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SOP DPS 11

Maintenance of Equipment containing SF₆ (Management and Leaks Control)

Revision List


Revision no.	Description	Written By/ Revised By	Date
0	First issue	J. Chircop	11.10.2010
1	Updating of Section 5.3 and Annex 2 to include only alarm check of pressure gauges and revision of Sections 5.4.1, 5.4.2, 5.5 and 5.6	J. Chircop	03.05.2011
2	Included operation and procedure for Phase 3	S. Scicluna	25.06.2014
3			

Revised by:	Verified by:	Approved by:
 [signed] S. Scicluna Environmental Coordinator	 [signed] J. Zammit Acting Manager (Maintenance) DPS	 [signed] I. D'Amato Acting DPS Station Manager

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1. Aim and Scope

The objective of this operational procedure is to specify detailed rules, times and responsibilities related to SF₆ management and leaks control at DPS. This SOP is related to the maintenance of equipment containing SF₆.

2. References

EN ISO 14001:04, clause 4.4.6

EN ISO 14001:04, clause 4.5.1


3. Terms and Definitions

RE	Responsible Engineer – Electrical Shift Maintenance Engineer
MT	Maintenance Electrical Technicians
SOP	Standard Operating Procedure
EC	Environmental Coordinator
PMO	Plant Maintenance Officer
DPS	Delimara Power Station

4. Responsibilities

Responsible Engineer (RE)

- Keeps records of interventions performed on equipment, and SF₆ gas consumption and recovery.
- Evaluates reports from operations section as per **SOP DPS 16 - Operations SF₆ Management and Leaks Control** and prepares the SF₆ Annual Report.

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Plant Maintenance Officer (PMO)

- Together with RE evaluates reports and carries out instructions as instructed by RE
- Supervises MT in all interventions performed on equipment.
- Compiles works report form (**Annex 1 – Template 11.1 - FRM 2.2 - Identification of SF6 loss**). This works report is to be retained by RE.

Maintenance Technicians (MT)

- Carry out works as instructed by the PMO, according to technical manuals.

5. Operative Rules

5.1 SF₆ Control Plan

The RE is to schedule High Voltage switchgear SF₆ alarm checks when practically possible and when operational circumstances permit.


SF₆ consumption is to be monitored, and RE is to keep track and record all SF₆ gas usage, including the gas which is recovered during any interventions. The method employed to determine loss/ recovery of gas, shall be the difference in weight of the SF₆ storage tanks.

5.2 Intervention in case of SF₆ Losses

The pressure control shall be carried out by the Operations Section as detailed in **SOP DPS 16 - Operations SF₆ Management and Leaks Control**. In the eventuality that a bay loses pressure, the RE shall be informed as per SOP and shall, together with his team:

- Evaluate the loss rate through records and take remedial measures accordingly, either by:
 - Topping Up
 - Locating leak and initiates measures to stop the gas leak.

N.B. Each situation should be assessed on an individual basis.

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- Complete **Annex 1 – Template 11.1 - Identification of SF₆ loss**
- The recorded sheet shall be filed at the RE's office for further reference.

5.3 SF₆ Pressure Alarm Verification Controls

Alarm checks will be carried out internally by Enemalta employees when practically possible and when operational circumstances permit. The test results are to be recorded in **Annex 2 – Template 11.2 - SF₆ Pressure Alarm Verification control sheet**. This log of alarm checks shall be compiled by the PMO, and retained by the RE and must indicate clearly the date when the check was performed. The control is to verify the correct functioning of the alarm. In the case that an alarm check results negative, measures to resolve the problem have to be taken as soon as possible and recorded as a remark in the same template. The fault is also to be reported through SAP®.

5.4 Instruments Calibration / Verification

5.4.1 SF₆ Detector

Since the SF₆ detector is used only as a means of detection for any leak of SF₆ gas, GO- NO GO, verification of the instrument will suffice.


5.4.2 Digital Balance

The digital balance used to weigh SF₆ gas is to be calibrated every five years by a third party and the calibration certificate shall be retained by the RE.

5.5 Reporting

The RE shall draw up an **Annual SF₆ Report** indicating:

- The overall consumption of SF₆ gas in kilograms used to top up any losses in the current year.
- The total weight of SF₆ gas recovered, if any, during the same year.
- A global assessment of areas and equipment which are most problematic for leakages.

