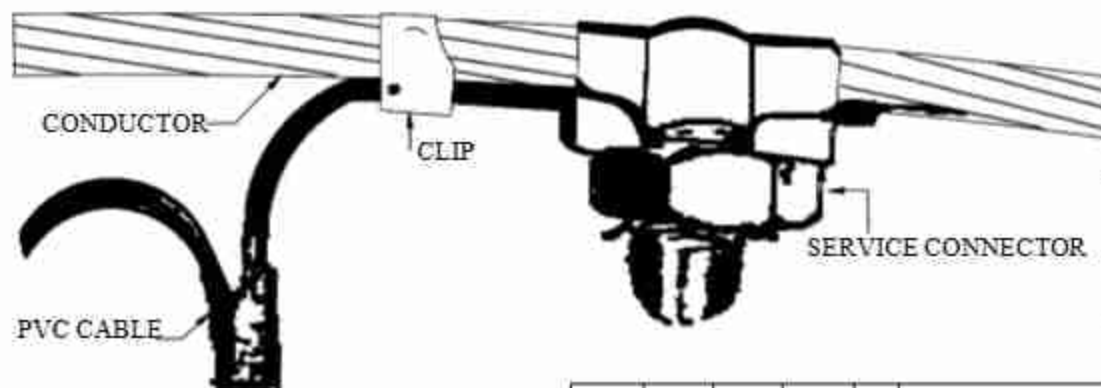
ELEVATION  
SEE DETAIL AT 'A'



SIDE

TWO STANDARD SIZES OF SERVICE CONNECTORS, TYPE A AND TYPE B SHALL HAVE THE FOLLOWING DIMENSIONS/ APPLICATIONS.

TYPE	DIMENSIONS					APPLICATIONS	
	a	b	c	d	e	LINE CONDUCTORS	SERVICE CABLE
A	36	12	35	10.5	21	30 mm ALSR AND 30 mm ALSR/AAC (WEASEL, RABBIT AND ANT)	2.5 mm TO 10 mm ALUMINIUM CABLE
B	30	12	30	8	16	20 mm ALSR, 30 mm ALSR AND 25 mm AAC (SQUIRREL, WEASEL AND GNAT)	2.5 mm TO 10 mm ALUMINIUM CABLE



ALL DIMENSION ARE IN MM.

FOR TENDER PURPOSE ONLY

Rural Electrification Corporation Ltd.

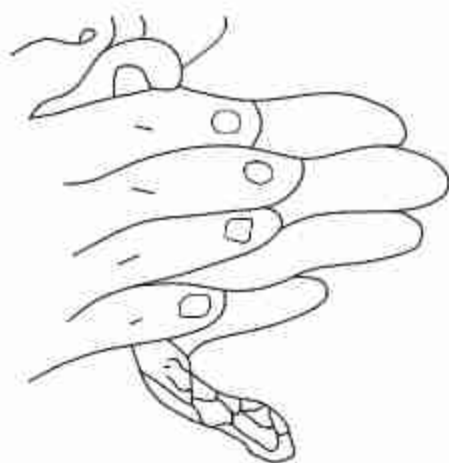
PROJECT:  
Revamped Distribution Sector Scheme (RDSS)

TITLE:  
Finished Joint Using Service Connector

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01					

REV. NO.	SCALE	DRG. NO.	REV. NO.	REV. NO.
A3	NTS	REC/RDSS/LT-OH/31	1 OF 1	0

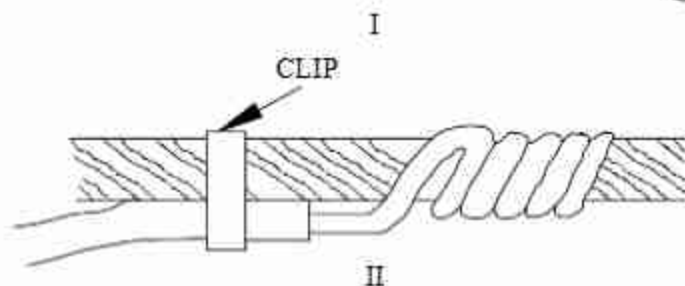




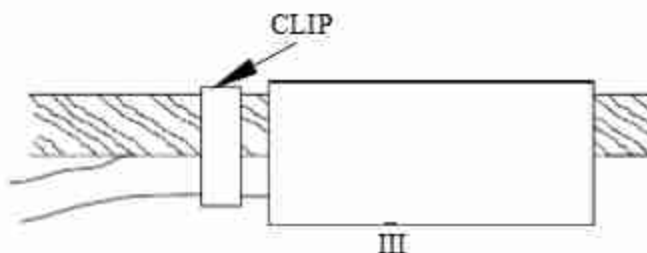
STEP I. MIX THE 'RESIN' AND 'HARDNER' AS PER INSTRUCTIONS OF THE MANUFACTURER TO PREPARE PUTTY.



STEP II. MIX T-JOINT BY TWISTING OF STANDS OR BY USING BINDING WIRE AS PER NORMAL PRACTICE.



STEP III. APPLY PUTTY OVER THE JOINT TO COMPLETELY ENCAPSULATE THE JOINT.



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Re-amped Distribution Sector Scheme (RDSS)

WORK:

Application of Epoxy Compound on T-Joint  
for L. T. Service Connections

REV:

A3

SCALE:

NTS

DRG. NO.:

REC/RDSS/LT-OH/32

DATE:

1/08/1

REV. NO.:

0

NO.	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT



FIGURE-I



FIGURE-II

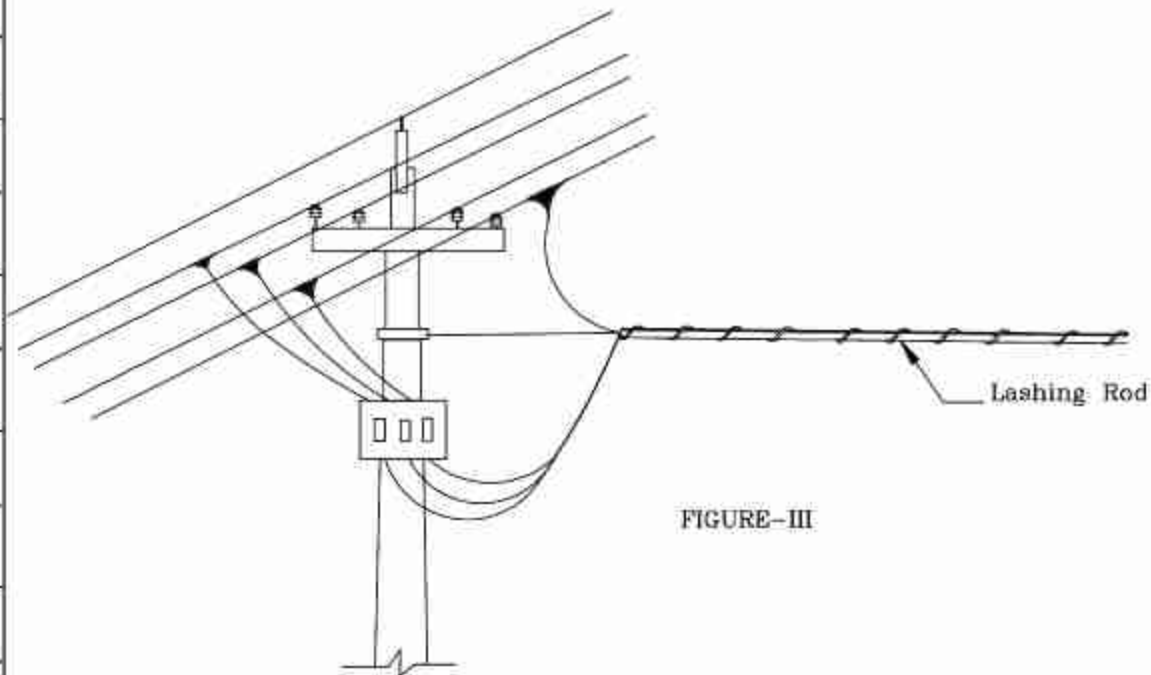


FIGURE-III

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TYPE:

Helically Formed Fittings Lashing Rods

RD	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DWG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/RDSS /LT-OH/33	1 OF 1	0

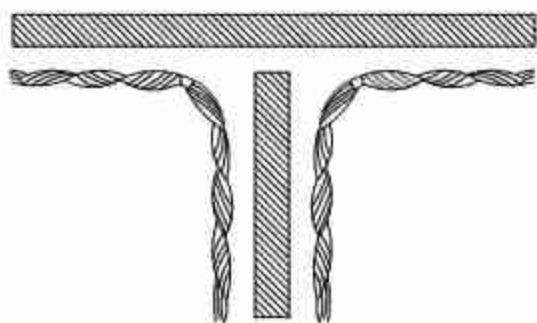


FIGURE-1

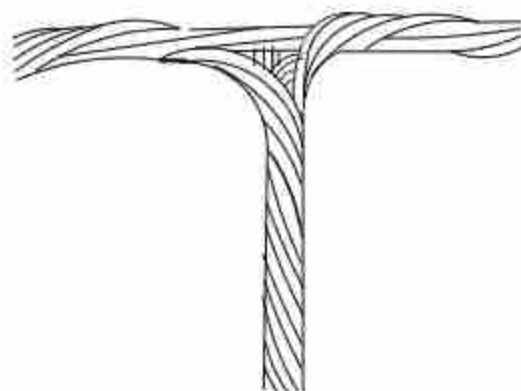


FIGURE-2

NOTE:- T-CONNECTOR CAN BE USED TO TAP SERVICE CONNECTIONS FROM THE LINE OR FOR TAPPING A BRANCH LINE FROM THE MAIN LINE

FIG.1 SHOWS THE T-CONNECTOR

FIG.2 SHOWS THE T-CONNECTOR IN POSITION.

