Non-OEM Pump Rebuild Shops Part I: Facts And Considerations

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In light of so many consolidations across the pump industry, is it any wonder that legacy brand experience often is lost? These days, some OEMs may not be able to offer the same engineering competence they once had in the area of pump rebuilding.

Trying to rebuild a vintage process pump to original OEM specifications makes no sense, given current pump rebuilding capabilities and changes to system performance that occur over time. Thus, a qualified independent rebuild shop deploying highly experienced personnel and a full range of state-of-the-art technologies (including balancing and alignment, vibration analysis, ultrasonics, infrared thermography, oil analysis and non-destructive testing techniques, among others) can verifiably offer high-quality upgrades that improve both uptime and efficiency consistent with current system performance requirements.

How, though, do you go about identifying such an operation? More importantly, how can you be sure that the shop to which you entrust your pumps will rebuild them to deliver the efficiency and reliability you desire? It™s not easy"you have many factors to take into consideration. This month, we discuss some general guidelines regarding the selection of a competent non-OEM pump repair operation.

Warranty issues

A competent repair facility will fully warrantee its work. There is no quibbling as to who supplied what associated parts and services, and which sub-vendors are responsible for delivering questionable or

inadequate components. Truly competent facilities will not shift responsibility in this regard. Their competence is their bond and they will have taken steps to assure quality at all levels. That being the case, an informed user will not claim that only the OEM stands behind his work. A competent repair facility will do no less and the case is closed.

Consider a large refinery with well over 3000 centrifugal pumps installed on its premises. The refinery owns pumps that rarely fail and others that fail rather often. Some are large and others are small. Some are critically important and others less so. Some are reliable but inefficient, or efficient, but less reliable overall. A well-informed pump user will have access to much pertinent information and, especially, will have failure frequency data relating to his pump population. These data and an understanding of what caused a given pump failure will enable the user or competent pump rebuild shop to point out and explain, specify or recommend a number of appropriate options. Once cost-effective options are selected, the competent pump rebuild shop, henceforth abbreviated to CPRS, should be asked to implement measures that include upgrading of sensitive components, avoidance of vulnerable lubricant application methods and others.

At the same time, there should be an understanding between the pump owner and CPRS as to whether hydraulic upgrade options exist. In other words, before embarking on the repair of a pump that presently operates at 65% of best efficiency point (BEP) flow and draws a current of, say, 100 amps, it would be nice to know if a different impeller would be available that might cause operation to shift to 95% of BEP and draw only 90 amps. A simple calculation might reveal the payback and straightforward overall cost justification for such an upgrade.

Also, based on an understanding of what failed and why, a reliability-focused user will surely want to implement routine shop upgrades, which are defined as those done on bad actor pumps. Bad actors are those that require repairs more often than the rest of the pump population, and routine upgrades are done on those pumps so as to reduce future failure risk.

Uptime-extending upgrades

The following list is a summary of routine shop upgrading done on pumps that fail frequently. This summary is presented early in this article because it seems these upgrade measures are rarely pursued by OEM shops, whereas an independent CPRS is more likely to explain and advocate them.

1. Double-row, single inner ring angular contact bearings in ANSI pumps can be replaced with modern double-row, double inner ring angular contact bearings.

2. The unbalanced constant level lubricator is discarded and a balanced model incorporating a sight glass is installed. The balance line is routed to the top of the bearing housing (former location of the

housing vent"now discarded).

3. The new balanced constant level lubricator is mounted on the up-arrow side shown in the vendor™s or manufacturer™s literature.

4. Oil rings are being replaced by suitable flinger discs. Flinger discs have a metal hub and are set-screwed or suitably fastened to the shaft. The actual disc is made of a suitable elastomer or flexible metal, and its lowermost 3/8 portion immersed in the lube oil. To be considered suitable, the manufacturer-endorsed peripheral speed limitation must be observed.

5. On larger bearings and in installations where circulating lube oil is often preferred, plant shops are encouraged to obtain input from their respective Plant Technical Services Group. With the concurrence of these reliability professionals, convert to direct oil spray lubrication with a device that pressurizes oil drawn from the bearing housing sump.

6. Pumps with dry sump oil mist previously applied at the center of the bearing housing should be modified to apply oil mist per API-610 8th Edition, e.g. the mist enters between the bearing protector seal and the bearing.

