

SELECTION OF TYPE OF MACHINERY FOR SEWAGE PUMPING FOR OPTIMAL EFFICIENCY & TROUBLE FREE SERVICES:

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The selection of pumping machinery depends on the following consideration:-

- A) Financial
- B) System Optimal efficiency
- C) Easy operation & Maintenance & repair
- D) Human - Welfare
- E) Avoidance of common -mistakes which are common.

A) FINANCIAL - CONSIDERATION :

This consists of the following factors:

- 1) Availability of land and price thereof.
- 2) Capital Cost of the machinery (Annual depreciation) which is hardly around 5% cost of total annual expenditure.
- 3) Annual maintenance (Civil & Mechanical) which is 10 % of total annual expenditure.
- 4) Annual power consumption - around 85% of the total annual expenditure.

It is now time tested that Sewage submersible pump sets are the best so for financial - consideration in totality (life cycle cost) is considered against old system of HNC, VNC type of pump sets with wet wells & dry wells.

Software is available for finding out the Life cycle cost (L.C.C) of the project.

This is inevitable now a day for arriving at most economical project.

B) SYSTEM OPTIMAL EFFICIENCY:

This depends on the selection of proper type and size of pump and pipes, valves etc. The Best Efficiency Point (BEP) of pump should match duty point of the system at least for 70% of time , for the remaining 30% time it may swing from +20% to -60% of the head due to the heavy fluctuation in receipt of sewage.

The pipes and valve sizes should be optimal so that friction head is minimized.

The pipes, valves and fittings etc, should be corrosion resistant if the effluent is coming from chemical factories (which is highly acidic) is mixing with the sewage.

BY AND LARGE SEWAGE SUB - PUMP SETS ARE THE MOST EFFICIENT NOW A DAYS.

C) EASY OF OPERATION & MAINTENANCE :

The SEWAGE SUBMERSIBLE PUMP SETS are the most operational & maintenance friendly , as these are submerged in sump so operator has to carry out all function from

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ground levels only and no need to go down for routine checking for oil, lubricating, temperature ,alignment checking etc,

D) HUMAN WELFARE - CONSIDERATION :

HNC, VNC Sewage pumping station creates foul smell and unhygienic environment so is not tolerable by human beings beyond some time that is why skilled pump operators avoid duty at such stations even if they are promoted from helper to operator.

Maintenance of such stations is not liked even by unskilled labourers so that maintenance is done by such labourers half heartedly which reduces the performance reliability and life of pumping system.

HOWEVER IN SEWAGE SUBMERSIBLE PUMPING STATION THIS NUISANCE IS MINIMIZED as these pumps are having life time lubricated bearings and problem of alignment does not arise as impeller & motor are on the same shaft. So no routine checkup & lubrication. Operation is also automatic with the help of level guards and relays in the control - panel.

E) AVOIDANCE OF COMMON MISTAKES , WHICH ARE COMMON., THESE ARE MENTIONED BELOW :

- 1) Improper reserve power in the electrical motor driving sewage pump sets.
- 2) Non - matching of BEP with duty point.
- 3) Under sized delivery (rising) main pipes.
- 4) Switching on and off of the pump beyond 6 times / hr. due to over sized pump sets.
- 5) Non - cleansing of the bottom of the sump regularly which encircles the pump and it gets burnt.
- 6) Non use of suitable valves.

E -1) RESERVES MARGIN IN THE ELECTRICAL MOTOR.

The client should clearly mention the reserve margin required in the electrical motor of the sewage submersible pump sets, as mentioned below,

- a) The power rating of the motor shall be the largest of the following
 - * Percentage margin as mentioned below over Break Kilo Watt (BKW) @ duty point,
 - Up to 1.5 BKW - 50%
 - 1.5 to 3.7 BKW - 40%
 - 3.7 to 7.5 BKW - 30%
 - 7.5 to 15 BKW - 20%
 - 15 to 75 BKW - 15%
 - Above 75 BKW - 10%
- b) Maximum power input while operating in the head range +20 to -60% of duty head.

E - 2) NON - MATCHING OF BEP WITH DP.

This is a very serious problem and is created at design level. Pump manufacturers , have standardized sizes of pump sets for Q,H ,N & power but at design level we ignore this fact and invite tender for THE NON- STANDARD SIZE OF THE PUMP SETS.

