



TECHNICAL SCOPE
NETWORK
REHABILITATION



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NETWORK REHABILITATION

Document Controlled by:

Project Department

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1. PURPOSE

This Technical Scope is developed as a comprehensive guideline for the various activities namely, Network Rehab, PMT Maintenance, LBS Installation & VCB Installation in the KE distribution network.

The purpose of this document is to ensure standardization in work practices regarding equipment, hardware, its installation, and erection throughout distribution network. It provides working guidelines to VENDOR, field engineers, supervisors, and field staff so that execution is performed as per standard network design.

2. BACKGROUND

Adherence to Safety Policy guidelines is of paramount significance in KE. The company has zero tolerance for accidents and therefore strong emphasis is laid on Contractor Safety management at all levels.

One such project is Network Rehab coupled with VCB, LBS & Knife Switch installation/dismantling. Hence it is imperative for Distribution to look at the work scope holistically since these projects form the backbone of our Network Improvement plan and their successful quality and safety focus is mandatory for the implementation of ADMS project of Distribution, which will be game changer in terms of Distribution Automation.

3. EXECUTIVE OVERVIEW



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The Technical Scope identifies the preliminary scope of a project. It establishes a common understanding of the technical scope among project stakeholders.

Technical energy losses in the network which mostly cannot be evaluated through simulation studies performed at MV & LV lines and transformers. For instance, high contact resistance paths due to asset deterioration, improper or deteriorated joints, and possible loose connection in both overhead and underground systems also contribute to technical energy losses in addition to losses incurred due to normal flow of current. Sustainable and effective rehabilitation initiatives have been planned on overhead network to address these issues.

Network Rehabilitation activities benefit in improving the reliability indices on a preemptive basis. Other planned activities include:

1. Replacement of deteriorated OH Conductor with Covered Conductor
2. Maintenance of PMTs & Sub-Stations
3. Replacement of OCBs with Vacuum Circuit Breaker (VCB)
4. Installation / replacement of Knife Switches with Load Break Switches (LBS)

Network Rehabilitation is one of the key initiatives of KE for next control period that guarantees long-term Sustainable Reliability & Operational efficiency, and will provide the following benefits:

1. Enhanced visibility provided by MDMS, OMS, SCADA and ADMS
2. SAP-PM driven Periodic/ Preventive Maintenance
3. Effective asset lifecycle management
4. Longevity of assets' useful life
5. Predict faults and failure of assets, predictive maintenance, theft identification
6. Holistic rehabilitation of aged assets

4. ABBREVIATIONS

ABC	Aerial Bundled Cable
AC	Alternating Current
ACB	Air Circuit Breaker
ACSR	Aluminum Conductor Steel Reinforced



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ADMS	Advanced Data Management System
AE	Assistant Engineer
AM	Assistant Manager
AMR	Automatic Meter Reading
AOC	Area Operation Centre
APM	Annual Preventive Maintenance
BF	Business Finance
BMC	Bill Management Cell
BOM	Bill of Material
CM	Corrective Maintenance
CMIC	Centralized Material & Invoice Processing Cell
CPMC	Centralized PQC Management Committee
DB	Distribution Box
DGM	Deputy General Manager
DM	Deputy Manager
DTS	Distribution Transformers
E&C	Engineering & Construction
EHT	Extra High Tension
FPI	Fault Passage Indicators
FY	Fiscal Year
GIS	Geographic Information System
GM	General Manager
GSM	Grid System Maintenance
HIRA	Hazard Identification and Risk Assessment
HSE	Health, Safety and Environment.
HSEQ	Health Safety Environment & Quality
HT	High Tension
IBC	Integrated Business Centre
IEC	International Electrotechnical Commission
IPC	Insulation Piercing Connectors
IRD	Invoice Receiving Desk
IT	Information Technology
KVA	Kilovolt-Ampere
KW	Kilowatt
LBS	Load Break Switch
LCP	Loss Control Project
LT	Low Tension
LV	Low Voltage
MCCB	Molded-Case Circuit Breaker
MM	Material Management
MTL	Mobile Transport Ladder
MV	Medium Voltage
MVA	Megavolt-Ampere
NE	Network Engineering
NEPRA	National Electric Power Regulatory Authority
NGR	Neutral Grounding Resistance
NOC	No Objection Certificate
NP	Network Planning
OCB	Oil Circuit Breaker



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OCR	Operation Control Room
OEM	Original Equipment Manufacturer
OH	Over-Head
OL	Overload
OSP	Outsourced Personnel
P&E	Planning & Engineering
PM	Preventive Maintenance
PMT	Pole Mounted Transformer
PO	Purchase Order
PPE	Personal Protective Equipment
PQC	Pre-Qualified Contractor
PT	Power Transformer
PTW	Permit-To-Work
PV	Photo Voltaic
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RC	Reconnect
RCA	Root Cause Analysis
RMU	Ring Main Unit
ROW	Right of Way
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAP	System Application Product
SD	Shutdown
SF6	Sulphur hexafluoride
SIP	System Improvement Proposal
SLD	Single Line Diagram
SOP	Standard Operating Procedure
SPE	Special Protective Equipment
SS	Sub Station
TBT	Toolbox Talk
TSW	Transformer and Switchgear Workshop
UG	Under Ground
VCB	Vacuum Circuit Breaker
WBS	Work Break-down Structure
XLPE	Cross-linked Polyethylene

5. TERMS & DEFINITIONS



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TERM	DEFINITION
Composite Pole	A pole having both LT and HT network.
End Pole	A pole on which conductor terminates on (with ref. to circuit)
Isolation Point	A pole where more than one circuit is terminated from different sources (i.e., PMT, Sub-station)
Mains	Mains Cable originating from PMT or Substation
Running Pole	A pole on which an HT or LT circuit is running on
Sub-Mains	Branches extending from mains circuit
T-Off	A pole where more than one circuit will pass.
Turning Point	A point at which the cable bends at an angle greater than 45°
Vacuum Circuit Breaker (VCBs)	Vacuum Circuit Breaker is required for switching and protection of 11 kV Distribution network
Load Break Switch (LBS)	Load Break Switch is used for overhead application sectionalizing of HT network.
Breakdown Voltage Test (BDV)	This test is performed for verifying the dielectric strength of the oil of the transformer. Dielectric Strength is the maximum capacity to resist the voltage of insulating oil.
TTR Test	Transformer Turns Ratio (TTR) is one of the most common tests used to assess the condition of the transformer's windings and core. In order to ensure that rated secondary voltage is maintained at the secondary terminals of the voltage.
Earth Fault Indicator (EFI)	Earth-Fault Indicator (EFI) device is required to identify the earth faults.

6. PROJECT SCOPE OF WORK

Network Rehabilitation scope of work mainly include:

1. Replacement of deteriorated OH Conductor with Covered Conductor



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2. Installation / Replacement of Knife Switches with Load Break Switches (LBS)
3. Maintenance of PMTs & Sub-Stations
4. Replacement of OCBs with Vacuum Circuit Breaker (VCB)

The complete Scope of Work & Key Deliverables for Network Rehab, Installation / Replacement of Knife Switch / LBS / OCB to VCB conversion is distributed in 04 Packages given below.

PACKAGE-I AREA / CLUSTER	NO. OF FEEDERS FOR REHAB	OH SPAN (BARE)	LENGHT OF SPAN (M)	NO. OF PMTs FOR MAINTENANCE	NO. OF SUB- STATIONS FOR MAINTENANCE	OCB TO VCB	KS REMOVAL	KS INSTALLATION	LBS INSTALLATION	LBS REMOVAL
BALDIA GULSHAN SOCIETY	54	1,710	57,723	1,068	60	72	123	22	76	8

PACKAGE-II AREA / CLUSTER	NO. OF FEEDERS FOR REHAB	OH SPAN (BARE)	LENGHT OF SPAN (M)	NO. OF PMTs FOR MAINTENANCE	NO. OF SUB- STATIONS FOR MAINTENANCE	OCB TO VCB	KS REMOVAL	KS INSTALLATION	LBS INSTALLATION	LBS REMOVAL
DEFENCE KOPRANGI	55	2,382	77,133	1,264	86	336	163	38	128	22

PACKAGE-III AREA / CLUSTER	NO. OF FEEDERS FOR REHAB	OH SPAN (BARE)	LENGHT OF SPAN (M)	NO. OF PMTs FOR MAINTENANCE	NO. OF SUB- STATIONS FOR MAINTENANCE	OCB TO VCB	KS REMOVAL	KS INSTALLATION	LBS INSTALLATION	LBS REMOVAL
BIN QASIM JOHAR	38	2,776	108,701	1,021	64	53	97	18	70	10

PACKAGE-IV AREA / CLUSTER	NO. OF FEEDERS FOR REHAB	OH SPAN (BARE)	LENGHT OF SPAN (M)	NO. OF PMTs FOR MAINTENANCE	NO. OF SUB- STATIONS FOR MAINTENANCE	OCB TO VCB	KS REMOVAL	KS INSTALLATION	LBS INSTALLATION	LBS REMOVAL
ORANGI SURJANI	43	2,726	89,666	1,289	40	40	107	22	76	10

GRAND TOTAL	NO. OF FEEDERS FOR REHAB	OH SPAN (BARE)	LENGHT OF SPAN (M)	NO. OF PMTs FOR MAINTENANCE	NO. OF SUB- STATIONS FOR MAINTENANCE	OCB TO VCB	KS REMOVAL	KS INSTALLATION	LBS INSTALLATION	LBS REMOVAL
	190	9,594	333,223	4,642	251	501	490	100	350	50

7. REPLACEMENT OF DETERIORATED OH CONDUCTOR WITH COVERED CONDUCTOR

7.1 WORK SCOPE - PROCEDURE

- 7.1.1 Vendor shall thoroughly conduct pre-execution survey feeder-wise along with KE representative in accordance with the scope details provided by KE Project Department to determine the network condition (i.e., condition of existing conductor, existing HT



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poles and other equipment), geographical locations and before initiating any work, identify & ensure necessary safety precautions, risk assessment and safety measure.

- 7.1.2 Vendor shall prepare strategy for execution and HT/LT shutdown (feeder-wise) and share complete execution plan with KE Project Department.
- 7.1.3 Vendor shall install New HT Poles & Supports (Stay and Strut) as per scheme drawing provided by KE Project Department. For Installation of HT/ LT poles, stay, strut units and GIS ID plate. *See Section 9* for HT Pole Installation and *See Section 11* for Support Installation. The approximate count of proposed pole would be around 10% of total no. of Span count.
- 7.1.4 Vendor shall provide earthing to every new pole installed by vendor as per KE standards. *See Section 13* For Support Installation.
- 7.1.5 Vendor shall rectify earthing for Deteriorated & Vandalized earthing of poles.
- 7.1.6 Vendor shall dismantle existing overhead bare conductor. *See Section 8* for Dismantling of Conductor Safely.
- 7.1.7 Vendor shall install necessary hardware and allied material on HT Poles as per requirement. *See Annexure 26.1* for Running Pole, *Annexure 26.2, 26.3* Shackle Pole and *Annexure 26.4* for End / Terminating Pole.
- 7.1.8 Vendor shall Install covered conductor (Tiger) maintaining below Standards & Protocols.
- 7.1.9 Vendor shall prepare and maintain the HT cable termination (if required) as per KE standards. *See Annexure 26. 5*
- 7.1.10 Vendor shall install Earth Fault Indicator (EFI) on HT Cable Pole / Sub-Station as per requirement. *See Section 18*
- 7.1.11 Refer *Section 25.1* for Quality Checklist and Acceptance Criteria.

7.2 SAFETY STANDARDS & PROTOCOLS

- 7.2.1 Ensure that site is safe for easy working and execution of tasks.
- 7.2.2 Ensure the good & safe Condition of Poles using Pole tapping method, Hardware on which the HT/LT main to be pulled.
- 7.2.3 Tree Pruning to be done first, if necessary. This will allow the necessary space to be available between poles. *See Section 14* for Tree Pruning



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- 7.2.4 Safety cones, Warning/Barricading Tapes are to be used to cordon off work area from the public (if permissible, depending on the actual work location and available space).
- 7.2.5 For road crossings, concerned Traffic authorities shall be informed for necessary action (If deemed necessary).
- 7.2.6 Before Conductor pulling take place, make sure there is a support or supporting wire / stay in place at both ends.
- 7.2.7 Movement/transportation of distribution equipment's shall be performed as per Standard Procedure (*See Section 20* for, Loading & Unloading of 11-KV Distribution Equipment).

7.3 QUALITY & EXECUTION STANDARDS & PROTOCOLS.

- 7.3.1 11-KV O/H conductor shall be Tiger for covered conductor even for T-offs where there is provision of 11-KV interlinking in future.
- 7.3.2 Red phase shall be on roadside, Yellow phase shall be on top (center) and Blue shall be inner most (at building side). Phase sequence shall be uniformly maintained throughout the feeder length and identical to the adjacent feeder at isolation points.
- 7.3.3 The length of O/H span between 02 Nos. 11-KV Poles shall be 50 Meter maximum for covered conductor. Vendor shall install additional HT pole to maintain the span length (If proposed).
- 7.3.4 Ground clearances shall be maintained as per Standard Safe Distance.
- 7.3.5 On every 6th 11-KV pole at 5th span, shackle point is to be made by using HT IPCs for covered conductor. At T-OFFs as well, shackle points must be made for ease in isolation. *See Annexure 26.3* for HT Shackle Point
- 7.3.6 To pass LT O/H or LT ABC circuit under 11-KV covered conductor, the distance between the earth wire and LT O/H or LT ABC must be maintained as defined in Safe Distance Standards.
- 7.3.7 For double earth wire on 11-KV Poles, guard wire shall be installed after every 10 feet distance for covered conductor, so that if phase conductor gets broken then it will fall over guard wire to provide human safety and protection activation. *See Annexure 26.6* for Double Earth Guard Wire Arrangement.
- 7.3.8 In case of HT O/H crossing rail track or road, guard wire shall be installed after every 5 feet, whereas for ford (Nala) crossing, guard wire must be installed after every 15 feet distance for Covered conductor. *See Annexure 26.6*

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7.3.9 In case of 11-KV crossing under EHT, these must be converted into 11-KV U/G Cable to avoid any chances of safety hazard or position of proposed 11-KV O/H shall be changed such that it remains at safe distance from EHT.

7.4 TRANSPORTATION OF XLPE COVERED CONDUCTOR TO THE INSTALLATION SITE

7.4.1 XLPE covered conductor shall come in a roller drum as shown in the below pictures, the drum shall be transported to site as SOP (*See Section 20.5* for Transportation / loading/unloading of Distribution Equipment).

7.4.2 Drums shall be transported with the drum axis horizontal, and any drum movement shall be avoided & Drum shall not be dropped.

7.4.3 For loading and unloading of drums, suitable lifting and hoisting equipment shall be used. See Figure 1.

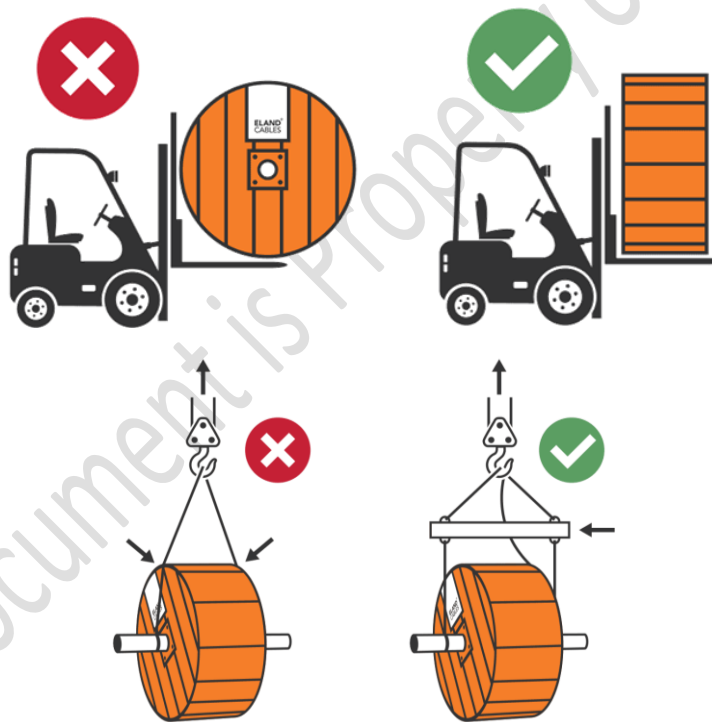


Figure 1 - Loading & Unloading of Cable

- a) Drums shall be rolled only for short distances over flat solid ground in the direction indicated on the flange. Wooden drum have an arrow marked on their flanges to indicate both the direction that is to be wound and the direction in which the drum is to be rolled. *See Figure 2*

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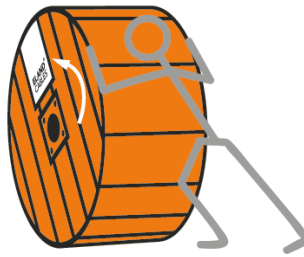


Figure 2 - Handling of Drums

- b) Conductor ends shall be firmly attached to the drum during transport and storage without damaging conductor ends. Both conductor ends shall be accessible.

7.5 SAFE WORKING PROCEDURE FOR COVERED CONDUCTOR INSTALLATION

- 7.5.1 Installation of Covered Conductor shall be done by authorized and skilled staff only. All national regulations shall be taken into account. Covered conductors shall be installed and operated in such a way not to impair their properties. Care shall be exercised during installation to avoid any damage to the conductor covering and to the conductor itself.
- 7.5.2 On installation site, cable trolley shall be used for covered conductor laying to avoid any damage to the covered conductor. *See Figure 3*
- 7.5.3 Cable shall be unwrapped with care such that its XLPE covering does not get damaged.



Figure 3 - Cable Trolley

- 7.5.4 Unwinding shall be made as shown in *Figure 4* To prevent the covering from damage any abrasive contact with soil, stones etc. is not permitted.

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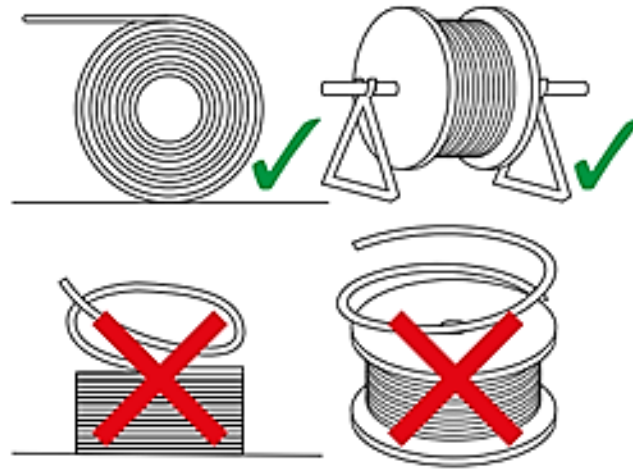


Figure 4 - Cable Unwinding

- 7.5.5 Special attention shall be paid to avoid bending radii which can cause deterioration of any property of the covered conductor.
- 7.5.6 Ends of covered conductors must be covered with end caps to prevent moisture ingress and in case of damage to moisture seals during installation, the seals/endcaps shall be inspected/replaced if necessary. *See Section 7.11.1*
- 7.5.7 Rollers in appropriate diameter and quantity have to be provided for installation. The rollers shall have a smooth clean surface, no sharp edges and shall rotate easily. To prevent the covering from damage any abrasive contact with soil or stone is not permitted. Abrasive contact of the covering with branches or similar shall be avoided.
- 7.5.8 Incineration of scrap conductors shall only be undertaken in accordance with national regulations.
- 7.5.9 Covered conductor shall be pulled by using appropriate pulling devices such as ratchet, wire grip come along, pulley and roller (ground). Laying and pulling on Roads/streets is prohibited. *See Section 24* for appropriate tools.
- 7.5.10 The pulling force shall be continuously monitored during the pull-up procedure and shall not exceed 5kN (510 Kgs).

7.6 MATERIAL (ALONGWITH PROCEDURE) TO BE USED DURING COVERED CABLE INSTALLATION

7.6.1 CONNECT/JOINT THE XLPE COVERED CONDUCTORS

- a) In span joints are not allowed in new execution/replacement. Joints shall be avoided during fault rectification, however in case of any emergency/ must requirement automatic splice of

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appropriate size may be used with overall covering of EPR/Adhesive Insulation tape to avoid moisture ingress. *See Figure 5*

- b) HT Adhesive or EPR tape shall be used for all open connecting points especially lugs with busbar.



Figure 5 - Adhesive Insulation Tape

7.7 ADHESIVE INSULATING TAPE USAGE PROCEDURE

- 7.7.1 Remove dust from the covered conductor/cable lugs/Splices where adhesive tape is required and ensure that the surface is clean and dry.
- 7.7.2 Appropriately stretch the tape and overwrap round the covered conductor/Splice with half-lapped layers (50%) up to the desired area.
- 7.7.3 Press the wrapped tape with hands to obtain a tight seal after completion.

7.8 SHORT AND GROUND FOR XLPE COVERED CONDUCTOR

- 7.8.1 HT IPCs shall be used for shorting and grounding purpose with addition/installation of grounding ring on secondary/tap side. These Grounding Rings shall remain intact permanently with the IPC and shall be utilized as per requirements of line isolation for shut down arrangement. *See Figure 6*



Figure 6 - Insulation Piercing Connector with Grounding Ring

7.9 CONNECTION OF COVERED CONDUCTOR WITH PMT BUS BAR

- 7.9.1 By using Bi-metallic lugs 185mmsq for Tiger and 300mmsq for Lynx XLPE covered conductor, the covered conductor may be connected to HT Busbar of PMT

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7.10 INSTALLATION PROCEDURE OF HELICAL TIE-ON PIN INSULATORS

7.10.1 The Covered conductor shall be mounted/installed on the 11 KV Pin Insulator with standard helical tie for straight/through lines. *See Figure 7*



Figure 7 - Helical Tie for Pin Insulator

- 7.10.2 In case of turning/bending of any covered conductor, shackle shall be made as the described helical ties are not recommended to use.
- 7.10.3 Align the Coated Top Tie with the conductor as shown, so that both legs are parallel to the conductor.
- 7.10.4 Once the position as mentioned in above step is set, rotate the Coated Top Tie in a clockwise direction and make sure that both legs go under the conductor as shown. This must be done to ensure the conductor is secured to the insulator.
- 7.10.5 Continue to rotate the legs until they are approximately parallel to the conductor.
- 7.10.6 Start to wrap one leg of the Coated Top Tie under the conductor as shown. Install the leg closest to you.
- 7.10.7 Continue to apply the first leg to completion. Make sure to snap the end of the leg into place with slight thumb pressure.
- 7.10.8 Wrap on the other leg of the Coated Top Tie as shown. Make sure to snap the end of the leg into place. Make sure tie loop is tight on insulator neck and under insulator head (see arrow).

7.11 INSTALLATION PROCEDURE OF END CAPS

7.11.1 After execution of Covered Conductor, end caps shall be installed at end of conductor to avoid moisture ingress in the conductor. *See Figure 8*



Figure 8 - End Caps for HT Covered Conductor

- 7.11.2 Ensure that open ends of covered conductor and end caps are free from dust and are dry.
- 7.11.3 Remove sharp edges from the conductor.
- 7.11.4 Put the end caps at the covered conductor's open ends.
- 7.11.5 Apply force inside and ensure that end caps are properly installed over the covered conductor ends and are not loose.



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8. DISMANLTING OF BARE CONDUCTOR

8.1 PRE-REQUISITES

- 8.1.1 At least two Linemen and three to four Helper as per requirement (per span) to perform the job.
- 8.1.2 Line Isolation to be done as per KE Line Isolation Policy for Line isolation for working on HT/LT system
- 8.1.3 Presence of security guard(s) as per requirement - Facility to be provided by KE
- 8.1.4 Poles and brackets health inspection. Stay / strut to be installed (if any).
- 8.1.5 All hooked / service connections to be removed from dismantled conductor with the coordination of concerned IBC.
- 8.1.6 Obstacles check (like TV cable, internet cable etc.) for each to be dismantled.

8.2 DISMANTLING PROCEDURE

- 8.2.1 Bare conductor dismantling to be started from the termination point/end pole.
- 8.2.2 Two linemen to climb on two different pole tops of the same span using MTL/Bamboo / FRP Ladder.
- 8.2.3 First lineman to cut red phase on Pole-1 followed by second lineman to cut blue phase on Pole-2 and then cut the remaining conductor ensuring that subject poles should not experience extensive tension.
- 8.2.4 Starting from termination end (preferred), all phase conductors are to be dismantled, span wise.
- 8.2.5 Helper standing at a safe distance from fallen conductor to start rolling the dismantled conductor by hand wearing working gloves.
- 8.2.6 Security guard to ensure that all dismantled conductors are dumped in the specified scrap truck.
- 8.2.7 After completion of process, in the presence of security guards, all dismantled conductor to be transported to designated Scrap Yard for weighing the conductor and submission to Baldia Scrap Yard (BSY).

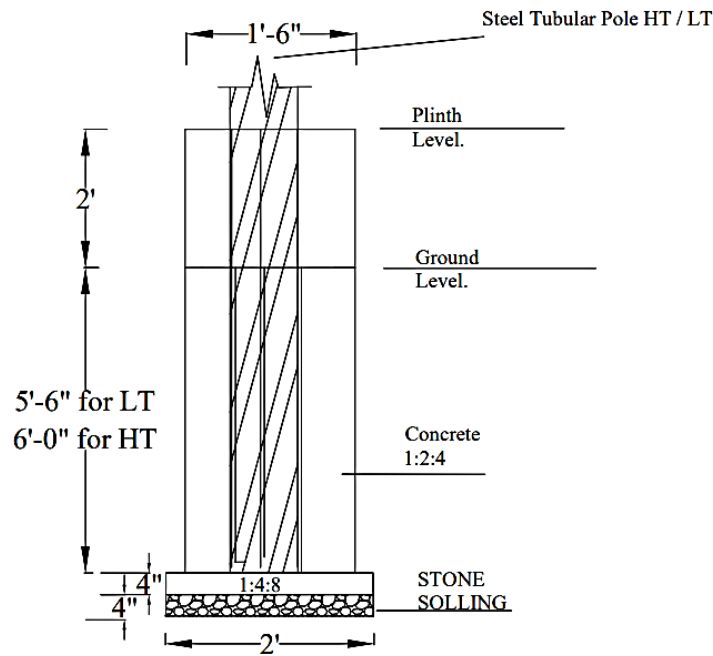
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9. INSTALLATION OF HT POLES

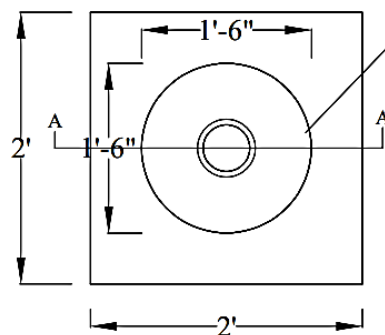
Steps for Pole Installation for both HT and LT steel / Lattice poles are described as below:

9.1 EXCAVATION FOR POLE FOUNDATION

9.1.1 After the selection of the location for pole erection, excavation is required for pole foundation. Excavation shall be done as per the drawings shown in *Figure 9*



TYP SECTION A-A



TYP PLAN OF STEEL TUBULAR FOUNDATION FOR HT/LT POLE

Note:
 All dimensions are in feet unless otherwise specified.
 Pole to be buried 6 ft in the ground.
 Modified OPC cement to be used for all concreting works.
 Concrete to be done by Machine mixing.

Figure 9 - Excavation for Pole



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9.1.2 Excavation of Pole pit minimum size should be.

Pole Type	Length	Width	Depth
Steel Tubular LT Pole	2 ft	2 ft	6 ft
Steel Tubular HT Pole	2 ft	2 ft	7 ft
Lattice LT Pole	2.5 ft	2.5 ft	6 ft
Lattice HT Pole	2.5 ft	2.5 ft	7 ft

Table 1 - Excavation Sizes of Poles

These dimensions (Length x width) are minimum and can be changed as per the site and working conditions.

9.1.3 Care should be taken while excavating. Excavation shall preferably be done manually.

9.1.4 While excavation, depending upon the soil type, care should be taken to avoid sliding of soil and the excavated material should be stored more than 2 ft away from the edge of the excavated area.

9.2 LEAN CONCRETE AND STONE SOLING

9.2.1 When excavation is completed, stone soling should be done as per the thickness specified in drawing. Stone soling should not be less than 4 inches in size. *See Annexure 26.7*

9.2.2 After the stone soling is completed, it should be compacted using a hand compactor to achieve maximum compaction and minimum voids.

9.2.3 Before Lean concrete, any extra material (garbage/debris of any sort) should be cleaned and taken out from the excavated area, and then the lean concrete to be done as per the thickness in the drawing.

9.3 POLE ERECTION BY CRANE

9.3.1 It is the safest way of pole erection & shall be chosen as a 1st priority to erect poles.

9.3.2 Crane should have a 3rd party fitness certificate and operator to have a valid license.

9.3.3 For lifting the pole through crane, it is feasible to use steel pole clamp to tie up with the rope of Crane.

9.3.4 Crane boom should be properly closed /locked.

9.3.5 Pole should be buried as per the following depths:

Steel tubular poles: 5.5 ft for LT pole and 6 ft for HT pole.



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Lattice poles: 5.5 ft for LT pole and 6 ft for HT pole.

