Weighing the Options of Chiller Maintenance

Mark Harbin, Manager of Compliance Information Services,
Environmental Support Solutions

Often contractors find themselves thrust into the role of a consultant or engineer. In order to get approval for a project, it is sometimes necessary for the contractor to review, explain, estimate and present all of the various avenues an owner can take with their CFC chillers. The key to doing this is to minimize your time in preparation while ensuring that a comprehensive list of options is provided.

System Needs

Weighing all system factors is critical before making a recommendation to an owner.

System condition is an important aspect to consider. A newer CFC chiller might seem like a good candidate for conversion until eddy current inspection of the heat exchanger tubes reveals irreversible damage due to haphazard water treatment. Suddenly, a retube job added to a relatively inexpensive conversion becomes a price contender with a replacement chiller.

Age and useful life of a chiller need to be part of any evaluation. ARI and ASHRAE estimate that large tonnage water chillers that have been regularly maintained will last 25 to 30 years. A neglected chiller will die an early death. But a well-maintained machine, although older, may still be a good candidate for conversion.

Load requirements are usually overlooked or misjudged. Few owners actually have load calculations run on their buildings unless it is being expanded. If windows have had solar reducing films applied or if the lighting system has been modernized, then most likely the cooling load has been reduced. The question is, *by how much?* Only by quantifying the actual cooling requirements of the facility can you determine if a particular transition strategy is correct.

For example, a fully occupied building that has a 500-ton chiller and load could not afford the 10 percent drop in tonnage associated with a conversion. However, relamping the entire facility drops the cooling requirements to 450 tons, making the conversion a feasible CFC transition strategy.

Maintenance requirements can range from yearly tune-ups and tube brushings to major overhauls and bearing inspections at multi-year intervals. Significant costs can add up when refurbishing a large tonnage chiller. Incorporation of these extended costs into CFC transition estimates can sway the balance in either direction— convert or replace, depending on the severity of the repairs.

Repair history and future refers to whether a chiller has been a problem child or a pussycat through its life. Lemons make poor conversion candidates. Likewise, pussycats make good ones. In some cases, reuse of an older chiller's heat exchangers and minor modifications to its compressor components can make it perform like a new, high efficiency chiller.

Cost of ownership incorporates first cost, energy cost, maintenance cost and incentives over the useful life of the chiller. First cost is the cost of the chiller plus the installation cost. A great deal

on a chiller won't seem so sweet if it costs a fortune for disassembly, re-assembly and rigging into a basement mechanical room.

Conversion Options

Presenting an owner with a comprehensive recommendation for a successful CFC transition requires analysis of all potential strategies, with pros and cons for each. Options for owners of CFC chillers include one or more of the following:

- **Containment**
- **Conversion**
- **Retrofit**
- **Replacement**

Containment is twofold**.** Conservation through improved service practices to minimize refrigerant loss during normal servicing, and installation of containment devices to prevent excessive or catastrophic refrigerant loss. Containment devices for low-pressure chillers include high efficiency purge units (sometimes including capture tanks), rupture disk relief valve assemblies, and off-cycle pressurizers. Containment devices for high-pressure chillers include over-pressurization capture tanks and dual-assembly low leakage relief valves. Always check with the local code enforcement authorities regarding proper venting of refrigerant relief piping.

Containment is a strategy for all chillers regardless of which type of refrigerant they use.

Conversion is the modification of a chiller to operate on a refrigerant other than that for which it was designed. In many cases, this is harder than it sounds. The first challenge is finding the original design conditions for the chiller. Owners are supposed to retain this information for their records, but few do, which leaves the option of getting the design data from the manufacturer. This is usually the best course of action because they can offer useful conversion information.

Conversion can affect performance. It all comes down to how much capacity the owner is willing to lose and how much more in energy they're ready to spend. In almost all cases a tonnage loss can be expected, but in some of those cases the energy efficiency actually gets better on a KW per ton basis.

Retrofit refers to the conversion of a centrifugal chiller through replacement of its motor, compressor, control panel and starter while utilizing the existing condenser and evaporator heat exchangers. Driveline retrofits are typically applied in situations where access to the chiller area is limited and a 10 to 30 percent tonnage loss is acceptable.
Driveline retrofits are available for low and high-pressure centrifugal chillers and can be applied to virtually all models of a chiller.

Replacement of a chiller can become very complicated when trying to review all of the options that today's technology brings. It gets even more complicated when trying to present these options to an owner without losing them in technical details. It is important to be thorough in analyzing the system while remembering to keep it simple for the client. Most owners care only in *what it will do for them*, not *how* it will do it.

The most important aspect to remember is that owners want the *benefits* of a project presented to them, not the nuts and bolts. Evaluating and presenting the merits of a project to an owner must be done from a lifetime cost of ownership perspective. The formula for this is as follows:

Add equipment cost, installation cost, and maintenance cost. Then deduct utility rebates or any other incentives and energy savings. Extend the costs and savings over the entire projected useful life of that piece of equipment to arrive at the *lifetime cost of ownership.* Comparisons between different CFC transition strategies and replacement chiller options become more meaningful to owners when viewed from this perspective.

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