AQUASNAP® 30RB060-390 Air-Cooled Liquid Chillers

Controls, Start-Up, Operation, Service and Troubleshooting

CONTENTS

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SAFETY CONSIDERATIONS

Installing, starting up, and servicing this equipment can be hazardous due to system pressures, electrical components, and equipment location (roof, elevated structures, etc.). Only trained, qualified installers and service mechanics should install, start up, and service this equipment. When working on this equipment, observe precautions in the literature, and on tags, stickers, and labels attached to the equipment, and any other safety precautions that apply. Follow all safety codes. Wear safety glasses and work gloves. Use care in handling, rigging, and setting this equipment, and in handling all electrical components..

⚠ WARNING

Electrical shock can cause personal injury and death. Shut off all power to this equipment during installation. There may be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.

⚠ WARNING

DO NOT VENT refrigerant relief valves within a building. Outlet from relief valves must be vented outdoors in accordance with the latest edition of ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigeration and Air Conditioning Engineers) 15 (Safety Code for Mechanical Refrigeration). The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation. Provide adequate ventilation in enclosed or low overhead areas. Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness or death. Misuse can be fatal. Vapor is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation. Decomposition products are hazardous.

→

⚠ WARNING

DO NOT USE TORCH to remove any component. System contains oil and refrigerant under pressure.

To remove a component, wear protective gloves and goggles and proceed as follows:

a. Shut off electrical power to unit.
b. Recover refrigerant to relieve all pressure from system using both high-pressure and low pressure ports.
c. Traces of vapor should be displaced with nitrogen and the work area should be well ventilated. Refrigerant in contact with an open flame produces toxic gases.
d. Cut component connection tubing with tubing cutter and remove component from unit. Use a pan to catch any oil that may come out of the lines and as a gage for how much oil to add to the system.
e. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Failure to follow these procedures may result in personal injury or death.

⚠ CAUTION

This unit uses a microprocessor-based electronic control system. Do not use jumpers or other tools to short out components, or to bypass or otherwise depart from recommended procedures. Any short-to-ground of the control board or accompanying wiring may destroy the electronic modules or electrical components.

⚠ CAUTION

To prevent potential damage to heat exchanger, always run fluid through heat exchanger when adding or removing refrigerant charge. Use appropriate brine solutions in cooler fluid loop to prevent the freezing of brazed plate heat exchanger, optional hydronic section and/or interconnecting piping when the equipment is exposed to temperatures below 32 F (0° C). Proof of flow switch and strainer are factory installed on all models. Do NOT remove power from this chiller during winter shutdown periods without taking precaution to remove all water from heat exchanger and optional hydronic system. Failure to properly protect the system from freezing may constitute abuse and may void warranty.

⚠ CAUTION

Compressors and optional hydronic system pumps require specific rotation. Test condenser fan(s) first to ensure proper phasing. Swap any two incoming power leads to correct condenser fan rotation before starting any other motors. Operating the unit without testing the condenser fan(s) for proper phasing could result in equipment damage.

⚠ CAUTION

Refrigerant charge must be removed slowly to prevent loss of compressor oil that could result in compressor failure.

⚠CAUTION

Puron® refrigerant (R-410A) systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on Puron refrigerant equipment. If service equipment is not rated for Puron refrigerant, equipment damage or personal injury may result.

→ **⚠CAUTION**

DO NOT re-use compressor oil or any oil that has been exposed to the atmosphere. Dispose of oil per local codes and regulations. DO NOT leave refrigerant system open to air any longer than the actual time required to service the equipment. Seal circuits being serviced and charge with dry nitrogen to prevent oil contamination when timely repairs cannot be completed. Failure to follow these procedures may result in damage to equipment.

GENERAL

This publication contains Controls, Operation, Start-Up, Service and Troubleshooting information for the 30RB060-390 air-cooled liquid chillers with electronic controls. The 30RB chillers are equipped with *Comfort*Link controls and electronic expansion valves.

NOTE: Unit sizes 315-390 are modular units that are shipped in separate sections as modules A or B as noted in position 8 of the unit model number. Installation directions specific to these units are noted in these instructions. For modules 315A, 315B, 330A, 330B, 345A, 345B, and 360B, follow all general instructions as noted for unit sizes 30RB160,170. For modules, 360A, 390A, and 390B follow instructions for 30RB190. See Table 1 for a listing of unit sizes and modular combinations.

NOTE: The nameplate for modular units contains only the first two digits in the model number. For example, 315A and 315B nameplates read 31A and 31B.

Table 1 — Modular Unit Combinations

UNIT SIZE	MODULE A	MODULE B
30RBA315	30RBA160	30RBA160
30RBA330	30RBA170	30RBA160
30RBA345	30RBA170	30RBA170
30RBA360	30RBA190	30RBA170
30RBA390	30RBA190	30RBA190

NOTE: An "A" in the model number indicates the design series.

Conventions Used in This Manual — The following conventions for discussing configuration points for the local display (scrolling marquee or Navigator™ accessory) will be used in this manual.

Point names will be written with the mode name first, then any sub-modes, then the point name, each separated by an arrow symbol (→). Names will also be shown in bold and italics. As an example, the Lead/Lag Circuit Select Point, which is located in the Configuration mode, Option sub-mode, would be written as ***Configuration →OPTN→LLCS***.

This path name will show the user how to navigate through the local display to reach the desired configuration. The user would scroll through the modes and sub-modes using the ▲ and ▼ keys. The arrow symbol in the path name represents pressing ENTER to move into the next level of the menu structure.

When a value is included as part of the path name, it will be shown at the end of the path name after an equals sign. If the value represents a configuration setting, an explanation will be shown in parenthesis after the value. As an example, ***Configuration→OPTN→LLCS* = 1** (Circuit A leads).

Pressing the ESCAPE and ENTER keys simultaneously will scroll an expanded text description of the point name or value across the display. The expanded description is shown in the local display tables but will not be shown with the path names in text.

The CCN (Carrier Comfort Network®) point names are also referenced in the local display tables for users configuring the unit with CCN software instead of the local display. The CCN tables are located in Appendix B of the manual.

Basic Control Usage

SCROLLING MARQUEE DISPLAY — The scrolling marquee display is the standard interface display to the *Comfort*Link Control System for 30RB units. The display has up and down arrow keys, an ENTER key, and an ESCAPE key. These keys are used to navigate through the different levels of the display structure. Press the ESCAPE key until the highest operating level is displayed to move through the top 11 mode levels indicated by LEDs (light-emitting diodes) on the left side of the display. See Fig. 1.

Once within a mode or sub-mode, pressing the ENTER and ESCAPE keys simultaneously will put the scrolling marquee display into expanded text mode where the full meaning of all sub-modes, items and their values can be displayed for the current selection. Press the ENTER and ESCAPE keys to return the scrolling marquee display to its default menu of rotating display items (those items in ***Run Status→VIEW***). In addition, the password will be disabled, requiring that it be entered again before changes can be made to password protected items. Press the ESCAPE key to exit out of the expanded text mode.

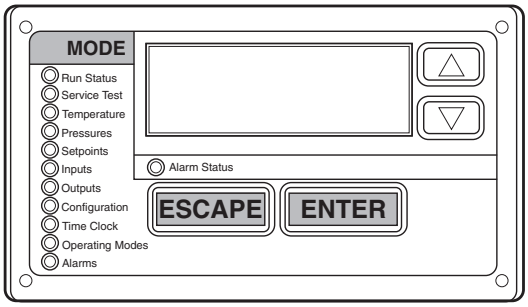


Fig. 1 — Scrolling Marquee Display

NOTE: When the Language Selection (***Configuration→ DISP→LANG***), variable is changed, all appropriate display expansions will immediately change to the new language. No power-off or control reset is required when reconfiguring languages.

When a specific item is located, the item name alternates with the value. Press the ENTER key at a changeable item and the value will be displayed. Press ENTER again and the value will begin to flash indicating that the value can be changed. Use the up and down arrow keys to change the value, and confirm the value by pressing the ENTER key.

Changing item values or testing outputs is accomplished in the same manner. Locate and display the desired item. Press ENTER so that the item value flashes. Use the arrow keys to change the value or state and press the ENTER key to accept

it. Press the ESCAPE key to return to the next higher level of structure. Repeat the process as required for other items.

Items in the Configuration and Service Test modes are password protected. The words 'PASS' and 'WORD' will alternate on the display when required. The default password is 0111. Press ENTER and the 1111 password will be displayed. Press ENTER again and the first digit will begin to flash. Use the arrow keys to change the number and press ENTER to accept the digit. Continue with the remaining digits of the password. The password can only be changed through CCN operator interface software such as ComfortWORKS®, ComfortVIEW™ and Service Tool.

See Table 2 and Appendix A for further details.

ACCESSORY NAVIGATOR™ DISPLAY MODULE — The Navigator module provides a mobile user interface to the *Comfort*Link control system, which is only available as a field-installed accessory. The display has up and down arrow keys, an ENTER key, and an ESCAPE key. These keys are used to navigate through the different levels of the display structure. Press the ESCAPE key until 'Select a Menu Item' is displayed to move through the top 11 mode levels indicated by LEDs on the left side of the display. See Fig. 2.

Once within a Mode or sub-mode, a ">" indicates the currently selected item on the display screen. Pressing the ENTER and ESCAPE keys simultaneously will put the Navigator module into expanded text mode where the full meaning of all sub-modes, items and their values can be displayed. Pressing the ENTER and ESCAPE keys when the display says 'Select Menu Item' (Mode LED level) will return the Navigator module to its default menu of rotating display items (those items in ***Run Status→VIEW***). In addition, the password will be disabled, requiring that it be entered again before changes can be made to password protected items. Press the ESCAPE key to exit out of the expanded text mode.

NOTE: When the Language Selection (***Configuration→ DISP→LANG***), variable is changed, all appropriate display expansions will immediately change to the new language. No power-off or control reset is required when reconfiguring languages.

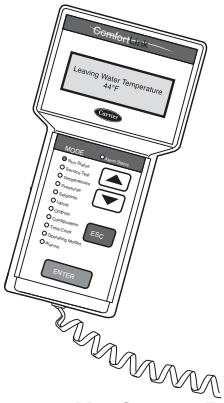


Fig. 2 — Accessory Navigator Display Module

When a specific item is located, the item name appears on the left of the display, the value will appear near the middle of the display and the units (if any) will appear on the far right of the display. Press the ENTER key at a changeable item and the value will begin to flash. Use the up and down arrow keys to change the value, and confirm the value by pressing the ENTER key.

Changing item values or testing outputs is accomplished in the same manner. Locate and display the desired item. Press ENTER so that the item value flashes. Use the arrow keys to change the value or state and press the ENTER key to accept it. Press the ESCAPE key to return to the next higher level of structure. Repeat the process as required for other items.

Items in the Configuration and Service Test modes are password protected. The words **Enter Password** will be displayed when required, with 1111 also being displayed. The default password is 0111. Use the arrow keys to change the number and press ENTER to enter the digit. Continue with the remaining digits of the password. The password can only be changed through CCN operator interface software such as ComfortWORKS, ComfortVIEW and Service Tool.

Adjusting the Contrast — The contrast of the display can be adjusted to suit ambient conditions. To adjust the contrast of the Navigator module, press the ESCAPE key until the display reads, "Select a menu item." Using the arrow keys move to the Configuration mode. Press ENTER to obtain access to this mode. The display will read:

> TEST OFF
METR OFF
LANG ENGLISH

Pressing ENTER will cause the "OFF" to flash. Use the up or down arrow to change "OFF" to "ON". Pressing ENTER will illuminate all LEDs and display all pixels in the view screen. Pressing ENTER and ESCAPE simultaneously allows the user to adjust the display contrast. Use the up or down arrows to adjust the contrast. The screen's contrast will change with the adjustment. Press ENTER to accept the change. The Navigator module will keep this setting as long as it is plugged in to the LEN (local equipment network) bus.

Adjusting the Backlight Brightness — The backlight of the display can be adjusted to suit ambient conditions. The factory default is set to the highest level. To adjust the backlight of the Navigator module, press the ESCAPE key until the display reads, "Select a menu item." Using the arrow keys move to the Configuration mode. Press ENTER to obtain access to this mode. The display will read:

> TEST OFF
METR OFF
LANG ENGLISH

Pressing ENTER will cause the "OFF" to flash. Use the up or down arrow keys to change "OFF" to "ON". Pressing ENTER will illuminate all LEDs and display all pixels in the view screen. Pressing the up and down arrow keys simultaneously allows the user to adjust the display brightness. Use the up or down arrow keys to adjust screen brightness. Press ENTER to accept the change. The Navigator module will keep this setting as long as it is plugged in to the LEN bus.

Table 2 — *Comfort*Link™ Display Menu Structure

MODE										
RUN STATUS	**SERVICE TEST**	**TEMPERATURE**	**PRESSURE**	**SET POINTS**	**INPUTS**	**OUTPUTS**	**CONFIGURATION**	**TIME CLOCK**	**OPERATING MODES**	**ALARMS**
Auto Display (VIEW)	Manual Test Mode (TEST)	Unit Temperatures (UNIT)	Circuit A Pressures (PRC.A)	Cooling Setpoints (COOL)	General Inputs (GEN.I)	Circuit A Outputs (CIR.A)	Display Configuration (DISP)	Time of Day (TIME)	Operating Control Type (SLCT)	Reset Current Alarms (R.ALM)
Remote User Interface (R.CCN)	Quick Test Mode (QUIC)	Circuit A Temperatures (CIR.A)	Circuit B Pressures (PRC.B)	Heating Setpoints (HEAT)		Circuit B Outputs (CIR.B)	Unit Configuration (UNIT)	Day, Date (DATE)	Operating Modes (MODE)	Current Alarms (ALRM)
Machine Starts/ Hours (RUN)		Circuit B Temperatures (CIR.B)	Circuit C Pressures (PRC.C)	Misc. Setpoints (MISC)		Circuit C Outputs (CIR.C)	Service Configurations (SERV)	Schedule 1 (SCH1)		Alarm History (H.ALM)
Compressor Run Hours (HOUR)		Circuit C Temperatures (CIR.C)				General Outputs (GEN.O)	Options Configuration (OPTN)	Schedule 2 (SCH2)		
Compressor Starts (STRT)							Reset, Demand Limit, Master/Slave (RSET)	Holidays (HOLI)		
Fan Run Hours (FAN)								Service Maintenance Configuration (MCFG)		
Compressor Disable (CP.UN)										
Predictive Maintenance (MAIN)										
Software Versions (VERS)										

CONTROLS

General — The 30RB air-cooled liquid chillers contain the *Comfort*Link™ electronic control system that controls and monitors all operations of the chiller. The control system is composed of several components as listed in the following sections. All machines have at the very least a main base board (MBB), scrolling marquee display, electric expansion valve board (EXV), fan board, one scroll protection module (SPM) per compressor, Emergency On/Off switch, an Enable-Off- Remote Contact switch and a reverse rotation board.

Main Base Board (MBB) — The MBB is the heart of the *Comfort*Link control system, which contains the major portion of operating software and controls the operation of the machine. See Fig. 3. The MBB continuously monitors input/ output channel information received from its inputs and from all other modules. The MBB receives inputs from status and feedback switches, pressure transducers and thermistors. The MBB also controls several outputs. Some inputs and outputs to control the machine are located on other boards, but are transmitted to or from the MBB via the internal communications bus. Information is transmitted between modules via a 3-wire communication bus or LEN (Local Equipment Network). The CCN (Carrier Comfort Network) bus is also supported. Connections to both LEN and CCN buses are made at TB3. For a complete description of main base board inputs and outputs and their channel identifications, see Table 3.

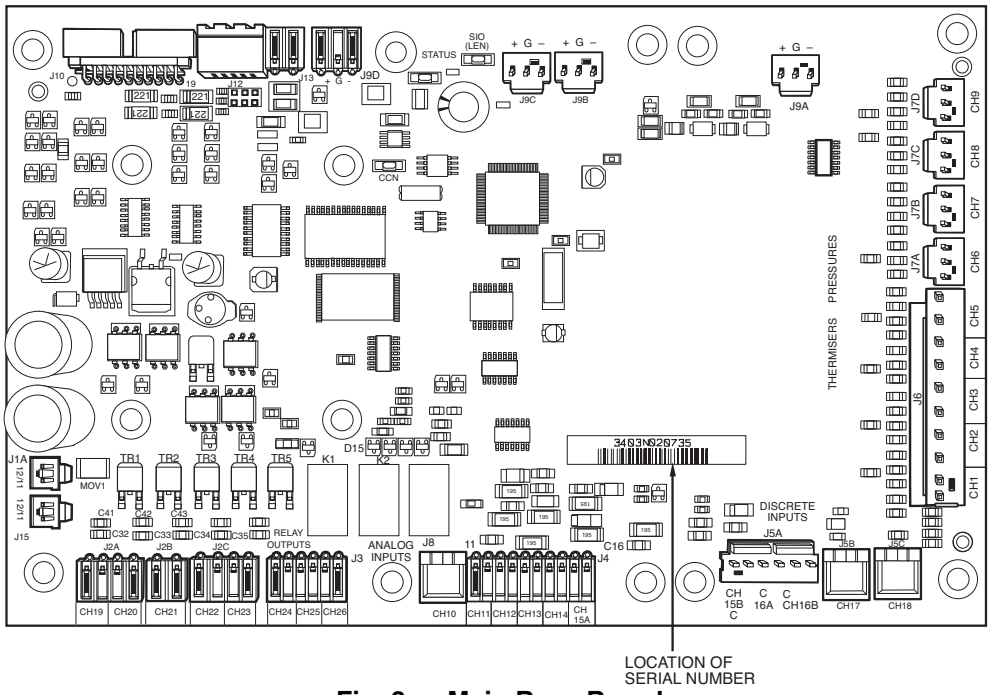


Fig. 3 — Main Base Board

Table 3 — Main Base Board Inputs and Outputs

DESCRIPTION	INPUT/OUTPUT	I/O TYPE	SCROLLING MARQUEE POINT NAME	CONNECTION POINT	
				Pin	Notation
Power (24 vac supply)	—	—	—	MBB-J1, MBB-J1A, MBB-J1B	
				11	24 vac
				12	Ground
Local Equipment Network	—	—	—	MBB-J9A, MBB-J9B, MBB-J9C, MBB-J9D	
				+	
				G	
				-	
Carrier Comfort Network® (CCN)	—	—	—	MBB-J12	
				+	
				G	
				-	
External Chilled Water Pump Interlock	PMPI	Switch	***INPUTS→GEN.I→LOCK***	MBB-J4-CH15A	
Chilled Water Flow Switch	CWFS	Switch	***INPUTS→GEN.I→LOCK***	MBB-J5A-CH15B	
				15B	
Demand Limit Switch #1	Demand Limit SW1	Switch	***INPUTS→GEN.I→DLS1***	MBB-J4-CH13	
Circuit A Discharge Pressure Transducer	DPTA	Pressure Transducer (0-5 VDC)	***PRESSURE→PRC.A→DP.A***	MBB-J7A-CH6	
				5V	5 vdc Ref.
				S	Signal
				R	Return
Circuit B Discharge Pressure Transducer	DPTB	Pressure Transducer (0-5 VDC)	***PRESSURE→PRC.B→DP.B***	MBB-J7C-CH8	
				5V	5 vdc Ref.
				S	Signal
				R	Return
Dual Chiller LWT Thermistor	DUAL	5k Thermistor	***TEMPERATURE→UNIT→CHWS***	MBB-J6-CH3	
Dual Set Point Input	Dual Set Point	Switch	***INPUTS→GEN.I→DUAL***	MBB-J4-CH12	
Entering Water Thermistor	EWT	5k Thermistor	***TEMPERATURE→UNIT→EWT***	MBB-J6-CH2	
Leaving Water Thermistor	LWT	5k Thermistor	***TEMPERATURE→UNIT→LWT***	MBB-J6-CH1	
Outdoor Air Thermistor	OAT	5k Thermistor	***TEMPERATURE→UNIT→OAT***	MBB-J6-CH4	
Pump #1 Interlock Pump #2 Interlock	PMP1 PMP2	Switch	***INPUTS→GEN.I→PUMP***	MBB-J5C-CH18	
				18	
				C	
Reverse Rotation Board	Reverse Rotation Board	Switch	***INPUTS→GEN.I→ELEC***	MBB-J5A-CH16B	
				16B	
Circuit A Suction Pressure Transducer	SPTA	Pressure Transducer (0-5 VDC)	***PRESSURE→PRC.A→SP.A***	MBB-J7B-CH7	
				5V	5 vdc Ref.
				S	Signal
				R	Return
Circuit B Suction Pressure Transducer	SPTB	Pressure Transducer (0-5 VDC)	***PRESSURE→PR.B→SP.B***	MBB-J7D-CH9	
				5V	5 vdc Ref.
				S	Signal
				R	Return
Unit Status	Remote Contact-Off-Enable	Switch	***INPUTS→GEN.I→ONOF***	MBB-J4-CH11	
Alarm Relay	ALM R	Relay	***OUTPUTS→GEN.O→ALRM***	MBB-J3-CH24	
Alert Relay	ALT R	Relay	***OUTPUTS→GEN.O→ALRT***	MBB-J3-CH25	
Cooler Heater	CL-HT	TRIAC	***OUTPUTS→GEN.O→CO.HT***	MBB-J2B-CH21	
Circuit A Minimum Load Control*	MLV-A	TRIAC	***OUTPUTS→CIR.A→HGB.A***	MBB-J2C-CH22	
Circuit B Minimum Load Control*	MLV-B	TRIAC	***OUTPUTS→CIR.B→HGB.B***	MBB-J2C-CH23	
Pump #1 Starter	PMP1	TRIAC	***OUTPUTS→GEN.O→PMP.1***	MBB-J2A-CH19	
Pump #2 Starter	PMP2	TRIAC	***OUTPUTS→GEN.O→PMP.2***	MBB-J2A-CH20	
Ready Relay	RDY R	Relay	***OUTPUTS→GEN.O→REDY***	MBB-J3-CH26	

* Controls discharge and liquid line isolation soleniods for 30RB120-190 brine units only.

Scroll Protection Module (SPM) — There is one SPM per compressor and it is responsible for controlling that compressor. See Fig. 4. The device controls the compressor contactor and the compressor crankcase heater. The SPM module also monitors the compressor motor temperature, and circuit high pressure switch. The SPM responds to commands from the MBB (main base board) and sends the MBB the results of the channels it monitors via the LEN (Local Equipment Network). See below for SPM board address information. See Table 4 for SPM inputs and outputs.

SPM-A1 DIP Switch	1	2	3	4	5	6	7	8
Address:	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF

SPM-A2 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF

SPM-A3 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF

SPM-A4 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF

SPM-B1 DIP Switch	1	2	3	4	5	6	7	8
Address:	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF

SPM-B2 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF

SPM-B3 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF

SPM-B4 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF

SPM-C1 DIP Switch	1	2	3	4	5	6	7	8
Address:	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF

SPM-C2 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF

SPM-C3 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF

SPM-C4 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF

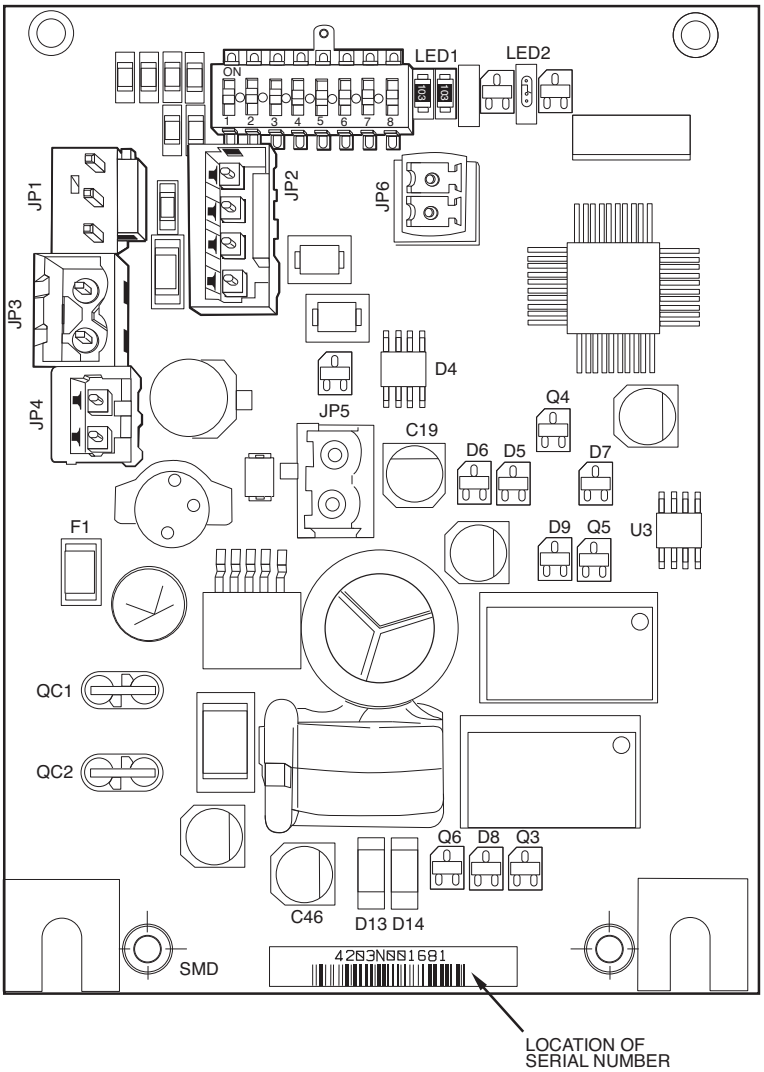


Fig. 4 — Scroll Protection Module

Electronic Expansion Valve (EXV) Board — At least one EXV board is used in all machines. There is one EXV board for 2 circuit machines. Three circuit machines have two EXV boards. See Fig. 5. The board is responsible for monitoring the return gas temperature thermistors. The board also signals the EXV motors to open or close. The electronic expansion valve board responds to commands from the MBB and sends the MBB the results of the channels it monitors via the LEN (local equipment network). See below for DIP switch information for EXV1 and EXV2. See Tables 5 and 6 for EXV inputs and outputs.

EXV1 DIP Switch	1	2	3	4	5	6	7	8
Address:	ON	ON	ON	ON	ON	ON	OFF	ON

EXV2 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	ON	ON	ON	ON	ON	OFF	ON

Table 4 — Scroll Protection Module Inputs and Outputs*

DESCRIPTION	INPUT/OUTPUT	I/O TYPE	SCROLLING MARQUEE POINT NAME	CONNECTION POINT	
				Pin	Notation
Power (24 vac supply)	—	—	—	SPM-xn-J1	
				QC1	24 vac
				QC2	Ground
Local Equipment Network	—	—	—	SPM-xn-JP1	
				1	+
				2	G
				3	-
				SPM-xn-JP2	
				2	+
				3	G
				4	-
Circuit x High Pressure Switch	HPS-x	Switch	Not available	SPM-xn-JP3	
				1	
				2	
Compressor xn Motor Temperature	MTR-xn	PTC Thermistor	Not available	SPM-xn-JP4	
				1	
				2	
Compressor xn Contactor	Cxn	Relay	***OUTPUTS→CIR.x→CP.xn***	SPM-xn-JP5	
				1	
				2	
Crankcase Heater	CCH	Relay	***OUTPUTS→CIR.x→HT.xn***	SPM-xn-JP6	
				1	
				2	
Circuit x High Pressure Switch	HPS-x	Switch	Not available	SPM-xn-JP2	
				1	

* "x" denotes the circuit, A, B or C. "n" denotes the compressor number, 1, 2, 3, or 4.