7. Unless shaft surface speeds exceed 10 m/s (~2000 ft/ min), all bad actor pumps and small steam turbines are being fitted with dual-face magnetic bearing housing seals. The bearing housing is now quasi hermetically sealed"nothing goes in or out. The bearing housing end cap is painted with white spray paint so that any (highly unlikely) oil leakage will show up easily.

8. Unless oil rings are used (in which case, a thinner oil may be needed), use ISO Grade 68 diester or PAO synthetic lubricant on all bad actor pumps (bad actors are those that fail more frequently than most others in a given plant). An aluminum or stainless steel label stating oil type is affixed to the top of the pump.

9. Cooling water is removed from all centrifugal pumps with rolling element bearings.

10. The shaft interference fit for back-to-back angular contact bearings is carefully measured and verified not to exceed 0.0003 on shafts up to and including 80 mm diameter.

Of course, pump repair and rebuilding efforts often go beyond just the routines that were described above. Repair scopes differ from pump to pump and must be defined if the goals of uptime extension and failure risk reduction are to be achieved.

Defining the repair scope

The CPRS has both the tools and the experience needed to define a work scope beyond the foregoing summary of routine upgrading. The CPRS takes a lead role in defining the repair scope and all parties realize that reasonably accurate definitions will be possible only after first making a thorough Incoming Inspection. On a written form or document, on both paper and in the computer memory, the owner-customer, manufacturer, pump type, model designation, plant location, service, direction of rotation

and other data of interest are logged in, together with operating and performance data. The main effort goes into describing the general condition of a pump, and this effort might be followed by a more detailed description of the work. Either way: it constitutes the condition review.

Condition reviews include photos of the as-received equipment and close-up photos of parts and components of special interest. End floats, lifts and other detailed measurements are taken and recorded on a dimensional record both before and after total dismantling. Components are marked or labeled, and hardware is counted and cataloged. Bearings, bushings and impellers are removed. Bead blasting, steam or other cleaning methods are listed and a completion date for these preliminary steps is agreed upon. It should be noted that only now would a competent shop consider it time to arrive at the next phase in its repair scope definition.

Non-destructive testing (NDT) is the next step and must be used where applicable. A good pump rebuild shop will issue a form that identifies the chosen inspection method, perhaps liquid dye penetrant or magnetic particle methods. While a detailed discussion of NDT inspection is beyond the scope of this presentation, its importance must be stressed and the CPRS will recognize this need.

There also may be a need for electrical runout readings at eddy current probe locations, rotor (shaft) total indicator readings (TIR), individual impeller balance, rotor balance and residual unbalance. Such a form would also list the authority for performing these inspections, acceptance criteria, condemnation limits and other items of interest. Some of the ultimate inspection results would be documented on this form as well; other inspection results would go on separate forms.

Recall that the term form refers to both paper and computerized formats. It also should be evident that there is a transitioning of documents that define initial work scope, to documents that deal with material certification, documentation of as-achieved (or as-built) dimensions, adequacy or fitness-forservice of auxiliary components or repair quality.

Repair procedures/restoration guidelines

Pump manufacturers usually supply pump maintenance manuals with detailed assembly and disassembly instructions that are either generic or specific to a particular pump style and model. A number of important checks should be performed by the CPRS for users whose serious goal it is to systematically eradicate failure risk. Both the CPRS and the user have responsibilities in ascertaining that all quality checks are performed with due diligence.

Concentricity and perpendicularity

Experience shows that after years of repairs, many pumps are due for a series of comprehensive dimensional and assembly-related checks. As a minimum, every pump that is labeled a bad actor and considered part of the reliability-focused user™s initial pump failure reduction program should be given the checks described in Figs. 1-4. The verification setup is conveyed in Fig. 1; it originates in decades-old vendor literature. These directives are still quite relevant today. After the various dial indicator checks of Fig. 1 are complete, the dimensional before vs. after findings listed in Figs. 2, 3 and 4 should be recorded in either the (preferred) electronic, or, as a minimum, paper format. Users and shops that do not take time to record these pump repair data will find it very difficult to reach their desired failure reduction objectives. (Note that certain seal-related dimensions may not apply to cartridge seals.)

Coming in September

In Part II of this series, we explain issues and guidelines regarding selection of competent non-OEM pump rebuilders in further detail, illustrating the discussion with actual case study accounts.

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