

Substation Maintenance Instruction

AFIC load control equipment

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SUBSTATION MAINTENANCE INSTRUCTION

ASSET STANDARDS & DESIGN	Document No : SMI 205 Amendment No : 6 Approved By : MAS&D Approval Date : 20/11/2018
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SMI 205 AFIC LOAD CONTROL EQUIPMENT

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1.0 PURPOSE

To define the maintenance requirements for audio frequency injection and control (AFIC) equipment.

2.0 SCOPE

This instruction is to be read in conjunction with Substation Maintenance Instruction SMI 100 – Minimum requirements for maintenance of transmission and zone substation equipment, which sets out the frequencies for each activity defined in this document.

This instruction outlines the broad maintenance requirements for audio frequency injection and control (AFIC) equipment.

3.0 REFERENCES

Internal

- Company Policy 9.9.1 (Network) – Network Asset Maintenance
- Company Procedure GSY 1066 – Worksite Hazard and Risk Assessment
- Company Procedure GSY 0050 – Hazardous Chemicals Management
- Environmental Management Standard EMS 0007 – Waste management
- Equipment Technical Specification ETS0018 – Audio Frequency injection control equipment
- Substation Maintenance Instruction SMI 100 – Minimum requirements for maintenance of transmission and zone substation equipment
- Substation Maintenance Instruction SMI 119 – Transmission and zone substation data , asset structure and nameplate details
- Substation Maintenance Instruction SMI 124 – Maintenance data entry and defect prioritization
- Workplace Instruction WPC 1400 – AFIC maintenance
- Electrical Safety Rules

External

Electricity Supply Act 1995 (NSW)

National Electricity (NSW) Act 1997

Work Health and Safety Act 2011 (NSW)

Electricity Supply (Safety and Network Management) Regulation 2014

Work Health and Safety Regulation 2017 (NSW)

AS 5577 – 2013 – Electricity network safety management systems

ENA National Electricity Network Safety Code (Doc 01-2008)

National Electricity Rules

SPM bearing checker device instruction

4.0 DEFINITIONS AND ABBREVIATIONS

AFIC

Audio Frequency Injection Control

AFIC Equipment

AFIC equipment consists of frequency generator unit (which could be either motor-generator set or SFU), coupling cell unit, and controller and supervision devices.

Content Server

Endeavour Energy's document management system

Coupling Cell

Coupling cell comprises of tuning coil, coupling capacitors, isolating transformer, current transformer and earth switches. Coupling cell allows the passage of high frequency AFIC signal.

MG

Motor generator set (used for generating audio frequency signals)

PE cell

Photo-electric cell, used in conjunction with AFIC to control the switching on-off of the streetlights

SCADA

Supervisory Control and Data Acquisition

SFU

Static frequency unit (used for generating audio frequency signals)

SILC

SCADA integrated load control

5.0 ACTIONS**5.1 General**

Maintenance tasks in the routine maintenance schedule for AFIC equipment include visual in-service inspection, minor overhaul and major overhaul, carried out by substation and Protection & Control technicians for primary and secondary equipment respectively.

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

All defects and abnormalities found during routine maintenance are to be recorded in Ellipse (Asset database) in accordance with SMI 124.

For the asset on which the maintenance work is being performed, the nameplate data that has been recorded in Ellipse shall be confirmed. Nameplate data that has not yet been recorded in Ellipse must be captured in accordance with requirement SMI 119 and entered into asset management database.

5.2 Tests

If investigation of AFIC equipment is required, the Substation Assets Manager, Asset Standards & Design may seek an additional test to record standing and injection currents harmonics at cell output.

All test results must be stored on the network drive, in G:\EE Maintenance.

5.3 Routine maintenance requirements

Routine maintenance must always be carried out in accordance with manufacturer's recommendations as a minimum requirement.

The set of maintenance requirements for AFIC is outlined in the maintenance schedule provided in Annexure 1 of this instruction. In this amendment the bearing test has been introduced for MG sets and instruction manual for bearing checker can be found on BMS with this standard.

6.0 AUTHORITIES AND RESPONSIBILITIES

Manager Asset Standards & Design has the authority and responsibility for approving the amendments to this Standard in accordance with GAM0001.

Substation Assets Manager has the authority and responsibility for keeping the content of this Standard up to date.

All Regional Transmission Managers have the authority and responsibility for:

- checking that the requirements of this instruction and data entry requirements are met when recording information in the equipment register;
- checking that Endeavour Energy employees and/or contractors engaged to perform the work and have appropriate qualifications and are competent to carry out the work;
- providing appropriate equipment and training;
- checking that abnormalities in the test results are identified ; and
- potential problems with AFIC and test equipment are appropriately actioned.

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

- meeting the requirements of this instruction;
- working in accordance with Endeavour Energy's Electrical Safety Rules;
- updating the Endeavour Energy's asset database; and
- communicating abnormalities found in data to the Regional Transmission Managers and Substation Assets Manager.

