CASE STUDIES – CS 9

Mine Drainage Pump

Description of the problem: Indian Copper Ltd. (ICL) is a state owned company engaged in extraction of copper ore and production of copper. They have underground mines in Eastern and North Western India. This company has been using Mather & Platt Plurovane pumps for mine dewatering. In a recent report the company has communicated two major problems with their mine dewatering pumps.

The problems are as follows:

1. Pump does not deliver any liquid- There are occasion when after the pump has been switched on, the delivery check valve does not open, the pump runs at closed valve and has to be stopped.
2. Pump casings, impellers and diffusers wear out very fast.

Details of the specific pump are as follows:

Make: Mather & Platt

Model: No. III Plurovane

Type: Bolted segment multistage

Capacity: 220m^3/hr

Head: 460m

Speed: 1480 rpm

Materials of construction:

End cover and middle bodies: **Cast iron**

Impellers: **Gun Metal LG2**

Diffusers: **Gun Metal LG2**

Shaft: **AISI 316**

Analysis of the problem:

a. **Pump characteristics:** Mine drainage duties involve pipeline which is generally vertical and therefore little different in length from the static head. This means that the pipe friction is a very small percentage of the total head.

   Many of the radial flow multistage pumps of relatively of older design (Plurovanes were designed in the 1930's) have high head per stage but drooping characteristics.

   For the pump to start satisfactory in a high static-head system, it is essential that closed valve head should be greater than the static head of the system. Similarly, if two pumps are to run in parallel, it is essential that the closed valve head of the second pump being brought into operation is more than the duty head.

   Combination of high static head and an unstable curve can cause problems when the supply frequency drops. Drop in the electrical supply frequency causes a drop in speed and consequently head-capacity curve drops following affinity laws.

   The attached curve illustrates the problem. With drop in speed, the closed valve head of the pump becomes lower than the system static head and consequently the deliver check valve does not open.

b. Analysis of mine water revealed pressure of solid particles. In addition PH value of water was found to be less than 5.0. Low PH value is indication of acidic mine water and existing CI casing material is unsuited to this application due to problem of corrosion-erosion.

Solution:

The company was advised to try-out a new pump with the following features:

a. Stable head capacity characteristics of the pump.
   This was achieved by using a new set of impellers with lower head/stage but higher specific speed impellers with a vane twist at the inlet.
b. The material was changed to adequate component life in a low PH acidic mine water environment.