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The original report is to be forwarded to the Manager (Maintenance) for archiving. A copy of the annual report is to be retained by the RE for operational reference.

The filled in forms, that is, **Template 11.1 and Template 11.2** are to be retained by the RE and made available to the Maintenance Manager upon request.

5.6 SF₆ Storage

SF₆ cylinders are pressure vessels and should therefore be protected from shocks, falls and heat. In particular:


- The vessels must be stored upright and properly secured to avoid toppling, even in the case of an earthquake or if manhandled.
- The cylinder valves should be tightly closed and where appropriate valve outlets should be capped or plugged.
- Storage places must be chosen far away from heat sources, and stockpiles of combustible material.
- The storage area must be well ventilated, and air tight rooms are not allowed.
- Segregate full, empty and used cylinders.
- Gas cylinders containing recovered SF₆ gas should be clearly identified.

6. Reference Documents

Manufacturer machinery manuals


Annual SF₆ report

SOP DPS 16 – Operations SF₆ Management and Leaks Control

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Annex 1

Template 11.1 – Identification of SF₆ Loss

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Annex 2

Template 11.2 - SF₆ Pressure Alarm Verification Control Sheet – Phase 1 and Phase 2

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Template 11.2 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 1 and Phase 2 (page 1 of 5)

Alarm Controls					
132kV Switchgear (Siemens ex Holec)		Functioning? Y/N	Date	Signature	Remarks
Bay 1 - For Future Use	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 2 - Block Main Transformer (Phase 2B)	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 3 - For Future Use	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 4 - For Future Use	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 5 - Marsa South DC (Outgoing Feeder 1)	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 6 - Generator Transformer 1 (Phase 1)	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 7 - Interbus Transformer 1	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 8 - Bus Coupler 1 (A)	CB Compartment				
	Arcing Chamber				
Bay 9 - Bus Section Reserve Busbar	Arcing Chamber				


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Template 11.2 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 1 and Phase 2 (page 2 of 5)

132kV Switchgear (Siemens ex Holec)		Functioning? Y/N	Date	Signature	Remarks
Bay 10 - Bus Section Main Busbar	CB Compartment				
	Arcing Chamber				
Bay 11 - Bus Coupler 2 (B)	CB Compartment				
	Arcing Chamber				
Bay 12 - Interbus Transformer 2	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 13 - Generator Transformer 2 (Phase 1)	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 14 - Marsa South DC (Outgoing Feeder 2)	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 15 - For Future Use	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 16 - Block 4 Interconnector	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 17 - For Future Use	CB Compartment				
	Arcing Chamber				
	Cable Box				
Bay 18 - For Future Use	CB Compartment				
	Arcing Chamber				
	Cable Box				


Template 11.2 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 1 and Phase 2 (page 3 of 5)

33kV Switchgear (ABB-Calor Emag)		Functioning? Y/N	Date	Signature	Remarks
Main Busbar A					
Main Busbar B					
Reserve Busbar A					
Reserve Busbar B					
Bay 1 - Marsascalea DC (Outgoing Feeder 7)	Breaker				
	Busbar 1A				
	Busbar 2				
Bay 2 - Generator Transformer 1 (Phase 2A)	Breaker				
	Busbar 1A				
	Busbar 2				
Bay 3 - Freeport (Outgoing Feeder 5)	Breaker				
Bay 4 - Tarxien DC (Outgoing Feeder 3)	Breaker				
Bay 5 - Tarxien DC (Outgoing Feeder 1)	Breaker				
Bays 3, 4, 5	Busbar 1A				
Bays 3, 4, 5	Busbar 2				
Bay 6 - Interbus Transformer 1	Breaker				
	Busbar 1A				
	Busbar 2				
Bay 7 - Station Transformer 1	Breaker				
	Busbar 1A				
	Busbar 2				


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Template 11.2 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 1 and Phase 2 (page 4 of 5)

