DOCUMENT CONTROL

Document Number	**TPDF02-DIS01-OCP-004**	
Title of Document	**HT CABLE JOINTING AND TERMINATION WORK**	
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Last Reviewed on		01.12.2022

Amendment Details:

Sr.	Issue No.	Rev. No.	Date	Amendment Details	Reviewed by	Approved by
1	1	0	01.12.2021	First Issue	Shilajit Ray Satish Shah	Snehal Shah Abdulrashid Shaikh
2	1	0	01.12.2022	First Review Done (No Changes)	Shilajit Ray Satish Shah	Ankit Saha Abdulrashid Shaikh

1. PURPOSE

1.1. 22 KV & 11 KV Cable Jointing and Termination Work

2. SCOPE OF DOCUMENT

2.1. The scope of this document is to define for 22 KV & 11 KV Cable Jointing and Termination Work

2.2. The process document aims to define the guidelines to ensure the process effectiveness as required by the Integrated Management System.

3. FIELD OF APPLICATION

3.1. This procedure is used for 22 KV & 11 KV Cable Jointing and Termination Work in TPL-D's Franchisee areas of Bhiwandi & SMK.

4. FREQUENCY

4.1. As and when required

5. AUTHORITIES AND RESPONSIBILITY

5.1. The Head of Distribution is responsible for implementation of this procedure for effectiveness.

5.2. The Head of HT O&M/Projects at respective locations are responsible for execution of this procedure for effectiveness.

6. REFERENCES

6.1. MERC Regulations (with its latest amendments)

6.2. Central Electricity Authority (Measures Relating to Safety & Electric Supply) Regulations 2010 (with its latest amendments)

6.3. OEM Manual for Jointing and Termination

6.4. OCP # TPDF02-STO01-OCP-006 (Operational Control Procedure for Handling, Collection, Storage and Management of Hazardous Waste)

7. SPECIFIC COMPETENCY REQUIREMENTS

7.1. Technician/GET/Jr. Exe/Exe/AM/M should have Knowledge of

(1) HT cable components

(2) Safe working practices and use of PPE

7.2. Technician/GET/Jr. Exe/Exe/AM/M having valid authorization from General Manager Distribution shall have authority for electrical isolation and issue of Permit to Work (PTW).

7.3. As per competency profile and assessment.

8. INTERFACE WITH OTHER DEPARTMENTS/SECTIONS, IF ANY

8.1. Store for material issue and return

8.2. Safety Department for information of work execution

8.3. Other Utilities for their network related information

8.4. Control room Department for Network Updation.

9. TOOLS AND TACKLES

9.1. Live line detector.

9.2. Kit of Wrap around Heat shrinkable sleeve if required.

9.3. Cable Jointing and Termination Kit as applicable

9.4. Excavation Tools (if required)

9.5. LPG Gas cylinder.

9.6. Gas torch.

9.7. Reusable boots.

9.8. Cable cutter/ Hack saw Blade.

9.9. Megger (IR tester) / Multimeter.

9.10. Discharge rod.

9.11. Jointer's tool kit.

9.12. Ladder if required.

10. PERSONAL PROTECTIVE EQUIPMENTS / SAFETY TOOLS

Following PPEs shall be used to carry out work at site.

10.1. Safety shoes/ Gum Boot

10.2. Safety Helmets

10.3. Insulated hand gloves of 22KV class

10.4. Flash back arrester.

10.5. Rubber mat 33kV insulated (if required)

10.6. Barricading tape (if required)

10.7. Caution board / "Men at work" sign board (if required)

10.8. Barricading cone (if required)

10.9. Fire extinguisher.

11. SIGNIFICANT RISK PARAMETRS

11.1. Quality Management System: Low

11.2. Impact on Environment: High

11.3. Health and Safety Risk: High

11.4. Energy Management: Medium

11.5. Asset Management Risk: High

12. PROCEDURE

12.1. JOB PREPARATION

(1) Identify type of Joint/Termination.

(2) Study of the cable route drawing or GIS drawing.

(3) Visit the site location for prelims for necessary tools, manpower and material requirement.

(4) Prelims for excavation work to be done, wherever permission of municipal corporation/ other agencies are required.

(5) Prepare Reservation / sub reservation for the material required to carry out the work.

(6) Collect and transport the material and equipment at site.

12.2. PRECAUTIONS

(1) Barricade the working area with barricading tape and appropriate sign board indicating work in progress wherever required

(2) Use all required PPEs during execution of the job.

(3) Check the LPG Gas bottle & its accessories

(4) At each location where isolation has been carried out and in which provision is there for padlocking, provide padlocking having LOTO/Padlock/NTC sticker and mention the details as under

(5) Keep LOTO/Padlock/NTC sticker and mention the details as under or put up caution board

(a) Reason for Isolation.
(b) Date and Time of Isolation.
(c) Isolation carried out by Engineer Name/ Sign of Engineer.