FIG.3 SHOWS TAPPING OF SERVICE CONNECTIONS USING T-CONNECTORS.

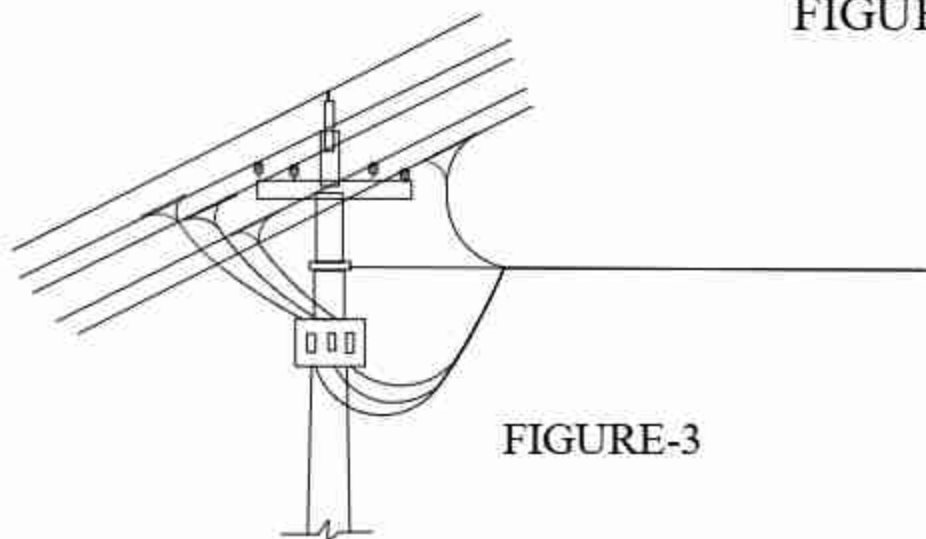


FIGURE-3

ALL DIMENSIONS ARE IN MM

FOR TENDER PURPOSE ONLY

Rural Electrification Corporation Ltd.

PROJECT

Revamped Distribution Sector Scheme (RDSS)

FIGURE

Hellically Formed Fittings T-Connector

NO	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

REV.	SCALE	ORIG. NO.	REV. NO.	REV. DATE
A3	NTS	REC/RDSS/LT-OH/34	1 OF 1	0

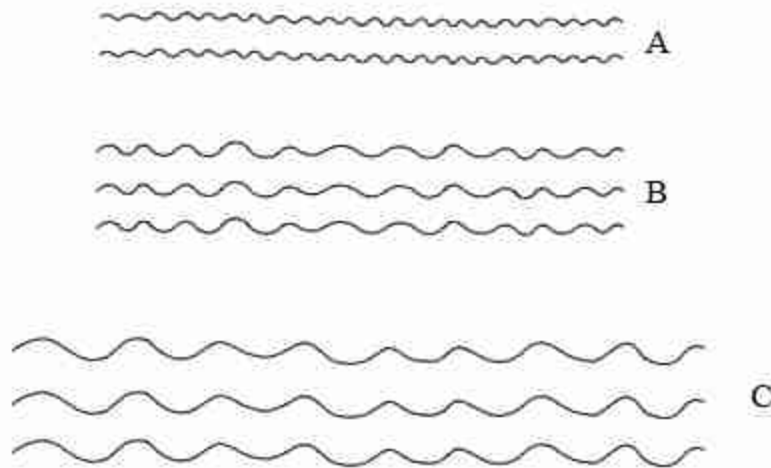


FIGURE-1



FIGURE-2

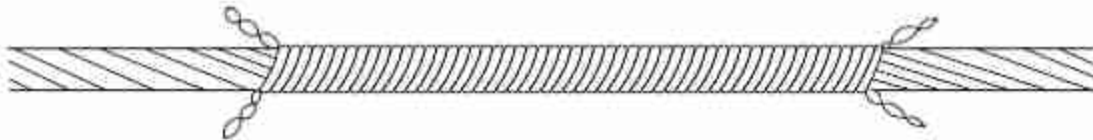


FIGURE-3

A. SHOWS THE CORE SPLICE  
B. SHOWS THE FILLER RODS  
C. SHOWS THE OUTER SPLICE  
FIG.1 SHOWS THE CORE SPLICE - IN POSITION  
FIG.2 SHOWS THE CORE SPLICE AND FILLER  
RODS IN POSITION  
FIG.3 SHOWS THE COMPLETE JOINT AND THE  
OUTER SPLICE IN POSITION.

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

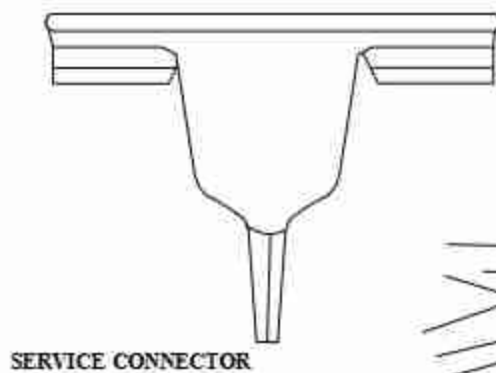
Revamped Distribution Sector Scheme (RDSS)

TITLE

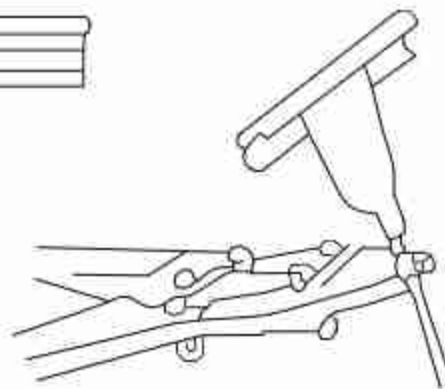
Helically Formed Fittings Splice For ACSR Joints

NO.	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

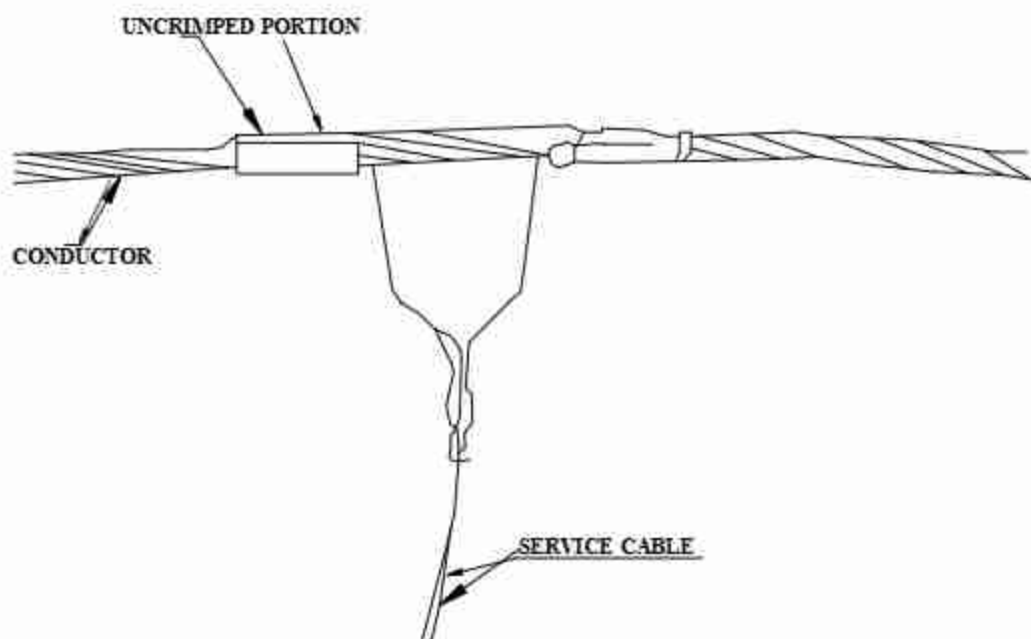
W/O	REC NO.	DRG. NO.	REV. NO.	REV. DTS
A3	NTS	REC/RDSS/LT-OH/35	(OF)	0



SERVICE CONNECTOR



APPLICATION OF CRIMPING TOOL



A VIEW OF CRIMPED SERVICE CONNECTOR (PARTLY CRIMPED)

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

Revamped Distribution Sector Scheme (RDSS)

