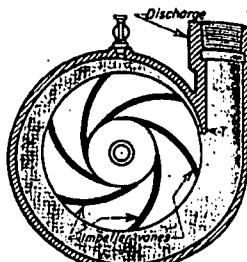


1 Wear in the running-joint clearances, as between wearing rings at A and stage pieces, B, increases the leakage from pump discharge side to the suction side



2 If the tongue T in a volute casing is worn uneven, smooth and flat

Overhaul That Pump at Right Time

Which is better? Pulling a pump apart once a year to see if it's in good condition or letting it run until trouble shows up? There's more than one answer to this important question. Here one authority tells you what he thinks is the best for your plant

By W E W JONES

ENGINEERS DON'T AGREE on how often you should completely overhaul a centrifugal pump. That's because it's almost impossible to set up general rules applying to all classes. Design of unit, service it's used for, kind of liquid handled, construction materials, overhaul cost, and power saved by replacing worn parts—all enter the decision of when a pump should be opened for inspection and repair.

Overhaul Schedule. Some pumps in severe services may need a monthly overhaul; others need be opened only every two or four years, or even less often. So a schedule for inspection and repair of pumps in one service may not suit those in another.

But, in general, a centrifugal pump need not be opened for inspection unless evidence shows overhauling is necessary. This means a decrease in pump performance, too much noise, or driver overload shows you have trouble. This isn't the whole story; we'll look at exceptions later.

Instruments. You need the right instruments and meters to run medium- and large-size centrifugal pumps successfully. They also help increase pump life. You must be able to find capacity and discharge pressure if you expect to have a good maintenance program.

Set up a schedule for testing each unit. Compare the test results with performance figures for the pump when it was new. These tests, and not a fixed period of service, should tell you when a pump needs overhaul. Testing a unit costs less than opening it for inspection; and unit doesn't have to be taken off the line.

Pump Performance. Let's see what effect internal wear has on centrifugal pump's performance. We'll assume its impeller delivers the same gross capacity at any given head. But pump has internal clearances at running joints, like those between impeller and casing wearing rings, A, and stage pieces, B, Fig. 1.

Leakage occurs through these joints and all fluid discharged by the impeller does not go out the pump discharge. Some of it leaks back to the impeller suction eye. Net capacity of the pump is the difference between gross discharge and internal leakage. In a new unit, leakage may be as low as 2% so the net capacity is 98% of impeller discharge.

But after pump is on the line awhile, running clearances wear and internal leakage or short-circuit losses increase. This reduces the net capacity of the pump for a given total head and horsepower. If we want the same net capacity

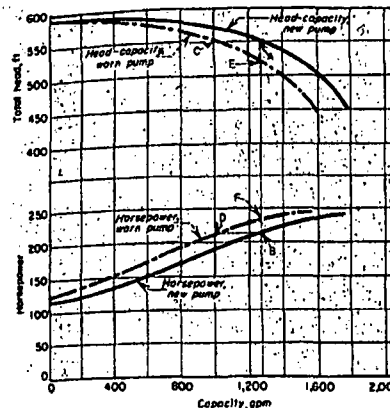
from the pump, total head on it must be reduced. Horsepower input increases.

Head Capacity. Horsepower and head-capacity curves, Fig. 3, show how internal leakage affects centrifugal pump performance. When this pump in good condition it delivers 1270 gpm at 550-ft head, point A, and needs 215 hp, point B.

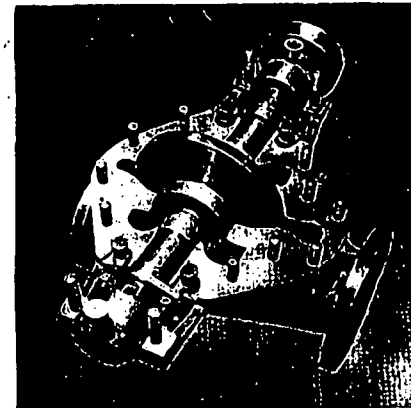
After the running clearances wear, leakage through them increases to when pump can deliver only 1000 gpm at 550 ft head, point C. Horsepower input remains the same, 215 hp, point D. You would expect this because the impeller delivers the same gross capacity under the same total head in both cases.

