HVAC HESS

PEOPLE

PRACTICES

SYSTEMS

Factsheet

The Importance of Cleaning Coils

Finned coils are used in a number of different applications in HVAC systems to transfer heat either into or out of air streams. There are two basic types of coils:

1. Condenser coils - Condenser coils transfer heat into a space. Refrigerant vapor is forced into the coil under pressure, condensing the refrigerant into a liquid, which results in the rejection of heat across the heat exchange surface.
2. Evaporator coils - Evaporator coils do the opposite to condenser coils. Liquid refrigerant is pumped into a low pressure coil, causing the refrigerant to evaporate into a vapor, absorbing heat across the heat exchange surface in the process.

Over time the surfaces of these coils can become dirty as the air moving over the coils can contain dust, dirt, pollen, moisture and other contaminants. A build-up of contaminants decreases the available surface area for heat transfer, reducing the efficiency of the heat transfer process, leading to excessive energy consumption and poor system performance. It is important that air conditioning coils are regularly inspected and maintained to ensure they operate at optimum efficiency.

In addition to the energy efficiency and system performance benefits, regular coil cleaning also improves equipment life spans and indoor air quality; a fact that has led to regular coil cleaning becoming a regulatory requirement in certain circumstances.

This Factsheet sets out the benefits of regular coil maintenance and provides guidance on cleaning.

Energy Efficiency

Dirty condenser and evaporative coils have a negative impact on energy efficient HVAC system operation. According to the US Department of Energy (DOE) "a dirty condenser coil can increase compressor energy consumption by 30%". A dirty evaporative coil will decrease airflow which reduces heat transfer thereby degrading the dehumidification process.[1]

Although the drop in capacity is not as large with dirty condenser coils as it is with dirty evaporator coils, the coefficient of performance (COP) is severely affected. The compressor has to work longer and, therefore, the system will use more power.

System Performance

A rise in condensing temperature from 35 to 40°C as a result of dirty coils can cut cooling capacity by 7% and increase power consumption by 10%, with a net compressor efficiency reduction of 16%. Such performance degradation in a 35kW unit operating for 2,000 hours in a year can increase operating costs by $250 per year [2].

Poor heat exchange of coils reduces system performance meaning air conditioning is less able to cope with extreme ambient conditions. As an illustration of this a study, focusing on practical maintenance, shows that on a typical 10.5kW rooftop unit if evaporator airflow is restricted by 36%, the capacity drop is 19.4%. In effect this changes the 10.5kW unit to an 8.8kW unit [3].

Equipment Life Cycle

Poorly performing coils also mean that other parts of the air conditioning system have to work harder or for longer resulting in reduced life cycles. With refrigerated air conditioning systems, compressors have to work harder and longer to achieve the required system performance. Poor coil performance in these systems can also lead to other problems that either reduce compressor life or in some circumstances cause catastrophic compressor failure. Likewise with water based systems, with decreased coil performance chillers, boilers and pumps all have to work harder. In addition, biological growth on coils can lead to fin corrosion that over time will significantly reduce the coils' performance to a point where they will need to be replaced.

1 Sheppard, Robert. "Clean HVAC System Coils Save Energy" www.buildings.com/article-details/articleid/8282/title/clean-hvac-system-coils-save-energy.aspx

2 U.S Department of Energy, Federal Energy Management Program Factsheet www1.eere.energy.gov/femp/pdfs/om_cooling.pdf

3 Stefura, Mark. "The Importance of Clean Coils In Commercial Equipment" icemeister.net/Articles/FYI/Clean_Coils_Commercial.pdf

Indoor Air Quality

In cooling coils the conditions often exist for the growth of microbiological contaminants. Contaminants, such as bacteria, mold and fungi can colonise on the cooling fins in air conditioning systems creating toxic allergenic organic fragments known collectively as Macromolecular Organic Dust. This has been linked with various health complaints in buildings. The buildup of contaminants also reduces heat transfer effectiveness and system efficiency. Regular cleaning reduces this build up.