- 9.3.6 Crane operator to ensure proper lifting and placement of pole inside the excavated pit with the help of designated employees.
- 9.3.7 Pole alignment should be checked by hand Level and, it should be 90 Degree from Earth. (Perfectly vertical aligned).
- 9.3.8 Concrete will be manually placed in foundation at site and to be filled by labor and Crane operator is to ensure its hanging until fixation of pole.
- 9.3.9 The concrete shall be of the ratio 1:2:4, with the following details:
- 1 - Part Cement
 - 2 - Part Fine aggregate or Sand
 - 4 - Part Coarse aggregate or Crushed stone
- 9.3.10 All the concrete to be done using Modified OPC cement along with addition of ground granulated blast furnace slag as per manufacturer's specifications to prevent the risk of sulfate and chloride attack, modified OPC to be used as per the following criteria:
- 9.3.11 Ordinary Portland Cement (OPC) meeting the above chemical composition can be used in lieu of modified cement and above plinth level OPC should be used.
- 9.3.12 Where ground granulated blast furnace slag is not available, a crystalline water proofing admixture (like Betocrete C16 by Aquafin Pakistan or MasterPel 760 by BASF or equivalent) can be used.
- 9.3.13 The concrete's ratio to be measured by Volume, using proper measuring tools of proper dimensions.
- 9.3.14 The surface where the concrete to be mixed shall be non-absorbent type. Use of plastic sheet or equivalent to be used for this purpose.
- 9.3.15 The concrete should be properly mixed before placement, with proper water/cement ratio of 0.5 (i.e. approximately 500 ml of water per kg or 25 liter per 50kg bag of cement). Care should be taken to avoid too much water as it will cause segregation and honey combing in the concrete.
- 9.3.16 Then designated supervisor shall give the clearance to operator to remove the crane along with lifting belt, after the concrete is set enough to support the pole.
- 9.3.17 Proper grounding should be provided. *See Section 13* for Pole Grounding & Earthing

9.4 POLE ERECTION BY TRUCK

- 9.4.1 Pole should be buried as per the following depths:



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Steel tubular poles: 5.5 ft for LT pole and 6 ft for HT pole.

Lattice poles: 5.5 ft for LT pole and 6 ft for HT pole

- 9.4.2 The pole shall be supported with 2 ropes of approx. 50 ft length each. These ropes to be fixed at the top of the pole for support. One additional rope to be wrapped around the pole and to be held from both the sides (opposite end) for stability.
- 9.4.3 Pole is slowly drifted towards the excavated hole by truck up till it reaches to the hole.
- 9.4.4 Karkuns/Labors, using the ropes, erect the pole in the already excavated foundation pit. It is to be made sure that the supporting ropes are on the opposite sides of the pole while erecting. (Atleast 6 Karkun/Labor for steel pole, and 5 Karkun/Labor for lattice pole to be used during this activity)
- 9.4.5 Pole alignment should be checked by hand Level and it should be 90 Degree from Earth.
- 9.4.6 The pole is fixed by using concrete.
- 9.4.7 The concrete shall be of the ratio 1:2:4, with the following details.
- 1 - Part Cement
 - 2 - Part Fine aggregate or Sand
 - 4 - Part Coarse aggregate or Crushed stone
- 9.4.8 All the concrete to be done using Modified OPC cement along with addition of ground granulated blast furnace slag as per manufacturer's specifications to prevent the risk of sulfate and chloride attack, modified OPC to be used as per the following criteria:
- 9.4.9 Ordinary Portland Cement (OPC) meeting the above chemical composition can be used in lieu of modified cement and above plinth level OPC should be used.
- 9.4.10 Where ground granulated blast furnace slag is not available, a crystalline water proofing admixture (like Betocrete C16 by Aquafin Pakistan or MasterPel 760 by BASF or equivalent) can be used.
- 9.4.11 The concrete's ratio to be measured by volume, using proper measuring tools of proper dimensions.
- 9.4.12 The surface where the concrete to be mixed to be non-absorbent type. Use of plastic sheet or equivalent to be used for this purpose.
- 9.4.13 The concrete should be properly mixed before placement, with proper water/cement ratio of 0.5 (i.e., approximately 500 ml of water per kg or 25 liters per 50kg bag of cement). Care should be taken to avoid too much water as it will cause segregation and honey combing in the concrete.



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9.4.14 Then designated supervisor shall give the clearance to operator to remove the crane along with lifting belt, after the concrete is set enough to support the pole.

9.4.15 Proper grounding should be provided. *See Section 13* for Pole Grounding & Earthing

9.5 POLE ERECTION BY MANUAL METHOD

9.5.1 In this case, labor should not be less than 6 in numbers for Steel tubular poles, and not less than 5 in numbers for Lattice poles.

9.5.2 The pole shall be supported with 2 ropes of approx. 50 ft length each. These ropes to be fixed at the top of the pole for support. One rope to be wrapped around the pole and to be held from both the sides (opposite end) for stability.

9.5.3 Pole is slowly pushed towards the pit by manpower until it reaches to the excavated area.

9.5.4 Then rope is stretched slowly, and manpower lifts it up from middle and slides it into pole pit completely. It is to be made sure that the supporting rope are on the opposite sides of the pole while erecting.

9.5.5 Pole alignment should be checked by hand level, and it should be 90 Degree from Earth

9.5.6 Foundation shall be poured with concrete.

9.5.7 The concrete shall be of the ratio 1:2:4, with the following details:

1 - Part Cement

2 - Part Fine aggregate or Sand

4 - Part Coarse aggregate or Crushed stone

9.5.8 All the concrete to be done using Modified OPC cement along with addition of ground granulated blast furnace slag as per manufacturer's specifications to prevent the risk of sulfate and chloride attack, modified OPC to be used as per the following criteria:

9.5.9 Ordinary Portland Cement (OPC) meeting the above chemical composition can be used in lieu of modified cement and above plinth level OPC should be used.

9.5.10 Where ground granulated blast furnace slag is not available, a crystalline water proofing admixture (like Betocrete C16 by Aquafin Pakistan or MasterPel 760 by BASF or equivalent) can be used.

9.5.11 The concrete's ratio to be measured by Volume, using proper measuring tools of proper dimensions.

9.5.12 The surface where the concrete to be mixed to be non-absorbent type. Use of plastic sheet or equivalent to be used for this purpose.



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- 9.5.13 The concrete should be properly mixed before placement, with proper water/cement ratio of 0.5 (i.e. approximately 500 ml of water per kg or 25 liter per 50kg bag of cement). Care should be taken to avoid too much water as it will cause segregation and honey combing in the concrete.
- 9.5.14 Then designated supervisor shall give the clearance to operator to remove the crane along with lifting belt, after the concrete is set enough to support the pole.
- 9.5.15 Proper grounding should be provided. *See Section 13* for Pole Grounding & Earthing

9.6 CONCRETING OF POLE PEDESTAL (POLE BASE)

- 9.6.1 Pole pedestal should be provided for every pole, as it protects the pole's base.
- 9.6.2 Place the molds (pole base iron frames) around the bottom of pole after cleaning out the ground surface.
- 9.6.3 Make sure that the Pole pedestal concrete shall be in contact with the foundation of the pole.
- 9.6.4 Fill the mold with mixture of cement, sand, and crush. (Concrete Ratio 1:2:4).
- 9.6.5 Size of the of pole Pedestal should be as per the drawings. *See Annexure 26.7*
- 9.6.6 Only Modified OPC cement to be used for concreting.

9.7 FOUNDATION IN ROCKY AREAS

- 9.7.1 In special cases only, where excavation upto the required depth is not possible due to hard strata (Hilly, rocky areas etc), and even bore drilling is not possible, only then the depth of the buried pole can be taken as 4 ft (Min). In these types of cases, the dimensions of the foundation to be increased as per the *Table 2*

Pole Type	DIA of Foundation	Min. Depth of Foundation
Steel Tubular LT Pole	3 ft	4 ft
Steel Tubular HT Pole	3 ft	4 ft
Lattice LT Pole	3.5 ft x 3.5 ft	4 ft
Lattice HT Pole	3.5 ft x 3.5 ft	4 ft

Table 2 - Excavation of Pole - Rocky Areas

9.8 FOUNDATION IN EXTREMELY SOFT SOIL (MOIST SILTY CLAY)

- 9.8.1 If the start is extremely soft soil, and it can be seen that the pole will not be stable in that soil, then soil of 1.5m x 1.5m x 2.0m shall be replaced with well graded granular fill.



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10. DISMANTLING OF HT POLES

Dismantling of poles in regular area

- 10.1.1 Pole identified for dismantling shall be marked by the concerned supervisor.
- 10.1.2 In case of alternate pole being installed, the dismantling will be done after the installation of new pole.
- 10.1.3 Shifting of mains to be done before the dismantling of the pole.
- 10.1.4 The pole to be dismantled shall be supported from the top, using Crane where possible and it shall be given priority, and securely attaching the lifting belt to the top of the pole throughout the process.
- 10.1.5 Where the crane access is not possible, chain block shall be used for holding the pole during the dismantling process.
- 10.1.6 At least 2 persons shall hold the pole using a rope wrapped around it, so that the pole does not sway after it is detached from the base while hanging from crane.
- 10.1.7 Pole shall be held away using the rope, from the position of the Person who is performing the cutting job.
- 10.1.8 The Pole pedestal (base) shall be dismantled if required using chisel and hammer.
- 10.1.9 Cutting of pole should be done using Gas welding/Disc grinder, while wearing the appropriate PPEs for the job. Grinder shall be equipped with guard.
- 10.1.10 After the cutting is completed, the pole should be lifted using Crane/Chain Block and to be stacked safely at site.
- 10.1.11 It is to be made sure that no remaining portion of pole to be left at site after cutting, and it is to be dismantled completely along with pole base. To ensure a levelled ground.

Dismantling of Poles in congested areas.

- 10.1.12 Following steps to be followed for removal of Poles, only in congested areas, where access of crane or Chain block etc. is not possible.
- 10.1.13 Tie and hold the pole from at least from 2 sides using the rope (at least 2 personnel required on each side to grip the rope).
- 10.1.14 Cut the pole from the base by using gas torch/disc grinder gradually with applying force on pole to bend /tilt on the desired side. (if Stay wire is installed on the pole, it is to be made sure that no tension is present on the wire before dismantling of pole/stay wire).
- 10.1.15 Slowly tilt the pole on the opposite side of the incision.



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- 10.1.16 Cut the stay wire with gas torch/ disc grinder.
- 10.1.17 Slowly bend the pole and move it towards the ground.
- 10.1.18 Once the pole is laid on the ground, cut the remaining portion of the pole base and the remove the pole from the site.
- 10.1.19 All the activities in these congested areas to be performed in the presence of Cluster safety coordinator and AM of the execution department. If above mentioned guidelines are not applicable, then the activity to be performed as per site conditions. Risk assessment to be performed for specific case.

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11. INSTALLATION OF SUPPORTS

11.1 INSTALLATION OF STRUT UNITS

- 11.1.1 First step to provide stay is to physically survey the site and check for any hindrance or obstacle.
- 11.1.2 Excavation is done as 1.5 ft diameter and 6 feet depth, then the girder is buried 6 feet in the hole leaving 4 ft above the ground and Concrete of ratio 1:2:4 is filled in it.
- 11.1.3 Pedestal is made with Pole Piece/ girder in the center and pole base frame is placed around it and Concrete (Ratio 1:2:4) is filled in it.
- 11.1.4 Strut pipe is fixed using Clamp on Girder.
- 11.1.5 The other end of the strut is connected on pole using stay clamp. *See Annexure 26.8*
- 11.1.6 Angle of strut unit with respect to horizontal shall be 45 degrees depending on the plane position. However, may be adjusted depending on the site conditions from 30 to 60 degrees.
- 11.1.7 Size of pedestal is about 2 feet high and 1.5 feet in diameter.
- 11.1.8 Strut to be clamped to the pole and is placed below earth bracket. And the position of the clamp to be adjusted as per the angle of strut.
- 11.1.9 Once the strut unit is attached, it needs to be confirmed that the pole is straight (90 degrees with the ground), which should be done by using hand level.
- 11.1.10 If the area is prone to theft, then the bolts of girder/clamp can be welded. (Continuous welding).

11.2 INSTALLATION OF STAY UNITS

- 11.2.1 Excavation of 4 ft depth will be done of around 1.5 ft dia. Stay rod shall be buried 3.5 feet in the pit leaving 2.5 feet above the ground and concrete with a ratio of 1:2:4 to be filled in it.
- 11.2.2 Pedestal is made with stay rod in the center and pole base frame is placed around it and Concrete of ratio 1:2:4 is filled.
- 11.2.3 Care shall be taken in cutting stay wire for fixing.
- 11.2.4 Following to be ensured while cutting stay wire:
 - Use of working Gloves
 - Ensure no one is standing opposite to cutting part



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- Cut materials straight across-Keep the material being cut at right angles to the cutting edges of jaws
- Use of appropriate Cable cutter
- Use of Face Shield/Safety Googles
- Use Working Gloves
- Use Safety Shoes

11.2.5 Stay wire is tied with straining screw at the bottom of the wire and adjusted to achieve maximum tension on stay wire.

11.2.6 The other end of the stay wire is connected on pole using stay clamp. Stay insulator shall be installed with Wire. *See Annexure 26.9*

11.2.7 Angle of stay wire with respect to horizontal shall be 45 degrees depending on the plane position. However, may be adjusted depending on the site conditions from 30 to 60 degrees.

11.2.8 While tying the stay wire with stay clamp, L/M should hook the full harness belt with strong source and check the hooks before plunging it in.

11.2.9 Size of pedestal should be about 2 feet high and 1.5 feet in diameter.

11.2.10 Stay Clamp is placed below earth bracket on HT pole. and for LT pole it is placed below the bottom (last) bracket and the position to be adjusted as per the angle of the wire. *See Annexure 26.9*

11.2.11 Once the stay is provided, it needs to be confirmed that the pole is straight (90 degrees with the ground), which should be done by using hand level. [Supervisor].

11.2.12 If the space is not available on ground for installation of stay unit, then flying/distance stay may be made / installed with installation of additional pole as a support for stay wire, as per site conditions and space availability.



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12. DISMANTLING OF STAY AND STRUT UNITS

- 12.1.1 In case of the pole being dismantled, the attached stay and strut units to be checked and if require they shall be dismantled too.
- 12.1.2 In case of existing Stay and Strut unit, if the attached pole is in use, then another Strut/Stay unit to be installed first before dismantling of the existing unit, so that the pole is supported.
- 12.1.3 The strut unit/ Stay wire shall be removed from the pole top clamp, using related safety protocols of working at height.
- 12.1.4 In case of Strut unit, the buried girder to be dismantled by chisel hammer and first the foundation base to be dismantled, then the girder to be cut using gas welding/ cutting disc grinder.
- 12.1.5 In case of stay wire, the foundation to be dismantled, then the rod to be cut using gas welding/ cutting disc grinder. following to be ensured while cutting stay wire:
- PVC tapping on both end of cutting part before cutting
 - Use of working Gloves
 - Ensure no one is standing opposite to cutting part
 - Cut materials straight across-Keep the material being cut at right angles to the cutting edges of jaws
 - Use of appropriate Cable cutter
 - Use of Face Shield/Safety Goggles
 - Use Working Gloves
 - Use safety Shoes



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13. GROUNDING & EARTHING OF HT NETWORK / EQUIPMENT

13.1 EARTHING/GROUNDING REQUIREMENT

13.1.1 Earth Resistance values for KE Distribution Network shall be according to *Table 3*

Sr. No.	Equipment / Material	Earth Resistance (Ohm)
1	HT/LT Poles/ Hardware / HT ABC messenger/UG Cable Armor and Metallic Enclosures	Not more than 5 Ohm
2	Distribution Transformer	Not more than 2.5 Ohm

Table 3 - Earthing Resistance Requirement

13.1.2 Earthing is required on all non-current carrying metallic enclosures of each equipment installed in KE Distribution Network including underground cables' termination.

13.1.3 Neutral terminal of transformer shall be separately Earthed. *See Annexure 26.10* for Sub-Station Earthing & *Annexure 26.11* for PMT Earthing.

13.1.4 The neutral of LT Network (OH bare/ ABC/ UG Cable) must be connected with neutral bushing of transformer.

13.1.5 Where other equipment(s) are available along with transformer, grounding of transformer neutral bushing and other enclosures shall be made with separate wires respectively.

13.1.6 All New HT poles must be earthed individually at the time of poles installation/replacement. *See Annexure 26.12 – 26.15* for Earthing of HT Pole

13.1.7 Double Earth and Guard Wire are required for HT Overhead Network (Bare and Covered Conductor i.e., Lynx, Tiger) with ACSR Rabbit.

13.2 EARTHING/GROUNDING PROCEDURE

Earthing/Grounding work will be carried out by any of the two methods, selection based on site condition

13.2.1 Direct Hammering/Nailing of Galvanized Rod

- Trial pit of size 1 m x 1 m x 1m shall be made for earthing on identified location/site. See Annexure 12.12 and 12.14
- Insert solid rod (Galvanized MS) at the center of pit and drive into earth with the help of hammering at the top up to the depth of 2850 mm leaving 150 mm exposed in pit for making connection with pole through U Clamp.



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- c) Connect the steel wire with driven rod through U-Clamp and another end with pole ground terminal through pole base/substation earthing terminal with 70 mm² copper lug. Lug shall be punched with crimping machine and welded through electrode welding on earthing bolts.
- d) Back Fill the pit with normal soil up to ground level.
- e) Sites where pits dimensions are not practically possible, length and breadth can be adjusted, keeping the depth of 1 meter at the minimum

13.2.2 Machine/Hand Bore Method

- a) Open trial pit of size 1 m x 1 m x 1m. *See Annexure 26.13 and 26.15*
- b) Bore up to depth of 2950 mm from the pit base with a circular diameter of 5 inch (125 mm).
- c) Fill in small quantity mixture of Lime, Salt and Coal in the ratio 1:2:3.
- d) Insert the Rod up to the depth of 2850 mm. Earth Wire connection with rod through U Clamp will be made before inserting rod within bore area.
- e) Connect the steel wire with rod using U-Clamp and another end with pole ground terminal through pole base/substation earthing terminal with 70 mm² Copper lug
- f) Lug to be punched with crimping machine and welded, after tightening nut, using electrode welding on earthing bolt
- g) Fill the bore with a mixture (30 Kg Approx.) of Lime, Salt and Coal in the ratio of 1:2:3 respectively up to pit level.
- h) Finally, back fill the bore with normal soil up to ground level.
- i) Sites where pit's dimensions are not practically possible, length and breadth can be adjusted, keeping the depth of 1 meter at the minimum thus total bore will be of 13 ft.

13.3 ALLIED REQUIREMENT WITH EARTHING/GROUNDING JOB

- 13.3.1 Pole Base will be part of Earthing Job and connectivity of Earth Wire with Earth Bolt shall be according to drawings attached. *See Annexure 26.12 and 26.13*
- 13.3.2 In case of availability of pole base, a slit of 50 mm x 50 mm shall be made and earth wire from rod will be connected with earthing terminal by passing through slit. Pole Base will be repaired after connectivity of Rod using wire with welded at earthing bolt of pole.



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- 13.3.3 Each pole of the PMT is to be earthed with separate earth electrode (driven rod). *See Annexure 26.11*
- 13.3.4 Connectivity of PMT Poles with neutral bushing and allied equipment(s) shall be made as per attached drawing. *See Annexure 26.11*
- 13.3.5 Check the earth resistance value and limits, as mentioned in *Table 3*
- 13.3.6 Earthing value will be checked by the executioner after completion of each job.
- 13.3.7 Earthing continuity wire from earth electrode (rod) is connected at the HT/LT Poles bottom side nut/bolt, whereas further connection(s) with earth ground are to be done through wire starting from the upper side nut/bolt at the pole.
- 13.3.8 If upper earthing bolt is not available, earthing wire is required to be connected with any of the pole bracket's Nut/bolts using Lugs. Existing Nut/Bolt shall be cleaned with the help of wire brush or emery paper.
- 13.3.9 At PMT/OH pole, earthing braid of HT cable and earthing wire must be connected at the same nut/bolt of the pole clamp.
- 13.3.10 If the required earth resistance is not achieved after inserting single rod, then 2nd rod of similar length will be installed at a distance/spacing not less than 4000 mm. *See Annexure 26.14 and 26.15*
- 13.3.11 2nd Rod (Electrode) installation will be guided by Site Supervisor.
- 13.3.12 In case of Substation, Earthing Wire Continuity will be maintained as per *Annexure 26.10*
- 13.3.13 Earthing connectivity at the neutral bushing of transformer will be provided by a separate earthing wire. Whereas other equipment(s) will be interconnected through separate earthing wire.
- 13.3.14 In substation, earthing continuity wire will be connected at the earthing terminal of one VCB. Whereas earthing bar of all other VCBs are required to be connected through inbuilt earthing connector at the bottom of VCB. Earthing braid of each HT cable to be connected with available provision at the bottom of switches. This procedure is applicable in case VCBs are of same make /model.
- 13.3.15 In substations where switches' earth bar is not aligned, earthing wire is to be looped at each switch separately.
- 13.3.16 In substation, earthing wire and earthing braid of local HT cable be connected at the same side of nut/bolt in HT cable clamp.
- 13.3.17 Vendor shall connect and maintain the Earthing Continuity with associated/allied equipment by following respective safety SOP(s) based on site requirement.

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13.3.18 Every New pole HT/LT (inclusive of replacement or shifting) shall be earthed at the time of Pole installation as per this SOP.

13.3.19 Same Excavation Pit for Pole shall be used for earthing prior to installation of pole.

13.4 MARKING/MAPPING OF EARTHED POLES

13.4.1 Unique Pole ID must be painted/printed/Sticker pasted on the pole vertically through stencil using any reflecting Color or suitable method as per KE Standards, at the height of 6 ft from ground level.

13.4.2 Unique Pole ID, Six-Digit Number, will be issued by KE Project Department to Vendor.

13.4.3 Font Size of Pole ID shall be 40mm x 25mm (length x width) with 5mm spacing between two characters, making it easily readable.

13.4.4 Once painted, using a GIS app interface same pole ID would be tagged on GIS on the exact position of the pole using GPS coordinates to mark the same.

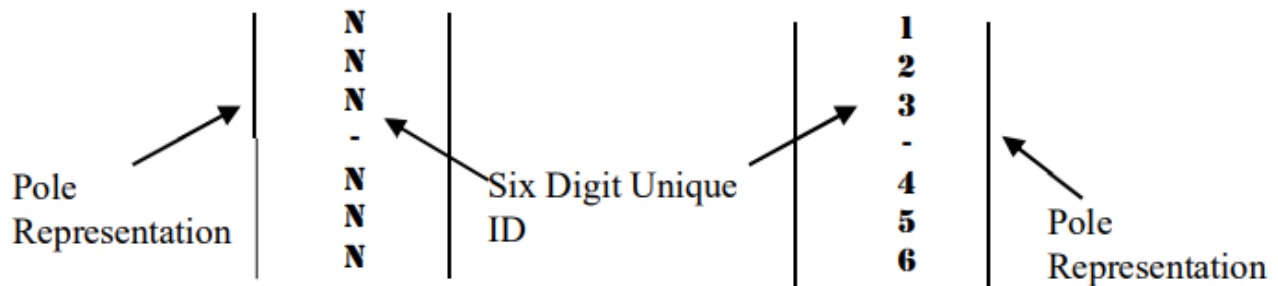


Figure 10 - Vertical Pole Marking

13.5 MEASUREMENT OF EARTH RESISTANCE

13.5.1 Earth Resistance Measurement method(s) will be followed as per available Instrument's Manual

13.5.2 Specification of the equipment can also be referred for details of measurement method.

13.6 SAFETY PRECAUTIONS FOR EARTHING / GROUNDING

13.6.1 The earthing work can be carried out in energized condition; however, safety precautions must be ensured before start of earthing.

13.6.2 Special considerations must be taken for underground cables inclusive of EHT underground cable and other utilities to avoid accidental pick axing during execution of earthing.



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- 13.6.3 KE Supervisor will confirm the "Earthing Pit" location to his team/workers with physical presence.
- 13.6.4 Vendor Supervisor must ensure usage of proper PPE(s)/SPE(s) and tools. Following are essentially required:
- Live line tester
 - Safety Helmet
 - Safety Shoes
 - HT/LT Rubber and Leather Gloves
 - Sledgehammer with Non-Conducting Material handle
- 13.6.5 KE supervisor/Vendor Supervisor shall check the presence of voltage on the pole or nearby stay wire / strut or any other metallic object with the "Live line tester" as per KE standard before starting of earthing work.
- 13.6.6 Job shall not be started in case of any voltage presence at the pole and call concerned team for proper isolation.
- 13.6.7 Use HT Rubber & Leather Gloves during earth rod hammering inside of the trial pit or boring work (Hand or Machine).
- 13.6.8 Recheck Earthing Rod and Pole with "live line tester" before connecting earth wire at rod and pole via U-clamp and lug.
- 13.6.9 Use LT Rubber and Leather gloves during earth wire connections at both ends.

14. TREE PRUNNING

14.1 INTRODUCTION

It provides the guidelines for adopting safe procedure for Tree Pruning on tree branches that come inline / cross with HT/LT OH lines (bare/insulated/covered) causing abrasion/breakage resulting area breakdown, tripping and wire broken faults or other technical faults that pose safety hazards.

14.2 SAFETY STANDARDS & PROTOCOLS

- 14.2.1 Before performing Tree Pruning, proper isolation and shut down shall be arranged by AOC (Area Operation Center) for HT and LT OH Network (bare/insulated/covered) along with Street Light as per Line Isolation Policy.
- 14.2.2 All mandatory precautionary measures with regard to safety shall strictly be followed at the time of Tree Pruning.
- 14.2.3 PPES, SPEs and equipment shall be used as per HSEQ practice and standards.



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- 14.2.4 After completion of the tree pruning activity, the remains shall be removed from the site considering public safety.

14.3 WORKING PROCEDURE

Following actions shall be taken before performing the work of Tree Pruning on concerned site location:

- 14.3.1 Survey of tree branches coming inline / crossing with the electrical HT/LT & Street Light OH lines (bare/insulated/covered) and PMTs, shall be performed.
- Work area shall be appropriately marked and isolated with Warning Tape and Cones.
 - Obstructions to MTL/Bamboo Ladder shall be identified.
 - Terrain characteristics and working conditions shall be identified and safe route shall be planned accordingly for any potential safety hazard.
 - Identification of hazards associated with job shall be done and control of these hazards shall be acknowledged.
 - During work, all safety measures shall be ensured to prevent damage to property and avoid safety risk to public.
- 14.3.2 Where the fall of a tree limb/branches shall create a hazard for an employee, pedestrian or vehicular traffic, a means such as, but not limited to, a barrier or traffic control cautions shall be used to prevent injury.
- 14.3.3 A verbal warning shall be given by tree pruner before dropping a limb. Separate work rope, controlled by an employee on the ground, shall be used to lower limbs which cannot be dropped.
- 14.3.4 Heavy/large branches shall be lowered carefully using Manila Rope.
- 14.3.5 If the tree is next to power lines, then lateral cuts are to be made to direct the tree growth back and away from the power lines.
- 14.3.6 Branches above the power lines shall be directed up and back, while those below the power lines shall be directed down and back or removed to the trunk.

14.4 TYPES OF TREE PRUNING SITES

- 14.4.1 Tree pruning shall be performed on trees that may come in line/cross the following types of power distribution lines:
- Only HT Overhead (bare/insulated/covered) of one feeder existing in between trees



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- b) Only HT Overhead (bare/insulated/covered) of more than one feeder with shackle points existing in between trees
- c) Only LT Overhead (bare/insulated/covered) single circuit with Street Light
- d) HT and LT Overhead (bare/insulated/covered) with Street Light
- e) HT and LT Overhead (bare/insulated/covered) Duplicate Circuits with Street Light
- f) LT Overhead (bare/insulated) with Street Light at Shackle Point
- g) LT Overhead (bare/insulated) with Street Light
- h) Service bracket hindered by trees.

14.5 CLEARANCES

- 14.5.1 Tree pruning of overgrown/dead tree branches shall be performed such that a radial distance of minimum 4 ft is maintained from the Pole/PMT.
- 14.5.2 To maintain a radial distance of minimum 4 ft from pole, tree pruning shall be performed greater than 4 ft, depending upon the growth rate of concerned trees.
- 14.5.3 Tree pruning of all bushes, limbs and foliage of living vegetation shall be performed such that a vertical and horizontal distance of minimum 4 ft is maintained from O/H Conductors (bare/insulated/covered).
- 14.5.4 To maintain a vertical and horizontal distance of minimum 4ft from O/H Conductors (bare/insulated/covered), tree pruning shall be performed greater than 4 ft depending upon the growth rate of concerned trees.

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15. INSTALLATION / REPLACEMENT OF KNIFE SWITCHES WITH LOAD BREAK SWITCHES

15.1 INTRODUCTION

A Load Break Switch is an SF6 insulated 11kV/50Hz switch gear installed on poles for overhead lines with the purpose of sectionalizing of HT circuits. LBS is an on load switching device used to make and break 11 KV circuit without feeder switching from Grid station or substation/RMU.

Replacement of Knife Switches with SF6 type Load Break Switch (LBS) is also part of the Project. Since a major portion of KE's system is underground (directly buried) and identification of fault requires more time.



