Electrical Isolation Safety Procedure
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<td><strong>Document Type</strong></td>
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<td>Safety Procedure</td>
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<th><strong>Document Author</strong></th>
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SUGGESTION FORM
1. INTRODUCTION

Pars Oil and Gas Company (POGC), a subsidiary of National Iranian Oil Company (NIOC), was established in 1998. POGC is a developmental and manufacturing organization that specializes in the fields of engineering and management of development projects, production, operation and integrated management of oil and gas reservoirs. POGC’s mission is to ensure sustainable and preservative production and development of Iran’s oil and gas industry in the areas under its responsibility, development of oil and gas value chain as well as optimization of energy supply processes at national, regional and international levels. POGC is also in charge of development of joint and non-joint oil and gas fields of the country including South Pars, North Pars, Golshan and Ferdowsi.

Aimed at creating superior value and boosting the level of satisfaction of the beneficiaries and with an approach focusing on sustainable, integrated and knowledge-oriented production and development, the company feels committed to comply with national and international requirements, regulations and standards in such areas as quality, safety, as well as occupational and environmental health.

2. PURPOSE

This Procedure describes requirements to ensure safety at work of personnel and equipment and to provide details of methods and principles for safe Electrical Isolation of electrical equipment.

3. SCOPE

This Specification applies to all electrical powered equipments and substations and other premises belonging to or occupied by POGC, Contractors or Sub-Contractors authorised to work on behalf of POGC.

4. RESPONSIBILITIES

4.1 Operations Field Supervisor

The Operations Assistant is responsible for ensuring that isolations are carried out by authorised responsible persons and in accordance with this procedure.

4.2 Head of Process /Head of Utility / Shift Superintendents

Head of Process /Head of Utility / Shift Superintendents are responsible for:

- Ensuring that all procedures and safeguards are fully implemented.
- Facilitating preparatory works in connection with work permits.
- Ensuring that equipment is operational after maintenance works are completed

4.3 Electrical Safety Supervisor
The Electrical Safety supervisor is responsible for:
- Conducting periodic checks on status of isolations and conformance with this procedure.
- Providing advice and / or assistance as requested / when required.

4.4 Authorised Electrical Persons
Senior Authorized Electrical Person –SAEP
An authorized electrical person who has been appointed in writing by the electrical discipline head to carry out high voltage and low voltage switching and isolation, the issue and cancellation of electrical permit to WORK, sanction for test, limitation of access, isolation/de-isolation certificate.

4.5 Authorized Electrical Person –AEP
A competent electrical person who has been appointed in writing by the electrical discipline head to carry out high voltage switching and low voltage switching, low voltage isolation and to receive electrical permit to work, sanction for test, limitation of access, electrical isolation and de-isolation certificate and permit to work.

See POGC PTW Manual (Doc. No. MA-64-POGC-001)
The Authorised Electrical Persons are responsible for:
- Performing electrical isolations as requested on Electrical Isolation Permits / Certificates and within the limits of their authorisation.
- Demonstrating to Operators and Working Party that concerned equipment will not / cannot start under any conditions or circumstances.
- Reinstating switching equipment to normal on completion of works.
- Participating in test runs with Operators and Working Party before cancellation of Permit to Work.

5. PROCEDURE
5.1 General
Requests to electrically isolate equipment, or a package, is made by the Working Party when first raising the Permit to Work by completion of the Complementary Electrical Isolation Permit(s).
In the particular case of generators, a Process / Mechanical Isolation Certificate must also be raised.
All equipment subject to electrical isolation must be padlocked by using a safety padlock. The safety padlock number must be mentioned on the Isolation Certificate.
If there are several Permits to Work rose for the same item of equipment to be electrically isolated, there must be different number of Isolation Certificates and safety padlocks applied.
- One PTW is not valid for different trades.
- PTW to be raised for different trade and task.
As example:
- Electrical: One PTW cannot cover work on transformer and switchboard together
- Electrical: Work on HV transformer or HV-LV transformer need one PTW and one Electrical Isolation complementary (by ticking HV-LV box).
- Mechanical: Electrical isolation certificate of Electrical PTW cannot cover mechanical work

