An Improved Process for Cleaning Cooling Coils

by Larry Maurer
President, Thermal Concepts, Inc.

by Stephen C. Turner
Senior Scientist, Chelsea Group, Ltd.

Dirty cooling coils reduce system capacity, with obvious effects on occupancy comfort. They also have several implications for indoor air quality. Impacted dirt can provide a suitable environment for microbial growth. This can result in distribution of microbial contamination throughout the building. In addition to such direct effects, dirt build-up on coils may indicate high level of particulate matter and an inadequate level of filtration. Another effect often goes unrecognized: a coil with impacted dirt obstructs airflow, lowering total airflow rates, outdoor air intake rates, and ventilation effectiveness.

Accepted methods for cleaning cooling coils can lead to impacted dirt on the coils. While a recent cleaning may lead a facility manager into thinking coils are clean, the problem may be worse than before the cleaning. This article presents information on how coils become impacted with dirt, how coils are typically cleaned, and how coils can be cleaned better to avoid the problem of dirt becoming impacted.

Dirty Coils and How They are Cleaned

The familiar scenario is unfolding once again. The air handler for the air-conditioning system serving the work area always worked well — but now the space is hot. The system just can't handle the load. And yet, a check of the system shows no obvious problems. The chilled water supply temperature (or high-side refrigerant pressure and subcooling) is good. The filters are clean. Supply air temperature is very cool. A drop light is visible when viewed through the coil. The coil has just been pressure washed from both faces; it's clean. Or is it?

A coil requires proper cleaning when dirt builds up on the air side, preventing adequate heat exchange and, in many cases, *obstructing airflow*. Frequently, even after a coil has been pressure-cleaned and no dirt is visible at the coil faces, a thin coating of dirt on inner rows and fins impairs heat exchange. Even more commonly, airborne dirt has congealed with residual moisture and cleaning chemicals to plug the coil, *obstructing airflow*. And even if the coil has been properly cleaned, the blower wheel has been ignored. Even if

some heat exchange has been restored, conventional coil cleaning often fails to restore proper airflow rates and ventilation effectiveness.

Traditionally, coil cleaning has been performed with pressure washers and chemicals from each face of the coil. Increasingly, steam is being used in a similar manner as an alternative to water and chemicals. These procedures can drive dirt into the inner rows, especially on deep, staggered-row coils or on row-split direct expansion coils. (Remember the Westinghouse self-contained air-cooled vertical package units popular in urban markets in the sixties? Two separate back to back coils ensured the accumulation of a packed dirt between coils. Access was nonexistent.) Sometimes, coils are just never cleaned. Impacted dirt, especially on coils with deep, staggered rows or convoluted fins, is often caused by improper cleaning, and cripples system performance.

In some cases, coils are so impacted that the required cleaning punishes the fins to the point of deterioration. In such cases, the only remedy is expensive coil replacement. This makes the cost for recommissioning work less difficult to justify. Baseline and comparative measurements can be used to evaluate coil cleanliness periodically, indicating better cleaning procedures before it is too late to salvage the coils.

Coil Cleaning

Some cases merely require some extra care and expertise, others require one of a number of extraordinary, costly procedures. Currently, the cleaners proving most effective on removing severely impacted dirt are highly alkaline potassium hydroxide products such as Nu-Clear, distributed by Trane. These cleaners require careful management, and must be prepared in strict accordance with applicable regulations and instructions for use to minimize corrosive effects on coil materials and potentially hazardous reactive gases.

The simplest systems to remedy have dirty coils with easily accessible and removable sheet metal safework on the top of the coil. Removal of this safework permits cleaning of the impacted dirt in the center of the coil. Typically, when cleaning is first attempted, there is no penetration into the coil. If a foaming cleaner is applied, it foams right back up out of the top of the coil. After many applications, the cleaner penetrates further, foaming out lower and lower down the coil faces, finally fully cleaning the coil. The key is to perform the cleaning from the center of the coil in order to overcome the tendency of system airflow and traditional cleanings to pack the dirt into the center of the coil, behind staggered tube rows.

The building owner or manager must be prepared to pay for this level of service. A recent job involved a coil with 25 square foot surface area. The coil was so impacted that it required 30 gallons of cleaner and 60 hours of labor to disassemble, clean, and reassemble.

An Improved Cleaning Process

Sometimes, access or construction does not permit cleaning from the top, or dirt is so impacted that greater efforts are required. Thermal Concepts, Inc. has developed a process using a small, high pressure, positive displacement blower to draw the cleaner into the center of the coil. The blower is made up to a sheet metal boot, usually about 18" by 18", which is temporarily hung on the downstream coil face. The upstream face of the coil is sealed off temporarily with plastic, except for the 18" by 18" area currently being cleaned.

The discharge of the blower is connected to an 8" round flexible aluminum duct. This is directed in a manner which permits further dilution and safe drainage of dirt and cleaner. After the initial application, it can even be run back around to the upstream coil face to permit recirculation of the cleaner through the coil. The key to this process is using the high suction pressure of the temporary blower to draw the cleaner into the dirt caked in the center of the coil. Especially on 8 row staggered coils with over 10 fins per inch, traditional cleaning methods rarely penetrate the coil properly. Note that the system blower can, in some cases, be used to provide this suction, but only if proper provisions can be made for capturing and disposing of the cleaner and dirt downstream of the coil without harming the system components.

Off-Site Cleaning

There are cases which require even more drastic methods but stop short of requiring coil replacement. Thermal Concepts, Inc., encountered such a case at a facility where paper particles and glue had congealed on the inner rows. This case required disassembly of the coils, which were then cleaned in custom built recirculating tanks off-site. This method had the further advantage of reducing the potential for exposure of occupants to cleaning chemicals.

In Conclusion

Often, facility managers and others insist that dirty coils are not the problem. "I can see my drop light" is not an adequate diagnosis. Traditional cleaning methods, when improperly or infrequently performed, are not sufficient to insure peak system performance. The proper diagnosis, and the proper resolution, must be developed on a building by building, system by system basis. Dirty coils are expensive to clean, but much more expensive to keep. Left uncleaned, they drive up energy costs, reduce occupancy comfort, provide sites for possible microbial growth, and, in the worst cases, lead to early coil replacement.

***IN*VIRONMENT®**
One Pierce Place
Suite 475E
Itasca, IL 60143-2618

Telephone: 630.775.9205
800.722.9093
Fax: 630.775.9231

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www.invironment.com