AIR Tech Notes
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SUBJECT: EVAPORATOR DEFROST

Industrial refrigeration evaporator designs vary widely depending upon the application and the engineering design.

When the evaporator's suction temperature falls below the freezing point of the medium to be cooled the evaporator will need to be defrosted. A defrost will clear the heat exchange surface of frost and ice which impairs the heat transfer. A defrost should also purge the refrigerant oil from the evaporator if it is piped correctly. Defrost cycles can be initiated based on time, demand or manual selection, and may be controlled by a defrost time clock, PLC or an evaporator control to name a few. There are several methods of defrosts including hot gas, water, electric element and air. Evaporators in a low temperature environment will include a heated pan to ensure that the condensate water will not freeze to the drain pan as the evaporator is defrosting.

To defrost an evaporator it will be necessary to evacuate (pump down) the evaporator followed by raising the evaporators suction pressure and/or warming up the evaporators coil surface temperature. The pressure may be raised by flowing hot gas through the evaporator or adding an additional heat source such as electric element heat or water. Air defrost is accomplished by ambient air flowing through the evaporator with the refrigerant control off.

The defrost control and operation will vary depending upon the design and installation of the evaporator control valve group. Items generally controlled during a defrost are:

1. Evaporator Fans
2. Liquid Feed Valve
3. Suction Valve
4. Soft Gas Valve
5. Hot Gas Valve
6. Bleed Valve

A typical low temperature evaporator with hot gas will operate as follows. Estimated times are shown but should be field verified and adjusted for a complete and safe defrost.

A. Pump down (10-30 min.)- liquid valve closed, fans on, suction valve open, soft gas closed, hot gas closed, bleed closed.
B. Soft gas (5-10 min.)- liquid valve closed, fans off, suction valve closed, soft gas open, hot gas closed, bleed closed.
C. Hot gas (10-20 min.)- liquid valve closed, fans off, suction valve closed, soft gas closed, hot gas open, bleed closed.
D. Bleed (5-10 min.)- liquid valve closed, fans off, suction valve closed, soft gas closed, hot gas closed, bleed open.

E. Fan delay (3-5 min.)- liquid valve open, fans off, suction valve open, soft gas closed, hot gas closed, bleed open,

- It is important that the evaporator is completely evacuated (pumpdown) before the hot gas is introduced into the evaporator or a hydraulic shock condition may occur when the hot gas and cold liquid meet.
- Optional soft hot gas helps to minimize hydraulic shock and thermal shock by pressurizing the evaporator slowly.
- It is best if the hot gas is free of condensate. This may require a liquid drainer on the hot gas header to remove this condensate and return it to the refrigeration system.
- A pressure regulator is typically installed to maintain a constant pressure in the evaporator coil during hot gas and remove any excessive pressure. Typically this regulator will be set at approximately 70 psi.
- Fans are to be off during defrost to minimize the condensation of the hot gas in the evaporator coil.
- The bleed time is complete when the evaporator pressure has lowered sufficiently to safely open the suction valve.
- Fan delay allows the remaining condensate water on the exterior of the coil to freeze before the fans restart and blow this condensate into the room.
- Defrost operation should be checked periodically to make sure the pressure regulator and solenoid valves operate properly and the times of each step are correct and adequate.
- Defrost operation may change with the seasons due to a change in the hot gas header pressure, and may require adjustments to times.
- Defrost schedule may need to be adjusted with the seasons, more in the summer and less in the winter.
- It is possible to over defrost and affect system efficiencies, room temperatures and cause excessive frost near the evaporator. Defrost using the minimum evaporator pressure and hot gas duration as necessary to completely defrost the evaporator.