

Substation Maintenance Instruction

HV reclosers, sectionalisers and load break switches

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SUBSTATION MAINTENANCE INSTRUCTION

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SMI 207 - HV reclosers, sectionalisers and load break switches

Contents

1.0	PURPOSE	3
2.0	SCOPE	3
3.0	REFERENCES	3
4.0	DEFINITIONS AND ABBREVIATIONS	3
5.0	ACTIONS	4
5.1	General	4
5.2	Routine inspections and tests	4
5.2.1	<i>Inspection</i>	4
5.2.2	<i>Operational check</i>	5
5.2.3	<i>Minor overhaul</i>	6
5.2.4	<i>Major overhaul</i>	6
5.2.5	<i>Final checks</i>	7
6.0	AUTHORITIES AND RESPONSIBILITIES	8
7.0	DOCUMENT CONTROL	8

1.0 PURPOSE

To set out in detail the broad maintenance requirements for HV reclosers, sectionalisers and load break switches.

2.0 SCOPE

This instruction is to be read in conjunction with SMI 100 - Minimum requirements for maintenance of transmission and zone substation equipment and SMI 101 - Minimum requirements for maintenance of distribution equipment. In addition to this instruction, reference is also to be made to appropriate Protection Maintenance Instructions.

The routine maintenance requirement is generally comprised of an inspection, a minor and/or a major overhaul. Other maintenance activities are also included for battery and protection operational works.

3.0 REFERENCES

- Board Policy 3.0 - Health and Safety
- Board Policy 4.0 - Environment
- Company Policy 9.9.1 - Network Asset Maintenance
- Company Procedure GSY 1066 - Worksite Hazard and Risk Assessment
- Protection Design Instruction PDI 4004 - Protection of distribution mains
- Protection Design Instruction PDI 4008 - Transmission feeder protection
- Protection Maintenance Instruction PMI 4120 - Maintenance of protection
- Substation Maintenance Instruction SMI 100 – Minimum requirements for maintenance of transmission and zone substation equipment
- Substation Maintenance Instruction SMI 101 – Minimum requirements for maintenance of distribution equipment
- Substation Maintenance Instruction SMI 102 – Substation batteries
- Substation Maintenance Instruction SMI 113 – Distribution data entry – asset structure and nameplate details
- Substation Maintenance Instruction SMI 124 – Maintenance data entry and defect prioritisation
- Endeavour Energy Network Management Plan (2013 Review)
- ENA National Electricity Network Safety Code (NENS 01-2008)
- *Electricity Supply Act* 1995 (as amended)
- AS 2981 – 2008- High voltage a. c. switchgear and controlgear-Vacuum interrupters- High voltage testing-Protection of personnel from x-ray emission
- AS/NZS ISO 31000:2009 Risk Management- Principles and guidelines
- IEEE Standards Requirement for Overhead, Pad-Mounted, Dry Vault, and Submersible Automatic Circuit Reclosers and Fault Interrupters for Alternating Current Systems up to 38kV

4.0 DEFINITIONS AND ABBREVIATIONS

Recloser	switching device that attempts to close back into the supply a preset number of times before locking out due to a persistent fault.
Sectionaliser	switch that is of <i>no load break</i> design that detects a loss of supply and opens to isolate a permanently faulted section of the feeder by coordinating with a protection device.
Load break switch (LBS)	switch whose the sole purpose is to isolate supply (no fusing) and is suitable for load breaking but not fault break/make.
Ellipse	Endeavour Energy asset database

SCADA	Supervisory Control and Data Acquisition
SDI	Substation Design Instruction
SEF	sensitive earth fault
SMI	Substation Maintenance Instruction
PMI	Protection Maintenance Instruction
PDI	Protection Design Instruction
ABS	air break switch
SF6	sulphur hexafluoride gas

Refer also to definitions listed in SMI 100 - Minimum requirements for maintenance of transmission and zone substation equipment (current version) for transmission and zone substation equipment, and SMI 101 - Minimum requirements for maintenance of distribution equipment (current version) for distribution equipment.

