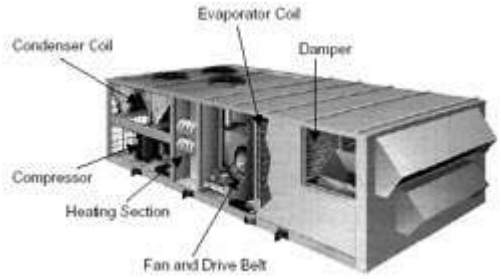

HVAC MAINTENANCE – by Mike Bryson, June 2008

Maintaining HVAC systems is critical to demonstrate that you are following the industry's "standard of care". Doing so will help protect your building occupants from unnecessary exposure to IAQ issues and help protect you from potential litigation.

There are some other very good reasons to properly maintain your HVAC system, including:

- Lower utility costs.
- Increase the service life of the HVAC equipment (reduce replacement costs).
- Greater comfort for the building's occupants.

Common best practices for maintaining a hygienic HVAC system follow.

Select Best Filter Capacity
Filters, and their ability to remove microorganisms can be best understood by using ASHRAE's standard (52.2-1999) which assigns an efficiency rating to filters called a MERV. The higher the MERV rating the more efficient the filter is in removing small particles. Generally speaking, a MERV rating of 11 or above is recommended.

Filter type can also make a difference in indoor air quality. Pleated filters made of cotton/synthetic fabrics may cost a little more, but the fabric can boost efficiency and the pleats increase the effective area.

Replace Filters (every 1—6 months)
Filters capture dust that can become a food source for mold and, depending on the filter, many of the spores themselves. Filters are made

to be replaced frequently. Intervals should be one to six months, depending on the dirt load. You may need to visually inspect filters at monthly intervals before you can assign an established replacement frequency.

One tip for easy maintenance is to install easy to open panels to gain access to the filters and coils.

Clean Evaporator and Condenser Coils (once or twice a year)
Evaporator coils which are continually damp provide one of the best places for mold to grow. In addition to the constant dampness, the supply side of the coil is in contact with warm, humid outside air and the dirt that gets past filters contains the nutrients that mold requires to grow.

The condenser coil, exposed to unfiltered outdoor air, suffers considerable degradation due to dirt. While the condenser coil does not affect indoor air quality, cleaning this coil the same time the evaporator coil is cleaned will improve energy efficiency.

Coils soiled with microbial growth are particularly difficult to clean. Bacterial metabolism creates a sticky waste, which creates a biofilm that locks particles to the growing organism. Some molds develop long branches, or hyphae, that help to further cement the mass together. A quality cleaning solution with an appropriate dwell time is necessary to effectively remove all microorganisms.

Built up fungal growth is difficult to clean from metal surfaces. Technicians can be tempted to use an aggressive (high acid or caustic) cleaner. Such overly aggressive cleaners can damage metal surfaces. Damage can range from pitting of surfaces that interferes with rapid flow of condensate from fin surfaces to accelerated structural deterioration of components. Residues from such cleaners can also contaminate the indoor air if not fully rinsed.

Products like BBJ's Power Coil Clean are specifically formulated to attack the particulates that hold biofilms together without damaging the HVAC equipment. Once we keep the biofilm from growing back (see treatment section), a less aggressive coil cleaner like BBJ's MicroCoil Clean can be used to rid the system of dirt through routine cleanings.

Keeping the coils clean through frequent maintenance and appropriate treatments (see next section) will dramatically reduce the time required to complete this job.

As previously mentioned , energy savings is another reason to keep coils clean. A study completed by Pacific Gas & Electric indicates that the

efficiency of a 10 ton package unit can be improved 16% simply by cleaning the evaporator and condenser coils. This can entirely offset the labor and product cost of cleaning the coil.

Treat Coils (after every cleaning)
Mold grows very quickly and a coil, once cleaned, can become fowled again in short order. Antimicrobial treatments, like BBJ MicroBiocide® for HVAC Systems, disrupts the reproductive cycle of mold spores and therefore inhibits the growth of mold.

The entire air handler should be treated once it is cleaned to make sure the unit remains free of microorganisms between cleanings.

Inspect Area Around Air Intake (twice annually)
Water can pool around air handlers, particularly those mounted on the roof. As with any place where water exists, mold can grow. Mold near the air intake will increase the likelihood that spores are sucked into the ventilation system. Make sure there is no standing water around the air handler.

