

# Preventive HVAC Maintenance is a Good Investment

By Robin Suttell

**I**magine working in an office tower that lacks proper ventilation and air circulation – one that is sweltering and stuffy in the summer, and frosty and downright cold in the winter. No one, including you and your staff, would want to work there, let alone lease the space inside.

Building systems are the lifeblood of any facility. Without lighting, water, or heating and cooling, a building would be uninhabitable. That's why a strong preventive and predictive HVAC maintenance program isn't an option; it's a must.

"Two issues – the asset and the life of the building – can be tied back to the fact that a solid program of preventive maintenance is absolutely paramount," says Anthony Shaker, vice president of operations and maintenance at UNICCO, Newton, MA. "The better it is maintained, the more likely you're going to get the appropriate life-cycle from the equipment. If not, it

will deteriorate. If you are looking for viable occupancy, you need to maintain the system so people can inhabit the building and [achieve] full productivity."

## KEY CONCEPTS

- HVAC system maintenance isn't expensive compared to what you might spend if your system degrades (and ultimately fails).
- The first place to turn when building a successful HVAC maintenance plan should be the manufacturer's operating and maintenance manual.
- By tracking different system indicators, you can pick up on many emerging problems before they reach a crisis situation.
- It's important to do a life-cycle cost analysis when determining if you should repair or replace an aging HVAC system component.

## A Case for Maintenance

Think of preventive HVAC maintenance in the same way as the preventive maintenance for your car: If you don't change your engine oil and replace belts and filters, the engine will lock up and the vehicle won't operate. The same holds true, in a sense, for HVAC systems. "If you spend \$30 on an oil change in your car, you will save \$3,000 on a new



According to Anthony Shaker, vice president of operations and maintenance at Newton, MA-based UNICCO, ideally, the ratio of spending for HVAC systems should be 70-percent preventive maintenance and 30-percent corrective maintenance.

engine," says Matt Ashwood, president and CEO at Bonded Filter Co., Nashville, TN. "Proper preventive maintenance [for] HVAC equipment will do the same thing."

Maintenance isn't expensive compared to what you might need to spend if your system degrades (and ultimately fails). Shaker provides this example: If you have a piece of equipment that costs \$10,000 to maintain and has a forecasted life of 10 years if properly maintained, you will spend only \$20,000 from first cost to replacement cost at the 10-year mark, assuming it would cost \$10,000 again to replace it at the end of its life-cycle. However, if you did not properly maintain the unit and it failed at the 5-year mark, you would need to spend \$10,000 to replace it after 5 years and then replace that same unit again in another 5 years if you continued to not perform maintenance. Your total cost would be \$30,000.

"[Those are] significant savings. Proper maintenance costs a lot less over the life of the equipment than to change out equipment on a more frequent basis," Shaker says. "The word 'preventive' speaks for itself. It keeps things from happening."

## Crafting the Perfect Plan

Two main issues are at the heart of any HVAC maintenance program:

1. The recommended performance and maintenance tasks for each piece of equipment.
2. The overall operation of the system in relation to the building in which it's installed.

"Depending on those two requirements – the sophistication of the equipment, as well as the environment and operation of the overall system – you need to decide if your preventive maintenance plan is a full-maintenance-coverage plan or if there's an opportunity for system-performance enhancement,"



PHOTO COURTESY OF UNICCO

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## The Incorporation of Air Filters

Even if your comprehensive preventive maintenance program is delinquent or deferred, don't forget one simple step: keeping tabs on the condition and age of the air filter.

"The air filter is important to the lifeblood of the building," notes Anthony Shaker, vice president of operations and maintenance at Newton, MA-based UNICCO. "A good air filter maintains the quality of the environment."

The mechanical health of your building's HVAC system can also rest on the condition of the air-filtration system. Changing air filters frequently and using a quality filter can extend the life of your expensive HVAC equipment.