Figure 11 - Load Break Switch (LBS)

15.2 LOAD BREAK SWITCH SCHEMATIC DIAGRAM

Figure 1 shows the Schematic Diagram of Load Break Switch

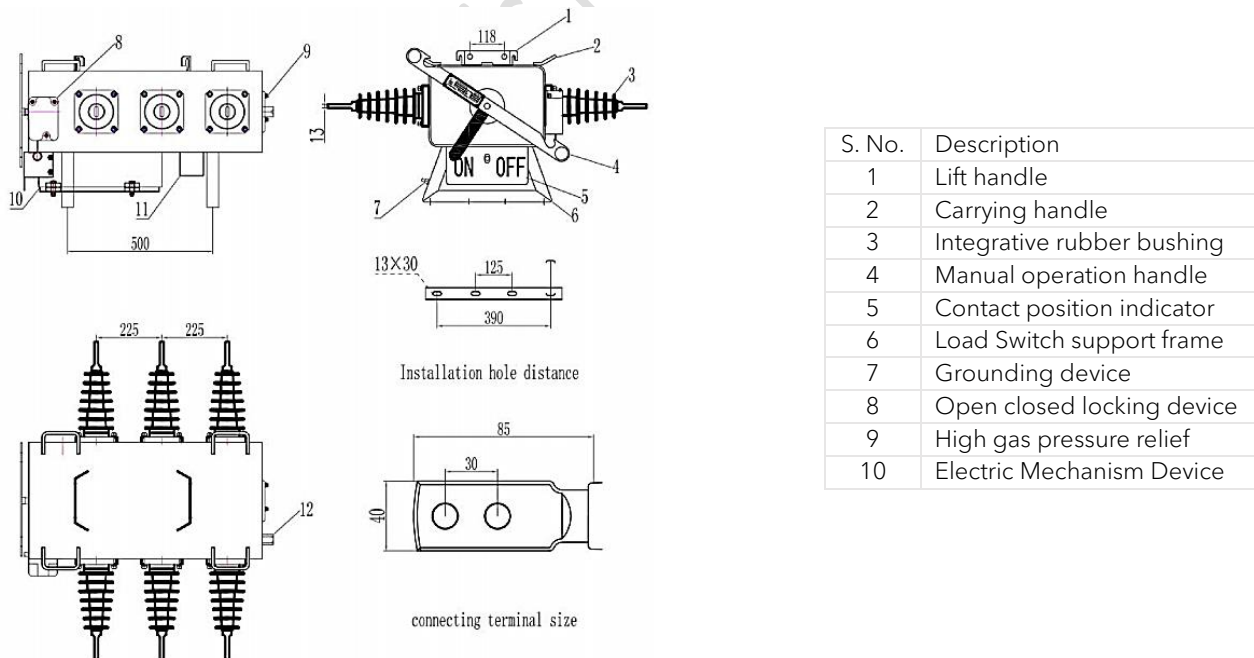


Figure 12 - Load Break Switch – Schematic Diagram



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15.3 WORK SCOPE

- 15.3.1 Vendor shall install Load Break Switches on proposed location (New or Replacing the Knife Switch with LBS). See Section 16.6 of this document.
- 15.3.2 Vendor shall dismantle existing Knife Switch (KS) safely and transport the Knife Switch to TSW.
- 15.3.3 Vendor shall inspect the health of Pole Structure and Pole Earthing during pre-execution survey prior to installation of LBS.
- 15.3.4 Vendor shall check the LBS appearance with eyes, confirm if the bushing, open/close indicator, manual handle, gas pressure gauge is in intact position.
- 15.3.5 Vendor shall Check the assembly and mounting items are either complete or not.
- 15.3.6 Vendor shall check and confirm if the SF₆ gas pressure is within the standard range (green area).
- 15.3.7 Vendor shall check the LBS by operating Manual Open/Close operation 5 times.
- 15.3.8 Vendor shall check the phase continuity of LBS with multimeter for both ON and OFF positions.
- 15.3.9 Refer **Section 25.3** for Quality Checklist and Acceptance Criteria.

15.4 LBS INSTALLATION PROCEDURE

- 15.4.1 During installation and energization of LBS the status of SF₆ gas pressure shall be checked from the pressure dial provided at the bottom of the LBS
- 15.4.2 Do not uplift LBS with the help of bushings or operation handle, the LBS may get damaged.
- 15.4.3 Install all the accessories along with bracket assembly onto the LBS. **See Annexure 26.17**
- 15.4.4 The L-type terminal clamps shall be installed in case of HT cable connection.
- 15.4.5 After fixing of accessories and bracket assembly, the LBS shall be lift up with the help of crane using lifting hooks to the installation point at the top side of HT pole.
- 15.4.6 Place the bracket assembly and cable clamp bracket (in case of cable only) on HT pole and tighten with washers and nuts.
- 15.4.7 Check the bracket assembly and cable clamp bracket with level gauge to verify its straight/horizontal position and avoid any tilting of LBS.
- 15.4.8 The cables/conductors shall be connected to the bushings of LBS. bushings shall be then covered with PVC boots provided.



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- 15.4.9 The body of LBS shall be provided with proper ground for the grounding point over the LBS body.
- 15.4.10 The earthing of LBS shall be performed by connecting Pole earthing to LBS enclosure with the help of conductor.
- 15.4.11 In case of termination of conductors on bushing terminals, umpiring shall be performed with the same conductor as of HT overhead. Jumpers shall be covered with heat shrinkable sleeves for effective insulation.

15.5 POST LBS INSTALLATION MEASURES

- 15.5.1 After installation of the LBS, visually inspect if the LBS main body is without any damage.
- 15.5.2 Check if the SF₆ gas pressure is in normal range.
- 15.5.3 Operate LBS with close/ open operations using hot stick.
- 15.5.4 It is to be ensured that hot stick operations are not hurdled with LT wires/cables.
- 15.5.5 Check if the opening/closing status of LBS main body is consistent with opening/closing operation i.e., there shall not be any movement/vibration.
- 15.5.6 In case of fault, report to project manager and replace the faulty unit with healthy one following the above-mentioned procedure.



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16. INSTALLATION OF VACUUM CIRCUIT BREAKER (VCB)

Replacement of most deteriorated OCBs with VCBs of only primary sub stations is being considered which would assist in fault reduction, asset up-keep and timely restoration of supply.

The protection is activated at the first terminating point of each feeder by replacing existing switches with new VCBs having relays with enhanced facility of broken conductor feature to ensure public safety.

16.1 INTRODUCTION

The switchgear panel consist of the basic MV module with the circuit breaker, cable, and busbar compartments by means of pad lockable shutters and the supplementary module consisting of the low voltage instrument compartment

All the compartments are partitioned off by means of sheet metal walls. The Circuit Breaker is Cassette type design which can be moved from the Service position to the Test / Disconnected position and, then to the maintenance or removed position.

The vertical sheet steel partition wall which separates the compartments is provided with Spouts for the upper and lower contacts of the Circuit Breaker. When the Circuit Breaker is situated in the disconnected and removed positions these openings are automatically closed by means of pad lockable Metallic Shutters. At the operator's side of the switchgear panel is closed by means of a sheet steel door with the hinges on left hand side. This door is provided with a double lock which is locked and unlocked by means of panel key & special handle.

The top front of the switchgear panel is closed by means of a relay and instruments cabinet which is separated from the high voltage section in such a manner that contact with live parts is precluded. The top cover of the switchgear panel consists of a pressure release flaps.

A separate control cable path is provided in the panel for routing the control cables in the channel from CT/PT compartments to the Low Voltage instrument cabinet.

16.2 INSTALLATION PROCEDURE

- 16.2.1 Vendor shall ensure that shutdown is arranged as per SOP for Line Isolation for Working on HT/LT System and Standard Operating Procedure shall be followed prior to Installation of VCB panels.
- 16.2.2 Vendor shall check and ensure all active parts with live line tester before operation of VCB.
- 16.2.3 Vendor shall ensure necessary safety precautions & safety risk assessment.
- 16.2.4 Movement / transportation of distribution equipment's shall be performed as per Procedure (See Section 20.6 of this document, Loading & Unloading of 11-KV Distribution Equipment)



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- 16.2.5 Vendor shall install the equipment as per drawings proposal provided by K-Electric
- 16.2.6 For all screw fastenings, comply with the tightening torques specified by manufacturer.
- 16.2.7 Tightening torques and control tightening torques for bolted joints by using Torque wrench.
- a) Tightening Torques: Torque applies to bolted joints
 - b) Control Tightening Torque: Torques apply when checking bolted joints
 - c) Ranges of Tightening Torque are shown in below Table 4.

S.no	Vendor	Type of VCB	Nut bolt size	Material	Tightening Torque
1	Schneider	Cassette type	M10	Steel	30~40 N.m
		Trolley type	M10	Steel	30~40 N.m
2	Siemens	Trolley type	M16	Steel	110/90 Nm
3	PEL	Cassette type	M12	Plain Steel	62 Nm
		Trolley type	M12	Plain Steel	62 Nm

Table 4 - Tightening Torque & Control Tightening Torque

- 16.2.8 Before installing the switchgear panel, vendor must ensure that the switchgear room is checked according to the specific switchgear documentation as shown in Figure 13
- a) Carefully clean the installation area of switchgear.
 - b) Observe the minimum distance between the switchgear and the wall of the building.
 - c) The load-bearing capacity of the fastening points must correspond to the weight of the switchgear (perform a stress analysis of the floor).
 - d) Check floor openings/trench for high-voltage cables.

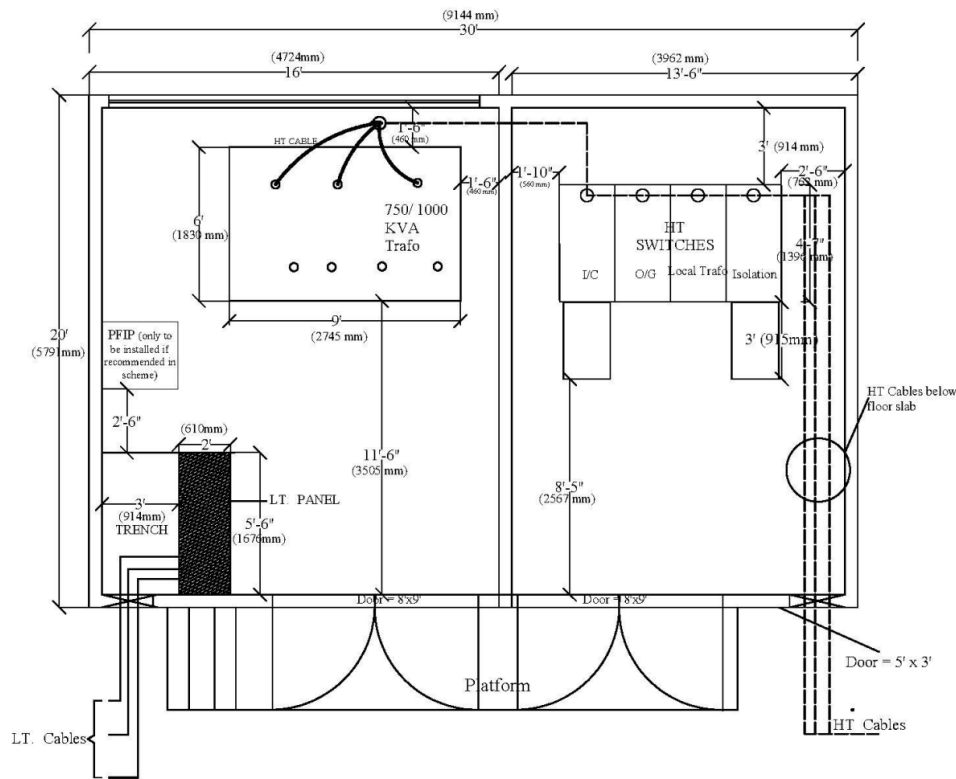


Figure 13 - 11kV Sub-Station Room (11kV Switchgear Room)

16.2.9 Vendor must comply following standard practices while shifting of VCB Switches.

16.3 SHIFTING OF VCB PANELS

16.3.1 Make sure the rope or the chain being used is strong enough to bear the weight of the panel.

16.3.2 On lowering the panels, make sure that the supporting platform is sufficiently stable and even.

16.3.3 Transport on the floor:

- Push panel onto cylindrical rollers as shown in Figure 14
- All cylindrical rollers shall be uniform in size.
- Thus, move the panel until it reaches its final location.

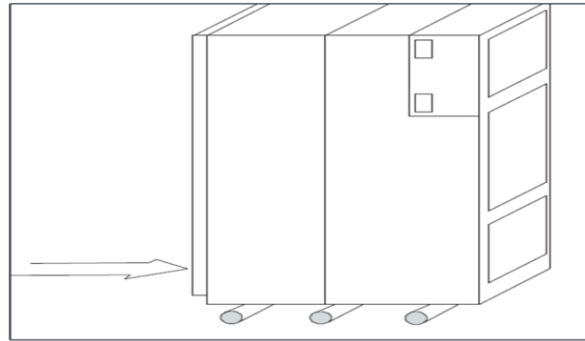


Figure 14 - Shifting of the VCB Panel on the Floor

16.4 INTERCONNECTING THE VCB PANELS

- 16.4.1 Aligning the panels
- 16.4.2 Grouting the panels to the foundation.
- 16.4.3 Bolting the panels together by using panel to panel coupling holes provided on side walls.
- 16.4.4 Opening the busbar compartment
- 16.4.5 Interconnecting/Assembling the busbars
- 16.4.6 Closing the busbar compartment on extreme right and extreme left-hand side of panel.
- 16.4.7 Assembling and interconnecting the earthing busbar.
- 16.4.8 Interconnecting the earthing busbar compartment.

16.5 ALIGNING THE PANELS

- 16.5.1 Observe the minimum distance to the side and the rear wall of the switchgear room in accordance with the switchgear arrangement.
- 16.5.2 As for the exact dimension and minimum distance of the panels, refer to the relevant dimension drawing and arrangement diagrams.
- 16.5.3 Align the panel horizontally.
- 16.5.4 Align the panel in vertical position.
- 16.5.5 The first panel may have a level difference of $\pm 3\text{mm/m}$ as a maximum.
- 16.5.6 Lay thin shims with 0.5 mm to 1.0 mm thickness under the panel frame, if required.
- 16.5.7 The panel is aligned.

16.6 FASTENING THE PANEL

- 16.6.1 Screw-fastening panel front & rear to one another using panel to panel coupling holes with Dia M12.
- 16.6.2 Fasten panels to one another at the top on the rear side using a connecting link. To this effect, use the screws provided on the panel and complete dimensional details are as shown in Figure 15

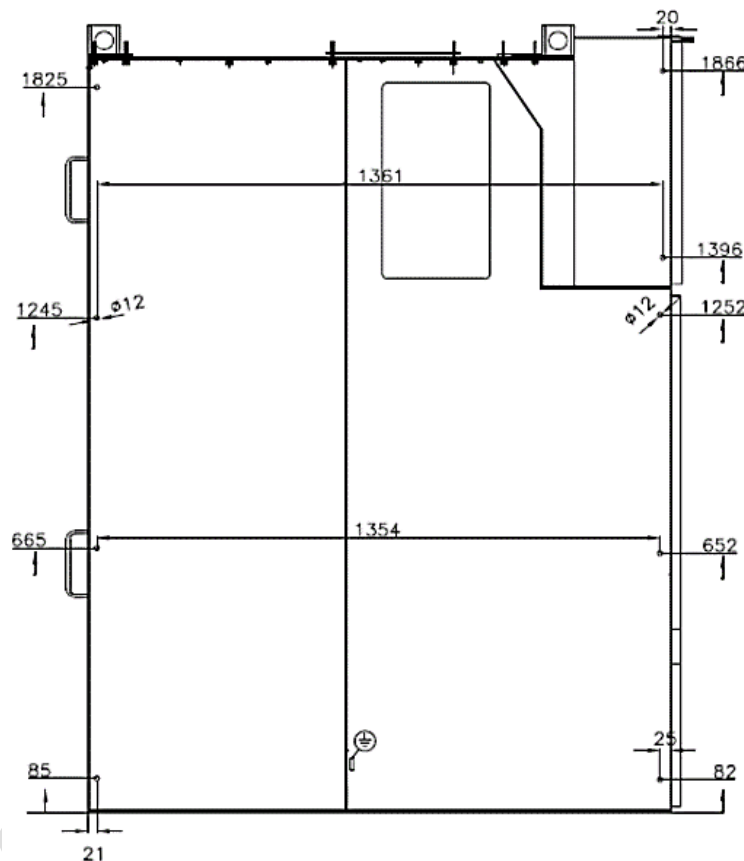


Figure 15 - Panel to Panel Coupling Holes

16.7 ASSEMBLING OF BUSBAR

- 16.7.1 Clean all contact areas of the Bus bars and feeder bars in the switchgear Panels.
- 16.7.2 The easiest way to assemble the busbar is from the side of the panel as shown in Figure 16 another side view.
- 16.7.3 The bolts, conical spring washers and nuts necessary for assembling the busbar are supplied in a bag unit together with each panel.
- 16.7.4 Check contact surfaces of busbar, brush if necessary and apply a thin film of Vaseline.

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- 16.7.5 Bolt the busbars to the corresponding feeder bars without distortions or gaps between both bars.
- 16.7.6 Observe the screwing direction of the bolts. The threads of the bolts and nuts must be dry and non-greasy.

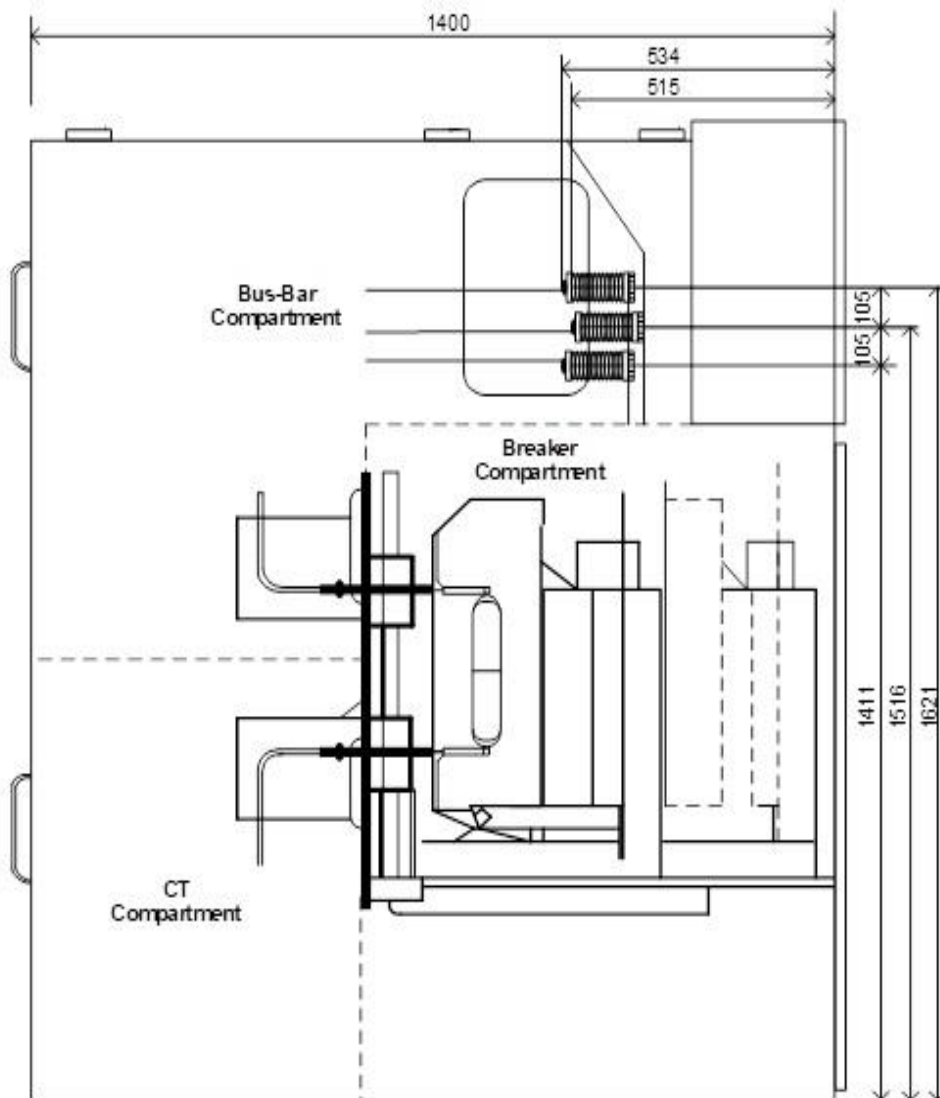


Figure 16 - Side view of Panel

16.8 ASSEMBLY OF THE EARTH BUS

- 16.8.1 An earthing bar is fitted inside the panel at the bottom of the CB rear side as shown in Figure 17.

- 16.8.2 Clean all contact areas of the connecting bar and the appropriate earth bar in the switchgear panels
- 16.8.3 Slip the connecting bar into the adjacent panel through the cutout in the panel-supporting structure.
- 16.8.4 Screw-fasten connecting bar on both sides to the earth bar in.
- 16.8.5 Connect earth bus to the earthing system of the switchgear building. *See Section 13* for Earthing of HT/LT Equipment.



Figure 17 - Earthing Terminal on VCB Panel

16.9 INSTALLATION OF EFI

- 16.9.1 Earth fault Indicator shall be installed with VCB Panel as per SOP. *See Section 18.5* for Installation of EFI inside VCB.

16.10 CABLE TERMINATION

- 16.10.1 Cable terminal of VCBs shall be carried out as per given *Figure 18* and shall be checked that the cable is assembled properly with cable clamp and closed the panel bottom opening with cover plate to avoid the access of lizards and mouse etc.



Figure 18 - Cable Termination of VCB



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17. MAINTENANCE OF PMT & SUB-STATIONS

17.1 PMT MAINTENANCE

17.1.1 Figure 19 & 20 shows the standard arrangement of 250kVA / 500kVa PMTs (With DBs and Unified Control Box Arrangement) along with hardware and allied material installed on it.

17.1.2 Vendor shall check and inspect all the allied material installed on PMT, PMT Pole and PMT Structure from top to bottom as per PMT Maintenance & Transformer Maintenance Checklist. *See Section 25.4*

17.1.3 11 KV Pin Insulator shall be installed at cross arm bracket.

S. No	PMT Environment	Condition	✓	Action Required
1	Pin Insulator	Not Available		Install
		Broken / Puncture		Replace
		Tilted		Align
		Busbar pin insulator by passed		Align
		Dusty		Clean
		Okay		No Action

17.1.4 11 KV Disc Insulator shall be installed.

S. No	PMT Environment	Condition	✓	Action Required
2	Disc Insulator	Broken / Puncture		Replace
		Dusty		Clean
		Okay		No Action

17.1.5 Insulated PMT Bus Bar Arrangement shall be installed as per Specification.

S. No	PMT Environment	Condition	✓	Action Required
3	Busbar	Not Available		Install
		Joint		Replace
		Jumber dropped without PG/Line tap		Install
		insulation damage		Replace / repair
		Okay		No Action

Note : PG Clamp Bronze/Copper shall be used instead of T-Clamps or Line Tape on PMT Bus Bar along with phase identification marking (R, Y, B) as per Specification.

17.1.6 Lead of suitable size as per the load requirement shall be used from PMT Bushing.

S. No	PMT Environment	Condition	✓	Action Required
4	Leading with Line Tape (Busbar ~ DO ~ PMT Bushing)	Not Available		Install
		Insulation Damage		Replace / Repair
		Okay		No Action
5	Leading with Lugs (Busbar ~ DO ~ PMT Bushing)	Not Available		Install
		insulation damage		Replace / repair
		Okay		No Action



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17.1.7 11 KV D/O Cutout (with MV Fuses) shall be installed along with D/O Covers as per Specification.

S. No	PMT Environment	Condition	✓	Action Required
6	DO Cut Out	Not Available / Damage		Install / Replace
		Fuse inappropriate size/rating		Replace
		Miss Align		Align
		DO clearances (Ph to Ph to Ground)		Rectify
		Fuse Cartridge Not Available / Damage		Install / Replace
		Installed Porcelain type		Replace with Polymer type
		Fuse Installed / Binding Wire		Replace with Fuse & cartridge
7	DO Covers	Okay		No Action
		Not Available		Install
		Damage		Replace
		Available		Okay

Note: 11 KV Fuse Links for D/O Cutout shall be used as per Specification. Current carrying capacity according to transformer ratings are specified as under:

- a) HT Fuse for 100 KVA (6 Amps)
- b) HT Fuse for 150 KVA (10 Amps)
- c) HT Fuse for 250 KVA (15 Amps)
- d) HT Fuse for 400 KVA (30 Amps)
- e) HT Fuse for 500 KVA (30 Amps)

17.1.8 Pilot Bracket and Pilot Insulator shall be used to provide proper support for the connection of Single Core XLPE Insulated Cable (11 KV Heat Shrinkable Tube) from D/O Cutout to Transformer HT Bushing.

S. No	PMT Environment	Condition	✓	Action Required
8	Pilot Bracket not Installed	Not Available		Install
		Damage		Replace
		Okay		No Action
9	Pilot Insulator (Pin Insulator) Required on Pilot Bracket	Not Available		Install
		HT Lead not tied with Pilot Insulator		Tied properly
		Puncture / Damage		Replace
		Miss Align		Align
		Okay		No Action
10	Pilot Insulator's (Pin Insulator) Condition	Puncture / Damage		Replace

17.1.9 Distribution Transformer Bushing Protection Covers for both HT/LT Bushings shall be used as per Specification.

S. No	PMT Environment	Condition	✓	Action Required
11	Bushing Covers Required at HT Bushings	Not Available		Install
		Damage		Replace



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S. No	PMT Environment	Condition	✓	Action Required
		Okay		No Action
12	Bushing Covers Required at LT Bushings	Not Available		Install
		Damage		Replace
		Okay		No Action

17.1.10 PMT LT Circuit Breaker (CB) shall be installed according to the rating of transformer as per Specification.

S. No	PMT Environment	Condition	✓	Action Required
13	Breaker Required	Not Available		Install
		Damage/Faulty		Replace
		Tripping Setting		Set as per LT Network Guideline
		Okay		No Action
14	Breaker Box Condition	Not Available		Install
		Damage		Replace / repair
		Door not Available / Damage		Install / Replace
		Door Open		Close
		No Earthing connection - Continuity		Install / Provide
		Okay		No Action

Note: Transformer ratings are specified as under:

- a) For 100 KVA LT CB (160 Amp)
- b) For 150 KVA LT CB (200Amp)
- c) For 250 KVA LT CB (400 Amp)
- d) For 400 KVA LT CB (630 Amp)
- e) For 500 KVA LT CB (800 Amp)

17.1.11 The DBs shall be installed at first HT/LT pole as shown in **Figure 19**. Additional DBs would be installed (where additional circuit is pulled from PMT).

S. No	PMT Environment	Condition	✓	Action Required
15	DB / ICTP Box	Not Available		Install
		Damage		Replace / repair
		Door not Available / Damage		Install / Replace
		More than 1 Circuit on DB Outgoing		Installed new DB as per SOP
		Door Open		Close
		Kara Installed instead of Fuse		Replace with fuse as per LT Network Guidelines
		Fuse Base Not Installed of Appropriate Rating		Install as per LT Network Guidelines
		No Earthing connection - Continuity		Install / Provide
		Fuse Not Installed of Appropriate Rating		Install as per LT Network Guidelines
		Okay		No Action



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17.1.12 LT Insulated Single Core Cable/Lead of suitable size as per the load requirement shall be used from - LT Circuit Breaker - CTO Chamber Box - Distribution Board (DB) - Overhead Mains.

S. No	PMT Environment	Condition	✓	Action Required
16	LT Leads with Lugs Condition	Not Available		Install
		Insulation Damage		Replace / Repair
		Burnt out		Replace
		Lugs Not Installed / Not Punched properly		Replace / Installed Properly
		Okay		No Action

17.1.13 Wooden Cleat shall be used as per **Figure 19** to keep connecting leads/wires away from Transformer body and also provide support to the cable leads.

S. No	PMT Environment	Condition	✓	Action Required
17	Wooden Cleat	Not Available		Install
		Damage / Broken		Replace
		Miss Align		Align
		Leads Bypassed		Route through Wooden Cleat
		Okay		No Action

1.1.1 Installation of Earth Fault Indicator (EFI) on PMT / HT Cable Pole / Sub-Station as per requirement. **See Section 18** for Installation of EFI.

S. No	PMT Environment	Condition	✓	Action Required
18	Earth Fault Indicator	Not Available		Install
		Push test button not working		Replace
		Damage / Faulty		Replace
		Okay		No Action
19	EFI Metallic Enclosure	Not Available		Install
		Damage / Faulty		Replace
		Enclosure Door Missing		Replace
		Enclosure Door Open		Closed Properly
20	EFI Twin Core Cable	Not Available		Install
		Insulation Damage		Repair/replace
		Okay		No Action
21	EFI CT	Not Available		Install
		Damage / Faulty		Replace
		Okay		No Action
22	EFI Installation	Not Installed at 7' Height		Install
		Okay		No Action



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17.1.14 The transformer must be earthed at the point where the manufacturer has provided the earthing termination. Check the Earth resistance for the healthiness of the earthing. Except live parts no other part of the transformer should be at any floating potential.

S. No	PMT Environment	Condition	✓	Action Required
23	Transformer Body Grounding with all accessories / Enclosure (mesh grounding)	Not Available		Install as per Earthing SOP
		Appropriate conductor / lead not used for earthing		Install as per Earthing SOP
		Proper size lug not used / punched		Install as per Earthing SOP
		Okay		No Action
24	Transformer Neutral Grounding Required as per SOP	Not Available		Install as per Earthing SOP
		Appropriate lead not used for earthing		Install as per Earthing SOP
		Leads ends not connected with appropriate rating / size lugs		Install as per Earthing SOP
		Okay		No Action

Note: LT neutral of all transformers (both PMT & Substation) must also be separately grounded.