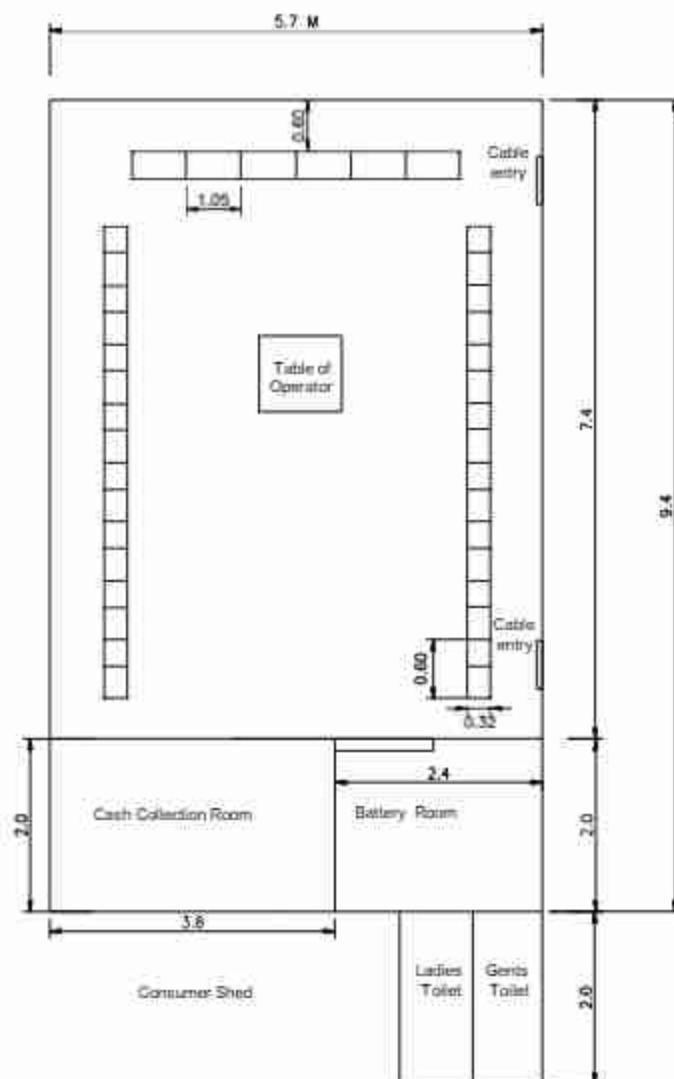
TITLE

CRIMPED JOINT FOR L.T. SERVICE CONNECTION

NO.	REV.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SL. NO.	REV. NO.	ISSUE NO.	REV. NO.	REV. DATE
A3	NTS	REC/RDSS/LT-OH/36	(01)	0





Proposed Control Room Layout plan  
of 33/11 KV Rural substation

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

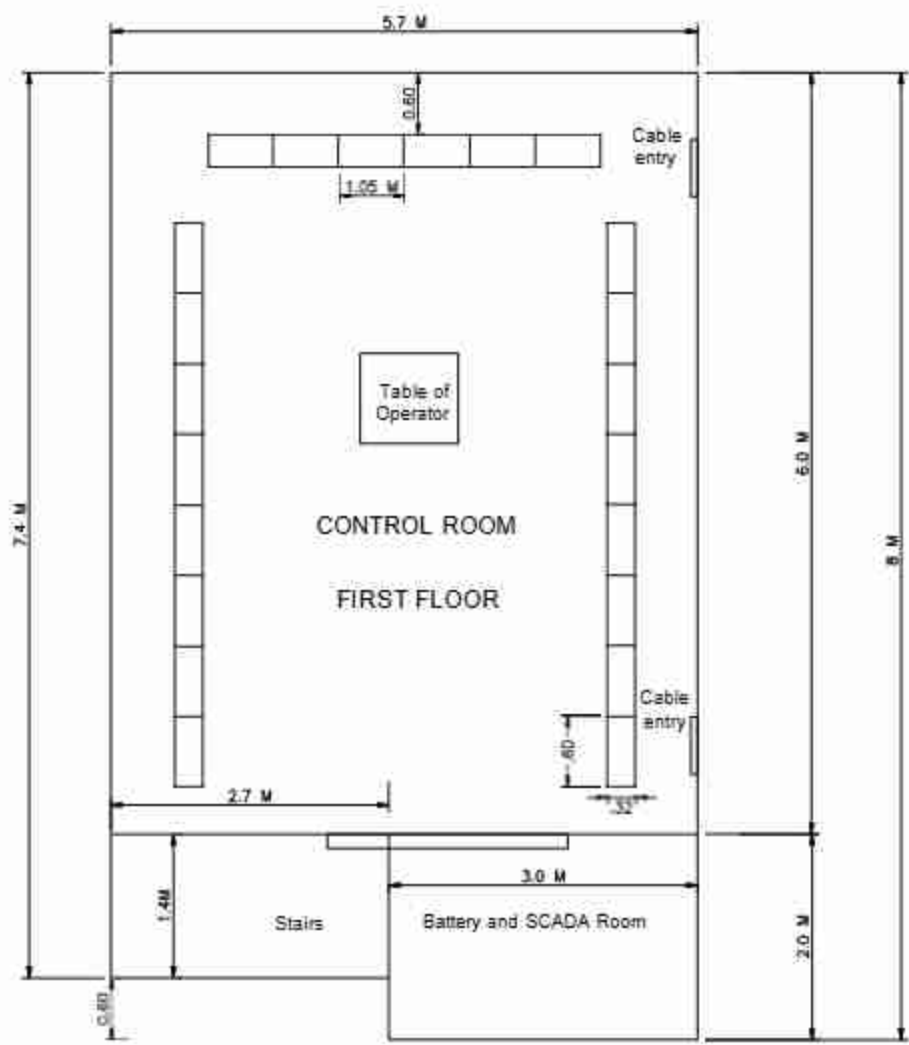
Revamped Distribution Sector Scheme (RDSS)

TITLE

Proposed Control Room Layout plan of 33 /11 KV Rural substation

NO.	REVISED	PREPARED	CHECKED	APPROVED	DATE	PROJECT

MTS	SCALE	REQ. NO.	SHT. NOS	SHEET NO.
A4	1:100	REC-RDSS/Control Room/01A	1 OF 1	1



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT: Revamped Distribution Sector Scheme (RDSS)  
 TITLE: Proposed Double story Control Room Layout plan. of 33 /11 KV/ substation in CITY/TOWN ZONE

REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT

SIZE	SCALE	DRG. NO.	SHEET NO.	REV. NO.
A4	1:100	REC/RDSS/Control Room/01B	1 OF 1	0



Proposed Double story Control Room Layout plan  
of 33 /11 KV substation in CITY/TOWN ZONE

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT:

Revamped Distribution Sector Scheme (RDSS)

TITLE:

Proposed Double story Control Room Layout plan of 33 /11 KV  
substation in CITY/TOWN ZONE

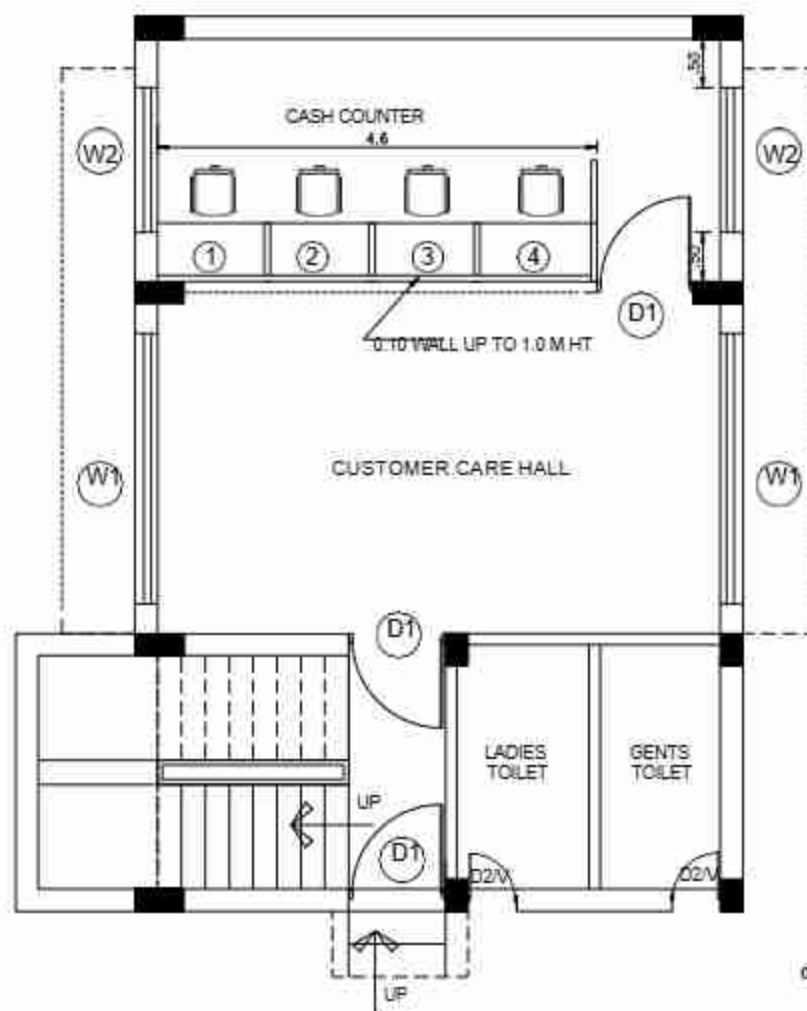
REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
01					

NO.	SCALE	DRG. NO.	SHEET NO.	REV. NO.
01	1:100	REC/RDSS/Control Room/01C	1 OF 1	01

