

System 002 - Site 501534, Canby OR

Site 501534 is a grocery store located in Canby, OR. There are seven refrigeration circuits that have been monitored. Circuits 1 and 2 (medium temperature Rack 1) and Circuit 3 (low temperature Rack 2) were installed in the 1990s. Circuits 4 and 5 are new medium and low temperature racks, respectively, installed more recently. Circuits 6 and 7 are medium temperature circuits, each with one compressor. Circuits 1, 2 and 3 share a single Emerson E2 refrigeration system controller. Control system information was not available for Circuits 4 to 7.

Circuits 1 & 2, Medium Temperature, Split Suction Rack 1

Rack 1 consists of separate circuits, Circuits 1 and 2. This is a medium temperature multiplex system with R4047a, six compressors (578 MBH total capacity), and 597 MBH total design load located in Canby, OR. Compressors 1 to 3 on Circuit 1 are controlled by a suction pressure setpoint with a sensor located on one end of the suction manifold. Compressors 4 to 6 on Circuit 2 are controlled by a suction pressure setpoint measured at the opposite end of the suction manifold. All six compressors discharge into a common discharge manifold. The circuits share a heat recovery desuperheater, condenser and common liquid manifold. The desuperheater recovers heat from the hot discharge gas to heat hot water, which also decreases the gas temperature before entering the condenser, increasing refrigeration efficiency. The condenser has four or five banks of two fans per bank, which are staged on as needed by a proportional signal. The compressors cycle to maintain a suction pressure setpoint and evaporative midpoint temperature.

This system uses a Tyler “Enviroguard” refrigerant control system to balance the refrigerant and achieve subcooling. The Enviroguard system allows for liquid storage in a “contingency receiver” when very hot conditions occur. Overflow liquid refrigerant is metered through a heat exchange coil at the discharge manifold and returned back to the suction manifold, bypassing evaporator coils.

Table 1. Measured data on Circuit 2

Measured Data	Variable Name(s)	Point Number
Outdoor Temperature	TT_OUTDOOR	--
Discharge Temperatures after Compressors 4 to 6	MISC4 to MISC6	2
Common Discharge Temperature, Before Enviroguard coil	AI_X11	2
Common Discharge Temperature, After Enviroguard coil	TT_RCOMP_OUT	2
Compressor Suction Temperatures	MISC10, AI_x13, AI_X14	1
Compressor Power, Comp 4 to 6	EP_COMP	--
Low Pressure, Suction Manifold	PT_RLP	1
High Pressure, Discharge Manifold	PT_RHP	2
Temperature in Enviroguard charge balancing loop after capillary tube	AI_X12	--
Condenser Entering Temperature	TT_RCOND_IN	3
Condenser Fan Power	EP_AUX_SECW	--
Liquid Line Temperature entering expansion device	TT_REXP_IN	7

Table 2. Calculated values on Circuits 1 and 2

Calculated Values	Variable Name	Measured Temperatures Used in Calculations	Point Number/ Process
Isentropic Compressor Efficiency	COMP_EFF_ISEN	Discharge and suction manifold conditions	1 to 2
Condensing Temperature	RHP_TCOND_MID	Dewpoint and bubble point temperatures at PT_RHP	c
Evaporator Temperature	RLP_TEVAP_MID	Dewpoint and bubble point temperatures temperature at PT_RLP	e
Desuperheater Capacity	RCAP_DESUPERHEAT	TT_RCOMP_OUT, TT_RCOND_IN	--
Heating COP	RCOP_HEAT	TT_RCOND_IN, TT_REXP_IN, Discharge and suction manifold temperatures	3 to 6
Condenser Capacity	RCAP_HEAT_COND	TT_RCOND_IN, TT_REXP_IN	
Heating Capacity	RCAP_HEAT	TT_RCOND_IN, TT_REXP_IN	
Cooling COP	RCOP_COOL	TT_REXP_IN, Discharge and Suction Temperatures	8 to 1
Cooling Capacity	RCAP_COOL	TT_REXP_IN, Suction Temperatures	
Subcooling	RSUBCOOL	TT_REXP_IN, , Bubble point temperature at PT_RHP	5 to 7
Superheat	RSUPERHEAT	Suction temperatures, Dew point temperature at PT_RLP	9 to 1

Figure 1. Pressure-enthalpy diagram for basic refrigeration cycle, neglecting pressure losses.

