Indoor / Outdoor Air-Cooled Systems

Indoor Air-Cooled Systems

Advantages

1. Shorter line runs.
2. Systems located off roof or dock space.
3. Weather covers are not required (saves cost).
4. Systems are more secure and easier to service.

Disadvantages

1. Very difficult to remove heat rejection from condenser air.
2. To adequately ventilate, the space requires 1,000 CFM per horsepower "exhaust".
3. If the area is air-conditioned space, the condenser discharge dramatically increases the tonnage of air conditioning required.

What to look for in outdoor systems:

1. When there is more than one refrigeration, air-conditioning, or ventilation system in an area, make sure the discharge air from one system does not feed another's intake.
2. Do not locate compressors more than one story above the evaporators. If this distance exceeds 20 feet, special care in the design of the suction lines should be exercised. The return of oil is the main concern.

Indoor Water-Cooled Systems

Water-Cooled Systems and Condenser Water Temperature

1. The designed temperature for water-cooled condensers is 85º Fahrenheit. This is the average water temperature from a closed loop water tower.

2. *Will it operate at lower water temperatures?* When a system operates on chilled water in lieu of condenser water, the temperatures are dramatically reduced. The water regulating valves on the condensers will function at 45ºF to 55ºF water. There are certain requirements under these circumstances, i.e.:

(A) The water-regulating valve needs to be on the outlet of the condenser. This prevents cavitations caused by limited water flow.

(B) The water lines to and from the condenser need to be insulated with ½" Armaflex.

3. *Which is more efficient: air or water-cooled?* Water-cooled are by far more efficient. The condensing temperature can be calculated at 90ºF instead of 105ºF on air-cooled. By using water-cooled, you can gain up to 10% additional capacity.

What are advantages and disadvantages in putting more than one fixture on one compressor?

Advantages

1. The obvious advantage is that it saves the cost of one compressor. The cost of a ½ hp compressor for one system versus the cost of a 1 hp compressor for two systems gives you a significant cost savings.

Disadvantages

1. Operation: If you are running a matched load (i.e. 3,000 BTU compressor with a 3,000 BTU evaporator), you have a consistent coil temperature. When you run a 6,000 BTU compressor with two 3,000 BTU evaporators, you are also matched until one evaporator is satisfied and cycles off. The coil temperature drops dramatically on the one still online. This can cause freeze ups of the evaporator even if a thermostat controls the fixture temperature. You can manage this, however, with an Evaporator Pressure Regulator (EPR). It is preferred that one EPR is used on each evaporator.

What criteria should be used in selecting electrical characteristics when given a choice?

208-230 volt, 3 phase is the desired voltage. 460 volt, 3 phase can be used from 1 hp and up, but step transformers must be used for control and freezer evaporator fan motors. The 460 volt breakers are more costly and replacement compressors are not as accessible at wholesalers. 208-230 volt, single phase is another option, however it is only recommended when other options will not work.

Compressors: Semi-Hermetic – Hermetic – Scroll, Which is right for me?

The semi-hermetic (cast iron) compressor has been the work horse of the industry. The hermetic (pot) is a means of reducing costs. It is built cheaper, lighter, and has a shorter life expectancy. The scroll compressor is heralded as the compressor of the future, and will most likely live up to that expectation. It is more efficient, has fewer working parts, and the failure rate is the lowest of all its counterparts.

Fan Motors

- Ball Bearing- Never needs oil or service, and will most likely last the life of the unit
- Sleeve Bearing- Depends upon an oil wick that needs oiling at least every 12 months. Probably two or more replacements will be required during the life of the unit if proper maintenance is not performed.

Defrost: Electric – Air – Off-Cycle, Which is right for me?

- Electric defrost is mandatory when the temperatures approach 33ºF or below.
- Air defrost requires a time clock that shuts down the refrigeration at night for an hour or so to prevent the evaporator from accumulating ice.
- Off-cycle requires no clock, but is limited in control. The principal is to defrost the coil completely during every off cycle. This works the majority of the time. You are limited as to the minimum cut-in temperature, as this cut-in must be above the frost melting point. This may result in the fixture getting above 40ºF before it cycles on and pulls back down. This type of defrost is the most common on medium temperature applications.

Fused Disconnects

All of RDT's systems come standard with an individual breaker per compressor. When the city requires an external disconnect, the majority of the time, the electrician has already included it in his bid. It is very common that two disconnects are paid for when RDT's option of fused disconnect is exercised. That is the sole reason that the fused disconnect is now classified as an option on RDT systems.

"Roof curbs" and "Pitch Pans"

We leave this design to the architect and roofing contractor. All of RDT's units are self-supporting and will mount to most any type of pad, sleeper, or rail.