Table 5 — EXV1 Board Inputs and Outputs

DESCRIPTION	INPUT/OUTPUT	I/O TYPE	SCROLLING MARQUEE POINT NAME	CONNECTION POINT	
				Pin	Notation
Power (24 vac supply)	—	—	—	EXV1-J1	
				11	24 vac
				12	Ground
Local Equipment Network	—	—	—	EXV1-J4	
				1	+
				2	G
				3	–
Circuit A Suction Gas Thermistor	SGTA	5k Thermistor	***TEMPERATURE→CIR.A→SGT.A***	EXV1-J3	
				THA	
Circuit B Suction Gas Thermistor	SGTB	5k Thermistor	***TEMPERATURE→CIR.B→SGT.B***	EXV1-J3	
				THB	
Circuit A EXV	EXV-A	Stepper Motor	***OUTPUTS→CIR.A→EXV.A***	EXV1-J2A	
				1	
				2	
				3	
				4	
Circuit B EXV	EXV-B	Stepper Motor	***OUTPUTS→CIR.B→EXV.B***	EXV1-J2B	
				1	
				2	
				3	
				4	

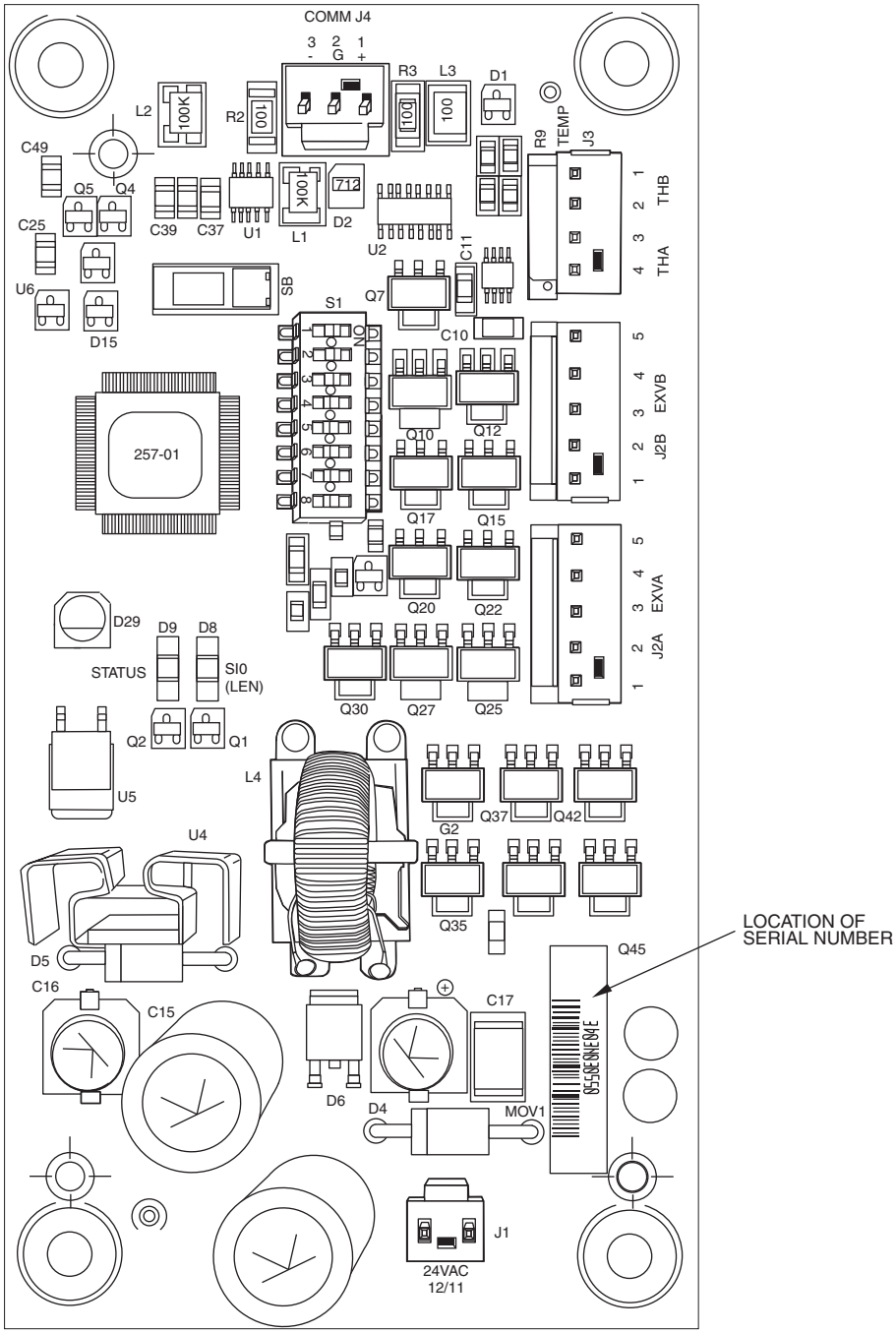


Fig. 5 — EXV Board

Fan Boards — At least one fan board is installed in each unit. See Fig. 6 and 7. There are two types of fan boards, with and without an analog output signal for the low ambient head pressure control fan speed controllers. If a unit does not have low ambient head pressure control installed, it will not have the analog connection terminals. The fan board responds to commands from the MBB and sends the MBB the results of the channels it monitors via the LEN. See below for fan board 1, 2 and 3 DIP switch addresses. See Tables 7-9 for inputs and outputs.

FAN BOARD 1 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	ON	OFF	OFF	ON	OFF	ON	OFF

FAN BOARD 2 DIP Switch	1	2	3	4	5	6	7	8
Address:	ON	ON	OFF	OFF	ON	OFF	ON	OFF

FAN BOARD 3 DIP Switch	1	2	3	4	5	6	7	8
Address:	OFF	OFF	ON	OFF	ON	OFF	ON	OFF

Table 6 — EXV2 Inputs and Outputs

DESCRIPTION	INPUT/OUTPUT	I/O TYPE	SCROLLING MARQUEE POINT NAME	CONNECTION POINT	
				Pin	Notation
Power (24 vac supply)	—	—	—	EXV2-J1	
				11	24 vac
				12	Ground
Local Equipment Network	—	—	—	EXV2-J4	
				1	+
				2	G
				3	–
Circuit C Suction Gas Thermistor	SGTC	5k Thermistor	***TEMPERATURE→CIR.C→SGT.C***	EXV2J3	
				THA	
Circuit C EXV	EXV-C	Stepper Motor	***OUTPUTS→CIR.C→EXV.C***	EXV2-J2A	
				1	
				2	
				3	
				4	

NOTE: EXV2 inputs and outputs are only used on 30RB210-300.

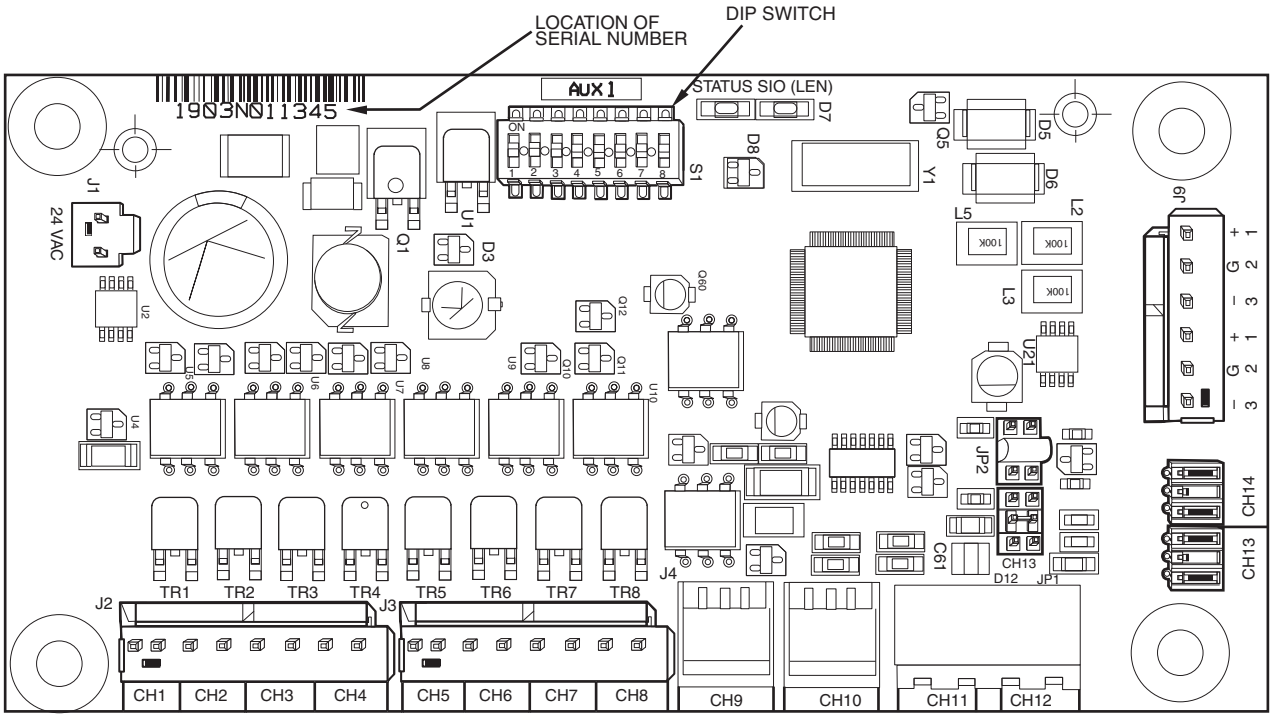


Fig. 6 — Fan Board (AUX 1) with Low Ambient Temperature Head Pressure Control

Table 7 — Fan Board 1 (AUX1, AUX2) Outputs*

DESCRIPTION	INPUT/OUTPUT	I/O TYPE	SCROLLING MARQUEE POINT NAME	CONNECTION POINT	
				Pin	Notation
Power (24 vac supply)	—	—	—	FB1-J1	
				11	24 vac
				12	Ground
Local Equipment Network	—	—	—	FB1-J9	
				+	
				G	
				-	
				+	
				G	
				-	
Circuit A Low Ambient Temperature Head Pressure Control Speed Signal	MM-A†	0-10 VDC	***OUTPUTS→CIR.A→SPD.A***	FB1-CH9	
				+	
				-	
Circuit B Low Ambient Temperature Head Pressure Control Speed Signal (sizes 060-150, 210-250)	MM-B†	0-10 VDC	***OUTPUTS→CIR.B→SPD.B***	FB1-CH10	
				+	
				-	
Outdoor Fan Motor 1	OFM1	TRIAC		FB1-J2-CH1 (sizes 060-110) FB1-J2-CH2 (sizes 120-150, 210-250) FB1-J2-CH3 (sizes 160-190, 275, 300, Duplex sizes 315-390)	
Outdoor Fan Motor 2	OFM2	TRIAC		FB1-J2-CH2 (sizes 060-110) FB1-J2-CH3 (sizes 120-150, 210-250) FB1-J2-CH4 (sizes 160-190, 275, 300, Duplex sizes 315-390)	
Outdoor Fan Motor 3	OFM3	TRIAC		FB1-J2-CH3 (sizes 060,070,090-110) FB1-J3-CH5 (size 080) FB1-J2-CH1 (sizes 120-150, 210-250) FB1-J2-CH2 (sizes 160-190, 275, 300, Duplex sizes 315-390)	
Outdoor Fan Motor 4	OFM4	TRIAC		FB1-J2-CH4 (sizes 060,070,130, 150,210-250) FB1-J3-CH6 (size 080) FB1-J3-CH7 (sizes 090-110) FB1-J3-CH5 (sizes 160-190, 275-300, Duplex sizes 315-390)	
Outdoor Fan Motor 5	OFM5	TRIAC		FB1-J3-CH5 (sizes 090-110) FB1-J3-CH6 (sizes 120-150, 210-250) FB1-J2-CH1 (sizes 160-190, 275-300, Duplex sizes 315-390)	
Outdoor Fan Motor 6	OFM6	TRIAC		FB1-J3-CH6 (sizes 090-110, 160-190, 275-300, Duplex sizes 315-390) FB1-J3-CH7 (sizes 120-150, 210-250)	
Outdoor Fan Motor 7	OFM7	TRIAC		FB1-J3-CH5 (sizes 120-150, 210-250)	
Outdoor Fan Motor 8	OFM8	TRIAC		FB1-J3-CH8 (sizes 120-150, 210-250)	

*Fan boards 1 and 2 will use the AUX1 board when the low ambient temperature head pressure control option is installed.
†Supplied on AUX1 board only

NOTE: Fan Board 1 is used on 30RB060-390.

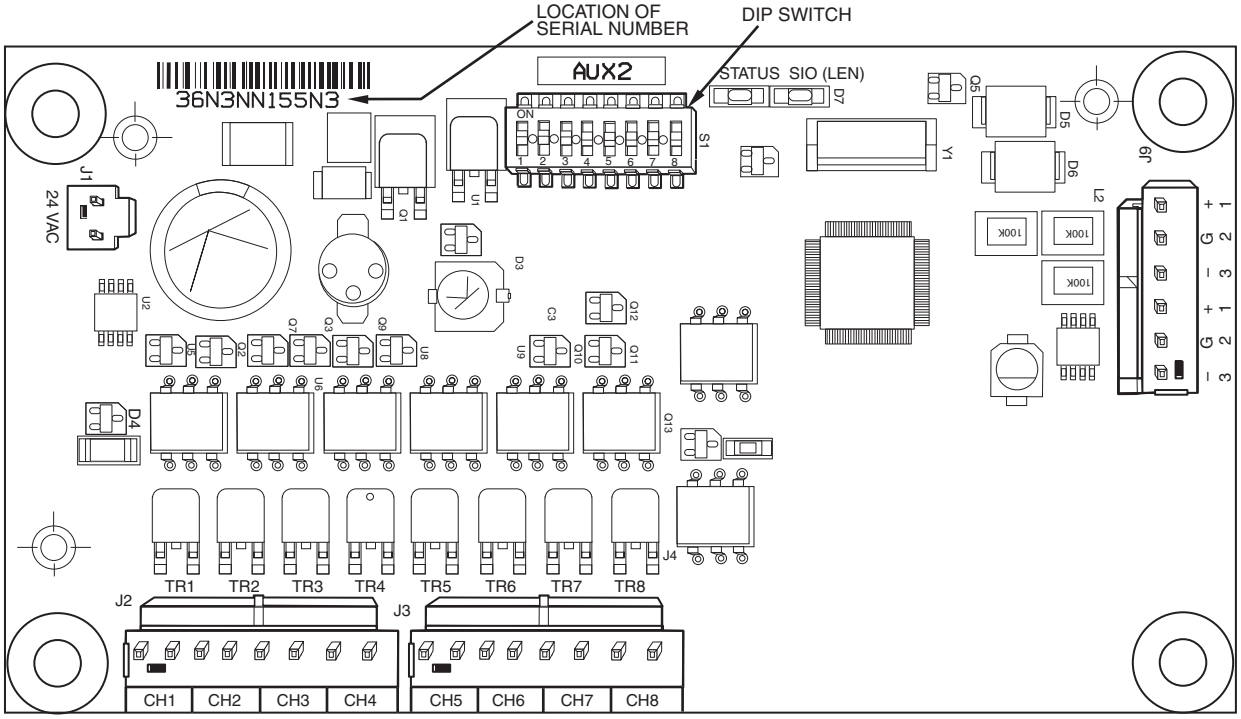


Fig. 7 — Fan Board (AUX 2) without Low Ambient Temperature Head Pressure Control

Table 8 — Fan Board 2 (AUX1, AUX2) Outputs*

DESCRIPTION	INPUT/OUTPUT	I/O TYPE	SCROLLING MARQUEE POINT NAME	CONNECTION POINT	
				Pin	Notation
Power (24 vac supply)	—	—	—	FB2-J1	
				11	24 vac
				12	Ground
Local Equipment Network	—	—	—	FB2-J9	
				+	
				G	
				-	
				+	
				G	
				-	
Circuit B Low Ambient Temperature Head Pressure Control Speed Signal (sizes 160-190, 275-300, 315-400)	MM-B†	0-10 VDC	***OUTPUTS→CIR.B→SPD.B***	FB2-CH9	
				+	
				-	
Outdoor Fan Motor 7	OFM7†	TRIAC		FB2-J2-CH2 (sizes 160, 170, 315-345, 360B) FB2-J2-CH3 (sizes 190, 275, 300, 360A, 390)	
Outdoor Fan Motor 8	OFM8	TRIAC		FB2-J2-CH3 (sizes 160, 170, 315-345, 360B) FB2-J2-CH4 (sizes 190, 275, 300, 360A, 390)	
Outdoor Fan Motor 9	OFM9	TRIAC		FB2-J2-CH1 (sizes 160, 170, 315-345, 360B) FB2-J2-CH2 (sizes 190, 275, 300, 360A, 390)	
Outdoor Fan Motor 10	OFM10	TRIAC		FB2-J2-CH4 (sizes 160, 170, 315-345, 360B) FB2-J3-CH5 (sizes 190, 275, 300, 360A, 390)	
Outdoor Fan Motor 11	OFM11	TRIAC		FB2-J2-CH1 (sizes 190, 275-300, 360A, 390)	
Outdoor Fan Motor 12	OFM12	TRIAC		FB2-J3-CH6 (sizes 190, 275-300, 360A, 390)	

*Fan boards 1 and 2 will use the AUX1 board when the low ambient temperature head pressure control option is installed.
†Output only on units with low ambient temperature head pressure control installed (AUX1).

NOTE: Fan Board 2 used on 30RB160-190, 275-300, 315-390.

Table 9 — Fan Board 3 (AUX1) Inputs and Outputs

DESCRIPTION	INPUT/OUTPUT	I/O TYPE	SCROLLING MARQUEE POINT NAME	CONNECTION POINT (Unit Size)	
				Pin	Notation
Power (24 vac supply)	—	—	—	FB3-J1	
				11	24 vac
				12	Ground
Local Equipment Network	—	—	—	FB3-J9	
				+	
				G	
				-	
				+	
				G	
				-	
Circuit C Discharge Pressure Transducer	DPTC	Pressure Transducer (0-5 VDC)	***PRESSURE→PRC.C→DP.C***	FB3-J7-CH13	
Circuit C Suction Pressure Transducer	SPTC	Pressure Transducer (0-5 VDC)	***PRESSURE→PRC.C→SP.C***	FB3-J8-CH14	
Minimum Load Value Circuit C	MLV-C*	TRIAC	***OUTPUTS→CIR.C→HGB.C***	FB3-J3-CH7 (sizes 210-300)	
Circuit C Low Ambient Temperature Head Pressure Control Speed Signal (sizes 210-300)	MM-C†	0-10 VDC	***OUTPUTS→CIR.C→SPD.C***	FB3-CH9	
				+	
				-	
Outdoor Fan Motor 9	OFM9	TRIAC		FB3-J2-CH2 (sizes 210, 225) FB3-J2-CH3 (size 250)	
Outdoor Fan Motor 10	OFM10	TRIAC		FB3-J2-CH3 (sizes 210, 225) FB3-J2-CH4 (size 250)	
Outdoor Fan Motor 11	OFM11	TRIAC		FB3-J2-CH1 (sizes 210, 225) FB3-J2-CH2 (size 250)	
Outdoor Fan Motor 12	OFM12	TRIAC		FB3-J2-CH3 (sizes 210, 225) FB3-J2-CH4 (size 250)	
Outdoor Fan Motor 13	OFM13	TRIAC		FB3-J2-CH1 (size 250) FB3-J2-CH2 (size 275) FB3-J2-CH3 (size 300)	
Outdoor Fan Motor 14	OFM14	TRIAC		FB3-J3-CH6 (size 250) FB3-J2-CH3 (size 275) FB3-J2-CH4 (size 300)	
Outdoor Fan Motor 15	OFM15	TRIAC		FB3-J2-CH1 (size 275) FB3-J2-CH2 (size 300)	
Outdoor Fan Motor 16	OFM16	TRIAC		FB3-J2-CH4 (size 275) FB3-J3-CH5 (size 300)	
Outdoor Fan Motor 17	OFM17	TRIAC		FB3-J2-CH1 (size 300)	
Outdoor Fan Motor 18	OFM18	TRIAC		FB3-J3-CH6 (size 300)	

*Controls discharge and liquid line isolation soleniods for 30RB210-300 brine units.
†Low ambient temperature head pressure control output is on AUX1 board only.

NOTE: Fan Board 3 used on 30RB210-300.

Reverse Rotation Board — The reverse rotation board monitors the three-phase electrical system to provide phase reversal, phase loss and under-voltage protection. See Fig. 8. The reverse rotation board has two LEDs (light-emitting diodes) and two adjustable dial settings. Under normal conditions, the upper LED will light up green. The lower LED is red and will flash (phase reversal) or turn on solid (phase loss and under-voltage) according to the conditions sensed.

DIAL SETTINGS — The reverse rotation board has two dials. See Fig. 8. The upper dial should be set to match the incoming three-phase voltage to the chiller with no compressors running. This dial must be adjusted for 208/230-v chillers operating on 208-v power supply. The dial should be adjusted to 200-v minimum setting for this case. The lower dial is used for trip delay and should be set fully counterclockwise to the minimum 0.1 second setting.

PHASE REVERSAL PROTECTION — The control monitors the three-phase power sequence supplied at terminals L1, L2, and L3. If the control senses an incorrect phase relationship, the relay contacts (11/14) on the board will open. The relay contacts will automatically reset when the correct phase sequence is applied.

PHASE LOSS AND UNDER-VOLTAGE PROTECTION — If the reverse rotation board senses that any one of the three phase inputs has no AC voltage or that any one phase has dropped more than 20% below the voltage dial setting, the relay contacts (11/14) on the board will open. Contacts will reset automatically when all three phases are present, in the correct sequence and are within the limits of the voltage dial setting.

LED STATUS	FUNCTION
Upper (green) LED on continuously	Relay contacts closed (normal operation)
Lower (red) LED blinking	Relay contacts open (phase reversal has occurred)
Lower (red) LED on continuously	Relay contacts open (phase loss or under-voltage has occurred)
Upper (green) LED off	Power not present at L1, L2, L3 (off)

NOTE: Normal operation of the reverse rotation board (for example, no faults are detected) results in a closed contact being applied to the MBB (plug J5A, channel 16B) through the closed 11/14 relay contact.

Enable-Off-Remote Contact Switch — This switch is installed in all units and provides the owner and service person with a local means of enabling or disabling the machine. It is a 3-position switch used to control the chiller. When switched to the Enable position the chiller is under its own control. Move the switch to the Off position to shut the chiller down. Move the switch to the Remote Contact position and a field-installed dry contact can be used to start the chiller. The contacts must be capable of handling a 24-vac, 20-mA load. In the Enable and Remote Contact (dry contacts closed) positions, the chiller is allowed to operate and respond to the scheduling configuration, CCN configuration and set point control.

Emergency On/Off Switch — This switch is installed in all units. The Emergency On/Off switch should only be used when it is required to shut the chiller off immediately. Power to the MBB, energy management module, and scrolling marquee display is interrupted when this switch is off and all outputs from these modules will be turned off.

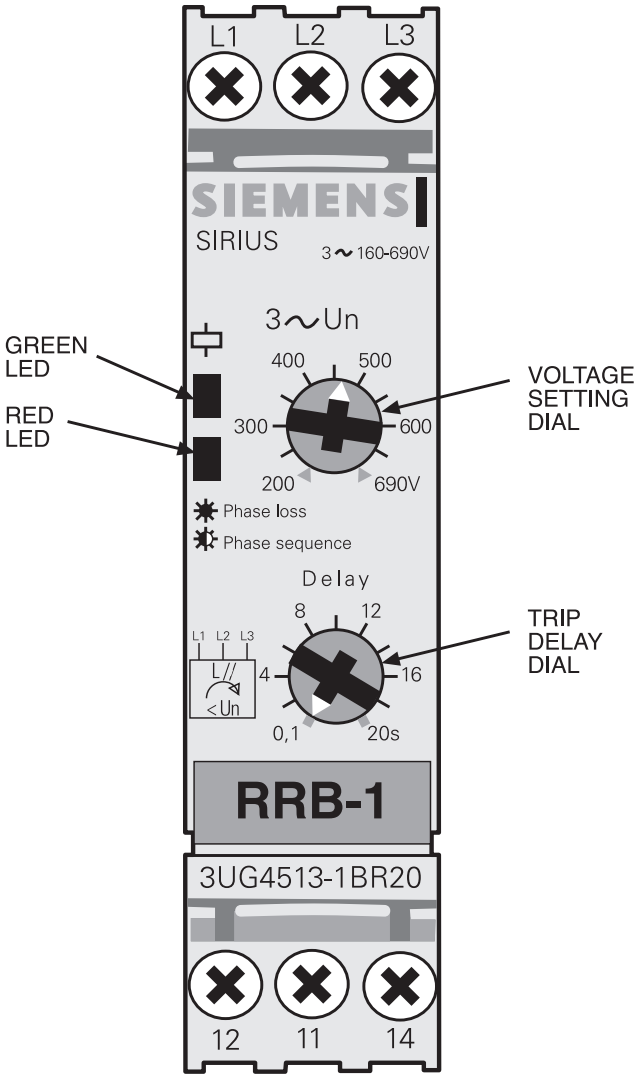


Fig. 8 — Reverse Rotation Board (RRB)

Energy Management Module (EMM) — The EMM is available as a factory-installed option or as a field-installed accessory. The EMM receives 4 to 20 mA inputs for the temperature reset, cooling set point reset and demand limit functions. The EMM also receives the switch inputs for the field-installed second stage 2-step demand limit, ice done, occupancy overrides, and remote lockout functions. The EMM communicates the status of all inputs with the MBB, and the MBB adjusts the control point, capacity limit, and other functions according to the inputs received. The EMM generates a 0 to 10 vdc output that directly corresponds to the unit percent total capacity. Contacts indicating unit run status and shutdown status are provided. See Table 10 and Fig. 9.

⚠ CAUTION

Care should be taken when interfacing with other manufacturer's control systems due to possible power supply differences, full wave bridge versus half wave rectification, which could lead to equipment damage. The two different power supplies cannot be mixed. *Comfort*Link™ controls use half wave rectification. A signal isolation device should be utilized if incorporating a full wave bridge rectifier signal generating device is used.

Energy Management Module Heat Reclaim (EMM HR) — The EMM HR is available as a factory-installed option. The EMM HR communicates the status of all of the inputs with the MBB. The MBB then determines the appropriate operating mode. Operating modes are: normal cooling, heat reclaim, and simultaneous one circuit cooling/one circuit heat reclaim. See Table 11 and Fig. 9.

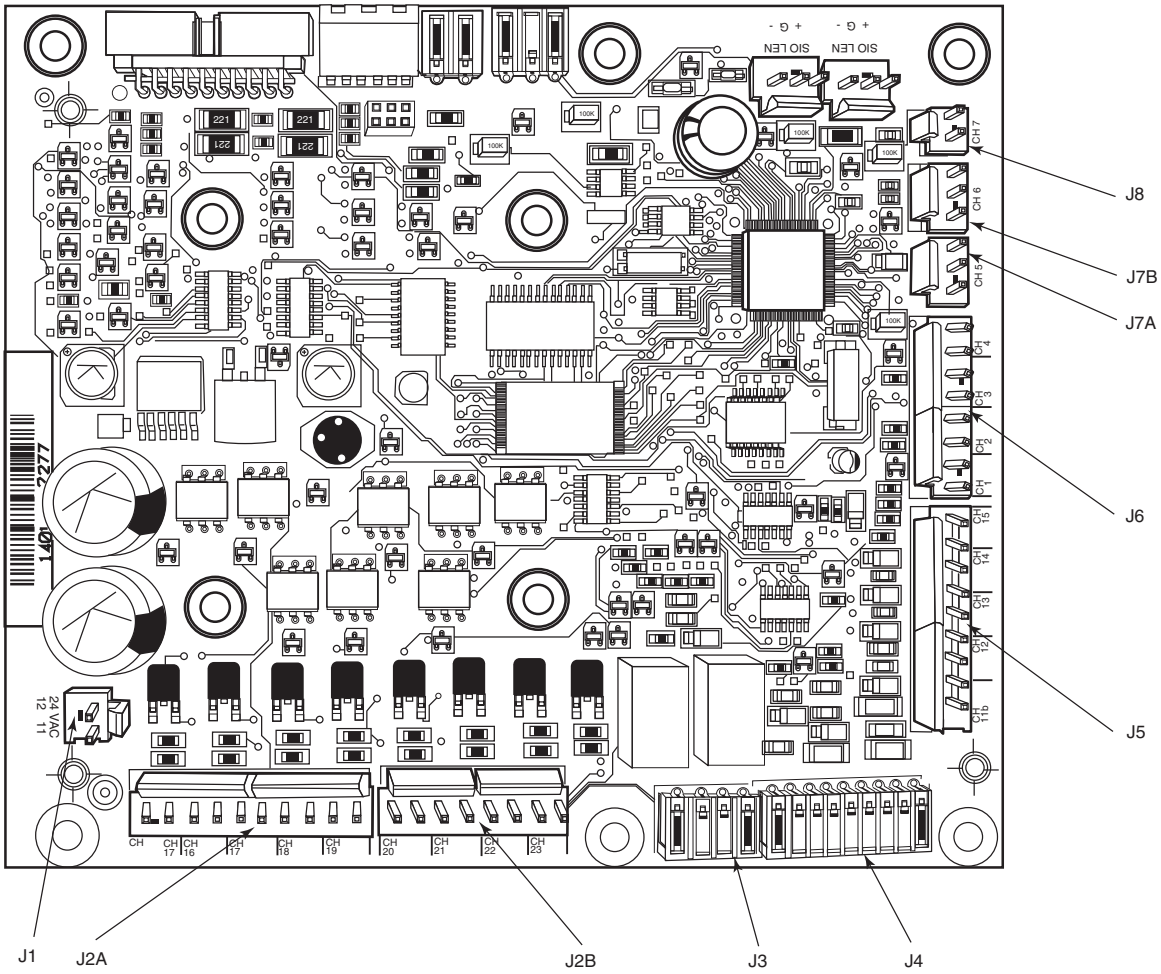


Fig. 9 — Energy Management Module and Energy Management Heat Reclaim Module

Table 10 — Energy Management Module (EMM) Inputs and Outputs

INPUT	DESCRIPTION	I/O TYPE	I/O POINT NAME	CONNECTION POINT
4-20 mA or 0-5 vdc Demand Limit	4-20 mA Demand Limit	0-5 vdc*	***INPUTS→GEN.I→DMND***	EMM-J7B-CH6
4-20 mA or 0-5 vdc Temperature Reset/Setpoint	4-20 mA Temperature Reset/ Set point	0-5 vdc*	***INPUTS→GEN.I→RSET***	EMM-J7A-CH5
Demand Limit SW2	Demand Limit Step 2	Switch Input	***INPUTS→GEN.I→DLS2***	EMM-J4-CH9
Ice Done	Ice Done Switch	Switch Input	***INPUTS→GEN.I→ICE.D***	EMM-J4-CH11A
Occupancy Override	Occupied Schedule Override	Switch Input	***INPUTS→GEN.I→OCCS***	EMM-J4-CH8
Remote Lockout Switch	Chiller Lockout	Switch Input	***INPUTS→GEN.I→RLOC***	EMM-J4-CH10
SPT	Space Temperature Thermistor	10k Thermistor	***TEMPERATURE→UNIT→SPT***	EMM-J6-CH2
OUTPUT	**DESCRIPTION**	**I/O TYPE**	**I/O POINT NAME**	**CONNECTION POINT**
% Total Capacity		0-10 vdc	***OUTPUTS→GEN.O→CATO***	EMM-J8-CH7
RUN R	Run Relay	Relay	***OUTPUTS→GEN.O→RUN***	EMM-J3-CH24
SHD R	Shutdown Relay	Relay	***OUTPUTS→GEN.O→SHUT***	EMM-J3-CH25

* 250 ohm, 1/2 watt resistor required for 4-20 mA input.

