

**King Fahad University of Petroleum and
Minerals**

Hafer Al-Batin Community College

Coop Training report

Final Report

**Maintenance at Hafer Al-Batin Water Treatment
Plant**

By

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A.M. F

Summary

This report mainly covers the topics related to practical hydraulic systems in particular for water treatment and supply. It discusses many problems and their solutions, that I encountered during the time I spent in the company.. Most of these problems were concerned with pumps, which can be solved by regular repairs and maintenance including replacement of parts.

The main problems that could occur for pumps were:

1. Bearings problems.
2. Leakage of water.
3. Lack of regular maintenance.
4. Problems due to dust and dirt.
5. Low oil levels, pressures, vibration etc.
6. Breakdown needing emergency repairs.

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1. Aims

Essentially, the aims that I wanted from this coop training include:

- a) To gain practical experience in hydraulic systems.
- b) To achieve some skills that will help in troubleshooting the practical and technical problems related to MET.
- c) To learn how to use proper tools in trouble shooting the mechanical problems.
- d) To complement my theoretical studies in an associate degree at HBCC with actual hands on field experience.
- e) To learn many things about the physical forms of the machines I would encounter related to hydraulic systems.
- f) To be familiar with many different objects, tools and equipments.
- g) To learn many tasks for the uses of the tools, and to get the skills of how to use these tools properly for each problem I am going to face.
- h) To learn the mechanism of a pump and how each component exactly works inside it.
- i) To be familiar with the routine maintenance like checking oil levels, pressure and so on because doing this maintenance regularly will reduce damage
- j) To gain the experience of doing emergency repairs that happen suddenly and unexpectedly, so the broken parts will be replaced with new ones and proper maintenance will be done.

2. Introduction to this report

This report provides a simple introduction of the working of Water Company's station in Hafer Al-Batin city. It also provides information about how the water is purified in the water company. It presents some of the problems and factors responsible for system breakdown in the company. When I worked in this company, I checked the main overt problems in various areas by observing the situation, and with the help from the supervisor, I was often able to figure out the solution before repairs began.

2.1 precautions for solving problems

- a) I must take notes of the obvious symptoms then check for the covert ones.
- b) To fix any problem on a machine I should ensure the machine is turned off.
- c) To solve a problem I must wear the proper safety gear and equipment.
- d) To comprehend a mechanical problem sometimes I need to read instructions from the same machine manual.
- e) To repair a mechanical problem properly I must use the proper tools.
- f) To increase the efficiency of any machine, I should take care of cleaning its parts and its surroundings.
- g) To reduce high temperature on a machine I should use the proper lubricants.
- h) To solve mechanical problem on a machine I should fix it step by step depending on priorities to avoid any accidents.
- i) To fix a mechanical problem in the shortest time I have to know how to use right tools properly.

2.2 Description of Hafr Al-Batin Water Purification Station

2.2.1 Water company station.

The water company's station consists of many processing stages; each stage will do a specific task for the main process which is producing clean and pure water. There are at least 8 stages needed to process the water.

2.2.1.1

The First stage are the storage tanks (no.1) Fig 1. They are two huge underground tanks that receive and store the incoming water. Their area is approx 30m*90m.



Figure no.1: Tanks (no.1).

2.2.1.2

The second stage is the pumps station (no.1) Fig2. It consists of pumps which pump the stored water from the tanks to another position called the cooler station. Each individual system of pumping consists of a butterfly valve, a pump, a motor which is attached to the pump and another butterfly isolator valve.



Figure no.2: Group of pumps in pump station no.1

2.2.1.2.1

One of the common parts of the pumping system in this company is the butterfly isolator valve Fig3. These simple "on" "off" valves can be used effectively in freshwater and saltwater. It is light in weight, and relatively small. It has a body, a resilient seat, a butterfly disk, a stem, packing, a notched positioning plate and a handle. These valves are used to isolate the water from the pump in case it has to be removed for repairs.

