

**KING FAHD UNIVERSITY OF PETROLUEM AND MINIRALS
DEPARTMENT OF ELECTRICAL ENGINEERING**



**Summer Training Report
Time: Summer-2010
Period: Two Months
Company: ITT Saudi Company
Location: Damman Second Industrial City
Prepared by
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**To
Prof. Sheikh, Asrar Ul Haq
Prof. Al Baiyat, Samir**



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1. Introduction

This report will represent my work in ITT Saudi Company during the summer training time. I have worked for ITT Company for two months during the period from 3-July to 25-August 2010.

2. Background about the company

ITT company describes itself in the official website www.ITT.com saying "ITT Corporation is a high-technology engineering and manufacturing company operating on all seven continents in three vital markets: water and fluids management, global defense and security, and motion and flow control. With a heritage of innovation, ITT partners with its customers to deliver extraordinary solutions that create more livable environments, provide protection and safety and connect our world".

Although ITT is working in all these fields, the branch located in KSA is involved only in fluids management, more precisely in the manufacture and the maintenance of pumps.

It is new for the Saudi market since it started in 2009. When I finished the training, they were waiting for the acceptance from Saudi Aramco to sign a contract with them to be one of Aramco suppliers.

There is only one branch in Saudi Arabia located in Dammam Second Industrial City.

3. Introduction to the summer training work

The duration of the summer training was two months, simply 8 weeks. I worked as a "Test and Quality Insurance Engineer". My concentration was not only on testing a pump or on quality insurance, rather it involves all process related to the pump except the manufacturing because they don't do that in here, rather they order the pump from the USA and they bring it in here to assemble it then they send it to the customer.

I was involved in the following departments:

- Assembly Department. (One Week)
- Disassembly Department. (Two Weeks)
- Pump Testing Department. (Three Weeks)
- Material Handling and Quality Insurance Department. (One Week)

Beside that, I had some tutorials about: (One Week)

- Safety instructions.
- Trading and Contracts tutorial.
- Behavior.
- Basic principles behind the operation of a pump.
- "6S" process of evaluation.

4. Safety Instructions

All the safety tutorials were conducted by the general manager of the branch himself, Mr.Emric Laposi. After that I was examined by him. I passed all the tutorials and the company gave me a certificate indicates that I have finished what they call "Safety Orientation". There were some references to study but mainly the test was simply an oral discussion about these topics:

- Carbon Monoxide
- Eye Protection
- Lifting Techniques
- Machine Guarding - An Overview
- Lockout/Tag out :De-energizing Equipment
- Temperature Extremes - Cold
- Prepare for Safety -Dress Safely
- Solvents
- Follow Safe Crane Operation Rules
- Basic Operating Rules
- Exits - Designated Path
- Electrical Safety - Accident Prevention
- Hearing Conservation



ITT

In recognition of successful completion of

Safety Orientation

Mohammad Jasem Al-Haji

is granted this Certificate

at ITT Saudi Company
2nd Industrial City, Dammam
Kingdom of Saudi Arabia

Mr. Emeric Laposi
General Manager
ITT Saudi Company – IP

Mr. Abdullah Al-Mutawa
FARO / ARM Engineer
ITT Saudi Company - IP

July 11, 2010
Date Of Completion

5. Trading and Contracts tutorial.

It is simply about business ethics and trading rules. It teaches how to act with some customers whom they want to write a price in the contract paper higher than the original so they can put the rest in their pockets. Also we discussed something called "Code of Conduct" which is defined as "Principles, values, standards, or rules of behavior that guide the decisions, procedures and systems of an organization".

6. Behavior

Clearly it is about behavior but not only in general rather, it is also about what to do if you detect some financial fraud. Also how to behave if you are in a group and you have an opinion different than what is chosen. In addition, it tells us how to use the company files. The company files, could be any file is sorted either as uncontrolled which means anyone can look at it or controlled which means it is secret and only the authorized people are allowed to see it and it is not allowed to take it home.

