شركة العين للتوزيع
Al Ain Distribution Company

Operating Instruction
Metal Clad Switchgear

Prepared by: _____
Senior Health, Safety and Environment Engineer

Reviewed by: _____
Health, Safety and Environment Department Manager

Approved by: _____
Managing Director

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Issued by: _____
HSE Management System Representative

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TABLE OF CONTENTS

1. PURPOSE

This operational instruction (OI) is mandatory and should be read in conjunction with the AADC system safety rules. This OI documents the procedure to be adopted when accessing and working on all types of high voltage and low voltage ground mounted metal clad switchgear to provide safety from the system.

The focus of this OI is specifically for work on or near to metal-clad switchgear. Switchgear operations on the electrical network are covered in operating instruction OI-004 Operational Switching; network earthing is covered in OI-003 Operational Earthing, and testing in OI-012 Electrical Testing.

2. DEFINITIONS

For this document the following definitions apply:

Competent Person	A person appointed in writing that has sufficient knowledge, experience to recognize and avoid danger.
Control Person	A person appointed in writing that has sufficient technical knowledge and experience to recognize danger. The duties are to be responsible for the operational control of the high voltage electricity network.
High Voltage (HV)	High voltage alternating current (AC) is above 1,000 volts or direct current (DC) over 1,500 volts.
Isolation	The physical disconnection of a portion of the network from the energized network.
Live	Connected to the power system and/or electrically charged.
LOTO	An abbreviation of Lock Out and Tag Out, which is the procedure to lock off with a control lock an isolation point on the network and apply danger and caution notices as appropriate.
Low Voltage (LV)	Low voltage alternating current (AC) above 50 volts and below 1,000 volts. Direct current low voltage is above 120 volts and below 1,500 volts.

Metal-clad switchgear	Includes all high voltage and low voltage switchgear that is ground mounted and enclosed within metal enclosures and when the switchgear is in service there are no exposed live conductors.
Primary Earth	Switchgear or portable earthing device applied to an isolated electrical network to effectively maintain the electrical conductors at zero potential to the mass of earth.

3. PROCEDURE

3.1 General

3.1.1 All work on metal-clad switchgear shall be in accordance with the AADC System Safety Rules.

3.1.2 Only Authorized and Competent Persons shall be allowed to access and operate switchgear.

3.1.3 All switchgear, busbars, cable terminations and voltage transformers shall be in good serviceable condition. If any switchgear or associated equipment is suspected of being damaged or defective then the equipment shall not be operated or worked on until it has been remotely isolated from the network, and earthed.

3.1.4 All switchgear and associated equipment shall have permanent labels prominently fixed to the front of the switchgear, and when appropriate also to the rear. The labels shall be of sufficient size indelible and clear to read in English.

3.1.5 All work on switchgear and associated equipment that is part of the electricity network shall be accompanied by a second person that has been appointed in writing to provide accompaniment.

3.1.6 When switchgear is to be removed from the site then an Asset Disconnection Certificate shall be issued in accordance with operating instruction OI-013 Connection and Disconnection of Assets. The issue of an Asset Disconnection Certificate will document that the switchgear is no longer under the jurisdiction of the AADC System Safety Rules.

3.2 High voltage withdrawable switchgear

3.2.1 When switchgear is racked out from the service position, then a visual inspection shall be undertaken to confirm that the busbar and feeder shutters have closed. When it is confirmed that the shutters are satisfactorily closed, then they shall be immediately locked with a safety lock and an approved danger notice secured by the lock. The Authorized or Competent Person shall securely retain the safety key for the

duration of the work.

3.2.2 If the busbar or feeder shutters fail to close completely then it is not permitted to enter the switchgear enclosure to operate the shutters manually. The panel door shall be closed with a safety lock applied, which also secures a danger notice. A maintenance defect report shall be raised for remedial action to be undertaken in a planned shut down.

3.2.3 When switchgear is physically removed from service and all protection and control flexible connections have been disconnected and then the switchgear shall be electrically discharged before work can be undertaken.

3.2.4 Routine maintenance or repair shall be undertaken in accordance with an approved procedure or the original manufacturers instruction.

3.2.5 Before withdrawable switchgear is returned to service the Authorized or Competent Person shall confirm the following:

a) maintenance, modification or repair work completed;

b) testing completed and recorded;

c) test connections removed from the bushings;

d) switchgear in the open position.

3.2.6 The safety document can then be cleared and cancelled and the switchgear returned to service.

3.3 High voltage busbars and voltage transformers

Single switch panel

3.3.1 When work is to be undertaken on a single switch panel, on the feeder, busbar or voltage transformer spouts, then the remote end of the circuit shall be isolated and LOTO applied. Then at the switch panel to be worked on a switchgear primary earth applied to the incoming circuit. The remote end of the circuit shall then have a primary earth applied by switchgear and LOTO applied.

3.3.2 When the HV circuit feeding the switchgear is from an overhead line that is isolated but cannot be earthed through switchgear, then via the switch at the substation a primary earth shall be applied to that circuit and then a portable primary applied to the cable termination closest to the substation, the overhead line shall first be proved dead using an approved voltage indicator with the indicator verified to be working immediately before and after use.