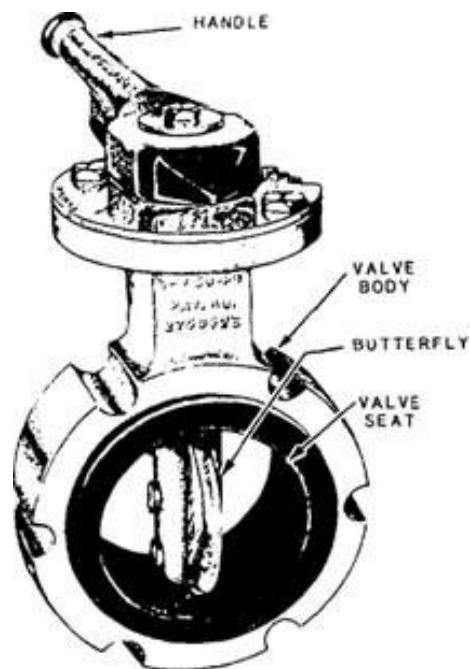


Figure no.3: Butterfly isolator valve

2.2.1.3

The third stage is the cooler station. In this position the stored water is passed through the coolers to reduce its temperature. Because this water was coming from under ground with high temperature, so it requires to be cooled, after cooling, it will be moved by the force of gravity through pipes to another place called the clarifier. But the cooler stage in this station is no longer in use.



Figure no.4: The cooler station

2.2.1.4

The Fourth stage is the clarifiers Fig5a, b. In this stage the cooled water flows by gravity. The cooled water is mixed with some chemicals called coagulants. Then it is mixed well with a big rotating paddle. Over time the coagulant causes the dirt in the water to settle to the bottom of the clarifier. After that the water flows by gravity to another place called the filters station.



Figure no.5: The clarifiers (a) and (b)

2.2.1.5

The Fifth stage is the Sand filter station Fig6. In this stage the chlorine is added to the water, and then the water is treated, filtered and cleaned from dust, rubbish, rocks and germs. And from there depending on the status of the water, it is separated by pumping them through pipes into two other places. One of them is the clean water which will go to tanks (no.2) and stored there. The other one is the dirty water which will go to open areas in a group of lakes and settle there.



Figure no.6: A Sand Filter in the Sand Filter Station

2.2.1.6

The Sixth position is tanks (no.2) Fig7. In this stage the water that is pumped from the filters will be stored there. Afterwards it will be pumped through pipes to reach the pump station (no.2).



Figure no.7: Tank (no. 2)

2.2.1.7

The Seventh stage is the main pump station (no.2) Fig8. Here all the pure water will be distributed through pipes to Hafer Al-Batin and Al-Qysumah by using powerful pumps.



Figure no.8: group of pumps in Pump Station (no. 2)

2.2.1.8

The eighth stage is where the impure water will be stored and settle in wide open areas.



Figure no.9: Areas dedicated for impure water (a) and (b)

3. About My Work During Coop

In the water company there is all the plant and equipment needed to produce clear and pure water. However, from time to time and for many different reasons this machinery develops some problems. These include, parts wearing, broken parts, and external factors that cause damage like dust, poor maintenance and problems resulting from friction causing increase in temperature.

In the following I shell explain the problems that I was faced with in the Water Company and how I solved them. Here is a daily/weekly summary of my activities during the period

3.1 Week#1

Monday 19/2/2007 (clarifier gearbox)

Three processes of regular maintenance were done depending on the period of time passed. First the oil was changed because it had become dirty. Second grease was put on some parts of the gearbox. Third the bearing in the gearbox was removed, then cleaned out of dust, and greased before it was put back.

Tuesday 20/2/2007 (clarifier pump)

The pump under the clarifier was checked. There is a gage to give the reading of the level of the oil above the pump. The oil was less than the standard level, so it was topped up.

Wednesday 21/2/2007 (pump station no.1)

A bearing in a pump needed to be replaced with a new one, because it was damaged from the effects of the heat and friction over time. The symptoms were the loud sound, the heat and the vibration of the pump.

3.2 Week#2

Saturday 24/2/2007 (The inner chlorine room)

The reading on a gauge gave high pressure in a by-pass connected to a pump and high pressure in a relief valve. This was causing water to return to the tank.

