EFFICENT

ENGINEERS (I) PVT. LIMITED

"Partners in Progress"

ENERGY CONSERVATION / MANAGEMENT

Conserving the energy is a smart act to take more work from the machinery at comparatively low operational & maintenance cost. This provides Win-Win situations to the client or customer, and the consultant or the machinery seller, supplying tailor made machinery, and not the conventional standard motor-pump sets. In this division there will be a consulting department for the pumping machinery and energy conservation industry. *The Company* serves its areas of all its business departments working to make its operations more productive and economic so far as the energy consumption & energy conservation are concerned by controlling energy bills and reducing expenses by energy conservation. So far such consultation providers on part of selection of right pumps, for operation of the pumps at the optimum efficiency are very few. Selection of the pump is one time investment for minimum 10 years of life of the pump. Bigger the pump, the matter of selection becomes more important. It's essential to run the pump at the Best Efficiency Point (BEP) Failing in selection of pump by even 5 % inefficient pump, can waste your thousands of dollars in future. If one goes for buying lower efficient pump, s/he which is not suitable perfectly to the application, and site hydraulic conditions s/he keeps on losing money on every energy bill.

This division serves potential clients by carrying out necessary energy audits, can suggest them the right pumping machinery available in the home country, North America or the world market, get them and the Nation benefited. The division will advise the customers/clients to go for identically suitable centrifugal pumps, rather than going for the standard pumps available in the market in order to get the advantages of the energy conservation / saving through the operational life of the pumps. Convinced customers will be saving lots of money in energy bills, only by selecting the right pumps for the right application, for the rated duty conditions. The Nation will conserve the energy, and the "ENERGY SAVED IS ENERGY PRODUCED. The consultation is not only limited to the procurement of new pumps, but also will be applied to the cases were the machineries would be operating at very low overall system efficiency. The pumping system would include Pumps, Motors, Pipelines, Valves, Control Panels, Automatic Power factor Correction Panels (APFC).

In case the fluctuation of the water level at the suction side is very, high, we need to go for the variable speed drives, by which we can control the speed of the pumps and manage the best efficiency conditions through the operating hours of the pumps. In order to be stable at the market place, we have decided to simultaneously go ahead with the possible businesses where the Company has expertise. The ultimate goal of this division of the Subsidiary is to initially provide engineering, and management consultancy services related to pumping & hydraulics, to enter in to the market successfully, and subsequently to sell the pumps and related electrical & mechanical instruments to the satisfied customers.

How to Conserve the Energy, and thereby reduce Electricity Bills.

Tech innovation in Urban Water Supply System

The pumping system accounts for nearly 20% of electrical energy demand. We can easily save 40-50% of this by adopting designs. We need to observe certain rules for reducing operating cost drastically. The following parameters need techno-economical consideration for innovation in the system.

1) Correct size of pump & driver.
2) Correct type of pump and driver.
3) Best Efficiency Point (BOP) of the pump set at duty point.
4) Minimum Friction losses of the pumping system from foot valve to E.S.R.
5) Re-engineering if rated duty conditions are not at BOP of the pump.
6) Optimum possible Efficiency of the drive
7) Energy audit to be carried out every year.

Energy Audit and rectification of Energy Conservation for the Pump Sets being used for Water Supply or Irrigation Purposes:

1) By Checking Selection of Correct type of Pumps
2) By Checking selection of ideal pump model for the selected type of Pumps for getting optimum efficiency of the pump motor sets.
3) By checking the rating of motor in a way that it will not be under rated at any point of time during pump operations, and at the same size, the capacity should not be so high that efficiency of Motor gets reduced.
4) By usage of Variable Speed Drives in case of frequent variation in head
5) By Application of Energy Improvement Coating at the inside surfaces of the pumps in contact with water/fluid.
6) By reducing system head by using appropriate size and material of Pipes.
7) By reducing deterioration of the pump efficiency by using appropriate Coating at the inside surfaces of the pumps in contact with water/fluid.

8) **By checking over all pumping system keeping major factor in mind who are Influencing Wastage of Energy in Centrifugal Pump Sets**

a) Wrong foot valve and strainer units, causing high friction losses and reduced discharge.
b) Undesired suction and/ or delivery pipes
c) Unnecessary height of delivery pipe, provision of more total head than required or too long suction pipe.
d) Non-matching of pump with pumping head & discharged required (i.e. operation not in the Vicinity of D.P.)
e) Oversized or undersized prime mover (Electric motor).
f) Use of electric motor with low efficiency.
g) Use of oversized electric motor i.e. under loading of motor which reduces the p.f. of motor and hence efficiency under loading beyond 25% reduces motor efficiency drastically.
h) Use of inferior quality of pipes and or wrong pipe fittings.
i) Non-replacement of worn out bearings of pumps and electric motors and absence of periodic oiling and greasing of bearings.
j) Excessive suction lift.
k) Non availability of information on drawn down discharge characteristics of wells.
l) None matching of pump characteristics with those of well characteristics.
m) Use of suction and delivery pipes with excessive friction
n) Leaky joints in the suction /delivery pipe lines
o) Too-tight gland packing, clogging of impeller / foot valve and improper bearings.
p) Unwanted construction work for delivery lines (instead of under ground delivery on line on pillars)

Design Criteria

SUCTION AND DELIVERY PIPING

Design – Velocities:

The suction and delivery piping, valves, suction bell mouth, Column pipes etc shall be designed on the basis of following design velocity.