If you want the same capacity, 1270 gpm, under both conditions, then the total head against which the pump runs must be reduced. For the worn pump to deliver 1270 gpm, total head must be reduced to 520 ft, point E; power input increases to 235 hp, point F. If you test pump regularly, you'll get a reliable picture of internal-clearance condition.

Overseeing Experience. Information from past use of a given pump or a similar one can serve as a guide for when it needs opening. For instance, assume you have several boiler feed pumps that ran 50,000 hr without needing an overhaul. That's enough evidence



3 Head-capacity and horsepower curves show how increased leakage will affect the performance of a centrifugal pump



4 Complete overhaul of a split-casing pump should include careful inspection of the horizontal flanges and gaskets

that similar units need not be opened for inspection until they've run 50,000 hr.

On the other hand, pumps on severe service may need an overhaul every three months. To get longer running periods you can replace the pump with one built of better materials or of sturdier construction. But until new equipment proves itself in service it's best to open it at the end of three months to find out how the better materials stand up.

Big Plants. It isn't wise to advise public utility operators to neglect having an adequate inspection schedule. They generally have spare pumps and plant won't be shut down if one fails. But during the last 10 years, at least 75% of utility-plant operators have had to judge pump condition by outside signs and instruments because of plant overloads.

Keep enough spare parts on hand when running an overloaded plant. Then if a pump fails, you can overhaul it quickly. This avoids possible delays in getting needed parts from the builder.

Check the Pump. Whether you do or don't open pump for inspection, make these scheduled checks. At least once every six months check pump and driver alignment and correct if necessary. Inspect stuffing-box packing. Drain oil-lubricated bearings; flush and refill. Check amount and condition of grease in bearings. Make as accurate a test of the unit as you can with the instruments you have on hand.

Besides the 6-month inspection, make a more complete one once a year. Take

out bearings and inspect them for wear and defects. Repack stuffing boxes unless experience shows you the packing can safely go for a longer time. On horizontal pumps with sleeve bearings, remove the packing and open coupling.

Check vertical movement of shaft at each end. Restore bearing clearance if it is more than 150% of the original. That is, if the original clearance was 0.002 in., recondition or replace bearing when wear increases its clearance to 0.003 in.

Opening the Pump. Dismantling a centrifugal pump is usually done to inspect internal surfaces and running clearances. This should show if materials are suitable for the liquids handled. If you find small pits or erosion on the casing, you may be able to fill these by welding, brazing, silver soldering or metal spraying. Examine all metal-to-metal fits, such as where casing rings fit into the casing, as at C, Fig. 1.

If the tongue or cut-water T in volute casings, Fig. 2, is worn uneven, cut it square across, and file it round and smooth. Horizontally-split casing pumps, Fig. 4, must have damaged gaskets between top and bottom halves replaced before reassembly. Be sure new gasket is the same thickness and material as the original one.

Check clearances between all running joints, as between casing and impeller wearing rings, A, stage pieces and impeller hubs, B, Fig. 1. When these clearances increase 100 to 150%, replace worn parts or renew their surfaces.

While you have a general-service

pump open, clean and paint casing waterways. If you work on shaft sleeve, check its concentricity after tightening it in place. Pump size, sleeve material, and size of your repair shop must all be taken into account when deciding if it's cheaper to install new shaft sleeves or resurface old ones.

Running Pumps. Where you have operators on constant duty, make hourly and daily inspections of the pumps. Investigate immediately any change in a running pump's sound. Check bearing temperatures and stuffing boxes every hour. See that rings in ring-alled bearings work right. Have just enough stuffing-box leakage to cool and lubricate packing. Too much leakage wastes fluid pumped. Too little may cause burned packing and scored sleeves.

If pump has pressure gages and a flowmeter, check every hour to see that pressure and flow correspond to plant operating conditions. Make a daily check of recording instruments to insure that output, pressure, or power consumption indicate right performance.

Be Careful. There are exceptions to the rule that a pump needn't be opened unless outside evidence shows it's necessary. On some jobs you may feel safer with clearance measurements and internal inspection. Just be sure to open pump at regular intervals. Otherwise, you won't have too much confidence in your maintenance.

Rules are made to be broken. A feeling of confidence in your pump is far more important than opening it a few more times than necessary.