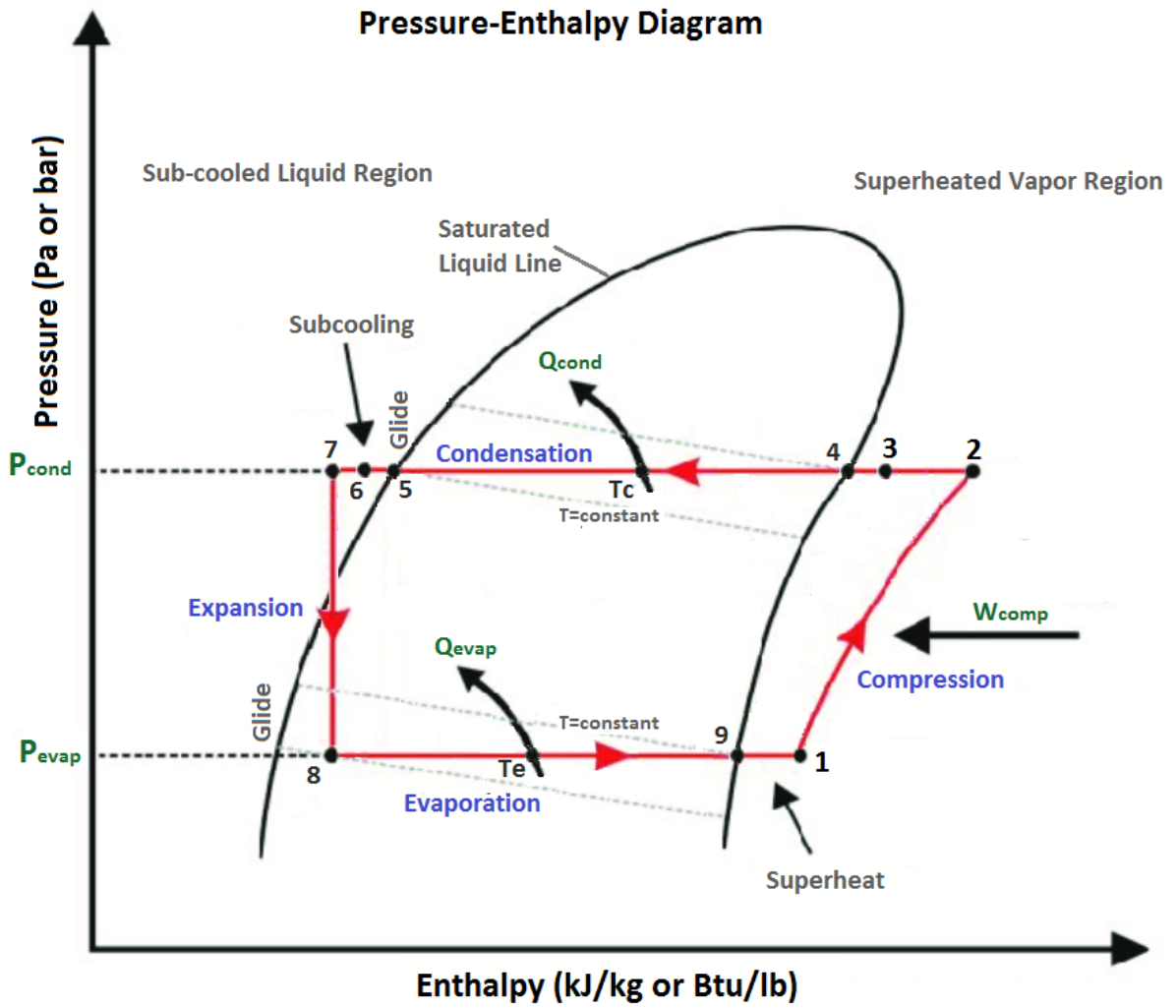


Figure 2. Circuits 1 and 2 ClimaCheck system diagram

1-13	BEVERAGE	20	1	1		2	Tyler DDCL	145 0	+20	OC	29,000
1-13	DELI	8		1		1	Hill OHMH	131 5	+22	OC	10,520
1-14	(NEW) SERVICE MEAT	12	1			1	SINGLE DECK	650	+15	OC	7,800
1-15	(NEW) MD MEAT	42	3	1		4	HP O5M- NRG	140 0	+26	OC	58,800
1-16	BEVERAGE	22		2	1	2	Tyler DDCL	145 0	+20	OC	31,900
							TOTAL SPLIT SUCTION LOAD=				597,20 0