7.0 DOCUMENT CONTROL

Documentation Content Coordinator : Substation Assets Manager

Documentation Distribution Coordinator : Standards Process Coordinator

Annexure 1: Maintenance Schedules – AFIC Equipment**A- VISUAL IN-SERVICE INSPECTION**

ROUTINE MAINTENANCE SCHEDULE (Performed by Substation technicians)		
VISUAL IN-SERVICE INSPECTION – Coupling Cell		
1.1	Inspect cage, gate/door, locking and fence conditions	
1.2	Inspect steel work/hardware for rust, corrosion, poor paintwork condition or other defects	
1.3	Inspect isolation transformer for any leakage	
1.4	Inspect tuning coil for signs of leaking or other defects	
1.5	Inspect coupling capacitor for leaks, deformation of housing	
1.6	Inspect surge arrestors, bushings and busbar for treeing, tracking visible effects of corona, cracks or other defects	
1.7	Inspect condition of earth switch and earth connections	
1.8	Before leaving visually inspect the equipment in general, check and note any defects that are not included above.	
Visual In-service inspection – MG set		
1.9	Visually inspect the equipment in general, check and note any defects.	
1.10	Check bearings using approved SPM bearing checker. Record the readings and raise defects in accordance with the instruction manual (Annexure 2). Note: By means of permanent marker or seal, make a mark at location of reading. For trending purposes the next reading should be taken from the same location on MG set	Pass Criteria: dBm ≤ 20dB dBc ≤10dB Δ dBm & dBc ≤ 8dB

B- MINOR OVERHAUL

ROUTINE MAINTENANCE SCHEDULE (Performed by Protection &Control technicians)	
MINOR OVERHAUL for AFIC with SFU –SFU, PE Cell, Contactor and Supervision Devices	
1.1	Check SFU cooling apertures for any blockage.
1.2	Clear debris/objects from SFU and clean dust.
1.3	Check wiring of SFU for loose connections.
1.4	Examine the connections and contacts associated with the auxiliary interlock circuit / contactor (of the SFU). Pay particular attention to connections to coils.
1.5	Tighten all secondary and earthing connections for SFU, where required.
1.6	Check SFU logs and alarms for correct operation and loading
1.7	Carry out functional check of SFU and test the alarms where required
1.8	Clean PE cell and tighten connections where required
1.9	Carry out functional check of PE cell
1.10	Clean supervision devices and tighten connections where required
1.11	Carry out functional check of impulse and voltage supervision devices in normal and failed conditions
1.12	Repeat functional check of SFU, PE cell and supervision devices (where feasible).
1.13	Inspect for any defects not listed above.
MINOR OVERHAUL for AFIC with MG set – Contactor Equipment, PE cell and Supervision devices	
1.14	Check condition and tightness of connections and mounting screws of contactors.
1.15	Check and clean contact surfaces. Replace if excessive wear is found.
1.16	Examine the impulse contactors for burning/discolouration/mis-alignment and confirm free & correct movement. Clean and dress the contacts as required.
1.17	Examine the contacts of the isolation switch for burning or discolouration. Clean and dress the contacts as required.
1.18	Examine the connections associated with the impulse (running) contactor. Pay particular attention to connections to coils.
1.19	Check condition of PE cells, where installed
1.20	Clean PE cell and tighten connections where required
1.21	Carry out functional check of PE cell
1.22	Clean supervision devices and tighten connections where required
1.23	Carry out functional check of impulse and voltage supervision devices in normal and failed conditions

ROUTINE MAINTENANCE SCHEDULE (Performed by Substation technicians)		
MINOR OVERHAUL – Coupling Cell		
1.1	Inspect cage, gate/door, locking and fence conditions	
1.2	Inspect steel work/hardware for rust, corrosion, poor paintwork condition or other defects	
1.3	Check all primary terminals and connections for security and condition, paying attention for discolouration/burning.	
1.4	Clean and dress all primary terminals and connections, where required.	
1.5	Inspect surge arrestors, bushings and busbar for treeing, tracking visible effects of corona, cracks or other defects	
1.6	Clean surge arrestors, bushings and busbar insulators, where required.	
1.7	Inspect isolation transformer for any leakage and loose connections	
1.8	Report defect and tighten the loose connections	
1.9	Inspect tuning coil for signs of leaking or other defects	
1.10	Report defect and tighten the tuning coil loose connections	
1.11	Inspect coupling capacitor for leaks, deformation of housing and loose connections	
1.12	Report defect and tighten the coupling capacitor loose connections, where required	
1.13	Inspect condition of earth switch and earth connections	
1.14	Report defect and tighten the earth connections, where required	
1.15	Clean cell room	
1.16	Capture the nameplate data that has not been recorded or incorrectly entered in Ellipse and update accordingly.	
1.17	Measure capacitor and discharge resistor values and compare to nameplate values	Pass Criteria: ± 5% of Nameplate Value
1.18	Measure inductance of tuning coil and compare to nameplate values	Pass Criteria: ± 5% of Nameplate Value
1.19	Repeat oil/fluid leak checks.	
1.20	Check tightness of primary, secondary and earthing connections.	
1.21	Inspect for any defects.	

C- MAJOR OVERHAUL

ROUTINE MAINTENANCE SCHEDULE (Performed by Substation technicians)		
MAJOR OVERHAUL - MG set		
1.1	Visually inspect the equipment in general, check and note any defects.	
1.2	Check bearings using approved SPM bearing checker. Record the readings and raise defects in accordance with the instruction manual (Annexure 2). Note: By means of permanent marker or seal, make a mark at location of reading. For trending purposes the next reading should be taken from the same location on MG set	Pass Criteria: dBm $\leq$ 20dB dBc $\leq$ 10dB Δ dBm & dBc $\leq$ 8dB
1.3	Review bearing checker readings and replace or lubricate bearing as required	
1.4	Check tightness of primary, secondary and earthing connections.	
1.5	Repeat bearing check after lubrication/replacement of bearing and record new readings.	
1.6	Inspect for any defects.	