Matt Ashwood, president and CEO at

Bonded Filter Co., Nashville, TN, offers these tips for proper air-filter maintenance:

- Make sure you install the correct filter size. If you don't, air will escape around without being filtered (air bypass) and defeat the purpose of having a filtration system.
- Check the filter media for damage.
- Seal the media in the frame.
- Install the filter according to the manufacturer's specifications.
- Visually inspect components to look for damage and areas of air bypass. Caulk and seal cracks in the duct wall by the filter housing.
- Replace all filters at the same time.

Ashwood also recommends that you take differential pressure-drop readings at specific cycles throughout the year to get a better idea of when you should change filters.

"The interval of when [the filter] needs to be changed will be determined by the type of facility, the demand within the facility is located," Ashwood says. "By using differential pressure-drop readings, you can put a gauge on the piece of equipment. An air filter, no matter who makes it, is going to look dirty. The differential pressure-drop reading will help you better know when it needs to be changed."

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## HVAC

notes Michael P. Bordes, senior vice president at EMCOR Facilities Services and president at Norwalk, CT-based EMCOR Services' Elmhurst, IL, office.

The first place to turn to if you have questions about how to build a successful HVAC maintenance plan should be right at your fingertips – or at least nearby on a bookshelf or in a desk drawer: It's the operating and maintenance manual, provided by the manufacturer.

Don't overlook these maintenance manuals. They provide a concrete blueprint for the steps you need to take to maintain chillers, boilers, motors, air-handling units – every piece of equipment in a building's HVAC system. "Manufacturers spend a lot of time and money testing their equipment to determine what the maintenance needs are," says Walter M. D'Ascenzo, senior project manager at Fairfax, VA-based Facility Engineering Associates PC. "They put this information into the manuals; it's all there in black and white. These maintenance manuals were not dreamt up in a conference room over doughnuts and coffee."

If you don't have the original manuals, you can easily get replacements. Call your manufacturer's representative with the pertinent model and serial numbers, and they can get you the replacement information you need.

Once you read the manuals and consider your system's specific needs, you will have all the necessary information to get a successful preventive and predictive maintenance program off the ground – one that is tailored to your building's HVAC system and operating environment.

### Focus Areas

Some aspects of a maintenance plan are simple – change the oil, change the belts, change the filters (just like your car). But, to keep a system operating at maximum efficiency, you'll need to expend more elbow grease beyond the basics from time to

time. Air-handler coils need to be cleaned periodically to keep heat transfer at maximum amounts. Boilers need to be cleaned annually; even 1/16-inch of soot and ash on heat-exchange surfaces in an oil-firing boiler can reduce efficiency by 10 percent.

And, don't forget fire testing. D'Ascenzo suggests fire testing and flame adjustment every 3 years. "You can't just test by eyeing the flame," D'Ascenzo says. "You can be so far off the mark by trying to eye-adjust a flame in a boiler. You've got to measure."

Predictive maintenance is also important. By tracking different system indicators such as oil temperature, RPM speeds, and other factors, you can pick up on many emerging problems before they reach a crisis situation. "A lot of different diagnostics can point to issues where service isn't being performed in the repetitive, regular nature that it is supposed to be," Bordes says.

Building automation systems can be invaluable in maintenance diagnostics by greatly improving response time to maintenance issues via troubleshooting.

"When you have someone sitting at a PC and [looking at] the issues to see what is going on, nine times out of 10 you can find out what is causing the problem and correct it with a keystroke," notes Jeffrey T. Hunt, senior project manager at Fairfax, VA-based Facility Engineering Associates PC's Dallas office. These building automation systems can also be linked to computerized maintenance management systems (CMMSs) to further enhance your operations.

