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E-BOOK 11 ADVANCED EDITION

HT Cable Hi-Pot Testing & Fault Location

Safe Procedures for 11 kV Underground Cables

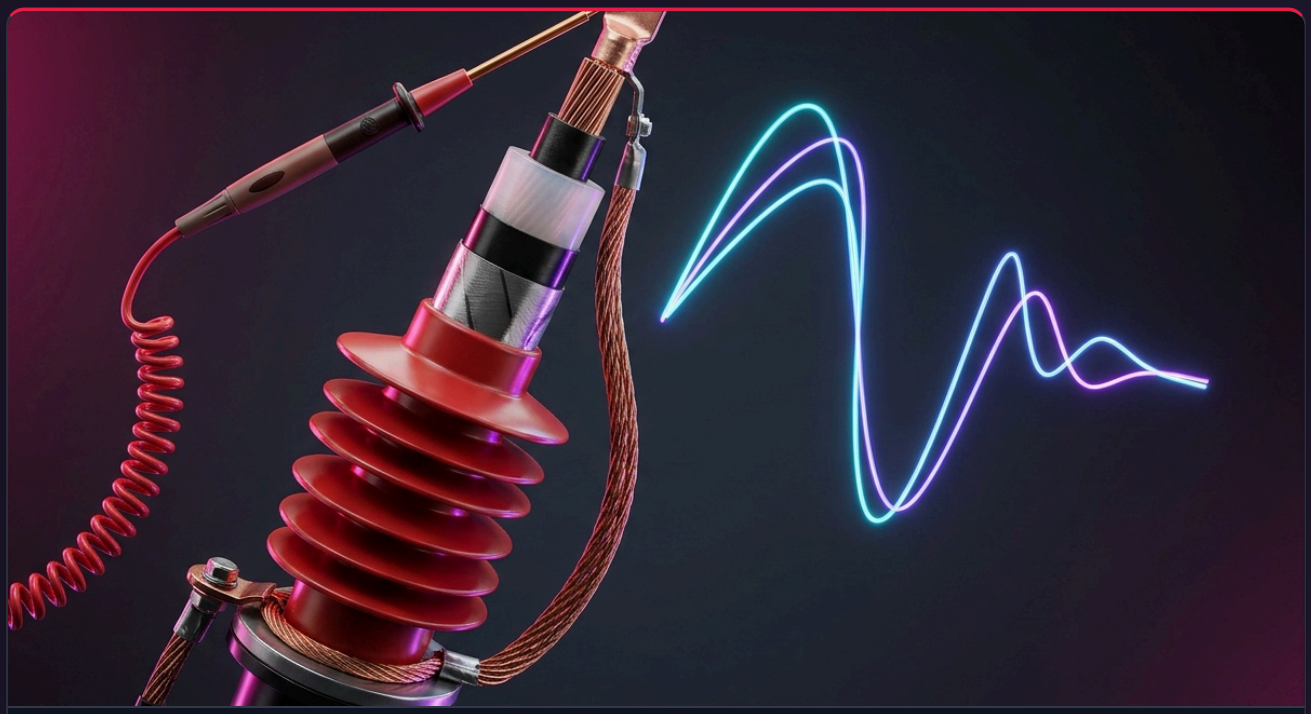


FIG 11.1 — 11 KV XLPE TERMINATION, HIPOT PROBE & TDR FAULT TRACE

SYLLABUS	CALCULATIONS	SITE READY
10 Structured Chapters	Worked SI Examples & Tables	Forms & Hinglish Glossary

Shree Ganesh Enterprises (SGE) — AMC MEP 24x7
Fire Fighting · Fire Alarm · Electrical · Plumbing · HVAC · IBMS · AMC

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HT Cable Hi-Pot Testing & Fault Location

Safe Procedures for 11 kV Underground Cables

A strict, safety-first procedure manual for 11 kV underground XLPE cable testing and fault location: cable anatomy, Permit-to-Work & LOTO isolation, IR/Megger diagnostics, VLF 0.1 Hz AC vs DC Hi-Pot testing principles, step-by-step discharge safety, TDR pre-location, acoustic thumper pinpointing without blind excavation, and sheath fault tracing.

Intended Audience: High-voltage testing & commissioning engineers, substation operators, electrical maintenance heads, and fault-location field crews.