17.1.15 PMT Structure Platform, PMT Structure, PMT Pole & Stay / Strut Unit shall aligned as shown in **Figure 19**.

S. No	PMT Environment	Condition	✓	Action Required
26	PMT Structure Platform (3 girders)	Not Available		Install
		Damage / Bended		Replace / repair
		Tilted		Align
		Okay		No Action
27	PMT Structure	Not Available		Install
		Damage / Bended		Replace / repair
		Tilted		Align
		Okay		No Action
28	PMT Poles	Foundation Damage		Repair
		Tilted		Align
		Okay		No Action
29	Stay / Strut Unit	Not Available		Install (if required as per SOP)
		Damage / Bended		Replace
		Base Damage		Repair
		Okay		No Action

17.1.16 HT/LT Cable and Allied Material on PMT Pole shall be maintained.

S. No	PMT Environment	Condition	✓	Action Required
30	HT Cable Ends / Terminations	Not Available		Install
		Damage / Hopeless		Replace / repair
		Burnt out		Replace
		Okay		No Action
31	HT Cable GI Pipe	Not Available		Install (if required as per SOP)
		Okay		No Action
32	HT GI Pipe Clamp	Not Available		Install (if required as per SOP)



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S. No	PMT Environment	Condition	✓	Action Required
		Okay		No Action
33	HT Cable Pole Clamp (2 Nos)	Not Available		Install (if required as per SOP)
		Okay		No Action
34	Cable Marking	Not Available		Provide / Mark
		Okay		No Action
35	HT / LT Cable	Not Buried		Buried as per SOP
		Okay		No Action
36	HT Cable Condition (exposed portion)	Over sheath Damage		Repair
		Okay		No Action
		Okay		No Action
37	Knife Switch	Dirty		Cleaning and maintenance of Knife Switch
		Damage / Faulty		Replace with LBS as per Network Design
		Contacts/Mechanism Jam		Use Electrical Grade Grease after cleaning using WD 40
		insulation damage		Replace / repair
		Okay		No Action
38	PVC Boots on LBS Bushings	Not Available		Install
		insulation damage		Replace / repair
		Okay		No Action
39	HT Jumpers Sleeves/boots on LBS Terminals	Not Available		Install
		Damage / Burn out		Replace
		Okay		No Action
40	HT Cable Mounting Bracket on LBS	Not Installed		Install (If required)
		Okay		No Action
41	LBS Grounding	Not Grounded		Ground as per SOP
		Okay		No Action

17.1.17 The PMT Pole Grounding must be Maintained as per KE Standards. *See Section 13* for Earthing of PMT Poles.

S. No	PMT Environment	Condition	✓	Action Required
42	PMT Poles Grounding	Not Available		Ground as per SOP
		Earth Wire Expose		Cover as per SOP
		Grounding Nut & Bolt with lugs not welded		Welding to be done as per SOP
		Trial Pit not back filled		Back fill
		Okay		No Action

17.1.18 AMR / Check Meter / CT Operated Energy Meter shall be installed as per Specification to record the sent-out units of PMT. Check Box shall be installed as shown in *Figure 19*.

S. No	PMT Environment	Condition	✓	Action Required
43	Check meter / AMR Meter	Not Available		Install (if required as per SOP)
		Meter or CTs condition hopeless / Faulty		Replace
		CTs installed of inappropriate rating		Replace
		Okay		No Action



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17.1.19 Other PMT Maintenance Quality Measures.

S. No	PMT Environment	Condition	✓	Action Required
44	Danger Board (2 Nos.)	Not Available		Install as per SOP
		Rusty / Not Readable		Replace / repair
		Okay		No Action
45	Name Plate with DTS ID	Not Available		Install as per SOP
		Rusty / Not Readable		Replace / repair
		Okay		No Action
46	PTCL/ Internet/ TV cable touches PMT Body/Structure/ Metallic Part	Available		Remove as per Policy
		Okay		No Action
47	Streetlight Control box	Not Available		Install
		Damage / Faulty		Replace
		Okay		No Action
48	PVC Pipe for Cross Leads	Not Available		Install (if required as per SOP)
		U-Clamps not available		Install
		Different PMTs Cross Leading from same pipe		Route through separate pipe for different PMT Circuits
		PVC Pipe Damage		Replace
		Okay		No Action
49	Tree Pruning	Tree branches touching pole / wires		Tree Pruning as per SOP
		Okay		No Action
50	Thermography (Check Loose Connections)	Check Hot Spots (Relative Temperature)		Repair heated points
		Check Connection points (Nut and Bolts)		Tight Nut and Bolt as per Torque Chart using Torque Range
		Okay		No Action
51	Measure Leakage Current Using Clamp Meter at Earth Points	Leakage Current > 30mA		Rectify the Cause of Leakage
		Leakage Current < 30mA		No Action
52	All exposed parts (terminals, splices, PG Clamps, Cable Lugs etc.)	Exposed		Wrap with adhesive insulating tape
		Damaged/Deteriorated		Replace and wrap with adhesive insulating tape
		Covered/Insulated		Okay

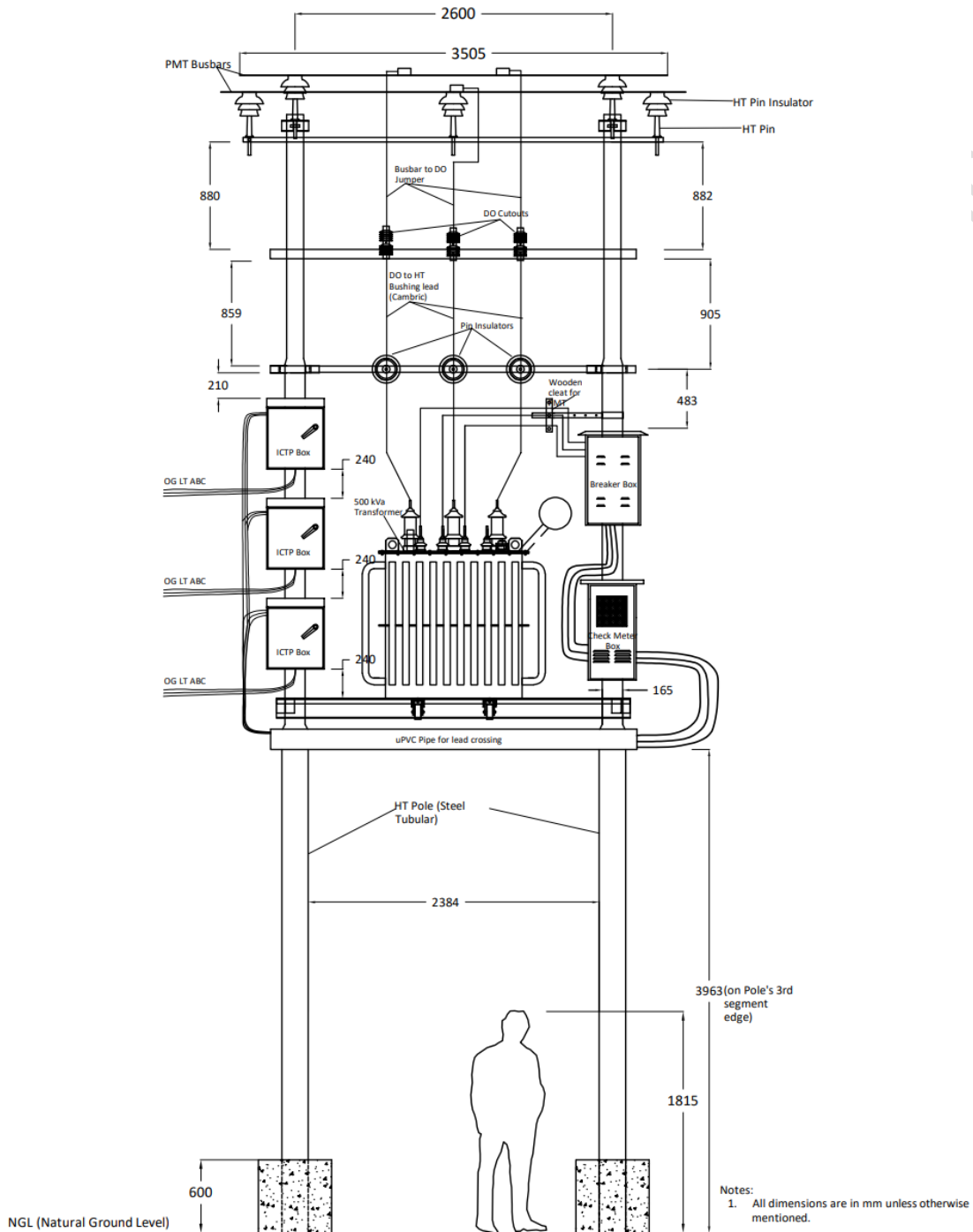
17.2 TRANSFORMER MAINTENANCE

17.2.1 Refer Section 25.5 for Transformer Maintenance Checklist.

17.3 TRANSFORMER MAINTENANCE

17.3.1 Refer Section 25.6 for Sub-Station Maintenance Checklist.

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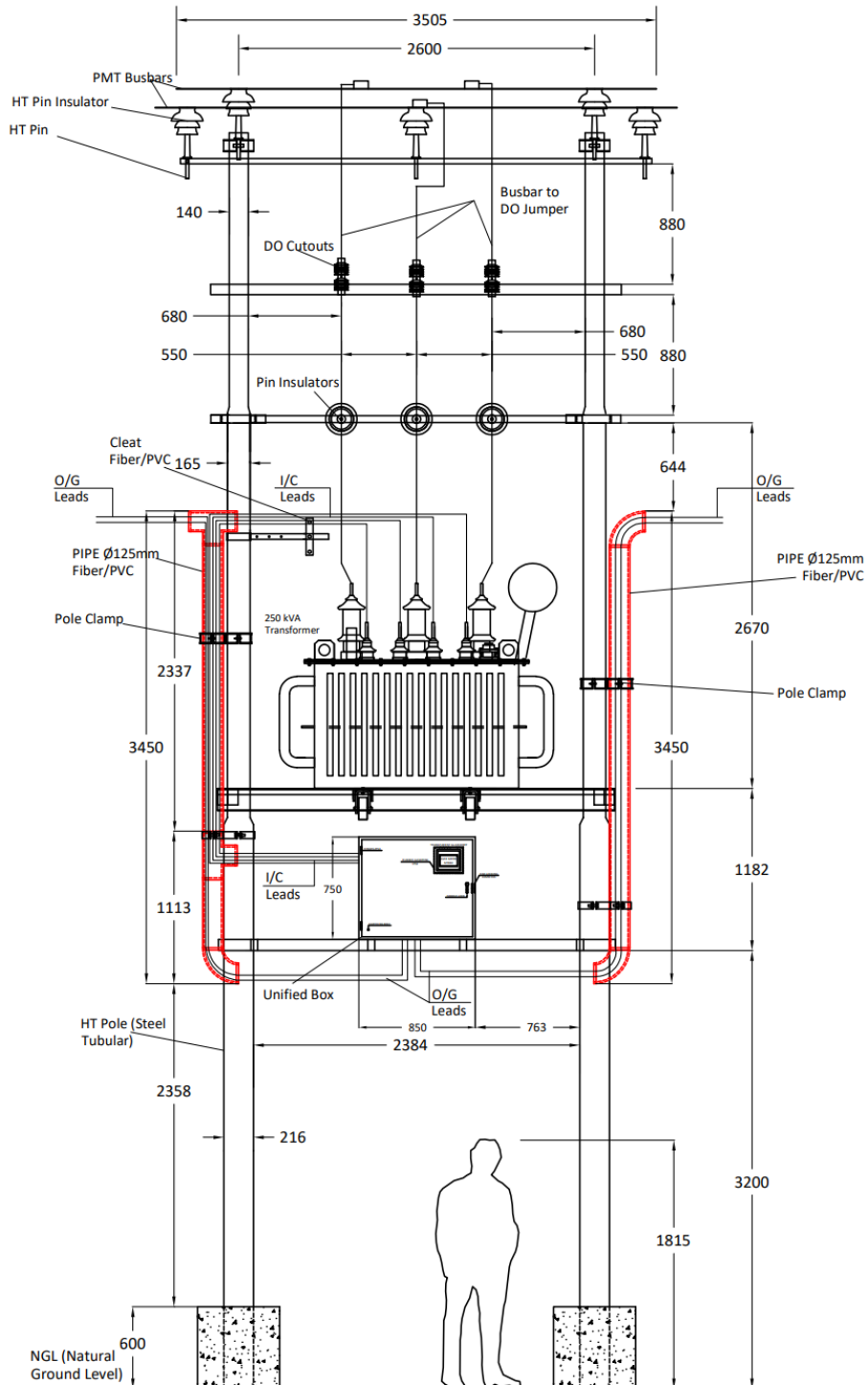


Figure 20 - PMT Arrangement (Unified Control Box)

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18. INSTALLATION OF EARTH FAULT INDICATOR

18.1 INTRODUCTION

Earth-Fault Indicator (EFI) device is highly used for earth-fault detection and signaling on medium voltage networks. Main functions of Device are given below:

- 18.1.1 Designed to be installed on MV cables (underground, overheads, switchgears, etc.).
- 18.1.2 Local earth fault signaling by means of flashing LED.
- 18.1.3 Correct operation (test) can be checked pressing the pushbutton on the front.
- 18.1.4 Self-powered by the internal lithium battery.
- 18.1.5 Battery can be easily replaced with lithium 3, 6V - ½ AA type.
- 18.1.6 Electronic module enclosed in IP65 box linked to the external current transformer CT.
- 18.1.7 Split-type resin current transformer CBCT ring-type, composed by two halves that can be installed without MV cables disconnection and held together by metallic screw tie.



Figure 21 - Earth Fault Indicator (EFI)

18.2 INSTALLATION OF EFI

EFIs shall be installed on recommendations of operations department as per network requirement. Recommended locations for installation for EFIs shall be as follows:

- 18.2.1 Incoming/outgoing cables of switches in substations.
- 18.2.2 Outgoing cable of double cable switches in Grid Stations.
- 18.2.3 Incoming/outgoing cables of RMU where FPIs are not available.
- 18.2.4 Cables terminating on Overhead HT poles with branches / T-Off.



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18.3 DURING INSTALLATION – ACCESSORIES

Following accessories of EFI must be ensured

- 18.3.1 Resin Split Ring Type C.Ts (50/5) having the 3 ½" (90mm) dia.
- 18.3.2 Electronic module.
- 18.3.3 Twin core flexible cables.
- 18.3.4 EFI device Enclosure (Required for Installation at Pole)

18.4 INSTALLATION OF EFI AT POLE

- 18.4.1 Pole structure health and Pole earthing *See Section 13* Earthing of Pole shall be verified during survey prior to installation.
- 18.4.2 Fix the EFI electronic module in separate metallic enclosure as shown in *Figure 22*
- 18.4.3 Then Install the complete assembly at 7 feet height on the 11 KV tubular pole with proper pole clamp by using MTL/Fiber Glass Ladder.
- 18.4.4 Resin Split Ring Type CT shall be installed around 11KV Cable as shown in *Figure 22*
- 18.4.5 Connect CT with 10-meter-long twin core cable to EFI electronic module as shown in Figure-3.
- 18.4.6 CTs connection details are shown in *Figure 23*

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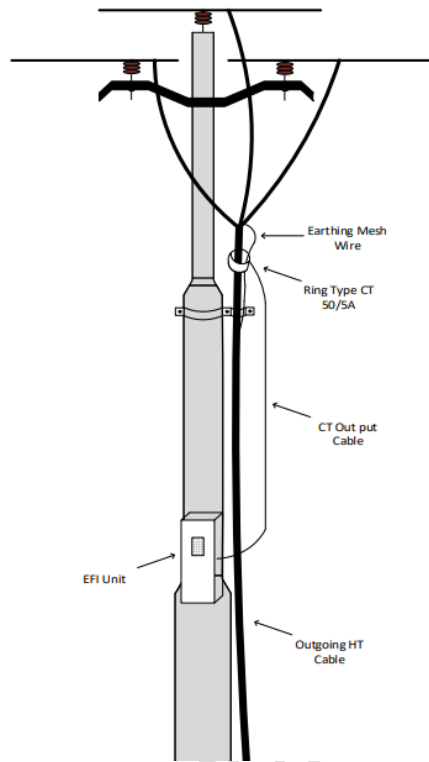


Figure 22 - EFI on Cable Pole

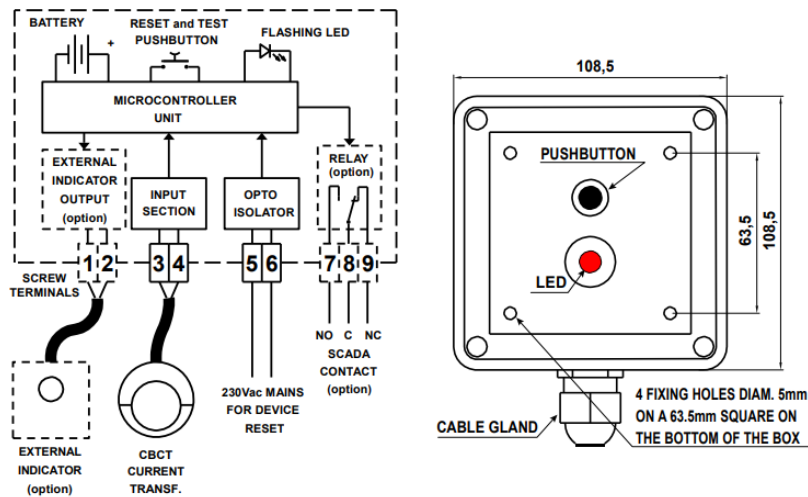


Figure 23 - EFI Connection Diagram

18.5 INSTALLATION OF EFI AT SUBSTATION/GRID STATION

18.5.1 Remove the back cover from CT compartment of VCB Panel.

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- 18.5.2 Resin Split Ring Type CT shall be installed around 11KV Cable at panel bottom cutout as shown in *Figure 24*. And CT can also be installed around 11KV cable in the trench depend on Substation/Grid station condition.
- 18.5.3 Connect CT with 10-meter-long twin core cable to EFI electronic module. Then place the EFI electronic module on front at Instrument box of Panel with double tape as shown in below *Figure 24*

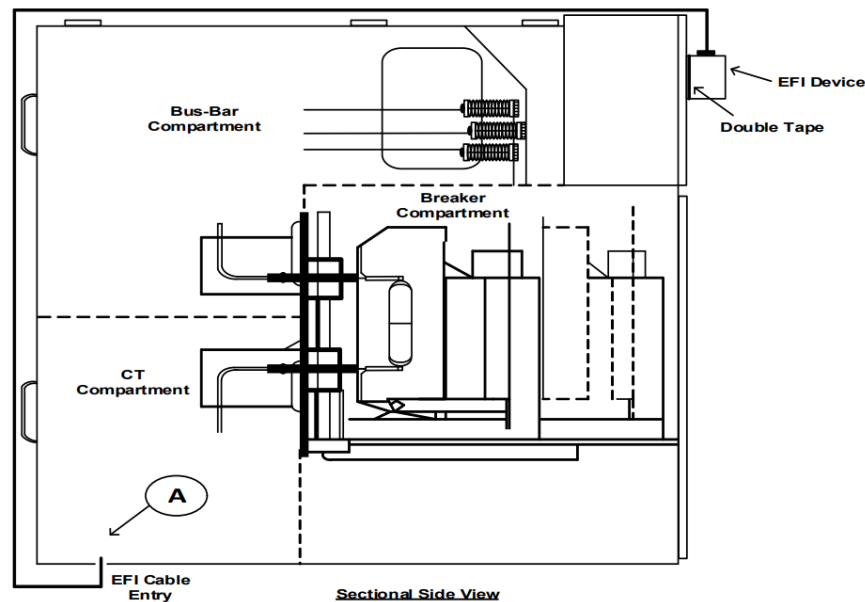


Figure 24 - EFI Connection

18.6 OPERATION OF EFI

- 18.6.1 The EFI device continuously checks the earth current by core balance sensing CT. When fault occurs, device trips and LED starts flashing.

18.7 DEVICE TEST

- 18.7.1 Simply press the pushbutton when the device is not in flashing mode, the EFI will start flashing.

18.8 DEVICE RESET

- 18.8.1 After the device has tripped and starts indicating in case of fault, it can be reset in the following ways:
- Pressing the pushbutton on the front up to 5 seconds.
 - EFI will reset automatically when the considerable time has elapsed.



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19. TECHNICAL TRAINING REQUIREMENT

19.1 INTRODUCTION

19.1.1 Scope of Training

- a) This includes the type of training, such as technical & safety; the level of training, such as basic, intermediate, or advanced; the frequency of training, such as initial, ongoing, or refresher, the duration of training, such as hours, days, or weeks; and any certification or accreditation associated with the training.

19.1.2 Quality of Training

- a) The VENDOR shall provide the quality of training to their staff. This includes standards, criteria, methods, tools, outcomes, objectives, feedback, and evaluation.
- b) The VENDOR shall be measured and reported the quality of training and shall be informed about the training gaps.
- c) Training shall be covered aspects such as organization best practices, regulatory requirements, organization expectation, and assessment & report.

19.1.3 Benefits of Training

- a) The VENDOR would gain the benefit of training, which generally may improve the VENDOR's performance, such as quality, efficiency, productivity, innovation, to satisfaction or loyalty to the VENDOR's staff such as engagement, motivation retention, or development.

19.2 VENDOR RESPONSIBILITY

19.2.1 VENDOR shall ensure that all VENDOR staff possess a skill level consistent with the requirements of this SOW. VENDOR staff should have satisfactorily completed all required training, as described the KE Training Program.

19.2.2 The VENDOR shall ensure that required training is provided to all field staff, and that operations are not adversely affected during the administration of training to any individual or group of individuals.

19.2.3 Course Catalog and Program Description(s) are incorporated herein for reference

19.2.4 VENDOR shall prepare and submit participant detail, records and report as required by KE in accordance with KE procedures.

19.2.5 Such records shall include regular attendance and participant final results.

See Section 19.3, and certificates of completion *See Section 19.4*



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19.3 SUBMISSION OF CERTIFICATE

- 19.3.1 VENDOR agrees to submit to KE a copy of the Certificate of Completion (or comparable document) it customarily issues upon successful completion of training program for each individual funded under this Agreement.
- 19.3.2 Such document shall be submitted as soon as possible following the participant's program completion, but no later than ninety days after completion.

19.4 TRAINING INSTITUTION

- 19.4.1 VENDOR shall register each individual for Technical Training in HUNAR FOUNDATION - Location link
- 19.4.2 HUNAR FOUNDATION shall be solely responsible for providing trainers, organizing, and delivering training, including cost of providing the training to VENDOR.
- 19.4.3 HUNAR FOUNDATION shall ensure that all VENDOR staff are trained based on the KE Technical Training Program delivered and that all trainees have completed the courses.
- 19.4.4 HUNAR FOUNDATION shall work very closely with the VENDOR Training Manager to review actual performance of VENDOR staff, identifying potential gaps and then organizing subsequent training to reduce these gaps.
- 19.4.5 Location Link is given below

The Hunar Foundation Pakistan

83/4, DEH DIH, Ibrahim Hyderi Road, Near Millennium Institute of Technology & Entrepreneurship (MiTE), Taluka Korangi District, Karachi, Sindh, Pakistan.



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20. TRANSPORTATION, LOADING, UNLOADING OF DISTRIBUTION EQUIPMENT (DTs, VCB/OCB PANEL, RMU, LBS, HT/LT CABLE DRUMS & HT/LT ST POLES)

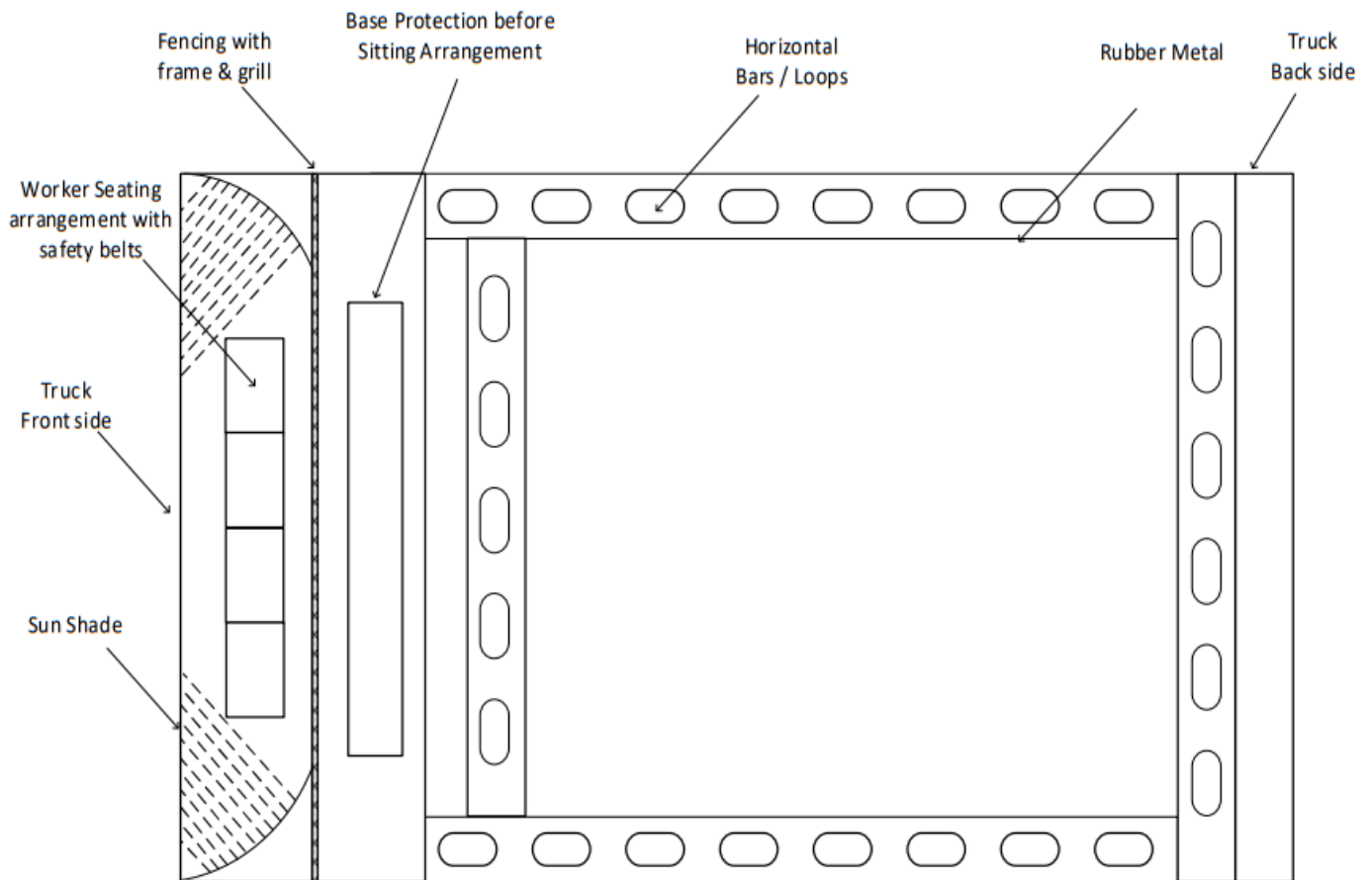
20.1 INTRODUCTION

- 20.1.1 This section covers the requirement of Safety Precautions to be applied in handling of DTs, VCB/OCB Panel, Isolator, RMU, LBS and HT/LT Cable Drums to protect the Field Staff from any hazard during transportation process.
- 20.1.2 To ensure the loading and unloading operations of above-mentioned heavy item on truck via Crane/ Loader/ Fork Lifter, should be completely safe and to eliminate the risk of accidents for field staff and Damaging of KE-assets.

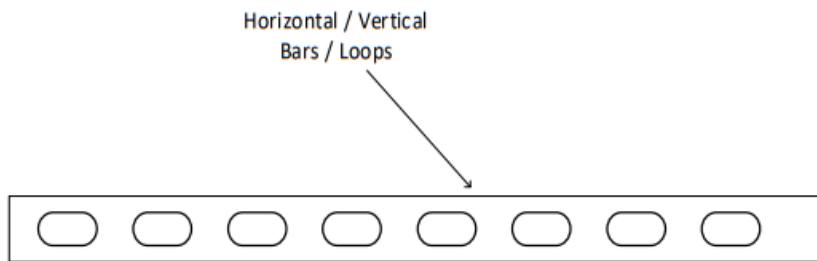
20.2 MODIFICATION IN LOADING TRUCK FOR TRANSPORTATION OF EQUIPMENT (OPTION-I)

- 20.2.1 In existing truck the following modifications are necessarily made by all Vendor for transportation in consultation of Fleet Management
- 20.2.2 The floor of the Truck/Vehicle must be covered with Rubber Mat of thickness ½". Wooden Block (3" x 3") should be used as spacers on the truck deck between the transformers.
- 20.2.3 The Channel frame with holes should be fix with the boundary walls of Truck.
- 20.2.4 Structured horizontal/vertical iron channels will be provided to Fix/Jam the equipment like DTs, VCB/OCB Panel, Isolator, RMU, LBS and HT/LT Cable Drums in horizontal/vertical positions of equipment and available space. As shown in *Figure 25*
- 20.2.5 Tighten the equipment with the help of belt/static ropes with hooks/clamp and holes used for jamming of equipment.

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Top View



- Openable barricade (partially used for channeling) 3'x 2' x 6.5'
- Fixed barricade: Length 9'x2'x6.5'
- Channel welded at 2' height from deck
- Adjustable channel 04 Nos. for fixing of loaded unit with provision of nut bolts
- Channel's Hole to hole distance 8"
- Channel's thickness 1.5mm
- Channel's width '2 x)' 2 L type(

Figure 25 - Horizontal / Vertical Bracket

20.3 LOADING / UNLOADING STEPS

The Steps for loading/unloading of heavy equipment are as follows:



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- 20.3.1 Before commencement of work, Vendor's Supervisor shall communicate the safety risk to their field staff.
- 20.3.2 Crane & truck shall be positioned for loading/unloading under supervision of concerned Supervisor.
- 20.3.3 Work site shall be cordoned off before loading/unloading of heavy equipment.
- 20.3.4 Rigger of Crane/Loader shall be fixed the clamps in the designated lifting hooks of equipment for loading it.
- 20.3.5 Rigger shall be guided crane/loader operator to be placed the transformer/equipment on the truck's bed in a manner that it is safeguarded by the channel from skidding
- 20.3.6 After placement of transformer, it shall be through static rope by tying it around the collar of the transformer and the side of the truck.
- 20.3.7 After reaching the destination, the transformer / equipment shall be untied the static rope & thereafter the rigger will guide the crane operator to place the transformer / equipment on the ground.
- 20.3.8 Vendor's Fleet Management (FM) is responsible to ensure that all above mentioned modifications in vehicles used for transportation of equipment.