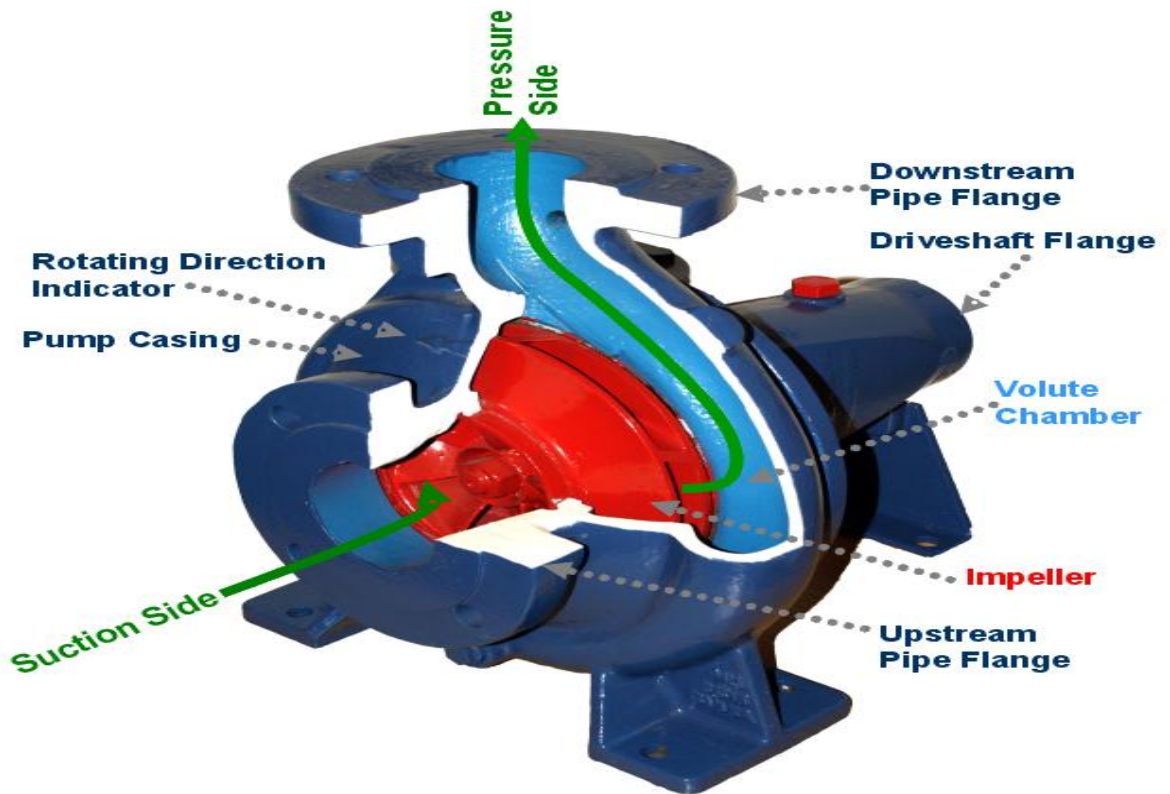
7. Basic principles behind the operation of a pump

I have been given some e-books by my supervisor talking about Pump protection , Centrifugal Pump Operation , Sensor-less flow and Explosion Protection.

The basic principles of hydraulics such as pump performance curve, net positive suction head , cavitations , speed and impeller design, system friction curves, parallel and series operation, field testing, casing design, specific speed, viscosity and high suction pressure are all discussed and illustrated in ITT Book. ITT book is sorted as controlled but I was lucky they gave us some notes about some of these topics to be aware of the operation of a pump.