Table 11 — Energy Management Module Heat Reclaim (EMM HR) Inputs and Outputs

INPUT	DESCRIPTION	I/O TYPE	I/O POINT NAME	CONNECTION POINT
PD.B	Circuit B Pumpdown Pressure Transducer	Pressure Transducer	***PRESSURE→CIR.B→PD.B***	EMM-J8-CH6
PD.A	Circuit A Pumpdown Pressure Transducer	Pressure Transducer	***PRESSURE→CIR.A→PD.A***	EMM-J8-CH5
HRS.B	Circuit B Liquid Subcooling	—	***TEMPERATURE→CIR.B→HRS.B***	—
HRS.A	Circuit A Liquid Subcooling	—	***TEMPERATURE→CIR.A→HRS.A***	—
HRT.B	Circuit B Liquid Temperature	Temperature	***TEMPERATURE→CIR.B→HRT.B***	EMM-J5-CH4
HRT.A	Circuit A Liquid Temperature	Temperature	***TEMPERATURE→CIR.A→HRT.A***	EMM-J5-CH3
HEWT	Heat Reclaim Entering Fluid	Temperature	***TEMPERATURE→UNIT→HEWT***	EMM-J5-CH2
HLWT	Heat Reclaim Leaving Fluid	Temperature	***TEMPERATURE→UNIT→HLWT***	EMM-J5-CH1
C.FLO	Condenser Flow Switch Status	Switch	***INPUTS→GEN.I→C.FLO***	EMM-J5-CH15
—	Power (24 vac supply)	—	—	EMM-J1-CH11,12
—	Local Equipment Network	—	—	EMM-J9
OUTPUT	**DESCRIPTION**	**I/O TYPE**	**I/O POINT NAME**	**CONNECTION POINT**
	Condenser 0-10 VDC Water Valve Output	0-10 VDC	—	EMM-J8-CH7
CND.P	Heat Reclaim Condenser Pump Status	Contactor	***OUTPUTS→GEN.O→CND.P***	EMM-J2-CH16
CN.HT	Heat Reclaim Condenser Heater	Contactor	***OUTPUTS→GEN.O→CN.HT***	EMM-J2-CH17
HR2.A	Circuit A, Leaving Air-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.A→HR2.A***	EMM-J2-CH18
HR2.B	Circuit B, Leaving Air-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.B→HR2.B***	EMM-J2-CH19
HR3.A	Circuit A, Entering Water-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.A→HR3.A***	EMM-J2-CH20
HR3.B	Circuit B, Entering Water-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.B→HR3.B***	EMM-J2-CH21
HR4.A	Circuit A, Leaving Water-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.A→HR4.A***	EMM-J2-CH22
HR4.B	Circuit B, Leaving Water-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.B→HR4.B***	EMM-J2-CH23
HR1.A	Circuit A, Entering Air-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.A→HR1.A***	EMM-J3-CH24
HR1.B	Circuit B, Entering Air-Cooled Cond Solenoid	Contactor	***OUTPUTS→CIR.B→HR1.B***	EMM-J3-CH25

Local Equipment Network — Information is transmitted between modules via a 3-wire communication bus or LEN (Local Equipment Network). External connection to the LEN bus is made at TB3.

Board Addresses — All boards (except the main base board and the energy management module) have 8-position DIP switches. Addresses for all boards are listed with the input/output tables for each board.

Control Module Communication

RED LED — Proper operation of the control boards can be visually checked by looking at the red status LEDs (light-emitting diodes). When operating correctly, the red status LEDs will blink in unison at a rate of once every 2 seconds. If the red LEDs are not blink in unison, verify that correct power is being supplied to all modules. Be sure that the main base board (MBB) is supplied with the current software. If necessary, reload current software. If the problem still persists, replace the MBB. A red LED that is lit continuously or blinking at a rate of once per second or faster indicates that the board should be replaced.

GREEN LED — All boards have a green LEN (SIO) LED which should be blinking whenever power is on. If the LEDs are not blinking as described check LEN connections for potential communication errors at the board connectors. See Input/Output Tables for LEN connector designations. A 3-wire bus accomplishes communication between modules. These 3 wires run in parallel from module to module. The J9A connector on the MBB provides communication directly to the scrolling marquee display or the Navigator™ display module.

YELLOW LED — The MBB has one yellow LED. The Carrier Comfort Network® (CCN) LED will blink during times of network communication.

Carrier Comfort Network (CCN) Interface — All 30RB units can be connected to the CCN, if desired. The communication bus wiring is a shielded, 3-conductor cable with drain wire and is field supplied and installed. The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system elements on either side of it, that is also required for the negative and signal ground pins of each system element. Wiring connections for CCN should be made at TB3. Consult the CCN Contractor's Manual for further information. See Fig. 10.

NOTE: Conductors and drain wire must be 20 AWG (American Wire Gage) minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of –20 C to 60 C is required. See Table 12 for recommended wire manufacturers and part numbers.

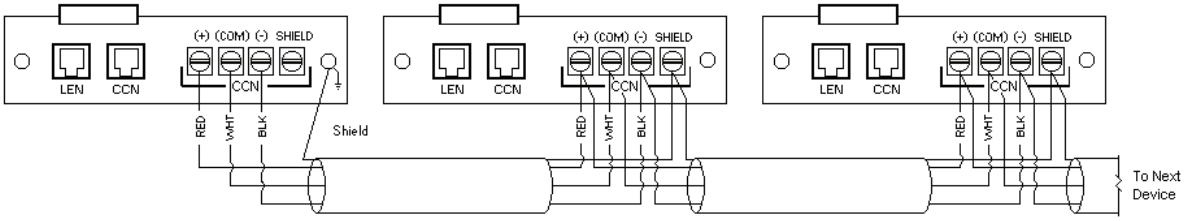


Fig. 10 — *Comfort*Link™ CCN Communication Wiring

Table 12 — CCN Communication Bus Wiring

MANUFACTURER	PART NUMBER	
	Regular Wiring	Plenum Wiring
Alpha	1895	—
American	A21451	A48301
Belden	8205	884421
Columbia	D6451	—
Manhattan	M13402	M64430
Quabik	6130	—

It is important when connecting to a CCN communication bus that a color-coding scheme be used for the entire network to simplify the installation. It is recommended that red be used for the signal positive, black for the signal negative, and white for the signal ground. Use a similar scheme for cables containing different colored wires.

At each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous shield must be connected to a ground at one point only. If the communication bus cable exits from one building and enters another, the shields must be connected to grounds at the lightning suppressor in each building where the cable enters or exits the building (one point per building only). To connect the unit to the network:

1. Turn off power to the control box.
2. Cut the CCN wire and strip the ends of the red (+), white (ground), and black (–) conductors. (Substitute appropriate colors for different colored cables.)
3. Connect the red wire to (+) terminal on TB3 of the plug, the white wire to COM terminal, and the black wire to the (–) terminal.
4. The RJ14 CCN connector on TB3 can also be used, but is only intended for temporary connection (for example, a laptop computer running Service Tool).

IMPORTANT: A shorted CCN bus cable will prevent some routines from running and may prevent the unit from starting. If abnormal conditions occur, disconnect the CCN bus. If conditions return to normal, check the CCN connector and cable. Run new cable if necessary. A short in one section of the bus can cause problems with all system elements on the bus.

Configuration Options

MINIMUM LOAD CONTROL (***Configuration→UNIT →HGBP***) reduces the capacity of the 30RB chiller below the lowest standard capacity step by use of hot gas bypass. This capacity step reduction provides more precise control of the leaving water temperature. **The minimum load valve accessory cannot be used on units configured for brine as the cooler fluid type** (***Configuration→ SERV→FLUD***). Refer to Brine Chiller Operation for additional information.

Minimum Load Control can be configured in three different ways. If Minimum Load Control is not used, ***HGBP*** must be set to **0**. If ***HGBP*** is set to **1**, the control will activate the minimum load control valve when the machine is started only. This will be the first step of capacity. If ***HGBP*** is set to **2**, all stages of capacity can utilize the minimum load control valve. If ***HGBP*** is set to **3**, the minimum load control valve will be used only when the circuit has a high pressure override active. This will reduce the capacity of the circuit.

RAMP LOADING (***Configuration→OPTN→RL.S***) limits the rate of change of leaving fluid temperature. If the unit is in a Cooling mode and configured for Ramp Loading, the control makes 2 comparisons before deciding to change stages of capacity. The control calculates a temperature difference between the control point and leaving fluid temperature. If the difference is greater than 4° F (2.2° C) and the rate of change (°F or °C per minute) is more than the configured Cool Ramp Loading (***Setpoints→COOL→CRMP***), the control does not allow any changes to the current stage of capacity.

MINUTES OFF TIME (***Configuration→OPTN→ DELY***) is a time delay added to the start when the machine is commanded ON. This is a field configurable item from 1 to 15 minutes. The factory default is 1 minute. This feature is useful when multiple units are installed. Staggering the start will reduce the inrush potential.

Dual Chiller Control — The dual chiller routine is available for the control of two parallel units supplying chilled fluid on a common loop. This control is designed for a parallel fluid flow arrangement only. One chiller must be configured as the master chiller, the other as the slave chiller. An additional leaving fluid temperature thermistor (Dual Chiller LWT) must be installed in the common chilled water piping as described in the Installation Instructions for both the master and slave chillers. See the Field Wiring section in the 30RB Installation Instructions for dual chiller LWT sensor control wiring. A chilled water flow switch is factory-installed for each chiller.

Parallel chiller control with dedicated pumps is recommended. Chiller must start and stop its own water pump located on its own piping. If pumps are not dedicated for each chiller, chiller isolation valves are required: each chiller must open and close its own isolation valve through the control (valve shall be connected to the pump outputs). Pump Control is enabled as described in the Cooler Pump Control section on page 31. One additional parameter is set for the dual chiller control. Lag Unit Pump Select (***Configuration→RSET →LAGP***) allows the user to configure the control to energize the pump for the lag chiller once the unit enters an occupied time period or delay the control until the lag chiller is started. It is recommended that this parameter be set to **0**, OFF IF UNIT STOPPED.

The control of the slave chiller is directed through commands emitted by the master chiller. The slave chiller has no action in master/slave operations it shall only verify that CCN communication with its master is present. See the Dual Chiller Sequence of Operation section on page 45.

Use dual chiller control to designate a lead chiller between the master and slave chiller. Configure the Lead/Lag Balance Select (***Configuration→RSET→LLBL***) to **ENBL** to base the selection on the Lead/Lag Balance Delta (***Configuration →RSET→LLBD***) between the master and slave run hours. If the run hour difference between the master and the slave remains less than ***LLBD***, the chiller designated as the lead will remain the lead chiller. The Lead/Lag changeover between the master and the slave chiller due to hour balance will occur during chiller operating odd days, such as day 1, day 3, and day 5 of the month, at 12:00 a.m. If a lead chiller is not designated, the master chiller will always be designated the lead chiller.

The dual chiller control algorithm has the ability to delay the start of the lag chiller in two ways. The Lead Pulldown Time (***Configuration→RSET→LPUL***) provides a field configurable time delay of 0 to 60 minutes. This time delay gives the lead chiller a chance to remove the heat that the chilled water loop picked up while being inactive during an unoccupied period. The Lead Pulldown Time parameter is a one-time time delay initiated after starting the lead chiller, manually or by a schedule, before checking whether to start an additional chiller. This routine provides the lead chiller an opportunity to pull down the loop temperature before starting another chiller. The second time delay, Lead/Lag Delay (***Configuration →RSET→LLDY***) is a time delay imposed between the last stage of the lead chiller and the start of the lag chiller. This prevents enabling the lag chiller until the lead/lag delay timer has expired. See Tables 13 and 14.

Table 13 — Configuring the Master Chiller

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	ENTER	CCNA	CCN Address	Confirm address of chiller. The master and slave chiller must have different addresses.
	ENTER	1		Factory default address is 1.
	ESCAPE	CCNA		
	↓	CCNB	CCN Bus Number	Confirm the bus number of the chiller. The master and slave chiller must be on the same bus.
	ENTER	0		Factory default is 0.
	ESCAPE	CCNB		
	ESCAPE	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST	Cooling Reset Type	
	↓ x 5	MSSL	Master/Slave Select	
	ENTER	0	Disable	
	ENTER	0	Disable	Flashing to indicate Edit mode. May require Password.
	↑	1	Master	Use up arrows to change value to 1.
	ENTER	1		Accepts the change.
	ESCAPE	MSSL		
	↓	SLVA	Slave Address	
	ENTER	1		
	ENTER	1		Flashing to indicate Edit mode.
	↑	2		Use up arrows to change value to 2. This address must match the address of the slave chiller.
	ENTER	2		Accepts the change.
	ESCAPE	SLVA		
	↓	LLBL	Lead/Lag Balance Select	
	ENTER	ENBL		Factory Default is ENBL
	ESCAPE	LLBL		
	↓	LLBD	Lead/Lag Balance Delta	
	ENTER	168		Factory Default is 168.
	ESCAPE	LLBD		
	↓	LLDY	Lead/Lag Start Delay	
	ENTER	10		Factory Default is 10.
	ESCAPE	LLDY		
	↓	LAGP	Lag Unit Pump Select	
	ENTER	0	Off if U Stp	Factory Default is 0, Off if unit is stopped. Master and slave chiller must be configured to the same value.
	ESCAPE	LAGP		
	↓	LPUL	Lead Pulldown Time	
	ENTER	0		Factory Default is 0.
	ESCAPE			
	ESCAPE			At mode level.
OPERATING MODES	ENTER	**SLCT**		
	ENTER	**OPER**	Operating Control Type	
	ENTER	0	Switch Control	Master chiller should be configured for job requirements, Switch Control, Time Schedule, or CCN.
	ESCAPE			At mode level.

NOTE: **Bold** values indicate sub-mode level.

Table 14 — Configuring the Slave Chiller

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	ENTER	CCNA	CCN Address	Confirm address of chiller. The master and slave chiller must have different addresses.
	ENTER	1		Factory default address is 1. The slave chiller address must match what was programmed in the Master Chiller SLVA item.
	ENTER	1		Flashing to indicate Edit Mode.
	↑	2		This item must match Master Chiller SLVA item.
	ENTER	2		Accepts the change.
	ESCAPE	CCNA		
	↓	CCNB	CCN Bus Number	Confirm the bus number of the chiller. The master and slave chiller must be on the same bus.
	ENTER	0		Factory default bus number is 0.
	ESCAPE	CCNB		
	ESCAPE	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST	Cooling Reset Type	
	↓ x 5	MSSL	Master/Slave Select	
	ENTER	0	Disable	
	ENTER	0	Disable	Flashing to indicate Edit mode. May require Password
	↑	2	Slave	Use up arrows to change value to 2.
	ENTER	2		Accepts the change.
	ESCAPE	MSSL		
	↓	SLVA	Slave Address	Not required.
	↓	LLBL	Lead/Lag Balance Select	Not required.
	↓	LLBD	Lead/Lag Balance Delta	Not required.
	↓	LLDY	Lead/Lag Start Delay	Not required.
	↓	LAGP	Lag Unit Pump Select	Must be configured to the same value as the master chiller.
	↓	LPUL	Lead Pulldown Time	Not required.
	ESCAPE			
	ESCAPE			At mode level
OPERATING MODES	ENTER	**SLCT**		
	ENTER	**OPER**	Operating Control Type	
	ENTER	0	Switch Control	
	ENTER	0		Flashing to indicate Edit Mode.
	↑	2	CCN Control	Use up arrows to change value to 2. NOTE: Slave chiller must be configured for CCN.
	ENTER	2		Accepts the value.
	ESCAPE	**OPER**		
	ESCAPE			At mode level

NOTE: **Bold** values indicate sub-mode level.

The Lag Unit Pump Select configuration must be set consistently. If pump control is NOT being used, set ***Configuration→RSET→LAGP*** to **1**. If pump control IS being used, set ***Configuration→RSET→LAGP*** to **0**, which is the default value. This must be set in both the master and slave chillers, and it must be consistent in both.

Capacity Control — The control system cycles compressors and minimum load valve solenoids (if equipped) to maintain the user-configured leaving chilled fluid temperature set point. Entering fluid temperature is used by the main base board (MBB) to determine the temperature drop across the cooler and is used in determining the optimum time to add or subtract capacity stages. Entering fluid temperature, space temperature (requires additional sensor), or outdoor-air temperature reset features can automatically reset the leaving chilled fluid temperature set point. It can also be reset from an external 4 to 20-mA signal (requires energy management module).

The control has an automatic lead-lag feature built in for circuit and compressor starts. If enabled, the control will determine which circuit (***Configuration→OPTN→LLCS*=0**) and compressor to start to even the wear. The compressor wear factor (combination of starts and run hours) is used to determine which compressor starts.

Compressor Wear Factor = (Compressor Starts) + 0.1 *(Compressor Run Hours)*

In this case, the circuit with the lowest average compressor wear factor (the average of the wear factors of all available compressors in the circuit) is the circuit that starts first. The compressor within the circuit with the lowest wear factor is the first to start. If the automatic lead-lag function for the circuit is not enabled [***Configuration→OPTN→LLCS*=1** (Circuit A leads), **2** (Circuit B leads), or **3** (Circuit C leads)], then the selected circuit will be the first to start. Again, the compressor with the lowest wear factor within the circuit will be the first to start. If Minimum Load Control is enabled (***Configuration→UNIT→HGBP*=1**), the valve will be operational only during the first stage of cooling.

Once the lead compressor has been started, the lag compressors will be determined by the wear factor and loading sequence selected. If equal loading is selected, (***Configuration→OPTN→LOAD*=0**), the circuit with the lowest average wear factor for the available compressors will start next, with the compressor with the lowest wear factor starting. The control will attempt to keep all circuits at approximately the same number of compressors ON. For this option to function properly, all circuits must have the same number of compressors available. If a circuit compressor is not available due to an alarm condition or demand limit, the capacity staging will change to staged. If staged loading is selected, (***Configuration→OPTN→LOAD*=1**), the started circuit will continue to turn on compressors according to the lowest wear factor until all are on, then start the next circuit with the lowest average wear factor. If Minimum Load Control is enabled for close control (***Configuration→UNIT→HGBP*=2**), the valve will be available at all stages for better temperature control. If Minimum Load Control is enabled for high ambient control (***Configuration→UNIT→HGBP*=3**), the valve will be used only when a high pressure override is active for that circuit.

The electronic expansion valves provide a controlled start-up. During start-up, the low pressure logic in the lead circuit will be ignored for 5 minutes to allow for the transient changes during start-up. As additional stages of compression are required, the processor control will add them. The following example is based on a 30RB225 machine, which has three 25-ton compressors in each circuit. See Table 15.

Each example below has different configurations and is intended to illustrate the loading sequences possible for normal operation.

In Example 1 (Table 16), assume the following configurations are in place:

***Configuration→UNIT→HGBP*=1** . . Minimum Load Control installed and enabled for Start-Up Only

***Configuration→OPTN→LOAD*=0**. . . .Equal Circuit Loading

***Configuration→OPTN→LLCS*=0** . .Automatic Circuit Select

Since Circuit A has the lowest average wear factor, it will be the lead circuit. Within the circuit, compressor A3 has the lowest wear factor and will start first with Minimum Load Control ON. The next stage will turn OFF the minimum load control. Stage 3 will start another circuit because of the Equal Circuit Loading configuration. The next circuit with the lowest wear factor is Circuit B, and the compressor with the lowest wear factor is B2. The next stage will be a circuit C compressor. The process continues until all compressors are ON. See Table 16.

In Example 2 (Table 17), assume the compressor starts and run hours are the same as in the previous example and the following configurations are in place:

***Configuration→UNIT→HGBP*=1** . . Minimum Load Control installed and enabled for Start-Up Only

***Configuration→OPTN→LOAD*=1**. . . Staged Circuit Loading

***Configuration→OPTN→LLCS*=0** . .Automatic Circuit Select

Since Circuit A has the lowest average wear factor, it will be the lead circuit. Within the circuit, compressor A3 has the lowest wear factor and will start first with Minimum Load Control ON. The next stage will turn OFF the minimum load control. Stage 3 will start a compressor in the same circuit because of the Staged Circuit Loading configuration. Compressor A2 has the next lowest wear factor and will be started next. Compressor A3 will be next to start. Since all compressors in Circuit A are ON, the next stage will start another circuit. Of the remaining circuits, Circuit B has the lowest wear factor, and the compressor with the lowest wear factor is B2. All of the Circuit B compressors will be started in the same manner as Circuit A. Once all Circuit B compressors are ON, then Circuit C will be started. The process continues until all compressors are ON. See Table 17.

Table 15 — Compressor Starts and Run Hours

COMPRESSOR	STARTS	RUN HOURS	WEAR FACTOR	CIRCUIT AVERAGE WEAR FACTOR
A1	25	249	49.9	44.8
A2	22	237	45.7	
A3	26	128	38.8	
B1	41	453	86.3	67.6
B2	38	138	51.8	
B3	35	297	64.7	
C1	93	103	103.3	80.3
C2	57	98	66.8	
C3	61	99	70.9	

Table 16 — Compressor Stages and Circuit Cycling, Example 1

STAGE	TOTAL CAP.	CIRCUIT A					CIRCUIT B					CIRCUIT C				
		Cir. Cap.	MLC	A1	A2	A3	Cir. Cap.	MLC	B1	B2	B3	Cir. Cap.	MLC	C1	C2	C3
0	0	0					0					0				
1	8	24	X			X	0					0				
2	11	33				X	0					0				
3	22	33				X	33			X		0				
4	33	33				X	33			X		33			X	
5	44	66			X	X	33			X		33			X	
6	55	66			X	X	66			X	X	33			X	
7	66	66			X	X	66			X	X	66			X	X
8	77	100		X	X	X	66			X	X	66			X	X
9	88	100		X	X	X	100		X	X	X	66			X	X
10	100	100		X	X	X	100		X	X	X	100		X	X	X

LEGEND

MLC — Minimum Load Control

NOTES:
1. Total Cap. (Total Unit Capacity) and Cir. Cap. (Circuit Capacity) are approximate percentage values.
2. Example is to determine minimum load control, staged circuit loading, and automatic circuit select.

Table 17 — Compressor Stage and Circuit Cycling, Example 2

STAGE	TOTAL CAP.	CIRCUIT A					CIRCUIT B					CIRCUIT C				
		Cir. Cap.	MLC	A1	A2	A3	Cir. Cap.	MLC	B1	B2	B3	Cir. Cap.	MLC	C1	C2	C3
0	0	0					0					0				
1	8	24	X			X	0					0				
2	11	33				X	0					0				
3	22	66			X	X	0					0				
4	33	100		X	X	X	0					0				
5	44	100		X	X	X	33			X		0				
6	55	100		X	X	X	66			X	X	0				
7	66	100		X	X	X	100		X	X	X	0				
8	77	100		X	X	X	100		X	X	X	33				X
9	88	100		X	X	X	100		X	X	X	66			X	X
10	100	100		X	X	X	100		X	X	X	100		X	X	X

LEGEND

MLC — Minimum Load Control

NOTES:
1. Total Cap. (Total Unit Capacity) and Cir. Cap. (Circuit Capacity) are approximate percentage values.
2. Example is to determine minimum load control, staged circuit loading, and automatic circuit select.

In Example 3 (Table 18), assume the following configurations are in place:

***Configuration→UNIT→HGBP*=1** . . Minimum Load Control installed and enabled for Start-Up Only

***Configuration→OPTN→LOAD*=0** . . . Equal Circuit Loading

***Configuration→OPTN→LLCS*=2** . . . . . Circuit B Leads

Since Circuit B has been selected, it will be the lead circuit. Within the circuit, compressor B2 has the lowest wear factor and will start first with Minimum Load Control ON. The next stage will turn OFF the minimum load control. Stage 3 will start another circuit because of the Equal Circuit Loading configuration. Comparing Circuit A and C, the circuit with the lowest average wear factor is Circuit A, and the compressor with the lowest wear factor is A3. The next stage will be a circuit C compressor. The process continues until all compressors are ON. See Table 18.

In Example 4 (Table 19), assume the compressor starts and run hours are the same as in the first example and the following configurations are in place:

***Configuration→UNIT→HGBP*=1** . . Minimum Load Control installed and enabled for Start-Up Only

***Configuration→OPTN→LOAD*=1** . . Staged Circuit Loading

***Configuration→OPTN→LLCS*=3** . . . . . Circuit C Leads

Since Circuit C has been selected, it will be the lead circuit. Within the circuit, compressor C2 has the lowest wear factor and will start first with Minimum Load Control ON. The next stage will turn OFF the minimum load control. Stage 3 will start a compressor in the same circuit because of the Staged Circuit Loading configuration. Compressor C3 has the next lowest wear factor and will be started next. Compressor C1 will be next to start. Since all compressors in Circuit C are ON, the next stage will start another circuit. Of the remaining circuits, Circuit A has the lowest wear factor, and the compressor with the lowest wear factor is A3. All of the Circuit A compressors will be started in the same manner as Circuit C. Once all Circuit A compressors are ON, then Circuit B will be started. The process continues until all compressors are ON. See Table 19.

If the circuit capacity is to be reduced, the compressor with the highest wear factor will be shut off first (in most cases). With Equal Circuit Loading, stages will be removed from each circuit, following the same criteria used in the loading sequence, but in the opposite order. Shown in Table 19 based on the current wear factor in the opposite to the loading sequence shown above, the compressor with the highest wear factor will be removed first. When Staged Circuit Loading is selected, the capacity from the last lag circuit will be removed first.

Table 18 — Compressor Stage and Circuit Cycling, Example 3

STAGE	TOTAL CAP.	CIRCUIT A					CIRCUIT B					CIRCUIT C				
		Cir. Cap.	MLC	A1	A2	A3	Cir. Cap.	MLC	B1	B2	B3	Cir. Cap.	MLC	C1	C2	C3
0	0	0					0					0				
1	8	0	X				24	X		X		0				
2	11	0					33			X		0				
3	22	33				X	33			X		0				
4	33	33				X	33			X		33			X	
5	44	33				X	66			X	X	33			X	
6	55	66			X	X	66			X	X	33			X	
7	66	66			X	X	66			X	X	66			X	X
8	77	66			X	X	100		X	X	X	66			X	X
9	88	100		X	X	X	100		X	X	X	66			X	X
10	100	100		X	X	X	100		X	X	X	100		X	X	X

LEGEND

MLC — Minimum Load Control

NOTES:
1. Total Cap. (Total Unit Capacity) and Cir. Cap. (Circuit Capacity) are approximate percentage values.
2. Example is to determine minimum load control, staged circuit loading, and automatic circuit select.

Table 19 — Compressor Stage and Circuit Cycling, Example 4

STAGE	TOTAL CAP.	CIRCUIT A					CIRCUIT B					CIRCUIT C				
		Cir. Cap.	MLC	A1	A2	A3	Cir. Cap.	MLC	B1	B2	B3	Cir. Cap.	MLC	C1	C2	C3
0	0	0					0					0				
1	8	0					0					24	X			X
2	11	0					0					33				X
3	22	0					0					66			X	X
4	33	0					0					100		X	X	X
5	44	33				X	0					100		X	X	X
6	55	66			X	X	0					100		X	X	X
7	66	100		X	X	X	0					100		X	X	X
8	77	100		X	X	X	33			X		100		X	X	X
9	88	100		X	X	X	66			X	X	100		X	X	X
10	100	100		X	X	X	100		X	X	X	100		X	X	X

LEGEND

MLC — Minimum Load Control

NOTES:
1. Total Cap. (Total Unit Capacity) and Cir. Cap. (Circuit Capacity) are approximate percentage values.
2. Example is to determine minimum load control, staged circuit loading, and automatic circuit select.

The capacity control algorithm runs every 30 seconds. The algorithm attempts to maintain the Control Point at the desired set point. Each time it runs, the control reads the entering and leaving fluid temperatures. The control determines the rate at which conditions are changing and calculates 2 variables based on these conditions. Next, a capacity ratio (SM2) is calculated using the 2 variables to determine whether or not to make any changes to the current stages of capacity. This ratio value ranges from –100 to +100%. If the next stage of capacity is a compressor, the control starts (stops) a compressor when the ratio reaches +100% (–100%). If the next stage of capacity is the Minimum Load Control, the control energizes (deenergizes) the Minimum Load Control when the ratio reaches +60% (–60%). If installed, the minimum load valve solenoid will be energized with the first stage of capacity. The control will also use the minimum load valve solenoid as the last stage of capacity before turning off the last compressor. If the close control feature (***Configuration→UNIT→HGBP*=2**) is enabled the control will use the minimum load valve solenoid whenever possible to fine tune leaving fluid temperature control. A delay of 90 seconds occurs after each capacity step change with Minimum Load Control. A delay of 3 minutes occurs after each compressor capacity step change.