20.4 PROCEDURE FOR HANDLING OF HT/LT ST POLES

- 20.4.1 Field Staff should be equipped with recommended PPEs/SPEs as defined in **Section 22** of this document.
- 20.4.2 Before commencement of work, Vendor's Supervisor shall communicate the safety risk to their field staff.
- 20.4.3 Work site shall be cordoned off before loading/unloading of Steel Tubular Poles.
- 20.4.4 For lifting of more than 4- ST Poles, Crane shall be used.
- 20.4.5 The crane & truck shall be positioned under the supervision of concerned Supervisor.
- 20.4.6 During the Loading & Unloading of ST Poles on Truck, wheels chocks shall be used to block the wheels. The crane operator shall be centered the Poles with the Truck so that the weight of Poles is evenly distributed over the Truck.
- 20.4.7 Rigger shall be guided crane operator to place the ST Pole on the Crescent Shape stands (on both front & rear sides) fixed on the truck in a manner that it should be safeguarded by the locking mechanism from skidding back ward.
- 20.4.8 Truck shall be of sufficient length and width to eliminate excessive overhang, if it is there, shall be legal & approved by traffic authorities.

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20.4.9 After placement of ST Poles, the poles shall be secured by through static rope from back & front positions with the body of Truck. *See Figure 26*



Figure 26 - Static Rope

20.4.10 During the transportation of ST Poles, Red Color Flags shall be used on back & front positions.

20.4.11 Whole activity shall be supervised by AM/DM & consequently checklist shall be filled & signed before handing it over to concerned AE/Supervisor.

20.4.12 When reached at the designation, the poles shall be untied the static rope & thereafter the rigger should be guided the crane operator to place the ST poles where to be erected.

20.4.13 In surrounding of working site, cones shall be placed.

20.4.14 *See Section 23* for Fleet details.

20.5 PROCEDURE FOR HANDLING OF HT/LT CABLE DRUMS

20.5.1 Field Staff should be equipped with recommended PPEs/SPEs as defined in *Section 22* of this document.

20.5.2 HT/LT Cable Drums have to be transported from Cable Yard / Store to an Installation Site.

20.5.3 Cable Drums should normally be lifted by Crane or Fork lifter, for routine check of load bearing capacity / load lifting capacity of vehicles / loader / crane should be done quarterly.

20.5.4 The Cable Drums should be placed horizontally to the direction of travel on the vehicle's loading bed, there must be enough room for the secured attachment of cable drums. The transportation vehicle must have appropriate tie down loops by them the cable drums can be secured.

20.5.5 Unloading of Cable Drum on the ground from a Truck should be done by using Crane or Fork lifter otherwise both the cable and drum may be damaged, or it may cause any mishap. *See Section 20.5*

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- 20.5.6 Cable Drum should be mounted at the most convenient position for cable pulling and for manual installation without any safety hazard.
- 20.5.7 For mounting of heavier drum, the fabricated A-Frames containing hydraulic jacks are necessary.

20.6 PROCEDURE FOR HANDLING OF 11- KV VCB/OCB/ISOLATOR

- 20.6.1 Field Staff should be equipped with recommended PPEs/SPEs as defined in *Section 22* of this document.
- 20.6.2 All loading & unloading will be supervised, records to be maintained, safety coordinators will be monitored the speed through tracker, driving of vehicle & license of Loader/Crane operators will be checked through Vendor Fleet Management.
- 20.6.3 The transportation of 11 KV VCB/OCB, RMU, Knife Switch & PMUs also needed special care while lifting, transit and unloading & firstly decide the type of vehicle according to load of equipment to be handled.
- 20.6.4 Due to heavy weight and dimensions the lifting of 11-KV switching devices requires different kind of machines like Lifters, Loader and crane having different capacities.
- 20.6.5 OCB/VCB Panel/Isolators should be placed on the wooden pallets & bolted to maintain balance. *See Figure 27*



Figure 27 - Wooden Pallet

- 20.6.6 Lifting of VCB/OCB trollies through the handles is prohibited, instead of it hold through the front panel opening whereas complete VCB/OCB are lifted through lifting lugs.
- 20.6.7 HT/LT Panel/Isolators should be tied properly with the help of fastening Belt/Static Rope. *See Figure 28*



Figure 28 - Fastening Belt

- 20.6.8 Two types of vehicles shall be used to transport these units like Loader/Crane which have space at its rear side for handling of unit and other vehicle is normal loading Truck which shall be Mazda 2600, Bedford rocket, FAW 220 etc.
- 20.6.9 As by design the Loader is capable to not only lift the unit but can transport the unit from one place to another which may be several Kilometers and there should not the sitting arrangement of work force not at rear side in Load lifting compartment.
- 20.6.10 In case of Crane utilization, an additional truck ultimately required to transport the unit from one place to another, this truck should have provision for sitting of work force in a cabin rather on rear side which will be extremely dangerous against any harsh breaking and sharp turning.
- 20.6.11 In case of crane utilization, an additional truck ultimately required to transport the unit from one place to another, this truck should have provision for sitting of work force in a cabin rather on rear side which will be extremely dangerous against any harsh breaking and sharp turning.
- 20.6.12 The arrangement for locking the units with rope or clamp should apply mandatory for any destination of transport
- 20.6.13 The training of crane or Loader operator should be essential with refresher arrangements.
- 20.6.14 Check List for special vehicle fitness must be monitored and recorded periodically by Fleet Management.

20.7 PROCEDURE FOR HANDLING OF DISTRIBUTION TRANSFORMER

- 20.7.1 The Hauler gang/Fitter gang/Rigger should be performed handling of transformers. Only experienced Truck drivers and handlers having authorized license shall be handled the transformers and other electrical equipment.
- 20.7.2 Field Staff should be equipped with recommended PPEs/SPEs as defined in *Section 22* of this document.



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- 20.7.3 Always lift the transformer from the designated lifting hooks after proper checking by the Supervisor.
- 20.7.4 Always keep the transformer at the center of the truck in case of transportation of 01-No. Transformer. In case of more than one Transformers are required to be transported than they will be placed in horizontal rows. Transformers will be fixed with separate fixing channels available on Truck body and also tighten with clamps, by the help of fasten belts / static rope of 10 mm dia. having breaking load of 3000 daN (kg).
- 20.7.5 Distribution Transformer wheels to be kept as accessories like separately in unassembled form during the transformer logistic and should be fixed at the site.
- 20.7.6 Each Transformer should be placed on wooden pallet, from ratings i.e. 25 KVA to 1000 KVA or wood log to be placed underneath the channel & nailed it to the deck, to restrict its movement. Each Transformer should be bolted to a suitable transport pallet, load the transformers together with the pallet.
- 20.7.7 To conduct loading and unloading operations without any hindrance from other adjacent activities, mobile machinery, and employees, if possible, a designated loading/unloading area will be established which will be clearly marked and sign-posted as a restricted area which should be firm, flat and free from potholes and other obstructions that may cause slips or trips.
- 20.7.8 Use min. 02 fasten belts/static ropes to tie each transformer safely with the body of truck.
- 20.7.9 Available loaders are for maximum 500 KVA Transformer Lifting and for more than 500 KVA lifting mobile crane is used to lift the unit.
- 20.7.10 Lifting / fastening belt should not be touched between bushings and conservator.
- 20.7.11 Clearance of 1-foot to be maintained from all sides between transformer & vehicle boundary.
- 20.7.12 Clearance of 450 mm to be maintained between transformers (wooden spacers should be used).
- 20.7.13 Clearance between crane boom & hook should be minimum area 1.5 feet² to be maintained for safe transportation.
- 20.7.14 Always use the overhead crane for lifting the transformers over 250 KVA rating.
- 20.7.15 All loading & unloading will be supervised, records to be maintained by safety coordinators. The speed through tracker, driving of vehicle & license of operator will be checked through Vendor Fleet Management.



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21. WAREHOUSE & MATERIAL MANAGEMENT

21.1 WAREHOUSE MANAGEMENT

- 21.1.1 The Vendor's Warehouse shall be in Karachi. The Vendor shall ensure that the Vendor's Warehouse is in a safe area and is adequately guarded.
- 21.1.2 The VENDOR shall undertake all measures to ensure the security of the VENDOR's Warehouse and all Equipment & Material and all other material, apparatus and equipment for the Project stored in such VENDOR's Warehouse.
- 21.1.3 The VENDOR shall allow the KE, the Engineer, the lender representatives and such other persons as the KE may notify to the VENDOR, access to the VENDOR Warehouse for inspection of the Equipment & Material and all other material, apparatus and equipment for the Project stored in such VENDOR's Warehouse as and when required by KE from time to time.
- 21.1.4 Periodic inventory checks will be carried out by KE, if required.

21.2 DAILY MATERIAL RECONCILIATION

- 21.2.1 The VENDOR shall maintain a material management system in suitable manner which shall enable the accounting of the acquisition, use, issuing, and disposition of all Equipment & Material in accordance with policies and procedures which shall be notified to the KE.
- 21.2.2 The VENDOR shall ensure that the material management system is accurate and up to date at all times. The material management system should allow and include reconciliation of recorded inventory quantities to physical inventory for each invoice issued to the KE.
- 21.2.3 As and when requested by KE, the VENDOR shall grant the access to the material management system for review. In the event KE at any time determines, in its sole opinion, that there is any deficiency in the records being maintained through the material management system.
- 21.2.4 In case of deficiency in record, the VENDOR shall respond in writing within fifteen (15) days of its disagreement with such determination and / or the corrective measures to be taken or that have been taken by the VENDOR in relation to such determination.
- 21.2.5 The response of the VENDOR will be evaluated by the KE who will make a final determination as to the:
 - a) outstanding deficiencies; and



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b) the adequacy of any proposed or completed corrective action.






21.2.6 As part of the final determination if KE determines that there are any deficiencies or if the corrective action proposed by the VENDOR is not suitable or otherwise not implemented, KE shall be entitled to receive from the VENDOR the amounts corresponding to such deficiencies and KE may set-off such amounts from any amounts owing or due to the VENDOR at any time.

21.2.7 Any disputes arising out of this Section (Material Reconciliation) shall be resolved in accordance with Dispute Resolution.






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22. STANDARD SAFETY GEAR






Sr. #	Name	Usage / Description	Picture	Standard & SOPs
1	Uniform (As per KE Standard)	For all the field staff at site (As per LI SOP)		KDTP-S278-15-00-KE-Uniforms
2	Full body harness with front position Safety Belt & Lanyard	For Work at Height (As per LI SOP)		KDTP-S348-17-00-KE-Safety Harness Belt
3	Safety Helmet with Chin Strip	For all the field staff at site (As per LI SOP)		KDTP-S336-23-03-Safety Helmet
4	Face Shield	For use in following activities: Metering Work HT switch operations Welding		KDTP-S336-23-03-Safety Helmet
5	Safety Shoes	For all the field staff (As per LI SOP)		KDTP-S279-23-01-Safety Shoes

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Sr. #	Name	Usage / Description	Picture	Standard & SOPs
6	Safety Gloves (Rubber & Leather)	<p>Rubber gloves are used for protection from electrocution while performing all network jobs (i.e., ABC Pulling, Earthing, Dismantling)</p> <p>The Leather Gloves can resist sparks and moderate heat. The risk of cuts and abrasions also can be minimized by wearing leather gloves.</p>		<p>KDTP-S51-23-03-HT Leather Protector Gloves</p> <p>KDTP-S50-23-05-HT Insulating Gloves</p> <p>KDTP-S346-23-01-LT Leather Protector Gloves</p>
7	Working Gloves	For material handling;		KDTP-S413-23-01- Working Gloves
8	Warning Tapes and Caution Cones	Barricading working area for all activities. (As per LI SOP)		-
9	LT Live Line Tester	For Live Line testing prior commencement of work where isolation is mandatory as per LI SOP		KDTP-S195-12-01-Live Line Tester
10	Manila Cordage Rope (3 Strands 1" Diameter)	It is used to lift tools, to hang cable and to lift overhead accessories		KDTP-S152-12-01- Manila Ropes






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23. RESOURCES and FLEETS





Sr. #	Name	Usage / Description	Picture	Standard & SOPs
1	Truck	Transportation of Material (Poles)		Special Vehicle Operation Procedure
2	Crane / Loader	For Pole Installation For Cable/Conductor Loading & Unloading Pole Dismantling		Special Vehicle Operation Procedure
3	MTL	For working at height (Poles) MTL Ladder to be used by Supervisors / Linemen gang working on LT Overhead Lines		KDTP-S395-18-00-16 Feet MTL Ladder
4	Lifter	For loading and unloading of drums, suitable lifting, and hoisting equipment.		Special Vehicle Operation Procedure
5	Fiber Ladder	For working at height (Poles)		KDTP-S395-18-01- Fiberglass Ladder

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24. STANDARD TOOLS & EQUIPMENT

Sr. #	Material Code	Tool Name	Usage / Description	Picture
1	10035042 400416	Cutter Plier 6" Cutter Plier 8"	Wire cutters or diagonal cutting pliers or diagonal cutters or side cutting pliers are pliers intended for the cutting of wire. The cutter shall be of high-grade steel and have maximum stability under load by additional inductive hardening and shall be chrome plated.	
2	400207	Nose Plier 8"	Cutting and gripping pliers are used to remove semi-conductive, rubber insulation on cables.	
3	10100343 400205	Plier 6" Plier 8"	Use to grip, splice, or cut wires, and strip insulation.	
4	400235 400237 400275 400239 10100346	Screwdriver Set Plain slotted 6" 8" 10" 12" 15"	Used for screwing and unscrewing (inserting and removing) screws.	
5	10100347 10100348 10100349 10100350	Screwdriver Set Cross slotted 6" 8" 10" 12"	A slotted screwdriver is used to drive screws with a slotted head.	

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Sr. #	Material Code	Tool Name	Usage / Description	Picture
6	400951	Fix Spanner Set (Complete Set) (6-23 mm)	The spanner shall be chrome plated, Double open end of Size 6X7, 8X9, 10X11, 12X13, 14X15, 16X17, 18X19, 20X22, 21X23 mm.	
7	400954	Ring Spanner Set (Double Ended) (1-19 mm)	A spanner in which the jaws form a ring with internal serrations which fit completely around a nut, usable in confined spaces. The ring spanner set shall be with suspension eye, deep cranked, with thin walled headed and chrome plated of size 1-19 mm.	
8	400251	Adjustable Spanner / Wrench (Size 15")	It is an open-end wrench with a movable jaw, allowing it to be used with different sizes of fastener head (nut, bolt, etc.) rather than just one fastener size, as with a conventional fixed spanner.	
9	10100324	Hacksaw Frame with Blade (Size 12")	Hack saw blades can be used to cut a variety of materials and shapes. The proper blade will provide maximum blade life and high cutting efficiency. The Hacksaw shall be supplied with Blade 12" in length. The blade position shall be lockable Handle shall be made up of plastic, hacksaw frame from die cast aluminum.	

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Sr. #	Material Code	Tool Name	Usage / Description	Picture
10	400405	Round Head Hammer 250 GMS (1/2Pound)	The hammer shall be of forged head, inductive hardened and coated.	
11	400285	Measuring Tape feet)	Measuring tape is a long tape use to measure length. A good quality measuring tape of 50 feet in length shall be supplied.	
12	400015	Canvas Bag tool (Size 16" in length 3 pocket)	The canvas bag are bags used to keep the tools in it and they are made of Canvas, which is an extremely durable plain-woven fabric.	
13	10100326	Blade Cutter	Blade cutter has a curved blade and a short handle, wire cutter, an edge tool used in cutting wire. A tool used for cutting or slicing.	
14	10002375	Manila Cordage Rope (3 Strands 1" Diameter)	It is used to lift tools, to hang cable and to lift overhead accessories	
15	400315	Pipe Adjustable Wrench 12"	It is an adjustable wrench/spanner used for turning soft iron pipes and fittings with a rounded surface. The design of the adjustable jaw allows it to lock in the frame, such that any forward pressure on the handle tends to pull the jaws tighter together.	

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Sr. #	Material Code	Tool Name	Usage / Description	Picture
16	403915	Ratchet Spanner Set (6-32mm)	<p>Pulled or pushed in one direction, the ratchet loosens or tightens the bolt or nut attached to the socket.</p> <p>The combination spanner set shall have content from 6 to 32 mm in black metal storage case and shall be chrome plated.</p>	
17	10100355	Drill Machine (DC Operated with chargeable Battery)	A drill machine is a tool primarily used for making round holes or driving fasteners.	
18	10025765	HRC Fuse Puller with Protective Sleeve	HRC Fuse Puller is used for inserting and removing of the HRC fuse from its base.	
19	402212	Machine; Welding Portable	Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion.	
20	10117479	Electric Jack Hammer	Used for dismantling concrete/floors in pole foundation and pole base, especially in areas where manual dismantling is difficult.	

Sr. #	Material Code	Tool Name	Usage / Description	Picture
21	10108557	Wire Grip Come Along for covered conductor	For Pulling of Covered Conductor	
2	10108557	Crimping Tool Foot Operated	For Lugs Punching	
3	10024548	Torque Spanner	For Tightening of Bolts	
4	10100339	XLPE Cable Cutter	Cutter; XLPE (For outer dia 25 mm)	
5	10101126	Draw Vice Ratchet	Vice; Draw Straining Ratchet 12"	
6	401866	Pulley; Mounting Stringing Block LV ABC	For safely pulling of OH Cable, prevent the cable from dragging and insulation damaging.	

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Sr. #	Material Code	Tool Name	Usage / Description	Picture
7	401755	Crimping Tool	For Cable Lugs Punching	
8	-	Hot Stick	For LBS Operations	
9	-	Tree Pruning Axe	For Cutting Heavy Branches	
10	-	Motorized Tree Cutter / Chain Saw	For Motorized Cutting Tree Branches	
11	-	Tree Saw	For Cutting Tree Branches (Manually)	



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25. ACCEPTANCE CRITERIA - QUALITY CHECK LIST

25.1 BARE HT CONDUCTOR INTO COVERED CONDUCTOR CHECKLIST

Conversion of Bare HT Conductor into Covered Conductor Checklist					
Span Location				Feeder IDs	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action Required	Remarks
1	Pin Insulator	Not Available		Install	
		Broken / Puncture		Replace	
		Tilted		Align	
		Busbar pin insulator by passed		Align	
		Dusty		Clean	
		Okay		No Action	
2	Disc Insulator	Broken / Puncture		Replace	
		Dusty		Clean	
		Okay		No Action	
3	Snail Clamp	Available / Damage / Deteriorated		Replace with HT Dead End Clamp	
3	HT Jumpers	Hopeless		Repair / Replace	
		Not Connected with PG Clamp / Line Tape		Connect with proper size PG Clamp / Line Tape	
		Not passing through pin insulator		Align using pin insulator	
		Lower jumper size b/w equal size conductor		Replace with same conductor size jumper	
		HT IPCs for covered conductor not installed / faulty		Installed / Replace	
		Improper jumper size b/w two different conductor shackles		Replace with Tiger conductor jumpers	
		Okay		No Action	
	HT IPCs	loosing of IPCs		Tightening till Shear off IPC Nut/bolt	
		IPC nut/bolt not sheared off		Shear off IPC Nut/bolt	
		Okay		No Action	
4	End Caps for Covered Conductor	Not Available		Install	
		Damaged/Deteriorated		Replace	
		Available		Okay	
5	Covered Conductor Binding on Pin Insulator	Binding Wire Used		Replace with Covered Conductor Ties (Helical Ties)	
		Not Binded		Bind with Helical Ties	
		Helical Tie Available		Okay	
6	All exposed parts (terminals, splices, PG Clamps etc.)	Exposed		Wrap with adhesive insulating tape	
		Damaged/Deteriorated		Replace and Wrap with adhesive insulating tape	
		Covered/Insulated		Okay	



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Conversion of Bare HT Conductor into Covered Conductor Checklist					
Span Location			Feeder IDs		
Cluster Name			Dated		
S. No	Check Point	Condition	✓	Action Required	Remarks
7	No of Joints	Not allowed during Conversion / new installation			
8	Conductor Sag	Improper		Maintain as per SOP	
		Okay		No Action	
9	Phase Bracket	Improper Size		Install proper size	
		Okay		No Action	
9	Earth Bracket	Not Available / Improper Size		Install proper size	
		Okay		No Action	
10	Double Earth along with guard wire	Not Available		Install	
		Deteriorated / mix conductor		Replace with same size of conductor as per SOP	
		No of joints >2/conductor /Span		Replace respective conductor	
		Okay		No Action	
11	Guard Wire	Not Available		Install	
		No of guard wire		As per SOP	
		Improper distance b/w guard wires		Maintain as per SOP	
		Okay		No Action	
12	Guard Wire Size Found Short	Short length guard wire		Install proper length GW	
		Okay		No Action	
13	PVC Boots on LBS Bushings	Not Available		Install	
		boot damage		Replace	
		Okay		No Action	
14	HT Jumpers Sleeves/boots on LBS Terminals	Not Available		Install	
		Damage / Burn out		Replace	
		Okay		No Action	
15	HT Cable Mounting Bracket on LBS	Not Installed		Install (If required)	
		Okay		No Action	
16	LBS Grounding	Not Grounded		Ground as per SOP	
		Okay		No Action	
17	HT Poles	Foundation Damage		Replace	
		Tilted		Align/Replace	
		Okay		No Action	
18	Earth Fault Indicator	Not Available		Install	
		Damage / Faulty		Replace	
		Okay		No Action	
19	EFI Metallic Enclosure	Not Available		Install	
		Damage / Faulty		Replace	
		Enclosure Door Missing		Replace	
		Enclosure Door Open		Closed Properly	
		Okay		No Action	
20	EFI Twin Core Cable	Not Available		Install	
		Okay		No Action	
21	EFI CT	Not Available		Install	



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Conversion of Bare HT Conductor into Covered Conductor Checklist					
Span Location				Feeder IDs	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action Required	Remarks
		Damage / Faulty		Replace	
		Okay		No Action	
22	EFI Installation	Not Installed at 7' Height		Install	
		Okay		No Action	
24	Pole Base	Not Available		Install	
		Damaged		Replace / repair	
		Okay		No Action	
25	Earthing wire	Exposed		Burry	
		Damaged		Replace / repair	
		Okay		No Action	
26	HT Pole Grounding	Not Available		Ground as per SOP	
		Earth Wire Expose		Burry as per SOP	
		Grounding Nut & Bolt with lugs not welded		Welding to be done as per SOP	
		Trial Pit not back filled		Back fill	
		Resistance value >5 Ohms		Maintain as per SOP	
		Okay		No Action	
27	Stay / Strut Unit	Not Available		Install (if required as per SOP)	
		Damage / Bended		Replace	
		Base Damage		Repair	
		Hopeless stay wire hanging / redundant		Remove	
		Okay		No Action	
28	HT Cable	Not Buried		Buried as per SOP	
		Okay		No Action	
29	HT Cable Ends	Not Available		Install	
		Damage / Hopeless		Replace / repair	
		Okay		No Action	
30	HT Cable GI Pipe	Not Available		Install (if required as per SOP)	
		Okay		No Action	
31	HT GI Pipe Clamp	Not Available		Install (if required as per SOP)	
		Okay		No Action	
32	LT GI Pipe Clamp	Not Available		Install (if required as per SOP)	
		Okay		No Action	
33	Cable Marking	Not Available		Provide / Mark	
		Okay		No Action	
34	HT Cable	Not Buried		Buried as per SOP	
		Okay		No Action	
35	LT Cable	Not Buried		Buried as per SOP	
		Okay		No Action	
36	HT Cable Condition (exposed portion)	Over sheath Damage		Repair	
		Okay		No Action	
37		Not Available		Install	



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Conversion of Bare HT Conductor into Covered Conductor Checklist					
Span Location				Feeder IDs	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action Required	Remarks
	Dead End Clamp for XLPE Covered Conductor	Damaged		Replace	
		Okay		No Action	
38	Grounding Ring with IPC for XLPE Covered Conductor	Not Available		Install	
		Damaged		Replace	
		Okay		No Action	
39	Tree Pruning	Tree branches touching pole / wires		Tree Pruning as per SOP	
		Okay		No Action	
40	PTCL/ Internet/ TV cable touches PMT Body/Structure/ Metallic Part	Available		Remove as per Policy	
		Okay		No Action	
41	LBS Installation	LBS not available as per simulation study		Install LBS	
42	Knife Switch	Knife switch will be replaced with LBS as per simulation study.		install LBS (If required)	
		Idle/Faulty knife switch available.		removed	
43	Covered Conductor Insulation	Damaged		Repair / Replace (depend upon damage)	
		Okay		No Action	
44	Covered conductor distance from approachable contact area (Safe Distance)	Compromised		Maintain as per SOP (minimum 4 Feet)	
		Okay		No Action	
Supervisor Name				Signature	
Department				Dated	



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25.2 VCB INSTALLATION CHECKLIST

FIXED TYPE VCB INSTALLATION CHECKLIST					
Feeder Name		Substation Name			
Cluster Name		Dated			
S. No.	Check Point	Observation	✓	Action	Remarks
1	Pre installation check for Civil	Civil construction of SS to be ensured as per substation construction SOP		ensure	
2		Floor Surface evenness		Must not exceed + (-) 3mm/meter	
3		Grouting Holes		ensure	
4	Panel Alignment	Check the Panels front for correct vertical and horizontal placement		Ensure Correct Placement	
5		Coupling of Same make panels through coupling holes on panels side walls		Ensure Alignment as per OEM instruction	
6		Interconnection of Main busbars and between panels with bolts & washers		Ensure	
7		Interconnection of Panel-to-Panel Earth bus bar		Ensure	
8		Panel foundation must be fixed with Rawal/anchor bolts.		Ensure	
9		Verification of Torque on all bolts as per OEM values		Ensure	
10		Clearance top, side rear need to verify as per OEM instruction.		Ensure	
11	Earthing	Connection of Main Earthing of Substation with Panel earth bus bar		Ensure	
12		Verification of earth continuity		Ensure	
13		PTs primary and secondary are properly grounded (for metering panel)		Ensure	
14	Instrument Box	Proper installation of EFI as per SOP (if available)		Ensure	
15		CTU output voltage and supply input volage connection		Verify	
16		Disconnection of CT terminals shorting links before energization		Ensure	
17		Check Control wiring/CT wiring for any loose connection		Verify & rectify if required	
18		Relay settings to be done as per protection manual		Ensure	
19	Cable Compartment	Cable should support with cable clamp and ensure the fixing of Panel bottom cover plate.		Ensure	
20		Cable armoring is connected through earth meshed wire to panel earth		Ensure	
21	SF6 Gas	In the red zone		Replace Panel	
22		In the Green zone		OK	
23	PT Connections	Auxiliary PT Connections for Incomer panel (LBS).		Verify	
24	Mechanical operation	Perform 2 Mechanical operation of breaker, earth switch, LBS		Perform	



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25.3 LOAD BREAK SWITCH INSTALLATION CHECKLIST

LOAD BREAK SWITCH CHECKLIST					
Span Location			Pole IDs		
Cluster Name			Dated		
Sr. No.	Check Point	Condition / Observation	✓	Action	Remarks
1	Pad Lock arrangement	Manual Pad Lock/ Locking Arrangements damaged or cannot operate		Repair	
2	L-Clamp	Dusty		Clean	
		Damage		Replace L-Clamp	
		Loose		Tighten	
		Okay		No Action	
3	LBS Bushing	Dusty		Clean	
		Damage		Replace LBS	
		Okay		No Action	
4	LBS Platform	LBS platform and cable bracket rusty or misaligned		Rectify	
		Okay		No Action	
5	ON/OFF Marking	Faded/Not available		Provide	
		Okay		No Action	
6	PVC Boots not Installed on LBS Bushings	Not Available		Install	
		insulation damage		Replace / repair	
		Okay		No Action	
7	HT Jumpers Sleeves/boots on LBS Terminals	Not Available		Install	
		Damage / Burn out		Replace	
		Okay		No Action	
8	HT Cable Mounting Bracket on LBS	Not Installed		Install (If required)	
		Okay		No Action	
9	LBS Grounding	Not Grounded		Ground as per SOP	
		Okay		No Action	
10	Gas pressure indication	In the red zone (SF6 Pressure Low)		Replace RMU	
		In the Green zone (SF6 Pressure OK)		No Action	
		Dusty		Clean	
11	LBS Installation Position	Inappropriate (Between phase Conductors)		Place below phase conductors	
		Okay		No Action	
Supervisor Name			Signature		
Department			Dated		



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25.4 PMT MAINTENANCE CHECKLIST