5.0 ACTIONS

5.1 General

All safety precautions shall be taken when maintaining a recloser, sectionaliser and load break switch (LBS). Potential hazards include possible X-ray emission from the vacuum interrupter, and handling SF6 gas. When handling SF6 gas in the vacuum equipment, it should be isolated or refer to the manufacturer's manual (or AS 2981.4, if no information is available in the manual), for the guide for protection of personnel from X-ray emission.

Distinct types or brands may not contain some of the components listed for routine maintenance, in which case that particular component is to be disregarded.

All work is to be carried out in accordance with the manufacturer's recommendations.

5.2 Routine inspections and tests

Where an inspection or test is carried out and a defect or result is obtained, it shall be entered into Ellipse in accordance with SMI 124 - Maintenance data entry and defect prioritisation.

If the defect or abnormality can be easily rectified on the spot, it shall be rectified.

All test results must be entered in flat files (single spreadsheet for each region) on the G:/TSSS drive within two weeks of testing.

Routine maintenance	Type of equipment			
	Oil	SF6	Vacuum	Electronic protection and control
5.2.1 Inspection				
To be carried out from ground level				
General				
Inspect the equipment and record any defects	X	X	X	X
Tank				
Inspect for oil leaks/gas leaks	X			
Check pressure gauge readings/low gas alarm Note: Gas leaks and low gas alarm shall be repaired and the volume of gas used shall be recorded.		X	X (a)	

Routine maintenance	Type of equipment			
	Oil	SF6	Vacuum	Electronic protection and control
Steelwork/hardware				
Inspect for rust, corrosion, poor paintwork condition or other defects	X	X	X	X
Bushings/bushing boots/arresters				
Inspect bushings for abnormalities, for example, cracks, chips, damaged flanges or other defects	X	X	X	X
Shrouds				
Inspect condition	X	X	X	X
Cables				
Inspect condition of HV dropper cable insulation	X	X	X	X
Links/ABS				
Inspect condition	X	X	X	X
Structure				
Inspect for cross arm cracks, rot or other defects	X	X	X	X
Earthing				
Inspect condition of connections	X	X	X	X
Inspect condition of earth batten	X	X	X	X
Solar panels				
Check condition of panel				X
Check output of panel				X
Electronic and protection control unit				
Check condition and record any defects				X
Control cabinet				
Check control cabinet for damage or leaks	X	X	X	X
Check vermin proofing	X	X	X	X
Wiring				
Inspect condition of control wiring	X	X	X	X
Inspect condition of electrical connections	X	X	X	X
Cyclometer				
Record reading	X	X	X	X
Contact wear indicator (where fitted)				
Record reading and advise operations manager if wear limit reached or is likely to be reached in near future	X	X	X	X

5.2.2 Operational check

To be carried out in conjunction with Protection Maintenance Instruction				
Simulate the complete protection and control sequence of recloser for correct function of recloser as per manual				X
SEF operation check				X
Perform five open close operations	X	X	X	X

Routine maintenance	Type of equipment			
	Oil	SF6	Vacuum	Electronic protection and control

5.2.3 Minor overhaul

To be carried out in conjunction with Protection Maintenance Instruction				
General				
Carry out inspection as in clause 5.2.1	X	X	X	X
Bushings/bushing boots/arresters				
Clean externally - replace if necessary	X	X	X	X
Battery				
Check battery in accordance with SMI 102	X	X	X	X
SF6 gas				
Check the pressure of the SF6 gas/low gas alarm. Note: Gas leaks and low gas alarm shall be repaired and the volume of gas used shall be recorded		X	X (a)	
Operating handle				
Check the condition of the recloser position indicator and the manual trip handle	X	X	X	
Final checks				
Carry out final checks as in 5.2.5	X	X	X	X

