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Escalating Efficiency of Soft Water Pumping Station by Altering Centrifugal Pump of Superior Capacity: A Case Study

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***Abstract*:This is experimentally observed from many times that the speed of Centrifugal Pump in soft water plant in many steel industries is not giving proper efficiency due to improper size of shaft, bearings, body or casing, impeller, improper location of soft water plant etc. After some running hours of pump will get damage from its bearing housing or shaft of the pump will worn out and many things which will be discussing in paper. This is also common for impellers. These faults were common in most of the pumps in companies and mostly these things are ignoring. Increasing the size of Centrifugal Pump can increases the efficiency of soft Water Pumping Station in organization and also increases the productivity of the company. These faults were studied and improved in one the furnace division in steel plant at one of the South Indian Company where soft water plant is also situated for company's production. In this paper experience of increasing efficiency of soft water plant is written after proper case study soft water plant and then fault is eliminated with the help of management.**

Keywords: Hard working environment, limited work place, vision, better condition

INTRODUCTION

The case study was passed out at a healthy known privately owned integrated steel manufacturing group situated in the south part of India. Case study having many interviews with the management, workers, staff, maintenance personals, foremen of the organization, production incharge, manager etc. This gives details of present situation of centrifugal pumps present in plant as well as it also helps to improve the situation of centrifugal pump. The concerned place of underground and overhead tank for work is available in maintenance area at furnace division in plant which is located at the north-west corner of the plant. The pump house is having 3 cooling towers with the capacity of 30000 ltrs and having 50HP induction motor for running the fan of cooling towers. All the cooling towers were round in shape which is having diameter of 5 mtrs. Tank capacities are as follows:
Capacity of overhead tank = 50,000 ltrs
Capacity of underground tank = 1, 30,000 ltrs

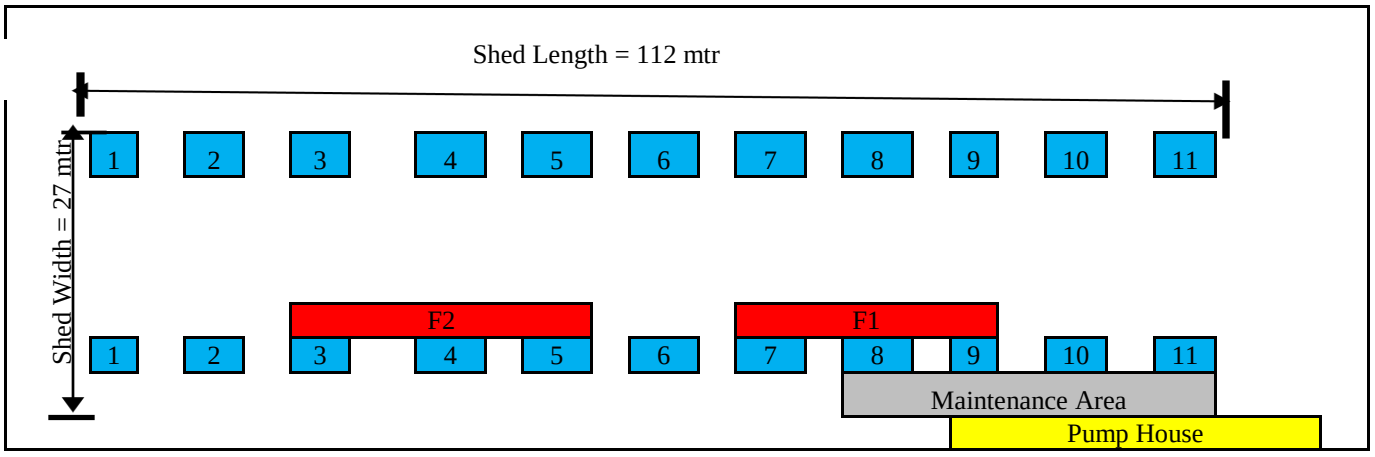


Fig 1: Layout of Furnace Division

As shown in figure, the shed length is 112 meter and the width of shed is 27 meter as well as shed height is 10 Mtr, it is having two furnaces that is F1 and F2 with pump section at rear side of the furnace 1 and side by side it is also having maintenance area at rear side of the furnace 1.Pump house provides soft water in both the furnaces for proper functioning as well as it provides cooling to the furnaces. It should have hardness of 8 – 25ppm. It is must for soft water to maintain its ppm other wise scaling occurs inside the furnaces coils and that is very harm to the furnace.

