The modern data center presents unique challenges to the service technician. The data centers, with all of the electrical equipment (servers, uninterruptible power supplies and storage units), produce heat. A typical data center can have hundreds of racks in the room, and each rack can have up to 42 servers. A typical data center also has a cooling density (heat load) of 50 W to 150 W per sq ft. A small data center sized for 5,000 sq ft is equal to 66 tons of cooling at the low end and 198 tons of cooling at the high end.

Server rooms operate 24 hours a day, seven days a week, 365 days a year. The design of the cooling equipment for a data center is to operate under these conditions. If the computer room air-conditioner, or CRAC units, were an automobile running at 50 mph, the equivalent mileage for the CRAC unit would be 438,000 at the end of one year. These units do need regular maintenance if they are to operate trouble free. Most CRAC manufacturers recommend at least a monthly inspection of the units with a more thorough maintenance completed on a quarterly basis.

**Heat removal**

The CRAC units are designed differently than comfort air-conditioning systems. The biggest difference is the sensible heat ratio. For comfort air-conditioning, the heat ratio is 60%–70%—that is, the coil/air flow is designed to remove 30%–40% latent heat load (moisture) and 60%–70% sensible heat load. The CRAC unit is designed for 85%–95% sensible heat load and 5%–15% latent load. These units will remove the high sensible heat load produced by the electronic equipment in a data center.

The CRAC units also have the ability to control the humidity levels to the space. The units can add humidity with a humidifier that is built into the unit.
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The system also can dehumidify the room with the cooling coil activated to remove the excessive moisture in the space. The units will clean the air continuously through the high-efficiency air filters and the system design of the blower operating all of the time. The air filters will remove any dust or contaminates that circulate in the air of the controlled space.

CRAC units have several options to remove the heat from a data room. A direct-expansion unit, with air-cooled, water-cooled or glycol-cooled condensing, is one option. Larger floor and ceiling units typically have one to four stages of cooling. Smaller units (less than 5 tons) are generally single-stage units.

Another option uses chilled water to remove heat. The units have a chilled-water coil used to remove the heat from the space. Smaller ceiling CRAC units will generally have a zone valve to control the water flow through the coil via the microprocessor. Most floor-mounted CRAC units will have modulating chilled-water valves. This allows the controller to regulate the chilled water through the coil to match the heat load of the space.

A third type is a hybrid unit that features both chilled-water and direct-expansion coils in the same cabinet. The idea is that the system can use chilled water from the building during the day when the building is occupied. Then, when the chiller shuts down for nights, weekends and holidays, the system automatically switches over to the DX mode of operation.

Glycol-cooled systems use a fluid cooler for the heat rejection for the compressor. Technicians need to be aware that there are several benefits and limitations to using a fluid cooler. The benefits include flexible location choices of the fluid cooler vs. the CRAC unit with an air-cooled condenser. An air-cooled condenser presents limitations on how far below the evaporator it can be located. The limit for most manufacturers’ air-cooled condensers is 10 ft–20 ft below the evaporator section. With a fluid cooler, there are no limitations on how far below the evaporator the fluid cooler can be located, other than general fluid-piping rules.

Another benefit to using a fluid cooler is that in areas with cold ambient, the cold glycol fluid can be used in an
A CRA control module automates the day-to-day processes of the data center.

**Air treatment**

In addition to the means of heat removal, there are other components for treating the air in the space, including humidification to add moisture to the space if the room gets too dry. There are several styles of humidifiers available from different manufacturers. Some of the more common are the electrode steam generators, infrared humidifiers, ultrasonic humidifiers and immersion humidifiers. Be sure to check the type of humidifier unit being serviced and refer to the manufacturer’s installation, operation and maintenance information. All humidifiers are designed to have the same results—they add moisture to the controlled space.

CRAC units also have the means to dehumidify if the relative humidity in the space is high. The humidity is removed by cycling the cooling via the DX or chilled-water coil. The temperature difference between the air over the coil and the cooler coil temperature will wring out the moisture from the air.

The CRA control module automates the day-to-day processes of the data center.

The CRAC unit is also equipped with “reheat” to help with dehumidification. The intent of the reheat feature is to cycle for a short amount of time to help stabilize the temperature in the space during dehumidification. During the dehumidification process, the room can become colder than desired. Remember, the primary design of the system is to remove sensible heat. If the heat load is not balanced with the cooling, this will result in a colder-than-desired space temperature. The design of the reheat is to temper the air leaving the coil to improve the dehumidification cycle.

Another function of the CRAC is to continuously clean the air in the space. Since the blower is operating 24/7, high-efficiency air filters are often used to clean the air. There are differing levels of efficiency for the air filters, which a MERV number indicates. In general the higher the MERV number, the higher the efficiency and the more
With both the chilled-water units with DX cooling and glycol unit with economizer coils, there is an option for compressor supplement to the chilled water of glycol.

restrictive the air filter is. It is very important to replace the air filter with the same MERV-rated air filter that came with the units. Most units are designed to a specification for pressure drape and cfm output. These specifications spell out the MERV rating for the air filter and the external static pressure for the CRAC unit. The blower drive set is based on this furnished information plus the internal static of the CRAC unit. If the filter rating is increased or decreased, the end user may not get the required performance.

Editor’s Note: Be sure to check out the January 2013 issue of RSES Journal for the second part of this three-part feature series.

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