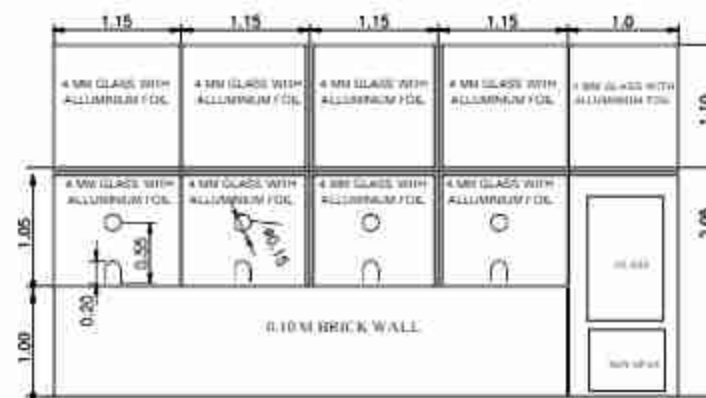
QTR	SCALE	DRG NO	REV NO	REV DO
04	1:500	REC/RDSS/CIVIL/01	(10)	0

DATE	TIME	UNIT	STATION	REMARKS
08	1000	REC	RDSS/CIVIL/02	





**GROUND FLOOR WORKING PLAN**

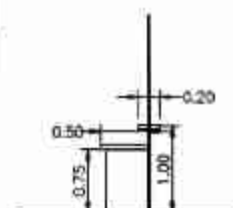


**ELEVATION**

**SPECIFICATION FOR ALUMINIUM SECTIONS**

FIRST SECTION	40 MMX60MM
CLEAT SECTION	15MM(TRIANGULAR)
DOOR STYLE ( TOP)	40 MMX100MM
DOOR STYLE ( BOTTOM)	40 MMX150MM

FOR TENDER PURPOSE ONLY



**SECTION**

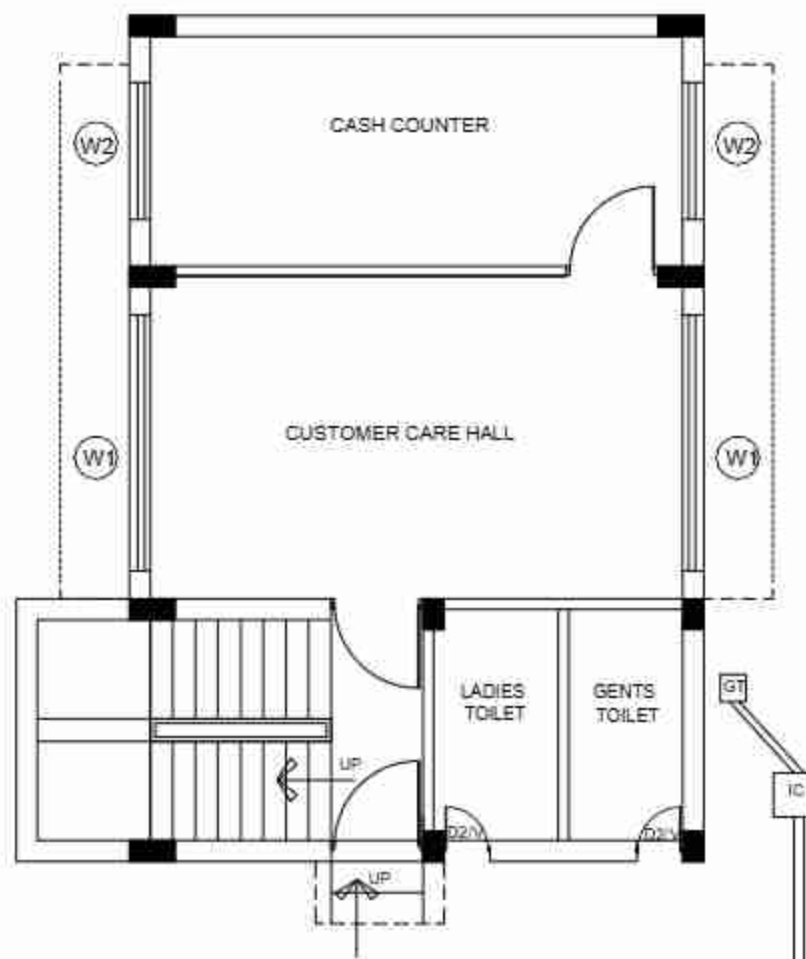


Rural Electrification Corporation Ltd.

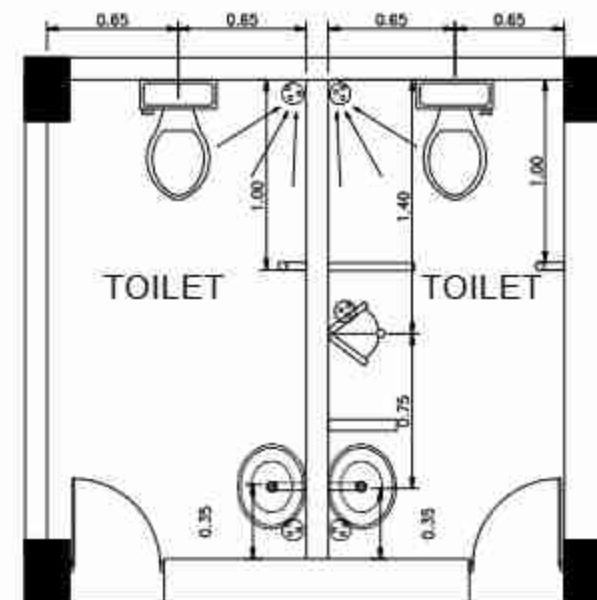
Revamped Distribution Sector Scheme (RDSS)

GROUND FLOOR COUNTER ALUMINIUM PARTITION DRAWING

REV. NO.	DATE	BY	CHECKED	APPROVED	DATE	PROJECT
01	1/1/2018	REC/RDSS/CIVIL/03				



GROUND FLOOR TOILET LAYOUT



TOILET DETAILS (1:20)

FOR TENDER PURPOSE ONLY

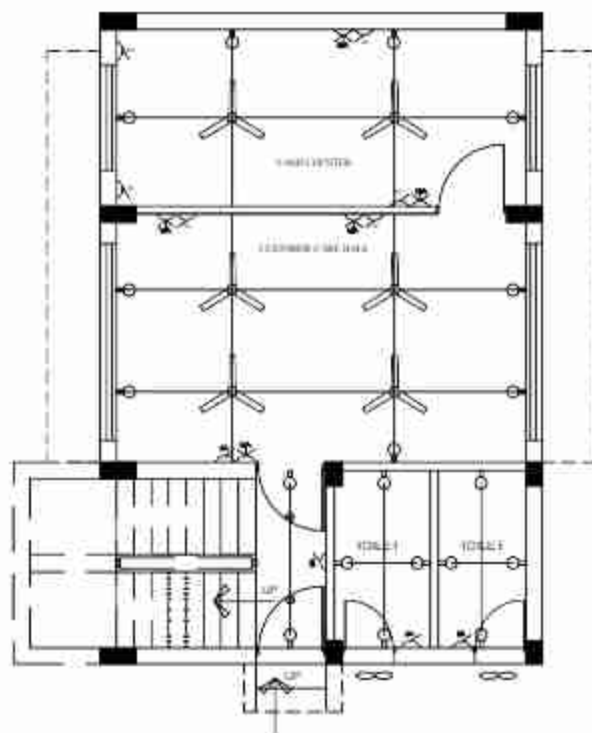


Rural Electrification Corporation Ltd.

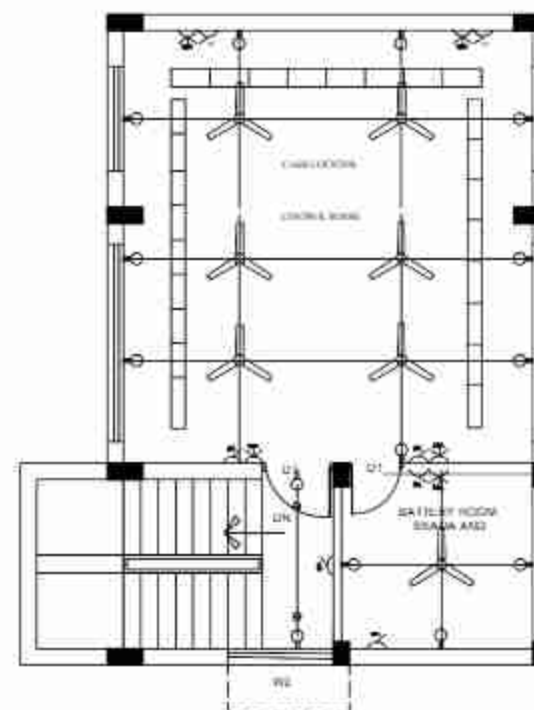
Revamped Distribution Sector Scheme (RDSS)

GROUND FLOOR TOILET LAYOUT










REV	REV. NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT	SCALE	W. ALL.	ORIG. NO.	REV. NO.	REV. DATE
04							04	1:100	REC/RDSS/CIVIL/04	1 OF 2	04



GROUND FLOOR ELECTRICAL PLAN



FIRST FLOOR ELECTRICAL PLAN

INDEX					
	5 AMP POINT		BRACKET POINT		DISTRIBUTION BOX
	15 AMP POINT		EXHAUST FAN		CEILING POINT
	FAN POINT		TUBE LIGHT POINT		BELL

REV	DATE	BY	CHECKED	APPROVED	DATE
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011
001	01/01/2011	001	001	001	01/01/2011