Regulatory Requirements

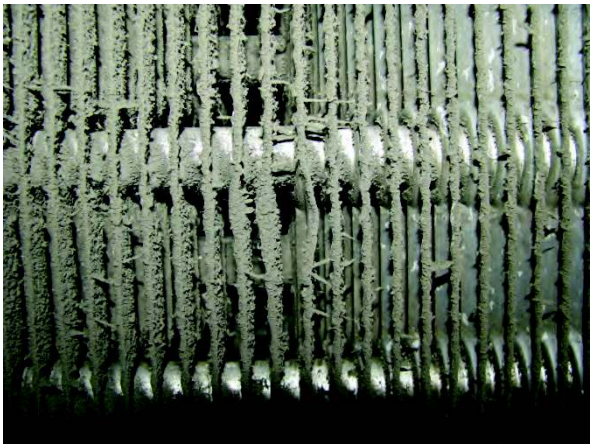
The Australian Standard AS/NZS3666.2:2011 Air-handling and water systems of buildings—Microbial control [4]— Operation and maintenance requires coils that are part of an air handling system be inspected monthly and cleaned when necessary. AS/NZS3666.2 is referenced in a wide range of legislation and regulation.

When and How to Clean

The HVAC HESS report The Measures [5], which underpins the HVAC High-Efficiency System Strategy states that "systems whose heat transfer surfaces have not been cleaned in the last three years an immediate energy saving of at least 10% is expected to be achieved following cleaning. "

A visual inspection offers a good general indication of when coil cleaning is needed. The image in Figure 1 [6] below shows the visual difference between a dirty and clean coil.

Figure 1: Image showing the difference between a dirty and clean coil



Coil prior to cleaning

Coil after cleaning

A more technical approach requires the measurement of the temperature difference between the air entering and the air leaving the coil and comparing this to the temperature differential expected given the operational circumstance of the coil. The expected temperature change will vary dependent on a range of variables and care should be taken with where and how the readings are taken. As such, this testing should be carried out by an experienced service provider.

Your air conditioning maintenance provider should be able to advise on how regularly coils should be checked for cleaning and how cleaning should be carried out. AIRAH Application Manual DA19 HVAV&R Maintenance provides guidance on cleaning for the various types of coils found in air conditioning systems. Cleaning can involve the use of compressed air or water sprays and the removal of biological contaminants and involve the use of carefully selected chemicals. Cleaning should be carried out by experienced service providers to ensure equipment is not damaged and air handling systems are not contaminated by the cleaning process.

In addition while cleaning coils improves energy efficiency, the greatest benefits are realised when the coils are considered in the context of the whole system including filters, ductwork, air intakes etc. Typically when building staff or HVAC contractors service a unit several tasks are performed. It will include cleaning the dampers and both the condenser and evaporator coils, changing the filters, tightening belts, inspecting and servicing the fans, and verifying refrigerant charge levels as well as damper and economiser functionality.

4 www.infostore.saiglobal.com/store/

5 *For the full report see http://ee.ret.gov.au/energy-efficiency/appliances-and-equipment/heating-ventilation-and-air-conditioning-hvac/hvac-high-efficiency-systems-strategy-measures*

6 Image supplied by Steril-Aire www.steril-aire.com.au

HVAC HESS

The Heating, Ventilation and Air-Conditioning High Efficiency Systems Strategy (HVAC HESS) is a ten year strategy under the National Strategy on Energy Efficiency (NSEE) that aims to drive long term improvements in energy efficiency of HVAC systems Australia wide. Under the Energy Efficiency Working Group (E2WG), the Buildings Committee manages the implementation of the HVAC Strategy. This committee is comprised of representatives from Australian, State and Territory Governments.

The Strategy takes a whole of life perspective in targeting HVAC efficiency improvement, encompassing the design, manufacture, installation, operation and maintenance stages of the HVAC lifecycle. The Strategy consists of a number of complementary measures that fall under the three broad initiatives - People, Practices and Systems. This Coil Cleaning Factsheet specifically relates to Practices. It is one of a suite of factsheets developed to provide a quick overview and reference to inform, educate, and encourage energy efficiency in the HVAC industry.

A series of HVAC HESS factsheets can be found at: http://ee.ret.gov.au/

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