King Fahd University of Petroleum and Minerals

*Electrical Engineering Department*

*EE-399*

*Summer Training*

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# *The Final Report*

*Prepared*

*for*

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# I. Abstract:

Summer training period is an important for student to give him clear idea about working in the field, how to apply what he studied so far and give him an experience that help him in future when he graduate. Also, it gives him a chance to work for that company, where he did his training. My summer training was in National Methanol Company (Ibn Sina). It was in the maintenance in the electric department in the period from 3 July 2010 to 25 August 2010.

# II. Introduction:

## i. History

National Methanol Company (Ibn Sina) is one of sixteen core industrial companies that form Saudi Basic Industries Corporation (SABIC). In February of 1981, SABIC joined forces with two major U.S. corporations, Celanese and Texas Eastern, and formally established a Saudi Limited Liability Company to build and operate a world-class methanol production facility in Jubail Industrial City. This new entity was to be called National Methanol Company and, like all SABIC affiliates, was given a short name, Ibn Sina, to honor one of the great scientists in Islamic history.

Building of the National Methanol Company complex began in April, 1982, based on designs by Davy Powergas, using a low pressure process licensed by ICI. Braun engineered the plant. Construction was completed in April, 1984, and methanol production commenced in June of the same year.

### ii. Methanol

Ibn Sina's methanol facility was designed for a production capacity of 700,000 metric tons per year. Over the years, however, various de-bottlenecking projects have increased annual capacity to one million metric tons per year. The primary feedstock, natural gas, is supplied to Ibn Sina by pipeline from Aramco. About 40% of the methanol produced is used captively in the production of MTBE, with the remainder being marketed worldwide by SABIC. Methanol is used in the production of formaldehyde, MTBE, acetic acid, and other chemical products.

### iii. Methyl Tertiary Butyl Ether (MTBE)

In 1994, Ibn Sina expanded and diversified its operations by moving into the production of methyl tertiary butyl ether (MTBE), one of the world's most efficient octane boosters and an oxygenate for gasoline, resulting in reduced emissions and cleaner air. The MTBE manufacturing facility was sited adjacent to Ibn Sina's methanol plant and construction began in March, 1992. Designed for an annual production capacity of 700,000 metric tons, the MTBE plant came on-stream in May, 1994. As with the methanol facility, annual production capacity has since been increased to one million metric tons per year. Of the two feedstocks, methanol is supplied by Ibn Sina's own methanol unit, and butane is supplied by pipeline from Aramco. All of the MTBE produced is marketed worldwide by SABIC.

### iv. Successes

Ibn Sina is ISO 9001-2000 and ISO 14001:2004 certified. It has had an exceptional safety record and has currently recorded almost 5 million man-hours worked since the last lost-time injury. Ibn Sina is a member of the Jubail Mutual Aid Association, a coalition of industrial and government entities set up to provide rapid-response mutual assistance in case of an extreme emergency. The company is also equipped with an advanced security system, including CCTV, intruder alarms, and computerized card access.

# III. Power Distribution Drawing

There are two main feeders coming from SCECO (34.5kV each). They pass through two switches into two main step down voltage transformers that convert the input voltage coming from SCECO, the 34.5kV transfers into 13.8kV. Then they reach into main breakers. Each signal will be distributed to feed five loads. There is an automatic transfer switch (ATS) that converts the convert the two groups of load where each group consists of five loads. And the idea of this switch is either to block one of the groups or transfer the load. There is ground sensor relay that will send a signal to the switch to block the loads if there is a ground fault. And the group would be fed by another feeder, when the switch gets a signal to do the transferring.

The 13.8kV would be converted to 4160V or 480V using step down transformers to run the motors and other equipments. The two feeders are separated by breakers which is normally open. If one of the feeders is tripped the load would be connected to the other feeders.

There are ten switchgears (substation lines). The substation lines located between two loads. Because when we want to do maintenance for transformers or some problem happened we can keep the power live in that load by transferring into other transformer. Some of these switchgears feed the maintenance and administration buildings, others for utility, for methanol plant and for methyl tertiary butyl ether (MTBE) plant.

Most of the transformers in the switchgears convert the 13.8kV into 4160V and 480V. And there are other transformers. Some of them convert into 220V and 110V.

# IV. Auto Transfer Switch

ATS Consists of:

1. ”G” Relay for Frequency: To check the Frequency between the Two Sources.

2. Three Voltage Sensors: To check the Voltage of the Three Phases of the Two Sources and if there is one Below the Set Value the Light of the Sensor of the Same Phase will go off and it won’t allow the Transfer.

3. Three TDR’s:

- Upper TDR: this is for transferring the Load from Normal Power to EG Power. It will send the Signal to the EG Engine to start and Calculate 6 Minutes to Check Voltage and Frequency to Transfer the Load To EG.
- Lower TDR: this is for Returning the Power from EG to the Normal Power. It will Calculate 10 Minutes to Check the Voltage and Frequency and to Cool Down the Engine of the EG.
- Start Engine TDR: this is Timer Delay for the Start of the EG Engine (How Much Time it should wait before starting the Engine).