FOR TENDER PURPOSE ONLY

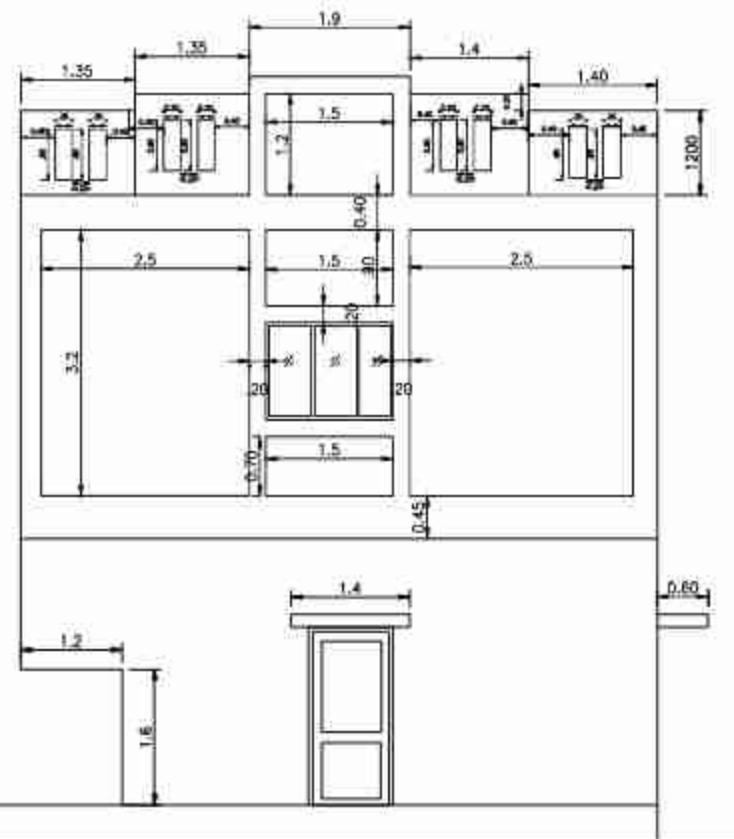
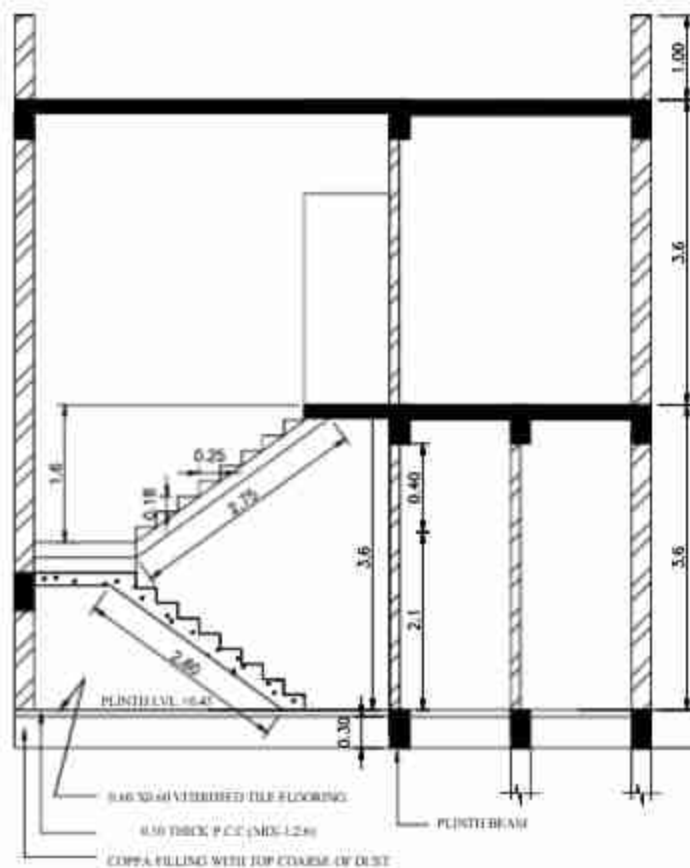


Rural Electrification Corporation Ltd.

PROJECT:  
Revamped Distribution Sector Scheme (RDSS)

GROUND & FIRST FLOOR ELECTRICAL LAYOUT

REV	SCALE	DESS NO	REV NO	REV NO
001	1:100	REC/RDSS/CIVIL/05	001	001



ELEVATION

FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

PROJECT

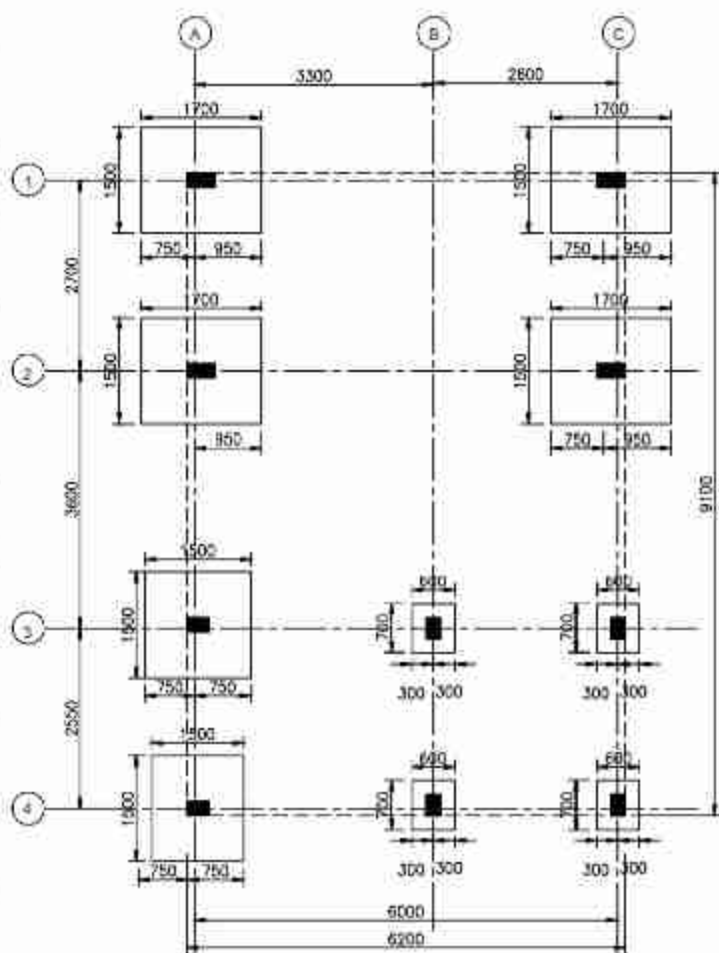
Revamped Distribution Sector Scheme (RDSS)

TITLE

ELEVATION & SECTION -XX

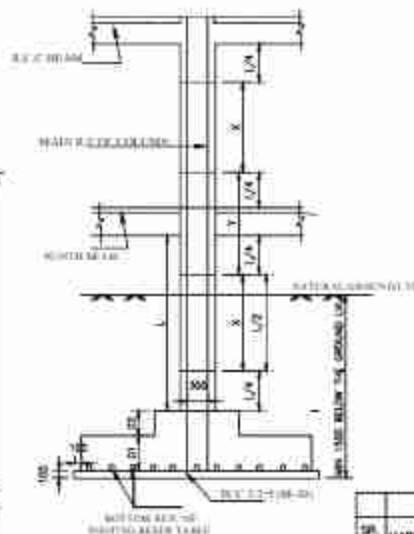
REV.	PREPARED BY	CHECKED BY	APPROVED BY	DATE	PROJECT
01					

REV.	SCALE	DRG. NO.	DATE	REV. NO.
01	1:100	REC/RDSS/CIVIL/06	11/11/11	01



SCHEDULE OF FOOTING

SR. NO.	COLUMN	FOOTING TYPE	EXCAVATION DIMENSION		FOOTING DIMENSION				FOOTING REINFORCEMENT			
			WIDTH	LENGTH	STEP	WIDTH	LENGTH	D1	D2	ALONG B	ALONG L	TOP
F1	C1	STEPPED	1200	900	1	1700	1000	200		10-#10@100	10-#10@100	
					2	400	700		200			
F2	C2	STEPPED	1500	1700	1	1200	1800	200		10-#10@100	10-#10@100	
					2	700	900		200			

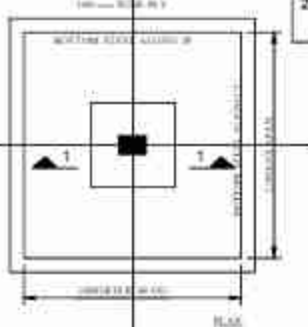


REINFORCEMENT DATA	
ITEM NO.	REMARKS
1	10-#10@100
2	10-#10@100

TYPICAL DETAIL OF RING HOOK

REINFORCEMENT DATA

SR. NO.	MARKED	DIMENSIONS		REINFORCEMENT	RING		SKETCH OF RING
		A	B		RING AT X	RING AT Y	
1.	C1	200	300	10-#10@100	at-#10@100/C	at-#10@100/C	10-#10@100
2.	C2	200	400	10-#10@100	at-#10@100/C	at-#10@100/C	10-#10@100



FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

Revised Distribution Sector Scheme (RDSS)