### Keeping Tabs on Work

Once you have your plan ironed out, take the list of HVAC tasks that need to be done monthly, quarterly, annually, etc., and input them into your maintenance management system, along with any of the documentation that goes with it, whether it is a paper-based system or a computerized one. Just make

## Good People = Good Preventive Maintenance

The most finely crafted preventive maintenance program is only as good as the people who bring it to life. "The more you and your staff know about your facility, the better you can maintain it," says Jeffrey T. Hunt, senior project manager at Fairfax, VA-based Facility Engineering Associates PC's Dallas office. "If your maintenance

people don't know what a piece of equipment does, how do you expect them to maintain it?"

First, hire people who can be taught and who want to learn. Second, train them on every piece of equipment they encounter; don't throw them out on the job and expect them to learn as they go. Have a formal training

process in place and provide refresher sessions at periodic intervals.

Also, keep your staff involved in such processes as retro-commissioning. "They know more about the system than anyone else and might [know] why something was changed from [its] original settings," Hunt says.

## Consider this example when thinking about preventive maintenance:

If you have a piece of equipment that costs \$10,000 to maintain and has a forecasted life of 10 years if properly maintained, you will spend only \$20,000 from first cost to replacement cost at the 10-year mark, assuming it would cost \$10,000 again to replace it at the end of its life-cycle. However, if you did not properly maintain the unit and it failed at the 5-year mark, you would need to spend \$10,000 to replace it after 5 years and then replace that same unit again in another 5 years if you continued to not perform maintenance. Your total cost would be \$30,000.

sure it is easily retrievable for anyone who works on the system. A solid program should provide a comprehensive history of maintenance conducted on every piece of equipment, as well as the corrective costs incurred.

"You need a good, clear record of service being performed and when it was performed," Bordes says. "You need to keep a paper trail. If you do, you will be able to see trends and better predict what should be done."

Placing stickers on your equipment is another way to keep maintenance professionals apprised of the work that has been done on a system's many and varied components. A simple decal affixed to the equipment that lists the last time the equipment was serviced, what was done, and who serviced it is invaluable. "[This way], you have a record of the last time someone was in this piece of [HVAC] equipment and what they did to it," Ashwood says. "All it takes is a quick visual check."

### Repair vs. Replace

In any system's life-cycle, there comes a point where you need to decide whether it's fiscally and practically feasible to continue maintaining and repairing an aging, degrading piece of equipment. It's important to do a life-cycle cost analysis when determining if you should repair or replace an aging HVAC system component, Hunt says.

"To keep the unit going, do you replace the part, which will cost 'X' dollars, or do you replace the entire unit?" he asks. "Consider all costs in a life-cycle cost analysis – the cost of the equipment, maintenance, and even energy. Maybe you are 10 years into the unit's life-cycle; it might have a typical service life of 15 years, but has only a little life left in it because of the way

it has been maintained and operated. A life-cycle cost analysis will consider the current condition and efficiency of the unit."

Let's say you have a 30-year-old chiller and have spent more money than anticipated on maintenance; and, new chillers have twice the efficiency of the old chiller. The decision to replace is an easy one, Hunt says, if you run a life-cycle cost analysis.

Ideally, the ratio of spending for HVAC systems should be 70-percent preventive maintenance and 30-percent corrective maintenance, according to Shaker – these numbers are benchmarks that UNICCO professionals use in charting the effectiveness of client maintenance programs. "If the corrective maintenance level is up to 70 percent, you know your program is out of control," he says. "The buildings where the numbers are in reverse are the buildings that people don't want to be in. That's what happens when preventive maintenance isn't instituted."

While every piece of equipment will need to be replaced eventually, following a stringent, comprehensive maintenance schedule will prolong your building's HVAC system and maintain not only a healthy bottom line, but happy, satisfied, and comfortable tenants.

"For the most part, facilities [managers] understand the exposure they have in large capital expenditures with negligence when it comes to preventive and predictive maintenance, especially [with] air-handlers, large chillers, and pumping systems," Bordes says. "They are aware of the necessity and the [responsibility] they have financially if they neglect it." **B**

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