

MINIMISE MAINTENANCE
MAXIMISE RELIABILITY & ENERGY CONSERVATION
B. M. Chatwani, CGM (E.M.I) MARS P & E SERVICES PVT. LTD.

Technically speaking there will be no/minimum necessity of maintenance if following 4 precautions are taken timely and sincerely:

- A. Selection & Sizing of Pumping Machinery is Correct.
- B. Installation of machinery is as per Manufacturers' requirement.
- C. Operation of machinery is as per Manufacturers' guidance.
- D. Routine maintenance of Oiling/ Greasing/ Nut Bolt tightening is done on time.

But we unfortunately lack insight and foresight in respect of the above mentioned 4 precautions. Almost all the 4 precautions go oversight & we are frequently compelled for heavy repairing & overhauling work; which creates downtime/ shutdown of machinery & also reliability is lost.

FOR PUBLIC SERVICES SUCH AS WATER-SUPPLY WE CAN ILL-AFFORD UNRELIABILITY OF PUMPING MACHINERY.

After playing & toying with pumping sets since 1961, I have following suggestions for our water supply engineers:

A. SELECTION & SIZING OF PUMPING MACHINERY

- i. Select machinery which is technically innovative produced by world class manufacturers having good market share and also are energy efficient. 5 – Star rated pumps should be preferred (if available).
- ii. Select machinery parameters befitting your requirement of Q, H, N & KW. Choose from the standard sizes of pumping machinery and adjust your flow rate accordingly by increasing/ decreasing the working hours. Calculate TOTAL HEAD judiciously to avoid over sizing of pump sets which consumes more power and compels for throttling the delivery lines.
- iii. Select machinery which is most economical in LIFE - CYCLE COST (L.C.C). Remember the cost of machinery is hardly 5% that of yearly expenditure on machinery, Energy Cost is 85%, and that of Civil & Mechanical maintenance is 10%.
- iv. Select the machinery which is economical in installation also. For example HSC-CF pumps sets require fully flooded suction therefore underground pump house 6-8 meters below ground level. V.T. Pumps require two storey Pump House and heavy slabs on top of first floor to withstand heavy vibration of pump set. V.T. Pumps also require heavy maintenance due to a lot of moving parts in it. It is also not economical above 20 meter column height.

- v. Select machinery which is easy to install and easy to remove for repair and requires minimal maintenance. **SUBMERSIBLE C-F PUMPS MAYBE GOOD – SOLUTION IN MANY CASES.** Techno-Economical study must be carried out before selecting the proper machinery.

REMEMBER WE EXPECT RELIABLE ECONOMICAL AND TROUBLE & HASSLE - FREE SERVICE FROM OUR SELECTED PUMPING MACHINERY FOR AT LEAST 15 YEARS. Frequently repaired machinery is not only costly but also loses reliability & efficiency which is not befitting for Public-Service in water supply schemes.

- vi. Immediately replace Mono-Sub pumps and polder pumps as these types of pumps are not meant for water-supply services but are useful for de-watering duties @ construction sites. These pumps are originally 20 – 25% less overall efficient than HSC-CF and Sub-CF pump sets and also are prone to frequent failures.

B. INSTALLATION OF PUMPING MACHINERY

Proper installation of machinery is more important than selection of machinery as even world class machinery may not function properly if installation is not technically sound and hassle free.

PROPER INSTALLATION REQUIRES FOLLOWING PRECAUTIONS:

- i. **Design of intake:** It should be as per norms laid down in H.I.S (Hydro Institute of State) in ANSI-98-2010. No compromise on Minimum Submergence, maximum Inflow Speed, Minimum Sump Volume etc. If intake design is faulty, pump efficiency & flow rate will be badly affected. More over heavy cavitations due to Vortices will damage the machinery parts in short time.
- ii. Foundation for machinery, valves etc. should be independent of pump house foundation to control vibrations.
- iii. Ventilation of pump house plays a vital role in cooling the machinery under temperature – control. 10^æ% C higher temperature than designed one will **halve** the insulation life of cables and motor windings and life of Bearings and Bushes.
- iv. Proper piping the pump set is very vital as selected pump set may be having B.E.P (Best Efficiency Point) at our duty point but wrong pipe diameters will change the operating point of pump to the left or right side of B.E.P. This type of function will put our designed parameters of Q, H, Efficiency & KW out of gear and we have to resort to throttling of delivery line or run near shut-off point (heating of pump) or at run-out of pump which will create vibration & pump breakdown prematurely.

