

GENERAL INSTRUCTION MANUAL

ISSUING ORG. SOUTHERN AREA OIL OPERATIONS

ISSUE DATE

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REPLACES

09/01/1986

SUBJECT ELECTRICAL SYSTEM, OPERATION AND MAINTENANCE

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1.0 CONTENT

This general instruction (GI) outlines the areas of responsibility for the operation, inspection, and maintenance of the 480 volt to 230 KV power system and related facilities in Southern Area Oil Operations Facilities.

2.0 PURPOSE

- 2.1 To ensure that the power distribution system and related facilities are installed, operated, inspected and maintained in a safe and proper manner.
- 2.2 To establish responsibilities for reporting and recording all electrical maintenance and malfunctions in Southern Area Producing.

3.0 RESPONSIBILITIES

The following organizations are responsible for the operations, inspection and maintenance of the power distribution system (480 V to 230 KV) and related facilities in Southern Area Oil Operations.

- a) Power Distribution Department (PDD)
- b) Southern Area Oil Operations (SAOO)

3.1 PDD responsibilities include:

3.1.1 Operation and log keeping of the following:

- 3.1.1.1 All 230KV, 115KV, and 69KV equipment.
- 3.1.1.2 All 34.5KV, 13.8KV, 4.16KV, 2.4KV, and 480 V incoming and bus-tie breakers including incoming PT's, CPT's and incoming bus PT's associated only with the first main substation incoming indoor bus at the SAOO receiving substation.

NOTE: Dhahran Power Dispatch/PDD retains full control over this equipment listed in 3.1.1.1 & 3.1.1.2.

- 3.1.1.3 All oil and SF₆ filled switches and Circuit breakers in switchyards.
- 3.1.1.4 All 13.8, 6.9, 4.16, and 2.4 KV overhead power line feeders and overhead line switches.
- 3.1.1.5 All Water Well incoming oil and fuse disconnect switches including 2.4 KV fuses on the MOV feeds.
- 3.1.1.6 All plant perimeter (SSD) 4.16 KV transformer elbows and switches on transformers only.
- 3.1.1.7 Application of equipment clearances, tagging and lockout procedures associated with pieces of equipment or systems operated by PDD.

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Administration of work permit procedures for all construction and maintenance jobs requiring access to switchgear, switchyards, power or control terminal points operated by PDD will be the joint responsibility of PDD and SAOO. SAOO will issue and PDD will countersign all work permits in the above case. Exception: PDD will be the issuer of work permits (with SAOO counter signature) only for work under PDD operating responsibility.

3.1.1.8 Where joint switching is required for clearance of the first main receiving bus, the switching sequence should be agreed prior to job commencement by all involved parties and accomplished using a switching checklist. PDD will prepare the switching program and issue a clearance in accordance with PDI 10.0 and 11.0. SAOO will issue the work permit in the above case, and PDD will countersign the permit. (Refer G.I. 2.100 requirements, PDI 10.0 and PDI 11.0).

3.1.2 Repair and Preventive Maintenance of the following:

- 3.1.2.1 All 230 KV, 115 KV, and 69 KV equipment.
- 3.1.2.2 All 230 KV, 115 KV, 69 KV, 34.5 KV, 13.8 KV, 6.9 KV, 4.16 KV, and 2.4 KV oil filled transformers, excluding desalter/dehydrator transformers.
- 3.1.2.3 All 13.8 KV, 6.9 KV, 4.16 KV, 2.4 KV, and 480 V incoming cables or bus duct including main and bus-tie circuit breakers associated with the first receiving bus excluding switchgear bus or compartments. Where no main circuit breakers are provided, PDD shall be responsible for the maintenance only up to the first joint or termination of the incoming bus or cable inside the switchgear room/van.
- 3.1.2.4 At the Water Supply Wells, the oil switch, transformer and cable from the transformer to the AC contactor only.
- 3.1.2.5 At Uth. WIP # 2 only, the 13.8 KV switchgear bus, incoming breaker, feeder breakers and the compressed air system associated with the switchgear, and batteries dedicated to the 13.8 KV switchgear.
- 3.1.2.6 At Shedgum WIP # 3 only, all 34.5 KV equipment, cables, and batteries dedicated to the 34.5 KV switchgear, including the 34.5 KV bus and all circuit breakers and breaker control wiring.
- 3.1.2.7 At Qurayyah Seawater only, all 34.5 KV equipment, cables, and batteries dedicated to the 34.5 KV switchgear. The 4.16 KV bus and bus duct or cables from the 34.5/4.16 KV transformer up to but not including the main incoming 4.16 KV breakers.
- 3.1.2.8 All protective relaying, coordination, calibration, troubleshooting, and maintenance including all voltages down to 480 V incomers, excluding 480 V thermal overloads, 480 V molded case circuit breakers, and branch circuit ground fault devices.
- 3.1.2.9 PT's and CT's associated with protective relaying as applies in 3.1.2.8. Replacement of PT's/CT's on SAOO bus or feeders will require assistance from SAOO Maintenance.

