CONDO
MANAGEMENT

Benefits of programmed air conditioning maintenance

by Scott Gordon

By implementing proper maintenance on building air conditioning systems, the useful life expectancy of the mechanical equipment can be extended and operational costs will be reduced.

All mechanical systems require preventative maintenance. Air conditioning equipment will break down if left unattended. When equipment does break down, it always seems to happen at the most inconvenient time. A preventative maintenance program will help avoid these problems.

Fundamentally, there are two kinds of maintenance programs — breakdown and programmed. Breakdown maintenance is simply fixing equipment after it fails. When such failures occur, the primary goal — providing a comfortable environment for the building occupants — is missed, thereby planting a seed of discontent about the building. The idea of programmed maintenance is to avoid breakdowns, by correcting problems before they become critical. This approach is preferred over breakdown maintenance for several good reasons.

The first reason programmed maintenance is preferable is because it offers the ability to see the need for a minor repair before it turns into a major repair. An example of this would be a technician during an inspection seeing that a set of compressor starter contacts are pitted or an overload is not operating properly. Both of these are minor repairs compared to thousands or possibly tens of thousands of dollars for a compressor replacement that would occur if these minor repairs are not made. This analogy can be carried through to chillers, cooling towers, pumps, air handlers and every other piece of mechanical equipment found throughout the building.

When maintenance is overlooked, equipment can consume significantly more energy than systems that are properly maintained. Some areas that are detrimental to system efficiency are:

- dirty evaporator and condensing coils,
- scale on water cooled condensers,
- improper water flow,
- duct leaks,
- dirty blower wheels,
- improper refrigerant charge and
- temperature control calibration.

Temperature controls that are not properly calibrated can be one of the single largest contributors to increased energy costs. Controls on multiple stage systems should be set up so that a second compressor will not energize until the first compressor can no longer satisfy the demand. Unloaders should be adjusted and set for the most efficient system operation.

Perhaps the largest and most overlooked cost of improper maintenance is the shortened life of the mechanical system. This loss may be as much as two thirds of a system's useful life. Cooling towers that are improperly maintained can cause them to need replacement in as short as five to seven years. Compare this to the average life expectancy for a cooling tower, which is around 20 years. In addition to the need for tower replacement, poor water treatment can cause damage to the piping throughout the building. There are buildings that are less than 10 years old that have been repiped and had new towers installed due to improper maintenance.

An effectively implemented preventative maintenance program will extend the useful lives of the building's systems and maintain their operating efficiency. Following is an example of how preventative maintenance procedures can be performed on the building's air conditioning system.

1) *Eddy current analysis for heat exchangers:* This analysis will test the condition of heat exchanger tubes found in equipment such as hooded chillers and water cooled condensers (shell and tube). This procedure is performed when the system is shut down, drained and opened. A technician measures the electrical conductivity of each heat exchanger tube, identifying tubes that are questionable in regards to pitting or cracks due to stress.

2) *Lubrication oil analysis:* Refrigerant oil analysis provides insight as to the machine's metal-to-metal wear rate. Moisture content of the oil is also determined. Most equipment manufacturers recommend that oil be tested annually, and replaced as determined by the analysis.

3) *Meg compressor motors:* Megohm meters are electrical meters used to check the resistance of the refrigerant/oil environment around the motor's

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windiness. The meter can also check the conditions of the motor windings themselves. Its main function is to detect weak motor winding insulation. As the contaminants in the refrigerant/oil mixture increase, the electrical resistance to ground will decrease. Because of this, regular preventative maintenance checks can be made with a megohm meter and can signal early motor winding breakdown from a system when accurate records are kept.

4) ***Vibration analysis for rotating equipment:*** Excessive vibration causes premature equipment failure. When rotating equipment is designed, an initial vibration analysis is performed to provide a baseline for performance that should be seen once the equipment is installed. All equipment will vibrate; however, if equipment falls beyond the industry standards, it is an indicator that damage can occur. Reasons for equipment vibration are: worn bearings and/or shaft, blower wheel torn up or loss of balance, chipped impeller, worn out vibration isolators.

5) ***Ultrasonic pipe measuring analysis:*** This non-disruptive procedure determines the pipe wall thickness. The test can be performed with or without water in the pipe. The reason the test can be performed is because the density of the pipe is different from water or air. The digital ultrasonic measuring device is emitted and the ultrasonic device will measure the time for the reflection of the sound wave. Different densities will have different sonic wave reflective times. Once the existing wall thickness has been determined, the calculated thickness is compared to industry standards of nominal wall thickness. From this comparison, a technician will be able to inform management of the pipe's remaining useful life.

6) ***Infrared thermal lighting:*** This allows non-destructive analysis of a wide assortment of existing equipment. Through infrared thermal imaging, abnormal sources of heat that often indicate any one of a variety of potential problems can be located quickly. Such analysis provides the ability to determine the extent of the need for replacement or the ability to determine the need for any necessary maintenance, extending the life of existing equipment. As with electrical motors, infrared thermal imaging can locate heat sources produced by the effect of wear on bearings or heat caused by vibration due to loss of lubrication. Cooling losses as a result of deterioration of pipe insulation can also be determined.

7) ***IAQ analysis:*** Indoor air quality of a building can be determined by measuring the amount of airborne particles and gases in the air stream. Based on the readings, different remedial procedures can relieve the problem. The level of carbon dioxide in the air is a very important factor in determining how healthy the air is inside a building. Several factors regarding maintenance, such as dirty coils and ductwork, plus controls that do not allow for the proper amount of air into the building, should be investigated.

A well-maintained building will operate more efficiently and last longer than a building without the benefit of a comprehensive preventative maintenance plan.

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