Engineering Notice & Standards Policy

This publication is an educational and field-reference guide prepared by **Shree Ganesh Enterprises (SGE)**. It is **not** a substitute for a stamped project design, statutory approval, or the governing text of the National Building Code of India (NBC), Bureau of Indian Standards (BIS) codes, Indian Electricity Rules / CEA Regulations, or your State/Municipal Fire Service Bye-Laws. Standards are cited at document level; always verify the **current applicable edition**, manufacturer datasheets, and local amendments before design, procurement, testing, or certification.

Worked numerical examples across this book are illustrative engineering demonstrations. All design inputs, pipe friction factors, battery deratings, and protective clearances must be re-checked for project conditions by a competent licensed professional. High-voltage electrical testing, pump-room servicing, and gaseous fire suppression operations can be fatal if undertaken without qualified personnel, written Permits-to-Work, and Lockout-Tagout (LOTO) controls.

Roman-script Hindi/Hinglish site terms are included cleanly to assist execution teams; formal English engineering terminology governs contractual and code interpretations.

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What You Will Learn

- Inspect 11 kV XLPE layered construction (semicon screens, insulation, copper tape screen, armour) and common failure triggers
- Enforce strict dual-end HV Isolation, Permit-to-Work, LOTO, Barricading, and Stored-Charge Earthing
- Understand why modern utilities favour VLF 0.1 Hz AC over DC Hi-Pot on aged XLPE cables—and how to verify test kV safely
- Execute high-voltage withstand tests with safe ramp-up, leakage monitoring, and earthing-stick discharge
- Pre-locate underground cable faults precisely with TDR pulse arithmetic (V/2 velocity calibration)
- Pinpoint exact fault coordinates acoustically with surge thumper + step-voltage before opening a single pit

Chapter 1: 11 kV XLPE Underground Cable Anatomy and Failure Mechanisms

Why 11 kV Cables Cannot Be Treated Like Ordinary 415 V Wires

Inside a 3-core 11 kV XLPE underground feeder, electrical stress gradients concentrate intensely around every sharp point, air void, or trapped moisture drop. Manufacturers build a precise multi-layer coaxial shield assembly where every microscopic layer prevents corona breakdown:

Cable Layer (Inside -> Outside)	Engineering Function	What Happens When Damaged on Site
Stranded Al/Cu Conductor	Carries 11 kV phase load amperes	Water wicks down strand gaps causing black oxidation
Conductor Semicon Screen	Smooths sharp wire-strand bumps into uniform circular electric field	Leaving scratches/knife nicks during stripping triggers partial discharge!
XLPE Main Insulation	High-dielectric polymer holding e.g. 6.35 kV phase-to-ground smoothly	Water treeing, voids, or bending crushes cut dielectric strength
Insulation Semicon Screen	Confines electric field purely inside XLPE; peeled carefully at terminations	Failure to paint/terminate stress-control cone causes surface flashover tracking
Copper Tape Metallic Screen	Carries capacitive charging current & phase-to-earth fault return	Un-earthed or corroded screen burns jackets rapidly
Galvanized Steel Armour & PVC Sheath	Protects against JCB digs & blocks underground groundwater	Sheath cuts admit subsoil moisture into metallic screen

WARNING (LETHAL HAZARD)

High-voltage (11 kV / 33 kV) cables act as massive electrical capacitors storing lethal DC/AC trapped energy **long after switchboards are turned OFF!** All testing, earthing, and termination work MUST be executed strictly by authorized, qualified HV personnel holding valid Electrical Supervisory Permits, PPE, insulated rescue hooks, and written Permits-to-Work.

HINGLISH

Semicon layer = taar ke upar ki kaali conducting parat jise joint banate samay bade dhyan se chheela jata hai.
Stress cone = 11 kV termination par electric dabav kam karne wala joint hissa.

Chapter 2: Mandatory Pre-Test HV Safety, Permits, LOTO and Earthing

Never Touch a Core Because an Incomer Light Is Off

1. **Both-End Isolation & Visible Break:** Open RMU / VCB / HT isolator switches at **BOTH sending end and receiving end**! Never rely solely on closed breaker indicator LEDs—rack out breakers physically to visible

disconnected test position.

