

COMMISSIONING GROUND MOUNTED DISTRIBUTION SUBSTATIONS AND SWITCHGEAR SWP

1. PURPOSE AND SCOPE

The purpose of this Standard Work Practice (SWP) is to standardise and prescribe the method for the commissioning ground mounted distribution substations and switchgear.

This SWP covers Padmounts, Ring Mains Units and associated equipment.

This SWP must be followed in conjunction with the Low Voltage Connections Manual (LVCM) - 2914128.

2. STAFFING RESOURCES

Licensed Electrical Worker with Switching Operator Authorisation
Competent Assistant with Switching Operator Assistant Authorisation

An additional Licensed Electrical Worker will be required for testing where multiple premises will be energised together. This Worker may also require a Safety Observer depending on the outcome of the hazard assessment on the switchboard.

Required Training and Certificates

Staff must be current in all Statutory Training relevant for the task.

All workers must have Completed Field Induction or have recognition of prior Ergon Energy Field Experience.

Contractors must have completed Ergon Energy's Generic Contractor Worker Induction.

Additional Training

Training Course Description for Authorisations or Certificates.
Switching Operator Lines
Switching Operator Assistant

3. DOCUMENTATION

HazChat

EQL SWMS - Safe Work Method Statements

Health and Safety Policy - 692225

Procedures for Safe Access to High Voltage Electrical Apparatus (SAHV) - 2904212

Electrical Safety Rules 2022 - 6503074

HV Switches - Field Data Collection - 2875361

Distribution Substations and Switchgear Commissioning Test Report - 2945461

Commissioning LV Underground Cable Installations - 2888218

Phase Out HV using Fameca TAG 5000 - 2964038

Energising Overhead Distribution Transformers - 2894942

Low Voltage Connections Manual (LVCM) - 2914128

Underground Distribution Construction Manual (South East)

Authorised Switching Sheet

Work Health and Safety Regulations (QLD)

Electrical Safety Regulation

Electrical Safety Code of Practice for Electrical Work

Electrical Safety Code of Practice for Working Near Overhead and Underground Electric Lines

4. KEY TOOLS AND EQUIPMENT

Pole top rescue kit (where required).

LV rescue kit (where required).

Roadway warning signs (where required)

Barricading

An insulated operating stick and tool head rated to the highest voltage present on the pole, structure or apparatus to be worked on.

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Approved Test equipment for performing earthing resistance, HV phasing, LV voltage, LV polarity and LV phase rotation tests.

Portable Earthing Devices rated for the prospective fault current for the location.

Additional PPE Required

Class 0 High Voltage Operating Gloves

Class 00 Low Voltage Gloves

5. TASK STEPS

5.1. Carry out an on-site hazard assessment

Prior to performing this activity any hazards associated with prerequisite tasks at the worksite shall be identified and assessed with appropriate control measures implemented and documented in accordance with the HazChat - On-Site Hazard Assessment.

If any hazards cannot be managed or reduced to an acceptable level, do not proceed with the task and seek assistance from your Supervisor.

Note: Ensure form Distribution Substations and Switchgear Commissioning Test Report - 2945461 is completed and signed off by the relevant person at each stage of the works being performed.

5.2. Preliminary steps

Use roadway warning signs/ barricading to control vehicle and pedestrian traffic around work zone and relevant exclusion zones around live parts.

As constructed drawing supplied to work crew along with construction folder.

Ensure any equipment that requires labelling is correctly identified and labelled.

Switching sheet required to commission distribution substation and switchgear.

Confirm HV Switching sheet aligns with commissioning requirements.

Confirm all test equipment within current test date, calibration and operational.

Ensure all persons required to use test equipment are competent in its operation.

Ensure class 00 gloves, and insulated mats are used while working on or near exposed live parts.

Live work on LV including testing is only to be performed where a documented safe system of work is implemented.

Persons performing electrical testing must ensure electrical equipment is tested to confirm electrical work performed is electrically safe and all persons not necessary for testing are electrically safe.

Ground conditions and potential slip/fall hazards in travel path, adjacent live parts and manual handling of test equipment considered on the HazChat - On-Site Hazard Assessment

Implement EQL SWMS - Safe Work Method Statements

Earth trench should be backfilled as soon as practicable after earth stakes and earthing conductors are installed and tested to minimise slip and trip hazards.

Fit reo caps to ends of each protruding earth stake while earth stakes are exposed.

Locks must be in place and operational.

Check Operation of switches and interlocks.

Visually inspect all equipment for transport damage, removal of transport bracing, connections tight, buswork correct.

HV earth connections to be checked, including surge diverters and earth mat resistance.

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Carry out phase rotation test at appropriate location using an approved Phase Rotation Meter and mark conductors with suitable indicators. Record direction of rotation.

Caution

If phase rotation cannot be confirmed, any three-phase motor/s shall be isolated before restoration of supply.

5.3. Confirm ready to energise

Barricade around open trenches.

Ensure relevant exclusion zones are maintained at all times while near exposed live parts.

Where multiple cables have been installed ensure that the correct cables/equipment is going to be energised.

Ensure HV cable and transformers are isolated from HV systems including secondary sources of supply in accordance with P53 Operate the Network Enterprise Process.

Ensure LV cables are isolated from all sources of supply and tagged in accordance with LV isolation requirements.

Ensure all members of working party sign on and understand requirements of LV Isolation Section of the HazChat - On-Site Hazard Assessment.

Comply with EQL SWMS - Safe Work Method Statements, when working aloft.

Ensure ground-based persons are clear of the no go zone while work is performed aloft.

Ensure all members of working party are notified and sign off Permit when surrendered.

Safety signs e.g. Danger HV and Authorised Persons Only to be in place.

