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## WRITE-UP FOR ELECTRICAL INTERLOCK SYSTEM

Doc.No.: 240-0101-EMEL-SP00-0008




**Job No.** : 240  
**Client** : BANGLADESH PETROLEUM EXPLORATION & PRODUCTION CO. LTD  
**Location** : SRIKAIL GAS FIELD, BANGLADESH  
**Item No.** :  
**Equipment Name** : WRITE-UP FOR ELECTRICAL INTERLOCK SYSTEM  
**Project Title** : 60 MMSCFD SILICAGEL DEHYDRATION TYPE GAS PROCESS PLANT  
**Year Built** : 2015

A	2015.10.28	5	ISSUED FOR APPROVAL	AS	MH	VG
Rev.	Date	Page	Description of Revision	Prepared	Checked	Approved

	<b>Document Number:</b> 240-0101-EMEL-SP00-0008			
Revision: A			Rev Date : 28-10-2015	
Job No: 240		Doc. Size: A4		

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## 1.0 Introduction

An interlock is a feature that makes the state of two mechanisms or functions mutually dependent. It may be used to prevent undesired states in a finite-state machine, and may consist of any electrical, electronic, or mechanical devices or systems. In most applications, an interlock is used to help prevent a machine from harming its operator or damaging itself by preventing one element from changing state due to the state of another element, and vice versa.

Reference Drawings: P&ID, Electrical Panels and Local device.

For this plant electric interlocking system consist of:

1. Generator interlocking
2. Synchronization of Generators
3. Manual interlock type changeover switch
4. Motor control circuit:
  - a. Direct on line (DOL).
  - b. Variable Frequency Driver (VFD)
  - c. Soft Starter.
  - d. Local Operation Switch
  - e. Remote Operation control
5. Interlock with vibration switch
6. Emergency Shutdown




## 2.0 Generator interlocking

3 (three) skid mounted, 4 (four) stroke gas engine driven; 6 or 12-cylinder electricity generators will be provided for each location. Each generator is for continuous duty i.e. one generator will be in operation and the other one will remain standby which will automatically be synchronized in case of failure of the running generator. Both the Generators will be connected with common busbar through incoming panel.

## 3.0 Synchronization of Generators

In an alternating current electric power system, synchronization is the process of matching the speed and frequency of a generator or other source to a running network. There are five conditions that must be met before the synchronization process takes place. The source (generator or sub-network) must have equal line voltage, frequency, phase sequence, phase angle, and waveform to that of the system to which it is being synchronized.

An AC generator will be delivered power to a common power distribution busbar and it will be run at the same frequency as the network. Failure of the synchronization of any of the generator caused disconnected. Synchronizing relays allow unattended synchronization of a machine with a system.

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#### **4.0 Manual interlock type changeover switch**

Manual interlock type changeover switch of 500 A will be provided for electricity demand for plant and domestic use may be met either from the generators or national grid but not from both at the same time.

#### **5.0 Direct on line (DOL)**

The **Direct On Line starter (DOL)** is a part of motor control center (MCC). The simplest form of motor starter for the induction motor is the **Direct On Line starter (DOL)**. The Direct On Line Motor Starter (DOL) consist a MCCB or Circuit Breaker, Contactor and an overload relay for protection. Electromagnetic contactor which can be opened by the thermal overload relay under fault conditions. Typically, the contactor will be controlled by separate start and stop buttons, and an auxiliary contact on the contactor is used, across the start button, as a hold in contact. The contactor is electrically latched closed while the motor is operating.

#### **6.0 Star-Delta Starter**

Most induction motors are started directly on line, but when very large motors are started that way, they cause a disturbance of voltage on the supply lines due to large starting current surges. To limit the starting current surge, large induction motors are started at reduced voltage and then have full supply voltage reconnected when they run up to near rotated speed. Two methods are used for reduction of starting voltage are star delta starting and auto transformer stating. Working principal is the reduced voltage starting method. During starting the motor windings are connected in star configuration and this reduces the voltage across each winding 3. This also reduces the torque by a factor of three. After a period of time the winding are reconfigured as delta and the motor runs normally.

#### **7.0 Variable Frequency Driver (VFD)**

A Variable Frequency Drive (VFD) is a type of motor controller that drives an electric motor by varying the frequency and voltage supplied to the electric motor. Other names for a VFD are variable speed drive (VSD), adjustable speed drive, adjustable frequency drive, AC drive, microdrive, and inverter.




Frequency (or hertz) is directly related to the motor's speed (RPMs). In other words, the faster the frequency, the faster the RPMs go. If an application does not require an electric motor to run at full speed, the VFD can be used to ramp down the frequency and voltage to meet the requirements of the electric motor's load. As the application's motor speed requirements change, the VFD can simply turn up or down the motor speed to meet the speed requirement depending on controller output signal of set point to keep process value.

#### **8.0 Soft Starter**

A motor soft starter is a device used with AC electrical motors to temporarily reduce the load and torque in the power train and electric current surge of the motor during start-up. This reduces the mechanical stress on the motor and shaft, as well as the electrodynamic stresses on the attached power cables and electrical distribution network, extending the lifespan of the system.

It can consist of mechanical or electrical devices, or a combination of both. Mechanical soft starters include clutches and several types of couplings using a fluid, magnetic forces, or steel shot to transmit torque, similar to other forms of torque limiter. Electrical soft starters can be any control system that reduces the torque by temporarily reducing the voltage or current input, or a device that temporarily alters how the motor is connected in the electric circuit.

Across-the line starting of induction motors is accompanied by inrush currents up to 7 times higher than running current, and starting torque up to 3 times higher than running torque. The increased torque results in sudden mechanical stress on the machine which leads to a reduced service life. Moreover, the high inrush

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current stresses the power supply, which may lead to voltage dips. As a result, the operability of sensitive consumers may be impaired.

### **9.0 Local Operation Switch**

Local control stations and motor control stations for use in hazardous areas covering the broadest possible range of applications for processing plants and various industrial applications. Push buttons and selector switches are used in conjunction with contactors or magnetic starters for remote control of motors in hazardous locations. They provide circuit control and/or selection. Pilot lights provide visual assurance that an electrical function is being performed at a remote or hazardous location.

### **10.0 Remote Operation control**

A distributed control system (DCS) is a control system for a process or plant, wherein control elements are distributed throughout the system at a central location. In a DCS is connected by communications networks for command and monitoring from control room as well as other different location.

### **11.0 Interlock with vibration switch**

A vibration switch is type of fail-safe device used to monitor industrial rotor applications, such as heat-exchangers, industrial ventilation and pumping apparatus. Vibration switches are installed for a variety of reasons, such as damage limitation from a failure in the machine, as a means of ensuring the safety. Often the operation of the switch will stop a limit of safety vibration failure. Fan driven air coolers will be protected by vibration alarm and shutdown devices.

### **12.0 Emergency Shutdown**

For safety of the plant some electrical items has to shutdown followed by safety matrix which will be controlled by safety I/Os integrated with main control system.

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