2. **Apply Personal Padlocks & Warning Tags (LOTO):** Each crew working on the feeder places an individual padlock and signed **"DANGER — MEN WORKING ON CABLE / HV TEST IN PROGRESS"** tag at *both* ends!
3. **Discharge & Solidly Earth Before Touching:** Verify dead state with a rated HV Contact/Proximity Voltage Detector (tested on live known source first -> test cable -> re-verify tester!). Apply dedicated heavy copper portable **Discharge & Earthing Leads** to all three phases (`R–Y–B`) cleanly before touching terminations with bare hands or insulated tools!
4. **Disconnect Sensitive Equipment Completely:** Isolate Potential Transformers (PTs), Surge Arresters (LAs), transformer bushings, and RMU SF6 bus links cleanly BEFORE applying high-voltage withstand pressure—testing with a Surge Arrester attached blows the arrester directly at ~8–10 kV!
5. **Perimeter Barricade & Guards:** Rope off both cable ends cleanly with bright caution tape and station a dedicated guard **at the far open end** with two-way radio contact so nobody walks into bare energized 20+ kV test tips!

> **HINGLISH**
> Earthing rod / Discharge stick = cable test karne ke baad andar bachi hui jaanleva bijli ko zameen mein utarne wali lambi insulated chhad. Both-end isolation = taar ke dono siron (sending aur receiving) se breaker khol kar lock karna.

Chapter 3: Diagnostic Tests — IR (Megger), VLF 0.1 Hz AC vs DC Hi-Pot and Sheath Test

Why Utilities Shifted Away from High-Voltage DC on XLPE

Years ago, field crews plugged heavy **DC Hi-Pot** sets blindly onto underground cables because DC sets were small and light. Experience proved **high-voltage DC damages aged extruded XLPE polymers** by trapping permanent space-charge pockets inside water trees—causing cables that *passed* a DC test on Monday to explode catastrophically on 50 Hz AC energisation on Wednesday! Therefore modern utilities and global standards (such as IEC 60502 / IS 7098 / IEEE 400.2) strongly favour **VLF (Very Low Frequency 0.1 Hz) Sinusoidal/Cosine-Rectangular AC** for field withstand tests on XLPE—keeping legacy DC tests restricted carefully (e.g., primarily PILC paper-oil cables or outer PVC sheath checks!).

Test Method	What It Finds Best	Modern Field Status for 11 kV XLPE	Key Field Precaution
1. DC Insulation Resistance (Megger e.g. 5 kV DC)	Gross dampness, direct earth/phase breakdown, dead shorts	Mandatory **BEFORE & AFTER** any Hi-Pot test!	Always verify discharge after test (`5x` test time minimum earth!)
2. VLF 0.1 Hz AC Withstand Test	Pinholes, bad joints, installation cuts inside XLPE cleanly	**Preferred modern standard** per utilities / IEEE 400.2	Confirm exact test kV & hold duration per cable standard/utility rules
3. DC Hi-Pot Test	Legacy paper-oil (PILC) insulation & low-kV sheath checks	Discouraged on *aged* XLPE cores by utilities	NEVER exceed vendor/utility approved sheath or core kV limits!
4. Outer PVC Jacket Sheath Test	Trench stone cuts/pinholes admitting soil water into armour	Routine acceptance & preventive check after backfilling	Disconnect armour earth pit bond temporarily at both ends cleanly!

NOTE (HOW TO DETERMINE CORRECT TEST VOLTAGE)

Do NOT guess or invent test kV numbers on site! Exact Hi-Pot / VLF test voltages vary depending on cable rated voltage (`Uo/U` , e.g., `6.35/11 kV` un-earthed vs `11/11 kV`), **New Acceptance Test vs Aged Maintenance Test**, waveform type (Peak vs RMS), and local **State DISCOM / BIS IS 7098 / IEC 60502** rules. Always extract the signed test voltage and minute duration directly from your approved OEM/Utility commissioning sheet before setting dials!