Furnace number 1 = F1
Furnace number 2 = F2
Shed column serial numbers = 1 to 11

Whole shed is enclosed by asbestos sheet. The roughly difference among each columns is 11 meter and having big area as scrap yard, BP set yard, sponge iron yard, finished goods say ingot storing yard etc. The corporation is having man power of something like 800 numbers including both women and men in day shift and men only in night shift. The main product of company is ingot of size 3.5" X 4.5" X 60". Total creation of ingots in company is approximately 2500 tons per month. For making this much production it is necessary to run the furnace with out breakdown due to heating of coils. So, for cooling the coils circulation of water is must. This is provided from underground tank and is pumped with the help of centrifugal pump. Centrifugal pump house is just like a nerve system of the furnace division. Company is having 4 centrifugal pumps. Previously the model of centrifugal pump is DB 65/20 but after study it is changed to DB 80/20 for increasing the speed of the water flow as well as it increases the life of the pump section.

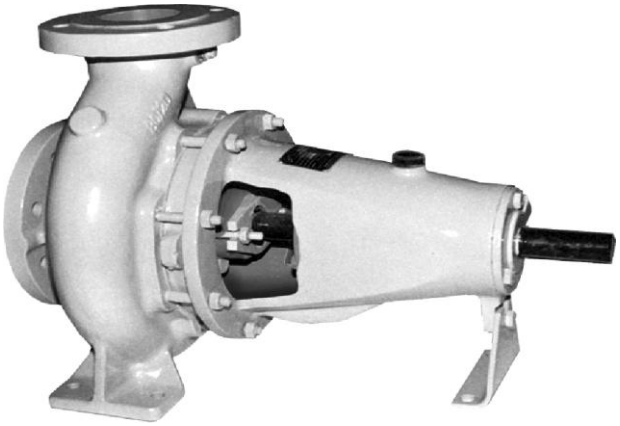


Figure 2: Typical view of Centrifugal Pump

The centrifugal pump as shown in figure 2 is defined by, a centrifugal pump is a device and it is a machine that imparts energy to a fluid. This energy mixture can cause a liquid to run, rise to a upper level or both. The centrifugal pump is an particularly simple machine. It is a part of a family known as rotary machines and consists of two essential parts:

1. The rotary element or impeller
2. The stationary element or casing (volute)

The figure below is a cross section of a centrifugal pump and shows the two basic parts.

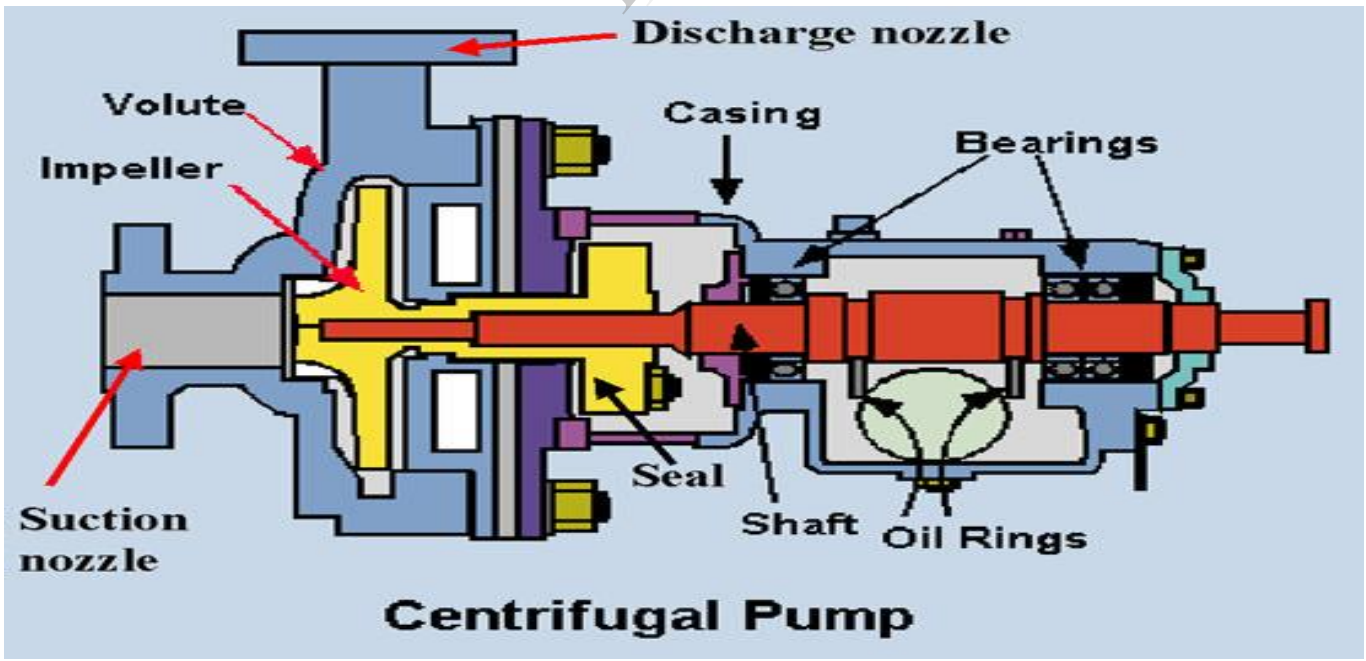


Figure 3: Nomenclature of Centrifugal Pump

The centrifugal pump's job is as simple as its design. It is filled by means of liquid and the impeller is rotated. Rotation imparts energy to the liquid causing it to exit the impeller's vanes at a superior velocity than it possessed when it entered. This external flow reduces the pressure at the impeller eye, allowing more liquid to enter. The liquid that exits the impeller is collected in the casing (volute) where its velocity is converted to pressure before it leaves the pump's discharge.