Sunday 25/2/2007 (Workshop)

A small portable pump for lifting water, was not working properly. There was no suction. The pump was opened to be checked. The pump cover which was covering over the impeller had the problem. It is permitting air to get in. The cover had become damaged because of corrosion and accumulated dust and gravel. The cover was replaced with another one.

Monday 26/2/2007

(abu musa al-ashaary)

A centrifugal pump had a covert problem, so it was checked and opened. The problem was a damaged bearing, so it was replaced with a new one.

Tuesday 27/2/2007

(Under the clarifier)

Daily routine maintenance was done. Oil levels were checked and topped up.

Wednesday 28/2/2007

(abu musa Al-Ashary)

A big pump was noisy and running hot. The pump was checked and opened. The problem was a bearing. There was a low amount of lubricant and also dust had accumulated in the bearing. The bearing was greased and cleaned and then put back.

3.3 Week #3

Saturday 3/3/2007 (Diesel driven pump)

A big diesel driven pump was washed and refilled with diesel fuel.

Sunday 4/3/2007 (pump station no.1)

In the pump station (no.1) a bearing had a high temperature; because of high friction. As a result the lubricant on the bearing was lost. So the bearing was replaced temporarily with another one, until it was repaired and the lubricant was put in.

Monday 5/3/2007 (Sand Filter Station)

I observed a filter being cleaned and washed by specialists with special tools and equipments.

Tuesday 6/3/2007 (Clarifiers)

I observed the clarifiers when they were cleaned with special equipments used by specialists, to remove and clean big amounts of dust and rust that had accumulated during long time while the clarifiers were working.

Wednesday 7/3/2007 (work shop)

In the workshop a modification was made on shaft to make it fit and attach to another one. A grinding machine was used for this modification. It was rotating with constant speed.

3.4 Week#4

Saturday 10/3/2007

Some daily maintenance was done in various places in the station. Like checking the oil, getting the reading from gauges and checking pressures.

Sunday 11/3/2007 (Abu Musa Al-Ashari station)

A centrifugal pump was making some noise because its bearing was damaged from high temperature. The bearing was replaced with a new one.

Monday 12/3/2007

A tire of one company car was replaced because it was damaged, so a spare one was used.

Tuesday 13/3/2007

Daily routine maintenances were done in various places in the station. The levels of the oil were topped up.

Wednesday 14/3/2007 (pump station no.2)

There was a loud noise coming from a pump because the rubber coupling between two shafts was missing because it had worn out. The joint between the shaft was making friction and noise. So a new coupling was added between the shafts in the pump.

3.5 Week#5

Saturday 17/3/2007 (chlorine plant)

In chlorine plant a pump was not working properly and the reading on its gauge implied that there is a high pressure in the pump. The problem was because there was a lot of dust accumulated in the fins of the rotors and also there was a lot of rusts. The pump was opened and the old damaged rotors inside the pump were replaced with new ones.

Sunday 18/3/2007

Daily routine maintenance was done in different places in the station. The oil level was topped up.

Monday 19/3/2007

An impeller inside a pump was damaged, because of the heat and the dust which filled its fins. The impeller was replaced with another one.

Tuesday 20/3/2007

Daily routine maintenances were done in different places in the station. Big pumps were washed and cleaned.

Wednesday 21/3/2007

Daily routine maintenances were done in different places in the station. The oil level was topped up.

3.6 Week#6

Saturday 24/3/2007

A daily routine maintenance was done. Lubricant was added on some part on a pipe.

Sunday 25/3/2007

A bearing on a pump was damaged because of the of dust. The bearing was replaced with another one.

Monday 26/3/2007

A pump under the filters room had a low efficiency because some objects were stuck inside it like plastic rubbish, gravels, and also a lot of dust and rust. The pump was opened and cleaned from inside.

Tuesday 27/3/2007 and Wednesday 28/3/2007 (Under the clarifier)

A daily routine maintenance was done. Under the clarifier the level of the oil was checked and also grease was added to some parts around a pipe.

3.7 Week#7

Saturday 31/3/2007

Daily routine maintenance was done. Lubricant was added to some parts of a pump.