(6) After isolation, ensure zero potential on equipment where work is to be carried out using suitable device (like HV line detector)

(7) Use 22 KV hand gloves and Full Mask Helmet while caring out Hot Phasing Activity

12.3. ISOLATION

(1) For isolation equipment from the system follows the procedure as per OCP No: TPDF02-DIS01-OCP-005 for Distribution Network Isolation and Normalisation as per the switching requirement.

(2) Authorised person issue “Permit to work” as applicable to competent person after required isolation and local earthing.

12.4. WORKING PROCEDURE

(1) HT Cable Jointing

(a) Check whether the trench and pits are ready for cable identification & jointing work.

(b) Identify Phase Sequence

I. Ensure that no person remains in the open trench or pit at the end of "CUT" cable.

II. Move isolator position from 'Earth' To 'OFF' position.

III. Earth any one (e.g. R) phase at far end

IV. The core at which IR value w.r.t. earth is zero /Multimeter shows continuity with earth this end is R-phase.

V. Similarly confirm other two phases.

VI. Mark all the three phases of cable.

VII. Repeat same procedure for another portion of cable.

(c) Cable Jointing

I. For XLPE-to-XLPE cable Joint

i. For Heat shrinkable (HS) straight through Joint follow the procedure as per OEM manual available with jointing kit.

(2) HT Cable Termination

(a) Ensure zero potential on equipment where work is to be carried out using suitable device (like HV line detector).

(b) Identify Phase Sequence

I. While operating switchgear at far end, ensure no person is working on cable.

II. Move isolator position from 'Earth' To 'OFF' position at far end substation

III. Earth anyone (e.g. R) phase at far end

IV. The core at which megger IR value w.r.t. earth is zero /multimeter shows continuity with earth at this end is R-phase.

V. Similarly confirm other two phases.

VI. Mark all the three phases of cable

(c) Start Termination process

I. For XLPE cable Termination:

i. For Heat shrinkable (HS) Indoor/ Outdoor/ touch proof Termination. Follow the procedure as per OEM manual available with termination kit.

(d) After above procedure insert boots in all cores and terminate the same in case of HT cable box of switch gear/ transformer.

(3) Wrap around Heat shrinkable sleeve on HT Cable

(a) Application of wrap around cable sleeve on the partially cut outer jacket or insulation for prevention of cable fault due to ingress of water.

(b) If require carryout excavation for opening sufficient length of cable.

(c) Cut the require portion of cable outer jacket.

(d) Apply Black Mastic around the damage Portion.

(e) Apply heat shrinkable wrap around sleeve on the cut portion of cable

I. Allow it to shrink till the sleeve completely takes the shape of cable outer jacket.

II. Allow it to cure for few minutes.

III. Cover the cable with cable protecting cover.

IV. Back fill the open trench

(4) Cable Phase Verification: Check phase sequence of newly terminated cable with already connect 11/ 22 KV cable using following procedure

(a) Cold Phasing using Voltage Presence Indication System (VPIS)

I. Check both isolators are in “OFF” position

II. Check at Voltage Presence Indication System (VPIS) that both cables are in charged condition

III. Ensure both cables are energized from different sources

IV. Check voltage difference between R-Phase indications of both VPIS.

V. If voltage difference is in range of 10 to 15 Volts, phase sequence is correct

VI. If voltage difference is in range of 50 to 70 Volts phase sequence is incorrect

i. For incorrect phase sequence check voltage difference between R-Phase indication of re-terminated cable VPIS with Y-phase and B-phase VPIS of reference source cable.

ii. Phase for which voltage difference is in range of 10 to 15 volts is the correct phase for re-terminated cable

VII. Similarly confirm phase sequence in other two phases

(b) Cold Phasing using Multimeter/Megger

I. While operating switchgear at far end, ensure no person is working on cable.

II. Move isolator position from 'Earth' To 'OFF' position at far end substation

III. Earth anyone (e.g. R) phase at far end

IV. The core at which megger value w.r.t. earth is zero /multimeter shows continuity with earth at this end is R-phase.

V. Similarly confirm other two phases.

VI. Mark all the three phases of cable.

(c) Hot Phasing (To be followed in EHV Substation panels only if required)

I. Rack out 22/11 KV HT breaker from compartment

II. Open both Busbar and cable side flaps in HT breaker compartment.

III. Ensure panel bus is in charged condition through panel indications / live line detector

IV. Ensure 22/11 KV power from alternate source is available at 11/ 22 KV cable using live line detector

V. Using 22/11 KV Hot Phase Checking Kit check phase angle between R-Phase of busbar and cable

VI. If phase angle is 0, phase sequence is correct

VII. If phase sequence is in multiple of 120° phase sequence is incorrect

i. For incorrect phase sequence check phase angle between R-Phase of cable with Y-phase and B-phase of busbar

ii. Phase for which phase angle is 0 is the correct phase for re-connection of cable.

