Division of Technical Resources | The National Institutes of Health | **Vol. 01, No. 65**
Office of Research Facilities | August 2015

News to Use

Design Requirements Manual

The formulae for building state of the art biomedical research facilities.

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'.
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Cooling Coil and Drain Pan Requirements for Air Handling Units

For NIH Facilities, cooling shall be provided by the use of chilled water/hydronic systems. Since chilled water is normally produced and delivered more efficiently, the use of air-cooled, self-contained refrigeration systems for building cooling coils in air handling units shall be avoided per the NIH Design Requirements Manual (DRM), unless chilled water is not available. The major focuses of this article are to highlight proper handling of condensate drain from chilled water cooling coil, improve coil performance, reduce moisture carryover, minimize potential of mold growth, reduce potential for corrosion, premature replacement of downstream components and facilitate coil maintenance and replacement.

Cooling coils on air handlers serving laboratories and animal facilities are designed to remove significant amount of latent heat loads from the outside air, which is 100% of total air, brought into the units. As a result, significant amount of moisture accumulates on the coil surface. This may lead to numerous failures unless addressed properly. Maintaining the proper air face velocity through the coil and ensuring proper drainage are essential to prevent moisture carryover. The cooling coil's air face velocity shall be sized for a nominal air face velocity not to exceed 2.0 m/s (400 fpm) for the present design conditions and 2.5 m/s (480 fpm) for the future growth capacity.

On high volume air handling units, the size of cooling coil may exceed the maximum individual coil size of 3.0 m (10 ft.) long by 0.91 m (3 ft.) high, and require that, multiple coils would need to be provided. Since the maximum single coil height is 0.91 m (3 ft.), the additional coils must be provided with a dedicated condensate drain pan and chilled water piping connections. Multiple coils shall be valved separately so that, if any individual coil fails or requires service, it can be isolated and drained as needed while the remaining coil(s) remain in operation. Coils shall be installed to allow the removal of individual coils without disturbing pipe headers or anything else that would prevent the remaining coils from operating. Coils shall be removable without major rigging. The return header for multiple-stacked coils shall be piped in a reverse return configuration to assist with the balancing of the water flow. Strainers shall be provided on the feed line for each coil bank. Control and balancing valves shall be installed on the return line. Each coil shall be provided with a balancing valve with integral memory stop. Combination balancing/shutoff, devices are not acceptable per the DRM.

On multiple or stacked coils, each coil or coil bank shall be provided with its own drain pan, wherein the upper coils shall be provided with a drain pan, also known as "intermediate drain pan". The drain pans shall be designed with the following criteria:

- Drain pans shall extend a minimum of 12-in downstream of the cooling coils. (ASHRAE 62t recommends one half of the installed vertical dimension of the coil or assembly.)
- The drain pan shall be stainless steel with a positive slope to a bottom drain connection. (ASHRAE 62t recommends that the slope shall be of at least 10 mm per meter (1/8 in. per foot) from the horizontal toward the drain outlet or shall be otherwise designed to ensure that water drains freely from the pan whether the fan is on or off.)
- The bottom pan drain shall extend a minimum of 18 inch downstream of cooling coils and shall be properly trapped and static pressure conditions that accounts for dirty filter(s) shall be used to calculate the trap height.

Other recommendations to maintain the optimum performance of the cooling coil while properly handling the condensate drainage are as follows:

- Ensure that the designed airflow quantity of outside air is adequately maintained to prevent excessive airflow and associated moisture brought onto the coil.
- When sizing the coil, consider the potential increase of internal latent load during the cooling coil design phase.
- Provide a plenum section downstream of the coil with sufficient distance to capture all the moisture before it reaches the next AHU compartment.
- The cooling coil shall be designed for maximum of 8 rows deep and 10 fins per inch to allow easy cleaning of coils. Deeper coils and denser fins clog hinder easy cleaning of coils.
- Cooling coil sections shall have access doors to permit inspections and maintenance.
- Cooling coils shall be arranged in a draw through configuration within the air handler to minimize moisture carryover.
- Condensate drain traps and associated piping need to be kept clean and free of obstructions.
- Moisture eliminators may be considered where carryover presents a problem. However, eliminators shall not impede service access for cleaning of the coil surface.
- Condensate drain traps must have proper tap depth, based upon maximum static pressure at design airflow with fully loaded air filters. Associated piping should be properly sized and kept clean and free of obstructions.
- Routine replacement of air filters as needed.

In summary, moisture condensation is the result of the cooling and dehumidification processes within the coil. Having a well-designed and properly maintained cooling coil can prevent the negative effects of airborne moisture or condensate blow off on to the downstream components. Ill effects from mold within the HVAC system and costs associated with its remediation can be significant. Having well-designed and maintained air handling units, including associated condensate management can minimize the potential for moisture carry-over and associated damage and costs.

Further details on this month's topic are available on the DRM website:
Design Requirements Manual
DRM Chapter 6 Section 2 Air Handling Systems