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General Electrical Installation Manual

A practical, field-ready guide for LV building and industrial installations (planning, installation, testing, and handover).

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Scope

This manual provides a general workflow and minimum good-practice requirements for low-voltage (LV) electrical works. Always follow the project specification, local regulations, and manufacturer instructions where they are stricter than this guide.

Intended users: supervisors, electricians, technicians, QA/QC inspectors, and commissioning teams.

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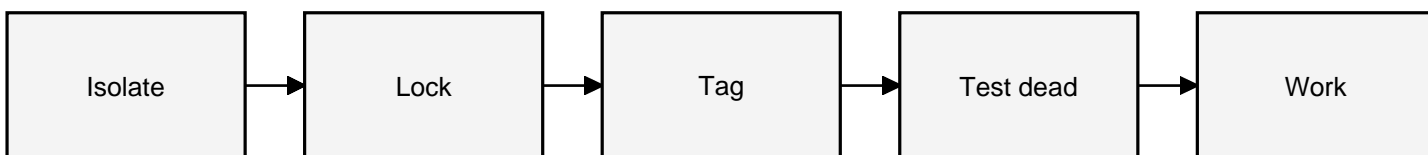
Note: Sub-sections, checklists, and typical diagrams are included for field use.

1. Safety rules (non-negotiable)

Apply these controls before any work starts:

- **Lockout/Tagout (LOTO):** isolate, lock, tag, then verify dead before work.
- **Test-before-touch:** prove tester on known live source, test circuit, prove again.
- **PPE:** safety boots, eye protection, insulated gloves; arc-rated PPE where required by risk assessment.
- **Live work:** avoid. If unavoidable: permit-to-work, barriers, standby person, insulated tools and PPE.
- **Work area control:** barricades, signage, adequate lighting; keep work area dry and tidy.

Lockout/Tagout (LOTO) - basic sequence



Always prove your tester on a known live source before and after testing.

2. Pre-installation planning

2.1 Documents you should have

- Single line diagram (SLD) / schematics (latest approved revision).
- Load schedule (including diversity assumptions) and equipment list.
- DB/MCC layouts and panel GA drawings; clearances and ventilation requirements.
- Cable schedule: sizes, types, routes, approximate lengths, voltage-drop checks.
- Earthing and bonding layout (earth grid/electrodes, MEB location, bonding points).
- Control/I-O documentation (if applicable): I/O list, interlocks, loop drawings.
- Method statement + Inspection & Test Plan (ITP); permits and risk assessment.

2.2 Site survey (minimum)

- Incoming supply: voltage, phase, frequency, earthing system (TN-S / TN-C-S / TT), and available fault level (if known).
- Cable routes: tray/ladder/conduit, penetrations, fire zones, access, and segregation requirements.
- Environment: heat, corrosion, water ingress, dust, UV exposure; hazardous area classification (if any).
- Space: panel room access, lifting/handling routes, working clearances, and ventilation.

3. Materials and workmanship minimums

- Use compliant cable types for the environment (e.g., XLPE/PVC, PVC/PVC, SWA, LSZH where required).
- Match enclosure IP rating to location (typical: indoor IP54, outdoor IP65 - confirm project specs).
- Use correct glands/lugs: match cable OD, armour, conductor material (Cu/Al), and Ex

requirements (if applicable).

- All terminations must be made with correct crimp tools and dies; no improvised crimping.
- Label everything (cables, cores, DB ways, devices) to match drawings and test sheets.

4. Recommended installation sequence

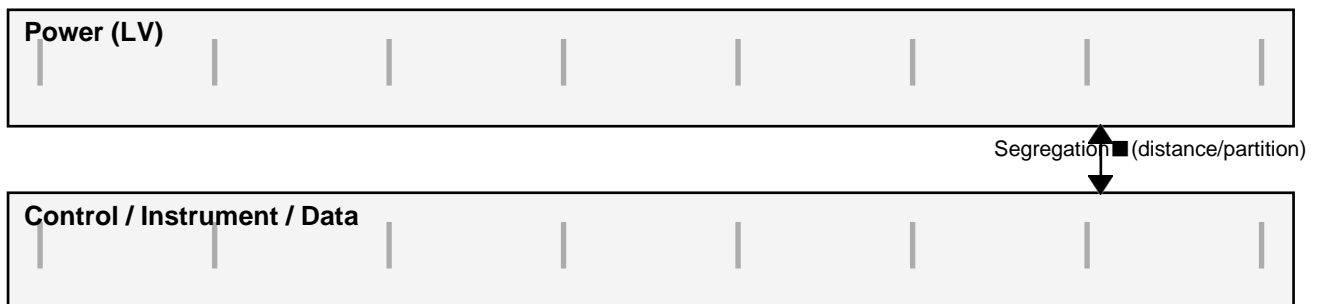
A consistent workflow reduces rework and makes QA/QC easier:

- Set out and mount supports (unistrut, brackets, hangers, anchors).
- Install containment (tray/ladder/conduit/trunking) and bond sections.
- Install panels (DB/MCC/UPS/VFD/PLC) - level, plumb, torque anchors, confirm clearances.
- Pull cables (maintain segregation); leave service loops for terminations.
- Gland and terminate; torque and mark witness paint where required.
- Complete earthing and bonding; verify continuity.
- Pre-commission tests (IR, continuity, polarity, phase sequence).
- Energization and functional commissioning.
- As-builts, test dossiers, and handover.