BRINE CHILLER OPERATION — For chiller sizes 120 to 390 with the factory-installed brine option, discharge and liquid line solenoids are added to all circuits (Circuit B only for size 120). The control system must be correctly configured for proper operation. The minimum load valve option must be enabled (***Configuration→UNIT→HGBP*=1**) and the fluid type must be set to medium temperature brine (***Configuration →SERV→FLUD*=2**). The Minimum Load Valve output is used to control the discharge and liquid line solenoid valves. As a result, Minimum Load Control (Hot Gas Bypass) cannot be utilized on brine duty chillers. The discharge and liquid line solenoid valves are wired in parallel so they will both open and close at the same time. The main function of the solenoid valves is to isolate a portion of the condenser section when only a single compressor is running to allow for proper oil return to the compressors. A chart showing solenoid operation is shown below:

CIRCUIT CAPACITY	DISCHARGE/LIQUID SOLENOID VALVE OPERATION
All compressors off	Solenoids energized
One compressor starting	Solenoids deenergized after 30-second delay
Two or more compressors running	Solenoids energized
Reduction from two to one compressor running	Solenoids deenergized with no delay

NOTE: Minimum load valve (HGBP) cannot be utilized if fluid type is set to medium temperature brine (***Configuration →SERV→FLUD*=2**).

CAPACITY CONTROL OVERRIDES — The following capacity control overrides (***Run Status→VIEW→CAP.S***) will modify the normal operation routine. If any of the following override conditions listed below is satisfied, it will determine the capacity change instead of the normal control.

Override #1: Cooler Freeze Protection — This override attempts to avoid the freeze protection alarm. If the Leaving Water Temperature is less than Brine Freeze Set Point (***Configuration→SERV→LOSP***) + 2.0° F (1.1° C) then remove a stage of capacity.

NOTE: The freeze set point is 34 F (1.1 C) for fresh water systems (***Configuration→SERV→FLUD*=1**). The freeze set point is Brine Freeze Set Point (***Configuration→SERV →LOSP***), for Medium Temperature Brine systems (***Configuration→SERV→FLUD*=2**).

Override #2: Circuit A Low Saturated Suction Temperature in Cooling
Override #3: Circuit B Low Saturated Suction Temperature in Cooling
Override #4: Circuit C Low Saturated Suction Temperature in Cooling — These overrides attempt to avoid the low suction temperature alarms. This override is active only when more than one compressor in a circuit is ON. If the Saturated Suction Temperature is less than Brine Freeze Set Point (***Configuration→SERV→LOSP***) –18.0 F (–10 C) for 90 seconds, or the Saturated Suction Temperature is less than –4 F (–20 C), a compressor in the affected circuit will be turned off.

Override #5: Low Temperature Cooling — This override removes one stage of capacity when the difference between the Control Point (***Run Status→VIEW→CTPT***) and the Leaving Water Temperature (***Run Status→VIEW→LWT***) reaches a predetermined limit and the rate of change of the water is 0 or still decreasing.

Override #6: Low Temperature Cooling — This override removes two stages of capacity when the Entering Water Temperature (***Run Status→VIEW→EWT***) is less than the Control Point (***Run Status→VIEW→CTPT***.)

Override #7: Ramp Loading — If the unit is configured for ramp loading (***Configuration→OPTN→RL.S*=ENBL**) and if the difference between the Leaving Water Temperature and the Control Point is greater than 4º F (2.2º C) and the rate of change of the leaving water is greater than Cool Ramp Loading Rate (***Setpoints→COOL→CRMP***) then no capacity stage increase will be made. Operating mode 5 (MD05) will be in effect.

Override #8: Service Manual Test Override — The manual test consists in adding a stage of capacity every 30 seconds, until the control enables all of the requested compressors and Minimum Load Control selected in the *Comfort*Link™ display Service Test menu. All safeties and higher priority overrides are monitored and acted upon.

Override # 9: Demand Limit — This override mode is active when a command to limit the capacity is received. If the current unit capacity is greater than the active capacity limit value, a stage is removed. If the current capacity is lower than the capacity limit value, the control will not add a stage that will result in the new capacity being greater then the capacity limit value. Operating mode 4 (MD04) will be in effect.

Override #10: Cooler Interlock Override — This override prohibits compressor operation until the Cooler Interlock (***Inputs→GEN.I→LOCK***) is closed.

Override #11: High Temperature Cooling — This override algorithm runs once when the unit is switched to ON. If the difference between the Leaving Water Temperature (***Run Status →VIEW→LWT***) and the Control Point (***Run Status →VIEW→CTPT***) exceeds a calculated value and the rate of change of the water temperature is greater than –0.1º F/min, a stage will be added.

Override #12: High Temperature Cooling — This override runs only when Minimum Load Control is Enabled (***Configuration→UNIT→HGBP* = 1**, **2** or **3**). This override will add a stage of capacity if the next stage is Minimum Load Control, when the difference between the Leaving Water Temperature (***Run Status→VIEW→LWT***) and the Control Point (***Run Status→VIEW→CTPT***) exceeds a calculated value and the rate of change of the water temperature is greater than a fixed value.

Override #13: Minimum On/Off and Off/On Time Delay — Whenever a capacity step change has been made, either with Minimum Load Control or a compressor, the control will remain at this capacity stage for the next 90 seconds. During this time, no capacity control algorithm calculations will be made. If the capacity step is a compressor, an additional 90-second delay is added to the previous hold time (see Override #22). This override allows the system to stabilize before another capacity stage is added or removed. If a condition of a higher priority override occurs, the higher priority override will take precedence.

Override #14: Slow Change Override — This override prevents compressor stage changes when the leaving temperature is close to the control point and slowly moving towards the control point.

Override #15: System Manager Capacity Control — If a Chillervisor module is controlling the unit and the Chillervisor module is controlling multiple chillers, the unit will add a stage to attempt to load to the demand limited value.

Override #16: Circuit A High Pressure Override
Override #17: Circuit B High Pressure Override
Override #18: Circuit C High Pressure Override — This override attempts to avoid a high pressure failure. The algorithm is run every 4 seconds. At least one compressor must be on in the circuit. If the Saturated Condensing Temperature for the circuit is above the High Pressure Threshold (***Configuration→ SERV→HP.TH***) then a compressor for that circuit will be removed. If Minimum Load Control was enabled for High Ambient (***Configuration→UNIT→HGBP*=3**), then the Minimum Control Valve will be energized.

Override #19: Standby Mode — This override algorithm will not allow a compressor to run if the unit is in Standby mode, (***Run Status→VIEW→HC.ST*=2**).

Override #22: Minimum On Time Delay — In addition to Override #13 Minimum On/Off and Off/On Time Delay, for compressor capacity changes, an *additional* 90-second delay will be added to Override #13 delay. No compressor will be deenergized until 3 minutes have elapsed since the last compressor has been turned ON. When this override is active, the capacity control algorithm calculations will be performed, but no capacity reduction will be made until the timer has expired. A control with higher precedence will override the Minimum On Time Delay.

Override #23: Circuit A Low Saturated Suction Temperature in Cooling
Override #24: Circuit B Low Saturated Suction Temperature in Cooling
Override #25: Circuit C Low Saturated Suction Temperature in Cooling — If the circuit is operating in an area close to the operational limit of the compressor, the circuit capacity will remain at the same point or unload to raise the saturated suction temperature. This algorithm will be active if at least one compressor in the circuit is on and one of the following conditions is true:

1. Saturated Suction Temperature is less than Brine Freeze (***Configuration→SERV→LOSP***) – 6º F (3.3º C).
2. Saturated Suction Temperature is less than Brine Freeze (***Configuration→SERV→LOSP***) and the circuit approach (Leaving Water Temperature – Saturated Suction Temperature) is greater than 15º F (8.3º C) and the Circuit

Superheat (Return Gas Temperature – Saturated Suction Temperature) is greater than 15º F (8.3º C).

NOTE: The freeze set point is 34 F (1.1 C) for fresh water systems (***Configuration→SERV→FLUD*=1**). The freeze set point is Brine Freeze Set Point (***Configuration →SERV→LOSP***), for Medium Temperature Brine systems (***Configuration→SERV→FLUD*=2**).

If any of these conditions are met, the appropriate operating mode, 21 (Circuit A), 22 (Circuit B) or 23 (Circuit C) will be in effect.

Override #26: Circuit A Operation Outside Compressor Operating Envelope
Override #27: Circuit B Operation Outside Compressor operating envelope
Override #28: Circuit C Operation Outside Compressor Operating Envelope — This override prevents compressor operation outside of its operating envelope.

1. If the mean saturated discharge temperature (SDT) is greater than 7° F over the limit, the circuit is unloaded immediately.
2. If the mean SDT is over the limit (but not greater than 7° F over the limit) for 90 seconds, then the circuit is unloaded.
3. If the mean SDT is more than the limit minus 2° F, the circuit is prevented from loading. This override shall remain active until the mean pressure goes below the limit minus 3° F.

Override #34: Circuit A Low Refrigerant Charge
Override #35: Circuit B Low Refrigerant Charge
Override #36: Circuit C Low Refrigerant Charge — The capacity override attempts to protect the compressor from starting with no refrigerant in the circuit. This algorithm runs only when the circuit is not operational, (no compressors ON). There are several criteria that will enable this override:

1. The Saturated Suction Temperature or Saturated Discharge Temperature is less than –13 F (–10.6 C).
2. All of these conditions must be true:
   a. The Saturated Suction Temperature or Saturated Discharge Temperature is less than Leaving Water Temperature by more than 5.4º F (3.0º C).
   b. Saturated Suction Temperature or Saturated Discharge Temperature is less than 41 F (5 C).
   c. Outdoor Air Temperature is less than 32 F (0º C).
   d. Saturated Suction Temperature or Saturated Discharge Temperature is less than the Outdoor Air Temperature by more than 5.4º F (3.0º C).
3. All of these conditions must be true:
   a. The Saturated Suction Temperature or Saturated Discharge Temperature is less than Leaving Water Temperature by more than 5.4º F (3.0º C).
   b. Saturated Suction Temperature or Saturated Discharge Temperature is less than 41 F (5 C).
   c. Saturated Suction Temperature or Saturated Discharge Temperature is less than the Brine Freeze Point (***Configuration→SERV→LOSP***) by more than 6º F (3.3º C).

   NOTE: The freeze set point is 34 F (1.1 C) for fresh water systems (***Configuration→ SERV→FLUD*=1**). The freeze set point is Brine Freeze Set Point (***Configuration→SERV→ LOSP***), for Medium Temperature Brine systems (***Configuration→SERV→FLUD*=2**).
4. All of these conditions must be true:
   a. The Saturated Suction Temperature or Saturated Discharge Temperature is less than Leaving Water Temperature by more than 5.4º F (3.0º C).
   b. Saturated Suction Temperature or Saturated Discharge Temperature is less than 41 F (5 C).
   c. Saturated Suction Temperature or Saturated Discharge Temperature is less than the Outdoor Air Temperature by more than 9º F (5º C).

If any of these conditions 1, 2, 3 or 4 are met, the appropriate operating mode, 21 (Circuit A), 22 (Circuit B) or 23 (Circuit C) will be in effect.

Override #37: Circuit A Low Superheat
Override #38: Circuit B Low Superheat
Override #39: Circuit C Low Superheat — This override attempts to avoid liquid slugging for the running compressors. It also protects against operation with excessively high superheat. No capacity steps will be added to the affected circuit until there is a superheat greater than 5º F (2.8º C) and less than 45º F (25º C). If the capacity of the machine must be increased, the control will look to another circuit for additional capacity.

Head Pressure Control — The main base board (MBB) controls the condenser fans to maintain the lowest condensing temperature possible, and thus the highest unit efficiency. The MBB uses the saturated condensing temperature input from the discharge pressure transducer to control the fans. Head pressure control is maintained through a calculated set point which is automatically adjusted based on actual saturated condensing and saturated suction temperatures so that the compressor(s) is (are) always operating within the manufacturer's specified envelope (see Fig. 11). Each time a fan is added the calculated head pressure set point will be raised 25° F (13.9° C) for 35 seconds to allow the system to stabilize. The control will automatically reduce the unit capacity as the saturated condensing temperature approaches an upper limit. See capacity overrides 16-18. The control will indicate through an operating mode that high ambient unloading is in effect. If the saturated condensing temperature in a circuit exceeds the calculated maximum, the circuit will be stopped. For these reasons, there are no head pressure control methods or set points to enter. The control will turn off a fan stage when the condensing temperature is below the minimum head pressure requirement for the compressor. Fan sequences are shown in Fig. 12.

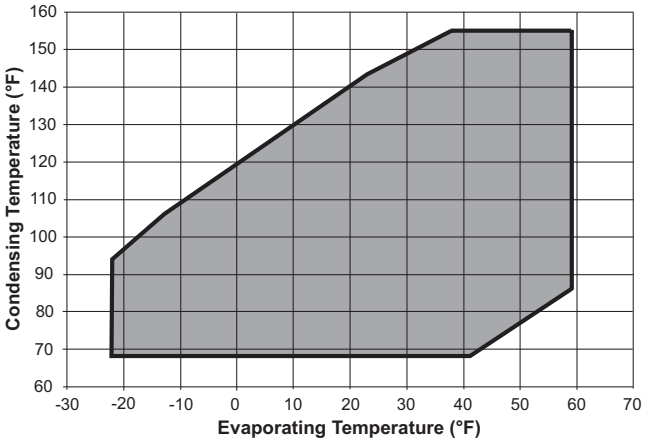


Fig. 11 — Compressor Operating Envelope

LOW AMBIENT TEMPERATURE HEAD PRESSURE CONTROL OPTION — For low-ambient operation, the lead fan on a circuit can be equipped with low ambient temperature head pressure control option or accessory. The controller adjusts fan speed to maintain the calculated head pressure set point.

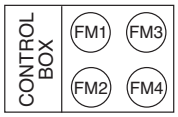
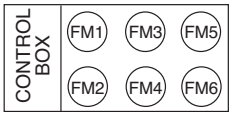
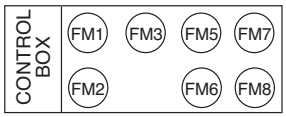
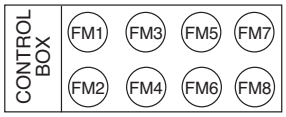
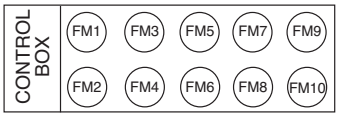
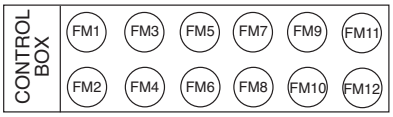
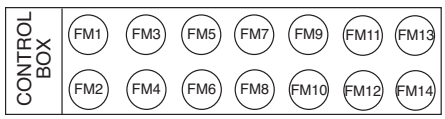
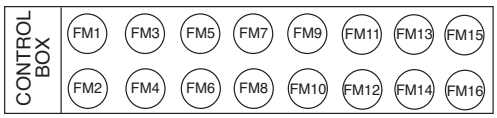
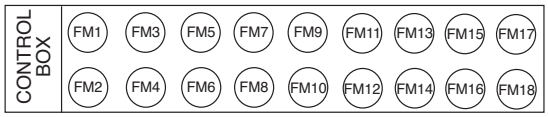
	MODEL	CIRCUIT	LOCATION	FAN STAGE					
				1	2	3	4	5	6
 30RB060,070,080	060,070	A	Fan Number	FM1	FM2	FM3	—	—	—
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	—	—	—
		B	Fan Number	FM4	—	—	—	—	—
			Fan Board/Channel	FB1/CH5	—	—	—	—	—
	080	A	Fan Number	FM1	FM2	—	—	—	—
			Fan Board/Channel	FB1/CH1	FB1/CH2	—	—	—	—
		B	Fan Number	FM3	FM4	—	—	—	—
			Fan Board/Channel	FB1/CH5	FB1/CH6	—	—	—	—
 30RB090,100,110	090,100, 110	A	Fan Number	FM1	FM2	FM3	—	—	—
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	—	—	—
		B	Fan Number	FM5	FM6	FM4	—	—	—
			Fan Board/Channel	FB1/CH5	FB1/CH6	FB1/CH7	—	—	—
 30RB120	120	A	Fan Number	FM3	FM1	FM2	—	—	—
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	—	—	—
		B	Fan Number	FM7	FM5	FM6	FM8	—	—
			Fan Board/Channel	FB1/CH5	FB1/CH6	FB1/CH7	FB1/CH8	—	—
 30RB130,150	130,150	A	Fan Number	FM3	FM1	FM2	FM4	—	—
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	FB1/CH4	—	—
		B	Fan Number	FM7	FM5	FM6	FM8	—	—
			Fan Board/Channel	FB1/CH5	FB1/CH6	FB1/CH7	FB1/CH8	—	—
 30RB160,170	160,170	A	Fan Number	FM5	FM3	FM1	FM2	FM4	FM6
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	FB1/CH4	FB1/CH5	FB1/CH6
		B	Fan Number	FM9	FM7	FM8	FM10	—	—
			Fan Board/Channel	FB2/CH1	FB2/CH2	FB2/CH3	FB2/CH4	—	—
 30RB190,210,225	190	A	Fan Number	FM5	FM3	FM1	FM2	FM4	FM6
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	FB1/CH4	FB1/CH5	FB1/CH6
		B	Fan Number	FM11	FM9	FM7	FM8	FM10	FM12
			Fan Board/Channel	FB2/CH1	FB2/CH2	FB2/CH3	FB2/CH4	FB2/CH5	FB2/CH6
	210,225	A	Fan Number	FM3	FM1	FM2	FM4	—	—
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	FB1/CH4	—	—
		B	Fan Number	FM7	FM5	FM6	FM8	—	—
			Fan Board/Channel	FB1/CH5	FB1/CH6	FB1/CH7	FB1/CH8	—	—
		C	Fan Number	FM11	FM9	FM10	FM12	—	—
			Fan Board/Channel	FB3/CH1	FB3/CH2	FB3/CH3	FB3/CH4	—	—
 30RB250	250	A	Fan Number	FM3	FM1	FM2	FM4	—	—
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	FB1/CH4	—	—
		B	Fan Number	FM7	FM5	FM6	FM8	—	—
			Fan Board/Channel	FB1/CH5	FB1/CH6	FB1/CH7	FB1/CH8	—	—
		C	Fan Number	FM13	FM11	FM9	FM10	FM12	FM14
			Fan Board/Channel	FB3/CH1	FB3/CH2	FB3/CH3	FB3/CH4	FB3/CH5	FB3/CH6
 30RB275	275	A	Fan Number	FM5	FM3	FM1	FM2	FM4	FM6
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	FB1/CH4	FB1/CH5	FB1/CH6
		B	Fan Number	FM11	FM9	FM7	FM8	FM10	FM12
			Fan Board/Channel	FB2/CH1	FB2/CH2	FB2/CH3	FB2/CH4	FB2/CH5	FB2/CH6
		C	Fan Number	FM15	FM13	FM14	FM16	—	—
			Fan Board/Channel	FB3/CH1	FB3/CH2	FB3/CH3	FB3/CH4	—	—
 30RB300	300	A	Fan Number	FM5	FM3	FM1	FM2	FM4	FM6
			Fan Board/Channel	FB1/CH1	FB1/CH2	FB1/CH3	FB1/CH4	FB1/CH5	FB1/CH6
		B	Fan Number	FM11	FM9	FM7	FM8	FM10	FM12
			Fan Board/Channel	FB2/CH1	FB2/CH2	FB2/CH3	FB2/CH4	FB2/CH5	FB2/CH6
		C	Fan Number	FM17	FM15	FM13	FM14	FM16	FM18
			Fan Board/Channel	FB3/CH1	FB3/CH2	FB3/CH3	FB3/CH4	FB3/CH5	FB3/CH6

Fig. 12 — Condenser Fan Staging

LOW AMBIENT TEMPERATURE HEAD PRESSURE CONTROL OPERATING INSTRUCTIONS — The 30RB low ambient control is a variable speed drive (VFD) that varies the speed of the lead condenser fan in each circuit to maintain the calculated head pressure control set point. The fan speed varies in proportion to the 0 to 10 vdc analog signal produced by the AUX1 fan board. The display indicates motor speed in Hz by default. There are two different VFDs used for these units, a Siemens Micromaster 420/440 and a Schneider Altivar 21. The Schneider Altivar VFD performs the same functions as Siemens drive. However, there are different control wiring connections and parameter programming.

Siemens VFD Operation — The low ambient temperature head pressure controller is pre-configured to operate from a 0 to 10 vdc analog input signal present on terminals 3 (AIN+) and 4 (AIN–). Jumpers between terminals 2 and 4 and terminals 5 and 8 are required for proper operation. The drive is enabled based on an increase in the analog input signal above 0 vdc. Output is varied from 0 Hz to 60 Hz as the analog signal increases from 0 vdc to 10 vdc. When the signal is at 0 vdc the drive holds the fan at 0 rpm. The head pressure control set point is not adjustable. The MBB determines the control set point as required.

Siemens VFD Replacement — If the controller is replaced the parameters in Table 20 must be configured. See Fig. 13 and 14.

Table 20 — Siemens VFD Head Pressure Control Parameters

PARAMETER*	VALUE	DESCRIPTION
P0010	1	Enter Quick Commissioning
P0311	1140	Rated Motor Speed
P3900	1	End of Quick Commissioning
P0003	3	User Access Level
P0757	0.50	Control Signal Scaling Offset
P0761	0.50	Control Signal Scaling Offset
P1210	6	Automatic Restart Setting
P1310	10	Continuous Boost Parameter

*Remove jumper from terminals 5 and 8 (or terminals 5 and 9 for 575-v units) before configuring parameter. Reinstall jumper after configuration is complete.

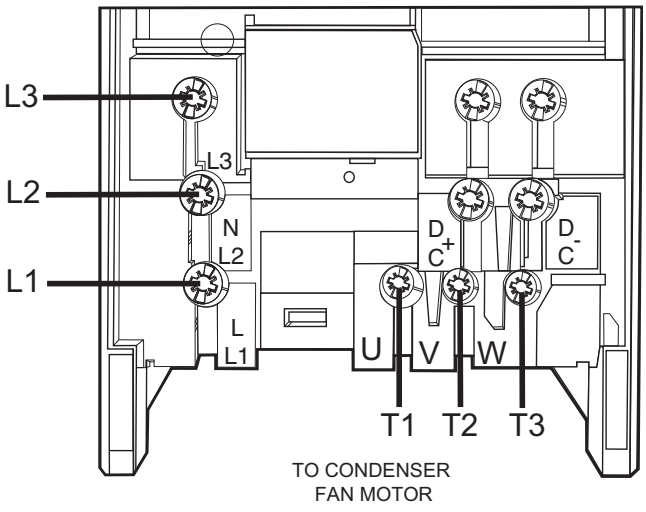
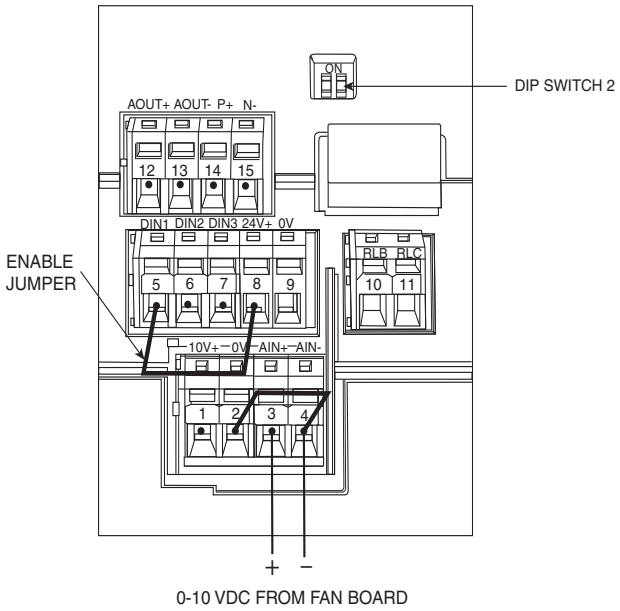


Fig. 13 — Low Ambient Temperature Control Power Wiring



NOTE: For 575-v units, jumper terminals are 5 and 9.

Fig. 14 — Low Ambient Temperature Control Signal Wiring

DIP switch settings:

DIP switch 1 is not used.

DIP switch 2 is the motor frequency. (OFF = 50 Hz, ON = 60 Hz)

Siemens VFD Programming — Parameter values can be altered via the operator panel. The operator panel features a five-digit, seven-segment display for displaying parameter numbers and values, alarm and fault messages, set points, and actual values. See Fig. 15. See Table 21 for additional information on the operator panel.

NOTE: The operator panel motor control functions are disabled by default. To control the motor via the operator panel, parameter P0700 should be set to 1 and P1000 set to 1. The operator panel can be fitted to and removed from the drive while power is applied. If the operator panel has been set as the I/O control (P0700 = 1), the drive will stop if the operator panel is removed.

Fig. 15 — Siemens VFD Low Ambient Temperature Controller

Changing Single Digits in Parameter Values with the Siemens VFD Operator Panel — For changing the parameters value rapidly, the single digits of the display can be changed by performing the following actions:

Ensure the operator panel is in the parameter value changing level as described in the Changing Parameters with the Operator Panel section.

1. Press Fn (function button), which causes the farthest right digit to blink.

2. Change the value of this digit by pressing ▲ or ▼ .
3. Pressing Fn (function button) again to cause the next digit to blink.
4. Perform steps 2 to 4 until the required value is displayed.
5. Press P (parameter button) to exit the parameter value changing level.

NOTE: The function button may also be used to acknowledge a fault condition.

Quick Commissioning with the Siemens VFD Operator Panel (P0010=1) — It is **important** that parameter P0010 is used for commissioning and P0003 is used to select the number of parameters to be accessed. The P0010 parameter allows a group of parameters to be selected that will enable quick commissioning. Parameters such as motor settings and ramp settings are included. At the end of the quick commissioning sequences, P3900 should be selected, which, when set to 1, will carry out the necessary motor calculations and clear all other parameters (not included in P0010=1 to the default settings. This will only occur in Quick Commissioning mode. See Fig. 16.

Reset the Siemens VFD to Factory Default — To reset all parameters to the factory default settings; the following parameters should be set as follows:

1. Set P0010=30.
2. Set P0970 =1.

NOTE: The reset process can take up to 3 minutes to complete.

Troubleshooting the Siemens VFD with the Operating Panel — Warnings and faults are displayed on the operating panel with Axxx and Fxxx. The individual messages are shown in Table 22.

If the motor fails to start, check the following:

- Power is present on T1, T2 and T3.
- Configuration jumpers are in place.
- Control signal between 1 vdc and 10 vdc is present on terminals 3 and 4.
- P0010 = 0.
- P0700 = 2.

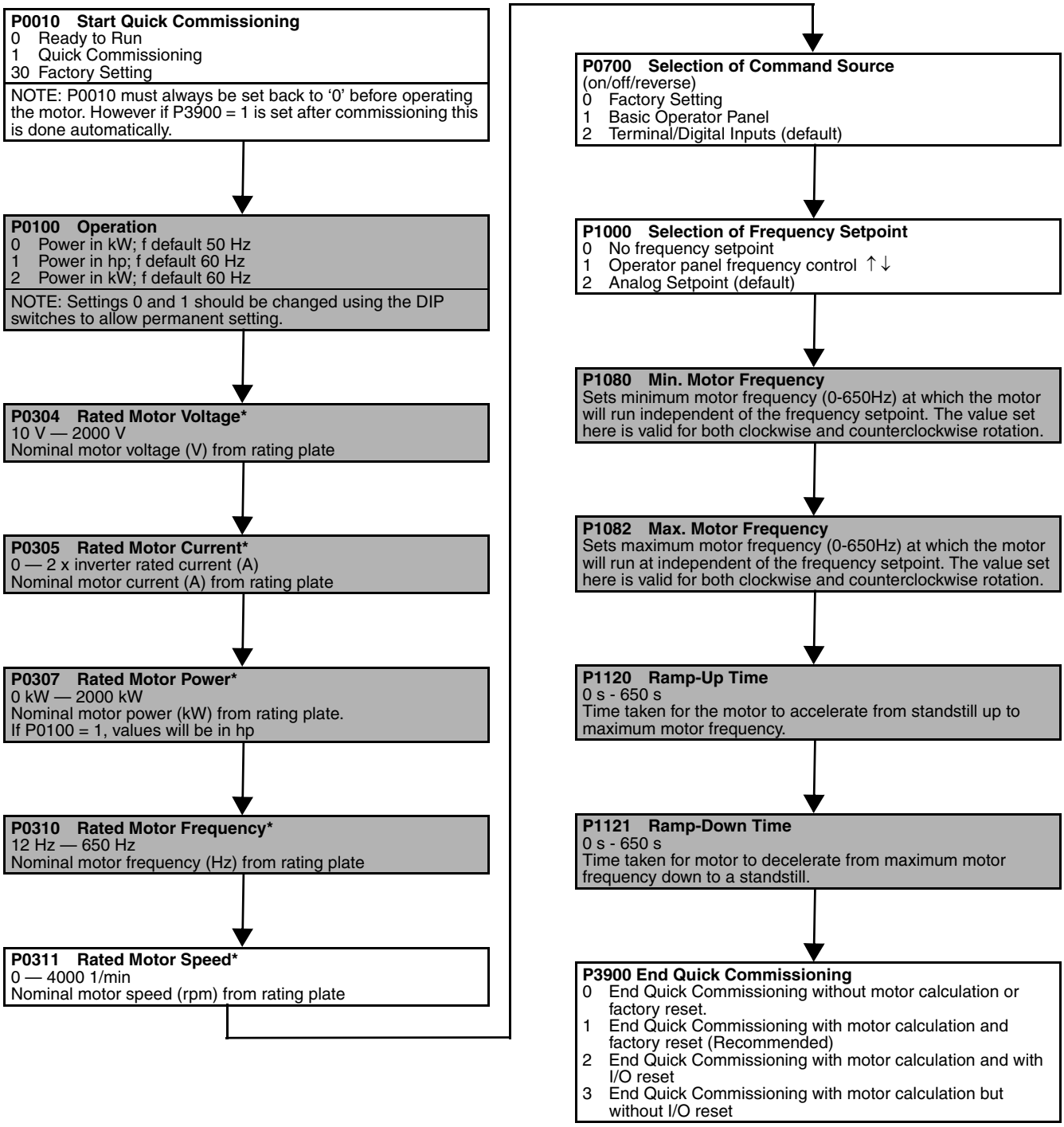
Siemens VFD Fault Messages (Tables 22 and 23) — In the event of a failure, the drive switches off and a fault code appears on the display.

