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CASE STORIES

Doing It Right The First Time!

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The most agonizing experience, whether person-ally or professionally, is having to return some-thing, which had supposedly been repaired earlier. It is especially true, when you entrust the job to the Original Equipment Manufacturer. A major paper mill customer in the Southeastern United States was experiencing diffuser vane failure on one of their primary boiler feed pumps. The customer came to Goulds PRO Services after experiencing a second failure on the unit that had been repaired by the original equipment manufacturer. During the first failure, damage was quite extensive. All the diffuser vanes on the first stage had been broken off or severely damaged. All but three diffuser vanes on the second stage were severely damaged as well. Most likely due to time constraints, the OEM service center weld repaired the diffuser vanes instead of replacing the diffusers completely. The OEM attributed the failures to improper operation of the unit, operating past the allowable operating region. The customer re-installed the pump and commenced operation, while also evaluating their operating practices. Later, the customer noted a seven-fold rise in vibration through his predictive maintenance program. Based upon experience from the prior failure, he suspected this was due to diffuser vane breakage. The customer shut the pump down and was able to inspect the first stage diffuser using a flexible boroscope, and found one of the vanes broken. Not satisfied with the previous performance of the OEM, the customer asked Goulds PRO Services to develop a repair proposal. Prior to the award of the project, the customer and PRO Service engineers discussed the nature of the failures and potential causes.

The customer was highly impressed by the professionalism of the group and awarded the rebuild to Goulds PRO Services. The pump arrived in the Baton Rouge Service Center and work began immediately. Engineers were on site to inspect the components as they were removed from the pump. They looked for obvious signs of mechanical failure and less obvious signs of flow recirculation. They examined the broken diffuser vane and concluded that it had broken off at the interface of the previous weld repair and the base material. They also discovered that all of the repaired diffuser vanes had significant amounts of material eroded away from the leading edges. These failures were most likely due to improper repair techniques (weld repair) or improper welding process (lack of heat-treatment or improper material type). They found, etched upon the surface oxidation of the channel rings, telltale signs of low-flow recirculation that occurred around the leading edge of the diffuser vanes. These indications were documented and discussed with the customer before the components were cleaned and sandblasted. The customer's operational data was reviewed and found to be within the published allowable operating region for the pump. The most likely cause of the diffuser vane failure was a result of two factors, hydraulic design and structural design of the vane. The etchings upon the channel ring clearly showed recirculation around the diffuser vane tip. The recirculation was so great in fact; that in some cases it eroded material from the channel ring. The customer data indicated normal operation well above the published minimum flow of the pump. The minimum flow of this unit should be much higher than published by the OEM. The second contributing factor was the vane design. The vane had a relatively high aspect ratio, tall and thin. Furthermore, the fillet at the base of the vane was very small. The loading placed upon the vane due to low

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flow operation resulted in the vane moving, or vibrating, at a small scale. Fretting on the channel ring, corroborates this theory. Given time, the continual movement of the vane resulted in fatigue failure. An engineer from the PRO Service group was present during the repair to review repair procedures and recommendations with the customer and answer his questions. The customer was suitably impressed with the overall coordination and repair. The pump is back on-line and operating with no problems. Attention to detail and customer concerns earned PRO Services high praise. The fact that the job was done right, the first time, will earn PRO Services an opportunity on the next job that comes along at that mill.