WORKED EXAMPLE 1

Why VLF 0.1 Hz Works Portable vs 50 Hz AC (Illustrative). A **0.8 km** (`800 m`) feeder of `11 kV 3C x 300 mm2 XLPE` has assumed core-to-screen capacitance `0.25 uF/km` -> Total capacitance `C = 0.8 x 0.25 = 0.20 uF` (`0.20 x 10^-6 F`). Assume an illustrative RMS test voltage of `19 kV` (check your utility spec!). Compare reactive capacitive charging current `I_c = 2 x pi x f x C x V` :

- On a normal **50 Hz** supply: `I_50Hz = 2 x 3.1416 x 50 x 0.20e-6 x 19,000 = 1.194 Amps` (~22.7 kVA heavy truck-mounted generator!).
- Using **0.1 Hz VLF AC**: `I_0.1Hz = 2 x 3.1416 x 0.1 x 0.20e-6 x 19,000 = 0.00239 Amps = 2.39 mA` ! (Powers off a **45 VA portable briefcase** on a single 230 V socket!).

HINGLISH

VLF 0.1 Hz test = XLPE cable ko bina nuksan pahunchaye uski asli ac-jaisi taaqat check karne wala modern machine. Sheath test = bahari kaale PVC cover mein gadda ya kankad se kata hua chhed check karna.

Chapter 4: Step-by-Step Hi-Pot / Withstand Test Execution and Post-Test Discharge

Clean Field Procedure (Single Phase at a Time)

1. **Establish Communications & Check Clean Ends:** Keep far end completely insulated cleanly inside outdoor air space (minimum safe creepage gap away from earthed steel gland cages!); guard confirms visually via radio!
2. **Pre-Test 5 kV IR (Megger) Baseline Check:** Record `R–E`, `Y–E`, `B–E`, `R–Y`, `Y–B`, `B–R` after 60 seconds stabilization (plus compute Polarization Index PI `10 min / 1 min` where required). Confirm dry wiped terminations!
3. **Earth Unused Phases:** Connect the two phases *not* currently under test solidly onto the metallic screen / station earth bar! (Testing `R–Phase` while `Y` and `B` float loose risks induction flash!).
4. **Ramp Voltage Smoothly:** Zero-check test dials -> Energise -> Raise test voltage smoothly in clean controlled steps per standard/utility test curve up to target test level, watching microamp/milliamp leakage meter continuously!
5. **Hold & Log Leakage Current Stability:** Steady or gently falling leakage current over the specified hold minutes indicates **healthy insulation**; climbing exponential leakage spike warns imminent breakdown -> abort gently to preserve diagnostic trace!
6. **Ramp Down, Solidly Earth & Discharge Completely!** Turn voltage down smoothly to ZERO -> Open HV relay -> Hook heavy **insulated discharge rod cleanly** onto tested phase -> Leave permanent **solid earth strap clamped >= 5 to 10 minutes** minimum (XLPE exhibits dangerous *dielectric absorption rebound* where voltage creeps back up on open cores!).
7. **Post-Test 5 kV IR Verification Check:** Must remain clean and match Pre-Test M-Ohm / G-Ohm magnitude without drop!

> **WARNING**
> **Dielectric Recovery Kills!** Even after tapping an 11 kV cable quickly once with an earth rod, residual charge trapped deep inside XLPE plastic rebounds slowly back to thousands of volts within seconds! Leave temporary earth clamps **firmly bolted onto all 3 cores** until ready to torque onto switchgear busbars!

Chapter 5: Cable Fault Classification

Never Connect a Thumper Before Measuring Fault Resistance

Before dragging heavy surge generators across campus, diagnose exact fault physics using a multimeter and 5 kV Megger:

Fault Class	Multimeter Continuity & 5 kV IR Behaviour	Typical Physical Site Cause
Dead Short (Phase-to-Earth / Phase-to-Phase)	`0–50 Ohms` low resistance (`0.00 G-Ohm` on Megger)	Excavator / auger struck feeder; crushed joint short
Open-Circuit Break	Zero continuity phase-to-phase on looped far end; IR high or medium	Burnt-out single core joint sleeve pulled cleanly apart
High-Resistance / Flashing Fault	Shows healthy on low-volt multimeter (`OL` M-Ohms), breaks down only when VLF/Hi-Pot climbs > 4–8 kV!	Hairline crack inside moisture-damp joint sleeve
Sheath / Jacket Fault	Phases measure G-Ohms OK cleanly; **Armour-to-Earth reads low Ohms!**	Backfill stone crushed outer PVC jacket allowing soil moisture in

HINGLISH

Flashing fault = jo mamuli megger par theek dikhe par high-voltage badhane par patakha maarke leak ho jaye!

