What Type of Cooling System is best for my Application?

The refrigeration system removes heat from the product and the air which lowers the temperature in the chamber. The heat is moved through the refrigeration system and rejected at the condenser. There are two choices when it comes to condensers, air-cooled or water-cooled. Each one has its positives and negatives.

Integral Air-Cooled Chambers

Many small chambers come standard as air-cooled. The only utility connection required for temperature cycling chambers without humidity is power. This is very convenient for moving a chamber from one area to another. However, there are some items need to be considered with air-cooled units.

First of all is the heat that is introduced into the room where the chamber is located. This is due to the fact that most chambers are located in air conditioned areas and can have a bearing on the faculties' ability to absorb this additional load. For example, a chamber that has a 2 HP cascade system can reject 24,000 Btu/Hr or more into the room under full load. When the chamber is at set-point, it can reject between 12,000 to 15,000 Btu/Hr into the room. The smaller the room where the chamber is located, the more critical it is that the air conditioning system can handle the additional heat load. A general "rule of thumb" for heat of rejection is: 1 Horsepower of refrigeration system is equal to 12,000 Btu/Hr. If a chamber is going to be installed in an area that is not air conditioned tell the chamber manufacturer.

The chamber's performance will be reduced if the ambient environment where the chamber will be located exceeds 30°C. In some cases, the chamber will not operate. Condensers must be oversized to operate in high ambient room conditions.

Second item to consider for an air-cooled system is dirt. Large volumes of air are passed through the condenser constantly. Most condensers are located near the floor which allows them to pick up dirt easily. The condenser must be clean for the system to perform and work efficiently. This requires someone to clean the condenser at regular intervals. If the chamber is located in a dirty environment the condenser can become clogged very quickly. Restricted air flow will cause the refrigeration system to run at high pressure which will cause the high pressure safety to trip. If the environment described above is the destination for a test chamber, a remote air-cooled condenser (see below) or water-cooled should be considered.

Remote Air-Cooled Chambers

Another type of air-cooled condenser is remote air-cooled. The air-cooled condenser is removed from the chamber and is placed in another location, normally outdoors. On the surface this sounds like the best option since the heat and noise is moved outdoors. However, this type of system is more complicated and expensive to install. This is due to several items: refrigeration piping must be sized and installed properly for the application,

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penetrations through the building roof or wall must be done by qualified personnel, a concrete pad or proper mounting (on roof) for the remote air-cooled condenser must be installed, and the roof must be able to support the weight of the remote air cooled condenser. This type of installation will normally require bids from the following contractors: Refrigeration, Electrician and Roofer. As you can see this type of installation can become very involved.

Water-Cooled Chambers

Larger chambers with refrigeration systems 6 horsepower or over are typically water cooled chambers. If your facility has process water that is pumped throughout the building and is routed to a cooling tower / dry cooler, a water-cooled chamber may be installed. A watercooled unit is easy to install and maintain. Be sure to ask your chamber supplier for the water flow and pressure requirements for the unit. The capacity of the process water system should be verified before purchasing the chamber. Most problems with water-cooled systems are due to inadequate water flow and/or differential water pressure supplied to the chamber.

If water cooled, provide and connect water supply and return lines to the inlet and outlet for the condenser. The line size should be equal to or larger than the inlet fitting provided on the chamber.

Note: Water cooled systems require a minimum of 40 PSI differential pressure (supply pressure minus return pressure) on the water system. Where water discharges to an open drain or non-pressurized return, supply must be 40 PSIG minimum. On systems using a closed loop cooling water system with a pressurized return, supply pressure must be at least 40 PSI greater than return pressure. Maximum water pressure should not exceed 80 PSI.