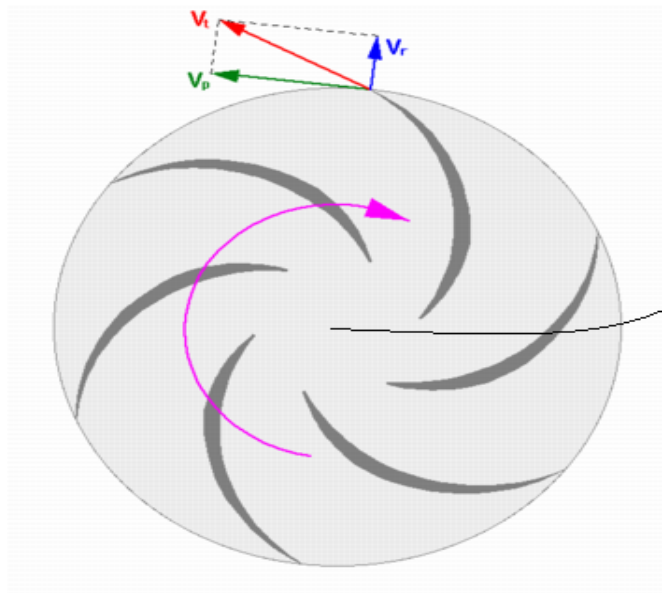
ITT deals only with centrifugal pumps. A pump is a mechanical device that moves fluid or gas by pressure or suction. Hence, the centrifugal pump is a pump that uses a centrifugal force to discharge the fluid into the pipes. That force is created by the rotation of the impeller of the pump. There are two main components to centrifugal pumps. The rotating component of a centrifugal pump consists of a shaft and an impeller. The stationary component of a centrifugal pump consists of a casing, a cover for the casing and bearings. Impellers fit inside the casing.

The following figure which shows a centrifugal pump might clear the definitions mentioned above:



* A Centrifugal Pump *

The impeller converts the input power coming from the power supply to a kinetic energy by accelerating the fluid. The fluid enters the pump through the eye of the impeller along or near to the rotating axis from the suction side shown above flowing radially outward into a diffuser or volute chamber to discharge through the outlet.



Here is the eye of the impeller

Another important component which is not clear from the figure of the centrifugal pump is the shaft. The basic purpose of a centrifugal pump shaft is to transmit the torques encountered when starting and during operation while supporting the impeller and other rotating parts.



This is the shaft

If the outlet piping is too high to allow the fluid to flow, the fluid kinetic energy is converted into pressure, and If the outlet piping is at a lower level, the fluid will be released at greater speed, as described by Bernoulli's principle.

Bernoulli's principle state that for an inviscid flow, an increase in the speed of the fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy. Inviscid flow means we assume that the fluid is ideal which is not having viscosity (Resistance of fluid).

8. 6S Process of Evaluation

6S is a process of evaluation developed from the 5S. The 5S is created by Hiroyuki Hirano (1990) and it is "the name of a workplace organization methodology that uses a list of five Japanese words which are seiri, seiton, seiso, seiketsu and shitsuke", all of them start with "s" and they mean sorting, stabilize, Cleanliness, Standardizing and Self Discipline respectively.

The origin of 5S seems rooted in the works of two American pioneers who were scrupulously studied by Japanese managers. These were Frederick W. Taylor's *Scientific Management* (1911) and Henry Ford (1922). Indeed, Ford's CANDO program (Cleaning up, Arranging, Neatness, Discipline, Ongoing Improvement), which builds on Taylor's work, appears as the obvious origin for 5S.the 6s is just added the safety .

This Process was in consideration in the company evaluation and it is named 6s following the American derivation.

9. Disassembly Department

This department involves the process of disassembling a pump to resolve the problem of that pump. We disassemble the pump in two cases, if the pump fails in the test or if the customer complains that it doesn't work properly.

After we disassemble the pump , we request the manual of the pump which contains all the design measurements of the pump and to see which liquid it is designed to carry on, we do that especially for non-ITT products which are painted in different colors than ITT color which blue.

Centrifugal pump has two popular types, horizontal pump and a vertical pump. The only difference between horizontal and vertical centrifugal pumps is shape. The choice between using a horizontal centrifugal pump or a vertical centrifugal pump is usually based on convenience.





From what I noticed, the majority of problems coming from the following:

1. The cavitations caused by the sudden change in the pressure of the liquid making it fall below its evaporation pressure.



The cavitations are clear on the impeller

2. The liquid is changed. If the suction head pressure drops below the evaporating pressure of the liquid, cavitations happen. Hence, by changing the liquid the evaporating pressure is changed and if that was not in consideration, the suction head pressure might go below the evaporating pressure of the liquid.

