EquiThrux™ - A new age vertical pump for boiler blowdown application

Pumping out boiler blowdown water is a perpetual challenge given the depth of pit from which the water is to be pumped and the high temperature aiding in low NPSHa.

EquiThrux™ Technology

The problems with conventional vertical sump pumps for boiler blowdown water pumping:

Boiler blowdown pumping is a unique application in terms of pump design with its own set of challenges. The blowdown water is at elevated temperature (typically > 90 deg C), it may contain small solids, and the pumping is a transfer duty requirement (i.e.) the pumping needs to be done periodically for transferring the blowdown water to the effluent pit. Typically, the blowdown water from the boiler is emptied into a pit of depth exceeding 5-6 metres and it needs to be pumped from this pit to the effluent pit. Operators often opt for a vertical sump pump to achieve the pumping. However, conventional vertical sump pumps have reliability issues since at 5-6 m depths, the pumps need to have intermediate supports which clog and seize the pump due to the small solids content. Additionally, with a deviation from the designed duty condition, the pump starts giving trouble since long shaft impeller assembly needs to handle the imbalanced radial thrust on the pump which results in deflection of the entire rotating shaft assembly. Operators who use vertical pumps for blowdown application certify that their biggest headache in vertical pumps is the wear and tear associated with the rotating parts, especially the wet bearings. With the new tested and proven design of the vertical pump, it truly becomes a fit and forget (or rather fit and remember) pump.

Radial Thrust: The achilles heel of all vertical pumps:

Radial thrust, (the main culprit in vertical pump operation problems) which is the force due to liquid leaving the pressurised casing chamber (based on Newton's 3rd law), gives rise to deflection on the entire rotating assembly of the pump, which includes the impeller, shaft, intermediate shaft supports (wet bearings) and the upper dry bearings. Due to the design structure of the pump, the radial thrust is absorbed by the wet bearings and finally by the upper dry bearings. Due to this deflection, there arises a need to continually monitor the health of the bearings by vibration monitoring and motor current spikes. Also, longer the installation depth of the pump, bigger the concern of deflection on the pump. Further, in blowdown water pumping case, the duty point of the pump deviates or needs to change, then there is higher chance of failure since the tolerance for a vertical pump to operate in a range of duty points is less than those with shirt shaft like horizontal end suction pumps. Else, one needs to design for a thicker shaft which increases the cost and reduces efficiency. However, with the new design approach, such problems associated with vertical

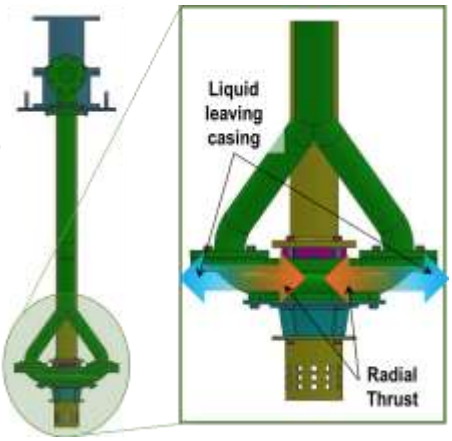
pump can be minimised to give highest reliability and MTBPM. Further, in blowdown water pumping application, due to high water temperature of > 90 deg C, there needs to be an external source for lubrication of the wet bearings since water at 90 deg C loses its lubricating property. So there is a cost in providing auxiliary water supply to the pump wet bearings.

EquiThrux™ to the rescue:

In blowdown water application, for reliability and long life of the vertical pump, the trick is to balance the radial thrust and nullify its effect on the pump, rather than to fight it. As with any force, in mechanical design, it is the unbalanced nature of the force which creates the problem. If the force can be balanced, most of the mechanical design issues are simplified. The same happens with EquiThrux™. The casing design ensures that the liquid, with same pressure leaves the casing in equal volume from diametrically opposite ends. Since there is radial thrust in same magnitude with opposite in direction, the effect of radial thrust, i.e. deflection on the rotating assembly, is minimised if not eliminated. Since the deflection is minimised, the resulting wear and tear on the wet and dry bearings is minimised improving the reliability drastically. Further, fp blowdown water application we can completely eliminate the wet bearings in the pump which avoids the need to supply external water for lubrication. The added benefit of this design is that the operating range for the pump is more or less not a constraint. The pump can be operated to near shut off to full valve (near pump runout) without much wear and tear on the pump.

What happens in double delivery?

- Radial Thrust is completely balanced by a double delivery design
- Unlike in single delivery, where the radial thrust deflects the shaft assembly, in double delivery design the radial thrust is balanced and shaft assembly does not deflect.



Benefits of the EquiThrux™ Design Vertical Pump for boiler blowdown application:

- Balanced hydraulics for trouble free operation with long life
- Eliminates intermediate sleeve & bush (wet bearings)
- No external flushing / lubrication required
- Pump can run any head & flow point even at shut off without any damage
- Pump can run completely dry for long time without any damage in cantilever design
- Less spares needed compared to conventional design

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