Sunday 1/4/2007 and Wednesday 4/4/2007

A daily routine was done. Oil level was checked in a reservoir on a pump.

Monday 2/4/2007

(In the workshop)

A diesel pump was not working properly when it was started, because its air intake was not clean and it was full of carbon. so the parts were opened and cleaned petrol and other chemicals.

Tuesday 3/4/2007

A bearing on pump in the distribution room was noisy while it was working, because it had become very dusty. It was then replaced with another one.

3.8 Week#8

Saturday 7/4/2007

A daily routine maintenance was done. .Lubricant was added on some parts on a pump in the clarifier.

Sunday 8/4/2007

(In the workshop)

A diesel pump was not working properly when it was started because its air inlet was not clean and full of carbon. So the parts were exposed and cleaned with petrol and other chemicals.

Monday 9/4/2007

A daily routine maintenance was done. A Lubricant was added on some parts on a pump in the clarifier.

Tuesday 10/4/2007

(Under the filters)

A pump had a problem. There were many objects like plastic rubbish and small stones were stuck in the vines inside the pump, so the pump did not work efficiently to produce water. The pump was cleaned from these objects and the dust.

Wednesday 11/4/2007

A bearing in the distribution room was damaged due to over heating, so it was replaced with another one.

3.9 Week#9

Saturday 14/4/2007 (pump station no.2)

In the pump station no.2, one of the pumps had a problem in its check valve. The check valve was damaged, so an amount of water was drained out over the weight on the check valve. The problem was solved by replacing it.

Sunday 15/4/2007

A pump under a clarifier had a problem due to an air lock. This problem was solved by releasing the air which was stuck inside the pump (priming the pump).

Monday 16/4/2007 (In the workshop)

A diesel pump was not working properly when it was started because its air inlet was not clean and full of carbon. So the parts were exposed and cleaned with petrol and other chemicals.

Tuesday 17/4/2007 (In the distribution room)

One of the pumps had some leakage of water, on the side of the check valve. This problem was solved by replacing a rubber gasket to seal that leakage.

Wednesday 18/4/2007

A daily routine maintenance was done. The level of oil was topped up.

3.10 Week#10

Saturday 21/4/2007

A daily routine maintenance was done. Oil was added to a reservoir on a pump to top it up.

From Sunday 22/4/2007 to Wednesday 25/4/2007

(In the distribution room NO.2)

The pump was opened to be cleaned and to check on the parts inside the pump like the impeller and the shaft (Fig 10 and Fig 11 a and b). The impeller was checked to see if it was damaged, bent or unbalanced. The shaft needed to be checked, to see if its rotation was accurate and its movement for the impeller is absolutely true. Also we had to replace the worn parts with new ones. Because this pump must work for long periods of time, the inner mechanism inside the pump needs to be maintained properly.