CENTRE LINE WITH COLUMN LAYOUT & FOOTING DETAILS

REV.	NO.	DESCRIPTION	DATE	BY	CHECKED	APPROVED
01						

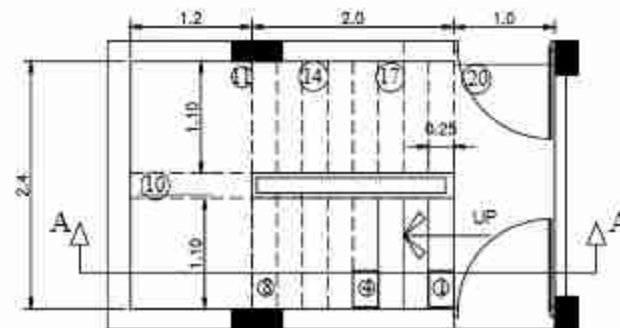
DATE	SCALE	DRG. NO.	SHEET NO.	TOTAL SHEETS
01/01/2020	1:100	REC/RDSS/CIVIL/07	1 OF 1	1



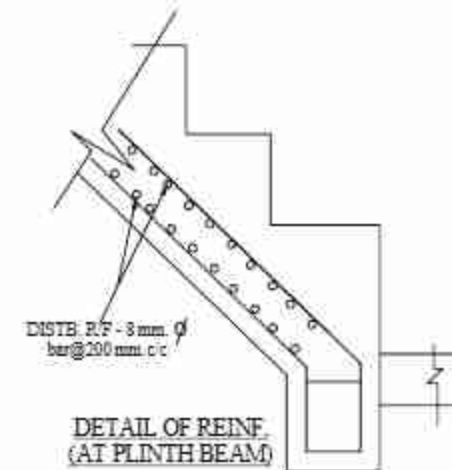
**STAIRCASE DETAILS**  
**RISER-150 mm Tread-250 mm**

**STAIRCASE B**

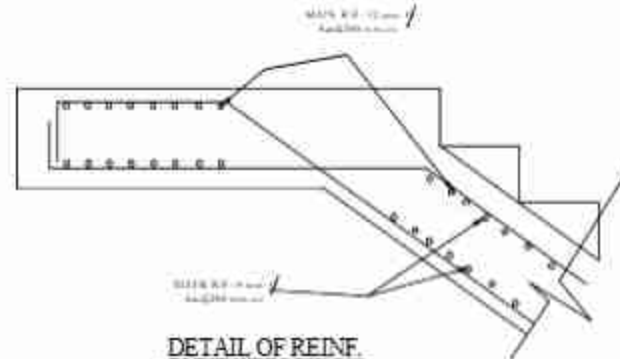
Walst Slab 110 mm. TH.  
 Main R/F-T 12 mm. @150 mm. c/c  
 Dlastb. R/F-T 10mm. @200 mm.c/c



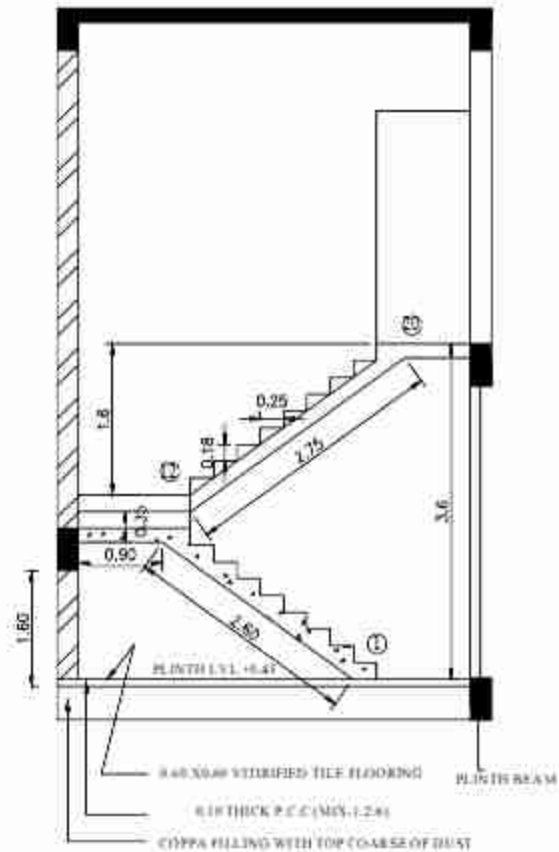
**PLAN**



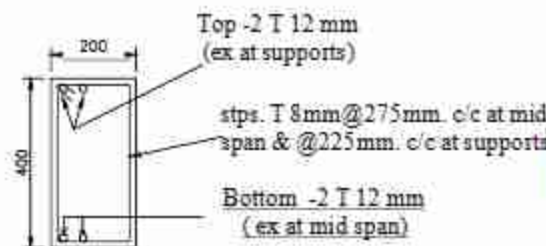
**DETAIL OF REINF.  
 (AT PLINTH BEAM)**



**DETAIL OF REINF.  
 (AT LANDING BEAM)**



**SECTION - AA'**



**LB(100 mm x 400 mm.)**

**FOR TENDER PURPOSE ONLY**



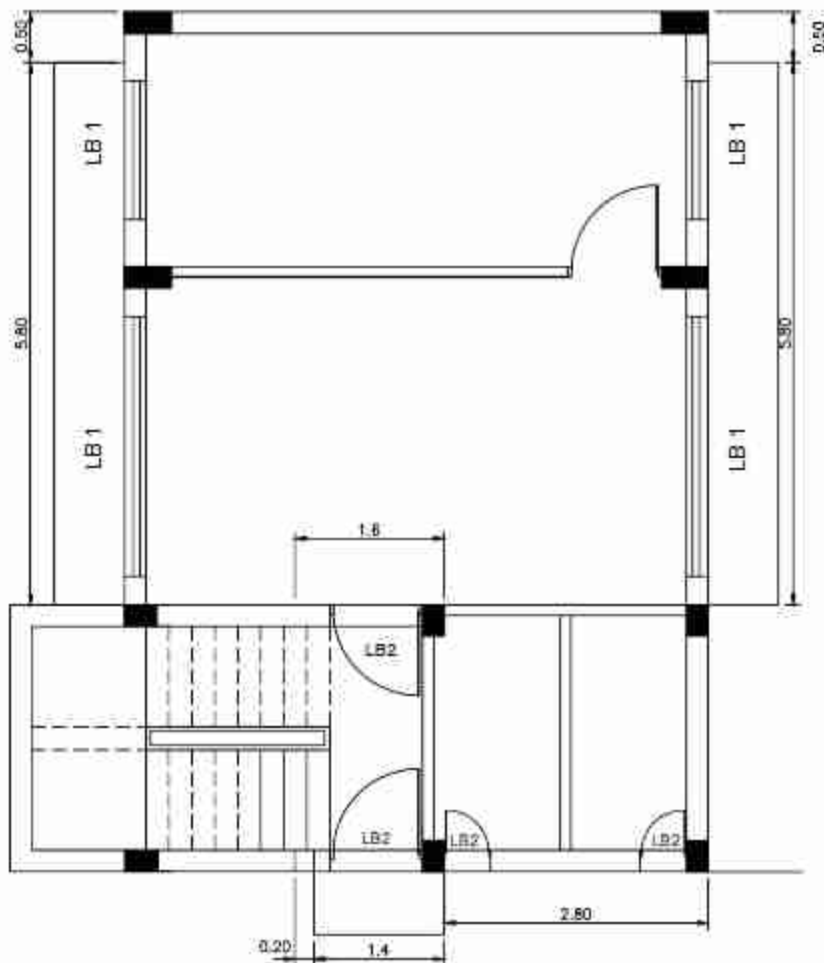
**Rural Electrification Corporation Ltd.**

**Revamped Distribution Sector Scheme (RDSS)**

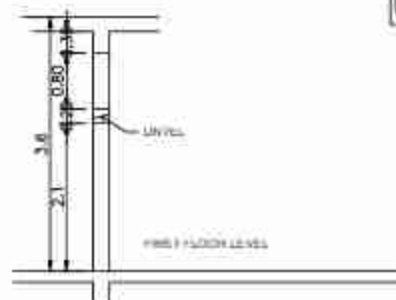
**STAIR DETAIL**

NO.	PREPARED	CHECKED	APPROVED	DATE	PROJECT
REC/08					

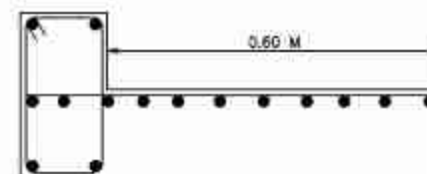
SIZE	SCALE	THEC NO.	REV. NO.	REV. NO.
A4	1:100	REC/RDSS/CIVIL/08	1	0



**GROUND FLOOR LINTEL PLAN**



**TYPICAL SECTION**



**TYPICAL R/F DETAILS OF CHAJJA**

**CHAJJA DIMENSIONS**

TYPE	THE SIZE	SHAPE	DISTRIBUTION
1	CANTILEVER BEAM	150 MM	150 MM

**BEAM DIMENSIONS**

		REINFORCEMENT						
		TOP REINFORCEMENT		BOTTOM REINFORCEMENT		STIRRUPS		
NO.	BEAM	SIZE	LENGTH	EXTRA AT JOINT	EXTRA AT JOINT	AT JOINT	AT JOINT	AT JOINT
1	LB1	200x200	2.80m	2.80m	2.80m	2.80m	2.80m	2.80m
2	LB2	200x200	2.80m	2.80m	2.80m	2.80m	2.80m	2.80m