ALWAYS OPTIMISE THE PIPE DIAMETER PRECISELY. Limit suction speed max. 1.5 m/sec and delivery speed max. 2.5 m/sec.

- v. Install valves, expansion bulbs etc. of world class quality only. In most of the pump houses sluice valves are not closed before starting pump & slowly opening with pump picking speed as most of the valves are not functioning. This creates over-loading of motor initially and in most cases motor is burning due to this.
- vi. Alignment of motor & pump set is very important in case of HSC-CF and V.T. Pumps & should get done through company - trained mechanic.
- vii. **TRIAL RUN AFTER INITIAL INSTALLATION:**

In almost all cases the Q, H and KW parameters differ beyond tolerance from the desired parameters due to over – sizing of pump sets/ motors and under sizing of pipe diameter, cable sizing, capacitor sizing etc. Corrective measures should be taken by changing the impeller, trimming the impeller, changing the driving motors, capacitor bank, cables etc. to achieve designed parameters for the smooth, and hassle free, reliable & energy efficient running of pumping machinery.

C. OPERATION OF MACHINERY:

- i. This should be strictly as per manufacturers' manual. The pump operators should be sent to the manufacturers' training facility for training. Such clause should be incorporated in the tender document.
- ii. Log – books and history sheets of machinery should be maintained at pump house for timely maintenance information. **DUTY POINT PARAMETERS SUCH AS Q, H, N AND KW SHOULD BE WRITTEN ON THE FIRST PAGE OF THE HISTORY SHEET.**
- iii. Standby pump sets should be equally used to keep the pump sets always **OPERATIONALLY FIT.**
- iv. Operators should be rewarded for good operation and also penalized for the following mistakes:
 - a. Running the pumps – dry i.e. w/o priming.
 - b. By passing capacitor prematurely in case of any fault.
 - c. Manipulating with various relays/ timers to avoid nuisance, tripping w/o finding out the cause & identifying and rectifying it.
 - d. Using copper wire in the fuse kitkat in place of tinned wire of specific current carrying capacity.
 - e. Not keeping pump house floor clean & dry.

- f. Not attending to various leakages in the pump house.
 - g. Not promptly closing the pump in case of undue noise/vibration/high temperature.
 - h. Unnecessarily trying to operate pump more than 7-8 times in an hour and thereby damaging control panel components.
 - i. Not closing the sluice valve before stopping the driving motors etc.
- v. Pump operators should be penalized if driving motor is burnt, because there is no scope of motor burning in pump house. Motor control panels provide sufficient safety against
- a. Low Voltage
 - b. High Current
 - c. Single Phasing
 - d. Short Circuit
 - e. Earthing Failure etc.

Remember rewinded motor not only reduces reliability but is also less efficient.

D. ROUTINE MAINTENANCE OF OILING/GREASING/NUT-BOLT TIGHTNING IS DONE ON TIME

- i. Prevention is better than cure, applies equally to the machinery maintenance. By proper maintenance as suggested by the machinery manufacturer, we can surely prevent it from premature break down.
- ii. Routine inspection of pumping machinery, monthly, half yearly, and yearly. Routine inspection will reveal the possibilities of forthcoming problems in the machinery.

In the modern pump houses the electrical engineering machinery such as transformers, motor-control centers, cables, capacitor panels, soft starter panels, instrumentation panels, driving motor is 70-80% of the total machinery. Remaining 20-30% machinery/Equipments are pumps, valves, pipes etc. are of mechanical engineering.

Inspection of the machinery should be done by the engineer of the relevant branch Electrical/Mechanical as applicable so as to give justice to the inspection duties.

- iii. Pump houses should be maintained as pump palaces, AIRY, less humid, full of natural light and tolerable temperature inside and flowering trees, fruit bearing trees and flowers in the periphery/compound of the pump house. Such pump palaces can be celebration spots for the public and pump operator will not feel isolated from public as is the case today.