NOTE: To reset the fault code, one of the following methods can be used:

1. Cycle the power to the drive.
2. Press the Fn button on the operator panel.

Table 21 — Siemens VFD Low Ambient Temperature Controller Operator Panel

PANEL/BUTTON	FUNCTION	DESCRIPTION
r0000	Indicates Status	The LCD displays the settings currently used by the converter.
I	Start Converter	The Start Converter button is disabled by default. To enable this button set P0700 = 1.
0	Stop Converter	Press the Stop Converter button to cause the motor to come to a standstill at the selected ramp down rate. Disabled by default, to enable set P0700 = 1. Press the Stop Converter button twice (or hold) to cause the motor to coast to a standstill. This function is always enabled.
↶	Change Direction	Press the Change Direction button to change the direction of rotation of the motor. Reverse is indicated by a minus (–) sign or a flashing decimal point. Disabled by default, to enable set P0700 = 1.
jog	Jog Motor	Press the Jog Motor button while the inverter has no output to cause the motor to start and run at the preset jog frequency. The motor stops when the button is released. The Jog Motor button is not enabled when the motor is running.
Fn	Functions	The Functions button can be used to view additional information. Press and hold the button to display the following information starting from any parameter during operation: 1. DC link voltage (indicated by d – units V). 2. Output current. (A) 3. Output frequency (Hz) 4. Output voltage (indicated by o – units V). 5. The value selected in P0005 (If P0005 is set to show any of the above [3, 4, or 5] then this will not be shown when toggling through the menu). Press the Functions button repeatedly to toggle through displayed values. **Jump Function** Press of the Fn button from any parameter (rXXXX or PXXXX) to immediately jump to R0000, when another parameter can be changed, if required. Return to R0000 and press the Functions again to return.
P	Access Parameters	Allows access to the parameters.
▲	Increase Value	Press the Increase Value button to increase the displayed value. To change the Frequency Setpoint using the operator panel set P1000 = 1.
▼	Decrease Value	Press the Decrease Value button to decrease the displayed value. To change the Frequency Setpoint using the operating panel set P1000 = 1.



*Motor-specific parameters — see motor rating plate.

NOTE: Shaded boxes are for reference only.

Fig. 16 — Siemens VFD Low Ambient Temperature Controller Flow Chart Quick Commissioning

Table 22 — Siemens VFD Low Ambient Temperature Controller Fault Messages

FAULT	POSSIBLE CAUSES	TROUBLESHOOTING
F0001 Overcurrent	• Motor power does not correspond to the inverter power • Motor lead short circuit • Ground fault	Check the following: 1. Motor power (P0307) must correspond to inverter power (P0206) 2. Motor cable and motor must have no short-circuits or ground faults 3. Motor parameters must match the motor in use 4. Motor must not be obstructed or overloaded After Steps 1-4 have been checked, increase the ramp time (P1120) and reduce the boost level (P1310, P1311, P1312).
F0002 Overvoltage	• DC-link voltage (r0026) exceeds trip level (P2172) • Overvoltage can be caused either by too high main supply voltage or if motor is in regenerative mode • Regenerative mode can be caused by fast ramp downs or if the motor is driven from an active load	Check the following: 1. Supply voltage (P0210) must lie within limits indicated on rating plate 2. DC-link voltage controller must be enabled (P1240) and have parameters set correctly 3. Ramp-down time (P1121) must match inertia of load
F0003 Undervoltage	• Main supply failed • Shock load outside specified limits	Check the following: 1. Supply voltage (P0210) must lie within limits indicated on rating plate 2. Supply must not be susceptible to temporary failures or voltage reductions
F0004 Drive Overtemperature	• Ambient temperature outside of limits • Fan failure	Check the following: 1. Fan must turn when inverter is running 2. Pulse frequency must be set to default value 3. Air inlet and outlet points are not obstructed 4. Ambient temperature could be higher than specified for the drive.
F0005 Drive I^2t	• Drive overloaded • Duty cycle too demanding • Motor power (P0307) exceeds drive power capability (P0206)	Check the following: 1. Load duty cycle must lie within specified limits 2. Motor power (P0307) must match drive power (P0206)
F0011 Motor Overtemperature I^2t	• Motor overloaded • Motor data incorrect • Long time period operating at low speeds	1. Check motor data 2. Check loading on motor 3. Boost settings too high (P1310, P1311, P1312) 4. Check parameter for motor thermal time constant 5. Check parameter for motor I^2t warning level
F0041 Stator Resistance Measurement Failure	Stator resistance measurement failure	1. Check if the motor is connected to the drive 2. Check that the motor data has been entered correctly
F0051 Parameter EEPROM Fault	Reading or writing of the non-volatile parameter storage has failed	1. Factory reset and new parameters set 2. Replace drive
F0052 Powerstack Fault	Reading of the powerstack information has failed or the data is invalid	Replace drive
F0060 Asic Timeout	Internal communications failure	1. Acknowledge fault 2. Replace drive if repeated
F0070 Communications Board Setpoint Error	No setpoint received from communications board during telegram off time	1. Check connections to the communications board 2. Check the master
F0071 No Data for USS (RS232 Link) During Telegram Off Time	No response during telegram off time via USS (BOP link)	1. Check connections to the communications board 2. Check the master
F0072 No Data from USS (RS485 Link) During Telegram Off Time	No response during telegram off time via USS (COM link)	1. Check connections to the communications board 2. Check the master
F0080 Analog Input - Lost Input Signal	• Broken wire • Signal out of limits	Check connection to analog input
F0085 External Fault	External fault is triggered via terminal inputs	Disable terminal input for fault trigger
F0101 Stack Overflow	Software error or processor failure	1. Run self test routines 2. Replace drive
F0221 PI Feedback Below Minimum Value	PID Feedback below minimum value P2268	1. Change value of P2268 2. Adjust feedback gain
F0222 PI Feedback Above Maximum Value	PID Feedback above maximum value P2267	1. Change value of P2267 2. Adjust feedback gain
F0450 (Service Mode Only) BIST Tests Failure	Fault value 1 Some of the power section tests have failed 2 Some of the control board tests have failed 4 Some of the functional tests have failed 8 Some of the IO module tests have failed 16 The Internal RAM has failed its check on power-up	1. Inverter may run but certain actions will not function correctly 2. Replace drive

LEGEND

I^2t — Current Squared Time

Table 23 — Siemens VFD Alarm Messages

FAULT	POSSIBLE CAUSES	TROUBLESHOOTING
A0501 Current Limit	• Motor power does not correspond to the drive power • Motor leads are too short • Ground fault	1. Check whether the motor power corresponds to the drive power 2. Check that the cable length limits have not been exceeded 3. Check motor cable and motor for short-circuits and ground faults 4. Check whether the motor parameters correspond with the motor being used 5. Check the stator resistance 6. Increase the ramp-up-time 7. Reduce the boost 8. Check whether the motor is obstructed or overloaded
A0502 Overvoltage Limit	• Mains supply too high • Load regenerative • Ramp-down time too short	1. Check that mains supply voltage is within allowable range 2. Increase ramp down times NOTE: If the vdc-max controller is active, ramp-down times will be automatically increased
A0503 Undervoltage Limit	• Mains supply too low • Short mains interruption	Check main supply voltage (P0210)
A0504 Drive Overtemperature	Warning level of inverter heat-sink temperature (P0614) is exceeded, resulting in pulse frequency reduction and/or output frequency reduction depending on parameters set (P0610)	1. Check if ambient temperature is within specified limits 2. Check load conditions and duty cycle 3. Check if fan is turning when drive is running
A0505 Drive I^2t	Warning level is exceeded; current will be reduced if parameters set (P0610 = 1)	Check if duty cycle is within specified limits
A0506 Drive Duty Cycle	Heatsink temperature and thermal junction model are outside of allowable range	Check if duty cycle is within specified limits
A0511 Motor Overtemperature I^2t	Motor overloaded	Check the following: 1. P0611 (motor I^2t time constant) should be set to appropriate value 2. P0614 (Motor I^2t overload warning level) should be set to suitable level 3. Are long periods of operation at low speed occurring 4. Check that boost settings are not too high
A0541 Motor Data Identification Active	Motor data identification (P1910) selected or running	Wait until motor identification is finished
A0600 RTOS Overrun Warning	Software error	—

LEGEND

I^2t — Current Squared Time

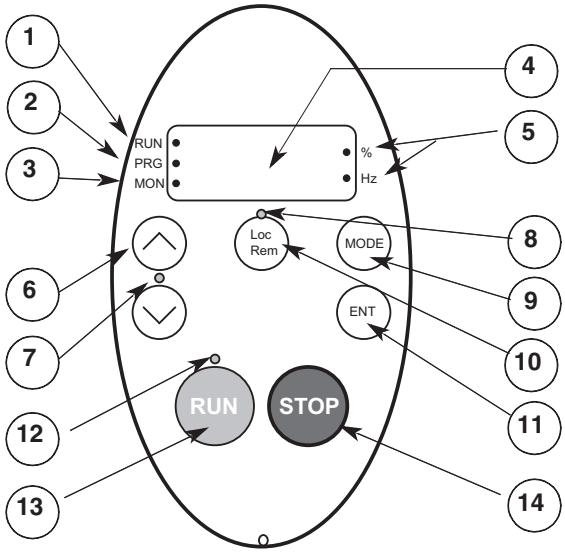
Schneider Altivar VFD Operation — The low ambient temperature head pressure controller is pre-configured to operate from a 0 to 10 vdc analog input signal present on terminals AI1 and COM. A jumper between terminals 24V and LI1 is required for proper operation. The drive is enabled based on an increase in the analog input signal above 0 vdc. Output is varied from 0 Hz to 60 Hz as the analog signal increases from 0 vdc to 10 vdc. When the signal is at 0 vdc the drive holds the fan at 0 rpm. The head pressure control set point is not adjustable. The MBB determines the control set point as required. The operating panel is shown in Fig. 17. Refer to the Quick Start Guide for how to access the programming mode, or the documentation on CD-ROM (shipped with each VFD) for a complete set of VFD parameters, fault codes and troubleshooting information.

Schneider Altivar VFD Replacement — For Altivar 21 VFDs, if the controller is replaced the parameters in Table 24 must be configured. It is recommended that the configuration of the VFD is verified per Table 24 prior to proceeding. Also, the following must be wired:

1. A jumper must be in place from terminal P24 to F.
2. Connect the red and black wires from fan board 0-10 VDC output to terminal VIA and CC respectively.
3. Connect the motor power wires T1, T2 and T3 respectively to terminal U/T1, V/T2 and W/T3 of the drive.
4. Connect the line power wires L1, L2 and L3 from control box respectively to terminal R/L1, S/L2 and T/L3 of the drive.

Table 24 — Schnieder Altivar 21 VFD Operating Parameters

PARAMETER	NAME	VALUE
uLu	Rated Motor Voltage	Nominal motor voltage(V) from rating plate
F201	VIA Speed Reference Level 1	5
F202	VIA Output Frequency Level 1	0
F203	VIA Speed Reference Level 2	100
F204	VIA Output Frequency Level 2	60
F401	Slip compensation	60%
F415	Rated Motor Current	Nominal motor current(A) from rating plate
F417	Rated Motor Speed	Nominal motor speed(RPM) from rating plate
F701	Keypad display: % or A/V	1
tHr	Motor Rated Current Overload Setting	Nominal motor current(A) from rating plate
uL	Rated Motor Frequency	60 Hz
FH	Maximum Frequency	60 Hz
LL	Low Speed	0 Hz
UL	High Speed	60 Hz
ACC	Ramp-up Time	10 Sec
dEC	Ramp-down Time	10 Sec
cnod	Remote Mode Start/Stop Control	0 (Control terminal logic inputs)
fnod	Remote Mode Primary Speed reference Source	1 (VIA)



CALL OUT	LED/KEY	DESCRIPTION
1	Display RUN LED	Illuminates when a run command is applied to the drive controller. Flashes when a speed reference is present with the run command.
2	Display PRG LED	Illuminates when Programming mode is active. Flashes when -GrU menus are active.
3	Display MON LED	Illuminates when Monitoring mode is active. Flashes in fault record display mode.
4	Display Unit	4 digits, 7 segments
5	Display Unit LED	The % LED illuminates when a displayed numeric value is a percentage. The Hz LED illuminates when a displayed numeric value is in hertz.
6	Up/Down arrows	Depending on the mode, use the arrows to: navigate between the menus, change a value, or change the speed reference when Up/Down LED (7) is lit.
7	Up/Down LED	Illuminates when the Up/Down arrows are controlling the speed reference.
8	Loc/Rem LED	Illuminates when Local mode is selected.

CALL OUT	LED/KEY	DESCRIPTION
9	MODE	Press to select the Keypad mode. Modes are: Run mode (default on power-up), Programming mode, and Monitoring mode. Can also be used to go back to the previous menu.
10	Loc/Rem	Switches between Local and Remote modes.
11	ENT	Press to display a parameter's value or to save a changed value.
12	RUN LED	Illuminates when the Run key is enabled.
13	RUN	Pressing this key when the RUN LED is illuminated starts the drive controller.
14	STOP	Stop/reset key. In Local mode, pressing the STOP key causes the drive controller to stop based on the setting of parameter F721. In Remote mode, pressing the STOP key causes the drive controller to stop based on the setting of parameter F603. The display will indicate a flashing "E". If F735 is set to 0 (default setting), pressing the stop key twice will reset all resettable faults if the fault condition has been resolved.

Fig. 17 — Schnieder Altivar 21 VFD Display Panel

Cooler Pump Control (*Configuration→OPTN→PUMP*) — The 30RB units can be configured for cooler pump control. Cooler Pumps Sequence is the variable that must be confirmed in the field. Proper configuration of the cooler pump control is required to provide reliable chiller operation. The factory default setting for Cooler Pumps Sequence is ***PUMP*=0** (No Pump), for units without the factory-installed hydronic package. For units with the hydronic package, the factory default setting for Cooler Pumps Sequence is ***PUMP*=1** (1 pump only) for single pump units, or ***PUMP*=2** (2 pumps auto) for dual pump units. For dual pump hydronic option units, three control options exist. If the Cooler Pumps Sequence (***PUMP***) is set to 2, the control will start the pumps and automatically alternate the operation of the pumps to even the wear of the pumps. If a flow failure is detected, the other pump will attempt to start. Two manual control options also exist. When the Cooler Pumps Sequence is set to ***PUMP*=3** Cooler Pump 1 will always operate. When the Cooler Pumps Sequence is set to ***PUMP*=4** Cooler Pump 2 will always operate.

It is recommended for all chillers that the cooler pump control be utilized unless the chilled water pump runs continuously or the chilled water system contains a suitable concentration of antifreeze solution. When the Cooler Pumps Sequence is configured, the cooler pump output will be energized when the chiller enters an "ON" mode. The cooler pump output is also energized when certain alarms are generated. The cooler pump output should be used as an override to the external pump control if cooler pump control is not utilized. The cooler pump output is energized if a P.01 Water Exchanger Freeze Protection alarm is generated, which provides additional freeze protection if the system is not protected with a suitable antifreeze solution.

For all Cooler Pumps Sequence (***PUMP***) settings (including 0), closure of both the chilled water flow switch (CWFS) and the chilled water pump interlock contact (connected across TB-5 terminals 1 and 2) are required. In addition, for Cooler Pumps Sequence settings of ***PUMP* = 1, 2, 3, 4,** normally open auxiliary contacts for Pump 1 and Pump 2 (wired in parallel) must be connected to the violet and pink wires located in the harness from the MBB-J5C-CH18 connector. The wires in the harness are marked "PMP1-13" and "PMP1-14." See the field wiring diagram in the 30RB Installation Instructions.

Regardless of the cooler pump control option selected, if the chilled water flow switch/interlock does not close within the **MINUTES OFF TIME** (***Configuration→OPTN→DELY***) period after the unit is enabled and in an **ON** mode, alarm P.14 will be generated. Other conditions which will trigger this alarm include:

- Cooler pump interlock is open for at least 30 seconds during chiller operation.
- Lag chiller in Master/Slave Control pump interlock does not close after 1 minute of the pump start command.

- Cooler pump control is enabled and the chilled water flow switch/interlock is closed for more than 2 minutes following a command to shut down the pump.

The last alarm criterion can be disabled. If Flow Checked if Pmp Off (***Configuration→OPTN→P.LOC***) is set to **NO**, the control will ignore the pump interlock input if the cooler pump output is **OFF**.

The *Comfort*Link™ controls is the ability to periodically start the pumps to maintain the bearing lubrication and seal integrity. If Periodic Pump Start (***Configuration→OPTN→PM.PS***) is set to **YES**, and if the unit is off at 2:00 PM, a pump will be started once each day for 2 seconds. If the unit has 2 pumps, Pump 1 will be started on even days (such as day 2, 4, or 6 of the month); Pump 2 will be started on odd days. The default for this option is ***PM.PS*=NO**.

The pump will continue to run for 60 seconds after an off command is issued.

Machine Control Methods — Three variables control how the machine operates. One variable controls the machine On-Off function. The second controls the set point operation. The third variable controls the Heat-Cool operation which is always set to cool. Table 25 illustrates how the control method and cooling set point select variables direct the operation of the chiller and the set point to which it controls. Table 25 also provides the On/Off state of the machine for the given combinations.

Machine On/Off control is determined by the configuration of the Operating Type Control (***Operating Modes→SLCT →OPER***). Options to control the machine locally via a switch, on a local Time Schedule, or via a Carrier Comfort Network® command are offered.

SWITCH CONTROL — In this Operating Type Control, the Enable/Off/Remote Contact switch controls the machine locally. All models are factory configured with ***OPER*=0** (Switch Control). With the ***OPER*** set to 0, simply switching the Enable/Off/Remote Contact switch to the Enable or Remote Contact position (external contacts closed) will put the chiller in an occupied state. The unit Occupied Status (***Run Status→VIEW→OCC***) will change from **NO** to **YES**. The Status Unit Control Type (***Run Status→VIEW→CTRL***) will change from **0** (Local Off) when the switch is Off to **1** (Local On) when in the Enable position or Remote Contact position with external contacts closed.

TIME SCHEDULE — In this Operating Type Control, the machine operates under a local schedule programmed by the user as long as the Enable/Off/Remote Contact switch is in the Enable or Remote Contact position (external contacts closed). To operate under this Operating Type Control, ***Operating Modes→SLCT*** must be set to ***OPER*=1**. Two Internal Time Schedules are available. Time Schedule 1 (***Time Clock→ SCH1***) is used for single set point On-Off control. Time Schedule 2 (***Time Clock→SCH2***) is used for dual set point On-Off and Occupied-Unoccupied set point control. The control will use the operating schedules as defined under the Time Clock mode in the scrolling marquee display.

CCN Global Time Schedule — A CCN Global Schedule can be utilized. The schedule number can be set anywhere from 65 to 99 for operation under a CCN global schedule. The 30RB chillers can be configured to follow a CCN Global Time Schedule broadcast by another system element. The ComfortVIEW™ Network Manager's Configure and Modify commands or the Service Tool's Modify/Names function must be used to change the number of the Occupancy Equipment Part Table Name (OCC1P01E) to the Global Schedule Number. The Schedule Number can be set from 65 to 99 (OCC1P65E).

The Occupancy Supervisory Part table name (OCC1P01S) number must be changed to configure the unit to broadcast a Global Time Schedule. The Schedule Number can be set from 65 to 99 (OCC1P65S). When OCC1PxxS is set to a value greater than 64, an occupancy flag is broadcast over the CCN every time it transitions from occupied to unoccupied or vice-versa. By configuring their appropriate Time Schedule decisions to the same number, other devices on the network can follow this same schedule. The Enable/Off/Remote Contact must be in the Enable position or Remote Contact position with the contacts closed for the unit to operate. The Status Unit Control Type (***Run Status→VIEW→STAT***) will be **0** (Local Off) when the switch is Off. The Status Unit Control Type will be **2** (CCN) when the Enable/Off/Remote Contact switch input is On.

Table 25 — Control Methods and Cooling Set Points

PARAMETER							ACTIVE SET POINT
Control Method (*OPER*)	Heat Cool Select (*HC.SE*)	Setpoint Select (*SP.SE*)	Ice Mode Enable (*ICE.M*)	Ice Done (*ICE.D*)	Dual Setpoint Switch (*DUAL*)	Setpoint Occupied (*SP.OC*)	
0 (Switch Ctrl)	0 (Cool)	1 (Setpoint1)	—	—	—	—	***CSP.1***
			Enable	Open	Closed	—	***CSP.3***
		2 (Setpoint2)	—	—	—	—	***CSP.2***
			Enable	Open	Closed	—	***CSP.3***
		3 (4-20mA Setp)	—	—	—	—	4-20 mA
		—	Enable	Open	Open	—	***CSP.1***
					Closed	—	***CSP.3***
				Closed	Closed	—	***CSP.2***
		4 (Dual Setp Sw)	—	—	Open	—	***CSP.1***
					Closed	—	***CSP.2***
			Enabled	Open	Closed	—	***CSP.3***
				Closed	Closed	—	***CSP.2***
1 (Time Sched)	0 (Cool)	0 (Setpoint Occ)	—	—	—	Occupied	***CSP.1***
						Unoccupied	***CSP.2***
			Enable	Open	—	Unoccupied	***CSP.3***
				Closed	—		***CSP.2***
2 (CCN)	0 (Cool)	—	—	—	—	Occupied	***CSP.1***
					—	Unoccupied	***CSP.2***
			Enable	Open	—	Unoccupied	***CSP.3***

— = No Effect

CCN CONTROL — An external CCN device such as Chillervisor controls the On/Off state of the machine. This CCN device forces the variable CHIL_S_S between Start/Stop to control the chiller. The Status Unit Control Type (***Run Status→VIEW→STAT***) will be **0** (Local Off) when the Enable/Off/Remote Contact switch is Off. The Status Unit Control Type will be **2** (CCN) when the Enable/Off/Remote Contact switch is in the enable or remote contact position with external contacts closed and the CHIL_S_S variable is Stop or Start.

UNIT RUN STATUS (***Run Status→VIEW→STAT***) — As the unit transitions from off to on and back to off, the Unit Run Status will change based on the unit's operational status. The variables are: **0** (Off), **1** (Running), **2** (Stopping), and **3** (Delay).

- 0 indicates the unit is Off due to the Enable/Off/Remote Contact Switch, a time schedule or CCN command.
- 1 indicates the unit is operational.
- 2 indicates the unit is shutting down due to the command to shut down from the Enable/Off/Remote Contact Switch, a time schedule or CCN command.
- 3 indicates the unit has received a command to start from Enable/Off/Remote Contact Switch, a time schedule or CCN command, and is waiting for the start-up timer (***Configuration→OPTN→DELY***) to expire.

Cooling Set Point Selection (*Operating Modes →SLCT→SP.SE*) — Several options for controlling the Leaving Chilled Water Set Point are offered and are configured by the Cooling Set Point Select variables. In addition to the Cooling Set Point Select, Ice Mode Enable (***Configuration→OPTN→ICE.M***), and Heat Cool Select (***Operating Modes→ SLCT→HC.SE***) variables also have a role in determining the set point of the machine. All units are shipped from the factory with the Heat Cool Select variable set to ***HC.SE*=0** (Cooling). All set points are based on Leaving Water Control, (***Configuration→SERV→EWTO*=NO**).

In all cases, there are limits on what values are allowed for each set point. These values depend on the Cooler Fluid Type (***Configuration→SERV→FLUD***) and the Brine Freeze Set point (***Configuration→SERV→LOSP***). See Table 26.

Table 26 — Configuration Set Point Limits

SET POINT LIMIT	COOLER FLUID TYPE, FLUD	
	1 = Water	2 = Medium Brine
Minimum*	38 F (3.3 C)	14 F (–10.0 C)
Maximum	60 F (15.5 C)	

*The minimum set point for Medium Temperature Brine applications is related to the Brine Freeze Point. The set point is limited to be no less than the Brine Freeze Point +5° F (2.8° C).

SET POINT 1 (***Operating Modes→SLCT→SP.SE*=1**) — When Set Point Select is configured to 1, the unit's active set point is based on Cooling Set Point 1 (***Set Point→COOL→CSP.1***).

SET POINT 2 (***Operating Modes→SLCT→SP.SE*=2**) — When Set Point Select is configured to 2, the unit's active set point is based on Cooling Set Point 2 (***Set Point→COOL→CSP.2***).

4 TO 20 mA INPUT (***Operating Modes→SLCT →SP.SE*=3**) — When Set Point Select is configured to 3, the unit's active set point is based on an external 4 to 20 mA signal input to the Energy Management Module (EMM).

See Table 25 for Control Methods and Cooling Set Points. The following equation is used to control the set point. See Fig. 18.

Set Point = 10 + 70(mA – 4)/16 (deg F)
Set Point = –12.2 + 38.9(mA – 4)/16 (deg C)

DUAL SWITCH (***Operating Modes→SLCT→SP.SE*=4**) — When Set Point Select is configured to 4, the unit's active set point is based on Cooling Set Point 1 (***Set Point→COOL→ CSP.1***) when the Dual Set Point switch contacts are open and Cooling Set Point 2 (***Set Point→COOL→CSP.2***) when they are closed.

Ice Mode — Operation of the machine to make and store ice can be accomplished many ways. The Energy Management Module and an Ice Done Switch is required for operation in the Ice Mode. In this configuration, the machine can operate with up to three cooling set points: Cooling Set Point 1 (Occupied) (***Set Point→COOL→CSP.1***), Cooling Set Point 2 (Unoccupied) (***Set Point→COOL→CSP.2***), and Ice Set Point (***Set Point→COOL→CSP.3***).

SET POINT OCCUPANCY (***Operating Modes→ SLCT→SP.SE*=0**) — When Set point Select is configured to 0, the unit's active set point is based on Cooling Set Point 1 (***Set Point→COOL→CSP.1***) during the occupied period while operating under ***Time Clock→SCH1***. If the ***Time Clock →SCH2*** is in use, the unit's active set point is based on Cooling Set Point 1 (***Set Point→COOL→CSP.1***) during the occupied period and Cooling Set Point 2 (***Set Point →COOL→CSP.2***) during the unoccupied period.

Temperature Reset — Temperature reset is a value added to the basic leaving fluid temperature set point. The sum of these values is the control point. When a non-zero temperature reset is applied, the chiller controls to the control point, not the set point. The control system is capable of handling leaving-fluid temperature reset based on cooler fluid temperature difference. Because the change in temperature through the cooler is a measure of the building load, the temperature difference reset is in effect an average building load reset method. The control system is also capable of temperature reset based on outdoor-air temperature (OAT), space temperature (SPT), or from an externally powered 4 to 20 mA signal. An accessory sensor must be used for SPT reset (33ZCT55SPT). The energy management module (EMM) is required for temperature reset using space temperature or a 4 to 20 mA signal.

Under normal operation, the chiller will maintain a constant leaving fluid temperature approximately equal to the chilled fluid set point. As the cooler load varies, the cooler fluid temperature difference will change in proportion to the load as shown in Fig. 19. Usually the chiller size and leaving-fluid temperature set point are selected based on a full-load condition. At part load, the fluid temperature set point may be lower than required. If the leaving fluid temperature were allowed to increase at part load, the efficiency of the machine would increase.

Temperature difference reset allows for the leaving temperature set point to be reset upward as a function of the fluid temperature difference or, in effect, the building load.

To use Water Temperature Difference Reset, four variables must be configured. They are: Cooling Reset Type (***Configuration→RSET→CRST***), Delta T No Reset Temp (***Setpoints→COOL→CRT1***), Delta T Full Reset Temp (***Setpoints→COOL→CRT2***) and Degrees Cool Reset (***Setpoints→COOL→DGRC***). In the following example using Water Temperature Difference Reset, the chilled water temperature will be reset by 5.0° F (2.8° C) when the ΔT is 2° F (1.1° C) and 0° F (0° C) reset when the ΔT is 10° F. The variable ***CRT1*** should be set to the cooler temperature difference (ΔT) where no chilled water temperature reset should occur. The variable ***CRT2*** should be set to the cooler temperature difference where the maximum chilled water temperature reset should occur. The variable ***DGRC*** should be set to the maximum amount of reset desired. To verify that reset is functioning correctly proceed to ***Run Status→VIEW***, and subtract the active set point (***SETP***) from the control point (***CTPT***) to determine the degrees reset. See Fig. 19 and Table 27.

Other, indirect means of estimating building load and controlling temperatures reset are also available and are discussed below. See Fig. 20.

To use Outdoor Air Temperature Reset, four variables must be configured. They are: Cooling Reset Type (***Configuration →RSET→CRST***), OAT No Reset Temp (***Setpoints→ COOL→CRO1***), OAT Full Reset Temp (***Setpoints→ COOL→CRO2***) and Degrees Cool Reset (***Setpoints→ COOL→DGRC***). In the following example, the outdoor air temperature reset example provides 0° F (0° C) chilled water set point reset at 85.0 F (29.4 C) outdoor-air temperature and 15.0° F (8.3° C) reset at 55.0 F (12.8 C) outdoor-air temperature. See Fig. 21 and Table 28.