DIFFICULTY WITH PRESENT CENTRIFUGAL PUMP

It was observed at first that the overall production of the company was around 1800 tons per month which is affected by the regular breakdown of centrifugal pump or by overheating of the furnaces coils. These breakdowns occur due to scaling in coils which generates steam having temperature of 90^{o}C to 150^{o}C. This type of breakdowns taking half an hour to 3 hours for rectification. So, all the staff is worried about the production of the company since it is competitive to withstand in the market. It is necessary for company to produce overproduction with good quality. So, after considering below factors such as,

a. Depth of under ground tank
b. Height of overhead tank
c. Centrifugal pump speed
d. Centrifugal pump height from bottom of the underground tank
e. Size of suction pipe
f. Size of outlet pipe
g. Capacity of Centrifugal pump
h. Head of pump
i. Length to travel from pump house to different furnaces
j. Size of furnace coils

So, on top there are some factors which were observed entirely for the duration of case study. It is seen that reducing the breakdown of centrifugal pump as well as increasing the speed and capacity of the pump affects the overall production of the company. Pumps speed and all the dimensions were low as compared to the requirements and capacity of furnaces.

FUNCTION OF CENTRIFUGAL PUMP IN COMPANY'S PROSPECTS

Centrifugal pump provides cold water to furnaces for proper functioning. It also cools the furnaces from heat. Temperature of out side crucible in furnace is around 60^{o}C to 90^{o}C at the time of running. Molten metal temp is around 1500^{o}C in crucible and is covered by ramming mass. So, soft water has to control the temperature of furnace and also saves it from unwanted scaling inside the coils.

Pump section is having 4 centrifugal pumps named,

Pump 1 = P1
Pump 2 = P2
Pump 3 = P3
Pump 4 = P4

P1 and P2 provides soft water to furnace 1 having distance of
P3 and P4 provides soft water to furnace 2.

FORMATION OF PROJECT TEAM

Considering that the association was influenced about the value of a better high configuration of the existing centrifugal pump in order to deal with the troubles as stated, a maintenance implementation team was shaped. The maintenance crew consisted of eight members from the corporation. 1 Mechanical Maintenance Engineer, 1 mechanical ITI fitter, 2 welder, 4 helpers, and two members from the institute for the purpose of research. All members make the well talented team having knowledge of 5 to 10 years. The squad member from group were answerable for providing the important data as necessary, initiating trial for job implementation including purchasing of inventories required for execution of work. The member from institute provides the data and know-how as required for changing the centrifugal pump.

METHODOLOGY

The methodologies worn to meet the objectives are,

(i) Examination of the existing blue print of pump house
(ii) Detailed re-engineering steps of designing pipe line and pump section
(iii) Installation and Commissioning of new pump

EXAMINATION OF THE EXISTING BLUE PRINT OF PUMP HOUSE

It is examined that the present position of pump house is suitable for work as it is near by the maintenance area. But one disadvantage of pump house is that most of the furnace dust comes directly to cooling tower and through cooling tower it is mixed with water. This water become slurry at bottom and it creates trouble to pump for sucking water. This mud also affects the life of pump as it is quite smaller in size. Pressure required for cooling the furnace is 7-9 kg/cm^2 and it is sometimes stucked by mud. Present centrifugal pump of model DB 65/20 is not sufficient for that much of pressure. Over all pump house location is good for organization but it is observed that pumps which are installed is quite smaller in capacity required.

DETAILED RE-ENGINEERING STEPS OF DESIGNING PIPE LINE AND PUMP SECTION

After examining the existing blue print of pump house, team members selected Kirloskar DB 80/20 series centrifugal pump instead of DB 65/20 series centrifugal pump and started their work for changing the size of the pump and according to the size of the suction and discharge workers designed or fabricated pipes. Below were some correct or incorrect manners of fixing pumps.