5.2 Electrical Isolation Principles

Electrical Isolation is a preparatory operation to allow a Permit to Work to be issued and to ensure that general safety precautions are observed when carrying out the isolations. General safety precautions are:
- Correct Personal Protective Equipment (PPE) must be worn.
- Work together with Shift Authority.
- Make sure that any equipment to be isolated is switched off.
- Check scope of work on equipment to be isolated: if equipment removal is contemplated, cables must be disconnected at concerned equipment and cable ends taped to prevent damage to connections or moisture ingress.
- Apply safety padlocks where necessary to ensure proper isolation.
- Log safety padlock numbers and document numbers in the sub-station Log Book provided for this purpose.
- Apply Isolation tag on which the complementary and main permit numbers registered.
- As safety padlocks have a unique key, they must be stored in the sub-station key-box to avoid risk of loss.
- Provide, wherever necessary, a multi hasp device to allow for fitting of several padlocks.
- Demonstrate to Shift Authority and to Working Party that equipment will not / cannot start under any conditions or circumstances.

5.2.1 HV Equipment Isolation

Motor Feeders
Some types of HV motor feeders are (but not limited) as below:
- 6 kV motors fed from 33 kV switchboards through a captive step-down transformer.
- 6 kV motors fed from 6 kV switchboards through circuit breaker.
- 6 kV motors fed from 6 kV switchboards through contactor and HRC fuses.

Depending on the work to be done on equipment, isolation may consist only of locking-off the main control device (circuit breaker or contactor). If any work is required on conductive parts however, EARTHING of HV cables is mandatory in addition to locking-off and tagging them. Control device locking-off consists of racking out the withdraw able circuit breaker / contactor in order to separate it from bars, although not necessarily removing it from the cubicle, and fitting safety padlock(s) at appropriate location(s) in such a way that racking-in is impossible without removing the safety padlock.

Locking-off isolation is only performed by an Authorised Electrical Person.
Earthing of HV cables is achieved by closing the earth-switch associated with the circuit breaker / contactor and locking-off in the closed position with a safety padlock.

This type of isolation (locking-off and earthing) is performed by a Senior Authorised Electrical Person who issues a Complementary Electrical Isolation Permit describing the work to be done by electrical personnel on conducting parts.

If work by electrical personnel is to disconnect the motor to allow removal by others (mechanical engineers, for example), this is part of the preparatory work and must be done before issue of the Main Permit to Work. (To mechanical engineers)

The scope of work is described on the Main Permit to Work and the Authorised Electrical Person is responsible for safety of personnel working under his directions and the equipment to be worked on.

Distribution Transformer Feeders
Some types of distribution transformers are (but not limited) as below:

- 33 to 6 kV
- 6 kV to 400 V

Some transforms such as (6kV to 400V) differ in that the secondary sides of transformers and are not provided with EARTHING facility at switchboard level.

Before isolation is performed, ensure that busbar which is supplied by this transformer is fed from another source by implementation automatic transfer (ATS) or automatic change over (ACO).

For this operation, the Shift Authority or Working Party (if a Permit to Work is issued) must ensure that any switching is done from the PDCS console located in CCR before effective isolation is started thus avoiding disturbance to running equipment.

Primary circuit breaker is also to be opened from PDCS / PMS console after the source change.

Every change in breaker position must be confirmed by radio or telephone from the concerned locations to PDCS / PMS Console Operator.

Once this is done, the following actions may be performed at the concerned switchboards:

- Racking out of circuit breakers.
- Closure of earthing switches (on 33, 6 kV switchboards).
- Fitting of safety padlocks.

For 33 to 6 kV transformers, access to terminals is only possible if the appropriate keys are retrieved from switchboards (keys are free when earthing switch is closed).

The same applies for 6 kV to 400 V transformers, but on the low voltage side. The key is free when the circuit breaker is racked out as there is no earthing mechanism.

This type of isolation must be performed under the supervision of a Senior Authorised Electrical Person.

Similarly for motors, if working on conducting parts to allow others to work, the Senior Authorised Electrical Person must issue a complementary Electrical
Isolation Permit to describe the scope of work by electricians. This is part of the Main Permit to Work preparatory works. This work is not to be done by electricians on the “Own Isolation” basis, the work must start under the responsibility and supervision of a Senior Authorised Electrical Person on the “Normal Isolation” (or his delegate who cannot be less than an Authorised Electrical Person) until all works on isolated equipment are complete. Restoration to a live condition must be under the supervision of a Senior Authorised Electrical Person.