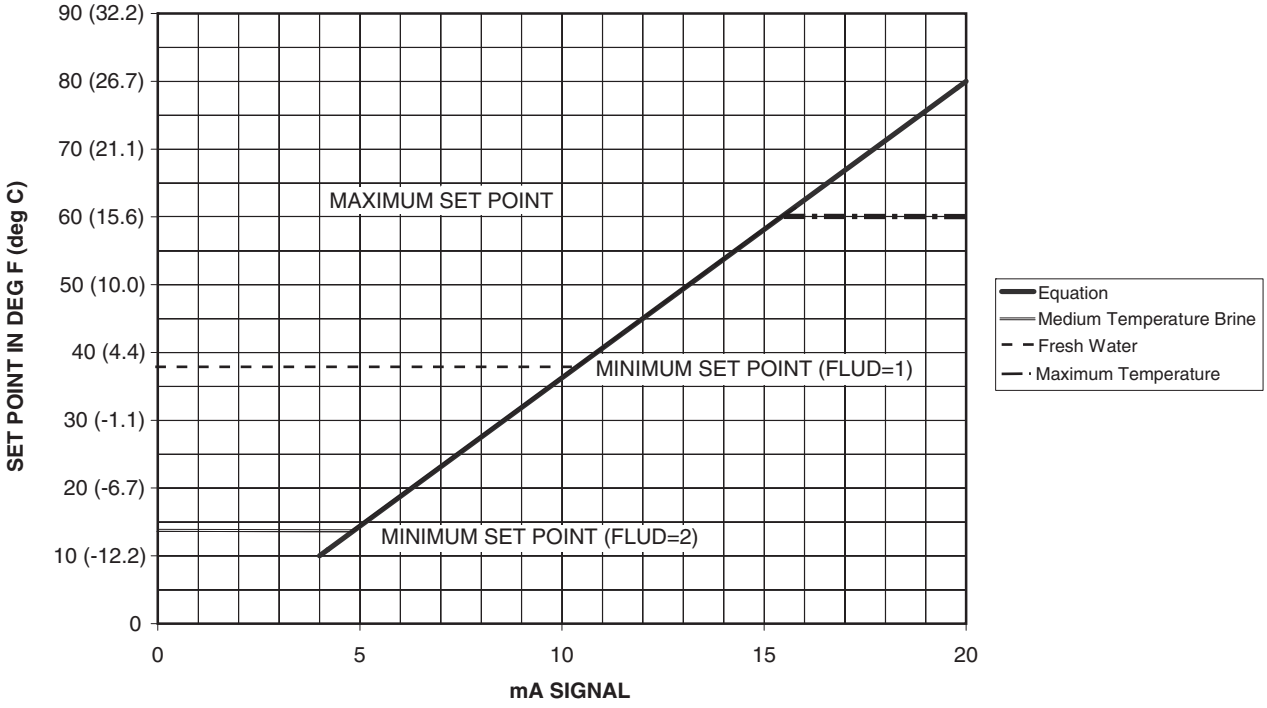


Fig. 18 — 4 to 20 mA Set Point Control

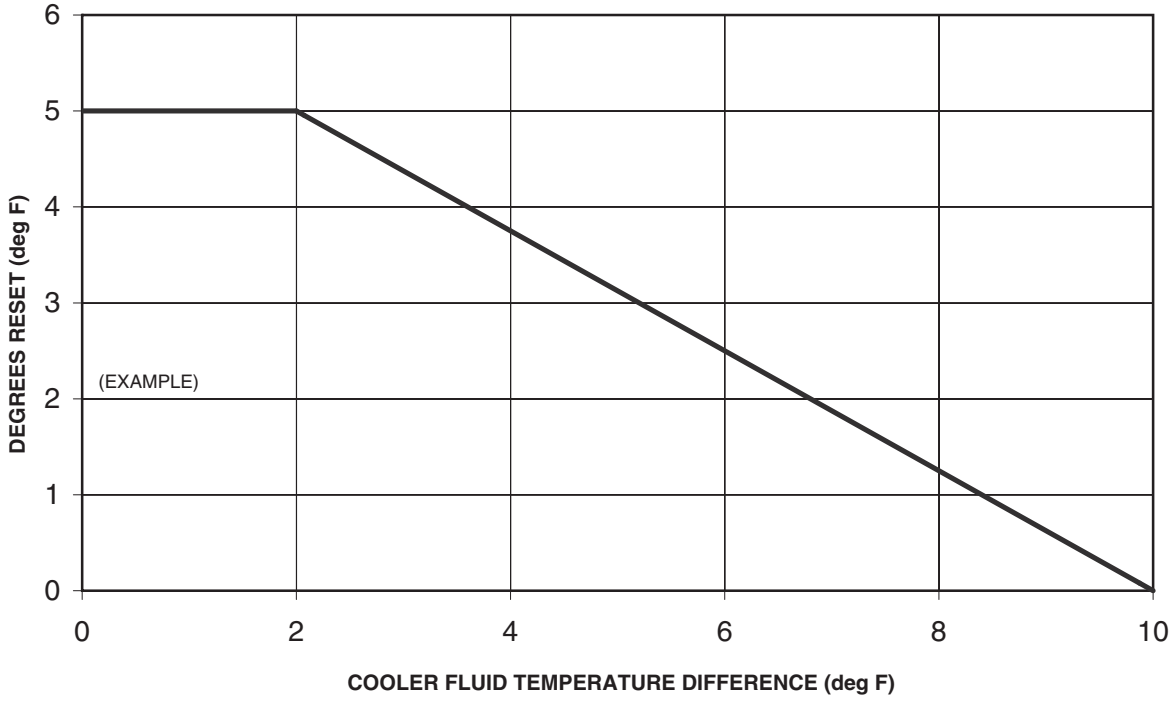
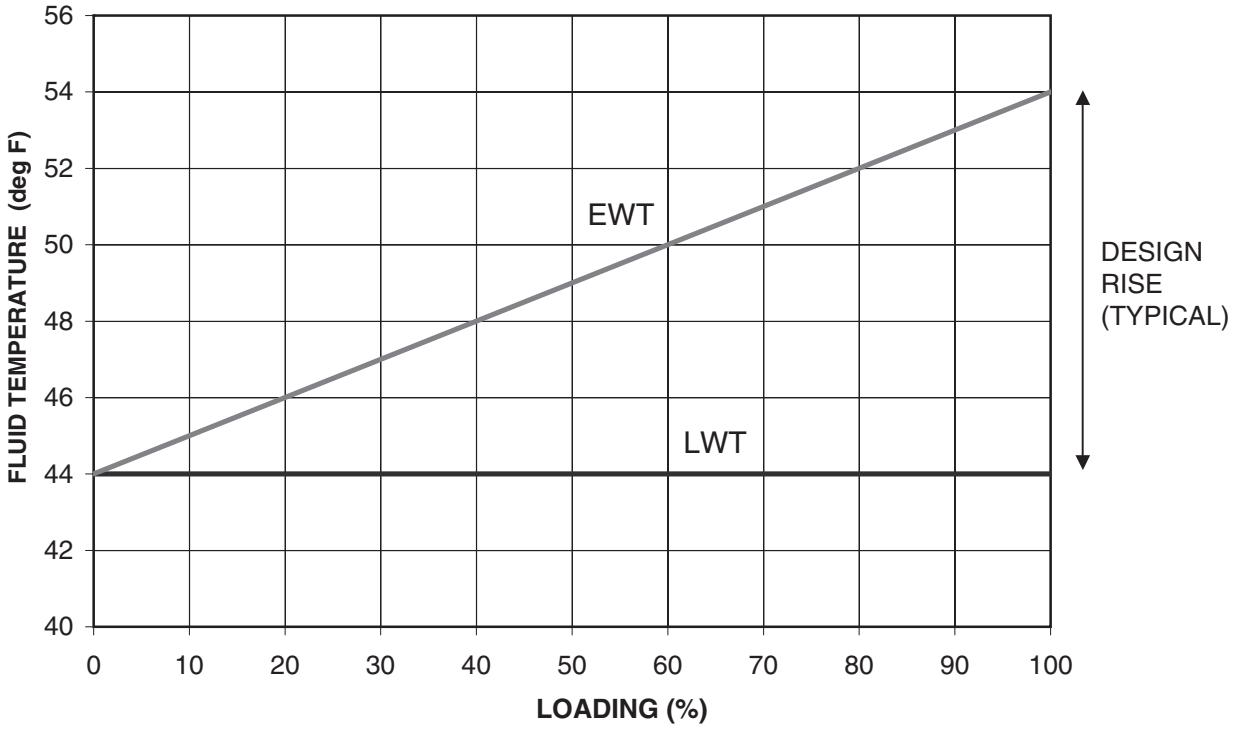


Fig. 19 — Water Temperature Difference Reset



LEGEND

EWT — Entering Water Temperature
LWT — Leaving Water Temperature

Fig. 20 — Chilled Water Temperature Control

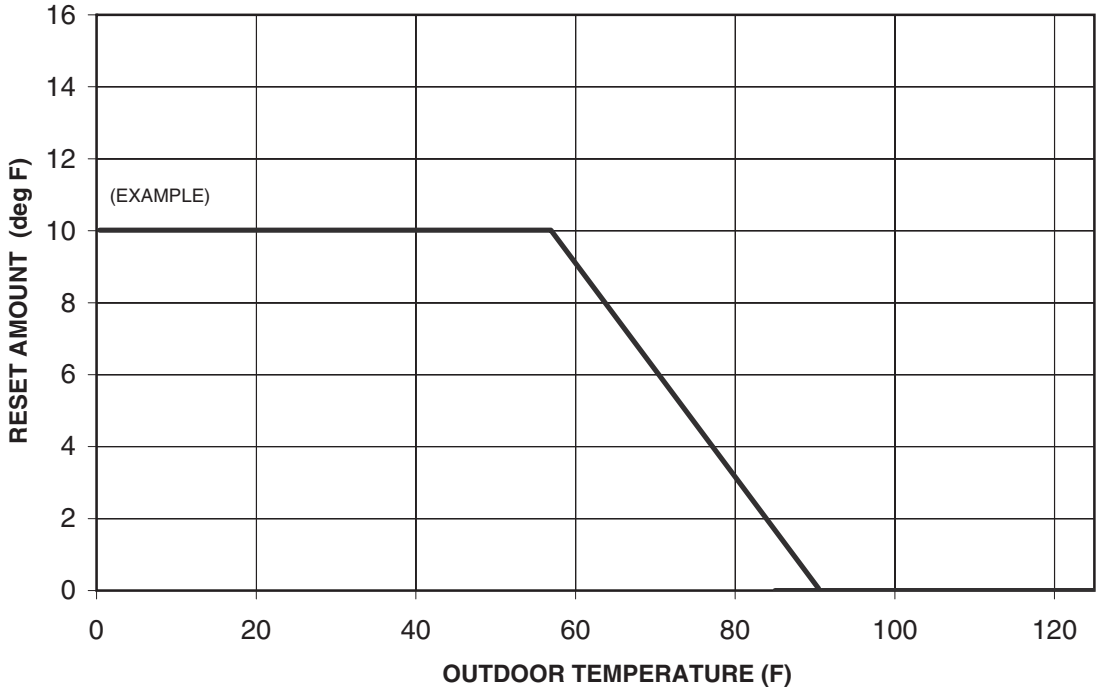


Fig. 21 — Outdoor Air Temperature Reset

Table 27 — Water Temperature Difference Reset Configuration

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST	Cooling Reset Type	
	ENTER	0	No Reset	
	ENTER	0	No Reset	Flashing to indicate Edit mode. May require Password
	↓ / ↑	2	Delta T Temp	Use up or down arrows to change value to 2.
	ENTER	2		Accepts the change.
	ESCAPE	CRST		
	ESCAPE			At mode level
SETPOINTS	↓ / ↑			Change to Setpoints Mode
	ENTER	**COOL**	Cooling Setpoints	
	ENTER	CSP.1	Cooling Setpoint 1	
	↓ x 4	CRV.2		
	↓	CRT1	Delta T No Reset Temp	Cooler Temperature difference where no temperature reset is required.
	ENTER	0		Value of CRT1
	ENTER	0		Flashing to indicate Edit mode
	↑	10.0		Value of No Temperature Reset, 10 from the example.
	ENTER	10.0		Accepts the change.
	ESCAPE	CRT1		
	↓	CRT2	Delta T Full Reset Temp	Cooler Temperature difference where full temperature reset, DGRC is required.
	ENTER	0		Value of CRT2.
	ENTER	0		Flashing to indicate Edit mode
	↑	2.0		Value of full Temperature Reset, 2 from the example.
	ENTER	2.0		Accepts the change.
	ESCAPE	CRT2		
	↓ x 4	CRS2		
	↓	DGRC	Degrees Cool Reset	Amount of temperature reset required.
	ENTER	0		Value of DGRC
	ENTER	0		Flashing to indicate Edit mode
	↑	5.0		Amount of Temperature Reset required, 5 from the example.
	ENTER	5.0		Accepts the change.
	ESCAPE	DGRC		

NOTE: **Bold** values indicate sub-mode level.

Table 28 — OAT Reset Configuration

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST	Cooling Reset Type	
	ENTER	0	No Reset	
	ENTER	0	No Reset	Flashing to indicate Edit mode. May require Password
	↓ / ↑	1	Out Air Temp	Use up or down arrows to change value to 1.
	ENTER	1		Accepts the change.
	ESCAPE	CRST		
	ESCAPE			At mode level
SETPOINTS	↓ / ↑			Change to Setpoints Mode
	ENTER	**COOL**	Cooling Setpoints	
	ENTER	CSP.1	Cooling Setpoint 1	
	↓ x 6	CRT.2		
	↓	CRO1	OAT No Reset Temp	Outdoor Temperature where no temperature reset is required.
	ENTER	0		Value of CRO1
	ENTER	0		Flashing to indicate Edit mode
	↑	85.0		Value of No Temperature Reset, 85 from the example.
	ENTER	85.0		Accepts the change.
	ESCAPE	CRO1		
	↓	CRO2	OAT Full Reset Temp	Outdoor Temperature where full temperature reset, DGRC is required.
	ENTER	0		Value of CRO2.
	ENTER	0		Flashing to indicate Edit mode
	↑	55.0		Value of full Temperature Reset, 55 from the example.
	ENTER	55.0		Accepts the change.
	ESCAPE	CRO2		
	↓	CRS1		
	↓	CRS2		
	↓	DGRC	Degrees Cool Reset	Amount of temperature reset required.
	ENTER	0		Value of DGRC
	ENTER	0		Flashing to indicate Edit mode
	↑	15.0		Amount of Temperature Reset required, 15 from the example.
	ENTER	15.0		Accepts the change.
	ESCAPE	DGRC		

NOTE: **Bold** values indicate sub-mode level.

To use Space Temperature Reset in addition to the energy management module, four variables must be configured. They are: Cooling Reset Type (***Configuration→RSET→CRST***), Space T No Reset Temp (***Setpoints→COOL→CRS1***), Space T Full Reset Temp (***Setpoints→COOL→CRS2***) and Degrees Cool Reset (***Setpoints→COOL→DGRC***). In the following space temperature reset example, 0° F (0° C) chilled water set point reset at 72.0 F (22.2 C) space temperature and 6.0° F (3.3° C) reset at 68.0 F (20.0 C) space temperature. See Fig. 22 and Table 29.

To use 4-20 mA Temperature Reset in addition to the energy management module, four variables must be configured. They are: Cooling Reset Type (***Configuration→RSET →CRST***), Current No Reset Val (***Setpoints→COOL→CRV1***), Current Full Reset Val (***Setpoints→COOL→CRV2***) and Degrees Cool Reset (***Setpoints→COOL→DGRC***). In the following example, at 4 mA no reset takes place. At 20 mA, 5° F (2.8° C) chilled water set point reset is required. See Fig. 23 and Table 30.

⚠ CAUTION

Care should be taken when interfacing with other control systems due to possible power supply differences such as a full wave bridge versus a half wave rectification. Connection of control devices with different power supplies may result in permanent damage. *Comfort*Link™ controls incorporate power supplies with half wave rectification. A signal isolation device should be utilized if the signal generator incorporates a full wave bridge rectifier.

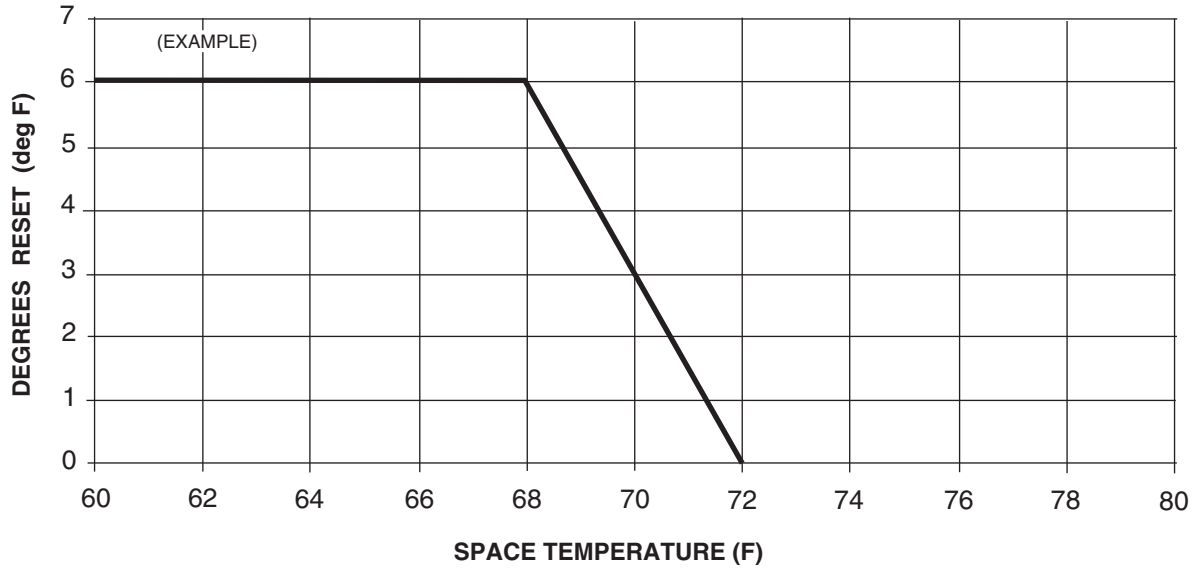


Fig. 22 — Space Temperature Reset

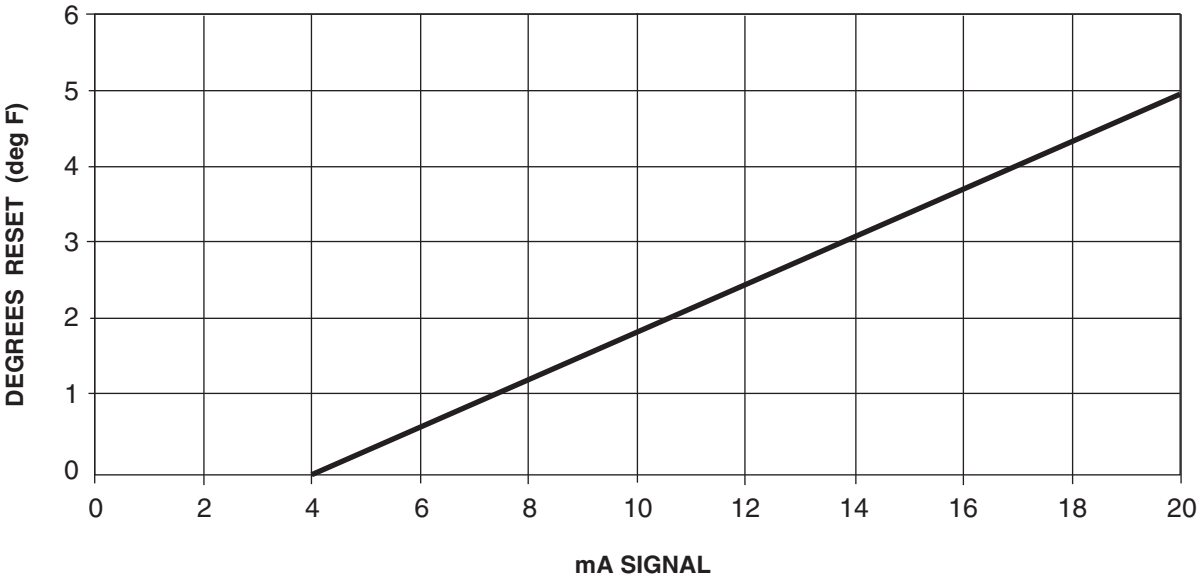


Fig. 23 — 4 to 20 mA Temperature Reset

Table 29 — Space Temperature Reset Configuration

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST	Cooling Reset Type	
	ENTER	0	No Reset	
	ENTER	0	No Reset	Flashing to indicate Edit mode. May require Password
	↓ / ↑	4	Space Temp	Use up or down arrows to change value to 4.
	ENTER	4		Accepts the change.
	ESCAPE	CRST		
	ESCAPE			At mode level
SETPOINTS	↓ / ↑			Change to Setpoints Mode
	ENTER	**COOL**	Cooling Setpoints	
	ENTER	CSP.1	Cooling Setpoint 1	
	↓ x 8	CRO2		
	↓	CRS1	Space T No Reset Temp	Space Temperature where no temperature reset is required.
	ENTER	0		Value of CRS1
	ENTER	0		Flashing to indicate Edit mode
	↑	72.0		Value of No Temperature Reset, 72 from the example.
	ENTER	72.0		Accepts the change.
	ESCAPE	CRS1		
	↓	CRS2	Space T Full Reset Temp	Space Temperature where full temperature reset, DGRC is required.
	ENTER	0		Value of CRS2.
	ENTER	0		Flashing to indicate Edit mode
	↑	68.0		Value of full Temperature Reset, 68 from the example.
	ENTER	68.0		Accepts the change.
	ESCAPE	CRS2		
	↓	DGRC	Degrees Cool Reset	Amount of temperature reset required.
	ENTER	0		Value of DGRC
	ENTER	0		Flashing to indicate Edit mode
	↑	6.0		Amount of Temperature Reset required, 6 from the example.
	ENTER	6.0		Accepts the change.
	ESCAPE	DGRC		

NOTE: **Bold** values indicate sub-mode level.

Table 30 — 4 to 20 mA Temperature Reset Configuration

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST	Cooling Reset Type	
	ENTER	0	No Reset	
	ENTER	0	No Reset	Flashing to indicate Edit mode. May require Password
	↓ / ↑	3	4-20 mA Input	Use up or down arrows to change value to 3.
	ENTER	3		Accepts the change.
	ESCAPE	CRST		
	ESCAPE			At mode level
SETPOINTS	↓ / ↑			Change to Setpoints Mode
	ENTER	**COOL**	Cooling Setpoints	
	ENTER	CSP.1	Cooling Setpoint 1	
	↓ x 2	CSP.3	Cooling Setpoint 3	
	↓	CRV1	Current No Reset Val	Outdoor Temperature where no temperature reset is required.
	ENTER	0		Value of CRV1
	ENTER	0		Flashing to indicate Edit mode
	↑	4.0		Value of No Temperature Reset, 4 from the example.
	ENTER	4.0		Accepts the change.
	ESCAPE	CRV1		
	↓	CRV2	Current Full Reset Val	Current value where full temperature reset, DGRC is required.
	ENTER	0		Value of CRV2.
	ENTER	0		Flashing to indicate Edit mode
	↑	20.0		Value of full Temperature Reset, 20 from the example.
	ENTER	20.0		Accepts the change.
	ESCAPE	CRV2		
	↓ x 6	CRS2		
	↓	DGRC	Degrees Cool Reset	Amount of temperature reset required.
	ENTER	0		Value of DGRC
	ENTER	0		Flashing to indicate Edit mode
	↑	5.0		Amount of Temperature Reset required, 5 from the example.
	ENTER	5.0		Accepts the change.
	ESCAPE	DGRC		

NOTE: **Bold** values indicate sub-mode level.

Demand Limit — Demand limit is a feature that allows the unit capacity to be limited during periods of peak energy usage. There are three types of demand limiting that can be configured. The first type is through 2-step switch control, which will reduce the maximum capacity to 2 user-configurable percentages. The second type is by 4 to 20 mA signal input which will reduce the maximum capacity linearly between 100% at a 4 mA input signal (no reduction) down to the user-configurable level at a 20 mA input signal. The third type uses the CCN Loadshed module and has the ability to limit the current operating capacity to maximum and further reduce the capacity if required.

NOTE: One-step Demand Limit is standard.

The 2-step switch control and 4 to 20-mA input signal types of demand limiting require the energy management module (EMM).

To use demand limit, select the type of demand limiting to use. Then configure the demand limit set points based on the type selected.

2-STEP SWITCH CONTROLLED — If using 2-step demand limit control, an energy management module must be installed. One-step demand limit control does not require the energy management module. To configure demand limit for 2-step switch control, three parameters must be configured: Demand Limit Select (***Configuration→RSET→DMDC***), Switch Limit Setpoint 1 (***Setpoints→MISC→DLS1***) and Switch Limit Setpoint 2 (***Setpoints→MISC→DLS2***). In the following example, Demand Limit Switch 1 is 60% and demand limit Switch 2 is 40%. Demand limit steps are controlled by two relay switch inputs field wired to TB5 for Switch 1 and TB6 for Switch 2. See Table 31.

For demand limit by 2-stage switch control, closing the first stage demand limit contact will put the unit on the first demand limit level. The unit will not exceed the percentage of capacity entered as Demand Limit Switch 1 set point. Closing contacts on the second demand limit switch prevents the unit from exceeding the capacity entered as Demand Limit Switch 2 set point. The demand limit stage that is set to the lowest demand takes priority if both demand limit inputs are closed. If the demand limit percentage does not match unit staging, the unit will limit capacity to the closest capacity stage without exceeding the value. To disable demand limit configure ***DMDC*** to **0**.

EXTERNALLY POWERED (4 to 20 mA Controlled) — The energy management module is required for 4 to 20 mA demand limit control. To configure demand limit for 4 to 20 mA control three parameters must be configured. They are: Demand Limit Select (***Configuration→RSET→DMDC***), mA for 100% Demand Limit (***Configuration→RSET→DMMX***) and mA for 0% Demand Limit (***Configuration→RSET→DMZE***). In the following example, a 4 mA signal is Demand Limit 100% and a 20 mA Demand Limit signal is 0%. The 4 to 20 mA signal is connected to TB6-1 and TB6-2. The demand limit is a linear interpolation between the two values entered. See Table 32 and Fig. 24.

⚠ CAUTION

Care should be taken when interfacing with other control systems due to possible power supply differences such as a full wave bridge versus a half wave rectification. Connection of control devices with different power supplies may result in permanent damage. *Comfort*Link™ controls incorporate power supplies with half wave rectification. A signal isolation device should be utilized if the signal generator incorporates a full wave bridge rectifier.

In Fig. 24, if the machine receives a 12 mA signal, the machine controls will limit the capacity to 50%.

CCN LOADSHED CONTROLLED — To configure demand limit for CCN Loadshed control, the unit Operating Type Control must be in CCN control, (***Operating Modes→SLCT→SP.SE*=2)** and be controlled by a Chillervisor module. The Chillervisor module can force the demand limit variable and directly control the capacity of the machine. Additionally, the unit's set point will be artificially lowered to force the chiller to load to the demand limit value.

Remote Alarm and Alert Relays — The 30RB chiller can be equipped with a remote alert and remote alarm annunciator contacts. Both relays connected to these contacts must be rated for a maximum power draw of 10 va sealed, 25 va inrush at 24 volts. The alarm relay, indicating that the complete unit has been shut down can be connected to TB5-12 and TB5-13. For an alert relay, indicating that at least 1 circuit was off due to the alert, a field-supplied and installed relay must be connected between MBB-J3-CH25-3 and TB5-13.