(5) SITE HOUSEKEEPING

(a) After completion of work remove all packing, waste material and dump, Collect & submit to stores.

(b) Clean the whole area.

(c) Remove barricades, temporary stakes etc.

(d) Ensure the backfield areas are level with ground surface & rammed it to avoid create potholes

(e) Extra soil to be remove and dump at proper location.

12.5. RESTORATION

(1) Take clearance from concerned person and Cancel “Permit to work”

(2) Shift all the manpower and tools and tackles from the site.

(3) Remove excess material & scrap from the job area.

(4) For normalisation of above switching follow the procedure as per OCP No: TPDF02-DIS01-OCP-005 for Distribution Network Isolation and Normalisation.

(5) Inform Control room regarding normalisation of section.

(6) Remove the temporary switching from the control room giving all relevant details.

12.6. WORK CHECKLIST

(1) Update Quality Check entries in Standard Format (Field Force Application or Hard copy)

12.7. UPDATION

(1) Upload site photographs of allocated job on respective order in SAP or Field Force Application

(2) Prepare jointing details (Joint Number, Jointer name, Type of Joint, Date of Joint made), length of cable, type of cable, size of cables etc. at the time of cable jointing work.

(3) Inform - Draftsman regarding Updating of Cable Joints in system.

(4) Update in GIS / SAP, if applicable.

(5) Give the changes made in network if required, so that same can be updated in SDB (System Diagram Book) by Drawing Department.

(6) Material reconciliation is to be done.

13. IMPACT ANALYSIS OF SIGNIFICANT RISKS

13.1. QUALITY MANAGEMENT SYSTEM

(1) Details of Quality Issues involved

(a) Incompetent manpower (Poor workmanship)

(2) Details of Quality Assurance plan

(a) Work Quality/OCP/on job Training

(b) Work Quality Audit

(c) Effective supervision

(d) Penalty mechanism

13.2. HEALTH AND SAFETY

(1) Details of Health and Safety Hazard involved

(a) Pick-axe on live cable

(b) Contact with sharp edges

(c) Hit by Excavation tool

(d) Penetration of dust particles in eyes during excavation

(e) Working in bending position / Awkward Posture

(f) Excessive workload

(g) Ingress of polluted water in excavated pit

(h) Contact with Live terminal/ cable/ wire/ busbar

(i) Use of faulty Tools

(j) Negligence of use of safety PPEs / Non usage of PPEs/ Use of faulty PPEs

(k) Wrong Methods of lifting material

(l) Contact with Hot Part of burner

(m) Flash Over during switching operation

(n) Fire due to LPG leakage/ mishandling

(o) Poor illumination

(p) Flash over during connection-Disconnection

(q) Accident to public due to working without Area barricading

(r) Inhalation of LPG gas

(s) Road/RCC breaking activity by JCB or Road breaker - Exposure to continuous Hand-arm & full-body vibrations

(t) Road/RCC breaking activity by JCB or Road breaker - Exposure to continuous Noise

(u) explosion of pressurized LPG gas cylinder or accessories

(2) Health and Safety Precautions required

(a) Ensure the Gas bottles & it's accessories in working and safe condition

(b) Hot work permit

(c) Ensure the PPEs in healthy condition during execution of the job

(d) Barricade the working area by barricading tape wherever required.

(e) Keep the fire extinguisher ready within reachable limit for any exigency

13.3. ENVIRONMENT

(1) Details of Environmental impact

(a) Land Contamination

(b) Resource Depletion

(c) Air Pollution

(2) Precautions to minimize Environmental impact

(a) Ensure that all type of generated waste including hazardous waste should be collected and submitted to stores as per OCP no: TPDF02-STO01-OCP-006.

(b) Ensure that all persons working at site are aware about environmental impact

(c) Ensure that there is no ignition source present near to the site

(d) Tool inspection & checking before usage

(e) Consumption Monitoring Records of Joints & Terminations

(f) Material / Scrap Reconciliation in SAP

13.4. ENERGY MANAGEMENT

(1) Details of energy use involved

(a) Usage of LPG gas for heat shrink termination

(b) Fuel consumption in transportation/ material movement

(2) Precautions to minimise energy use

(a) Optimum usage of LPG in termination work

(b) Ensure Optimum Usage & Turn off the engine of the vehicle when not in use

13.5. ASSET MANAGEMENT

(1) Details of Asset related Risk

(a) NIL

(2) Mitigation plan for asset related risks- NIL

(a) NIL

14. LIST OF ATTACHMENTS

Sr	Document /Record Description	Reference No.
1.	Hot Work Permit	TPDF02-SAQ02-OCP-008-F01
2.	Permit to Work (PTW)	TPDF02-SAQ02-OCP-005-F02
3.	Deviation format	TPDF02-DIS00-FOR-001

***** End of Procedure *****