Generators:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>OUTPUT</th>
<th>CONNECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel engine-driven</td>
<td>6 kV</td>
<td>Connected to 6 kV essential switchboard through circuit breakers</td>
</tr>
</tbody>
</table>

In order to allow safe work on packages, isolations are made at following locations:
- Electrical switchboard where power lines are connected.
- Generator UCP where excitation controls output is located.
- Gas and / or diesel oil supply line (Mechanical / Process isolations).
- Auxiliary package switchboard (depending on scope of works).
- Starting systems (Mechanical / Process and / or Electrical Isolation).

Similarly as for previous equipment, preparatory works start by bringing the machine off-line and control of main circuit breakers is to be done from PDCS / PMS console.
Electrical isolations may be of the simple lock-off type when work does not involve conductive parts, otherwise EARTHING must be done at switchboards and at generator terminals for main generators.
Package-dedicated switchboards may also need to be isolated at incomers.
In all cases there must be the same number of Isolation Certificates as items of equipment.
Isolations must be performed under the supervision of a Senior Authorised Electrical Person.

Switchboards
All HV switchboards (33 or 6 kV) are composed of two busbars, A and B, which can be interconnected by means of a bus-tie circuit breaker.
Isolation of busbars is strictly electricians’ work but, as this may have consequences on running plant; preparatory works are of prime importance to ensure a minimum of disturbance to running equipment.
Such works should not take place more than once in every three to five and should ideally be planned during an area shutdown although this may not always be possible.
This procedure considers this last case scenario, i.e., out with an area shutdown period.
This type of isolation must be performed under the supervision of a Senior Authorised Electrical Person after development of a detailed Procedure agreed by the Process / Utility / Shift Superintendents.
This Procedure must highlight:
- Actions by Operators to put the plant in a safe running condition.
- Possible risks and hazards.
- Back-up solutions in the event of a failure.

Main actions and responsibilities to complete preparatory work and begin maintenance work are shown in the Table 1:

<table>
<thead>
<tr>
<th>ACTIONS</th>
<th>RESPONSIBILITY/LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>All preparatory works.</td>
<td>Operators</td>
</tr>
<tr>
<td>Switching (to ensure that all switchboards depending on bus to be</td>
<td>PDCS console</td>
</tr>
<tr>
<td>isolated) are fed by alternate source.</td>
<td></td>
</tr>
<tr>
<td>Position change-over enable / disable control switch to</td>
<td>Switchboard location electrician</td>
</tr>
<tr>
<td>OFF position.</td>
<td></td>
</tr>
<tr>
<td>Open primary circuit breaker of transformer supplying the busbars to</td>
<td>PDCS / PMS console</td>
</tr>
<tr>
<td>be worked on.</td>
<td></td>
</tr>
<tr>
<td>Busbar is now de-energised.</td>
<td></td>
</tr>
<tr>
<td>Every circuit breaker movement must be confirmed by radio or</td>
<td>PDCS / PMS console operator</td>
</tr>
<tr>
<td>telephone.</td>
<td></td>
</tr>
<tr>
<td>All circuit breakers and contactors must be removed from cubicle</td>
<td></td>
</tr>
<tr>
<td>(including bus-tie breaker).</td>
<td></td>
</tr>
<tr>
<td>Shutters at bus-tie breaker compartment must be locked with</td>
<td></td>
</tr>
<tr>
<td>safety padlock.</td>
<td></td>
</tr>
<tr>
<td>Certain keys must be retrieved to allow earthing of busbars.</td>
<td></td>
</tr>
<tr>
<td>A detailed procedure per switchboard will be developed later to</td>
<td></td>
</tr>
<tr>
<td>consider specifics and key numbers of each switchboard.</td>
<td></td>
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5.3 LV Equipment Isolation

5.3.1 Motor Feeders

At this voltage level (400 V) isolation consists only of locking-off the main control device (circuit breaker or contactor).

Control device locking-off consists of racking out breaker / contactor and applying safety padlock(s) at appropriate location(s) in such a way that racking-in is impossible without removing the safety padlock.

This type of isolation (locking-off) is only performed by a Competent Electrical Person.

If the scope of work of a Main Permit to Work involves removal of the motor from site, then the preparatory work must also include disconnection of cables at the motor. This fact must be clearly mentioned on the Isolation Certificate.