3.3.3 When the switchgear is feeding a transformer or other circuit, then they shall be isolated, proved dead, primary earth and LOTO applied.

Multi switchgear panel

3.3.4 To work on a multi-panel board it shall be isolated from all sources of supply; the outgoing circuits shall be opened first then the transformer incoming circuit breaker opened.

3.3.5 When the transformer circuit breaker is part of the work to be undertaken, then the transformer higher voltage side shall be isolated, proved dead, primary earth and LOTO applied.

3.3.6 When a voltage transformer (VT) is connected to the switchgear, then the VT shall be isolated, racked out, and LOTO applied to the VT shutter.

3.3.7 Primary earth shall be applied to all remote ends of the circuits that are fed from the switchboard.

3.3.8 When only one side of a multi-panel switchboard with more than one section is to be worked on, then the bus-section circuit breaker shall be opened and racked out. The bus bars shutters shall be locked closed with a safety lock with both caution and danger notices attached.

3.3.9 Primary earth shall then be applied to the bus bar by the transformer incoming circuit breaker.

3.3.10 When the transformer incoming circuit breaker is to be worked on then, the HV side of the transformer shall have a primary earth applied and the busbar primary earth applied by a different circuit breaker to be worked on. The busbar earth will be safety locked closed and LOTO applied.

3.3.11 An appropriate safety document shall be issued for the work to be undertaken which shall be under the personal control and supervision of an Authorized Person.

3.4 Vacuum switchgear

3.4.1 During high voltage testing, vacuum switchgear can generate X-rays across the open contact gap. Testing should be undertaken with the switch in the manufactures enclosure with the door closed. All personnel shall be positioned not less than 2 meters away from the unit under test. See OI-011 High Voltage Electrical Testing.

3.4.2 On withdrawable vacuum switchgear when the switch is withdrawn for operational reasons, the primary isolating contacts shall be inspected for burning or corrosion and if any defects are evident do not return the circuit breaker to service.

3.5 Oil switchgear

3.5.1 When a sight glass is available the circuit breaker oil level shall be checked. If the oil level cannot be determined then the switchgear shall not to be operated live, the switchgear shall be made dead remotely.

3.5.2 When the remote operation of oil circuit breakers is available, then this shall always be used to operate the circuit breaker.

3.5.3 On withdrawable oil switchgear when the switch is withdrawn for operational reasons, the primary isolating contacts shall be inspected for burning or corrosion and if any defects are evident do not return the circuit breaker to service.

3.5.4 Oil isolators and fused isolator switches shall have a mechanical delay mechanism fitted to the operating handle to prevent the switchgear being operated to a closed or earthed position and then immediately opened.

3.6 Sulphur Hexafluoride switchgear

3.6.1 Check the switchgear SF6 gas pressure on the circuit breaker pressure gauge and when this is indicating low, then the switchgear is not to be operated while energized and shall be made dead remotely.

3.6.2 When a leak of SF6 is suspected then personal hygiene is important, and hands should be thoroughly washed before drinking and eating and avoid wiping the nose, eyes or face with other than clean paper tissues.

3.6.3 SF6 gas is heaver than air and will settle in any low area when a leak is suspected do not enter a cable basement or other level below that of the switchgear.

3.7 Low voltage switchgear

3.7.1 To undertake work on a 240/415volt panel with fused switches on the outgoing circuits then the fuse switches shall each be opened. Then at the remote end of each low voltage circuit it shall be isolated and proved dead using an approved voltage indicator with the indicator verified to be working immediately before and after use. A primary earth and LOTO shall then be applied directly to the circuit.

3.7.2 When the outgoing circuits are complex or when a customer is connected to the circuit before the point of isolation then each customer connection shall be isolated with LOTO applied to prevent back feeding from generation at a consumers' premises.

3.7.3 The incoming feed to the low voltage panel shall be isolated on the low voltage side of the transformer with a primary earth, and LOTO applied. When there is no isolation point between the low voltage side of the transformer and the panel then the transformer shall be made dead, isolated, earthed on the high voltage and low voltage side and LOTO applied.

3.7.4 When the low voltage panel has more than one busbar section, than the procedure in 2.8.3 shall be applied to each transformer supplying a low voltage busbar section.

3.7.5 The low voltage panel busbars, on each busbar section, shall be proved dead using an approved voltage indicator with the indicator verified to be working immediately

before and after use. The primary earth shall then be first connected to the substation main earth system and then each busbar section in turn.

3.7.6 When there is insufficient space in the panel to apply all the primary earth insulated hand clamps, then the fuse in each fused switch shall be replaced with a solid link and then closed to earth the busbars through the solid link. When this is adopted each fuse switch shall be made inoperable with a safety lock, and caution notices applied.

4. REFERENCES

4.1 AADC System Safety Rules

4.2 Article 98 of Federal Law No. 8 for 1980 on Regulation of Labour Relations

4.3 Abu Dhabi Occupational Health and Safety Management System Framework (OSHAD-SF) – Management Systems Elements – Element 05 – Training, Awareness and Competency, Version 3.1 March 2017

5. APPENDICES

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