PMT - MAINTENANCE CHECKLIST					
PMT Name				DTS ID	
Cluster Name				Dated	
S. No	PMT Environment	Condition	✓	Action Required	Remarks
1	Pin Insulator	Not Available		Install	
		Broken / Puncture		Replace	
		Tilted		Align	
		Busbar pin insulator by passed		Align	
		Dusty		Clean	
		Okay		No Action	
2	Disc Insulator	Broken / Puncture		Replace	
		Dusty		Clean	
		Okay		No Action	
3	Busbar	Not Available		Install	
		Joint		Replace	
		Jumper dropped without PG/Line tap		Install	
		insulation damage		Replace / repair	
		Okay		No Action	
4	Leading with Line Tape (Busbar ~ DO ~ PMT Bushing)	Not Available		Install	
		insulation damage		Replace / repair	
		Okay		No Action	
5	Leading with Lugs (Busbar ~ DO ~ PMT Bushing)	Not Available		Install	
		insulation damage		Replace / repair	
		Okay		No Action	
6	DO Cut Out	Not Available / Damage		Install / Replace	
		Fuse inappropriate size/rating		Replace	
		Miss Align		Align	
		DO clearances (Ph to Ph to Ground)		Rectify	
		Fuse Cartridge Not Available / Damage		Install / Replace	
		Installed Porcelain type		Replace with Polymer type	
		Fuse Installed / Binding Wire		Replace with Fuse & cartridge	
Okay		No Action			
7	DO Covers	Not Available		Install	
		Damage		Replace	
		Available		Okay	
8	Pilot Bracket not Installed	Not Available		Install	
		Damage		Replace	
		Okay		No Action	
9	Pilot Insulator (Pin Insulator) Required on Pilot Bracket	Not Available		Install	
		HT Lead not tied with Pilot Insulator		Tied properly	
		Puncture / Damage		Replace	
		Miss Align		Align	
10		Okay		No Action	
		Puncture / Damage		Replace	



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PMT - MAINTENANCE CHECKLIST					
PMT Name				DTS ID	
Cluster Name				Dated	
S. No	PMT Environment	Condition	✓	Action Required	Remarks
	Pilot Insulator's (Pin Insulator) Condition	Okay		No Action	
11	Bushing Covers Required at HT Bushings	Not Available		Install	
		Damage		Replace	
		Okay		No Action	
12	Bushing Covers Required at LT Bushings	Not Available		Install	
		Damage		Replace	
		Okay		No Action	
13	Breaker Required	Not Available		Install	
		Damage/Faulty		Replace	
		Tripping Setting		Set as per LT Network Guideline	
		Okay		No Action	
14	Breaker Box Condition	Not Available		Install	
		Damage		Replace / repair	
		Door not Available / Damage		Install / Replace	
		Door Open		Close	
		No Earthing connection - Continuity		Install / Provide	
		Okay		No Action	
15	DB / ICTP Box	Not Available		Install	
		Damage		Replace / repair	
		Door not Available / Damage		Install / Replace	
		More than 1 Circuit on DB Outgoing		Installed new DB as per SOP	
		Door Open		Close	
		Kara Installed instead of Fuse		Replace with fuse as per LT Network Guidelines	
		Fuse Base Not Installed of Appropriate Rating		Install as per LT Network Guidelines	
		No Earthing connection - Continuity		Install / Provide	
		Fuse Not Installed of Appropriate Rating		Install as per LT Network Guidelines	
Okay		No Action			
16	LT Leads with Lugs Condition	Not Available		Install	One Joint applicable for neutral only. Junction
		Insulation Damage		Replace / Repair	
		Burnt out		Replace	
		Lugs Not Installed / Not Punched properly		Replace / Installed Properly	
		Okay		No Action	
17	Wooden Cleat	Not Available		Install	
		Damage / Broken		Replace	



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PMT - MAINTENANCE CHECKLIST					
PMT Name				DTS ID	
Cluster Name				Dated	
S. No	PMT Environment	Condition	✓	Action Required	Remarks
		Miss Align		Align	
		Leads Bypassed		Route through Wooden Cleat	
		Okay		No Action	
18	Earth Fault Indicator	Not Available		Install	To be removed
		Push test button not working		Replace	
		Damage / Faulty		Replace	
		Okay		No Action	
19	EFI Metallic Enclosure	Not Available		Install	
		Damage / Faulty		Replace	
		Enclosure Door Missing		Replace	
		Enclosure Door Open		Closed Properly	
		Okay		No Action	
20	EFI Twin Core Cable	Not Available		Install	EFI to be replaced
		Insulation Damage		Repair/replace	
		Okay		No Action	
21	EFI CT	Not Available		Install	EFI to be replaced
		Damage / Faulty		Replace	
		Okay		No Action	
22	EFI Installation	Not Installed at 7' Height		Install	
		Okay		No Action	
23	Transformer Body Grounding with all accessories / Enclosure (mesh grounding)	Not Available		Install as per Earthing SOP	
		Appropriate conductor / lead not used for earthing		Install as per Earthing SOP	
		Proper size lug not used / punched		Install as per Earthing SOP	
		Okay		No Action	
24	Transformer Neutral Grounding Required as per SOP	Not Available		Install as per Earthing SOP	
		Appropriate lead not used for earthing		Install as per Earthing SOP	
		Leads ends not connected with appropriate rating / size lugs		Install as per Earthing SOP	
		Okay		No Action	
25	Distribution Transformer	Refer separate sheet for transformer check list			
26	PMT Structure Platform (3 girders)	Not Available		Install	
		Damage / Bended		Replace / repair	
		Tilted		Align	
		Okay		No Action	
27	PMT Structure	Not Available		Install	
		Damage / Bended		Replace / repair	
		Tilted		Align	



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PMT - MAINTENANCE CHECKLIST					
PMT Name				DTS ID	
Cluster Name				Dated	
S. No	PMT Environment	Condition	✓	Action Required	Remarks
		Okay		No Action	
28	PMT Poles	Foundation Damage		Repair	
		Tilted		Align	
		Okay		No Action	
29	Stay / Strut Unit	Not Available		Install (if required as per SOP)	
		Damage / Bended		Replace	
		Base Damage		Repair	
		Okay		No Action	
30	HT Cable Ends / Terminations	Not Available		Install	
		Damage / Hopeless		Replace / repair	
		Burnt out		Replace	
		Okay		No Action	
31	HT Cable GI Pipe	Not Available		Install (if required as per SOP)	
		Okay		No Action	
32	HT GI Pipe Clamp	Not Available		Install (if required as per SOP)	
		Okay		No Action	
33	LT GI Pipe Clamp	Not Available		Install (if required as per SOP)	
		Okay		No Action	
34	HT Cable Pole Clamp (2 Nos)	Not Available		Install (if required as per SOP)	
		Okay		No Action	
35	LT Cable Pole Clamp (2 Nos)	Not Available		Install (if required as per SOP)	
		Okay		No Action	
36	Cable Marking	Not Available		Provide / Mark	
		Okay		No Action	
37	HT Cable	Not Buried		Buried as per SOP	
		Okay		No Action	
38	LT Cable	Not Buried		Buried as per SOP	
		Okay		No Action	
39	HT Cable Condition (exposed portion)	Over sheath Damage		Repair	
		Okay		No Action	
40	PMT Poles Grounding	Not Available		Ground as per SOP	
		Earth Wire Expose		Cover as per SOP	
		Grounding Nut & Bolt with lugs not welded		Welding to be done as per SOP	
		Trial Pit not back filled		Back fill	
		Okay		No Action	
41	Check meter / AMR Meter	Not Available		Install (if required as per SOP)	
		Meter or CTs condition hopeless / Faulty		Replace	
		CTs installed of inappropriate rating		Replace	
		Okay		No Action	
42	Danger Board (2 Nos.)	Not Available		Install as per SOP	
		Rusty / Not Readable		Replace / repair	
		Okay		No Action	
43	Name Plate with DTS ID	Not Available		Install as per SOP	
		Rusty / Not Readable		Replace / repair	
		Okay		No Action	



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PMT - MAINTENANCE CHECKLIST					
PMT Name				DTS ID	
Cluster Name				Dated	
S. No	PMT Environment	Condition	✓	Action Required	Remarks
44	PTCL/ Internet/ TV cable touches PMT Body/Structure/ Metallic Part	Available		Remove as per Policy	
		Okay		No Action	
45	Streetlight Control box	Not Available		Install	
		Damage / Faulty		Replace	
		Okay		No Action	
46	PVC Pipe for Cross Leads	Not Available		Install (if required as per SOP)	
		U-Clamps not available		Install	
		Different PMTs Cross Leading from same pipe		Route through separate pipe for different PMT Circuits	
		PVC Pipe Damage		Replace	
47	Tree Pruning	Okay		No Action	
		Tree branches touching pole / wires		Tree Pruning as per SOP	
48	Knife Switch	Dirty		Cleaning and maintenance of Knife Switch	
		Damage / Faulty		Replace with LBS as per Network Design	
		Contacts/Mechanism Jam		Use Electrical Grade Grease after cleaning using WD 40	
		Okay		No Action	
49	Thermography (Check Loose Connections)	Check Hot Spots (Relative Temperature)		Repair heated points	
		Check Connection points (Nut and Bolts)		Tight Nut and Bolt as per Torque Chart using Torque Range	
		Okay		No Action	
50	Open Contacts / Connections i.e., Lugs with Eye or any other	Open Contacts of Bus bar with cable lugs		Cover using HT Adhesive Tape	
		Loose Connections		Tight Nut and Bolt as per Torque Chart using Torque Range	
		Okay		No action	
51	Thermography (Check Loose Connections)	Check Hot Spots (Relative Temperature)		Repair heated points	
		Check Connection points (Nut and Bolts)		Tight Nut and Bolt as per Torque Chart using Torque Range	
		Okay		No Action	
52	Measure Leakage Current Using Clamp Meter at Earth Points	Leakage Current > 30mA		Rectify the Cause of Leakage	
		Leakage Current < 30mA		No Action	
53	PVC Boots on LBS Bushings	Not Available		Install	
		insulation damage		Replace / repair	
		Okay		No Action	



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PMT - MAINTENANCE CHECKLIST					
PMT Name				DTS ID	
Cluster Name				Dated	
S. No	PMT Environment	Condition	✓	Action Required	Remarks
54	HT Jumpers Sleeves/boots on LBS Terminals	Not Available		Install	
		Damage / Burn out		Replace	
		Okay		No Action	
55	HT Cable Mounting Bracket on LBS	Not Installed		Install (If required)	
		Okay		No Action	
56	LBS Grounding	Not Grounded		Ground as per SOP	
		Okay		No Action	
57	All exposed parts (terminals, splices, PG Clamps, Cable Lugs etc.)	Exposed		Wrap with adhesive insulating tape	
		Damaged/Deteriorated		Replace and wrap with adhesive insulating tape	
		Covered/Insulated		Okay	
Supervisor Name				Signature	
Department				Dated	



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25.5 TRANSFORMER CHECKLIST

TRANSFORMER MAINTENANCE CHECKLIST					
Substation Name		Substation ID			
Cluster Name		Dated			
S. No	Check Point	Condition	✓	Action	Remarks
1	Bushing Condition	No Discrepancy/ Good Condition		No action required	No
		Deposition of dust particles		Cleaning of Bushing	No
		HT & LT Bushing Flashover marks		Onsite replacement of bushing	No
		HT & LT Bushing Insulator glaze chip Off		Onsite replacement of bushing	No
		HT & LT Bushing Damage		Onsite replacement of bushing	No
2	Main Tank Condition	No Discrepancy/ Good Condition		No action required	No
		Thermometer Gauge Broken/ Not Readable		Onsite replacement of Thermometer Gauge	No
		Main Tank Rusted without leakage		Onsite cleaning and painting of tank	No
		Main Tank Leak Minor		Onsite welding of main tank	No
		Main Tank Deformed/Bulge		To be repaired at TSW (Replacement)	Yes
		Main Tank Leak Major (Rusted/ Without Rusted)		To be repaired at TSW (Replacement)	Yes
3	Cooling Equipment	No Discrepancy/ Good Condition		No action required	No
		Cooling tube missing more than one		To be repaired at TSW (Replacement)	Yes
		Cooling tube Rusted without leakage		Onsite welding of Cooling tube	No
		Cooling tube Leak Minor		Onsite welding of Cooling tube	No
		Cooling tube Deformed/Bulge		To be repaired at TSW (Replacement)	Yes
		Cooling tube Leak Major (Rusted/ Without Rusted)		To be repaired at TSW (Replacement)	Yes
4	Conservator Tank Condition	No Discrepancy/ Good Condition		No action required	No
		Oil level Gauge Blur (Not readable)/Oil level Gauge Damage		Onsite Maintenance of Oil Level Gauge	No
		Conservator Tank Rusted without leakage		Onsite cleaning and painting of Conservator tank	No
		Conservator Tank Leak Minor		Onsite welding of Conservator tank	No
		Conservator Tank Deformed/Bulge		To be repaired at TSW (Replacement)	Yes



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TRANSFORMER MAINTENANCE CHECKLIST					
Substation Name		Substation ID			
Cluster Name		Dated			
S. No	Check Point	Condition	✓	Action	Remarks
		Conservator Tank Leak Major (Rusted/ Without Rusted)		To be repaired at TSW (Replacement)	Yes
5	Foundation	No Discrepancy/ Good Condition		No action required	No
		Transformer Base Channel Tilted/Damage		To be repaired at TSW	Yes
		PMT structure Tilted		Alignment of structure onsite	No
		PMT structure rusted (Network)		Replacement of structure	No
6	Grounding	No Discrepancy/ Good Condition		No action required	No
		Earthing values not in specified range.		Neutral to be separately grounded	No
		Body earthing Missing.		Body Earthing to be provided as per SOP	No
		Missing Earthing Terminal on Main Tank		To be welded Onsite only on stiffener.	No
		Transformer Neutral not separately grounded.		Neutral to be separately grounded	No
7	Gaskets Conditions	No Discrepancy/ Good Condition		No action required	No
		Cracks/Damage in Gaskets		Onsite replacement of Gasket	No
		Oil Leakage from Gaskets		Onsite replacement of Gasket	No
8	Terminal Connectors	No Discrepancy/ Good Condition		No action required	No
		Non-Homogenous surface		Replace Terminal Connector (TSW)	No
		Loose Connections		To be tighten with placement of washer (Network)	No
		Hot Spots at contact point		Replace Cable Lug and/or Terminal Connector (Network)	No
9	Oil Level	No Discrepancy/ Good Condition		No action required	No
		Lower than minimum mark on Oil level Gauge		Top up Oil -by TSW (Onsite Maintenance)	No
		Oil level is not visible on Oil Level Gauge		Top up Oil -by TSW (Onsite Maintenance)	No
10	Breather Condition	No Discrepancy/ Good Condition		No action required	No
		Silica Gel Color change from Orange to pink/green/black		Silica Gel to be replaced Onsite Maintenance	No
		Breather Damage		Breather to be replaced Onsite Maintenance	No
		Breather not available		Breather to be provided Onsite Maintenance	No



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TRANSFORMER MAINTENANCE CHECKLIST					
Substation Name				Substation ID	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action	Remarks
11	Tap changer Condition	No Discrepancy/ Good Condition		No action required	No
		Tap Changer not available.		To be repaired at TSW (Replacement)	Yes
		Tap position is not readable.		To be repaired at TSW (Replacement)	Yes
		Knob Damage		To be repaired at TSW (Replacement)	Yes
		Tap changer found jammed (Smooth movement of tap changer at all Position)		To be repaired at TSW (Replacement)	Yes
		TTR Values not in specified range (Verification of turns ratio at all steps as per rating plate)		To be repaired at TSW (Replacement)	Yes
12	Oil Leakages	No Discrepancy/ Good Condition		No action required	No
		Oil Seepage/ Leakage from Transformer valves		Onsite replacement of gaskets and faulty valve	No
13	Insulation Resistance	>200 M Ohm		No action required	No
		50-200 M Ohm,		Onsite replacement of gaskets and faulty valve	No
		0-50 M Ohm		Onsite replacement of gaskets and faulty valve	No
14	Transformer Turn Ratio Test	$\Delta TR \leq 0.5\%$ of the rated value		No action required	No
		$\Delta TR > 0.5\%$ of the rated value		To be repaired at TSW (Replacement)	Yes
15	Dielectric Strength of Oil	Dielectric Strength of Transformer Oil (Oil Dielectric Strength >55 kV)		No action required	No
		Dielectric Strength of Transformer Oil (Oil Dielectric Strength <55 kV & >40 kV)		Onsite Oil Replacement	No
		Dielectric Strength of Transformer Oil (Oil Dielectric Strength <40 kV)		Onsite Oil Replacement	No
16	Water Content in Oil	Water content within Transformer Oil (Water Content <20 PPM)		No action required	No
		Water content within Transformer Oil (Water Content >20 PPM & <30 PPM)		Onsite Oil Replacement	No



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TRANSFORMER MAINTENANCE CHECKLIST					
Substation Name			Substation ID		
Cluster Name			Dated		
S. No	Check Point	Condition	✓	Action	Remarks
		Water content within Transformer Oil (Water Content >20 PPM)		Onsite Oil Replacement	No
17		Additional four PMT U-Bolts provided if wheels are not available with PMT		Install if not available	
18		Temp gauge			
Supervisor Name			Signature		
Department			Dated		



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25.6 SUB-STATION MAINTENANCE CHECKLIST

Substation Checklist					
Substation Name				Substation ID	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action	Remarks
1	Earthing of Transformer Body	Not Available		Install	
		GI Plate not Available		Install	
		Under size conductor used		Replace	
		Okay		No Action	
2	Earthing of Transformer Neutral (Separately)	Not Available		Install	
		GI Plate not Available		Install	
		Under size conductor used		Replace	
		Okay		No Action	
3	LT Panel Earthing	Not Available		Install	
		GI Plate not Available		Install	
		Under size conductor used		Replace	
		Okay		No Action	
4	HT Panel Earthing	Not Available		Install	
		GI Plate not Available		Install	
		Earthing Inter Connection of Panel not provided		Install	
		Under size conductor used		Replace	
		Okay		No Action	
5	HT & LT Earth Meshing	Not Available / Damage		Provide / Replace	
		Earthing conductor under size		Replace with appropriate size as per SOP	
		Earthing wires ends not connected with lugs		Connect with lugs of appropriate sizes	
		GI Plate not Available / Damaged		Provide / Replace / Repair	
		Okay		No Action	
6	HT Panel	Panel contact faulty / dirty		Replace/clean & lubricant with electrical grade silicon grease	
		VCB end panel side poly carbonated cover missing / damaged		Provide / Replace	
		Oil low level for OCB & isolator		Replace OCB & isolator with VCB	
		Phase barriers missing / damaged for VCB trolley & cable compartment (For 600mm & 650 mm width VCBs)		Install / replace through TSW	
		Marking not provided / Updated		Provide / Update	
		Relay missing / Faulty		Install / Replace	
		Improper Relay Setting		Set as per Protection Manual	
		Contact terminal (Male - Female) burnt out / damaged		Install / replace through TSW	
		Loose finger contacts		Tight Finger contacts properly with necessary pressure / torque to avoid loose connections and hot spots through TSW	



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Substation Checklist					
Substation Name				Substation ID	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action	Remarks
		Greasing of contacts by electrical grade contact grease (Male-Female contacts)		To be applied	
		No of mechanical operations exceeds from specified / recommended no of operations		Replace with new switch	
		Incoming / outgoing HT Cable not properly sealed / clamped & earthed.		Seal Properly / clamp & earth	
		Panels not coupled with each other		Couple as per VCB installation SOP	
		Back Plates/ Top Plates/ Side Plates of HT Switches not available / Damaged		Install / Repair	
		HT Cable ends connected with VCB without / damaged Termination		Provide / Replace HT Termination	
		Joint in HT OCB dropper leads		Copper dropper with 11KV insulation to be installed by TSW.	
		Oil DI-electric Strength of <55kv for OCB		Centrifuge / Re-generate	To be done by TSW
		HT Busbar Sleeve damaged		replace	
		Carbonization in busbar compartment		Refurbish through TSW	
		Carbonization in cable compartment		Refurbish through TSW	
		Rusting issue in breaker compartment		Refurbish through TSW	
		Electrical components in Instrument box damaged.		Install/Replace	
		Base plates with proper Rawal bolts		Provided as per VCB installation SOP	
		Losing of connection at busbar		Tightening to be done	
		Losing of connection at CT terminals		Tightening to be done	
		Verify earth continuity		Ensure as per SOP	
		Spouts/Shrouds damaged		Replace through TSW	
		Okay		No Action	
7	Marking on HT Panels (Switches)	Not Available / Un-readable		Write & Readable	
		Okay		No Action	
8	Marking on Cables	Not Available / Un-readable		Write & Readable	
		Okay		No Action	
9	EFI	EFI Damage / Hopeless		Replace / Repair	
		EFI Cable Missing		Install	
		EFI Cable Damage		Replace / Repair	
		EFI CT Missing		Install	
		EFI CT Damage / Hopeless		Replace	
		Okay		No Action	



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Substation Checklist					
Substation Name				Substation ID	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action	Remarks
10	Distribution Transformer	Refer separate sheet for transformer check list			
11	LT Panel Condition	Hopeless LT Panel Condition		Replace with recommended type LT Panel	
		Busbar missing or Damage		Install / Replace	
		Cable not routed through cable glands (in case of polymer type panel)		Route properly	
		LT Leads not connected through lugs		Connect through proper lug	
		Cable in & out marking not available		Mark / Provide	
12	Molded Case Circuit Breaker (MCCB)	Okay		No Action	
		Knob Damage/faulty		Replace	
		Trip Setting		Select as per Standard Rating	
		Connection Loose		Tight as per Torque Chart	
		Phase barriers not available		Install	
13	Check Meter / AMR Meter	Okay		No Action	
		Not Available		Install (if required as per SOP)	
		Meter or CTs condition hopeless / Faulty		Replace	
		CT wires not connected properly or damaged / hopeless		Connect CT wires & replace if hopeless	
14	Basement of Substation	Okay		No Action	
		Garbage / Shrubs/Rodents Present		Clean	
		Door Open		Close	
		Door Damage/deteriorate		Repair	
		Door Missing		Install	
		Lock Missing/damage		Install	
15	Sealing of Cable Entry/ Exit Points	Okay		No Action	
		Not Sealed		Seal Properly	
16	Sub-Station SLD	Okay		No Action	
		Missing / Not Updated		Provide / Update	
		Deteriorated / Damaged		Replace / Repair	
17	Lighting	Okay		No Action	
		Not Available/Damage/Non-Functional		Install	
18	Fire Extinguisher (ceiling mounted)	Okay		No Action	
		Not Available/Damage		Install	
19	HT Cable	Okay		No Action	
		HT Cable Termination Hopeless		Replace / Repair	
		HT Cable Condition Hopeless		Replace / Repair	
20	LT Leads from local to LT Panel	Okay		No Action	
		Terminated without lugs		Terminate with lug	
		Lead Damage / Hopeless		Replace / Repair	



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Substation Checklist					
Substation Name				Substation ID	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action	Remarks
		Under size leads		Install as per LT Network Guideline	
		Joints in lead		Replace	
		Okay		No Action	
		Not Available		Install SS Cable tray	
21	Wooden Cleat with Frame	LT Leads bypassed		Route through wooden cleat	
		Damage / Broken		Replace / Repair	
		Okay		No Action	
22	Painting of S/S	Front Wall not Painted / Deteriorated		Repair / Paint	
		KE Logo on front wall not available		Provide	
		Okay		No Action	
23	Cleaning/ House Keeping	Not Cleaned		Clean properly	
		Lighting arrangement missing / Damaged		Install / Repair	
		Okay		No Action	
24	Door(s)	Not Available		Install	To be done through FMS
		Damage		Replace / Repair	To be done through FMS
		Not Painted		Paint	
		Lock missing		Install new lock	
		Lock arrangement missing		Install / Repair	
		Okay		No Action	
25	Ventilation in S/S	Ventilation Damaged / Chocked		Replace / Repair	To be done through FMS
		Okay		No Action	
26	Cable Loops outside Sub Station	Not Buried / Partially Buried		Burry	
		Okay		No Action	
27	HT Local Cable Ladder / Clamps	Not Available		Install	
		Damaged / Deteriorated		Install	
		Okay		No Action	
28	Cable Loops in Trench	Not Buried / Partially Buried		Burry	
		Okay		No Action	
29	Trench Slabs	Not Available		Install	
		Damage / Broken / Hopeless		Replace	
		Okay		No Action	
30	Structure of SS	Cracks		Repair	To be done through FMS



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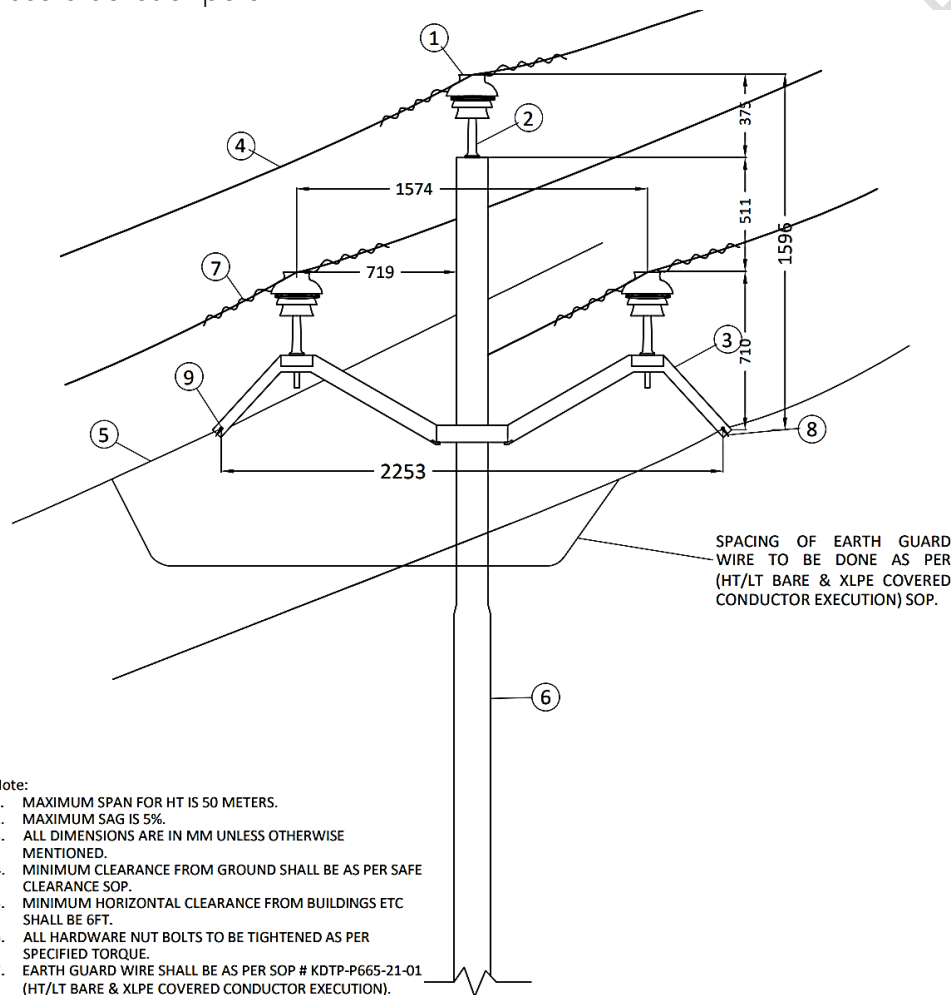
Substation Checklist					
Substation Name				Substation ID	
Cluster Name				Dated	
S. No	Check Point	Condition	✓	Action	Remarks
		Floor damage/Sunk		Repair	To be done through FMS
		Okay		No Action	
31	Measure Leakage Current Using Clamp Meter	Leakage Current > 30mA		Rectify the Cause of Leakage	
		Leakage Current < 30mA		No Action	
32	Thermography (Check Loose Connections)	Check Hot Spots (Relative Temperature)		Repair heated points	
		Check Connection points (Nut and Bolts)		Tight Nut and Bolt as per Torque Chart using Torque Range	
		Okay		No Action	
Supervisor Name				Signature	
Department				Dated	

26. ANNEXURE

26.1 HT RUNNING POLE

26.1.1 Like HT Overhead Bare Conductor, XPLE Covered Conductor shall be placed under groove of Pin Insulators.

26.1.2 XLPE cable shall be secured with Helical Ties under any condition to avoid contact with phase bracket or pole.

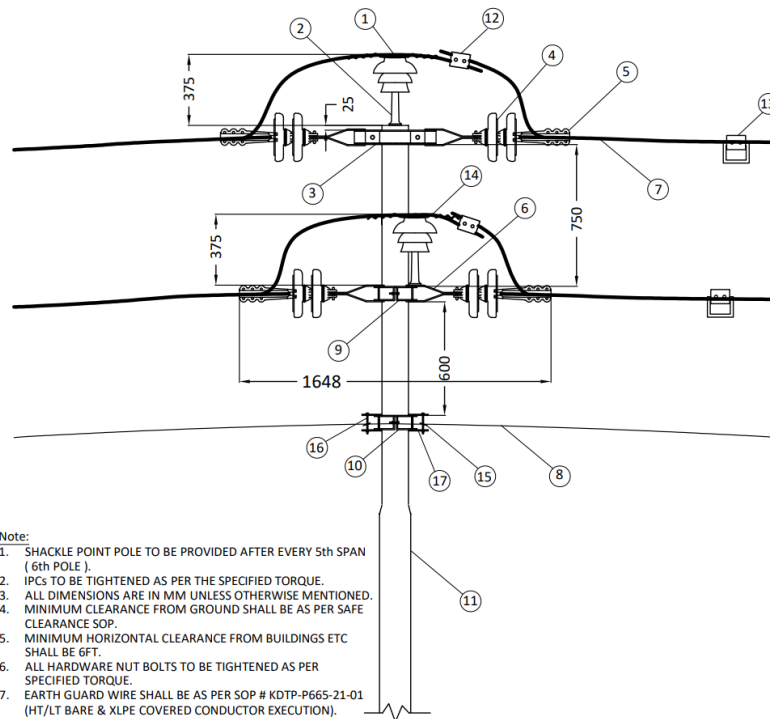


S. No	SAP Code	Material Description	Quantity	Material Composition
1	10001449	INSULATOR; PIN TYPE 11 KV	3	Porcelain
2	10001448	PIN; FOR PIN INSULATOR	3	Galvanized steel
3	10001211	BRACKET; ANTIPERCHENT POLE S/P 5-1/2"	1	Galvanized steel
4	10102094	CONDUCTOR; XLPE COVERED ACSR TIGER	As per requirement	Aluminum
5	10002052	CONDUCTOR; ACSR RABBIT 2SWG	As per requirement	Aluminum
6	10000360	POLE; HT ST 36' X 5-1/2"	1	Galvanized steel
7	10121786	TIE; PIN INSULATOR FOR COVERED CONDUCTORS	3	PVC
8	10001097	WIRE; BINDING 14SWG	As per requirement	Galvanized steel
9	10001612	BOLT&NUT; GI 5"X1/2"	2	-