FOR TENDER PURPOSE ONLY



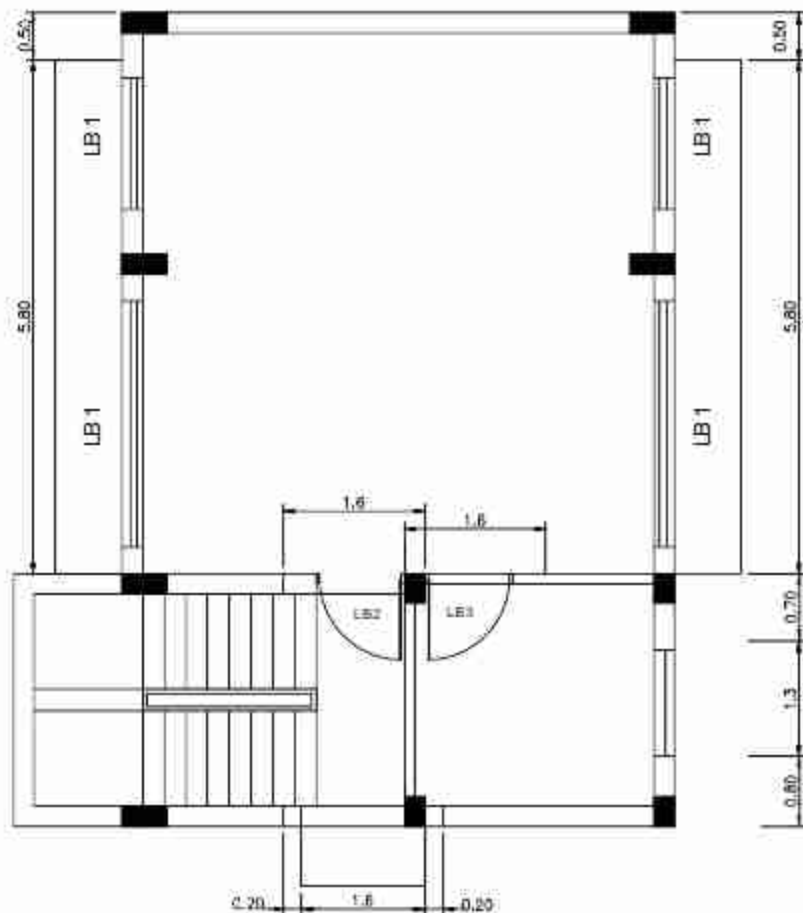
Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

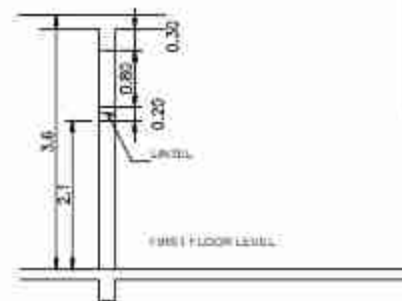
GROUND FLOOR LINTEL CHAJJA LAYOUT & DETAIL

REV.	NO.	DATE	BY	CHKD.	APPD.	DATE	PROJECT	REV.	NO.	DATE	BY	CHKD.	APPD.	DATE	PROJECT
1	1	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1	1	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010

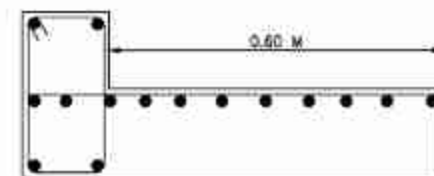
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1	1	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1	1	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010	1/1/2010



**FIRST FLOOR LINTEL PLAN**



**TYPICAL SECTION**



**TYPICAL R.F. DETAILS OF CHAJIA**

**CHAJIA SLAB DETAIL**

TYPE	THICKNESS	SLAB R.C.	REINFORCEMENT
R.F.	100MM	100MM	100MM

**LINTEL BEAM DETAIL**

REINFORCEMENT								
			TOP REINFORCEMENT		BOTTOM REINFORCEMENT		SIDE REINFORCEMENT	
NO.	SLAB	SIZE	SPACING	EXTRA AT ENDS	SPACING	EXTRA AT ENDS	AT SUPPORTS	AT ENDS
1	100	100MM	200mm	100mm	200mm	100mm	100mm	100mm
2	100	100MM	200mm		200mm		100mm	100mm
3	100	100MM	200mm		200mm		100mm	100mm

**FOR TENDER PURPOSE ONLY**



**Rural Electrification Corporation Ltd.**

**PROJECT**

**Revamped Distribution Sector Scheme (RDSS) Jharkhand (DDUGJY)**

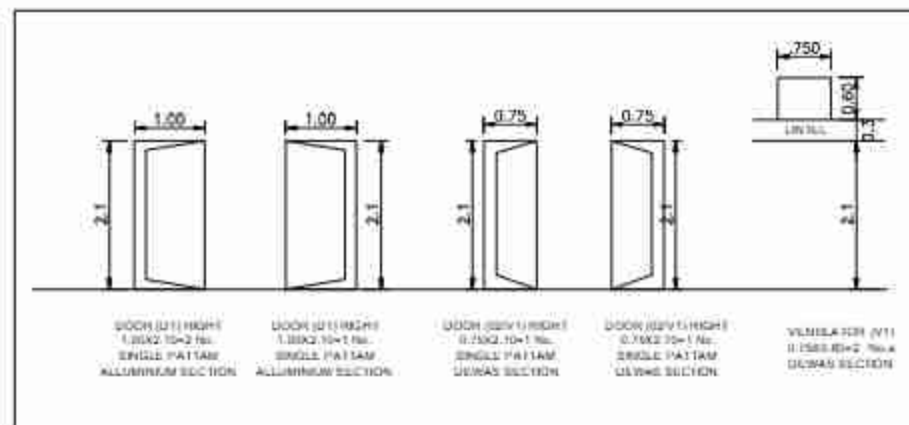
**TITLE**

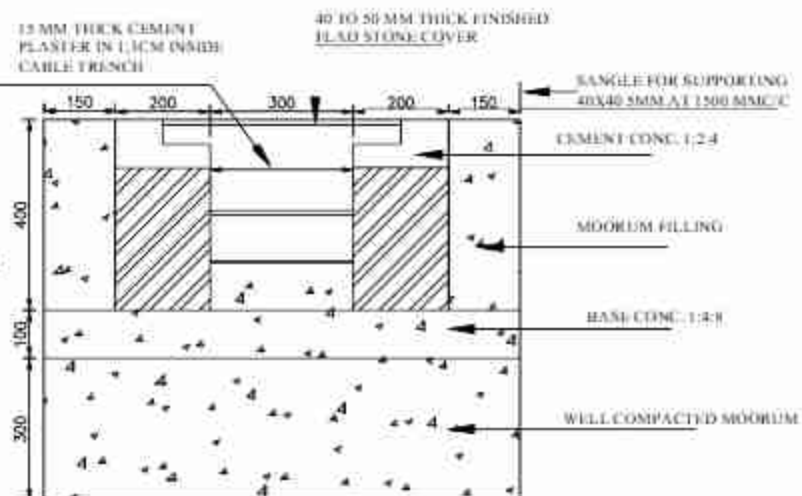
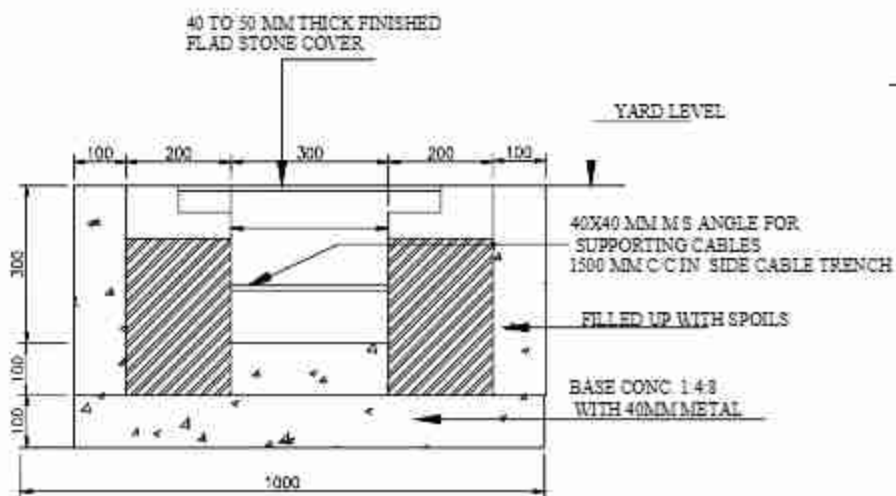
**FIRST FLOOR LINTEL CHAJIA LAYOUT & DETAIL**

NO.	REV.	DESCRIPTION	DATE	PROJECT
01				

REV.	WALL	SLAB	NO.	REV.	NO.
01	100			01	01

**REC/RDSS/CIVIL/10**





FOR TENDER PURPOSE ONLY



Rural Electrification Corporation Ltd.