Chapter 6: Pre-Location Without Digging — TDR, Arc Reflection and Murray Loop

Finding Fault Metres Inside Your AC Control Van

Pre-location calculates *how many metres down the trench* the fault hides before touching a single pickaxe!

1. **TDR (Time Domain Reflectometry / Pulse Radar):** Fires tiny safe low-voltage nano-second radar pulses cleanly down the copper/aluminium conductor. Open breaks bounce positive upward echoes; dead short circuits bounce sharp inverted downward echoes! Measure round-trip time `t` cleanly!
2. **Arc Reflection / Multiple Impulse Method (ARM / MIM):** When high-resistance flashing faults stay invisible to tiny 5 V TDR pulses, a controlled high-voltage pulse momentarily sparks an arc across the fault gap—holding a temporary short circuit for a millisecond while the TDR fires right across it cleanly locking exact fault distance!
3. **Bridge Method (Murray / Glaser Bridge):** High-precision DC resistance bridge comparing faulted core length against a healthy return core loop (super-accurate on steady low-to-medium ohmic shorts & jacket sheath faults!).

FORMULA

`TDR Cable Distance: d (metres) = (v x t) / 2 = (V/2_m_per_us) x t_us Where v = signal propagation velocity inside XLPE cable (~ 170 to 176 m/us , typically V/2 ~ 85 to 88 m/us !).` **`ALWAYS calibrate exact V/2 by echoing off a known healthy length or far open core of the exact same feeder before trusting meter readout!`**

WORKED EXAMPLE 2

TDR Fault Pre-Location Calculation (Illustrative). A crew echoes a shorted 11 kV 3C x 300 mm2 XLPE feeder. First, on the healthy Yellow phase with its far end **OPEN cleanly in air**, total round-trip open-end pulse triggers at `t_total = 6.98 microseconds`, matching exact known route + pit coils length of `600 m` -> Calibrated `V/2 = 600 m / 6.98 us = 85.96 m/us` (`~86 m/us`)! Now switch TDR onto the faulted Red phase -> Sharp inverted downward **short-circuit echo** returns early at `t_fault = 4.62 microseconds`:

Estimated Cable Length to Fault = `86 m/us x 4.62 us = 397.3 metres`! Field Cross-Check: Engineer reviews As-Built trench layout -> notices 12 metres of slack loop coiled inside Inspection Chamber #2 at ~200 m -> deducts 12 m slack -> targets ground marker ~385 m trench chainage (`within +/- 2 m` !) cleanly ready for exact acoustic pinpointing!

HINGLISH

TDR = cable ke andar light speed ka radar pulse bhej kar wapas aane ke time se fault ki doori nikalne wali machine!

Chapter 7: Acoustic Pinpointing (Thumper), Surge Generator and Route Tracing

Digging ONE Exact 2 m x 1.5 m Pit Under Concrete Roads

TDR knows *how many cable metres* (397 m), yet buried trenches meander around foundations! Never excavate concrete driveways just on meter reading alone:

1. **Walk Exact Buried Path with Magnetic Cable Route Locator:** Clamp safe audio-frequency transmitter signal onto cable conductor/armour -> walk surface holding locator wand tracking paint marks directly over exact center line and reading depth (`e.g. 1.05 m`) cleanly!
2. **Discharge Controlled Surge Pulses ("Thumper" / Acoustic Pinpointing):** Connect HV Surge Generator firing mild periodic capacitor impulses safely along `+/- 5 m` bracket marked on the ground -> flashover inside the buried fault emits a distinct sharp physical **thump ("dak-dak")** shockwave AND electromagnetic flash pulse!
3. **Walk with Ground Microphone Receiver (`Coincidence Timing`):** Watch digital **Electromagnetic vs Acoustic milliseconds gap** narrow steadily as you step toward ground zero! Zero millisecond delay right directly above the loudest acoustic spike pinpoints fault location accurately within **~300 mm**, letting contractors cut **ONE clean single joint pit** rather than ripping up half a factory road!

