CASE STUDY

SHAFT BREAKAGE AT KINGSBURY THRUST BEARING

Kingsbury thurst bearing upgrade

Industry:	Oil + Gas - downstream oil
Region:	Americas
Territory:	USA
Category:	Mechanical design upgrade
API Type:	BB5

ClydeUnion Pumps Aftermarket Technical Services team has experience across a range of services on critical rotating and reciprocating equipment to improve operational safety, reliability and efficiency. The upgrade of the Pacific 4" barrel pump for the oil and gas market is one of our success stories documented in our library of case studies. These case studies highlight the requirement from the customer, how we achieved the goal and the process we followed to deliver the improvements.

Image left: Refinery

Situation

The customer requested ClydeUnion Pumps, an SPX Brand, to perform an upgrade on a Pacific 4" barrel pump installed in a refinery in Salt Lake City, Utah. One of the requirements was replacement of the existing stack up rotor designed such that the impellers were individually secured to the shaft. As part of this upgrade we also replaced all the original cast iron internals with cast steel parts. An additional problem reported by the customer was numerous shaft breakages just outboard of the thrust collar at the thrust collar check nut threads.

Challenge

The challenge was to determine the reason for the regular shaft continuously had breakages occurring at this location and to prevent future breakages. The problem could be caused by one of several reasons - improper shaft design, excessive thrust loading, excessive runout of the shaft and/or thrust collar or improper shaft material.

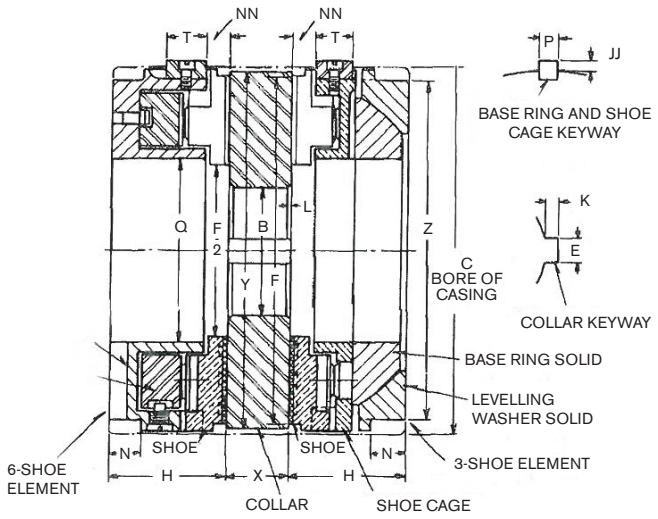
Upon the disassembly and initial inspection of the pump assembly the cause of the shaft breakages and the solution was easily determined. The pump thrust bearing was a Kingsbury tilt pad thrust bearing of an old outdated design known as a JHN. On the active side of the thrust bearing there are 6 pads which sit on individual levelling plates. On the inactive side there are only 3 pads that sit on two large conical washers (see picture overleaf showing this type of thrust bearing). The problem is that the two large conical washers will fret against each other and lock up thus not allowing the thrust pads to move with the thrust collar. Instead they force the thrust collar to move with the pads thus rocking the collar back and forth on the shaft. This in turn forces the shaft to be bent back and forth until it fails. This problem has been known in the pump industry for over 35 years. Upon inspection of the two conical washers it was very evident that the washers had fretted and locked up.

Solution

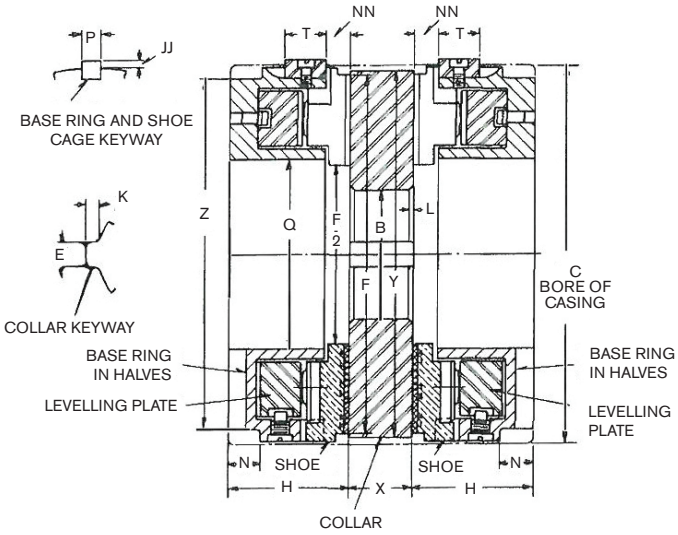
The solution was to simply replace the JHN type thrust bearing with a JHJ type bearing. The difference is the JHJ replaces the 3 pads and conical washers on the inactive side with the same arrangement it has on the active side – it also has 6 pads that sit on individual levelling plates. This arrangement is less likely to fret and lock up thus allowing the pads to continuously move with the thrust collar.

With this solution the JHJ is a drop in replacement of the JHN in that they both have the same envelope dimensions and no modifications are required. You may need to look at the thrust collar bore and keyway as this may be different depending upon the shaft design. The cost increase of the JHJ over the JHN is minimal.

6 and 3-Shoe Self-Aligning - Equalizing Style JHN



6-Shoe Self-Aligning - Equalizing Style JHJ (Double, Split)



Bearing Number	JHN-7
3-Shoe Element Area (Net Sq. In.)	12.3
6-Shoe Element Area (Net Sq. In.)	24.5
JHN Bearing, complete Spare Collar 6 Spare Shoes	43 12½ 6
B (Bore)* C E	2.500 7.375 ½
F (Normal Size)* H JJ	7 2 3/8 3/16
K L (Chamfer) N	1/4 1/16 3/8
NN P Q	7/16 3/8 3 3/4
T X Y	13/16 1 1/4 7 1/8
Z	6 7/8

Bearing Number	JHJ-7
Area (Net Sq. In.)	24.5
J H Bearing, complete JHJ Bearing, complete Spare Collar 6 Spare Shoes	30 47 12½ 6
B (Bore)* C E	2.500 7.375 ½
F (Normal Size)* H JJ	7 2 3/8 3/16
K L (Chamfer) N	1/4 1/16 3/8
NN P Q	7/16 3/8 3 3/4
T X Y	1 3/16 1 1/4 7 1/8
Z	6 7/8

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