Suction pipe / Valve	-----	1.75 m/s
Delivery pipe / Valve	----	2 .0 m/sec
Column pipes	-----	2.0 – 2.75 m/s
Suction Bell mouth	-----	1.3 – 1.4 m/s.

The Sizes of the above parts of the pumping system should be designed in such a way that the velocity of the in side fluid do not exceed the above limits.

Strainer:

Strainer shall be provided for V.T. Pumps on canal intake where drawl is from canal and therefore, floating material may be encountered. The net area of openings for strainer shall be 3 times the inlet area of bell mouth.

Specials:

The specials on suction and delivery pipe line as follows shall be provided.

I. Enlarger on suction side shall be eccentric
II. Enlarger on delivery side shall be con-centric
III. Bends on suction side shall be long bend to avoid problem of variation in velocities in suction line and consequently ill – effect on impeller.
IV. Suction bell mouth shall be gradually flared & smooth.

Valves:

Valves as follows shall be provided:

I. Butter fly valve on suction side of C.F. pump as positive suction is generally kept.
II. Single or multi door reflux valve (NRV) on delivery pipe immediately after dismantling joint.
III. Sluice valve as delivery valve if diameter is 750 mm or less and butterfly valve if diameter is greater than 750 mm shall be provided on individual delivery of each pump.
IV. If size of delivery valve is 300 mm and above, electro-mechanical valve actuator shall be provided. Valve of diam. Less than 300 mm shall be manually operated.
V. Additional manually operated butterfly valve shall be provided is major pumping stations having number of working pumps 3 or more, is delivery line of each pump to enable repairs to the reflux or delivery valve without resorting to total shut down.

Dismantling Joint:

Dismantling joints shall be provided on both suction & delivery pipe line of each pump between valve & reducer/ enlarger to facilitate removing pumps & valves.

Common – Manifold:

The common manifold shall be of full diameter equal to diameter of pumping main. The delivery line of each pump shall be connected to the common manifold by radial bends and tees.

The tees for future pumps of ph-2 shall be blank flanged. The free end of common manifold shall have dished end.

Lifting Equipment:

Lifting equipment of following types shall be provided on basis of criteria as below:

I. If BKW of individual pump is 200 KW or more, electrically operated traveling (E.O.T) crane shall be provided.
II. If BKW is less than 200 KW, hand operated traveling (HOT) crane be provided.
III. Monorail shall be provided for load if it is more than 300 Kg.

1) Reengineering the operating point when not within the preferred operation range (P.O.R.) :-

The centrifuged pumps are designed to work efficiently within the flow rate of +20% and 30% and head range of +10% and -25% of the design/duty point. After installation and commissioning of the pump set if it is found not within the POR. We should trim / change the impeller or replace the pump set, as pump set working outside the range will be inefficient in energy reliability and will also get reduced as it may be working either towards shut off or run out points, which is also unsafe for working of pump set.

2) <u>Efficiency of the pump set @ duty point:-</u>

Due to increased cost of power and more and more running hours of pump sets it is calculated that one percent pump efficiency improvement is very generally equivalent to the price of pump set.

One should put-up efficiency required as near to the attainable efficiency as possible. This can be easily calculated from literature of HIS (Hydraulic Institute of state) and pump hand books.

Also the power loading per KW extra consumed should be incorporated in the tender documents.

3) <u>Correct type of pump & driver :-</u>

This parameter requires deep study as life time economics (financial gain/ loss) is involved in it.

Main comparison is between HSCF pump sets versus vertical turbine pump sets & submerged centrifugal pumps (water supply version of the sewage submersible pump set) we used to opt for HSCF pumps with underground pump house for positive suction, but it was very costly affairs due to the heavy construction cost. Then we started to opt for vertical turbine pumps with motor above ground level.

This reduced somewhat construction cost but increased heavy maintenance & repair cost due to the more moving parts in it.

Now, the concept is in favor of submerged centrifugal pump sets. Which has pump efficiency as high as that of HSCF and motor efficiency is also never to that of dry induction motor run above grounds.

Though these pump sets are little costlier than that of HSCF due to the advanced technology and less production at present but are economical when we consider the saving in civil construction cost and life cycle cost consisting of the following elements:

a) Initial cost

b) Energy cost

c) Pump house cost

d) Maintenance cost

CORROCOAT EFFICIENCY IMPROVEMENT SOLUTIONS.