Distribution Transformer Feeders

As there is no possibility of “back feed”, isolation of LV distribution transformers is carried out in the same way, and by the same Authorised Electrical Person, as the motor feeders.

Switchboards

There are three types of switchboards:
- Switchboards comprising two busbars and a bus-tie circuit breaker.
- Switchboards with only one busbar and double feed.
- Switchboards with only one busbar and single feed.

<table>
<thead>
<tr>
<th>SWITCHBOARD TYPE</th>
<th>DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two busbars and bus-tie circuit breaker</td>
<td>These are isolated using the same principles as HV switchboards but EARTHING of bus bars is performed using approved portable EARTHING devices made of flexible cables ending with C clamp type connectors. Such isolations are performed under the supervision of an Authorised Electrical Person.</td>
</tr>
<tr>
<td>Single busbar and double feed</td>
<td>As above except that there is no bus-tie circuit breaker.</td>
</tr>
<tr>
<td>Single busbar and single feed</td>
<td>As for motor feeders</td>
</tr>
</tbody>
</table>

5.3.2 UPS & DCP
In principle, UPS & DCP systems (whether AC or DC) are critical items that cannot be isolated entirely. Maintenance teams may only begin work after preparation of concerned area is completed under the supervision of an Authorised Electrical Person and proper Limitation of Access (LOA) is documented. Because of the presence of batteries in these UPS systems, it is possible to be exposed to contact with voltages that are hazardous to the human body.

5.4 Distribution Boards
Small power distribution boards can be isolated as for motor feeders when it is necessary to work on common bars or wiring.
Isolation of individual outgoers from such switchboards by use of safety padlocks will also need a suitable locking device fitting to concerned circuit breakers to prevent accidental closure.
As with UPS units, shutdown of associated distribution boards may not be possible without a major upset to the running plant. Maintenance works may have to be done in live conditions, in which case a Limitation of Access (LOA) Certificate must be prepared and documented before starting work. If a shutdown is unavoidable, a procedure detailing other disciplines specific works requires to be prepared and agreed before the shutdown can take place.

5.5 De-Isolation
De-Isolation is the reverse process of Isolation and consists of:
- Cancelling main permit in complete case.
- Removing all safety padlocks, tags and keys.
- Restoring all open and racked-out, or closed (earth switches), switching devices to working order.
- Cancelling / closing Electrical Isolation Permit.
- Updating log books etc.
This process can take place only when Working Party has declared the work is complete or if requested to do so by Shift Authority.
Main Permits to Work are cancelled by Shift Authority only after running tests have been successfully conducted.
Responsible Persons are the same as for Isolation.
If running tests are not conclusive, and it is not possible to complete troubleshooting or repair work on the spot, Isolations must be re-instated as they were originally and new documentation must be prepared.

5.6 Sanction for test
A form of declaration signed and issued by a Senior authorized electrical person to an authorized electrical person in charge of testing high voltage equipment or a competent electrical person in charge of testing low voltage equipment for the purpose of making known to such persons exactly what equipment is to be tested and the conditions under which testing is to be performed.
The Sanction for test permit, when signed by involved disciplines and Area Authority in allocated location, to be de-isolated by HSE Electrical Person (S.A.E.P or A.E.P) for performing the test. Complementary sanction for test permit will be attached to Main permit and Complementary electrical Isolation permit will be held in HSE electrical office up to end of the test. If the result of test is satisfied the main permit will be signed Off and all isolations on PTW’s to be reinstated to the original isolations as before.

6. Training
All people shall be trained based on permit requirements and their responsibilities.

7. DEFINITION & Abbreviation:
CAUTION NOTICE
A notice in an approved form attached to electrical equipment or its controls conveying a warning against interference with such EQUIPMENT. These notices will be attached to all points of ISOLATION from which EQUIPMENT can be made LIVE.
DANGER
It is a risk of bodily injury or loss of life or health from shock, burn, asphyxiation or other causes.
DANGER NOTICE
A notice in an approved form reading ‘DANGER’ with any additional wording that can call attention to the DANGER of approaching or interfering with such LIVE EQUIPMENT.
EARTH, EARTHEd / EARTHING
Connecting to or connected to the general mass of earth in such a manner as will ensure at all times that the body being earthed discharges immediately any electrical energy stored in it and furthermore, is maintained at a safe potential with respect to the general mass of earth.
LV Earth
LV Earth is an earth of an approved design that may be used on low voltage equipment when it is worked on under an electrical permit to work.