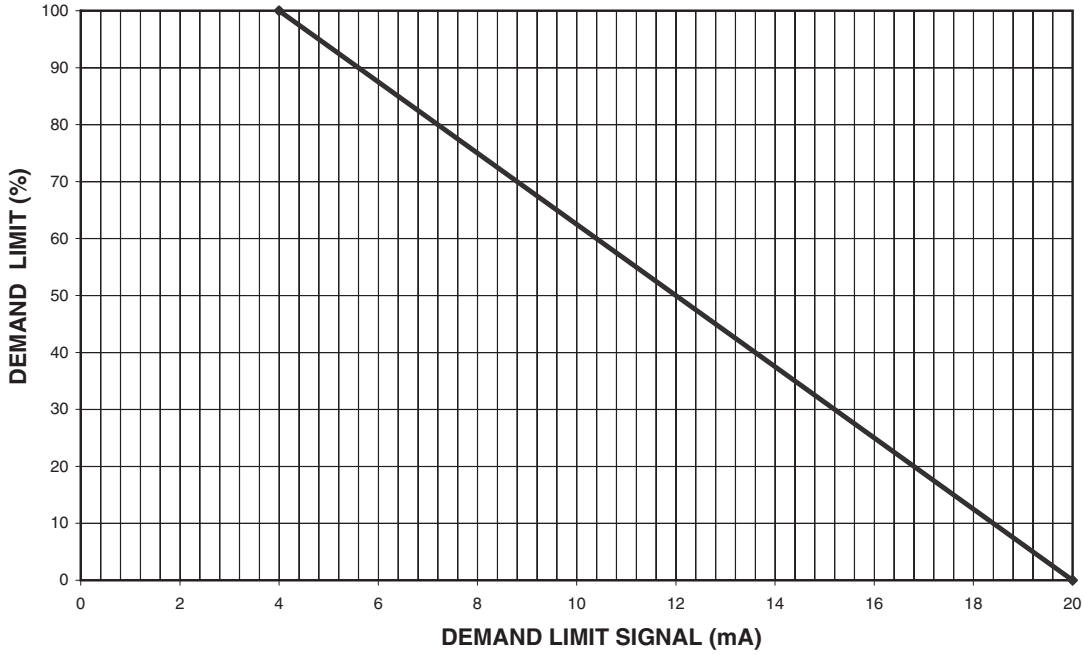


Fig. 24 — Demand Limit

Table 31 — 2-Step Demand Limit Configuration

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST		
	↓	HRST		
	↓	DMDC	Demand Limit Select	
	ENTER	0	None	
	ENTER	0	None	Flashing to indicate Edit mode. May require Password
	↓ / ↑	1	Switch	Use up or down arrows to change value to 1.
	ENTER	1		Accepts the change.
	ESCAPE	DMDC		
	ESCAPE			At mode level
SETPOINTS	↓ / ↑			Change to Setpoints Mode
	ENTER	**COOL**	Cooling Setpoints	
	↓	HEAT		
	↓	MISC	Miscellaneous Setpoints	
	ENTER	DLS1	Switch Limit Setpoint 1	
	ENTER	0	None	Current value for DLS1.
	ENTER	0	None	Flashing to indicate Edit mode. May require Password
	↑	60	Switch	Use arrows to change value to 60 from the example.
	ENTER	60		Accepts the change.
	ESCAPE	DLS1		
	↓	DLS2	Switch Limit Setpoint 2	
	ENTER	0		Current value of DLS2
	ENTER	0		Flashing to indicate Edit mode
	↑	40		Use arrows to change the value for DLS2 to 40 from the example.
	ENTER	40		Accepts the change.
	ESCAPE	DLS2		
	ESCAPE x 2	DGRC	SETPOINTS	

NOTE: **Bold** values indicate sub-mode level.

Table 32 — Externally Powered Demand Limit Configuration

MODE	KEYPAD ENTRY	DISPLAY	ITEM EXPANSION	COMMENT
CONFIGURATION	ENTER	**DISP**		
	↓	**UNIT**		
	↓	**SERV**		
	↓	**OPTN**		
	↓	**RSET**	Reset Cool and Heat Tmp	
	ENTER	CRST		
	↓	HRST		
	↓	DMDC	Demand Limit Select	
	ENTER	0	None	
	ENTER	0	None	Flashing to indicate Edit mode. May require Password
	↑	2	4-20 mA Input	Use up arrows to change value to 2.
	ENTER	2		Accepts the change.
	ESCAPE	DMDC		
	↓	DMMX	mA for 100% Demand Limit	
	ENTER	0		
	ENTER	0		Flashing to indicate Edit mode
	↑	4.0		Use up arrows to change the value to 4.
	ESCAPE	DMMX		
	↓	DMZE	mA for 0% Demand Limit	
	ENTER	0		
	ENTER	0		Flashing to indicate Edit mode
	↑	20.0		Use up arrows to change value to 20.
	ESCAPE	DMZE		

NOTE: **Bold** values indicate sub-mode level.

PRE-START-UP

IMPORTANT: Complete the Start-Up Checklist for 30RB Liquid Chillers at the end of this publication.

The checklist assures proper start-up of a unit, and provides a record of unit condition, application requirements, system information, and operation at initial start-up.

Do not attempt to start the chiller until the following checks have been completed.

System Check

1. Check auxiliary components, such as the chilled fluid circulating pump, air-handling equipment, or other equipment to which the chiller supplies liquid are operational. Consult manufacturer's instructions. If the unit has field-installed accessories, be sure all are properly installed and wired correctly. Refer to unit wiring diagrams.
2. Open compressor suction (if equipped) and discharge shutoff valves.
3. Open liquid line shut off valves.
4. Fill the chiller fluid circuit with clean water (with recommended inhibitor added) or other non-corrosive fluid to be cooled. Bleed all air out of high points of system. An air vent is included with the cooler. If outdoor temperatures are expected to be below 32 F (0° C), sufficient inhibited propylene glycol or other suitable corrosion inhibited antifreeze should be added to the chiller water circuit to prevent possible freeze-up.

   The chilled water loop must be cleaned before the unit is connected. Units supplied with the accessory hydronic package include a run in screen. If the run-in screen is left in the suction guide/strainer, it is recommended that the Service Maintenance be set to alert the operator within 24 hours of start-up to be sure that the run-in screen in the suction guide/strainer is removed. To set the time for the parameter, go to ***Time Clock→MCFG→ W.FIL***. Values for this item are counted as days. Refer to the hydronic pump package literature if unit is equipped with the optional hydronic pump package.
5. Check tightness of all electrical connections.
6. Oil should be visible in the compressor sight glass. An acceptable oil level in the compressor is from $^{3}/_{4}$ to $^{7}/_{8}$ full sight glass. Adjust the oil level as required. No oil should be removed unless the crankcase heater has been energized for at least 24 hours. See Oil Charge section for Carrier-approved oils.
7. Electrical power source must agree with unit nameplate.

8. Crankcase heaters must be firmly seated under compressor, and must be energized for 24 hours prior to start-up.
9. Verify power supply phase sequence. Fan motors are 3 phase. Check rotation of non-VFD controlled fans by using the quick test. Fan rotation is counterclockwise as viewed from top of unit. If fan is not turning counterclockwise, reverse 2 of the power wires at the main terminal block.
10. → Check compressors and compressor mounting sled. Compressor or shipping braces and shipping bolts must be removed.

START-UP

⚠ CAUTION

Do not manually operate contactors. Serious damage to the machine may result.

Actual Start-Up — *Actual start-up should be done only under supervision of a qualified refrigeration technician.*

1. Be sure all shut off valves are open. Units are shipped from factory with suction valves (if equipped) open. Discharge and liquid line shut off valves are closed.
2. Using the scrolling marquee display, set leaving-fluid set point (***Setpoints→COOL→CSP.1***). No cooling range adjustment is necessary.
3. If optional control functions or accessories are being used, the unit must be properly configured. Refer to Configuration Options section for details.
4. Start chilled fluid pump, if unit is not configured for pump control, (***Configuration→OPTN→PUMP*= 0**).
5. Complete the Start-Up Checklist to verify all components are operating properly.
6. Turn ENABLE/OFF/REMOTE CONTACT switch to ENABLE position.
7. Allow unit to operate and confirm that everything is functioning properly. Check to see that leaving fluid temperature agrees with leaving set point Control Point (***Run Status→VIEW→CTPT***).

Operating Limitations

TEMPERATURES — Unit operating temperature limits are listed in Table 33.

Table 33 — Temperature Limits for Standard Units

TEMPERATURE	F	C
Maximum Ambient Temperature	125	52
Minimum Ambient Temperature	32	0
Maximum Cooler EWT*	95	35
Maximum Cooler LWT	60	15
Minimum Cooler LWT†	40	4.4

LEGEND

EWT — Entering Fluid (Water) Temperature
LWT — Leaving Fluid (Water) Temperature

*For sustained operation, EWT should not exceed 85 F (29.4 C).
†Unit requires brine modification for operation below this temperature.

Low Ambient Operation — If unit operating temperatures below 32 F (0° C) are expected, refer to separate unit installation instructions for low ambient temperature operation using accessory low ambient temperature head pressure control, if not equipped. Contact a Carrier representative for details.

NOTE: Wind baffles and brackets must be field-fabricated and installed for all units using accessory low ambient head pressure control to ensure proper cooling cycle operation at low-ambient temperatures. See the 30RB Installation Instructions or the low ambient temperature head pressure control accessory installation instructions for more information.

⚠ CAUTION

Brine duty application (below 40 F [4.4 C] leaving chilled water temperature) for chiller normally requires factory modification. Contact a Carrier representative for details regarding specific applications. Operation below 40 F (4.4 C) leaving chilled water temperature without modification can result in compressor failure.

VOLTAGE

Main Power Supply — Minimum and maximum acceptable supply voltages are listed in the Installation Instructions.

Unbalanced 3-Phase Supply Voltage — Never operate a motor where a phase imbalance between phases is greater than 2%.

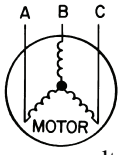
To determine percent voltage imbalance:

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from avg voltage}}{\text{average voltage}}$$

The maximum voltage deviation is the largest difference between a voltage measurement across 2 legs and the average across all 3 legs.

Example: Supply voltage is 240-3-60.

AB = 243v
BC = 236v
AC = 238v



1. Determine average voltage:

$$\text{Average voltage} = \frac{243+236+238}{3} = \frac{717}{3} = 239$$

2. Determine maximum deviation from average voltage:
   (AB) 243 – 239 = 4 v
   (BC) 239 – 236 = 3 v
   (AC) 239 – 238 = 1 v
   Maximum deviation is 4 v.
3. Determine percent voltage imbalance:

$$\% \text{ Voltage Imbalance} = 100 \times \frac{4}{239} = 1.7\%$$

This voltage imbalance is satisfactory as it is below the maximum allowable of 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact the local electric utility company immediately. Do not operate unit until imbalance condition is corrected.

MINIMUM FLUID LOOP VOLUME — To obtain proper temperature control, loop fluid volume must be at least 3 gallons per ton (3.25 L per kW) of chiller nominal capacity for air conditioning and at least 6 gallons per ton (6.5 L per kW) for process applications or systems that must operate at low ambient temperatures (below 32 F [0° C]). Refer to application information in Product Data literature for details.

FLOW RATE REQUIREMENTS — Standard chillers should be applied with nominal flow rates within those listed in the Minimum and Maximum Cooler Flow Rates table. Higher or lower flow rates are permissible to obtain lower or higher temperature rises. Minimum flow rates must be exceeded to assure turbulent flow and proper heat transfer in the cooler. See Table 34.

⚠ CAUTION

Operation below minimum flow rate could subject tubes to frost pinching in the tube sheet, resulting in failure of the cooler.

Consult application data section in the Product Data literature and job design requirements to determine flow rate requirements for a particular installation.

OPERATION

Sequence of Operation — With a command to start the chiller, the cooler pump will start. After verifying water flow, the control will monitor the entering and leaving water temperature. At any time that a compressor is not operating, its crankcase heater is active. If the need for mechanical cooling is determined, the control decides which circuit and compressor to start. The compressor will deenergize the crankcase heater as it starts. Compressors will be staged with minimum load control (if equipped and configured) to maintain LWT set point.

Shutdown of each circuit under normal conditions occurs in increments, starting with the minimum load control (if equipped) and finishing with the last running compressor. Once minimum load control is disabled, one compressor is shut down. Eight seconds later the next compressor will shut down. The process will continue until all of the compressors are shut down. The EXV will close completely, 1 minute after the last compressor has shut down. There are several abnormal conditions that, if detected, will shut down the circuit immediately. In this case, minimum load control and all compressors are turned off *without* an 8-second interval between them. The cooler pump will remain ON for 20 seconds after the last compressor has been turned OFF.

Dual Chiller Sequence of Operation — With a command to start the chiller, the master chiller determines which chiller will become the lead chiller based on ***Configuration→RSET→LLBL*** and ***Configuration→ RSET→LLBD***. The lead chiller is always started first and the lag chiller is held at zero percent capacity by the master chiller forcing the lag demand limit value to 0%. The lead chiller's water pump will be started. The lag chiller's water pump shall be maintained off if ***Configuration→RSET→LAGP*=0**. The internal algorithm of lead chiller will control capacity of the lead chiller.

If Lead Pulldown Time (***Configuration→ RSET→LPUL***) has been configured, the lead chiller will continue to operate alone for that specified time. After the Lead Pulldown Time timer has elapsed, if the lead chiller is fully loaded and either all available compression is on or at the master demand limit value, then the lag start timer (***Configuration→RSET→ LLDY***) is initiated. When the pulldown timer and lag start timer have elapsed and the Combined Leaving Chilled Water Temperature is more than 3° F (1.7° C) above the set point, then the lag chiller is started.

Table 34 — Minimum and Maximum Cooler Flow Rates

SIZES 060-300

30RB SIZE	MINIMUM COOLER FLOW RATE (gpm)	MAXIMUM FLOW RATE (gpm)	MINIMUM LOOP VOLUME (gal.)	MINIMUM COOLER FLOW RATE (l/s)	MAXIMUM COOLER FLOW RATE (l/s)	MINIMUM LOOP VOLUME (liters)
060	72	288	180	5	18	681
070	84	336	210	5	21	795
080	96	384	240	6	24	908
090	108	432	270	7	27	1022
100	120	480	300	8	30	1136
110	132	528	330	8	33	1249
120	144	576	360	9	36	1363
130	156	624	390	10	39	1476
150	180	720	450	11	45	1703
160	192	768	480	12	48	1817
170	204	816	510	13	51	1931
190	228	912	570	14	58	2158
210	252	1008	630	16	64	2385
225	270	1080	675	17	68	2555
250	300	1200	750	19	76	2839
275	330	1320	825	21	83	3123
300	360	1440	900	23	91	3407

SIZES 315-390

30RB SIZE	MINIMUM COOLER FLOW RATE (gpm)		MAXIMUM COOLER FLOW RATE (gpm)		MIN LOOP VOLUME (gal.)	MINIMUM COOLER FLOW RATE (l/s)		MAXIMUM COOLER FLOW RATE (l/s)		MIN LOOP VOLUME (liters)
	Module A	Module B	Module A	Module B		Module A	Module B	Module A	Module B	
315	192	192	768	768	945	12	12	48	48	3577
330	192	204	768	816	990	12	13	48	51	3748
345	204	204	816	816	1035	13	13	51	51	3918
360	204	228	816	912	1080	13	14	51	58	4088
390	228	228	912	912	1170	14	14	58	58	4429

If the lag chiller's water pump was not started when the machines went into occupied mode, then the lag chiller water pump will be started. The lag chiller will start when the master chiller forcing the lag chiller demand limit value (LAG_LIM) to the master's demand limit value. If lead/lag capacity balance is selected, once the lag chiller has started, the master chiller will try to keep the difference in capacity between lead and lag to less than 20%. The master chiller will then be responsible for water loop capacity calculation, and will determine which chiller, the lead or lag, will increase or decrease capacity. When the load reduces, the lag chiller will unload first. To accomplish this, the lead chiller set point is decreased by 4° F (–2.2° C) until the lag chiller unloads.

To configure the two chillers for dual chiller operation, the master chiller must have the Control Method variable (***Operating Mode→ SLCT→OPER***) set to meet the job requirements. The slave chiller must be set to Control Method variable (***Operating Mode→ SLCT→OPER***) = **2** (CCN Control) and the remote-off-enable switch must be in the enable position. The master chiller and the slave chiller CCN addresses (***Configuration→ OPTN→CCNA***) must be configured. The master and slave chillers can be addressed from 1 to 239. Each device connected to the network must have its own unique address. Both chillers must have the same CCN Bus Number (***Configuration→OPTN→CCNB***). Lead/Lag Chiller Enable must be set for both chillers by configuring Master/Slave Select (***Configuration→RSET→ MSSL***) to **1** (Master) for the master chiller. The slave chiller Master/Slave Select must be set to **2** (Slave). The master chiller can be configured to use Lead/Lag Balance (***Configuration→ RSET→LLBL***) to rotate the lead and lag chillers after a configured number of hours of operation. The Lag Start Delay (***Configuration→RSET→LLBD***) can be configured. This prevents the Lag chiller from starting until the lead chiller is fully loaded and the delay has elapsed.

Operating Modes

MODE 1 (***Operating Mode→MODE→MD01***) — Startup Delay in Effect

Criteria for Mode — Tested when the unit is started. This mode is active when the Minutes Off Time (***Configuration→ OPTN→DELY***) timer is active.

Action Taken — The unit will not start until the timer has expired.

Termination — The mode will terminate when the timer expires.

Possible Causes — This mode is in effect only due to the Minutes Off Time timer.

MODE 2 (***Operating Mode→MODE→MD02***) — Second Setpoint in Use

Criteria for Mode — Tested when the unit is ON. This mode is active when Cooling Setpoint 2 (***Setpoints→COOL→ CSP.2***) or Ice Setpoint (***Setpoints→COOL→CSP.3***) is in use. While in this mode, the Active Setpoint (***Run Status →VIEW→SETP***) will show the ***CSP.2*** or ***CSP.3*** value.

Action Taken — The unit will operate to the Cooling Setpoint 2 (***CSP.2***) or Ice Setpoint (***CSP.3***).

Termination — This mode will terminate when the Cooling Setpoint 2 (***CSP.2***) or Ice Setpoint (***CSP.3***) is no longer in use.

Possible Causes — This mode is in effect only due to programming options.

MODE 3 (***Operating Mode→MODE→MD03***) — Reset in Effect

Criteria for Mode — Tested when the unit is ON. This mode is active when Temperature Reset (***Configuration→RSET→ CRST***) is enabled either by ***CRST*=1** (Outside Air Temperature), ***CRST*=2** (Return Water), ***CRST*=3** (4-20 mA Input), or ***CRST*=4** (Space Temperature) and is active.

Action Taken — The Active Setpoint (***Run Status→VIEW →SETP***) will be modified according to the programmed information and will be displayed as the Control Point (***Run Status→VIEW→CTPT***).

Termination — This mode will terminate when the Temperature Reset is not modifying the active leaving water set point, so ***SETP*** is the same as ***CTPT***.

Possible Causes — This mode is in effect only due to programming options.

MODE 4 (***Operating Mode→MODE→MD04***) — Demand Limit Active

Criteria for Mode — Tested when the unit is ON. This mode is active when Demand Limit (***Configuration→RSET→ DMDC***) is enabled either by ***DMDC*=1** (Switch), ***DMDC*=2** (4-20 mA Input) or the Night Time Low Sound Capacity Limit (***Configuration→OPTN →LS.LT***).

Action Taken — The Active Demand Limit Value (***Run Status→VIEW→LIM***) will display the current demand limit according to the programmed information and the unit's capacity will be reduced to the amount shown or lower.

Termination — This mode will terminate when the Demand Limit command has been removed.

Possible Causes — This mode is in effect when capacity is being limited by the demand limit function.

MODE 5 (***Operating Mode→MODE→MD05***) — Ramp Loading Active

Criteria for Mode — Tested when the unit is ON. This mode is active when Ramp Loading (***Configuration→OPTN →RL.S***) is enabled and the following conditions are met:

1. The leaving water temperature is more than 4° F (2.2° C) from the Control Point (***Run Status→VIEW→CTPT***), and
2. The rate of change of the leaving water temperature is greater than the Cool Ramp Loading (***Set Points→COOL→CRMP***).

Action Taken — The control will limit the capacity step increase until one of the two conditions in Mode 5 is no longer true.

Termination — This mode will terminate once both conditions in Mode 5 are no longer true.

Possible Causes — This mode is in effect only when capacity is being limited by the ramp loading function.

MODE 6 (***Operating Mode→MODE→MD06***) — Cooler Heater Active

Criteria for Mode — Tested when unit is ON or OFF. This mode is active when the cooler heater is energized, if the Outdoor Air Temperature (***Temperature→UNIT→OAT***) is less than the calculated value (Freeze Setpoint + Cooler Heater Delta T Setpoint [***Configuration→SERV→HTR***] default – 2° F [1.1° C]), and either the Leaving Water Temperature (***Temperature→UNIT→LWT***) or the Entering Water Temperature (***Temperature→UNIT→EWT***) are less than or equal to the Freeze Setpoint + Cooler Heater Delta T Setpoint (***HTR***).

The Freeze Setpoint is 34 F (1.1 C) for fresh water systems (***Configuration→SERV→FLUD*=1**). The Freeze Setpoint is the Brine Freeze Setpoint (***Configuration→SERV→LOSP***) for Medium Temperature Brine systems (***Configuration →SERV→FLUD*=2**).

Action Taken — The cooler heater will be energized.

Termination — The cooler heater will be deenergized when both the Entering Water Temperature (***EWT***) and Leaving Water Temperature (***LWT***) are above the Freeze Setpoint + Cooler Heater Delta T Setpoint (***HTR***).

Possible Causes — This mode will be enabled for freeze protection. If the temperatures are not as described above, check

the accuracy of the outside air, entering and leaving water thermistors.

MODE 7 (***Operating Mode→MODE→MD07***) — Water Pump Rotation

Criteria for Mode — Tested when the unit is ON or OFF. This mode is active when the Cooler Pump Sequence (***Configuration→OPTN→ PUMP)* =2** (2 Pumps Automatic Changeover) and the Pump Rotation Delta Timer (***Configuration→OPTN →ROT.P***) has expired.

Action Taken — The control will switch the operation of the pumps. The lead pump will be operating normally. The lag pump will be started, becoming the lead, and then the original lead pump will be shut down.

Termination — This mode will terminate when the pump operation has been completed.

Possible Causes — This mode is in effect only due to programming options.

MODE 8 (***Operating Mode→MODE→MD08***) — Pump Periodic Start

Criteria for Mode — This mode is active when the cooler pump is started for the Periodic Pump Start configuration (***Configuration→ OPTN→PM.PS*=YES**).

Action Taken — If the pump has not run that day, a pump will be started and will run for 2 seconds at 2:00 PM. If the machine is equipped with dual pumps, Pump no. 1 will run on even days (such as day 2, 4, 6 of the month). Pump no. 2 will run on odd days (such as day 1, 3, 5 of the month).

Termination — This mode will terminate when the pump shuts down.

Possible Causes — This mode is in effect only due to programming options.

MODE 9 (***Operating Mode→MODE→MD09***) — Night Low Noise Active

Criteria for Mode — This mode is active when the Night Time Low Noise Option has been configured and the time is within the configured time. Programming a Night Low Noise Start Time (***Configuration→OPTN→LS.ST***) and a Night Low Noise End Time (***Configuration→OPTN→LS.ND***) configures the option.

Action Taken — The control will raise the head pressure set point to reduce the number of condenser fans on, thereby reducing the sound of the machine. Additionally, if the Night Time Low Sound Capacity Limit (***Configuration→OPTN →LS.LT***) has been configured, the units capacity will be limited to the programmed level.

Termination — This mode will terminate once the Night Low Noise End Time (***LS.ND***) has been reached.

Possible Causes — This mode is in effect only due to programming options.

MODE 10 (***Operating Mode→MODE→MD10***) — System Manager Active

Criteria for Mode — Tested when the unit is ON or OFF. This mode is active if a System Manager such as Building Supervisor, Chillervisor System Manager, or another CCN device is controlling the machine.

Action Taken — The machine will respond to the specific command received from the System Manager.

Termination — The mode will be terminated if the System Manager control is released.

Possible Causes — This mode is in effect only due to programming options.

MODE 11 (***Operating Mode→MODE→MD11***) — Mast Slave Ctrl Active

Criteria for Mode — Tested if the machine is ON. This mode is active if the Master Slave Control has been enabled. Having 2 machines programmed, one as the master (***Configuration →RSET→MSSL=1*** [Master]) and the other as a slave (***Configuration→RSET→MSSL=2*** [Slave]).

Action Taken — Both the master and slave machine will respond to the capacity control commands issued by the master controller. This may include control point changes and demand limit commands.

Termination — This mode will terminate when the Master Slave Control has been disabled.

Possible Causes — This mode is in effect only due to programming options.

MODE 12 (***Operating Mode→MODE→MD12***) — Auto Changeover Active

Criteria for Mode — This mode is not supported for Cooling Only units.

Action Taken — None.

Termination — None.

Possible Causes — This mode is in effect only due to programming options.

MODE 13 (***Operating Mode→MODE→MD13***) — Free Cooling Active

Criteria for Mode — This mode is not supported for Cooling Only units.

Action Taken — None.

Termination — None.

Possible Causes — This mode is in effect only due to programming options.

MODE 14 (***Operating Mode→MODE→MD14***) — Reclaim Active

Criteria for Mode — This mode is not supported for Cooling Only units.

Action Taken — None.

Termination — None.

Possible Causes — This mode is in effect only due to programming options.

MODE 15 (***Operating Mode→MODE→MD15***) — Electric Heat Active

Criteria for Mode — This mode is not supported for Cooling Only units.

Action Taken — None.

Termination — None.

Possible Causes — This mode is in effect only due to programming options.

MODE 16 (***Operating Mode→MODE→MD16***) — Heating Low EWT Lockout

Criteria for Mode — This mode is not supported for Cooling Only units.

Action Taken — None.

Termination — None.

Possible Causes — This mode is in effect only due to programming options.

MODE 17 (***Operating Mode→MODE→MD17***) — Boiler Active

Criteria for Mode — This mode is not supported for Cooling Only units.

Action Taken — None.

Termination — None.

Possible Causes — This mode is in effect only due to programming options.

MODE 18 (***Operating Mode→MODE→MD18***) — Ice Mode in Effect

Criteria for Mode — Tested when the unit is ON. This mode is active when Ice Setpoint (***Setpoints→COOL→CSP.3***) is in use. While in this mode, the Active Setpoint (***Run Status →VIEW→SETP***) will show the ***CSP.3*** value.

Action Taken — The unit will operate to the Ice Setpoint (***CSP.3***).

Termination — This mode will terminate when the Ice Setpoint (***CSP.3***) is no longer in use.

Possible Causes — This mode is in effect only due to programming options.

MODE 19 ***Operating Mode→MODE→MD19***) — Defrost Active on Cir A

MODE 20 (***Operating Mode→MODE→MD20***) — Defrost Active on Cir B

Criteria for Mode — This mode is not supported for Cooling Only units.

Action Taken — None.

Termination — None.

Possible Causes — This mode is in effect only due to programming options.

MODE 21 (***Operating Mode→MODE→MD21***) — Low Suction Circuit A

MODE 22 (***Operating Mode→MODE→MD22***) — Low Suction Circuit B

MODE 23 (***Operating Mode→MODE→MD23***) — Low Suction Circuit C

Criteria for Mode — The criteria are tested when the circuit is ON. The appropriate circuit mode will be active if one of the following conditions is true:

1. If the circuit's Saturated Suction Temperature (SST) is more than 6° F (3.3° C) less than the freeze point and both the cooler approach (Leaving Water Temperature-SST) and superheat (Suction Gas Temperature – SST) are greater than 15° F (8.3° C).
2. If there is more than 1 compressor ON in the circuit and the circuit's SST is greater than 18° F (10.0° C) below the freeze point for more than 90 seconds.
3. If there is more than 1 compressor ON in the circuit and the circuit's SST is greater than –4° F (–20.0° C) and the SST 30 seconds ago was 18° F (10.0° C) below the freeze point.
4. If the circuit's saturated suction temperature is greater than 6° F (3.3° C) below the freeze point for more than 3 minutes.

For a fresh water system (***Configuration→SERV→FLUD*=1**), the freeze point is 34° F (1.1° C). For medium temperature brine systems, (***Configuration→SERV→FLUD*=2**), the freeze point is Brine Freeze Set Point (***Configuration→SERV→ LOSP***).

Action Taken — For criterion 1, no additional stages will be added. For criteria 2, 3 and 4, one stage of capacity will be removed.

Termination — The mode will terminate when the circuit's Saturated Suction Temperature is greater than the freeze point minus 6° F (3.3° C) or the circuit has alarmed.

Possible Causes — If this condition is encountered, see Possible Causes for Alarms P.05, P.06, and P.07 on page 67.

MODE 24 **(*Operating Mode→MODE→MD24*)** — High DGT Circuit A

MODE 25 (***Operating Mode→MODE→MD25***) — High DGT Circuit B

MODE 26 (***Operating Mode→MODE→MD26***) — High DGT Circuit C

Criteria for Mode — This mode is tested for when any circuit is running. The circuit saturated condensing and suction temperatures are monitored to ensure that the compressors always operate withing their allowed "map." Operation at conditions at or outside the "map" boundaries will cause this mode to be in effect. Operation at extremely low suction pressures and high condensing temperatures will cause the mode to be generated.

Action Taken — The circuit will not be allowed to increase capacity and may be automatically unloaded or stopped.

Termination — This mode will terminate when or if the circuit refrigerant conditions return to within the compressor "map."

Possible Causes — This mode could be in effect due to a low fluid flow rate, overcharge of oil in a circuit, dirty condenser coils, refrigerant overcharge, or excessive brine concentration.

MODE 27 (***Operating Mode→MODE→MD27***) — High Pres Override Cir A

MODE 28 (***Operating Mode→MODE→MD28***) — High Pres Override Cir B

MODE 29 (***Operating Mode→MODE→MD29***) — High Pres Override Cir C

Criteria for Mode — Tested when the circuit is ON. The appropriate circuit mode will be active if the discharge pressure for the circuit, Discharge Pressure Circuit A (***Pressure →PRC.A→DP.A***), Discharge Pressure Circuit B (***Pressure→PRC.B→DP.B***), or Discharge Pressure Circuit C (***Pressure→PRC.C→DP.C***) is greater than the High Pressure Threshold (***Configuration→SERV→HP.TH***).

Action Taken — The capacity of the affected circuit will be reduced. If the unit is equipped with Minimum Load Control and has been configured for High Ambient (***Configuration →UNIT→HGBP*=3**), the minimum load control valve will be energized. Two minutes following the capacity reduction, the circuit's saturated condensing temperature (SCT) is calculated and stored. The affected circuit will not be allowed to add capacity for at least 5 minutes following the capacity reduction. If after 5 minutes, the circuit's saturated condensing temperature is less than SCT – 3° F (1.7° C), if required, another stage of capacity will be added.

If additional steps of capacity are required, the control will look for other circuits to add capacity.

Termination — This mode will terminate once the circuit's saturated condensing temperature is less than SCT – 3° F (1.7° C).

