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Submersible Pumps for Large HP / High-Head Applications ?

Due to capital cost restraints, space limitations, flooding concerns and other reasons, designers of sewage and wastewater pumping stations are often tempted to select submersible pumps for increasingly larger and higher-head applications than had been common in the past. Although an alternative to a conventional dry-well/wet-well pump system design, the use of submersible pumps for large horsepower demand high-head applications may result in excessive operational problems and increased overall maintenance and repair costs. We hope that the following information will be helpful as part of the decision making process for the station design:

1) Basic Design Considerations

Submersible pumps (dry-pit and wet-pit types) are of the "close-coupled" design. This means that the pump impeller is attached directly to the motor shaft. In this design arrangement, the motor shaft and bearings must bear the full radial and thrust loads created by the pump. Conventional flexible-coupled dry-pit wastewater pumps utilize a full bearing frame assembly that is separate from the motor. In this design arrangement, the radial and thrust bearings handle the pumping loads instead of the motor. As a result of this design difference, the "close-coupled" motor/pump shaft is limited in design flexibility for these applications, risking premature failure, shortened bearing life and sealing problems.

2) Maintenance/Repair Considerations

For large horsepower ratings, the submersible motors will typically be of a specialized or unique design. In many cases the local end-user personnel will not be able to provide repair and servicing. Large submersible motors must typically be repaired or serviced only by highly-trained factory personnel. Furthermore, should replacement be required, the end-user will typically have no alternative but to obtain new motors from the original pump manufacturer. With conventional flexible-coupled or intermediate lineshaft-driven wastewater pumps, replacement motors can normally be obtained from numerous independent commercial manufacturers. Also, repair and maintenance of the pump rotating components can typically be accomplished by end-user plant personnel or local independent service companies. Therefore, repair, maintenance and replacement costs of large submersible pumps is normally greater than for conventional dry-pit wastewater pumps.

3) Flooding Concerns – Dry Pit Stations

For installations in geographical areas prone to flooding, the historical method utilized for motor protection has been to locate the motors at an upper floor elevation, with connection to the dry-pit pumps by means of flexible intermediate lineshafts (“cardan” shafts). This arrangement typically requires a physically larger station size, with associated increased capital costs. Some customers have experienced operational and maintenance problems with intermediate lineshafts and bearings. These factors provide strong incentive for the end-user to consider submersible pumps, as the station size can be decreased and intermediate lineshafting is eliminated. Unfortunately, many end-users fail to consider the higher costs for equipment replacement and maintenance of submersible pumps. In many cases these increased lifetime costs can easily exceed those associated with conventional dry-pit pumping stations. It should be noted that improved shafting technology and modern installation techniques have greatly reduced or eliminated many of the problems previously associated with intermediate flexible lineshafts.

4) An Alternative – Immersible (IP67) Motors – Direct Flexible Coupled

Where the use of intermediate drive shafts is not practical or preferred, the use of direct flexible-coupled immersible (IP-67) motors with conventional dry-pit pumps is an alternative to close-coupled submersible pumps. Typically, the immersible (IP67) motor is a modified commercially available TEFC design equipped with special sealing devices capable of withstanding temporary flooding in a non-energized condition. Likewise, the pump bearings are equipped with special seals to prevent damage during temporary flooding. When station flooding occurs, a water level sensing device will de-energize the motor to prevent operation during a submerged condition. When the floodwater has receded, the motor will then automatically be re-energized to resume normal operation. The use of direct flexible-coupled immersible motors provides the end-user with the benefits of conventional dry-pit pumps as well as protection from flooding, while still allowing the user the flexibility for competitive service.

For further information or to discuss specific project requirements please contact the factory.

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