CHILLER COMPRESSOR OVERHAUL

CUSTOMER REPORT

The Customer Report you provide to your customers differs from past Y.E.S. Offers in that it will be included as a financial comparison within your proposal before the service is done. An example of a well constructed proposal developed by the Chicago District Service Office is provided as a guide for development of your own District's format.

Note the effective use of specific equipment information in a personalized proposal to "sell" both the financial decision makers, and equipment personnel. While this report format may be difficult to create as a standard "form," a word processor can construct the basic skeleton of your own District proposal, with blanks to be filled in later after specific customer data is secured.

The key to an effective proposal is a personalized, individual style that makes the customer aware of YORK's commitment to service excellence. The proposal task will become more efficient and polished as they are repetitively accomplished. The service is a relatively big ticket item and the customer will need to see value-added input from YORK before signing a preventive maintenance compressor overhaul.

After the job has been secured, and the work completed, remind the customer of the value and peace of mind now made possible as a result of the wise decision to allow YORK to overhaul the chiller's compressor. Discuss what was done, any findings, and offer recommendations on how the customer can further reduce operating costs and increase equipment reliability. They'll thank you for the attention.

A YORK Preventive Maintenance Compressor Overhaul Estimate Sheet has been included in the Zone/District Service Manager Y.E.S. Pricing section. This sheet should be calculated and presented along with the customer proposal report which follows in this section. Be sure to include the preventive overhaul versus failure parts comparisons from the Chicago study or from your District.

SAMPLE

CHILLER EVALUATION

UNIVERSITY OF WISCONSIN, OSHKOSH, BLACKHAWK COMMONS

YORK CHILLER MODEL HT 230 (WO-002456)

This chiller was installed approximately 15 years ago and has provided reliable service except for 3 years when the building cooling system was not used. Since it runs at night most of the summer it has an estimated 30,000 hours of operation on the compressor. A chiller driveline deteriorates and finally fails based on five factors: the number of on-off cycles, the number of operating hours, the average % of full load the compressor usually sees, total age since new or overhaul, and how much air leakage and purging has occurred over the years. The last two are related and compounded.

York as a manufacturer has not established a standard time at which a teardown should be completed. This chiller evaluation is based upon local service records and experience with approximately 300 centrifugal chillers over a 20 year period. A typical compressor runs 8 and 14 years before needing an overhaul. You might have confidence that your chiller would run 14-15 years if it ran under ideal conditions. Referring to the 5 factors mentioned earlier it would have to:

1) Run 24 hours/day once started for the season

2) Run 2000 hours or less per season

3) Rarely run at less than 70% load

4) Be as new a chiller as possible

5) Be so tight it requires purging no more than once a week.

Looking at your particular chiller, it rates high on items (1) and (2), about average at best for (3), (4) and (5). Based on our experience I would not expect your chiller to reach the 15 year point. Actually very few of them (maybe 10%) ever do, because they don't see ideal conditions.

We can also analyze the cost of compressor failures and consider the option of performing a preventative maintenance overhaul of an apparently healthy compressor purely from a financial perspective. During seven years as York's service manager in St. Louis I noticed many compressor repairs were extremely costly in parts if the compressor was allowed to run to failure. Ignoring the associated crises situation this generally caused in the heat of the summer, we just looked at the cost of parts used in some 32 overhauls. We calculated a ratio of total parts used to the cost of the standard overhaul bearing kit that would be necessary if an older compressor was torn down for overhaul prior to failure.

Attachment 1 lists all overhauls performed on failed compressors in St. Louis for a seven year period. No jobs were left out to insure the analysis was statistically accurate. Parts prices reflect then current pricing in the year the work was done since we were searching for a ratio, not absolute cost numbers. The jobs with high costs of additional parts resulted from such bearing wear that internal parts could move until interference would damage impellers, gears, or drive shafts. Nearly all these compressors were running fine until failure. No indication such as low oil pressure made anyone suspect imminent failure. High shaft speeds and a 30 second coast down time are apparently sufficient to destroy the bearings before an oil pressure failure safety can shut down the compressor if it is already in operation and the bearing surface starts to go. If a healthy compressor was torn down for overhaul little beyond the cost of the bearing kit would be required for replacement parts. The 2.82 x bearing kit price ratio can be used as an estimate of the average cost of parts to overhaul a compressor which is run to failure. We assume that the labor would be identical whether the work was done during the off season or during a summer emergency which is probably being conservative as extremely damaged compressors are harder to disassaemble.

An estimate sheet is used to determine what the average cost per year of service would be for the compressor if it was overhauled now, assuming only an overhaul kit being necessary to return the compressor to like new condition. Comparing this average annual cost to the estimated overhaul cost for run-to-failure, determines how long the compressor must continue to run before failure in order to realize the same average annual cost of operation. If an owner chooses to continue to run the compressor as is, he must be hoping that he can reduce the average annual cost by getting more years of operation before the overhaul is completed. He is in effect gambling that the compressor will run enough additional years to offset the increase in parts cost to make the repair when it does fail.

For this analysis, which is purely financial, our assumption is that the owner should be indifferent to which overhaul approach is taken if his expected annual costs of operation are equal. Attached 2 presents the comparison between an overhaul this spring for replacement of bearings and seals, and running the compressor to failure. Based on 100 hours of labor at our billing rate and a bearing kit for $5795 the long term cost of operation for the past 12 years would compute to an average of $1024/year. With the higher 2.82 parts cost factor your run to failure cost for an emergency overhaul would be $22841. To achieve the same $1024/year average cost you could lock in now through a preventive maintenance overhaul the compressor must run another 10.3 years, or total of 22.3 years before failure. It won't.

Attachment 3 looks at the same issue but with our labor reduced by using one of your people like Rick, as the second man on the job. The evaluation now requires that the compressor run an unbelievable 25.7 years before failure to equate average annual operating costs.

After performing the analysis I would recommend tearing the compressor down now to replace bearings and seals. Because you are already going to remove the oil charge to install the orifice plate it would make sense to overhaul the compressor and replace the suction elbow gaskets at the same time. If you wanted us to inspect the compressor we could supervise the other work while on the job. This would save the cost to remove and replace the charge at some future time, as well as any costs for us to help replace the suction elbow, which will probably be about $300 in labor.

One last possibility might be worth considering. If your people would handle the charge removal and replacement we could remove the compressor rotor support/motor assembly and take bearing clearance readings without disassembling the entire compressor. The critical areas for compressor failure are the high and low speed thrust bearing clearances and what is termed runout of the impeller wheel. Taking these measurements would not allow visual inspection of bearings or their replacement but would indicate if they were badly worn.

York could furnish the rigging equipment and expertise to perform the minor inspection and reinstallation of the compressor driveline in about 24 hours on the job, with one of your people for help. Including drive time and expenses for 3 days the total cost would be under $1800.

Based on the inspection results you would know if the compressor would need to be overhauled immediately or could be run confidently until a planned preventive maintenance bearing changeout could be scheduled for a winter shutdown period.