In such cases renderers quote for the trimmed impeller pump sets which are not energy - efficient more over B.E.P of such pumps rarely match with duty point .such pump's loses its operating head range also.(+20% to -60% of D.P. point head)

IT WILL BE PRUDENT TO SELECT THE PUMP SETS OUT OF THE STANDARD PUMP SETS MANUFACTURED BY REPUTED MANUFACTURERS, IN SUCH SELECTION WE MAY HAVE TO REDESIGN OUR FLOW RATE, TIME ETC, BUT THAT IS THE ONLY BEST SOLUTION.

E - 3) UNDER SIZED RISING MAIN:

This is very vital parameter in energy efficient running of pump sets. In tender we mention the velocity in delivery line shall not be more than 2.5m/sec but do not mention the expected flow rate which is always more than design flow due to many reasons. This under size pipe creates more friction head & unnecessary load on the motor and motor loses the reserve margin.

THE BURNING OF THE ELECTRICAL MOTOR IS DUE TO THIS UNDER SIZED PIPE SIZES AND IT BECOMES MORE SERIOUS WHEN ELECTRICAL MOTOR ITSELF IS UNDERSIZED.

E - 4) SWITCHING PUMPING SET ON / OFF MORE THAN 6 TIMES / HR.

Motor control panels for sewage sub - pumps are designed to withstand switching on / off 6 -7 times/hr. Switching on - off, beyond this motor as well as control panel may get damaged.

This mostly happens due to

- * Over sized pump sets
- * Improper lowering of water level guards in the sump , for switch on and switch off functions.

E - 5) NON - CLEANING OF SUMP

Regular cleaning of sump - bottom is inevitable for smooth, safe & stream lined operation of pump sets.

As sediment deposits buries the pump sets which creates obstacle in operation and ultimately pump sets are burnt out.

The best solution is to provide shredder in the pump itself so that problem of settlement of sediments can be minimized.

Mechanically stirring of sump occasionally is also recommended.

E - 6) NON USE OF SUITABLE VALVES

Before pump, knife gate should be used and then check - valve and plug valve suitable for sewage pumping should be used.

A) COMBINATION OF PUMP CAPACITY TO TACKLE AVERAGE FLOW & PEAK FLOW

The norms for total pumping capacity is 6 times DWF

Presently capacity distribution of sewage pump sets as per manual is as follows:

Sr. no.	For pumping station UP TO 15 MLD	For pumping station BEYOND 15 MLD
1	One pump of 1DWF	Two pump of 1/2DWF
2	One pump of 2DWF	Two pump of 1DWF
3	One pump of 3DWF	One pump of 3DWF
Total	3 Pumps 6 DWF	5 Pumps 4 ½ DWF

Recently we have designed so many sewage pumping station having capacity up to 15 MLD and changed the capacity of pumps as mentioned below:

$$\begin{array}{l}
 \text{Two pump of } 1 \text{ DWF} = 2 \text{ DWF total} \\
 \text{Two pump of } 2 \text{ DWF} = 4 \text{ DWF total}
 \end{array}
 \left. \vphantom{\begin{array}{l} \\ \\ \end{array}} \right\} 6 \text{ DWF}$$

The reasons and benefits found are as mentioned below.

- I. 3 DWF flow is rarely received at such stations.
- II. Pump inventory and spare parts , Control panel etc are reduced by 33%
- III. 100 % stand by for each capacity of pump so reliability is achieved.
- IV. Switchin and switch out less than 6 per hour, so safety in operation
- V. Pump lifting capacity reduced due to avoidness of 3 DWF pump sets
- VI. Only two type of pumps instead of 3 sets so installation , operation , maintenance is economical.
- VII. Total KW in the both the systems are found same or nearby from the below mentioned example.

as per manual

1 DWF --- 1x9.5 kw
 2 DWF --- 1x18.5 kw
 3 DWF --- 1x30 kw
 Total ---- 58 kw

Recommended By Us

1 DWF --- 2x9.5 kw = 19 kw
 2 DWF --- 2x18.5 kw = 37 kw
 Total ----- = 56 Kw

VII. Total KW in the both the systems are found same or nearby from the below mentioned example.

1. We shall select the standard size (flow rate) of the pump by getting information from the reputed manufacturers and then re-engineer our time accordingly. Time may be reduced from 15 minutes to 12 minutes. Head remaining the same. By adopting this standard size , we will get most energy - efficient pumping system.
2. Regarding K.W. rating of the pump sets above mentioned 3 criteria should be mentioned in tender.
3. Regarding flow rate of the pump, it should be mentioned that B.E. (best efficiency) Point of the pump (Best Efficiency) should intercept duty point invariably.
4. System head curve should be supplied to the tenderer to select the pump properly.