Drain Lines and Drain Line Heaters

The rule of thumb for all freezer drain lines is to exit the freezer space as soon as possible. We recommend a 240 volt self regulating heat tape properly secured and insulated. The power supply can be taken from N and 4 on the evaporator which makes it hot all the time, except during the defrost cycle. The majority of the time, a 7/8" OD drain is adequate as long as you have plenty of slope.

Refrigerant Lines and insulation

ACR hard copper, nitrogen charged, cleaned and capped, with long radius-welded fittings is the best. The sizing should correspond to the BTU's and the refrigerant. When a riser is installed, there needs to be a "Pee" trap at the lowest point and a reduction in size of the suction riser to assist the oil return. When the highest elevation is established, a slope of ½" per every 10' back towards the compressor is mandatory on all suction lines. This takes the oil back to the compressors. Hanger supports are required every 6 feet. ¾" wall insulation on medium temperature and 1" wall insulation on low temperature is usually adequate, assuming superheat is set and no unusually high dew points exist.

Pressure Control Settings

All systems are on "pump down" cycle. This means when the temperature is reached or defrost is initiated, a liquid line solenoid closes pumping the refrigerant into the receiver. When this pump down is achieved, the low pressure switch shuts the compressor off slightly above 0 PSI. To achieve this, the low pressure switch is set at approximately 20 lbs. cut in with 20 lbs. differential. The high pressure cut out is set at 400 lbs. These same settings work on both R-404a and R-22.

Expansion Valve Settings

Much has been written and discussed about expansion valve superheat. It is important, it is controllable, and it must be attended to. Common sense must prevail on these settings. After manufacturer recommended settings are achieved, stay with the system long enough to make sure the compressor is getting enough saturated vapor back on the suction to keep the compressor cool. Do not allow the compressor end bell to frost up. The frost line should not go past the suction valve of the compressor. This applies primarily to "low" temperature applications. It has been RDT's experience that the "factory" setting is usually very close. It is recommended that if all the above "signs" are achieved, that these settings are left as set. In all cases, make sure the remote bulb is tightly secured to the suction line where no obstructions exist.

Head Pressure Control

Headmasters are only recommended where extremely cold climates exist or where multi-circuited condensers are used. Fan-cycling switches are used in moderate climates. Settings are approximately 275 cut-in with 50 lbs. differential. Some units come with encapsulated controls that are non-adjustable

Wiring

Electric Defrost: Interconnecting wiring compressor to coil.
RDT's standard electric defrost coil requires 7 wires from the compressor, allowing a time initiated, temperature terminated defrost cycle. The evaporator fans will delay after defrost and the compressor will pump down before the heaters are energized. The liquid line solenoid is wired to N and 4 with one leg being broken by the thermostat. The compressor pumps down either by timed defrost or by satisfied temperature. When more than one evaporator is used with electric defrost, one coil must be designated the number one coil. The number 2 coil is wired partly in series with number 1 and party parallel. (Please see diagram). The medium temperature off-cycle or air defrost require no interconnecting wires from the compressor. The compressor responds to the liquid line solenoid fed by the house current to the evaporator fans controlled by a thermostat.

Protection from the Elements

What are my options to protect aluminum finned condensers from corrosion?

One might think that switching to copper fins would be best. However, this is not necessarily the case. Copper is much more expensive, weighs more, and most importantly, corrodes itself. We have used AME Techni-Coat 10-1 for several years with great success. If you specify a marine coating, this type of coating is applied. (Please see cut sheet in Catalog)

Multi-circuited condensers vs. a single condenser and fan per compressor:

1. You can accommodate many more compressors in a smaller footprint with multi-circuited compressors.
2. You must use headmasters exclusively as condenser fan cycling is severely limited.
3. Getting the compressor into the air flow for compressor body cooling is difficult.
4. If you have condenser fan problems, all systems are affected.

In conclusion, if space considerations are the driving factor, a multi-circuited rack is the best choice. For simplicity and serviceability, however, the autonomous condenser compressor rack system is the best choice.

Parallels

The term parallel means that multiple compressors running in parallel on a single system.

Advantages

1. More efficient , i.e. you could conceivably have one compressor running and taking care of multiple fixtures. As long as this compressor holds the suction pressure (which relates to temperature), it stays on line by itself.
2. It does not matter how small the case load is; a parallel takes care of it with very minimal reaction.
3. You can utilize hot gas defrost, if desired. You always have a bank of hot gas to defrost one circuit while others are refrigerating.
4. The compressor controller has communications capabilities. These can be very simpler or very complex. Please see enclosed cut sheet "CPC"
5. System can be designed as “split suction” with low temperature dedicated compressors combined with medium temperature dedicated compressors.

Disadvantages

1. Requires more sophisticated service technician.
2. Single refrigerant bank makes all branches at risk to a single leak.

Note: The parallel rack can be air-cooled, water-cooled, or evaporator condenser. These condensers can be built in on remote.