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26.2 HT SHACKLE POLE (THROUGH)

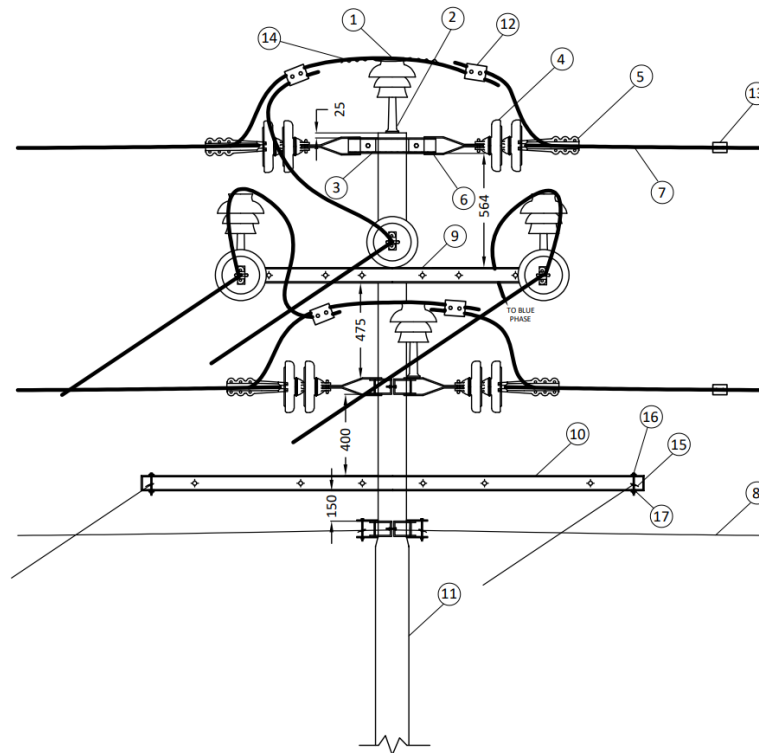
- 26.2.1 Shackle point must be created at every 5th span, 6th pole or according to operational flexibility as deemed necessary.
- 26.2.2 The branch circuit will be connected with IPC after the point of dead end by creating the loop of wires.
- 26.2.3 Covered conductors of same size shall be connected using HT IPCs by directly connecting both conductors with each other.
- 26.2.4 End caps shall be installed at conductor ends



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10001449	INSULATOR; PIN TYPE 11 KV	3	Porcelain
2	10001448	PIN; FOR PIN INSULATOR	3	Galvanized steel
3	10001206	BRACKET; POLE CH. I 14" X 5-1/2"	1	Galvanized steel
4	10001450	INSULATOR; DISC TYPE	12	Porcelain
5	10103583	CLAMP; DEADEND HT FOR XLPE INS CONDUCTOR	6	Galvanized steel
6	10120791	BEND; STRIP FOR DISC INSULATOR	12	GI
7	10102094	CONDUCTOR; XLPE COVERED ACSR TIGER	As per requirement	Aluminum
8	10002052	CONDUCTOR; ACSR RABBIT 2SWG	As per requirement	Aluminum
9	10001213	BRACKET; PHASE HT 5' X 5-1/2"	1	Galvanized steel
10	10001214	BRACKET; EARTH 8'X5-1/2 DIA.	1	Galvanized steel
11	10000360	POLE; HT ST 36' x 5-1/2"	1	Galvanized steel
12	10103582	CONNECTOR; IPC HT 95-240/50-185 MM2	6	Polyamide + Aluminum
13	10121183	RING; GROUNDING HT IPC XLPE CONDUCTOR	3	Aluminum
14	10121786	Tie; Pin Insulator for Covered Conductors	3	PVC
15	10001097	WIRE; BINDING 14SWG	As per requirement	Galvanized steel
16	10001612	BOLT&NUT; GI 5"X1/2"	6	-
17	10001668	STRIP; SHACKLE G.I 19/18	8	GI

26.3 HT SHACKLE WITH T-OFF (STEEL POLE)

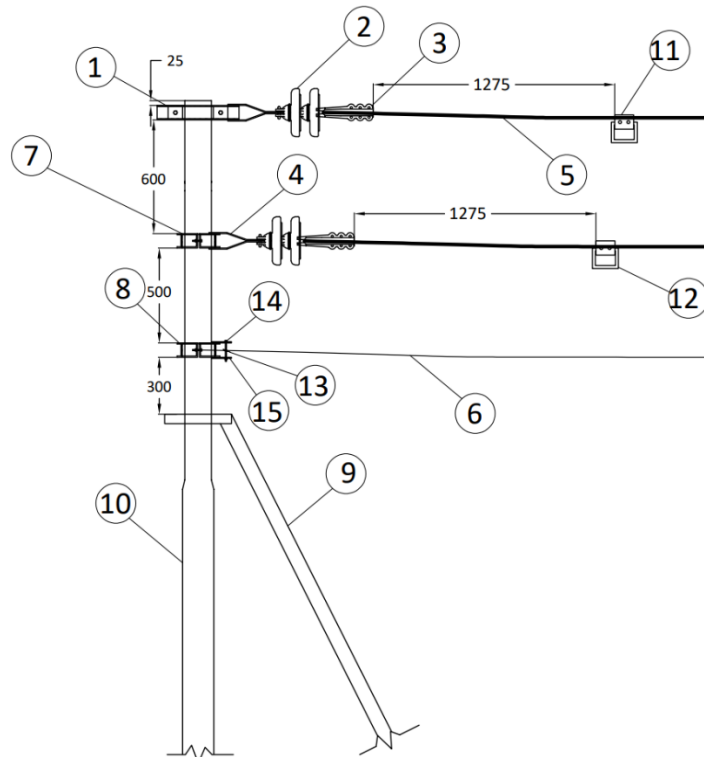
- 26.3.1 Through shackle point/ T point should be created according to operational flexibility as deemed necessary/ branch circuit needs to be connected/ extend.
- 26.3.2 The branch circuit will be hold by HT dead end clamp and will be directly connected with main XLPE covered conductor through IPCs.
- 26.3.3 Recommended to make Shackle Point at T-Off points
- 26.3.4 End caps shall be installed at conductor ends



S.No	SAP Code	Material Description	Quantity	Material Composition
1	10001449	INSULATOR; PIN TYPE 11 KV	5	Porcelain
2	10001448	PIN; FOR PIN INSULATOR	5	Galvanized steel
3	10001206	BRACKET; POLE CH. I 14" x 5-1/2"	2	Galvanized steel
4	10001450	INSULATOR; DISC TYPE	18	Porcelain
5	10103583	CLAMP; DEADEND HT FOR XLPE INS CONDUCTOR	9	Galvanized steel
6	10120791	BEND; STRIP FOR DISC INSULATOR	18	GI
7	10102094	CONDUCTOR; XLPE COVERED ACSR TIGER	As per requirement	Aluminum
8	10002052	CONDUCTOR; ACSR RABBIT 2SWG	As per requirement	Aluminum
9	10001213	BRACKET; PHASE HT 5' X 5-1/2"	2	Galvanized steel
10	10001214	BRACKET; EARTH 8'X5-1/2 DIA.	2	Galvanized steel
11	10000360	POLE; HT ST 36' x 5-1/2"	1	Galvanized steel
12	10103582	CONNECTOR; IPC HT 95-240/50-185 MM2	12	Polyamide + Aluminum
13	10121183	RING; GROUNDING HT IPC XLPE CONDUCTOR	6	Aluminum
14	10121786	Tie; Pin Insulator for Covered Conductors	5	PVC
15	10001097	WIRE; BINDING 14SWG	As per requirement	Galvanized steel
16	10001612	BOLT&NUT; GI 5"X1/2"	10	
17	10001668	STRIP; SHACKLE G.I 19/18	12	GI

26.4 HT END / TERMINATING POLE

- 26.4.1 HT dead end clamp shall be used for XLPE Covered conductor holding instead of snail clamp.
- 26.4.2 Loop of cable end shall be secured or tightened with main covered conductor using cable tie.
- 26.4.3 Loop of XLPE cable shall be secured with ties under any condition to avoid contact with phase bracket or pole.
- 26.4.4 End caps shall be installed at conductor ends

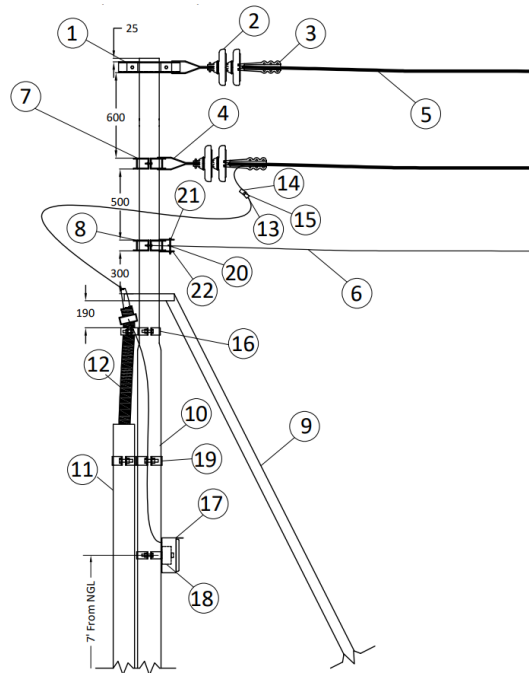


S. No	SAP Code	Material Description	Quantity	Material Composition
1	10001206	BRACKET; POLE CH. I 14"x 5-1/2"	1	Galvanized steel
2	10001450	INSULATOR; DISC TYPE	6	Porcelain
3	10103583	CLAMP; DEADEND HT FOR XLPE INS CONDUCTOR	3	Galvanized steel
4	10120791	BEND; STRIP FOR DISC INSULATOR	6	GI
5	10102094	CONDUCTOR; XLPE COVERED ACSR TIGER	As per requirement	Aluminum
6	10002052	CONDUCTOR; ACSR RABBIT 2SWG	As per requirement	Aluminum
7	10001213	BRACKET; PHASE HT 5'X 5-1/2"	1	Galvanized steel
8	10001214	BRACKET; EARTH 8'X5-1/2 DIA.	1	Galvanized steel
9	10022542	STRUT UNIT; COMPLETE FOR HT POLE	1	Galvanized steel
10	10000360	POLE; HT ST 36'x 5-1/2"	1	Galvanized steel
11	10103582	CONNECTOR; IPC HT 95-240/50-185MM2	3	Polyamide +Aluminum
12	10121183	RING; GROUNDING HT IPC XLPE CONDUCTOR	3	Aluminum
13	10001097	WIRE; BINDING 14SWG	As per requirement	Galvanized steel
14	10001612	BOLT & NUT; GI 5"X1 /2"	4	
15	10001668	STRIP; SHACKLE G.I 19/18	4	GI

26.5 HT CABLE TO HT POLE

26.5.1 The HT cable will be connected with O/H using lugs of 185/300mmsq for covered conductor and 300mmsq for HT cable leads.

26.5.2 Above Scheme is designed if Knife Switch or LBS is not installed / available. However, it is recommended to install LBS for intermediate connection as per company policy.



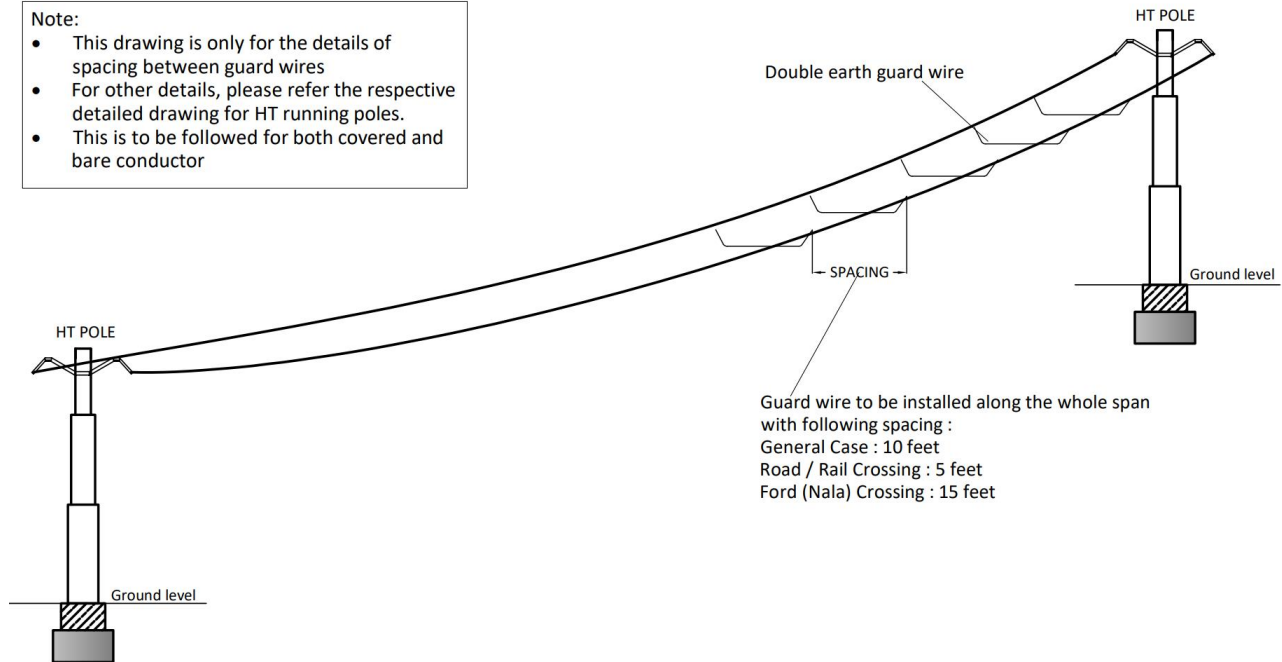
S. No	SAP Code	Material Description	Quantity	Material Composition
1	10001206	BRACKET; POLE CH.11 14" x 5-1/2"	1	Galvanized steel
2	10001450	INSULATOR; DISC TYPE	6	Porcelain
3	10103583	CLAMP; DEADEND HT FOR XLPE INS CONDUCTOR	3	Galvanized steel
4	10120791	BEND; STRIP FOR DISC INSULATOR	6	GI
5	10102094	CONDUCTOR; XLPE COVERED ACSR TIGER	As per requirement	Aluminum
6	10002052	CONDUCTOR; ACSR RABBIT 2SWG	As per requirement	Aluminum
7	10001213	BRACKET; PHASE HT S' X 5-1/2"	1	Galvanized steel
8	10001214	BRACKET; EARTH 8'X5-1/2 DIA.	1	Galvanized steel
9	10022542	STRUT UNIT; COMPLETE FOR HT POLE	1	Galvanized steel
10	10000360	POLE; HT ST 36' x 5-1/2"	1	Galvanized steel
11	10001185	PIPE; GI 6"φ	As per requirement	Galvanized steel
12	10005075	CABLE; AL HT XLPE 3 CORE 300MM2	As per requirement	Aluminum
13	10000316	TERMINATION; HT OUTDOOR 300MM2	1	-
14	10000591	LUG; BIMETALLIC 185MM2	1	Bimetallic
15	10025973	BOLT&NUT; GI 1-1/2"X1/2" W/WASHER	3	Galvanized steel
16	10002161	CLAMP; POLE GI FOR HT CABLE 5-1/2"x4"	1	Galvanized steel
17	10021230	EFI; ENCLOSURE FOR HT STEEL TUB	1	MS
18	10000352	INDICATOR/LOCATOR; EARTH FAULT	1	-
19	10113278	POLE CLAMP 8 1/2" x 5" FOR HT CAB	1	Galvanized steel
20	10001097	WIRE; BINDING 14SWG	As per requirement	Galvanized steel
21	10001612	BOLT&NUT; GI 5"X1/2"	4	-
22	10001668	STRIP; SHACKLE G.I 19/18	4	GI

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26.6 DOUBLE EARTH GUARD WIRE ARRANGEMENT

Note:

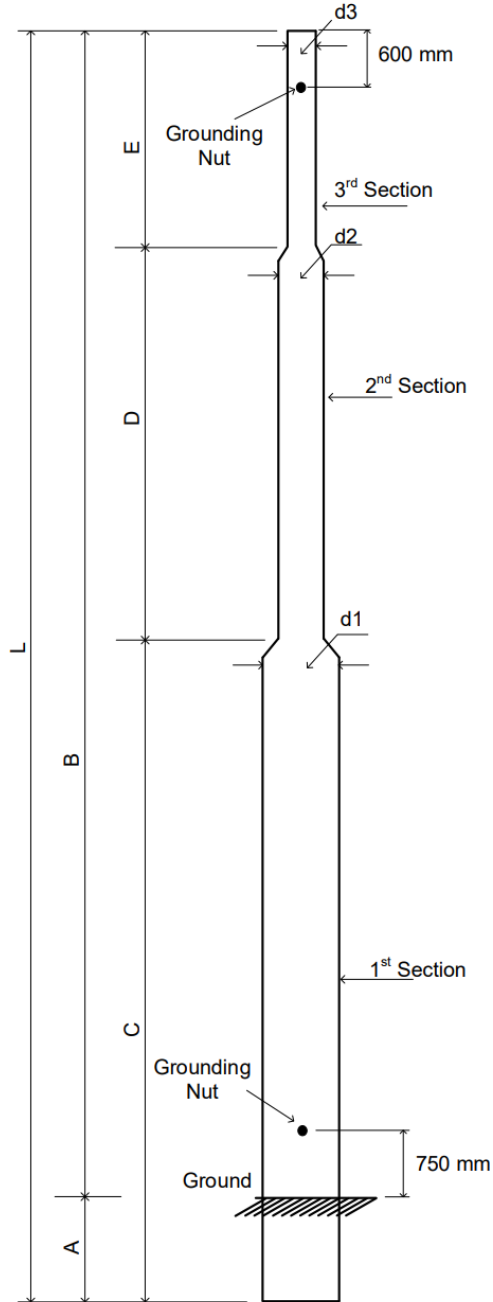
- This drawing is only for the details of spacing between guard wires
- For other details, please refer the respective detailed drawing for HT running poles.
- This is to be followed for both covered and bare conductor



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10001449	INSULATOR; PIN TYPE 11 KV	6	Porcelain
2	10001448	PIN; FOR PIN INSULATOR	6	Galvanized steel
3	10001206	BRACKET; POLE CH. I 14" X 5-1/2"	2	Galvanized steel
4	10001450	INSULATOR; DISC TYPE	24	Porcelain
5	10103583	CLAMP; DEADEND HT FOR XLPE INS CONDUCTOR	6	Galvanized steel
6	10120791	BEND; STRIP FOR DISC INSULATOR	12	GI
7	10102094	CONDUCTOR; XLPE COVERED ACSR TIGER	As per requirement	Aluminum
8	10002052	CONDUCTOR; ACSR RABBIT 2SWG	As per requirement	Aluminum
9	10001213	BRACKET; PHASE HT 5' X 5-1/2"	2	Galvanized steel
10	10001214	BRACKET; EARTH 8'X5-1/2" DIA.	2	Galvanized steel
11	10000360	POLE; HT ST 36' x 5-1/2"	2	Galvanized steel
12	10103582	CONNECTOR; IPC HT 95-240/50-185 MM2	12	Polyamide + Aluminum
13	10121183	RING; GROUNDING HT IPC XLPE CONDUCTOR	3	Aluminum
14	10121786	Tie; Pin Insulator for Covered Conductors	6	PVC
15	10001097	WIRE; BINDING 14SWG	As per requirement	Galvanized steel
16	10001612	BOLT&NUT; GI 5"X1/2"	6	-
17	10001668	STRIP; SHACKLE G.I 19/18	8	GI

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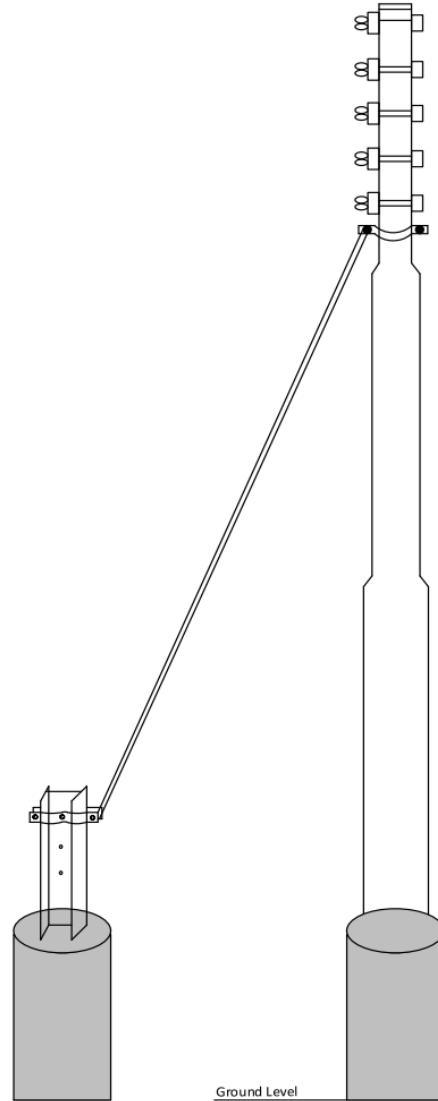
26.7 HT POLE INSTALLATION



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10000360	POLE; HT ST 36' x 5-1/2"	1	Galvanized steel
2	10001886	SHINGLE (BAJRI)	As per requirement	-
3	10013181	CEMENT; OPC	1	Ordinary Portland Cement (OPC)

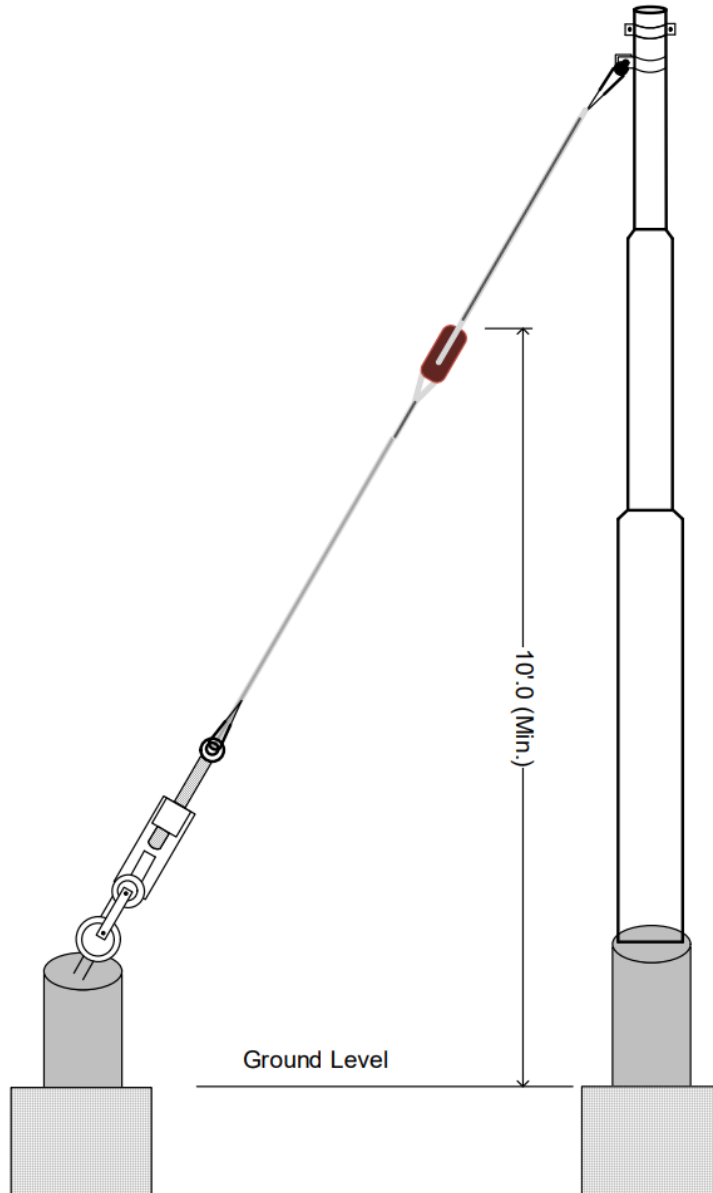
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26.8 HT STRUT INSTALLATION



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10022542	STRUT UNIT; COMPLETE FOR HT POLE	1	Galvanized steel
2	10025973	BOLT&NUT; GI 1-1/2"X1/2" W/WASHER	3	Galvanized steel
3	10001668	STRIP; SHACKLE G.I 19/18	4	GI
4	10001886	SHINGLE (BAJRI)	As per requirement	-
5	10013181	CEMENT; OPC	1	Ordinary Portland Cement (OPC)

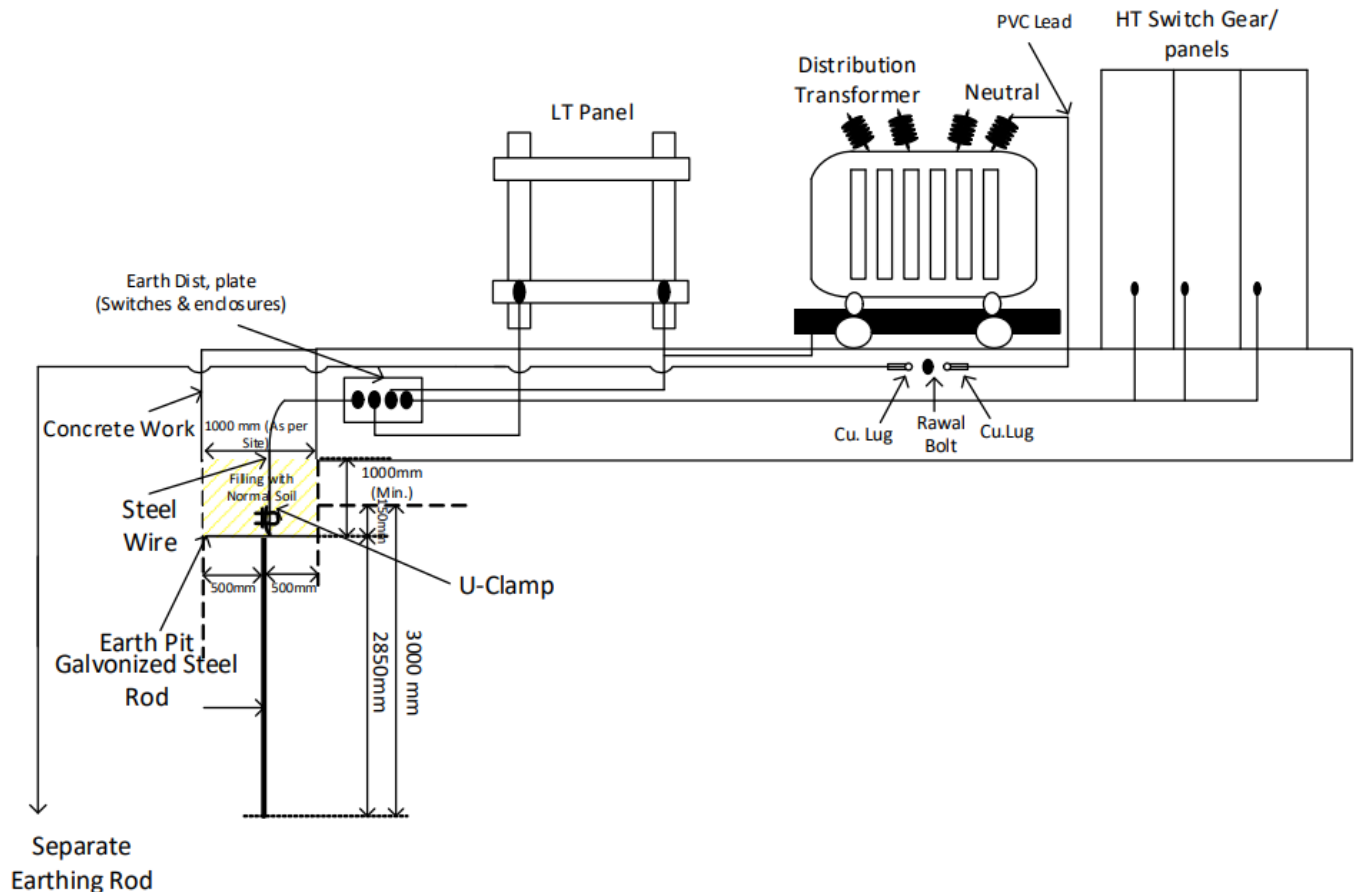
26.9 HT STAY INSTALLATION



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10023757	STAY UNIT; HT COMPLETE	1	Galvanized steel
2	10025973	BOLT&NUT; GI 1-1/2"X1/2" W/WASHER	3	Galvanized steel
3	10001099	WIRE; STEEL STAY G.I 7/8SWG	As per requirement	Galvanized steel
4	10001256	CLAMP; POLE GI STAY 6-1/2"	1	GI
5	10001254	CLAMP; POLE GI STAY 5-1/2"	1	GI
6	10116204	INSULATOR; STAY WIRE	1	Porcelain
7	10001886	SHINGLE (BAJRI)	As per requirement	-
8	10013181	CEMENT; OPC	1	Ordinary Portland Cement (OPC)