Fix Leaks in Cabinet and Supply Duct (annually)
Annual checkups should include a survey of air leaks and corrective action such as replacing screws or latches, and patching or replacing gaskets. Cabinet and duct integrity is particularly important on the supply-air side, where high pressure can force air out a small crack.

Clean and Adjust Dampers (annually)
One of the most common problems with commercial HVAC equipment is improper damper operation. A study of 13 units conducted by PG&E found not one with properly operating dampers. This can negatively affect indoor air quality and also increases utility consumption.

Operating properly, dampers keep the compressor from running when outside air temperature is below 60 degrees Fahrenheit. But unless they are kept clean and well-lubricated they stick, robbing the unit of free cooling potential (if closed) or overloading the cooling coil with too much hot outside air (if open).

During servicing, moveable surfaces should be cleaned and lubricated. As long as a service technician is on the roof, this should take about 15 minutes.

After cleaning and lubrication, a damper should be run through its full range. Tools can generate electrical control signals to drive the actuator, or the economizer setpoint can be manipulated at the control panel. Afterward the setpoint should be checked.

Inspect Fan, Bearings and Belts (twice annually)
While proper operation of fans, bearings and belts have minimal impact on indoor air quality, it only makes sense to include this step as a best practice in preventative maintenance. Avoiding the emergency situation of a unit that has shut down (usually on the hottest day of the year) will make best utilization of your HVAC labor force.

Impeller blades on a forward curved fan can fill up with dirt, lowering efficiency and air flow. Cleaning the blades on a small fan can take an hour or more; cleaning larger fans, especially those with multiple wheels on a single shaft, can be a major project.

Many HVAC technicians have found fan motors running in the wrong direction. Because they still supply perhaps 50 percent of rated flow even running backwards, this may not be readily apparent. The most common cause is switched wire leads on the motor. Clear labels on the fan housing, pulleys, motor, and wires can help prevent this problem.

Newer fans have self-lubricating bearings (sealed-cassette ball bearing cartridges preloaded with grease). When they finally fail, typically after several years of service, the bearing cassette must be replaced. Signs of impending failure are excessive noise, vibration, or heat emanating from the bearing.

Conventional greased ball bearings are occasionally found in packaged units. Their most common problem is over greasing, which can be as damaging as under-greasing.

Improperly adjusted belts rob the drivertrain of power, create noise, and must be replaced sooner than well-adjusted belts. Belts should be aligned to prevent lateral wear. Proper tension should be maintained; loose belts slip on the pulley wheels, causing torque loss and rapid wear. Belts that are too tight put an excessive load on the motor and fan shaft bearings, causing early failure of the bearings and/or belts.

Clean Air Ducts (Inspect every 2 years)
There is no real consensus regarding the frequency of cleaning supply and return air ducts. It will depend on the maintenance of the HVAC system (a

well maintained system will put a lower dirt load into the ducts) and the use of the building. The North American Duct Clearers Association (NADCA) recommends inspecting supply side and return air ducts every two years (annually in hospitals). If the inspection reveals contamination, the ducts should be cleaned.

Quality Assurance Audits (on-going)
There are many ways for today's facility managers confirm that best practices to deliver good indoor air quality are in place. These include:

- ***Look up***. As you walk through your facility, pay attention to the air vents. This very simple inspection can help you determine if mold or other pollutants are entering your occupied space.

- ***Follow your nose***. The presence of mold often creates a "musty" odor. Tuning in your sense of smell to the air flowing through your facility could alert you to pending trouble.

- ***Ask building occupants***. Use periodic random surveys to keep in touch with your building occupants. This can be done through "desk drops" (leaving surveys on employees' desks after hours, or through the e-mail system.

- ***Listen to your building's occupants***. People's complaints may be an indication of an indoor air quality issue.

- ***Confirm record keeping***. Record keeping ideas in the "Toolbox" section of this manual. If you choose to use any of these, make sure you routinely inspect them to make sure they are up to date.

- ***Testing devices***. Swab tests of the HVAC system can provide a clear indication of the systems' cleanliness. They can detect the level of microbial growth. Maintaining a history of readings can provide confirmation the system is clean or a warning that more attention is required.