CAUTION ON THUMPING

Keep surge generator output voltage **strictly as low as possible** to jump the fault spark cleanly; indiscriminate high-voltage max-level thumping repeatedly cracks adjacent old XLPE insulation and accelerates failures down the road! Also avoid high-current prolonged "burning" methods on delicate polymeric XLPE wherever ARM pre-location succeeds!

Chapter 8: Step-Voltage Sheath Fault Location and Post-Joint Re-Testing

Finding Outer Jacket Cuts Cleanly

Using a dedicated Sheath Fault Locator DC pulse transmitter tied across Armour-to-Earth: walk along traced cable route plunging two twin handheld **A-Frame Earth Spikes** gently into damp soil/verge (`step-voltage gradient`)! The galvanometer arrow swings cleanly forward approaching the puncture -> reverses polarity violently the exact inch you straddle the jacket pinhole!

Post-Repair Checklist Before Re-Energising Feeder

- ☐ Complete OEM **Heat-Shrink / Cold-Shrink Straight-Through Joint** under clean dry tent (keep zero dust, sweat, or oil inside splice sleeve; follow exact torque shear-bolt crimping and stress-control tube lengths!).
- ☐ Perform full **Pre-Energisation 5 kV IR & Sheath Continuity Test** PLUS **Utility-Approved Post-Repair VLF/Withstand Check** cleanly before sealing trench back with river sand, bricks, and caution tape!
- ☐ Update **GPS / Landmark Coordinates** of the new straight-through joint directly onto Plant As-Built Drawings!

WORKED EXAMPLE 3

Blind Excavation vs Pinpointed Fault Cost-Downtime Logic (Illustrative). A critical 600 m 11 kV feeder fails beneath a 150 mm reinforced concrete driveway. Blind trial excavation cutting exploratory trenches every 40 m tears up 10+ concrete cuts across 5 days of noisy breaking—and frequently nicks intact cables nearby! Targeted TDR (`397 m` pre-location) + Route Tracer + Acoustic Thumper pinpoints exact failed joint coordinates in **under 3 hours**—opening **one clean pit** and cutting civil reinstatement costs drastically!

Chapter 9: HT Test Record Templates, Instrument Calibration and Permit Forms

Printable 11 kV HT Cable Testing & Permit-to-Work Checklist

Safety & Preparation Item	Verification Detail	Status	Witnessed By (Eng / Client)
Upstream & Downstream Isolators OPEN + Racked Out	Breakers: _____ & _____	[ ] VERIFIED	_____
Both-End Personal LOTO Locks & Danger Tags Fitted	Padlock IDs: _____ / _____	[ ] LOCKED	_____
Both Cable Ends Proven Dead & Earthed Prior to Test	Discharge Stick Verified Clean	[ ] EARTHED	_____
PTs, Surge Arresters & Bus Terminations Disconnected	Clear air gap verified both ends	[ ] CLEAR	_____
Test Barricade Tape & Far-End Radio Guard Stationed	Far-End Guard Name: _____	[ ] STATIONED	_____

11 kV Test & TDR Log Sheet Template

Phase	Pre-Test IR (5 kV, 60s)	Withstand Mode & Approved Target kV	Hold Time (Min)	Steady Leakage (mA)	Post-Test Solid Earth Hold (Min)	Post-Test IR (5 kV, 60s)	TDR Fault Echo (`t` us / `m`)	Result
Red – Earth	_____ G-Ohm	_____ @ _____ kV	___ min	_____ mA	___ min	_____ G-Ohm	_____ us / _____ m	[ ] PASS
Yellow – Earth	_____ G-Ohm	_____ @ _____ kV	___ min	_____ mA	___ min	_____ G-Ohm	_____ us / _____ m	[ ] PASS
Blue – Earth	_____ G-Ohm	_____ @ _____ kV	___ min	_____ mA	___ min	_____ G-Ohm	_____ us / _____ m	[ ] PASS

Chapter 10: Safety Cheat Sheet, FAQ and Bilingual HV Glossary

6 Golden Commandments of 11 kV Testing

1. **Test ONLY Under Written Permit-to-Work & Both-End LOTO.**
2. **Disconnect Equipment (LAs/PTs/Transformers) Totally Before Pressurising.**
3. **Solidly Earth Idle Cores (`Y–B` while testing `R`).**
4. **Never Leave Guarded Far-End Cable Tails Unmanned During Live Pressures.**
5. **Clamp Portable Earth Leads >= 5–10 Mins Post-Test (Rebound Kills!).**