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- 3.1.2.10 All switchgear metering, and circuit wiring for control and relaying systems associated with the incomers, bus-tie and feeder circuit breakers operated or maintained by PDD.
- 3.1.2.11 Switchgear metering of all the feeder circuit breakers under the maintenance responsibility of SAOO.
- 3.1.2.12 At Shedgum WIP-2, NAD Sta Nos. 1,2,3,4,5 and Ain Dar WIP-1 the 13.8 KV switchgear, switchgear bus, and fused switches.
- 3.1.2.13 All battery banks and chargers essentially dedicated to switchgear protective relaying systems. Where DC supply circuits for switchgear protective system are derived from UPS associated battery banks, PDD's responsibility starts at the DC distribution board branch circuit breaker or fuse load terminals. See paragraph 3.2.2.2.
- 3.1.2.14 All oil filled voltage regulators and associated bypass switches located in PDD substation yards.
- 3.1.2.15 All 34.5 KV, 13.8 KV, 13.2 KV, 4.16 KV & 2.4 KV oil switches.
- 3.1.2.16 Annunciator inputs associated with equipment PDD maintains.
- 3.1.2.17 All 13.8 KV, 4.16 KV, and 2.4 KV overhead distribution systems including feeder circuit breaker, primary cables, distribution line hardware, and equipment/service, drop cables.
- 3.1.2.18 All plant (SSD) perimeter lighting 4.16 KV distribution disconnect switches, and step-down transformers excluding 4.16 KV AC contactors.
- 3.1.2.19 Re-lamping and repairs to substation and plant pole mounted lighting that requires the use of a bucket. Power supply to the light is SAOO's responsibility.
- 3.1.2.20 All cable terminations in main substation yards and on all non-motor feeders 2.4 KV and above, running off site.
- 3.1.2.21 Repair and maintenance of all SCADA equipment related to PDD maintained equipment.
- 3.1.2.22 Repair and maintenance of all high voltage overhead power lines fed from producing facility including CP and Khuff gas.
- 3.1.3 Recommendations of spare parts and equipment for power system repairs in Southern Area Oil Operations
- 3.1.4 Furnish to Southern Area Oil Operations six months in advance, schedules of preventive maintenance activities for equipment under PDD responsibility.
- 3.1.5 Supply Southern Area Oil Operations monthly progress reports of maintenance performed on equipment under PDD responsibility.

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3.1.6 Reports and relevant information will be sent to SAOO on electrical equipment failures/anomalies falling under the Maintenance, Operations, and Engineering responsibility of PDD.

3.1.7 All work on the main bus, vertical bus risers, switchgear CT's and PT's, or any alterations to high voltage barriers/cubicles, must be performed with the related components de-energized.

3.1.8 All substations, feeders, switches or equipment feeding facilities outside SAOO plants regardless of voltage level.

3.2 Southern Area Oil Operations responsibilities include:

- a) Operations
- b) Maintenance
- c) Engineering

3.2.1 The Operations Department has the final responsibility for the safe start and operation of the Gas Oil Separator Plants, the Water Injection Facilities and Qurayah Seawater Plant.

3.2.2 SAOO operations responsibilities include all switchgear and buses not addressed under PDD Operations responsibilities (3.1.1) and the following:

3.2.2.1 All 34.5 KV motor VCB's to be operated by SAOO & racked in or out by PDD. All 13.8 KV, 6.9 KV, 4.16 KV, 2.4 KV, and 480 volt feeders, including on site CP. Includes feeders to station services transformers and other transformers located in HV switchyard, all plant motor breakers, contactors, and subsequent equipment. (Exception: PDD will operate all oil filled switches in HV switchyard). In general, all feeders off the first incoming bus except 13.8 & 4.16 overhead lines.

3.2.2.2 Battery banks and chargers associated with plant UPS systems including DC distribution panel board supplied from the battery bank. See paragraph 3.1.2.13.

3.2.2.3 UPS Systems.

3.2.2.4 All plant and SSD perimeter lighting systems. See paragraphs 3.1.2.18 and 3.1.1.6.

3.2.2.5 Report to PDD all electrical anomalies concerning incoming breakers and bus-tie breakers.

3.2.2.6 Operations will keep a log which will include the alarm and failures of equipment under their jurisdiction.

3.2.2.7 Administration of work permit procedures for all jobs done on switchgear equipment and feeders including feeders to transformers located in the HV switchyard under the operations responsibility of SAOO. See paragraphs 3.1.1.7 and 3.2.2.8.