33kV Switchgear (ABB-Calor Emag)		Functioning? Y/N	Date	Signature	Remarks
Bay 8 - Bus Coupler	Breaker				
	Busbar 1A				
	Busbar 2				
Bay 9A - Bus Section Main Busbar	Breaker				
Bays 6, 7, 8, 9A	Busbar 1A				
Bays 6, 7, 8, 9A	Busbar 2				
Bay 9B - Bus Section Main Busbar	Breaker				
Bay 10 - Station Transformer 2	Breaker				
Bay 11 - Interbus Transformer 2	Breaker				
Bay 12 - Tarxien DC (Outgoing Feeder 2)	Breaker				
Bays 9B, 10, 11, 12	Busbar 1B				
Bays 9B, 10, 11, 12	Busbar 2				
Bay 13 - For Future Use	Breaker				
Bay 14 - Marsascala DC (Outgoing Feeder 6)	Breaker				
Bays 13, 14	Busbar 1B				
Bays 13, 14	Busbar 2				
Bay 15 - Generator Transformer 2 (Phase 2A)	Breaker				
	Busbar 1B				
	Busbar 2				
Bay 16 - For Future Use	Breaker				
	Busbar 1B				
	Busbar 2				



Template 11.2 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 1 and Phase 2 (page 5 of 5)

13.8kV Switchgear (ABB)		Functioning? Y/N	Date	Signature	Remarks
Gas Turbine Generator 3A Breaker					
Gas Turbine Generator 3B Breaker					
Steam Turbine Generator 3 Breaker					

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Annex 2

Template 11.3 - SF₆ Pressure Alarm Verification Control Sheet – Phase 3


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Template 11.3 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 3 (page 1 of 3)

Alarm Controls					
132kV Switchgear (Siemens –8DN8)		Functioning? Y/N	Date	Signature	Remarks
Bay 1 – Spare (Not installed)					
Bay 2 - 40 BAT10 Main Block Transformer 41	Main Busbar Disconnecter				
	Reserve Busbar Disconnecter				
	CB Compartment				
	Line voltage transformer				
	Line disconnector and cable termination box				
Bay 3 - 40 AEA03 Existing DPS Main 132kV Switchboard	Main Busbar Disconnecter				
	Reserve Busbar Disconnecter				
	CB Compartment				
	Line voltage transformer				
	Line disconnector and cable termination box				
Bay 4 - 40 AEA04 New outgoing feeder 130MVA	Main Busbar Disconnecter				
	Reserve Busbar Disconnecter				
	CB Compartment				
	Line voltage transformer				
	Line disconnector and cable termination box				


Template 11.3 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 3 (page 2 of 3)

132kV Switchgear (Siemens –8DN8)		Functioning? Y/N	Date	Signature	Remarks
Bay 5 - 40 BAT20 Main block transformer 42	Main Busbar Disconnecter				
	Reserve Busbar Disconnecter				
	CB Compartment				
	Line voltage transformer				
	Line disconnector and cable termination box				
Bay 6 - 40 AEA06 MBT- Future Inder BV1	Main Busbar Disconnecter				
	Reserve Busbar Disconnecter				
	CB Compartment				
	Line voltage transformer				
	Line disconnector and cable termination box				
Bay 7 - 40AEA07 Future to 132kV switchgear on Block 5	Main Busbar Disconnecter				
	Reserve Busbar Disconnecter				
	CB Compartment				
	Line voltage transformer				
	Line disconnector and cable termination box				
Bay 8 - 40 BAT30 Main Block Transformer 43	Main Busbar Disconnecter				
	Reserve Busbar Disconnecter				
	CB Compartment				
	Line voltage transformer				
	Line disconnector and cable termination box				

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Template 11.3 – DPS MAINTENANCE SECTION: SF₆ Pressure Alarm Verification Control Sheet – Phase 3 (page 3 of 3)

132kV Switchgear (Siemens –8DN8)		Functioning? Y/N	Date	Signature	Remarks
Bay 9 - 40 AEA09 Bus coupler	Main Busbar				
	Reserve Busbar				
	CB Compartment				
Bus coupler VT's	Main Busbar				
	Reserve Busbar				
Generator Neutral Earthing resistor (Siemens –8DJH-RK)		Functioning? Y/N	Date	Signature	Remarks
40BAA10.40 DE43	Switchgear vessel				
40BAA10.30 DE42	Switchgear vessel				
40BAA10.20 DE41	Switchgear vessel				
40BAA20.40 DE45	Switchgear vessel				
40BAA20.30 STG	Switchgear vessel				
40BAA20.20 DE44	Switchgear vessel				
40BAA30.40 DE48	Switchgear vessel				
40BAA30.30 DE47	Switchgear vessel				
40BAA30.20 DE46	Switchgear vessel				