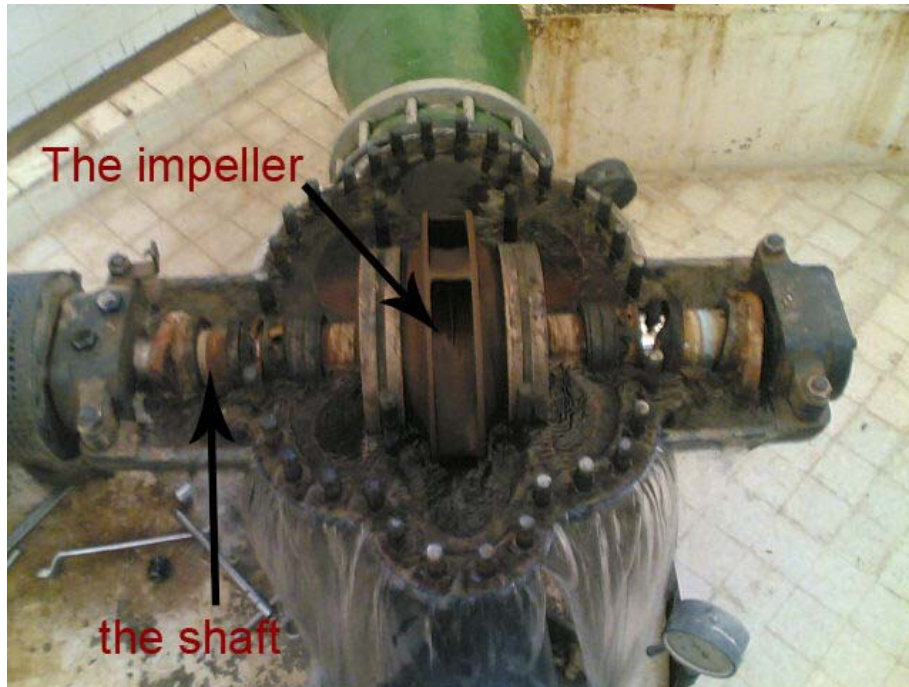


Figure 10: An open Pump in the distribution area (no.2)



Figure 11: Removing the pump cover (a) and (b)

3.11 Week#11

Saturday 28/4/2007 and Sunday 29/4/2007

Daily routine maintenance was done. Lubricant was added around some parts on a pump.

Monday 30/4/2007 and Tuesday 1/5/2007
(On the top of a clarifier)

Some maintenance was done on the top parts of a clarifier. Removing of oily dust around the moving parts, checking the gearbox which rotates the pillar to mix the water and adding some lubricant in various places.

Wednesday 2/5/2007

Daily routine maintenance was done. The level of oil was topped up on a pump.

3.12 Week#12

Saturday 5/5/2007

Daily routine maintenance was done. Grease was added on different parts of a pump.

Sunday 6/5/2007 and Tuesday 8/5/2007

Daily routine maintenance was done. Under the clarifier the level of the oil was topped up and also a lubricant was added on some parts around a pipe.

Monday 7/5/2007

A diesel pump was not working properly when it was started because its air inlet was not clean and full of carbon. So the parts were exposed and cleaned with petrol and other chemicals.

Wednesday 9/5/2007

A bearing on a pump was damaged because of the overheating. It was replaced with another one.

3.13 Week#13

Saturday 12/5/2007, Monday 14/5/2007 and Tuesday 15/5/2007

A daily routine maintenance was done. Under the clarifier the level of the oil was topped up.

Sunday 13/5/2007

A diesel pump was not working properly when it was started because its air inlet was not clean and full of carbon. So the parts were exposed and cleaned with petrol and other chemicals.

Wednesday 16/5/2007

A daily routine maintenance was done. Lubricant was added on different parts on a pump.

3.14 Week#14

Saturday 19/5/2007

A big tire of a truck in the station was damaged and needed to be changed. It was removed from the truck and replaced with another good one.

Sunday 20/5/2007

A big diesel pump was washed in an open area, was refueled with fuel and was left to dry.

Monday 21/5/2007

A daily routine maintenance was done. Under the clarifier the level of the oil was topped up.

Tuesday 22/5/2007

A bearing on a pump was damaged because of the over heat. It was replaced with another one.

Wednesday 23/5/2007

A daily routine maintenance was done. Lubricant was added on the gearbox on a clarifier.

4. Conclusions

In the water company's station, I encountered many problems and defects; As a result I have learned many things from my experience during my time there.

- a) I have learned many things about the physical forms of the machines I was encountered with related to hydraulic system.
- b) I have familiarized with many different objects, tools and equipments.
- c) I have learned what are the many tasks those tools could be used for, and I got the skills of how to use these tools properly for each problem I have faced.
- d) I have learned the mechanism of a pump and how each component exactly works inside it.
- e) Routine maintenance like checking oil levels, pressure and so on. Doing this maintenance regularly will reduce damage.
- f) I have learned to do emergency repairs that happen suddenly and unexpectedly, so the breakdown parts are replaced with new ones and proper maintenance is done.

5. References

There were some references which helped to support my knowledge in MET. I got some of my information from

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2. MET 229 Hydraulics and pneumatics printed sheets for M.S.Abdulgaffar.
3. Fluid power circuit & controls.
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4. Pump Manuals & information.
www.ksb.com