ENGINEERING POLICY

Tecumseh Compressor Company
Compressor Group

Engineering Policy on: Heat Pumps Reverse Cycle

EP-4
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The scope of this policy deals with Reverse Cycle Heat Pump systems capable of operation in either the heating or cooling mode on thermostat demand. The specific types are listed.

1.0 Non-Defrost with REVERSE CYCLE capabilities:

1.01 Package-Water to Air (air coil in conditioned space)

1.02 Remote-Water to Air (air coil in conditioned space)

2.0 Natural Defrost on heating mode with REVERSE CYCLE capabilities. Natural defrost utilizes outdoor air above freezing to remove ice buildup while the compressor is off. Separate means of heat is provided below the point where natural defrost is effective.

3.0 Reverse Cycle Defrost with some means of shutting the compressor off below its DESIGN MINIMUM EVAPORATOR TEMPERATURE.

4.0 Solar Assist on heating mode with REVERSE CYCLE capabilities.

A system such as A, B or C but with a SOLAR HEAT SOURCE assisting the heating mode.

Heat-pump system RELIABILITY MUST be designed into a product and, therefore, the objective of this policy is to specify the items considered essential to a reliable design.

1.1 Liquid in the Compressor on Start-Up

Please refer to the requirements stated in Policy Bulletin No. PB-107 (EP-1) on the subject of OFF-CYCLE HEAT.

1.2 Liquid Return to the Compressor During operation

Heat pumps by design operate over a very wide ambient range resulting in an excess of refrigerant charge at certain ambient that must be stored to prevent UNCONTROLLED LIQUID FLOODBACK to the compressor. Excess refrigerant on an expansion valve system will be stored in the high side and on a capillary or bleed port expansion valve system in the high and low side.

A SUCTION LINE ACCUMULATOR (selection based on ER-12) located between the reversing valve and the compressor is MANDATORY on heat pump systems with REVERSE CYCLE DEFROST, as well as all REMOTE HEAT PUMPS.

Heat Pump designs other than these MUST be tested under the guidelines of EP-2 to determine the need for an accumulator.

Reverse Cycle Defrost systems will require on the heating mode the return of a CONTROLLED amount of LIQUID REFRIGERANT to the compressor for cooling purposes. Systems using expansion valves on the heating mode will require a bleed port sized to allow flood back to the accumulator BELOW an EVAPORATOR TEMPERATURE of approximately 25°F (-3.9ºC).

The discussion in EP-2 regarding a system design to achieve the LOWEST PRACTICAL REFRIGERANT CHARGE continues to be of major importance for all heat pumps.

1.3 Oil Return

Care must be taken to insure against the possibility of the OIL NOT RETURNING to the compressor. The system must therefore be designed to maintain a MINIMUM velocity of 750 FEET PER MINUTE (3.81 m/sec) when operating at the LOWEST DESIGN OUTDOOR AMBIENT. Further, care must be exercised to ELIMINATE COLLECTION OF OIL in the bottom of long runs of horizontal interconnect lines between the units or in any other similar traps. Refer to ER-1 for line sizes.

1.4 System Components

Particular care should be taken in the selection of system components as regards their QUALITY and RELIABILITY. Malfunction of the reversing valve, defrost mechanism, refrigerant control device, or fan motors WILL CAUSE COMPRESSOR ABUSE and POTENTIAL FAILURE.

1.5 Design Guidelines:

Evaporator Temperature (ET)
Superheat at Compressor Inlet
Discharge Line Temperature (D2)

The compressor internal operating temperatures are highly dependent upon refrigerant gas cooling, which is influenced by the combination of flow rate and return gas temperature.

The flow rate is determined by the operating pressures whereas the return gas temperature is influenced by: the type of expansion device and its setting, the system load, the amount of refrigerant charge and the suction line ambient along with the degree of insulation used on the suction line.

Therefore, the system DESIGN, APPLICATION AND INSTALLATION should be done while recognizing the need to maintain the operational limits discussed below:

A) Evaporator Temperature:

The evaporator temperature (ET) range is established on the compressor performance curves. The ET Low End Limit shown on the performance curves is based on 20°F (11.1°C) Superheat (SH) at the compressor inlet and a specific Condensing Temperature. The ET Low End Limit may be lowered with a reduction in SH however the minimum ET is shown in Table I.

B) Superheat at Compressor Inlet:

The return gas Superheat measured on the suction line 6" to 12" (152.4 to 304.8 mm) from the compressor should not exceed the listed ranges.

1. 0° to 20°F (0° to 11.1°C) on systems with accumulators that comply with ER-12. (Refrigerant flooding to accumulator allowed.)

2. 5° to 20°F (2.8° to 11.1°C) on systems without accumulators or with accumulators that do not comply with ER-12. (Refrigerant flooding not allowed as this would enter compressor and dilute the oil.)

This can be accomplished by, proper choice of refrigerant control device, proper adjustment of that control, proper location and installation of the controlling component (bulb) of that device and proper insulation of the suction line.

C) Discharge Line Temperatures:

Tecumseh has long recognized the external discharge line temperature measurement as being an effective way of sensing CRITICAL OPERATING TEMPERATURES within the compressor. This external discharge line measurement is called "D2" and values listed in Table I SHALL NOT be exceeded under ANY operating conditions.

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Table 1

Compressor Family	Minimum Evaporator Temperature Deg. F (Deg. C) *(M.E.T.)	Maximum Discharge D2 Insulated *** Deg. F (Deg. C)
AE	32 (0)	---
AK	32 (0)	---
AJ	32 (0)	---
RG	-15 (-26.1)	260 (126.7)
RK	-15 (-26.1)	260 (126.7)
AB	-15 (-26.1)	290 (143.3)
AW	-15 (-26.1)	290 (143.3)
AH	-15 (-26.1)	290 (143.3)
SA	-15 (-26.1)	260 (126.7)
AV	-15 (-26.1)	290 (143.3)
AG	-15 (-26.1)	290 (143.3)
SF	-15 (-26.1)	260 (126.7)
AN 2/Solid State	-15 (-26.1)	**
AN w/ILB O/L	-15 (-26.1)	290 (143.3)

* Steady State Run. Excursions below M.E.T. such as start-up dip are permitted.
** Limited by Motor-Compressor Protection System.
***See below.

- IMPORTANT NOTE -

Failure to maintain operation within the above guidelines will lead to premature oil failure resulting in valve coking or inadequate bearing lubrication.

***The method used to record this temperature is very important as to the exact location, application, and thermal protection of the thermocouple as shown in the following sketch.