5.2.4 Major overhaul

To be carried out in conjunction with Protection Maintenance Instruction				
General				
Carry out minor overhaul as in clause 5.2.3	X	X	X	X
Tank				
Apply correct setting stickers to tank if not already fitted	X	X	X	
Contacts (fixed)				
Examine for abnormalities, for example, erosion, burning, loose or bent components - dress or replace if necessary	X			
Contacts (moving)				
Examine contact load surfaces for erosion and abnormalities and dress contact surfaces or replace interrupter assembly if necessary	X			
Examine contact arcing tips for erosion and abnormalities and dress or replace if necessary	X			
Tank internal				
Check tank liner for soft or spongy areas. Replace if necessary	X			
Flush out and clean with clean oil	X			
Refill with clean oil	X			
Clean internal surfaces to remove all traces of carbon	X			
After unit is re-assembled and all hardware has been checked for correctness and tightness, wash down all the components that are normally contained in oil with clean oil	X			
Time delay unit				
Check fluid level if applicable	X			

Routine maintenance	Type of equipment			
	Oil	SF6	Vacuum	Electronic protection and control
Gaskets				
Inspect condition and replace if necessary	X			
Solenoids/coils				
Inspect closing coil for cracks or damage	X			
Check condition of contactor contact tips and replace if necessary	X			
Inspect trip coil condition	X			
Internal insulation				
Inspect for abnormalities, for example, cracks, chips, damaged flanges or other defects	X			
Mechanism (operating mechanical)				
Examine for defective parts, for example, springs, linkages, circlips, split pins	X			
Mechanism (operating hydraulic)				
Examine for defective parts, for example, pistons, springs, valves	X			
Turbulators				
Inspect condition	X			
Clean with clean oil	X			
Dash pots				
Inspect condition	X			
Clean with clean oil	X			
Seals				
Inspect oil seals and glands	X			
Final checks				
Carry out final checks as in clause 5.2.5	X	X	X	X

5.2.5 Final checks

To be carried out in conjunction with Protection Maintenance Instruction				
Insulation resistance and contact resistance				
Measure recloser insulation resistance at 2.5kV in accordance with manufacturer's recommendations	X			
Contact resistance test	X			
Protection and operation check				
Protection calibration maintenance	X	X	X	X
Test alarms	X	X	X	X
Test SCADA	X	X	X	X
Operational check as in clause 5.2.2	X	X	X	X
Cyclometer				
Record reading	X	X	X	X

(a) If equipment uses SF6 as an insulation medium.

6.0 AUTHORITIES AND RESPONSIBILITIES

Chief Engineer has the authority and responsibility for approving this instruction.

Manager Primary Systems has the delegated authority and responsibility for approving this document for minor changes and to make recommendations to the Chief Engineer for major changes.

Network Maintenance Manager, Primary Systems has the authority and responsibility for keeping the content of this instruction up to date.

Regional Transmission Managers have the authority and responsibility for:

- **engaging** Endeavour Energy employees and/or contractors **who** have appropriate qualifications and are competent to carry out the work; and
- providing appropriate equipment and training.

All **Endeavour Energy employees and/or contractors** have the authority and responsibility for:

- **meeting** the requirements of this instruction, SMI 100 (for transmission and zone substation equipment) and SMI 101 (for distribution substation equipment), are met when carrying out maintenance on HV reclosers, sectionalisers and load break switches;
- **working** in accordance with local and statutory requirements;
- **upholding** a high level of public safety;
- **working** in accordance with Endeavour Energy's Electrical Safety Rules;
- recoding maintenance and test data Endeavour Energy's electronic database; and
- communicating abnormalities found to the Regional Transmission Managers and the **Network Maintenance Manager, Primary Systems**.

7.0 DOCUMENT CONTROL

Documentation content coordinator: **Network Maintenance Manager**

Documentation process coordinator: **Standards** Process Coordinator