Revamped Distribution Sector Scheme (RDSS)

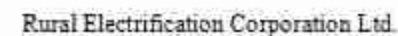
PROPOSED CABL TRENCH

REV.	PREPARED	CHECKED	APPROVED	DATE	PROJECT	REV.	SCALE	DRG. NO.	SHEET NO.	TOTAL SHEETS
01						01	1:20	REC/RDSS/CIVIL/12	11/17	12





FOR TENDER PURPOSE ONLY

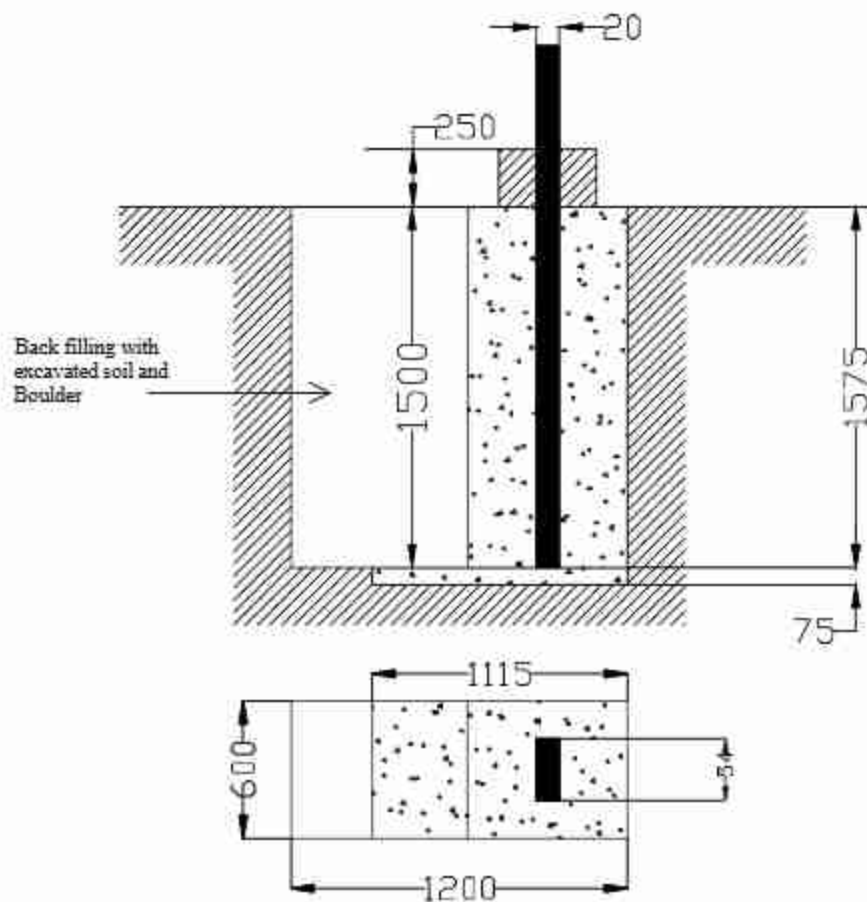


Revised Distribution, Sector Scheme (RDS) (DDUGJY)

FIRST FLOOR WORKING & OPENING DETAIL

						DATE	SCALE	DESS NO	REV NO	DES NO
REV						04	1:100	REC/RDSS/CIVIL/13	1 OF 1	0
REV. NO.	REVISION	CHECKED	APPROVED	DATE	PROJECT					




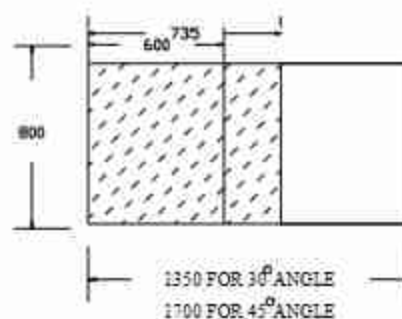
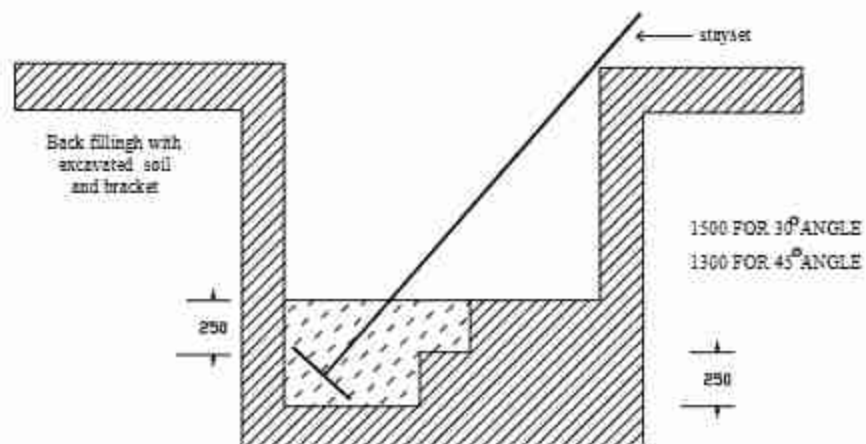


FOR TENDER PURPOSE ONLY

All dimensions are in mm.


NO.	DESCRIPTION	QUANTITY	UNIT	REMARKS
1	CONCRETE	1.00	M <sup>3</sup>	
2	STEEL	1.00	KG	
3	BRICK	1.00	M <sup>3</sup>	
4	CEMENT	1.00	KG	
5	SAND	1.00	M <sup>3</sup>	
6	GRAVEL	1.00	M <sup>3</sup>	
7	WATER	1.00	L	
8	LABOR	1.00	HR	
9	TRANSPORT	1.00	HR	
10	MAINTENANCE	1.00	HR	
11	TOOL	1.00	HR	
12	OTHER	1.00	HR	
13	TOTAL	1.00	HR	

		Rural Electrification Corporation Ltd.	
PROJECT:		Revamped Distribution Sector Scheme (RDSS)	
TITLE:		DRAWING FOR CONCRETING OF DPFLH LONG 140 KG PCC POLE	
SIZE	SCALE	DWG. NO.	SHT. NO.
A3	NTS	REC/RDSS/CIVIL/15	1 OF 1
			REV. NO.
			0



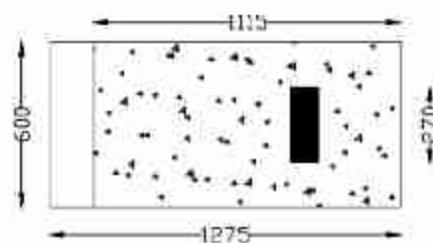
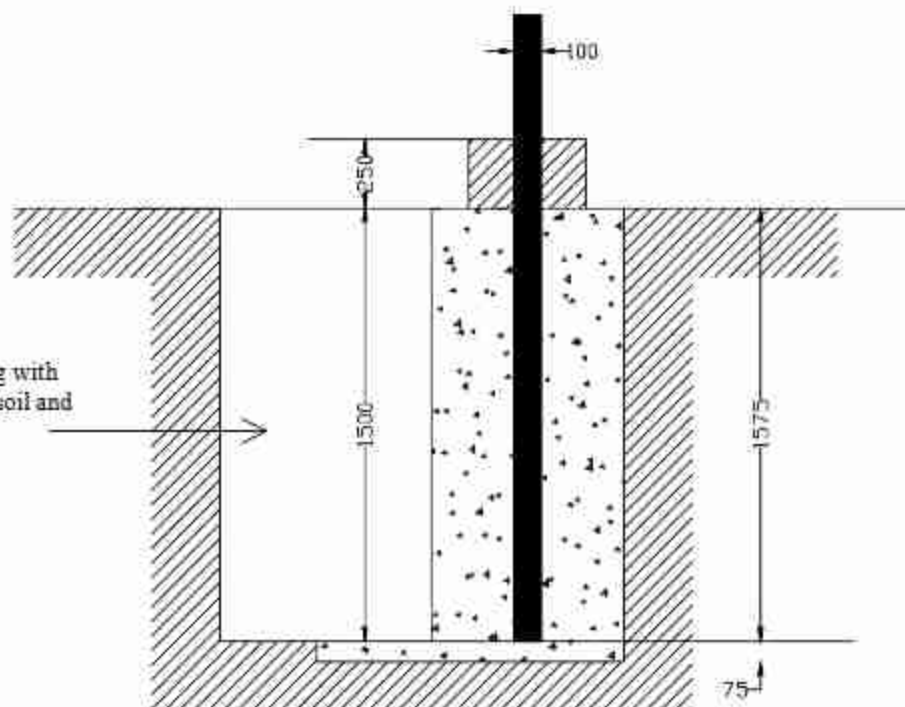
All dimensions are in mm.

FOR TENDER PURPOSE ONLY

		Rural Electrification Corporation Ltd.	
PROJECT		Revamped Distribution Sector Scheme (RDSS)	
TITLE		CONCRETING FOR STAY SET FOR 11-KV LINE AND LT LINE	
SIZE	SCALE	DWG. NO.	SHT. NO. REV. NO.
AS	NTS	REC/RDSS/CIVIL/15	1 OF 1 0

BY	CHECKED	DATE	DATE	DATE
BY	CHECKED	DATE	DATE	DATE

Back filling with  
excavated soil and  
Boulder



All dimensions are in mm.

**FOR TENDER PURPOSE ONLY**



Rural Electrification Corporation Ltd.

PROJECT: **Recon and Disposal of Power Lines in GADSDUGGY**

TITLE: **DRAWING FOR CONCRETING OF PCC/PSC PILE DOUBLE STRUCTURE FOR TRANSFORMER MOUNTING**

DESIGN	REVIEWED	CHECKED	APPROVED	DATE

SIZE	SCALE	DRG. NO.	SHT. NO.	REV. NO.
A3	NTS	REC/KISS/CIVIL/17	1 OF 1	0