Daishowa Reduces Pump Maintenance by Installing Fluid Rotating Vanes

Installation diminishes noise and vibration caused by severe pump cavitation and eliminates need to rebuild pump every six months

By DARRELL A. DANIELSON

Located on a thin stretch of land known as Ediz Hook, Daishowa America Co. Ltd.'s directory paper facility in Port Angeles, Wash., has more of a "real estate" problem than most other mills. The north side of the thermomechanical pulp (TMP) mill sits only 20 ft from the Strait of Juan de Fuca, and a public access roadway abuts the other side. With space at a premium, it is not always possible to arrange process piping in the ideal fashion.

A whitewater pump installation left no possible way to obtain the necessary 5- to 10-pipe dia between an elbow and the pump suction. Daishowa's engineers tried to mitigate the problem by slowing the flow to the 12-in. pump suction with a reducing tee arrangement. The pump center lies parallel with the side wall of the whitewater chest. A 16-in. discharge stub protrudes from the chest wall, with a knife-gate blocking valve mounted to the stub. The downstream flange of the knife gate is a scant 22 in. from the pump centerline.

Also, the pump suction flange lies less than 15 in. from the centerline of the chest discharge stub, making the installation extremely difficult. In an effort to overcome the difficulties they knew faced them, Daishowa engineers extended the 16-in. discharge pipe beyond the pump suction and installed a 12-in. stub into the side of the pipe in a reducing tee configuration. This short stub fed directly into the pump suction.

Unfortunately, this did not solve the inherent problem of unequal pressures and high localized velocities created when a flow changes direction by 90°. The characteristics of flow through an elbow are still maintained, causing cavitation and resulting in high maintenance costs, including a pump rebuild every six months. During these rebuilds, the impeller had to be replaced because of the extensive damage the cavitation had caused, even to the relatively hard surface of 316 stainless steel.

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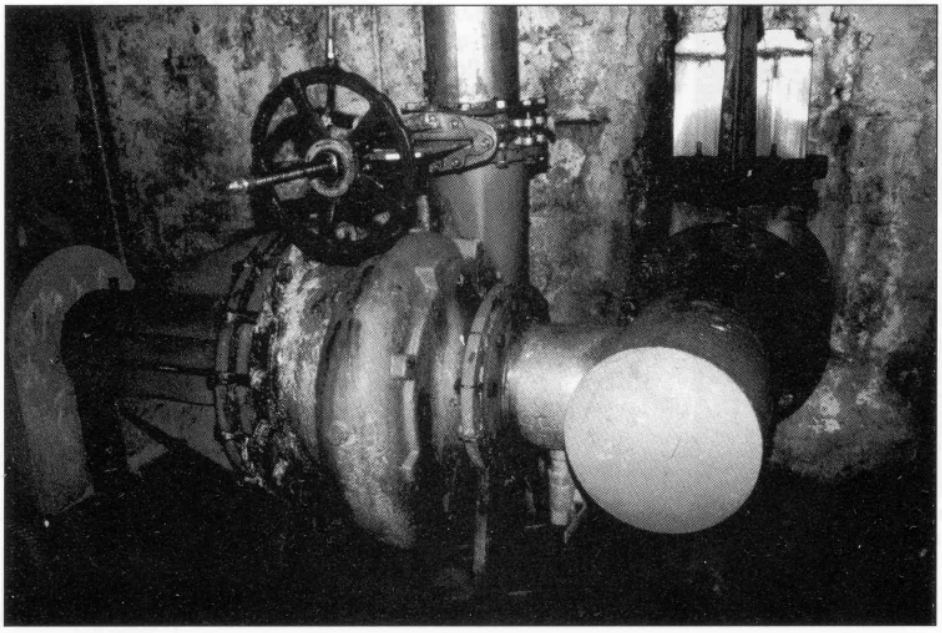
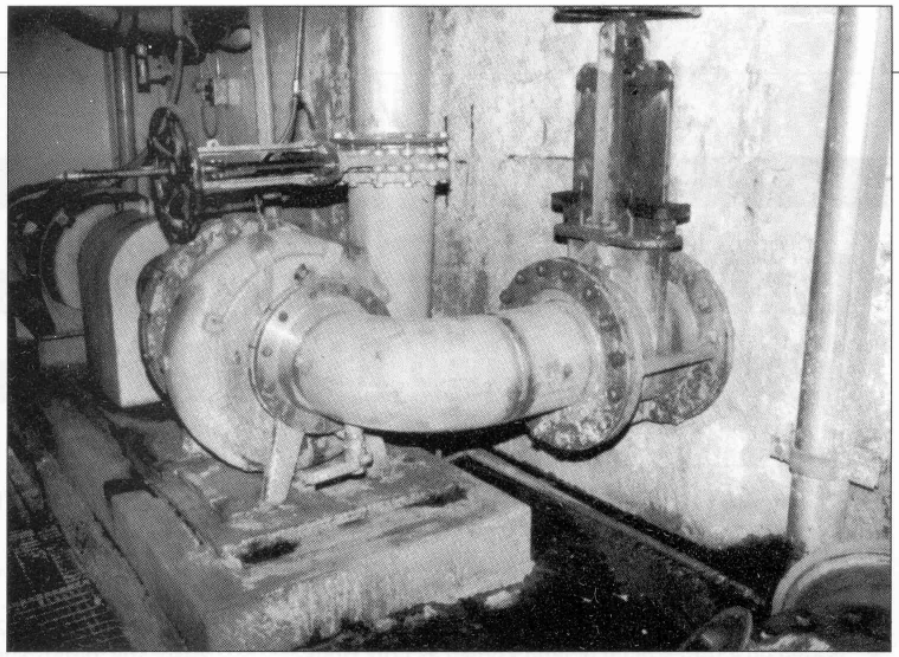
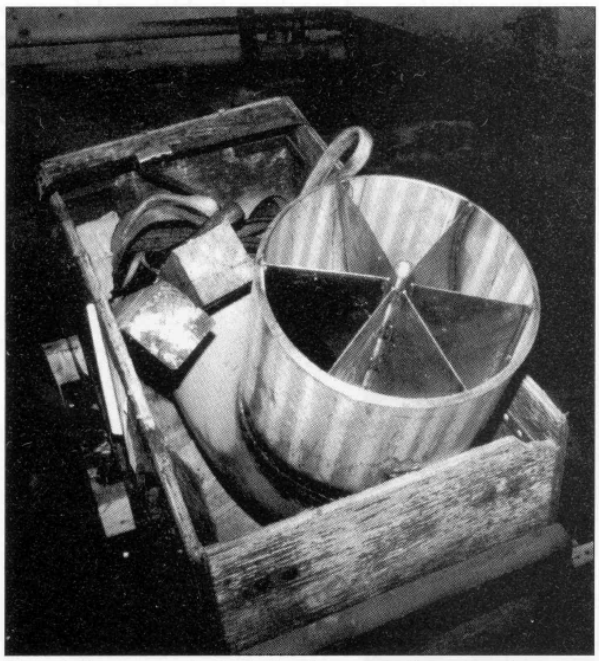