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- 3.2.2.8 Application of equipment lock-out and tagging procedures as per Aramco General Instruction No. 6.012.
- 3.2.2.9 Report to PDD all relay target information in the event of a protective relay trip.
- 3.2.2.10 Under emergency conditions, if assistance from PDD is required for maintenance of the facilities maintained or operated by Southern Area Oil Operations, SAOO will issue a work order form 981-1 approved by the SAOO Superintendent to PDD.
- 3.2.2.11 SAOO can trip, only during emergencies, the incomer and bus-tie breakers or overhead line feeders under the operating responsibility of PDD. Closing these circuit breakers by SAOO personnel is prohibited.
- 3.2.2.12 All switchgear buildings or rooms within the perimeter fence of SAOO facilities including substation switchyard fences. Sand control and removal inside and around these areas. PDD will provide, as needed, reasonable support to Producing Maintenance to check that contractor/maintenance Work inside the high voltage yard is reasonably safe. Work permit procedures shall be as described in par. 3.1.1.7.
- 3.2.2.13 PDD shall maintain all electrical equipment as outlined in 3.1.2 under a maintenance work order chargeable to the proponent under SAOO budget with PDD thru 5879E's. Major new work and upgrades must be planned and budgeted.
- 3.2.2.14 All electrical equipment located within the plant perimeter security fence shall be considered to be SAOO asset. This shall include all distribution feeders overhead and underground as well as H.V. incoming structures.
- 3.2.2.15 SAOO shall assure that planned routine, periodic and regular maintenance of the assets under their jurisdiction is carried out. In case of unforeseen circumstances preventing this maintenance, a new schedule for the same shall be formulated by SAOO with PDD. Frequency of routine preventive maintenance shall be established in the Aramco Maintenance Management System (AMMS) and MMP/PM.
- 3.2.2.16 Determination, cataloging and stocking of spare parts of newly introduced electrical capital items within Saudi Aramco system shall be coordinated by SAOO with PDD and the PMT of Projects organizations in accordance with the procedures outlined in G.I. No. 321.006.
- 3.2.2.17 The replacement of electrical equipment due to damage, failure or obsolescence will be funded through capital or expense accounts as determined by Saudi Aramco Capital Programs Division. SAOO will be responsible for obtaining the required capital funding plus purchasing of equipment.

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3.2.3 SAOO Maintenance responsibilities will include all equipment not addressed under PDD Maintenance responsibilities 3.1 and the following:

- 3.2.3.1 All equipment outlined in 3.2.2.
- 3.2.3.2 Desalter/dehydrator transformers.
- 3.2.3.3 Ensure lockout and tagging procedures as per Aramco G.I. No. 6.012 are implemented plus the Switching Checklist as referenced in 3.1.1.8.
- 3.2.3.4 Notify PDD one week in advance when equipment will be available for preventive maintenance (i.e. shutdown, T&I, etc.).
- 3.2.3.5 Repair and calibration of the 13.8 KV and 4.16 KV transducers on motors.
- 3.2.3.6 All control wiring and associated indication and auxiliary devices for all feeder circuit breakers under the Maintenance responsibility of SAOO. See paragraph 3.1.2.11.
- 3.2.3.7 The testing and preventive maintenance of the equipment outlined in 3.2.3.
- 3.2.3.8 All work on the main bus, vertical bus risers, switchgear CT's and PT's, or any alterations to high voltage barriers/cubicles, must be performed with the related components de-energized.
- 3.2.3.9 Supply of all logistical support to PDD (such as communication equipment, scaffolding etc.) to enable PDD to provide the required maintenance services.

3.2.4 Southern Area Producing Engineering Department with its Technical Support Divisions shall be the overall technical advisors on matters concerning electrical systems at SAOO facilities, when necessary, in consultation with the Consulting Services Department, and PDD Relay and Operations Engineering Division.

- 3.2.4.1 Review and/or preparation of engineering design change packages.
- 3.2.4.2 Assist PDD when requested on work associated with pieces of equipment or systems under the operating, maintenance and engineering responsibility of PDD.
- 3.2.4.3 Updating of drawings after an SAOO job is completed.
- 3.2.4.4 Advise SAOO maintenance, SAOO operations, on application of engineering standards, and issue resolutions to out-of-standard installations in consultation with PDD and Consulting Services Department.
- 3.2.4.5 To furnish technical information or assistance requested by PDD, SAOO Operations, and SAOO Maintenance to ensure system integrity, economy, and efficiency.
- 3.2.4.6 Inspection of electrical installations, including new constructions or modifications done by PDD or SAOO Maintenance, to ensure strict adherence to all applicable codes and Aramco standards.

SAUDI ARABIAN OIL COMPANY (Saudi Aramco)

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SOUTHERN AREA OIL OPERATIONS

* CHANGE

** ADDITION

NEW INSTRUCTION ☐

COMPLETE REVISION ☐