6. **Confirm Approved Test kV Strictly from Governing Utility / Standard Tables.**

Frequently Asked Questions (HV Cable Testing & Faults)

1. **Can I test an 11 kV cable using a normal 500 V domestic electrician megger?** A 500 V or 1,000 V meter finds dead metal shorts cleanly, yet easily passes hairline cracks/moisture slots inside 11 kV XLPE! Minimum pre/post check requires **2.5 kV / 5 kV DC Insulation Tester** alongside approved VLF withstand verification.
2. **Why must Surge Arresters / Lightning Arresters be unbolted before running an 11 kV Hi-Pot test?** Arresters clip voltage smoothly around 9–11 kV above normal line stress—connecting your HV tester straight through an arrester mimics a short-circuit failure and blows the arrester!
3. **Why did a clean core pass 5 kV Megger cleanly, yet still fail VLF / trip the substation VCB?** Moisture inside a hairline joint defect forms a tiny air-gap barrier that holds 5 kV cleanly without sparking—only high alternating AC voltage (`VLF 0.1 Hz`) reaches inception stress to flash across!
4. **How do I locate a buried route if no original As-Built layout survives?** Inject low-frequency tracer tone onto metallic armour (disengaged from local earth pits temporarily) and sweep slowly across paved courtyards holding a calibrated multi-frequency magnetic cable locator receiver!
5. **Can high-voltage testing hurt an otherwise healthy new XLPE feeder?** Standard approved VLF 0.1 Hz test steps do **not** harm sound new XLPE—whereas excessive unjustified high DC Hi-Pot tests repeated frequently across *old* damp cables risk leaving damaging trapped space-charge.
6. **What causes water to travel 50 metres inside a cable after just one tiny JCB jacket cut?** Capillary siphon action sucks ground water down loose copper tape channels & unblocked stranded wires whenever heated load cycles cool off at night (**water treeing**!). Inspect open cut ends closely for green/white damp dust before patching!
7. **Is a metallic copper earth pit required when calibrating the TDR or Thumper?** Yes—HV test leads require solid clean station ground return (`Earth Terminal`) tied straight onto transformer earth grid so stray currents never electrify instrument chassis!
8. **Why does the acoustic thumper sound faint under thick wet sand or mud vs crisp concrete slabs?** Wet clay and thick concrete transmit crisp vibrations differently; switch acoustic receiver band filters cleanly and measure exact **Electromagnetic-to-Acoustic Delta-Time (ms)** numbers rather than trusting bare ears alone!
9. **Can we test ONLY one failed core after repairing a joint without testing the other two cores?** Always perform full **3-phase check + outer jacket sheath test** after sealing a straight-through joint—because heat-shrink torches and knife cuts affect adjacent phases inside a tight joint box!
10. **What does 'Polarization Index (PI)' mean in a Megger test?** Ratio of Insulation Resistance read at **10 minutes** divided by **1 minute** (`IR_10m / IR_1m`). Good dry insulation resists polarization leakage (`>= 1.5–2.0`), whereas wet mud tracks stay flat near `1.0` !
11. **Why do technicians wipe porcelain bushings and epoxy XLPE stress cones with isopropyl cleaner before Hi-Pot?** Surface dust and salty humidity create tiny tracking leakage across open terminal tails during 20 kV air tests—making a perfectly good underground cable look faulty on the panel gauge!
12. **Who issues final safe Clearance to Energise post fault repair?** The designated Authorized Person / Substation Engineer ONLY after receiving signed Permit-to-Work cancellation, confirming ALL portable earthing leads are visibly removed and counted, and verifying final phase-sequence rotation!