A whitewater pump installation at the mill was such that there was no possible way to obtain the necessary 5- to 10- pipe dia between an elbow and the pump suction.



With the installation of the Cheng Rotating Vanes (CRV), even though the elbow is discharging directly into the pump intake, the flow into the pump is smooth and symmetrical, eliminating cavitation.

PROBLEM SOLVED. In February 1992, Daishowa replaced the stub tee with a standard 12-in. short radius elbow and a set of Cheng Rotating Vanes (CRV) (manufactured by Cheng Fluid Systems of Sunnyvale, Calif.) between the elbow and the knife gate. The CRV, a set of stationary foils, induce a rotation of the fluid prior to entry into the elbow, such that all the stream lines are of equal length through the elbow. The result is an even velocity/pressure distribution at the elbow discharge. Even though the elbow is discharging directly into the pump intake (a piping engineer's "no-no"), the flow into the pump is smooth and symmetrical, eliminating the cavitation that Daishowa had been experiencing.



The rotating vanes eliminate the flow separation normally encountered in an elbow by inducing a rotation to the flow that essentially creates equal flow paths for each particle flowing through the elbow.

In the previous installation, the cavitation had been so bad that the crackling sound could be heard above the other mill noise, even while standing several feet from the pump. Pump vibration was severe. With the CRV installed, the noise level was what could be expected from a properly operating pump, with no evidence of the crackle caused by cavitation in the pump suction.

Vibration was also greatly reduced, causing Cecil Radich, the acting maintenance foreman, to comment that, "We will not be replacing the mechanical seals as often as before." While no attempt was made to quantify the noise reduction or flow rate improvements, Radich did comment, "That pump is now one of the quietest in the plant."

The rotating vanes eliminate the flow separation normally encountered in an elbow by inducing a rotation to the flow that essentially creates equal flow paths for each particle flowing through the elbow. The result is a plug flow profile at the elbow discharge. The CRV installation allows for placement of a pump, flowmeter, flow control, or check valve directly on the discharge of the elbow, with little or no deterioration in the performance of the installation. Pressure drop through the elbow is reduced as well, by as much as 80% to 85%, further helping attain net positive suction head (NPSH) requirements for pumps. Radich's replacement, Terry Barton, is now looking at several other installations within the compact mill to enhance performance or reduce maintenance costs and headaches.

Additional CRV installations are found at MacMillan Bloedel Inc.'s Pine Hill, Ala., mill, where a CRV is smoothing flow to the headbox for more even distribution to the wire; at Bear Island Paper Co. in Ashland, Va.; and at Boise Cascade Corp. in Wallula, Wash., where the CRVs are eliminating or greatly reducing elbow erosion in steam/condensate runs. ■

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