3. Design problems: the pump is very sensitive for measurement that is 1 mm would make a difference in the performance of the pump. For example if the clearance or the gap between the liner and the impeller is not fixed to a specific number, could be any number depending on the design, the fluid would go back to the suction side and will not discharge. Maybe I am exaggerating about the 1 mm but to be accurate as much as possible in taking the measurements of the pump is recommended anyway.

10. Assembly Department

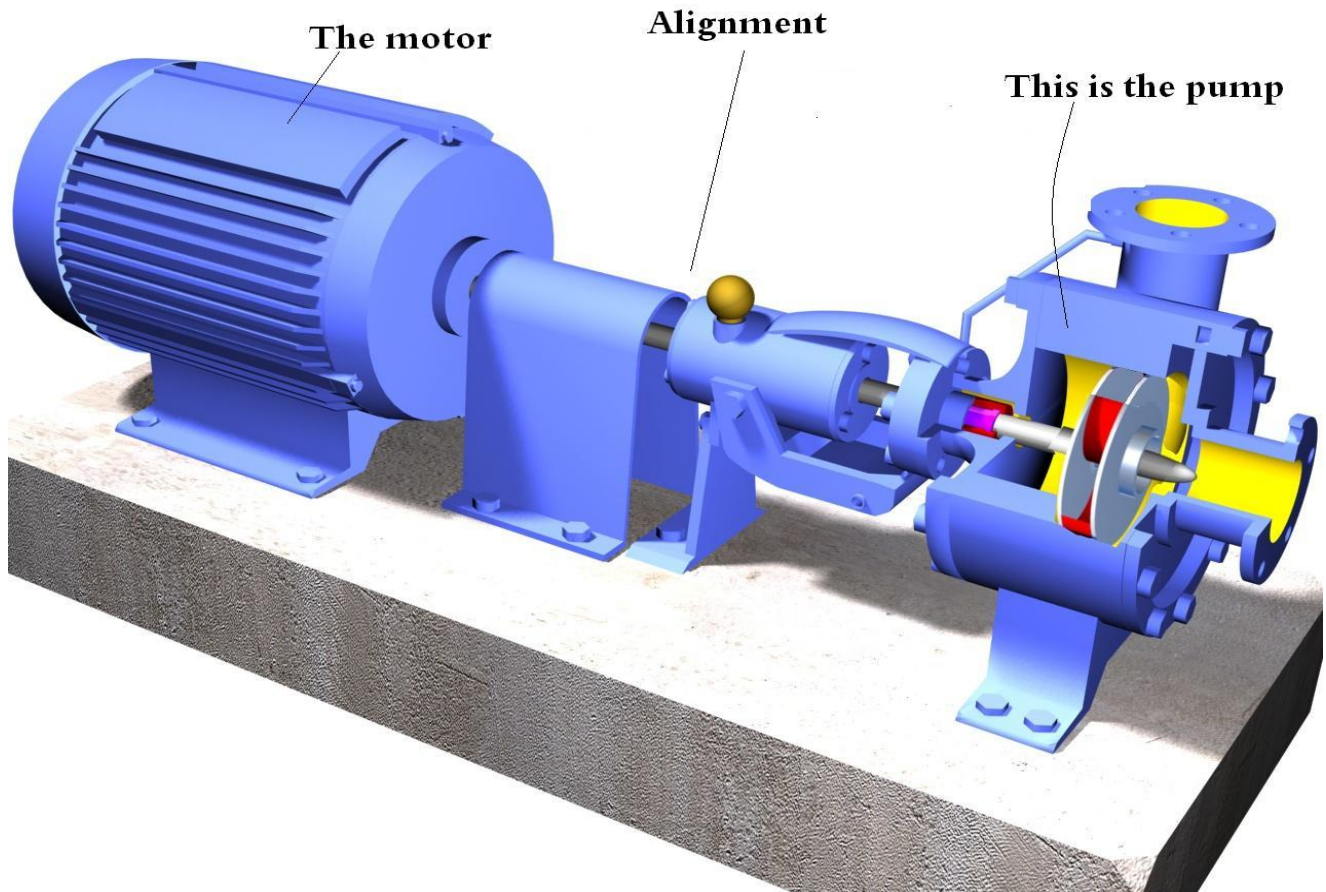
The role in this department is the reverse of the disassembly department. Here we assemble the pump in order to send it to the customer.