4. Synch Check Relay: this is for Synchronizing the Two Sources Together.

5. Two Control Transformers:

- Emergency Control Transformer: this is tagged By E1… for the Emergency power Circuit.
- Normal Control Transformer: this is tagged by N1… for the Normal Power Circuit.

# V. Preventive Maintenance (PM):

We did several types of the preventive maintenance.

### i. Maintenance of pump motor (PM):

We did that maintenance for different pump motors.

First we go to Motor Control Centre (MCC) with our tools. We look for the location of our equipment that we want to check and open the cubical after tripping the breaker. We check for any hot spot, loose connections, and damaged wires or cables and solve any problem there. We clean the power contactor and magnetic core mating surfaces.

We check the overload relay and record the overload relay heater size. Also, we record the time delay relay (TDR) and setting time and we check its performance and the continuity between the three phases. We do one minute megger test of the motor with the cable and we do the polarization index test of the motor with cable, apply it for 1 minute and 10 minutes, then we record the readings.
We run the motor and check the rotation and take the three phases current. We compare the inrush current with the full load current of the motor that we got from the nameplate of the motor.

In the motor side and before running the motor we open the terminal box and check the connections and the cables. We get some information from the nameplate such as the full load current and the power. And we check the terminal box cover and gaskets.

### ii. Maintenance of the Sirens

The type of check for our department is to check the batteries, take the reading of the voltages and check the connections of the cables.

## VI. Protection System:

There are current transformers calibrated into certain value and they will send a signal to the transformer differential current relays that compare the current with the original one. If there are some problems or differences they will send a signal to the lock out relay which will transfer the load into the other circuit or feeder.

Also, over temperature alarm is connected to the transformer to give an alarm if the temperature goes up and the load would be transferred to the other feeder.

If ground fault happened the current will increase but the over current relay there will send a signal to the lock out relay to block the circuit to protect the other feeder or circuit.

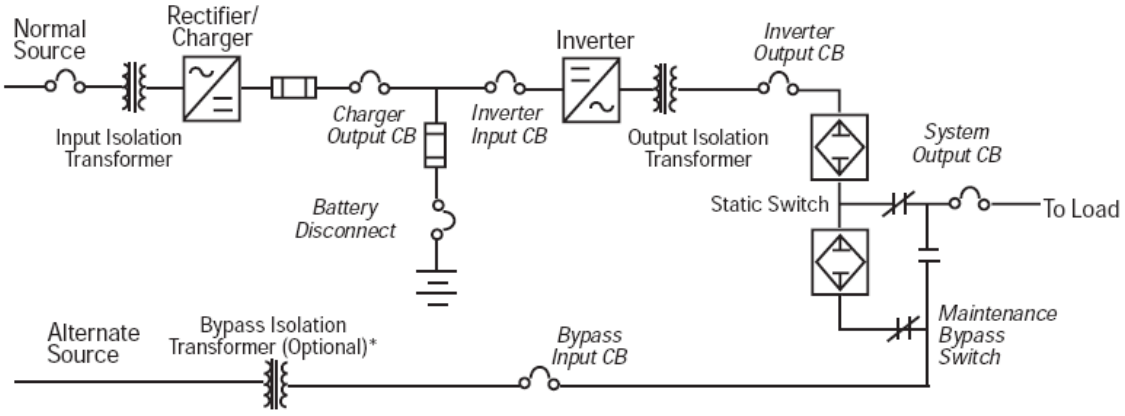
# VII. Uninterrupted Power Supply (UPS):

An uninterruptible power supply (UPS) system is a carefully monitored and controlled piece of equipment to prevent equipment shutdowns in case of main power failures. The need for some form of uninterruptible power has been used for emergency lighting, alarm systems, critical instrumentation, and similar types of loads.

The Uninterrupted Power Supply (UPS) consists mainly of four parts. Those four parts are rectifier, batteries, inverter and static switch.

There are two input sources. The first one is normal AC input (480V). And the second source is the emergency generator and the voltage is 120V, two phases.

The normal signal come into a transformer with ratio of 1 (V1/V2 =1) and the purpose of this transformer is to make the signal stable, there will be not swing in the signal it will neither go up nor down. After that, the signal reaches a rectifier to convert the AC into DC to charge the batteries and the output voltage of the rectifier is 270V. Then, there is an inverter which converts that signal into AC and the voltage is about 130V. Then the signal will pass through another transformer to do the same as first one. And there is a static switch that does switching between the signals coming from the emergency generator and the other path. When any failure happened in the normal input the load would be fed by the batteries and the emergency generator will run and warm up. However, the batteries would be consumed within about two hours. So, the static switch will convert the load to the emergency generator without interruption even in microsecond.



