California Groundwater Association

Tube and Shaft Standards

All major turbine pump manufacturers specify in their calculation/engineering section for tube and shaft selections that the shafting and the shaft coupling should be made of the same material. The engineering required to compute shaft stretch and bowl thrust calculations assumes both shaft and couplings must have the same stretch coefficient. If different materials are used for shaft and couplings one has to compute the difference in thrust or stretch in order to establish total stretch of the pump assembly. Without knowing total stretch or down thrust, it is impossible to set impeller clearance for maximum efficiency and therefore maximize bowl life.

If different materials, or materials that do not have the same stretch coefficient or tensile strength are used, it is impossible to compute total stretch. This can be compensated for by using dissimilar materials/metals, such as 1045 shaft with 416 SS couplings, however the less noble metal, the 1045 shaft, will be sacrificed through electrolysis.

The reason given by tube and shaft manufacturers for using 1045 shaft and 1215 couplings (both mild steel) is that galling has occurred during installation or removal of the couplings. The manufacturers feel there is no or little galling using 1215 couplings. In reality, the stretch issue doesn't come into play until the down thrust load reaches the upper limits of the 1045 shaft load ratings. At that point, the coupling's stretch and the bowl lateral exceeds design point and a pump failure occurs. Either couplings break or hourglass, impellers drag on the bowl castings or both likely occur, damaging the bowl and requiring the removal of the pump.

How do we correct this engineering design problem? If the pump manufacturers de-rate the setting depth/thrust calculation for a given size of tube and shaft and acknowledge that the current practice is the utilization of different materials, that would allow accurate pump installation to occur. The thrust would then be calculated using 1045 shaft and 1215 couplings. However, this would require larger shaft to be utilized, and even at that, the cost of a proper installation would increase. At best, all the engineering calculation for pump design will have to be redone. A better solution would be to specify a compound that mitigates the galling of shaft and couplings. Without a solution to the problem, industry cannot depend on manufacturer representation as found in their engineering standards to be accurate, and the risk of failure should lie with the manufacturer of both the pump and the tube and shaft manufacturers and suppliers.

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Another issue of concern is the coupling used on column pipe. Two types are currently used; ductile iron and mild steel. Both products are machined for threading properly with the column pipe, the column pipe is generally made of mild steel. The couplings are paint coded the same. Issues arise in the field when the pump must be pulled for servicing. Ductile iron couplings are less expensive than mild steel and will not stand much impact. This impact occurs when installers hit the coupling with hammers to break the rust or scale and corrosion that occurs during use. The net result of impact is a cracked or broken ductile iron coupling and many times, a dropped pump. Dropping a pump may destroy both the pump and the well.

We would recommend a color or coding process that identifies ductile iron couplings. This could easily be incorporated into the casting process. A load rating should also be specified by the pump manufacturers and column suppliers for both products, especially those suppliers using cast couplings.

By creating reliable standard for column, tube and shaft as well as for bowl and pump design, industry will eliminate inequalities in the marketplace and provide our customers with products that truly represent quality installation.