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26.10 EARTHING OF 11KV SUB-STATION

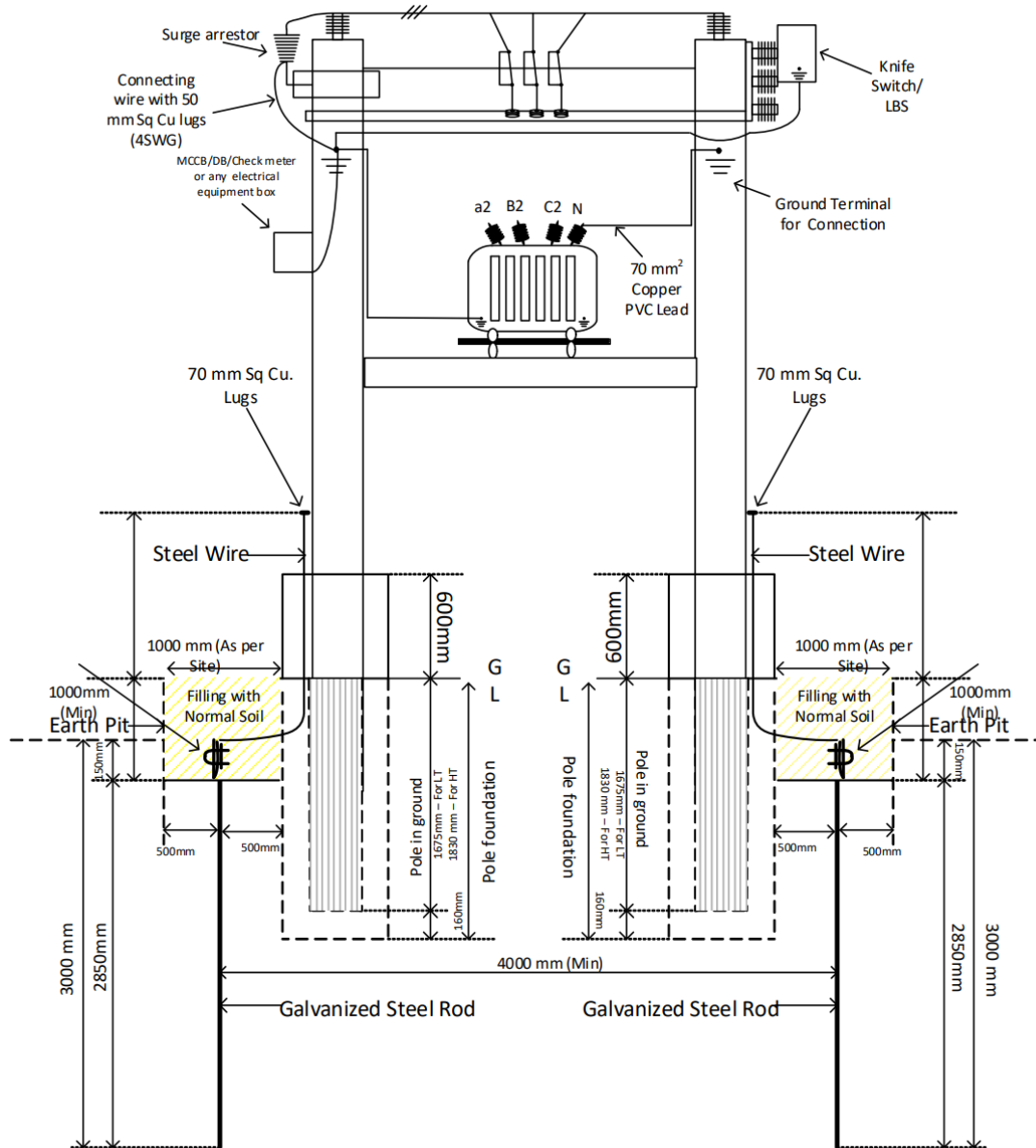


NOTE :

IF IT IS NOT POSSIBLE TO INSTALL/INSERT EARTHING ROD DIRECTLY INTO GROUND, EARTHING SHALL BE DONE THROUGH BORING AS PER THIS SOP.
 IF THE SPECIFIED EARTH RESISTANCE VALUE IS NOT ACHIEVED WITH ONE EARTHING ROD, TWO OR MULTIPLE EARTHING RODS SHALL BE INSTALLED AS PER PROCEDURE DEFINED IN THIS SOP
 ABOVE DRAWING IS INDICATIVE, EQUIPMENT(S) OTHER THAN SHOWN ABOVE SHALL ALSO BE EARTHED AS PER THIS SOP

S. No	SAP Code	Material Description	Quantity	Material Composition
1	10115491	WIRE; 7/3.25MM-10MM DIA GALVANIZ STEEL	18	Galvanized steel
2	10115513	ROD; 3000X16MM GROUNDING GALVANIZED MS	2	Galvanized MS
3	10115514	U-CLAMP; GROUNDING GALVANIZED MS (SET)	2	Galvanized MS
4	10001081	LUG; CU 70 MM2	2	CU
5	10025126	BAR; COPPER EARTHING DISTRIBUTION	1	CU
6	10025127	ROWAL BOLT G.I. 10MM DIA	3	GI
7	10013181	CEMENT; OPC	As per requirement	Ordinary Portland Cement (OPC)

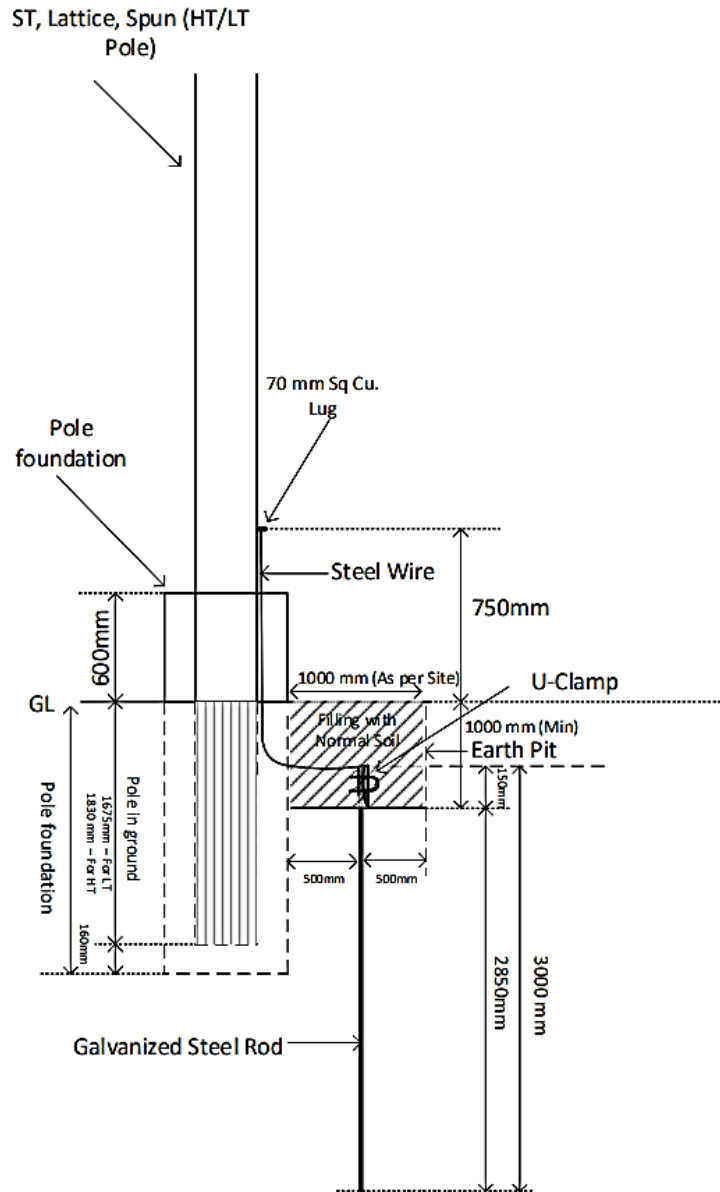
26.11 EARTHING OF 11KV PMT



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10115491	WIRE; 7/3.25MM-10MM DIA GALVANIZ STEEL	24	Galvanized steel
2	10115513	ROD; 3000X16MM GROUNDING GALVANIZED MS	2	Galvanized MS
3	10115514	U-CLAMP; GROUNDING GALVANIZED MS (SET)	2	Galvanized MS
4	10001081	LUG; CU 70 MM2	2	CU
5	10025126	BAR; COPPER EARTHING DISTRIBUTION	1	CU
6	10025127	ROWAL BOLT G.I. 10MM DIA	3	GI
7	10013181	CEMENT; OPC	As per requirement	Ordinary Portland Cement (OPC)

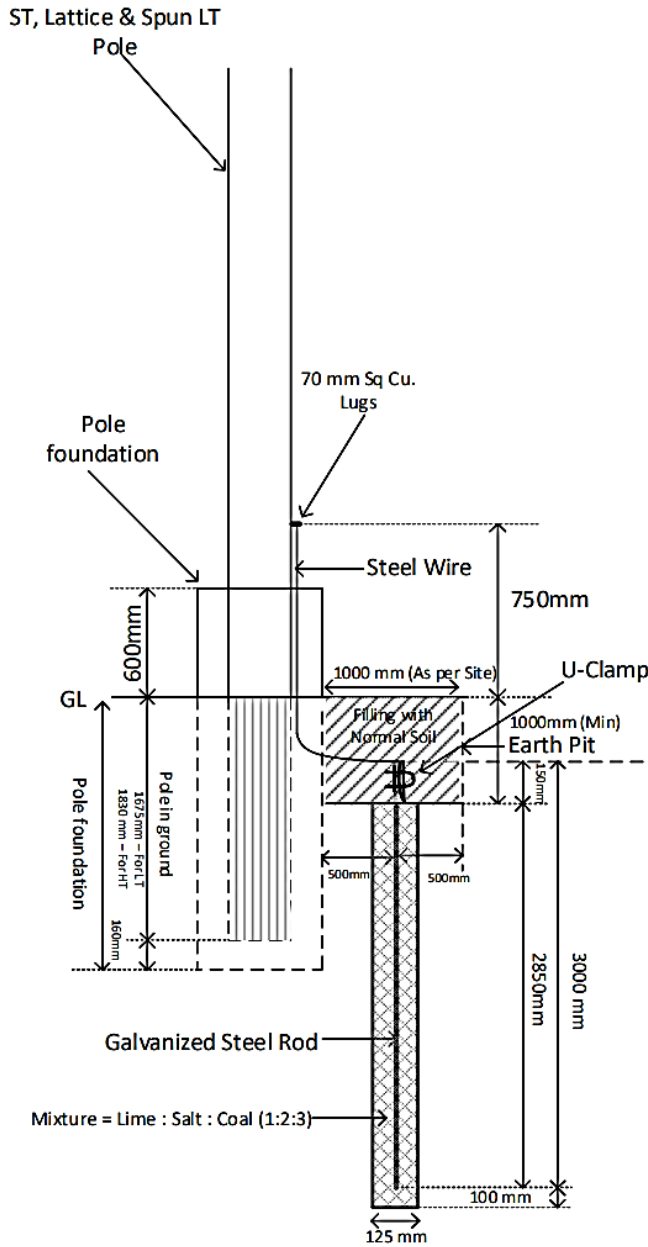
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26.12 EARTHING OF HT/LT POLE (Without Bore)



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10115491	WIRE; 7/3.25MM-10MM DIA GALVANIZ STEEL	3.5	Galvanized steel
2	10115513	ROD; 3000X16MM GROUNDING GALVANIZED MS	1	Galvanized MS
3	10115514	U-CLAMP; GROUNDING GALVANIZED MS (SET)	1	Galvanized MS
4	10001081	LUG; CU 70 MM2	1	CU
5	10001620	BOLT&NUT; GI 1-1/2"X1/2"	1	GI
6	10001552	ELECTRODE; WELDING MS 12 SWG	0.02	MS
7	10013181	CEMENT; OPC	As per requirement	Ordinary Portland Cement (OPC)

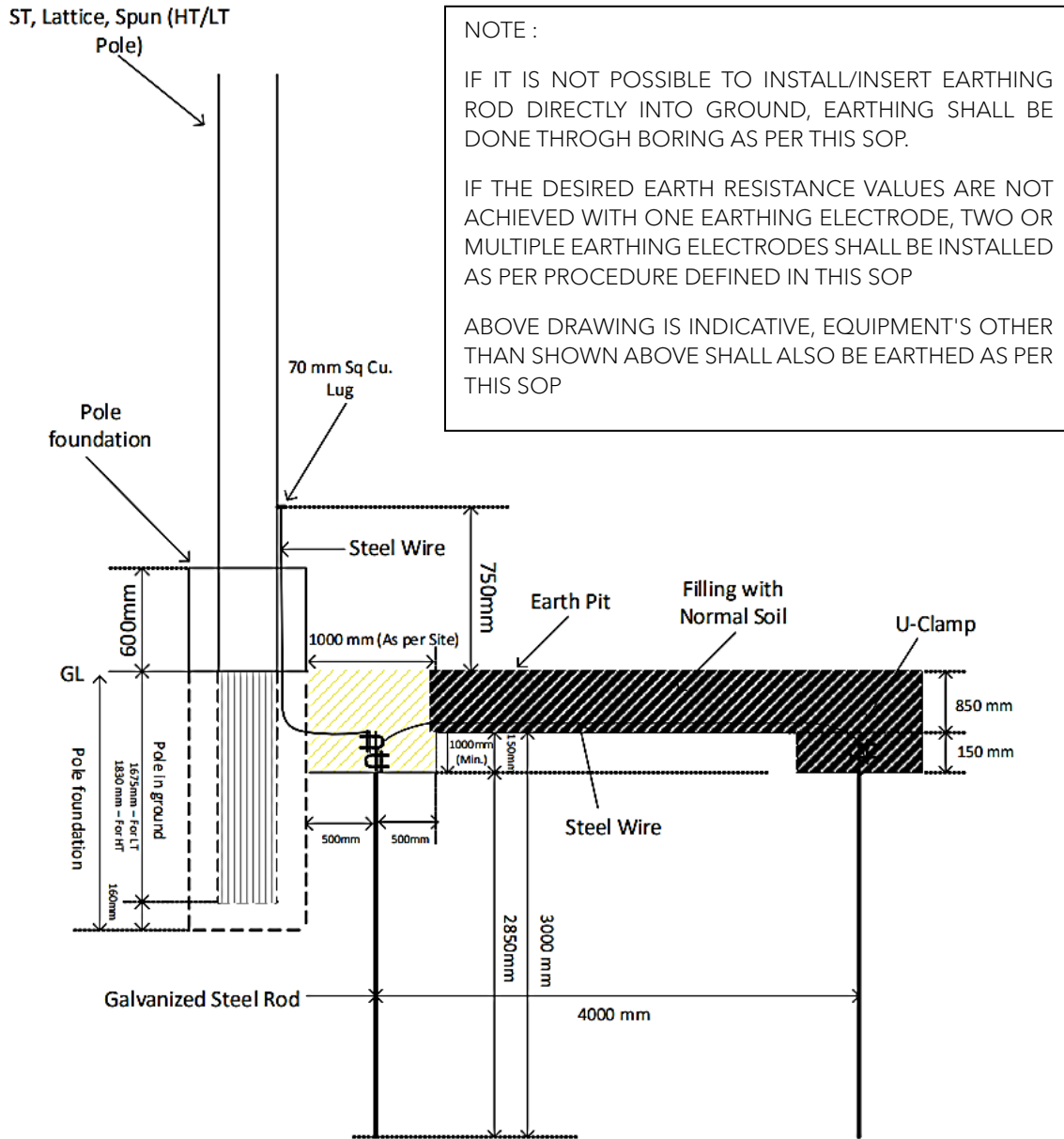
26.13 EARTHING OF HT/LT POLE (With Bore)



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10115491	WIRE; 7/3.25MM-10MM DIA GALVANIZ STEEL	3.5	Galvanized steel
2	10115513	ROD; 3000X16MM GROUNDING GALVANIZED MS	1	Galvanized MS
3	10115514	U-CLAMP; GROUNDING GALVANIZED MS (SET)	1	Galvanized MS
4	10001081	LUG; CU 70 MM2	1	CU
5	10001620	BOLT&NUT; GI 1-1/2"X1/2"	1	GI
6	10001552	ELECTRODE; WELDING MS 12 SWG	0.02	MS
7	10013181	CEMENT; OPC	As per requirement	Ordinary Portland Cement (OPC)

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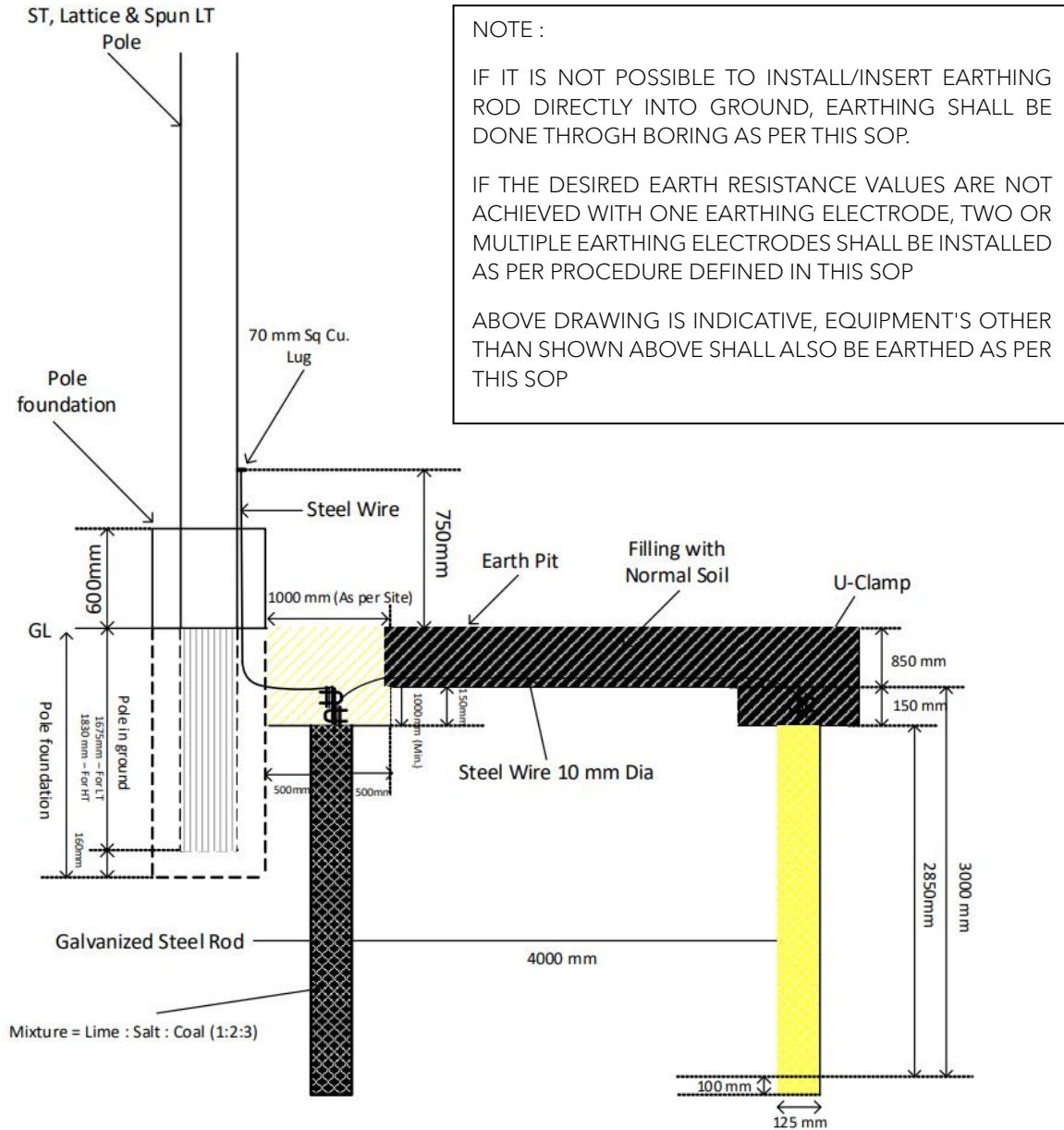
26.14 EARTHING OF HT/LT POLE MULTIPLE ROD (Without Bore)



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10115491	WIRE; 7/3.25MM-10MM DIA GALVANIZ STEEL	8	Galvanized steel
2	10115513	ROD; 3000X16MM GROUNDING GALVANIZED MS	2	Galvanized MS
3	10115514	U-CLAMP; GROUNDING GALVANIZED MS (SET)	3	Galvanized MS
4	10001081	LUG; CU 70 MM ²	1	CU
5	10001620	BOLT&NUT; GI 1-1/2"X1/2"	1	GI
6	10001552	ELECTRODE; WELDING MS 12 SWG	0.02	MS
7	10013181	CEMENT; OPC	As per requirement	Ordinary Portland Cement (OPC)

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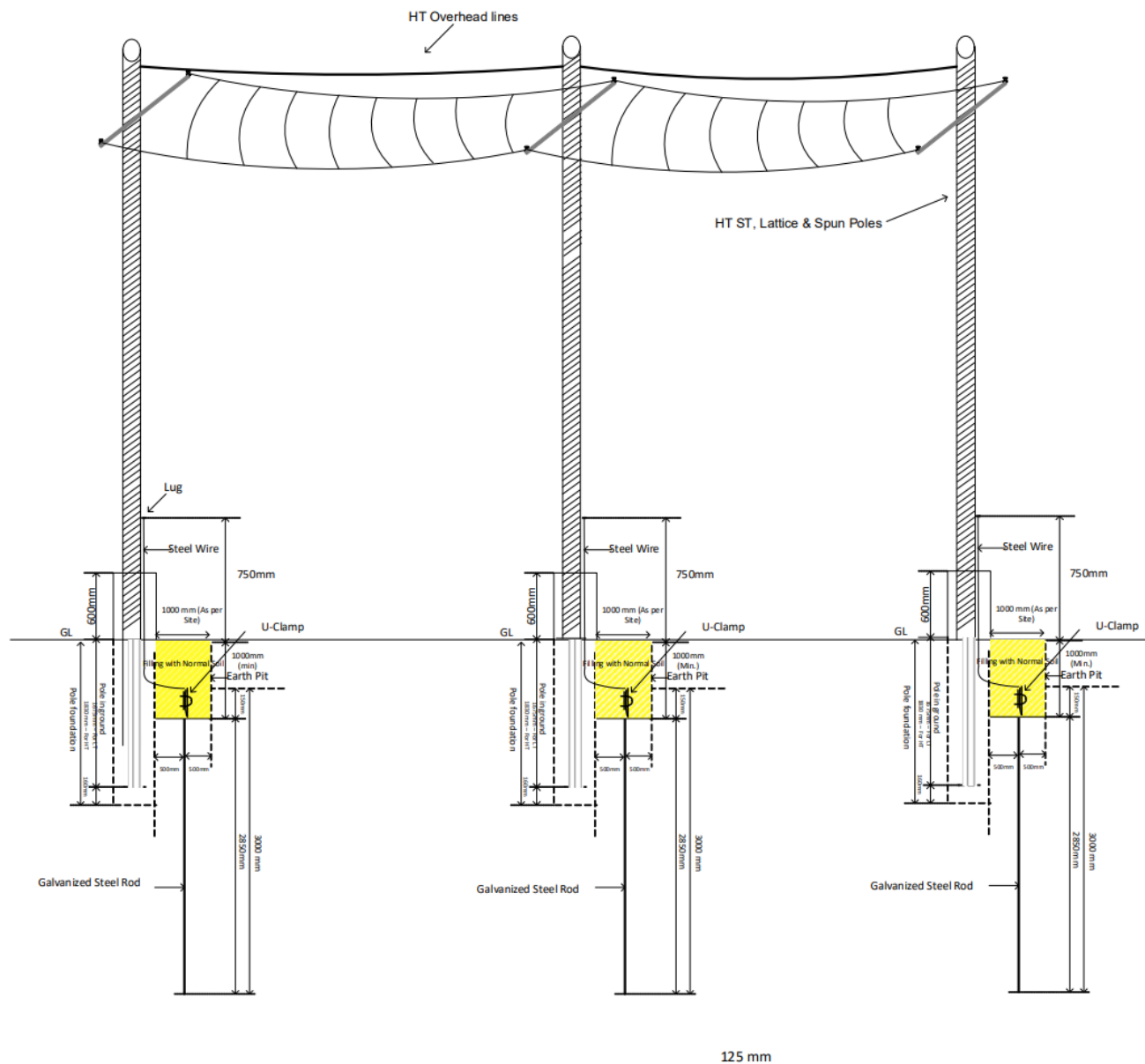
26.15 EARTHING OF HT/LT POLE MULTIPLE ROD (With Bore)



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10115491	WIRE; 7/3.25MM-10MM DIA GALVANIZ STEEL	8	Galvanized steel
2	10115513	ROD; 3000X16MM GROUNDING GALVANIZED MS	2	Galvanized MS
3	10115514	U-CLAMP; GROUNDING GALVANIZED MS (SET)	3	Galvanized MS
4	10001081	LUG; CU 70 MM2	1	CU
5	10001620	BOLT&NUT; GI 1-1/2"X1/2"	1	GI
6	10001552	ELECTRODE; WELDING MS 12 SWG	0.02	MS
7	10013181	CEMENT; OPC	As per requirement	Ordinary Portland Cement (OPC)

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26.16 PROVISION OF EARTHING WITH HT O/H



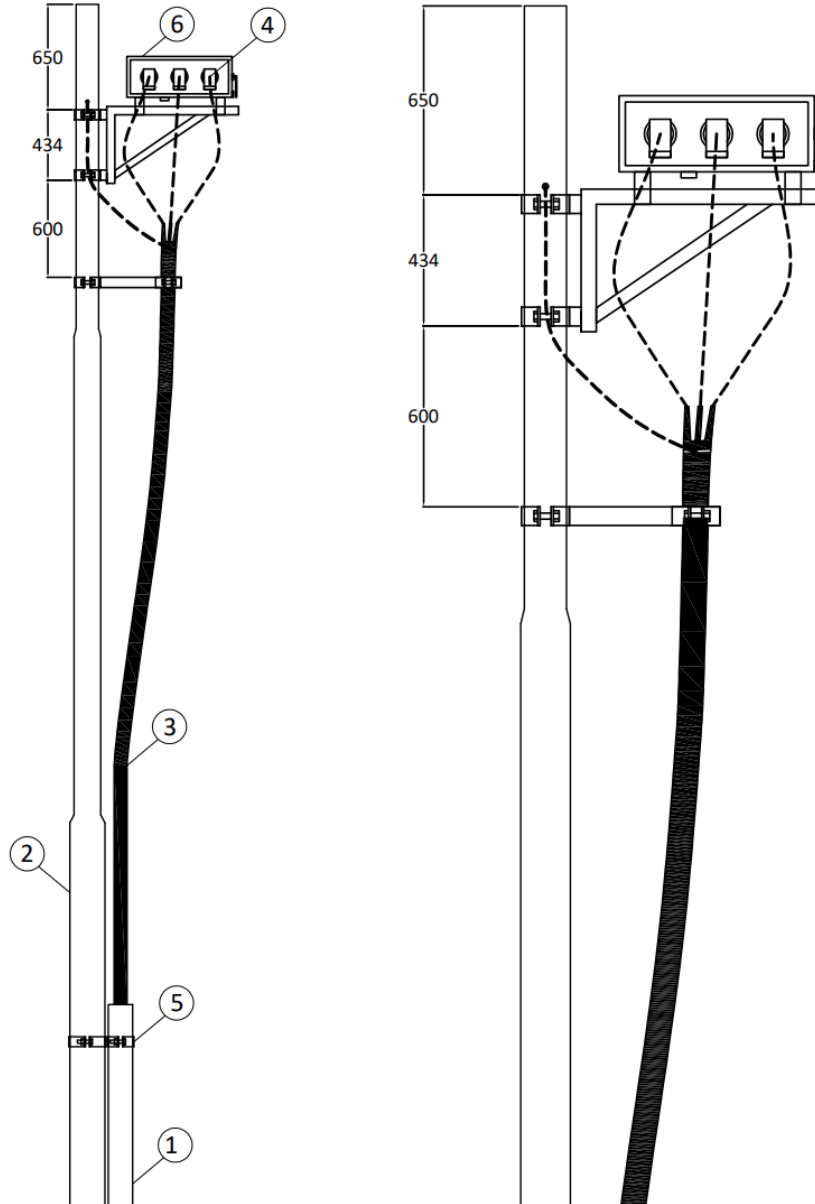
NOTE :

IF THIS IS NOT POSSIBLE TO INSTALL/INSERT EARTHING ROD DIRECTLY INTO GROUND, EARTHING SHALL BE DONE THROUGH BORING AS PER THIS SOP.

IF THE SPECIFIED EARTH RESISTANCE VALUE IS NOT ACHIEVED WITH ONE EARTHING ROD PIT, TWO OR MULTIPLE EARTHING RODS SHALL BE INSTALLED AS PER PROCEDURE DEFINED IN THIS SOP

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26.17 INSTALLATION OF LBS ON HT POLE



S. No	SAP Code	Material Description	Quantity	Material Composition
1	10001185	PIPE; GI 6"0	As per requirement	Galvanized steel
2	10000360	POLE; HT ST 36' X 5-1/2"	1	Galvanized steel
3	10005075	CABLE; AL HT XLPE 3 CORE 300MM2	As per requirement	Aluminum
4	10000316	TERMINATION; HT OUTDOOR 300MM2	1	-
5	10113278	POLE CLAMP 8 1/2" X 5" FOR HT CAB	1	Galvanized steel
6	10099946	LOAD BREAK SWITCH WITH ACCESSORIES	1	-