Confirm transformer nameplate voltages and configurations are consistent with system requirements and record details on Field Data Collection Forms.

Check surge arrester voltage against system voltage prior to commissioning where applicable.

Check HV and LV fuse size and rating comply with Construction Folder details.

Confirm HV fuses installed with correct striker pin orientation where fitted.

Perform visual inspection and earth tests to ensure mechanical and electrical integrity of substation earthing system including MEN bonds and record.

Confirm wiring, bridging and earthing correct by visual inspection and connections tight including RMU to transformer cables.

HV and LV cable tests to be completed.

Confirm substation, switchgear and cables numbers/labelling are affixed and correct.

Confirm all cable ends are terminated prior to energisation.

Perform low resistance tests across circuit breakers contacts and fuses as required.

Disconnect LV neutral/s as follows:

Option 1. If LV earth connection is made at transformer neutral bushing, disconnect transformer neutral bridge from the neutral connection bar.

Option 2. If the LV earth connection is made at neutral connection bar, disconnect all outgoing LV circuit neutrals from neutral connections bar. **Or alternately use Option 3.**

Option 3. Disconnect the main neutral and LV earth from the neutral bar and connect together.

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Option 4. If LV board is supplied by an external circuit or generator while replacing a transformer then disconnect the main neutral from neutral bar **ensuring tank earth is connected.**

Confirm HV tank earth & LV earth is connected to the transformer to provide star reference point.

Caution

Non standard voltages could be present at the transformer bushings, if the **transformer neutral is not connected to earths** prior to it being energised.

Confirm Access/Test Permit surrendered prior to commissioning.

Confirm any LV Mains/Customer Installation/s have been prepared for Low Voltage Connect Tests in accordance with the requirements of the Low Voltage Connections Manual.

5.4. Energise from HV supply

Energise from HV supply (e.g. EDO fuses, ABS, RMU, CB, SFU, etc). Don't perform single-phase energisation of transformer fed by HV cables without engineering direction to ensure effects of ferroresonance have been addressed.

Check HV phasing across open point where second HV source exists (eg RMU).

Monitor for any abnormal signs immediately after substation or switchgear energisation and evacuate to safe location if abnormalities become evident.

5.5. Confirm Transformer Neutral and No-Load Volts

For Single Phase Transformer, use an independent to earth and prove the neutral of the transformer by testing between;

- Transformer active to transformer neutral - ~ **230 V**
- Independent earth to transformer neutral - ~ **0 V**

- Independent earth to transformer active - ~ **230 V**

For a Three Phase Transformer test between:

- LV mains neutral and each LV mains active - ~ **230 V**
- Phases A-B, B-C, C-A - ~ **400 V**

Confirm LV supply "no load" volts* within statutory limits and record.

Allowable No Load Margins	
Phase to Neutral - 230V	216V - 253V
Phase to Phase - 400V	376V - 440V
Phase to Phase - 460V	432V - 506V
Neutral to Independent Earth	0 - 6V

Note: If voltage is not within statutory limits it will be necessary to isolate the HV supply to the transformer, confirm LV supply is de-energised and then change tap position.

Caution

If tap position changer is within the exclusion zone, isolate HV to the transformer, test and earth. Issue access permits then change tap position.

Isolate transformer, test LV is de-energised and then for:

Options 1 and 2. Reconnect LV network neutral/s.

Option 3. Disconnect the main neutral from the LV main earth and reconnect to the neutral bar.

Option 4. Reconnect the main neutral to the neutral bar.

5.6. Connect to LV Mains/ Customer's Installation (where applicable)

Confirm all LV cable ends terminated and shrouded prior to energisation.

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Prepare any outgoing LV circuits such as LV Mains/Customer Installation/s for Low Voltage Connect Tests in accordance with the requirements of the Low Voltage Connections Manual e.g. create Test Section. Close transformer LV isolator to energise LV bus where required.

Check phase rotation correct (ensure same phase rotation meter is used prior to and after isolation when replacing transformer) and record.

Phase out (check phasing) across any system open points

Close switches (open points) to supply LV system from transformer where applicable.

Following energisation of the transformer, connect/reconnect any new or previously de-energised LV mains/circuits in accordance with the Low Voltage Connections Manual.

This includes phasing out or phase rotation tests and connection/reconnection of outgoing LV mains/Customer neutrals.

After confirming outgoing circuit neutrals by test, connect neutral/s previously disconnected in Step 5.3 as follows:

- If the LV earth connection is made at neutral connection bar, reconnect all outgoing LV circuit neutrals to the neutral connections bar.
- If LV earth connection is made at transformer neutral bushing, reconnect transformer neutral bridge to the neutral connection bar.

Complete LV connections tests.

5.7. Final checks

Check “on-load” volts.

Record LV voltages and tap settings at final tap position.

Check the CT metering test block to confirm that the CT shorting links have been removed.

Copy of as constructed LV substation area drawing to be maintained in padmount substation cubicle.

Check the current load on the transformer to ensure it is within the acceptable limits of the transformer.

Insulation resistance in meg ohms:

- LV ϕ -E >100,
- HV ϕ -E >1000,
- HV ϕ -LV ϕ >1000.

Record all details as required on Distribution Substations and Switchgear Commissioning Test Report - 2945461.

Ensure all final tests have been carried out and completed works have been built to the design plan / construction standards.

Check that the cabinet / padmount is locked, or the pillar lid is replaced and securely bolted down, where work has been carried in these areas.

Caution

Where multiple cables have been installed and not all cables are being commissioned then confirm that the correct cables have been energised and any un-terminated cables are still de-energised. Perform test to confirm that the correct HV Equipment has been energised and equipment labelling is correct (E.g. Ring Main Units)

Make the site electrically and mechanically safe and tidy the area before leaving.

Update all records relevant to the work undertaken.