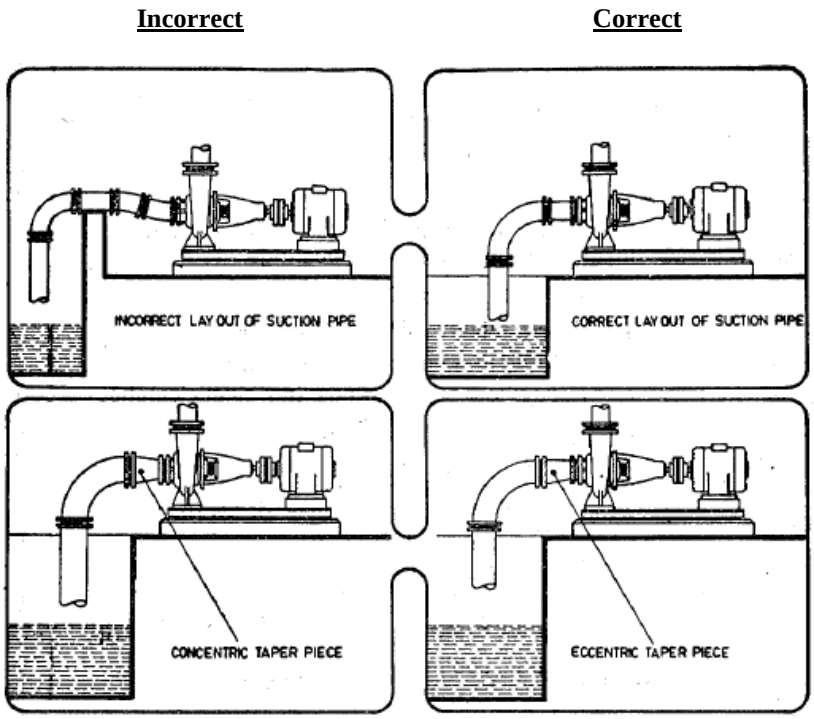
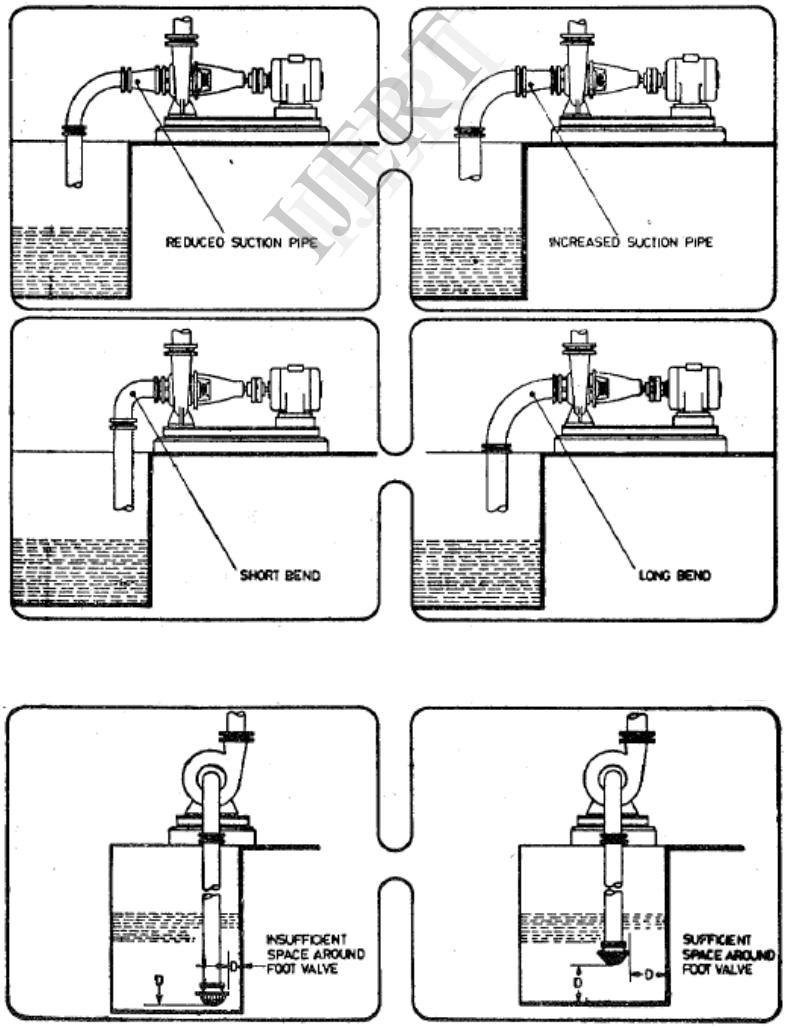


Fig 4: Positions of Pumps Installation



INSTALLATION AND COMMISSIONING OF NEW PUMP

After successful completions of fabrication of system with proper design of centrifugal pump, it is time to test the system for proper functioning, like pressure, head, and any type of wear and tear as well as for vibration. It was found that there is no unwanted sound or vibration in new installed centrifugal pump. It is also giving high pressure which is suitable for furnace working.

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