Hindi–English Bilingual Glossary

English Term	Hinglish / Site Hindi	Technical Meaning
XLPE Cable	Cross-linked pakka insulation cable	High-temp polymer underground feeder
Semicon Screen	Kaali conducting parat	Carbon-polymer field-smoothing layers around core
Metallic Screen (Cu Tape)	Taambe ki patti ki parat	Earth-return copper foil under armour
Stress Cone / Termination	Sire par dabav ghatane wala kit	Heat/cold-shrink kit shaping high-voltage field
Insulation Resistance (IR)	Megger dwara leak janch	DC resistance check in Mega/Giga-Ohms
VLF (0.1 Hz AC) Test	Kam frequency ka AC parikshan	Safe modern AC withstand method for XLPE
DC Hi-Pot Test	High-voltage DC dabav janch	Steady DC pressure test (caution on aged XLPE)
Capacitance Charging Current	Cable bharne wala khali current	Current absorbed charging coaxial cable cylinder
Dielectric Rebound / Absorption	Band karne ke baad wapas voltage aana	Residual voltage creeping up on un-earthed cores
Discharge / Earthing Rod	Bijli zameen mein utarne wali chhad	Insulated safety hook earthing tested phase cleanly
Permit to Work (PTW)	Khatarnak kaam ki likhit anumati	Formal signed safety isolation authorization
Surge / Thumper Generator	Zameen ke neeche patakha bhejne wali machine	High-energy impulse tester aiding acoustic locate
TDR (Time Domain Reflectometer)	Radar pulse se doori naap machine	Digital radar pinpointing fault metres
Velocity of Propagation (`V/2`)	Signal chalne ki raftar aadhi	Calibration speed constant matching XLPE polymer
Arc Reflection (ARM)	Arc banakar radar se fault pakadna	Pairs HV pulse + TDR cleanly on high-ohmic faults
Ground Microphone / Pinpointer	Zameen par aawaz sunne wala sensor	Acoustic dish measuring thump delay millisecond
Step-Voltage Test (A-Frame)	Zameen mein chhed dhundhne wali kalam	Locates outer PVC sheath moisture leaks cleanly
Sheath Fault	Bahari kaala cover katna	Outer PVC damage letting water hit steel armour
Water Treeing	Nami se insulation mein jaal banna	Microscopic wet moisture degradation channels
Straight-Through Joint	Zameen ke andar do cable jodne wala box	Waterproof heat/cold-shrink buried splice pit
Flashing / High-Ohmic Fault	High-volt par jaake leak hone wala fault	Intermittently sparks only above medium kV
Dead Short	Seedha aapas mein jud jana	Near-zero Ohm phase/earth solid failure

English Term	Hinglish / Site Hindi	Technical Meaning
Cable Route Tracer	Dabbi cable ka rasta dikhane wala yantra	Magnetic receiver mapping path & depth
Polarization Index (PI)	10-minute aur 1-minute IR ka anupat	Diagnostic index exposing damp vs dry windings
Surge Arrester / LA	Bijli jhatka rokne wala device	Must disconnect cleanly before HV withstand tests!
Dry/Clean Termination Prep	Isopropyl se saaf karke sukhana	Prevents surface dust tracking during test

HT Cable Hi-Pot Testing & Fault Location

A strict, safety-first procedure manual for 11 kV underground XLPE cable testing and fault location: cable anatomy, Permit-to-Work & LOTO isolation, IR/Megger diagnostics, VLF 0.1 Hz AC vs DC Hi-Pot testing principles, step-by-step discharge safety, TDR pre-location, acoustic thumper pinpointing without blind excavation, and sheath fault tracing.

COMPLETE 12-VOLUME SGE ENGINEERING LIBRARY

01 Fire Fighting System A to Z
02 Fire Protection Design Handbook
03 The Fire Pump House Manual
04 Pressure Switch & Pump Controller Field Manual
05 Sprinkler System Design Workbook
06 Fire Alarm Design & Cable Calculation Guide
07 Special Hazard Suppression Guide
08 Fire NOC & Building Approval Playbook
09 Fire Extinguishers, Home & Office Safety
10 Cable Sizing, LT Panel & Short-Circuit (kA) Guide
11 **HT Cable Hi-Pot Testing & Fault Location**
12 The Site Engineer's Calculation Handbook

Need This Executed or Audited on Your Site?

Shree Ganesh Enterprises (SGE) designs, supplies, installs, tests, commissions, and maintains Fire Fighting, Addressable Fire Alarm, HT/LT Electrical, Plumbing, HVAC, and IBMS systems — backed 24×7 by AMC MEP 24x7.

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