The major problem faced pumping industry is the rise in efficiency due to metallurgical constraints and retention of the efficiency for the longer period of time. With practical achievable figure of 1.8 micron for SS surface further reduction of surface roughness amplitude and retention of its erosion is a very difficult task. Erosion and corrosion of parent material under various circumstances changes the hydraulic clearance- causing drop in efficiency and hydraulic performance.

Corrocoat high technology composite resign system can be used to retain/restore the hydraulic passages of the pump. These hydraulic passages can be applied with the specially formulated "Fluiglide range" of products to overcome above mentioned challenges.

The Fluiglide system has very low surface roughness amplitude as compared to original metal substrate. With this not only performance is improved over the existing one but the life of the equipment also increases.

The application of "Fluiglide" system has shown efficiency gain of 2 to 4% in the pumps coated. These savings translate into savings of millions of rupees for minimal initial outlays.

These coating are known to be effective by two established characteristics:

a. The reduction of surface roughness.
b. The hydrophobic nature of the surface.

a. The reduction of surface roughness:-

It is well known that surface roughness has substantial bearing on flow characteristics.

A rough surface introduces micro or even turbulence and eddies in the boundary layer causing an increase in velocity gradient and effective reduction in cross sectional area for laminar flow.

"Fluiglide" coating with roughness amplitude significantly lower than that of cast iron /SS offers a smooth passage for fluid flows thus reducing the frictional losses and directly contributing to enhancement of efficiency.

b. The hydrophobic nature of the surface:-

When the force of attraction between the substrate and the water molecules exceed the cohesive forces in the liquid, then the water or other media will spread across the surface until a state of equilibrium is reached between the two. Therefore, where the surface energy is high, low contract angles will be achieved and surface energy or attraction is low, the high contact angles will result in larger gradients in velocity between the mainstream flow and boundary layer. In the case of aqueous media, materials which have low surface attraction or are hydrophobic and repel water thus result in lower friction losses than surfaces which are highly attractive to water molecules.

As all common untreated metals have relatively high attraction energies wetting out of the surface with aqueous media and the consequent low contract angle is readily achieved. A substantial reduction in boundary layer friction can therefore be achieved by utilizing a coating, which is hydrophobic. The effects of this are illustrated in figure below.

It has been observed that efficiency gains from coating for pumping systems are presented in two different ways:

1. An increase in flow (water output) for the same input energy (electrical consumption).
2. A reduction in input energy for the same water output.

CORROCOAT "FLUIGLIDE' COATING SYSTEM FOR EFFICIENCY IMPROVEMENT OF PUMPS & MECHANICAL ACCESSORIES OF THE SYSTEM, INCLUDING PIPES

A wide range of coating combinations are available with us to suit variety of applications. By application of these coating, the life and reliability of the equipment can be extended manifolds. These products are also used inside the Pump components to increase the efficiency of the pumps thereby resulting in precious savings in power bills.

With the application of FLUIGLIDE system specially developed by CORROCOAT to reduce fluid friction and micro turbulence in water Transport System, efficiency of the pump is increased, which results in reduction in power consumption. Over the years the process has been used for many major water supply, cooling water and sewage system all over the world.

The FLUIGLIDE coating is known to be effective by two established qualities, this being the reduction of surface roughness and hydrophobic nature of the surface. The surface roughness amplitude of FLUIGLIDE coating is 0.08 microns. The third and extremely important quality established is the imperceptible Hydroxylation and dissolution of resin at the boundary layer. The latter property is observed as a difference in performance between resin types both having the first two properties but differing entirely in the Third. It is well known that roughness has substantial bearing in flow characteristics. A rough surface introducing micro or even macro turbulence and eddies in the boundary layer causing an increase in velocity gradient and effective reduction in cross sectional area for laminar flow. The boundary layer creates the blockage in passage. With the thin layer of coating, boundary layer is suppressed and effective passage is more.

These coating in addition to increasing the efficiency of Pump also help to give protection against corrosion & Erosion thereby increasing the life and reliability of the costly equipment.

MAJOR BENEFITS OF "FLUIGLIDE" COATING

1. Improvement of Pump efficiency guaranteed over the existing efficiency at duty point for new pumps depending on type of pump and specific speed. This improvement will vary from 1 to 2 points based on type of pump and specific speed.
2. Consistency of higher efficiency over operation period.
3. Increase in equipment life by manifolds due to prevention against Corrosion & Erosion.
4. Improvement in efficiency over and above the achievable efficiency from Hydraulic point of view without changing the running clearance. It may be noted that the running clearances will remain standard without affecting the reliability. Hence, efficiency improvement in mainly because of reduction in hydraulic losses. (Less friction loss eddies and suppressed boundary layer).
5. Saving in energy bill.
6. High reliability, reduction in down time and spare parts.
7. The efficiency of the pumps will be retained for a longer period as compared to non-coated / epoxy coated Pumps. The efficiency of the coated Pumps is expected to remain constant for at least 3 years whereas there will be drop in efficiency of un coated Pump of at least@ 1% per year.
8. Most effective Techno-economic system.
9. Prevents fungal / microbial growth on the wetted surfaces.
10. Portable water certification available.