The most important thing in our work in this department is to know the standards the customer uses. As an example, Aramco uses different standards than the standards used in ITT. So, we need to check which standards they use is it API standards which stands for "American Petroleum Institute standards" or ANSI which stands for " American National Standards Institute". These two standards involves the design measurements of the pump, not only that but also the names of the components and the different types of pumps.

11. Test Department

I worked for this department for three weeks exactly. When the pump is assembled, it is ready to be tested. There is a control unit with PCs inside it. These PCs are connected to the sensors in the test area. Once the pump is aligned, we run the system allowing the fluid to flow the pump. The PCs are used to measure the net suction head, the pressure, the temperature, the flow rate and the time.

The tough work is in this department. It takes sometimes two days to align the pump by the technicians. Aligning the pump is the process of connecting the pump to the motor and to the hall piping system as shown in the next figure:



Sometimes it takes more if the pump requires a higher RPM so the need to replace the motor with another one. Also sometime the plate they put the pump over it as shown in the previous figure, is over-drilled, so they make a new plate.

There are several types of motors in the test area, every motor is used only based on the RPM the pump requires.

In addition to that, there is a unit near the test area where the high voltage is delivered to the test area. When a problem happens, nobody is allowed to try to fix the problem. Rather, the supplier company is invited to see the problem. We were dealing with ABB, Siemens and Sceco.



Motor



Test Control Room

12. Material Handling Department

I worked in this department for 1 week exactly. In this department I learned how to receive any equipment or devices or anything entering the shop. For example, what to do if the material coming is not intact or something missing or damaged.

Also how to write a small report about it and how to achieve it.

13. Experience with Equipments

I was advised by my supervisor to concentrate on the balance machine because we need to fix the shaft which is a common problem source. The balance machine is a machine used to check the shaft run out, in other words, to check the circumference of the shaft to see whether it is intact or there is a bend in or bend out in it. First thing to do is to measure the length of the shaft then to check the service areas in the shaft. The meaning of the service areas is the areas where the shaft holds other items of the pump. If the areas of service are not well indicated or marked on the shaft, it is better to divide the shaft into equal parts depending on a label on the shaft itself. Then the shaft is adjusted and put on the machine to be rotatable using two pulleys. Remember to use the safety means of the machine to avoid the fall or ejection of the shaft. A "dial indicator mm" is used to check the run out of the shaft. Every 10 degrees represents 4 toes and each toe represents 0.01 inch. The allowable range for the shaft to be intact is from 2.5 to 3 and depends on the type of the shaft itself. When the dial indicator is set where the pendle is roughly touching the shaft, make sure there is not too much noise or vibrations near the machine because the dial indicator is sensitive. After that, move the shaft by the pulleys until the dial indicator gives the highest positive read and mark it. Then do the same until it gives the highest negative read. If the two reads

are within the range then the shaft is fine but if it is lower or upper it needs to be fixed .

So there is mainly two problems with the shaft run out, either bend in or bend out. In the case of bend out, it is suffice to heat that spot then suddenly cooled down so the shaft bend in a little bit then we do the check again if the measurements are within the range then ok, and if not we re-heat the shaft again. Be aware of something, before you do the check of shaft run out make sure the temperature is reasonable otherwise the reading is not accurate. Also, do not re-heat the shaft directly after the first attempt because it would give a false reading too. Just wait until it cools down then redo the heating up. Also if the shaft is too cool then it would give a false reading.

14. Conclusion

At the end of the summer training I can summarize what I have gained from the opportunity to work for ITT and that I have the ability to the following:

- To know the different types of pumps.
- To know how to align a pump.
- To know what are the common problems occur with pumps.
- To understand the theory of pump operation and the characteristic of a pump.
- To be aware of cheating in contracts.
- To classify environments if safety or not.

Finally I like to say that I was pleasant to work for ITT because it really prepared me for the real job where we need to contribute with the other engineers in their fields as it is clear that most of what learned is more closer to a mechanical engineer.