EARTHED NOTICE
A notice in an APPROVED form reading ‘EARTHED’ that can be used to identify EQUIPMENT that has been used to apply a CIRCUIT MAIN EARTH to a circuit.

ELECTRICAL ISOLATION
An act which ensures safe isolation of electrical EQUIPMENT by physically opening electrical circuits by removing and padlocking in open position the main circuit control EQUIPMENT.

ELECTRICAL ISOLATION /DE-ISOLATION PTW
A form of request raised by a working party and signed and issued by a responsible member of a Custodian Department to a suitably authorized electrical person to ensure the safe ISOLATION of electrical circuits prior to non-electrical works by a third party.

OWN ISOLATION
A statement by electrician in charge of works on main PERMIT to WORK to indicate that works to perform under his responsibility will require ELECTRICAL ISOLATION of EQUIPMENT, such ISOLATION being made and documented by himself for himself and his team.

ELECTRICAL ISOLATION/DE-ISOLATION CERTIFICATE must be used the same way, as above with the exception that signature of Area Authority is not required.

ELECTRICAL PTW/ CERTIFICATE
A form of declaration signed and issued by a SENIOR AUTHORISED ELECTRICAL PERSON to a COMPETENT ELECTRICAL PERSON in charge of work to be carried out on any EQUIPMENT, for the purpose of making known to such a person exactly what HIGH VOLTAGE EQUIPMENT is DEAD, ISOLATED from all LIVE conductors, has been discharged, connected to EARTH, and it is safe to work.

An ELECTRICAL PERMIT to WORK shall also be issued to a person in charge of work on LOW VOLTAGE EQUIPMENT when either it is necessary to:

Apply a CIRCUIT MAIN EARTH to the HIGH VOLTAGE side of a transformer feeding the LOW VOLTAGE EQUIPMENT
Or Apply a LV EARTH to the bus-bars of a LOW VOLTAGE switchboard.

HIGH VOLTAGE EQUIPMENT (HV)
Any equipment, apparatus and conductor which are normally operated at a voltage exceeding 1000 V AC or 1500 V DC.

LOW VOLTAGE EQUIPMENT (LV)
Any equipment, apparatus and conductor which is not EXTRA LOW VOLTAGE and which are normally operated at a voltage not exceeding 1000 V AC or 1500 V DC.

EXTRA LOW VOLTAGE EQUIPMENT
Any equipment, apparatus and conductor which are normally operated at a voltage not exceeding 50 V AC or 70 V DC.

ISOLATED / ISOLATION
EQUIPMENT disconnected from LIVE system by an open disconnecting or by an adequate physical gap.

**LOTO**
Lock out Tag out is a safety system including of all Safety padlocks, keys, Tags and tokens used to lock means of ISOLATION and EARTHING.

**LIMITATION of ACCESS (LOA)**
A form issued and cancelled by a SENIOR AUTHORISED PERSON to a COMPETENT ELECTRICAL PERSON, defining the limits and nature of work which may be carried out on, or in the vicinity of, LIVE EQUIPMENT.
A LIMITATION of ACCESS may be issued when an ELECTRICAL PERMIT to WORK or a SANCTION for TEST is not applicable and when verbal instructions are not considered sufficient.

**PDCS**
Power Distribution Control System

**PSMS**
Power System Monitoring and Simulation

**PMS**
Power Management System

**POGC**
Pars Oil & Gas Company

**UPS**
Uninterruptable Power Supply

**SLD**
Single Line Diagram

**LOA**
Limitation Of Access

**DCP**
Display and Control Panel

**ACO**
Automatic Change Over

**ATS**
Automatic Transfer System

**8. APPENDIX :**

N/A
SUGGESTIONS FOR THE POGC 
ELECTRICAL ISOLATION SAFETY PROCEDURE

MANAGER, HSE Department  
Pars Oil & Gas Company  
Tehran I.R. Iran

Please consider the following suggestion(s) relative to the POGC Electrical Isolation safety procedure

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(Signature)                                                                                             
(Date)                                                                                                    
(Address)                                                                                                 
Contact Telephone Number                                                                                 
Contact FAX Number