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CHILLER O&M BASICS

By following a few simple operations and maintenance guidelines, you can keep your chiller running efficiently and reliably.

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Chiller system sizing, location, fluid selection and maintenance procedures all affect a chiller's cooling performance. Overlook one of these variables, and your plant likely will waste thousands of dollars on excess energy consumption and equipment repair.

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13 Tips for Efficient Chiller Operation

As energy costs continue to increase, conservation strategies have become crucial. There are a number of steps you can take that not only will improve the operation of your chiller system but also will increase overall system energy efficiency.

By following some basic guidelines before, during and after installation, you can avoid these problems and ensure that your chiller system will provide the required cooling capacity at a maximum level of efficiency and reliability.

Proper Sizing and Location

Selecting the appropriate chiller size is crucial to ensuring efficient operation. Sizing parameters should be determined by performing a thorough calculation of the maximum cooling and process load demands. It is important to understand that cooling loads fluctuate over time, and the size or capacity of a chilled water system must be designed to accommodate these load changes.

Location also is an important consideration. The chiller system should be installed as close as possible to the process for the following reasons:

- To reduce the amount of piping required and thus minimize the amount of ambient heat absorbed by the heat transfer fluid through the piping.
- To reduce the volume of fluid required to fill the circuit, and thereby speed the system's temperature response during startup and operation.
- To improve heat transfer characteristics in the refrigeration circuit by decreasing system pressure drops and increasing fluid flow rates.

Both air- and water-cooled chillers should be located away from any equipment that might restrict or impede the chiller's operation. Placement near walls and external heat sources also should be avoided to ensure that airflow and component accessibility remains unobstructed for proper operation and maintenance.

Fluid Selection

Fluid type, quality and treatment should be considered when selecting a fluid for use in a chiller system. Industrial nonautomotive glycols with corrosion inhibitors suitable for chiller systems should be

used for most applications.

When attempting to operate below normal operating temperatures (45°F [7°C]), a premixed solution of water and glycol should be used to provide freeze protection. In closed-loop systems and installations where ambient air temperatures are higher than normal, algaecide and biocide additives might be required to ensure that the water loop remains clean.

General Maintenance

Preventive maintenance procedures should be performed regularly to keep the chiller system clean and well-maintained. In air-cooled chillers, any dust or dirt that accumulates on the condenser coil will insulate the condenser and reduce the transfer of heat from the refrigerant to the air. A dirty condenser also forces the compressor to work much harder than it should, which increases energy consumption and potentially shortens the life of the condenser. Air-cooled condensers should be vacuumed clean or chemically treated on a regular basis to remove dust and dirt particulate. A filter also can be used on the condenser inlet to prevent clogging.

In water-cooled systems, tube-side scale buildup acts as an insulator, reducing the system's ability to transfer heat and overworking the system components. Process cooling and condenser water lines should be flushed periodically to remove any rust or other dirt particulate that might have accumulated. Water-cooled condensers also should be back-flushed with a diluted concentration of boric acid to increase efficiency. Process strainer screens should be cleaned regularly to maintain flow rates and minimize power consumption.

In addition to cleaning, preventive maintenance procedures should include checking refrigerant levels. In most systems, this evaluation can be performed simply by checking the system's refrigerant sight glass window for aspiration (gas bubbles). The presence of gas bubbles indicates a leak somewhere in the refrigeration circuit that is allowing the refrigerant to escape. A certified refrigeration technician should be able to find and repair the system leak. Although refrigerant leaks are not common, the loss of refrigerant can prevent a chiller from cooling properly. Low fluid levels in the system's reservoir tank can cause the fluid to "vortex," or spin, which will allow air to mix with the water in the process water pump, reducing overall efficiency.

Selecting the appropriate chiller size is crucial to ensuring efficient operation.

A routine check of all electrical connections within the system's electrical box also should be performed periodically to ensure that the electrical components are operating within the manufacturer's specifications for safe operation. Make sure to turn off and lock out the main power supply, then check all component wire terminations to ensure they are firmly seated in the terminals and making solid contact. Repair or replace any wiring or components that look worn.

To ensure accurate temperature control, consider using an autotuning microprocessor controller on your chiller. The autotune function should be retuned whenever the chiller is moved from one process to another, particularly when the cooling load changes substantially.

You cannot control the price of energy and labor, but by taking steps to increase the efficiency and reliability of your equipment, you can minimize your energy and labor costs. Following these basic sizing, installation and maintenance guidelines can help you ensure that your chiller system will operate safely, efficiently and reliably for many years to come. **PC**

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Chillers

Troubleshooting Chiller Systems

Several conditions can cause a chiller system to sound an alarm or shut down completely. The system manufacturer should provide a troubleshooting section in the operator's manual that includes a list of common problems, possible causes and corrective measures. While only a qualified refrigeration technician should attempt to repair any part of the refrigeration circuit, some basic system checks can be performed by the end user to help determine the cause of the problem.

For example, a high-refrigerant-pressure shutdown usually involves water-related problems that affect the operation of the system's condenser in water-cooled units, or a dusty, dirty condenser or improper fan rotation on an air-cooled system. Conversely, low-refrigerant-pressure shutdown conditions could be attributed to low ambient air temperatures or an incorrect water/glycol mixture concentration.

The end user also can check the main power phasing to the system. Incorrect power levels can result in improper compressor or pump motor rotation, causing a safety hazard. Attempting to operate the chiller below designed operating temperatures can cause a low-temperature shutdown. These conditions can be diagnosed or verified easily by nonspecialized personnel. The goal is not to eliminate the services of a certified refrigeration technician, but perhaps to minimize these calls to save both you and your service technician some time.

A competent service technician will listen closely to the equipment operator to minimize the troubleshooting and repair time. If you require the services of a refrigeration technician, take the time to call around and talk with several of them to ensure that you feel comfortable with the contractor you select.