Coil Cleaning to Save Energy

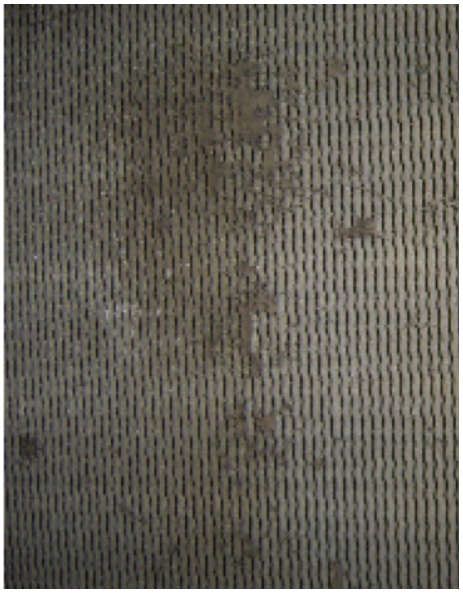
OVERVIEW

Dirt on heating and cooling coils can have a significant impact on building energy use. Dirty coils reduce airflow, decrease heat exchanger efficiency, and reduce Heating, Ventilation and Air Conditioning system (HVAC) capacity. In addition, dirty coils contribute to poor indoor air quality and are a major cause of compressor failures in refrigeration systems.

There are two types of coils in HVAC systems: indoor and outdoor. Indoor coils, located inside air handlers or ducts, use filters to keep the coils clean. However, even the best filters cannot prevent dust and dirt particles from reaching the coil, which builds up over time and restricts the air flow passing over the coil. The result is that the air handling system works harder and uses more energy, thereby reducing the overall efficiency of the HVAC system. Outdoor coils, used for air conditioning systems, do not have filters and therefore are more exposed to dirt build-up. Even a small amount of particulate can reduce the coil surface area and effect system efficiency. For example 0.25 millimetre build-up can result in a 20% decrease in system efficiency.

A clogged or dirty coil can:

- increase the static pressure and reduce the air flow velocity which causes the fan to work harder and use more energy
- decrease the heat transfer rate which causes fans and pumps to operate longer, reducing the life expectancy of the motors
- force compressors to run longer and work harder than required, increasing their energy consumption up to 30% (according to US DOE)
- cause inefficiencies in the dehumidification process (where applicable)
- decrease occupancy comfort
- affect air quality through the spread of mold and biological contaminants



COIL MAINTENANCE PRACTICES

It is critical to have regular coil maintenance practices to achieve high energy efficiency of HVAC building systems. Maintenance practices for heating and cooling coils include regular filter replacement and cleaning of the heat exchanger surfaces. Good filter practices can help to keep coils free of dirt and debris. To ensure that filters are performing as intended, coil inspections should be carried out. The US Department of Energy recommends inspecting coils a minimum of once per year. Different types of coils require various types of regular maintenance.

Indoor Coils

Having clean filters is important because indoor coils are often located in tight spaces, making them difficult and expensive to clean. Filters should be changed whenever they become dirty. In some facilities, pressure gauges, filter indicator lights and filter alarms alert maintenance personnel to ensure timely filter replacement.

Indoor coils also have drain pans that require careful cleaning to prevent their accumulated debris, which can contain mold and bacteria, from becoming airborne. Ensuring debris is contained and carefully removed from the system is important to protect indoor air quality.

Outdoor Coils

Outdoor coils collect dirt depending on the quantity of particulates in the outdoor air. The frequency of cleaning depends on the location of the unit. If located in an industrial area or near a dirt road, the coil may require cleaning every two or three months. Units located in a moist region with clean air may only need cleaning once or twice a year.

Maintenance for Newer Systems

Newer and more efficient HVAC systems are more likely to benefit from regular coil inspection and cleaning than older systems. Higher-efficiency units are equipped with larger coils to increase the transfer of heat. They also operate at greatly increased pressures and are more sensitive to increases in static pressure.

New air conditioning units with high Seasonal Energy Efficiency Ratios (SEER) often have variable-speed fan motors that adjust fan speed based on demand. These units lose much of their effectiveness when forced to run harder than necessary due to fouled condenser vanes.

INCENTIVES

BC Hydro has an incentive program for coil cleaning and has completed demonstration projects with their Alliance partner, Nalco. BC Hydro has provided incentives of up to 50% of the coil cleaning costs for variable volume systems and the resulting payback is often less than two years.

CASE STUDY

Richmond Hospital instituted a coil cleaning and filter change demonstration project in 2010 that showed the difference good maintenance practices can have on building energy performance. The hospital used their three constant volume air handling units which had very similar performance and service to compare the effects of different maintenance practices on energy savings. The air handing units, installed in 1997, were each equipped with 20 hp supply fan motors and 5 hp return fan motors.

After four weeks of post-demonstration monitoring and verification (M&V) data collection, the savings show that a combination of regular coil cleaning and filter changes results in the best saving potential. The savings from coil cleaning only; filter replacement only; and both ranged from 10% to 26% of total fan energy consumption.

MAINTENANCE CATEGORY	SYSTEM	SAVINGS (kWh)
Coil Cleaning Only	AHU-1	14,000
Filter Change Only	AHU-3	8,000
Coil Cleaning + Filter Change	AHU-2	29,000
TOTAL		51,000

Extrapolating over a year, the demonstration project was shown to deliver 51,000 kWh in annual savings as shown in the table. The total cost savings using a blended BC Hydro rate of $0.055/kWh was $2,800. The total cost for both the coil cleaning and the new filters was $4,170 plus HST. The simple payback was 1.5 years.

A second installation occurred for coil cleaning along with new filters at Eagle Ridge Hospital in July 2010. This project featured variable speed drives on the supply fans and is a variable air volume (VAV) system. One year of post installation energy use was collected to calculate the savings of 282,000 kWh per year of fan energy savings (18% of fan energy) and 86,000 kWh per year for chiller savings (29% of chiller energy). Thirty-five percent (35%) of the fan savings was attributed to the filter change while the balance was from the coil cleaning. The coil cleaning and filter change-out on this project resulted in a simple pay back of 6 months. *(Source: BC Hydro Technology and Innovation)*

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