5. Cable containment and routing

5.1 Segregation

- Separate LV power from control/instrument/data using different trays or partitions.
- Keep VFD output cables away from sensitive signals; cross intersections at 90 degrees.
- Maintain separation distances and bonding as per project standard.



5.2 Bends, fill, and supports

- Respect minimum bend radius (per cable datasheet).
- Do not exceed conduit/trunking fill limits; provide pull boxes on long runs or multiple bends.
- Support spacing must suit load and environment (closer spacing for vibration and heavy cable runs).

6. Cable pulling and handling

- Use rollers, pulling socks/grips, and approved lubricant if required.
- Do not exceed maximum pulling tension (manufacturer limit).
- Avoid sharp edges; protect cables at tray entries and penetrations (bushings/grommets).
- Identify both ends immediately after pulling; maintain cable schedule updates.

- Leave sufficient slack for termination and maintenance (service loop).

7. Terminations and connections

7.1 Termination rules

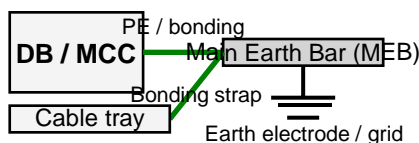
- Use correct lug type and size (ring/fork/pin) and match stud size.
- Clean contact surfaces; use joint compound for aluminium where required.
- Torque to manufacturer values using a torque wrench; record torque where required.
- Use ferrules for flexible conductors where required; avoid loose strands.

7.2 Glanding

- Select glands suitable for armoured/unarmoured cable and IP rating; use Ex glands in hazardous areas.
- Ensure armour termination and bonding is reliable; fit shrouds where specified.
- Seal unused entries with certified blanking plugs.

8. Earthing and bonding

- Install and identify a Main Earth Bar (MEB) connected to earth electrodes/earth grid.
- Bond all metallic containment (trays, ladders, conduits) including across joints.
- Bond panels, doors, removable covers, and exposed conductive parts.
- Use separate 'clean earth' only if specified by design; avoid creating parallel earth paths unintentionally.



9. Protection and control basics

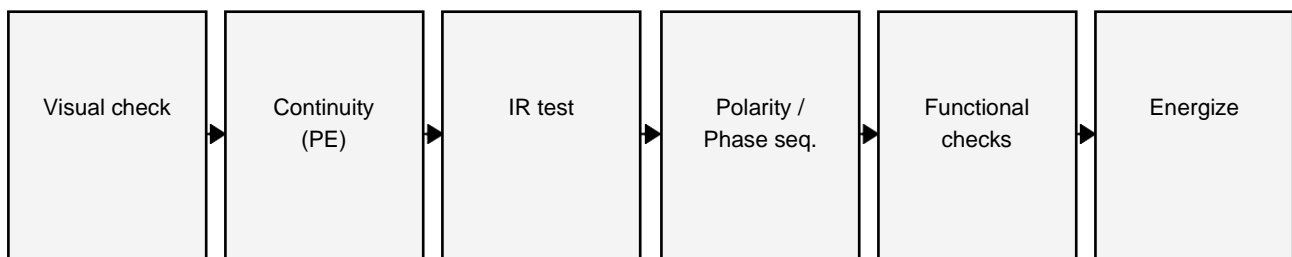
- Protective devices must match load current (I_n) and have breaking capacity \geq available fault level (I_{cu}/I_{cs}).
- Use correct device type/curve (MCB B/C/D, MCCB settings) as per coordination study or design.
- Ensure discrimination/selectivity between upstream and downstream devices.
- Use RCD/RCBO where required (wet areas, sockets, personnel protection) and verify trip times.

10. Testing and commissioning

10.1 Minimum pre-energization tests

- Visual inspection: labels, segregation, gland tightness, IP seals, covers in place.
- Earth continuity (CPC/PE) and bonding checks - record results.
- Insulation resistance (IR) testing with appropriate test voltage per standards and equipment limitations.
- Polarity checks on single-phase circuits; phase sequence checks on three-phase circuits.
- Functional checks: interlocks, E-stops, trips, indications, and control logic.

Typical test flow (field sequence)



10.2 After energization

- Confirm supply voltage at DB and at farthest load under normal operation.
- Check phase balance (three-phase), motor rotation direction, and VFD parameters (if used).
- Carry out RCD trip tests and protection verification as required.
- Thermal scan/hot-spot checks where available; rectify any loose connections immediately.

11. Handover pack (typical)

- As-built drawings: SLD, layouts, cable schedules, termination drawings (where applicable).
- Test results: IR, continuity, RCD tests, functional test records, torque records (if required).
- Equipment datasheets and certificates required by the contract.
- O&M; manuals and recommended spares list.
- Commissioning report and punch list closeout.

Quick checklists

Site readiness checklist	Pre-energization checklist
<ul style="list-style-type: none">• Approved drawings and latest revisions available on site.• Permit-to-work and LOTO system in place.• Electrical rooms/plinths ready, dry, ventilated, and accessible.• Cable routes clear; supports installed; penetrations prepared.• Earthing system installed and initial continuity checks done.	<ul style="list-style-type: none">• All terminations completed, torqued, and marked.• All glands tight; shrouds fitted; IP seals correct.• Earth continuity verified and recorded.• Insulation resistance test passed and recorded.• DB schedules and circuit labels correct; circuits identified.• Covers installed; no exposed live parts; barriers in place.

Note: This is a general guide. Always apply project specifications, OEM instructions, and local electrical codes.