# VIII. Emergency Generator (EG):

## i. The procedure:

First of all When there is Power failure from SEC the ATS will Sense it and operate the EG, it will check the Voltage and Frequency, Then, it will take 5 Sec to transfer the Critical Load From the SEC Power to The EG Power. The Starting of the EG is done through the Crank (Starter OR Igniter) which are a two Motor to start the Big Mech. Motor of the Engine. Then, the Mechanical Shaft will start to rotate and rotate the Mechanical Lube oil Pump which feeds the Engine Pistons which makes the Ignition which increases the Mechanical Shaft Rotation and Rotate the Rotor of the EG which induces the Magnetic Field on the Stator Winding to have our Power(480V).on the Electric Motor of EG there is a make-up Magnetic Field which Simulates the Rotation Speed of the Motor to the Control Circuit By AC Voltage (which Means if the Voltage is 35V, That Means that the Rotation Speed is 1800 Rpm) and it Controls the Actuator (Valve) which is Directly Proportional with the Motor Rotation Speed (if the Motor is on High Speed, the Valve will Open More to Consume More Fuel). Finally, When the SEC Power Comes Back, the EG will transfer the Load to the Normal Source and Stay for Some time to Cool up the Motor and to make Sure that the Power Still there.(Time for MeoH is 10Minutes and MTBE is 5 Minutes).

## ii. Shut Downs of the Emergency Generator:

1. Low Lube Oil: When the EG Engine oil level go low, Pressure will go low, then low lube oil shut down will appear and Trip the EG.
2. High Temperature: When the Engine oil Temperature go high to a certain Degree, High Temperature shut will appear and Trip the EG.
3. Over Crank: It Means that when U EG want to activate, it will use the Batteries and will try 6 times in Batteries and if Not operated, Over Crank shut down will Appear and won't allow any activation Commands of EG.
4. Over Speed (the Governor): When the EG Speed go high more than a Certain Speed/rpm, Over Speed shut down will appear and Trip the EG.

# IX. Safety:

## 7.1 Preface

One of the most important tasks in the factories is the safety. Ibn Sina gives priority to safety with the objective of protection and safety of its personnel and property. So, they are working now on a project called Safety, Health and Environment Management (SHEM) Standard. Which will cover every things about safety in the company and each department will submit its job to come out with a complete project. For example, in electric department they are working to define minimum safety requirements for working with or near electrical equipment or electrical system.

## 7.2 General Safety Principles

- Avoid walking under a load lifted or an overhead mobile crane.
- Observe safe work procedures and principles.
- Refer to your supervisor or manager for safe work procedures before performing any unfamiliar work.
- Immediately report any unsafe work conditions to your supervisor.
- Abide by all safety signs and traffic instructions in the plant.
- Each employee must wear the necessary Protective Personal Equipment
- ( PPE ).
- Employees must know the places of the exits at work area.

## 7.3 Protective Personal Equipment ( PPE)

Safety glasses, hard hat (helmet), safety shoes, ear plugs, and gloves.

# X. Meetings:

We attended a meeting that controlled by Mr Al-Thawadi, the manager of the maintenance. In this meeting, he talked mainly about a new project for Ibn Sina that would be established in 2011 and he encouraged all to do the best and to do more practices for the employees. And he asked to increase the number of the employees and improve the performance.

Also, there is a weekly meeting in the electric department to discuss some of the topics that regarding out job.

And there is daily meeting in the morning to see what we have finished and what to do on that day and distribute the tasks.

# XI. Instrumentation:

I learnt more about a distributed control system (DCS), control modes, and transmitters and also I got brief description and explanation about High Performance Process Manager (HPM), Triconex, Bently Nevada, and Programmable Logic Controller Gateway (PLCG).

I discussed some of the operations about the Universal Station. I saw and got information about the vibration monitoring. Also, we discussed some drawings used in instruments. I knew some of the systems used there. I knew where to use different types of sensors (thermocouple and RTD). I learnt the procedures of flow indication control, pressure indication control, temperature indication control and level indication control.

## XII. Conclusion:

To sum up, I was interesting during the summer training period in the company of Ibn Sina. I learnt many things about the job, how to deal with some tasks or some problems and I got good experience. I worked as a member in a team and I made good relationships with other employees and we are respecting each other. Also, I learnt how to deal with people, machines, rules of the company and look for manuals and drawing of the equipments and machines. In the company many things are important such as safety, responsibility, respecting the rules and time, relationships, dealing with contractors, planning and solving problems. I learnt that if any bodies want to be successive in his job they should have enthusiasm and interest in work and the quality of his works should be very good. I learnt also how to behave with tasks. So, working in Ibn Sina gives people good experience and help them to improve their knowledge themselves. My advice to every student to do his summer training in Ibn Sina and do the best to work for this company.