Possible Causes — If this condition is encountered, see Possible Causes for Alarm A1.03. on page 64.

MODE 30 (***Operating Mode→MODE→MD30***) — Low Superheat Circuit A

MODE 31 (***Operating Mode→MODE→MD31***) — Low Superheat Circuit B

MODE 32 (***Operating Mode→MODE→MD32***) — Low Superheat Circuit C

Criteria for Mode — Tested when the circuit is ON with at least 1 compressor ON. The appropriate circuit mode will be active is the circuit's superheat is less than 5° F (2.8° C).

Action Taken — No additional stages of circuit capacity will be added until the circuit's superheat is greater than 5° F (2.8° C).

The control will look for other circuits to add capacity if additional steps of capacity are required.

Termination — This mode will terminate once the affected circuit's superheat is greater than 5° F (2.8° C).

Possible Causes — If this condition is encountered, see Possible Causes for Alarms P.11, P.12 and P.13 on page 67.

Optional Heat Reclaim Module — For chillers with the heat reclaim option, ***Configuration→UNIT→RECL*** should be set to YES from the factory.

This option requires the installation of an additional board. This is the same board as used for energy management module (EMM).

This board allows control of:

- a heat reclaim condenser pump
- a heat reclaim condenser heater
- solenoid valves to shut off the normal cooling coil (one, two or three for each circuit, depending on the unit size)
- two solenoid drain valves for the heat reclaim coil (one for each circuit)
- two solenoid valves to shut off the water condenser (one for each circuit)
- two solenoid drain valves for the water condenser (one for each circuit).

For more control details, refer to the unit low voltage control schematic.

Selecting the heat reclaim mode can be done with either the local interface or remotely with the (***RECL_SW***) contact or by CCN. For remote connection, Position 14 and 15 on terminal block 7 should be used to switch to air cooled (open) or heat reclaim mode (closed). The ***RECL_SW*** contact can be accessed through (***Input→GEN.I→RECL***).

In local mode, the reclaim select must be set to "Switch Control" (***Operating mode→RL.SE*** **= Switch Ctrl**).

In CCN mode, the reclaim select must be set to YES (***Operating mode→RL.SE*** **= YES**).

The heat reclaim function becomes active when the heat reclaim entering water temperature is lower than the heat reclaim setpoint (***Setpoints→MISC→RSP***), minus half or quarter of the heat reclaim dead band (***Setpoints→MISC→RDB***). The default heat reclaim dead band is 8° F and the recommended dead band range is 5 to 20° F.

The difference between the reclaim entering water temperature and reclaim set point will determine if one or two circuits are required to provide heat reclaim capacity. See Table 35 for details.

Table 35 — Heat Reclaim Circuits

HEAT RECLAIM ENTERING WATER TEMPERATURE	NO. OF CIRCUITS IN RECLAIM		
	START UP	hr_ewt>rsp+hr_deadb/4	hr_ewt>rsp+hr_deadb/2
hr_ewt < ***rsp-hr_deadb***/2	Two	One	Zero
rsp-hr_deadb/2<***hr_ewt*** < ***rsp-hr_deadb***/4	One	One	Zero

The heat reclaim function is not active when the heat reclaim entering water temperature is higher than the heat reclaim set point, plus half of the heat reclaim dead band.

Heat reclaim active mode is indicated by ***MODE_14*** = 1. Mode_14 can be accessed through CCN.

The following is the changeover procedure from cooling mode to heat reclaim mode. First is the start-up of the condenser pump. Then, verification of the condenser flow switch control contact. If this remains open after one minute of condenser pump operation, the circuit remains in cooling mode and an alarm will be activated. The control will then wait until the difference between saturated condensing temperature and saturated suction temperature is higher than 10° F. When this occurs, the pumpdown sequence is activated.

During pumpdown, the control will open the water condenser inlet valve and close the air condenser air valves 3 seconds later. After one minute or when the subcooling value is above 13.2° F, the heat reclaim operation is effective.

Heat reclaim entering water temperature (***HEWT***), leaving water temperature (***HLWT***), heat reclaim pump hours (***HR.CD***), refrigerant sub-cooling (***hr_subcx***) can be can be accessed through following paths:

Temperature→HEWT

Temperature→HLWT

Run Status→RUN→HR.CD

Temperature→CIR.A→HRS.A

Temperature→CIR.B→HRS.B

RECLAIM CONDENSER WATER VALVE OUTPUT — This output (0 to 10 Vdc) is used to control heat reclaim condenser 3-way water valve position through a variable speed device.

The 3-way valve should be installed to facilitate the cold water start-up (below 59 F) and maintain a stable head pressure control during heat reclaim operation. The minimum position of the water valve should be set at 20% and maximum position should be set at 100%.

When the entering water temperature is below 68 F, the water valve should remain at 20% position to allow a maximum re-circulating of the warm water between the 3-way water valve and heat reclaim condenser.

When the entering water temperature is above 104 F, the water valve will remain fully open, allowing no recirculation of the warm water.

When the entering water temperature is between 68 F and 104 F, the water valve will be adjusted between 20% and 100% position in linear proportion to the value of the entering water temperature.

SERVICE

Electronic Expansion Valve (EXV) — See Fig. 25 for a cutaway view of the EXV. High-pressure liquid refrigerant enters valve through the top. As refrigerant passes through the orifice, pressure drops and refrigerant changes to a 2-phase condition (liquid and vapor). The electronic expansion valve operates through an electronically controlled activation of a stepper motor. The stepper motor stays in position, unless power pulses initiate the two discrete sets of motor stator windings for rotation in either direction. The direction depends on the phase relationship of the power pulses.

The motor directly operates the spindle, which has rotating movements that are transformed into linear motion by the transmission in the cage assembly. The valve cone is a V-port type which includes a positive shut-off when closed.

There are two different EXVs. For circuits with 1 or 2 compressors, the total number of steps is 2785. For circuits with 3 or 4 compressors, the total number of steps is 3690. The EXV motor moves at 150 steps per second. Commanding the valve to either 0% or 100% will add extra 160 steps to the move, to ensure the value is open or closed completely.

The EXV board controls the valve. Each circuit has a thermistor located in a well in the suction manifold before the compressor. Suction pressure as measured by the suction pressure transducer is converted to a saturated suction temperature. The thermistor measures the temperature of the superheated gas entering the compressor and the pressure transducer determines the saturated temperature of suction gas. The difference between the temperature of the superheated gas and the saturated suction temperature is the superheat. The EXV board controls the position of the electronic expansion valve stepper motor to maintain superheat set point.

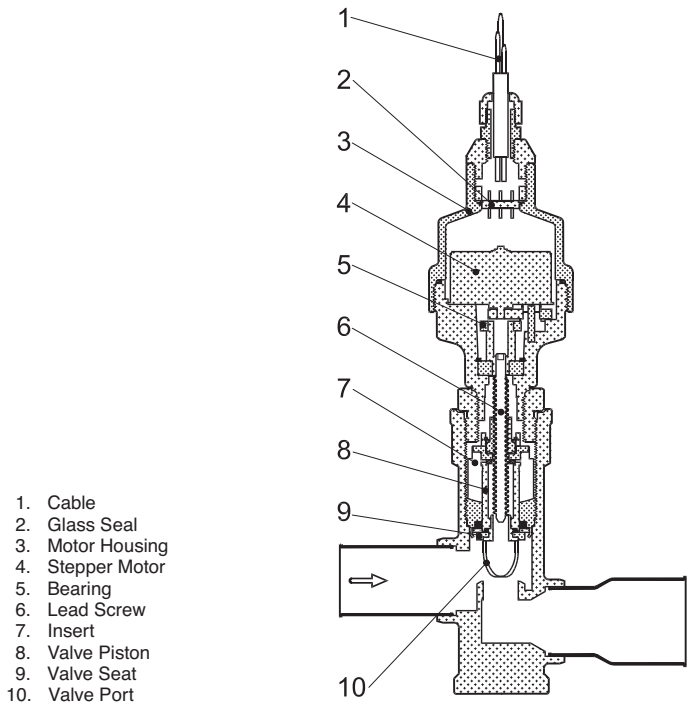


Fig. 25 — Cutaway View of the Electronic Expansion Valve

The MBB controls the superheat leaving cooler to approximately 9.0° F (5.0° C). Because EXV status is communicated to the main base board (MBB) and is controlled by the EXV boards, it is possible to track the valve position. The unit is then protected against loss of charge and a faulty valve. During initial start-up, the EXV is fully closed. After initialization period, valve position is tracked by the EXV board by constantly monitoring the amount of valve movement.

The EXV is also used to limit cooler saturated suction temperature to 50 F (10 C). This makes it possible for the chiller to start at higher cooler fluid temperatures without overloading the compressor. This is commonly referred to as MOP (maximum operating pressure).

If it appears that the EXV module is not properly controlling circuit operation to maintain correct superheat, there are a number of checks that can be made using test functions and initialization features built into the microprocessor control. See the EXV Troubleshooting Procedure section to test EXVs.

EXV TROUBLESHOOTING PROCEDURE — Follow the steps below to diagnose and correct EXV problems. Check EXV motor operation first. Switch the Enable/Off/Remote (EOR) Contact switch to the Off position. Press ESCAPE on the scrolling marquee until the highest operating level is displayed. Use the arrow keys to select the Service Test mode and press ENTER . The display will be **TEST**. Use the arrow keys until display shows **QUIC**. Press ENTER (password entry may be required) and use ▲ or ▼ to change **OFF** to **ON**. The Quick Test sub-mode is now enabled. Move the arrow down to the appropriate circuit EXV, Circuit A EXV % Open (***Service Test Mode→QUIC→EXV.A***), Circuit B EXV % Open (***Service Test Mode→QUIC→EXV.B***), or Circuit C EXV % Open (***Service Test Mode→QUIC→ EXV.C***), and press ENTER. The current value of **0** will be displayed.

Press ENTER and the value will be flashing. Using the ▲ increase the EXV position to select 100% valve position (hold ▲ for quick movement) and press ENTER. The actuator should be felt moving through the EXV. Press ENTER again twice if necessary to confirm this has occurred. This will attempt to force the EXV to 100% again. To close the valve, press ENTER, select 0% with ▼ and press ENTER. The actuator should knock when it reaches the bottom of its stroke. If it is believed that the valve is not working properly, continue with the following test procedure:

Check the 8-position DIP switch on the board for the proper address. Check the EXV output signals at appropriate terminals on the EXV module. Connect positive test lead to EXV-J2A terminal 5 for sizes 060-190 or EXV1-J2A terminal 5 for sizes 210-300 for Circuit A. Connect lead to EXV-J2B terminal 5 for sizes 060-190 or EXV1-J2B terminal 5 for sizes 210-300 for Circuit B. Connect lead to EXV2-J2A terminal 5 for sizes 210-300 for Circuit C. Set meter to approximately 20 vdc. Using the Service Test procedure above, move the valve output under test to 100%. DO NOT short meter leads together or pin 5 to any other pin, as board damage will occur. During the next several seconds, carefully connect the negative test lead to pins 1,2,3 and 4 in succession. Digital voltmeters will average this signal and display approximately 6 vdc. If the output remains at a constant voltage other than 6 vdc or shows 0 volts, remove the connector to the valve and recheck.

Press ENTER and select 0% to close the valve. If a problem still exists, replace the EXV board. If the reading is correct, the expansion valve and EXV wiring should be checked. Check the EXV connector and interconnecting wiring.

1. Check color-coding and wire connections. Make sure they are connected to the correct terminals at the EXV board and EXV plug and that the cables are not crossed.
2. Check for continuity and tight connection at all pin terminals.

Check the resistance of the EXV motor windings. Remove the EXV module plug. Module plug is labeled EXV-J2A on sizes 060-190 or EXV1-J2A on sizes 210-300 for Circuit A, EXV-J2B for sizes 060-190 or EXV1-J2B for sizes 210-300 for Circuit B, or EXV2-J2A on sizes 210-300 for Circuit C.

Check the resistance of the two windings between pins 1 and 3 for one winding and pins 2 and 4 for the other winding. The resistance should be 52 ohms (± 5.2 ohms).

Inspecting/Opening Electronic Expansion Valves

IMPORTANT: Obtain replacement gaskets before opening EXV. Do not re-use gaskets.

To check the physical operation of an EXV, the following steps must be performed.

1. Close the liquid line shut off valve of the circuit to be checked. Put the Enable/Off/Remote Contact switch in the Off position. Using the scrolling marquee, enter the Service Test mode and change ***Service Test→TEST →T.REQ*** from **OFF** to **ON**. A password may be required. Switch the EOR switch to the Enable position. Under the COMP sub-mode, enable the one of the compressors (***Service Test→TEST→CP.xn***) for the circuit. Let compressor run until gage on suction pressure port reads 10 psig. Press ENTER, ▼ and ENTER to turn the compressor off. The compressor will turn off. Immediately after the compressor shuts off, close the discharge valve.
2. Remove any remaining refrigerant from the system low side using proper reclaiming techniques. Turn off the line voltage power supply to the compressors.
3. The expansion valve motor is hermetically sealed inside the top portion of the valve. See Fig. 26. Carefully unscrew the $1^{1}/_{16}$ in. (27 mm) retaining nut securing the motor portion to the body of the valve making sure the EXV plug is still connected. The EXV operator will come out with the motor portion of the device.
4. Enter the appropriate EXV test step under the (***Service Test→QUIC***) sub-mode in the Service Test mode. Locate the desired item ***Service Test→QUIC→EXV.A***, ***Service Test→QUIC→EXV.B***, or ***Service Test→QUIC →EXV.C***. Press ENTER twice to make the valve position of 0% flash. Press and hold ▲ until 100% is displayed and press ENTER. Observe the operation of the lead screw. See Fig. 25. The motor should be turning, raising the operator closer to the motor. Motor actuator movement should be smooth and uniform from fully closed to fully open position. Press ENTER twice, use ▼ to select 0% and press ENTER again to check open to closed operation. If the valve is properly connected to the processor and receiving correct signals, yet does not operate as described above, the sealed motor portion of the valve should be replaced.

Installing EXV Motor

IMPORTANT: Obtain replacement gasket before opening EXV. Do not re-use gaskets.

If re-installing the motor, be sure to use a new gasket in the assembly. See Fig. 26. It is easier to install the motor assembly with the lead screw in the fully closed position. Using the steps outlined above, move the EXV position to 0. Insert the motor into the body of the EXV. Tighten the motor to the body to 36 ft-lb (50 N-m) and then tighten the valve another 30 degrees.

Moisture Liquid Indicator — Clear flow of liquid refrigerant indicates sufficient charge in system. Bubbles in the sight glass indicate undercharged system or presence of noncondensables. Moisture in system measured in parts per million (ppm), changes color of indicator. See Table 36. Change filter drier at first sign of moisture in system.

Table 36 — Moisture Liquid Indicator

REFRIGERANT R-410A	AT 75 F (24 C) (ppm)	AT 125 F (52 C) (ppm)
Green — Dry	<20	<60
Yellow-green — Caution	20 to 165	60 to 500
Yellow — Wet	>165	>500

IMPORTANT: Unit must be in operation at least 12 hours before moisture indicator can give an accurate reading.

With unit running, indicating element must be in contact with liquid refrigerant to give true reading.

Filter Drier — Whenever moisture-liquid indicator shows presence of moisture, replace filter drier(s). There is one filter drier on each circuit. Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, for details on servicing filter driers.

Liquid Line Service Valve — This valve is located immediately ahead of filter drier, and has a $^{1}/_{4}$-in. Schrader connection for field charging. In combination with compressor discharge service valve, each circuit can be pumped down into the high side for servicing except on units equipped with MCHX condenser coils.

Cooler

FREEZE PROTECTION — Coolers can be ordered with heaters installed in the factory. If equipped, the main base board based on the outdoor-air temperature and the entering and leaving water thermistors controls the cooler heaters. The Heater Set Point is the sum of the freeze point and Cooler Heater DT Setp (***Configuration→SERV→HTR***).

If the entering or leaving water temperature is less than the Heater Set Point and the outdoor air temperature is less than the Heater Set Point – 2° F (1.1° C), then the heater will be turned on.

If the Entering or Leaving Water Temperature is less than the Brine Freeze Setpoint (***Configuration→SERV→LOSP***) + 1.0° F (0.5° C), then the heater will be turned on along with the pump.

Entire cooler is covered with closed-cell insulation applied over the heater. Heater plus insulation protect cooler against low ambient temperature freeze-up to –20 F (–28 C).

IMPORTANT: If unit is installed in an area where ambient temperatures fall below 32 F (0° C), it is recommended that a suitable corrosion-inhibited antifreeze solution be used in chilled water circuit.

LOW FLUID TEMPERATURE — Main base board is programmed to shut chiller down if leaving fluid temperature drops below 34 F (1.1 C) for water or below Brine Freeze Setpoint (***Configuration→SERV→LOSP***) for brine units. The unit will shut down without a pumpout. When fluid temperature rises to 6° F (3.3° C) above the leaving fluid set point, safety resets and chiller restarts. Reset is automatic as long as this is the first occurrence.

LOSS OF FLUID FLOW PROTECTION — All 30RB machines include an integral flow switch that protects the chiller against loss of cooler flow.

TUBE PLUGGING — A leaky tube can be plugged until retubing can be done. The number of tubes plugged determines how soon the cooler *must* be retubed. If several tubes require

plugging, check with a local Carrier representative to find out how the number and location of tubes can affect unit capacity. Fig. 27 shows an Elliott tube plug and a cross-sectional view of a plug in place. See Tables 37 and 38 for plug components.

⚠ CAUTION

Use extreme care when installing plugs to prevent damage to the tube sheet section between the holes.

Table 37 — Plug Component Part Numbers

COMPONENTS FOR PLUGGING	PART NUMBER
For Tubes	
Brass Pin	853103-312*
Brass Ring	853002-322*
For Holes without tubes	
Brass Pin	853103-375
Brass Ring	853002-377
Loctite	No. 675 †
Locquic	"N" †

*Order directly from Elliot Tube Company, Dayton, OH or RCD.
†Can be obtained locally.

Table 38 — Plug Component Dimensions

PLUG COMPONENT	SIZE	
	in.	mm
Tube sheet hole diameter	0.377-0.382	9.58-9.70
Tube OD	0.373-0.377	9.47-9.58
Tube ID after rolling (includes expansion due to clearance.)	0.328	8.33

NOTE: Tubes next to gasket webs must be flush with tube sheet (both ends).

For the 30RB150-390 coolers, the pass partition has a perforated distribution plate in the inlet pass to more uniformly distribute the refrigerant as it enters the first pass tubes of the cooler. The perforated distribution plate is on the tubesheet side of the pass partition. A tube plug in a first pass tube will interfere with the installation of pass partition. The tube plug must be flush with the tube sheet to prevent this interference. The pass partition is symmetrical, meaning the partition plate can be rotated 180 degrees, however, the performance of the machine will be affected if the pass partition is installed incorrectly.

RETUBING — When retubing is required, obtain service of qualified personnel experienced in boiler maintenance and repair. Most standard procedures can be followed when retubing the coolers. An 8% crush is recommended when rolling replacement tubes into the tubesheet.

The following Elliott Co. tube rolling tools are required:
- Expander Assembly
- Cage
- Mandrel
- Rolls

Place one drop of Loctite No. 675 or equivalent on top of tube prior to rolling. This material is intended to "wick" into the area of the tube that is not rolled into the tube sheet, and prevent fluid from accumulating between the tube and the tube sheet.

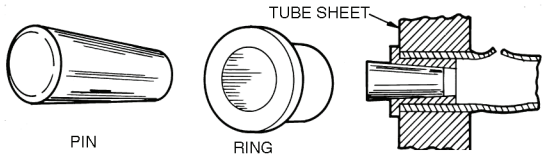
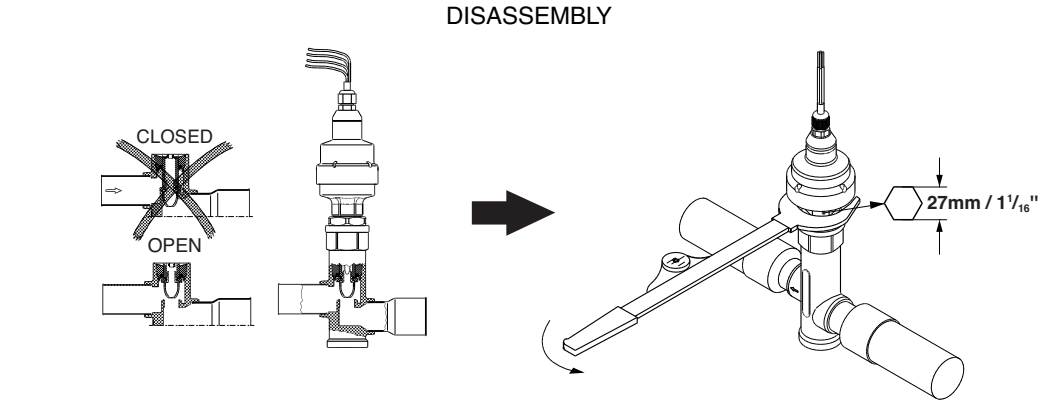
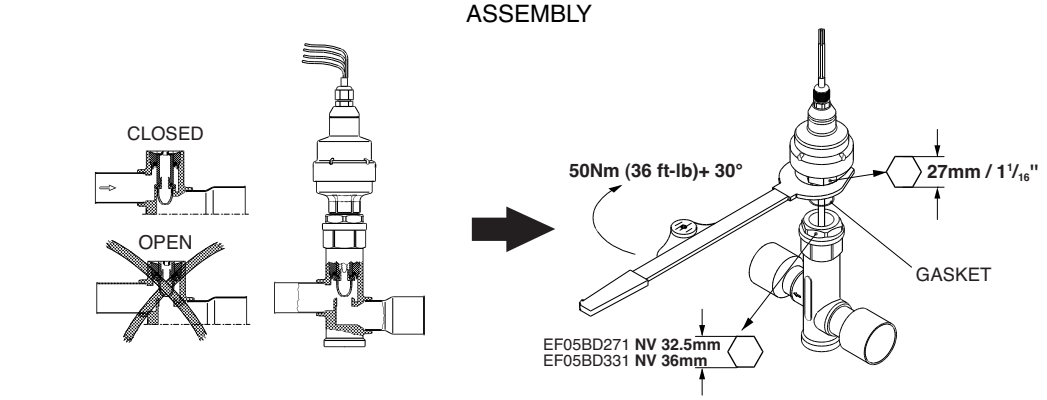


Fig. 27 — Elliott Tube Plug



NOTE: Open valve in Quick Test sub-mode before disassembling.



NOTES:
1. Push down on valve piston to close valve before assembling.
2. After valve is assembled close valve in Quick Test sub-mode or cycle power before opening service valve.

Fig. 26 — Disassembly and Assembly of EXV Motor

TIGHTENING COOLER HEAD BOLTS (Fig. 28-32)

Gasket Preparation — When reassembling cooler heads, always use new gaskets. Gaskets are neoprene-based and are brushed with a light film of compressor oil. *Do not soak gasket or gasket deterioration will result*. Use new gaskets within 30 minutes to prevent deterioration. Reassemble cooler nozzle end or plain end cover of the cooler with the gaskets. Torque all cooler bolts to the following specification and sequence:

$^5/_8$-in. Diameter Perimeter Bolts (Grade 5). . . . 150 to 170 ft-lb (201 to 228 N-m)

$^1/_2$-in. Diameter Flange Bolts (Grade 5) . . . . . 70 to 90 ft-lb (94 to 121 N-m)

$^1/_2$-in. Diameter Center Stud (Grade 5). . . . . 70 to 90 ft-lb (94 to 121 N-m)

1. Install all bolts finger tight, except for the suction flange bolts. Installing these flanges will interfere with tightening the center stud nuts.
2. Bolt tightening sequence is outlined in Fig. 27-31. Follow the numbering or lettering sequence so that pressure is evenly applied to gasket.
3. Apply torque in one-third steps until required torque is reached. Load *all* bolts to each one-third step before proceeding to next one-third step.
4. No less than one hour later, retighten all bolts to required torque values.
5. After refrigerant is restored to system, check for refrigerant leaks using recommended industry practices.
6. Replace cooler insulation.

CHILLED WATER FLOW SWITCH — A factory-installed flow switch is installed in the cooler nozzle for all machines. This is a thermal-dispersion flow switch with no field adjustments. The switch is set for approximately 0.5 ft/sec flow. See Table 39 for unit flow rate information.

Table 39 — Unit Flow Rates

UNIT SIZE 30RB	COOLER CONNECTION SIZE (in.)	MINIMUM FLOW - WATER (GPM)	MINIMUM FLOW - 40% EG (GPM)
060-100	4	20	53
110-300	6	44	117
315-390	6	44 (per module)	117 (per module)

The sensor tip houses two thermistors and a heater element. One thermistor is located in the sensor tip, closest to the flowing fluid. This thermistor is used to detect changes in the flow velocity of the liquid. The second thermistor is bonded to the cylindrical wall and is affected only by changes in the temperature of the liquid. The thermistors are positioned to be in close contact with the wall of the sensor probe and, at the same time, to be kept separated from each other within the confines of the probe.

In order to sense flow, it is necessary to heat one of the thermistors in the probe. When power is applied, the tip of the probe is heated. As the fluid starts to flow, heat will be carried away from the sensor tip. Cooling of the first thermistor is a function of how fast heat is conducted away by the flowing liquid. The difference in temperature between the two thermistors provides a measurement of fluid velocity past the sensor probe. When fluid velocity is high, more heat will be carried away from the heated thermistor and the temperature differential will be small. As fluid velocity decreases, less heat will be taken from the heated thermistor and there will be an increase in temperature differential.

When unit flow rate is above the minimum flow rate, then the output is switched on, sending 24 vac through a 560 ohm dropping resistor. This provides 12 vac to the MBB to prove flow has been established.

For recommended maintenance, check the sensor tip for build-up every 6 months. Clean the tip with a soft cloth. If necessary, build-up (e.g., lime) can be removed with a common vinegar cleansing agent.

RTPF (Round Tube Plate Fin) Condenser Coil Maintenance and Cleaning Recommendations — Routine cleaning of coil surfaces is essential to maintain proper operation of the unit. Elimination of contamination and removal of harmful residues will greatly increase the life of the coil and extend the life of the unit. The following maintenance and cleaning procedures are recommended as part of the routine maintenance activities to extend the life of the coil.

REMOVE SURFACE LOADED FIBERS — Surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges can be easily bent over and damage to the coating of a protected coil) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

PERIODIC CLEAN WATER RINSE — A periodic clean water rinse is very beneficial for coils that are applied in coastal or industrial environments. However, it is very important that the water rinse is made with very low velocity water stream to avoid damaging the fin edges. Monthly cleaning as described below is recommended.

ROUTINE CLEANING OF COIL SURFACES — Monthly cleaning with Totaline® environmentally sound coil cleaner is essential to extend the life of coils. This cleaner is available from Carrier Replacement parts division as part number P902-0301 for a one gallon container, and part number P902-0305 for a 5 gallon container. It is recommended that all coils, including the standard copper tube aluminum fin, precoated fin, copper fin, or E-coated coils be cleaned with the Totaline environmentally sound coil cleaner as described below. Coil cleaning should be part of the unit's regularly scheduled maintenance procedures to ensure long life of the coil. Failure to clean the coils may result in reduced durability in the environment.

Avoid the use of:
- coil brighteners
- acid cleaning prior to painting
- high pressure washers
- poor quality water for cleaning

Totaline environmentally sound coil cleaner is non-flammable, hypoallergenic, nonbacterial, and a USDA accepted biodegradable agent that will not harm the coil or surrounding components such as electrical wiring, painted metal surfaces, or insulation. Use of non-recommended coil cleaners is strongly discouraged since coil and unit durability could be affected.

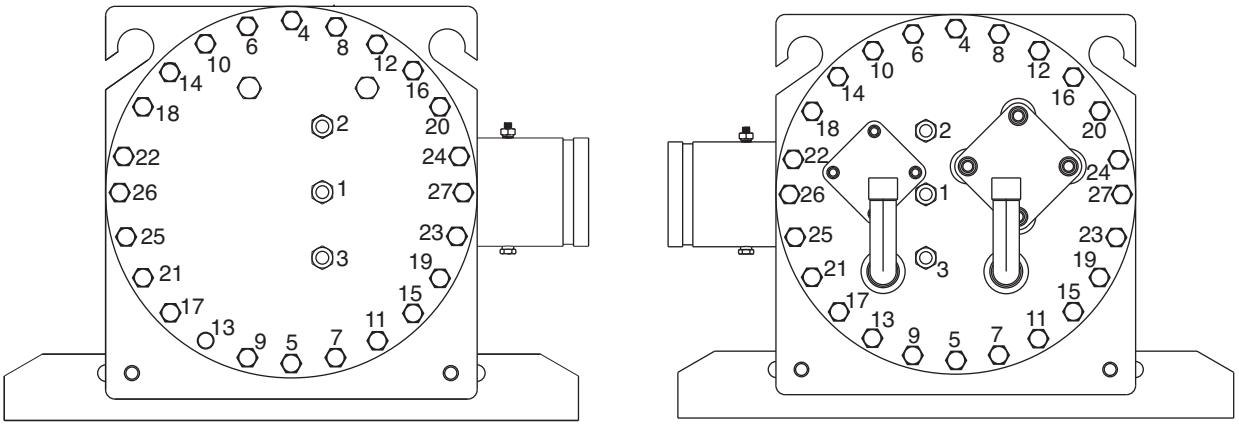


Fig. 28 — Bolt Tightening Sequence, 30RB060,070

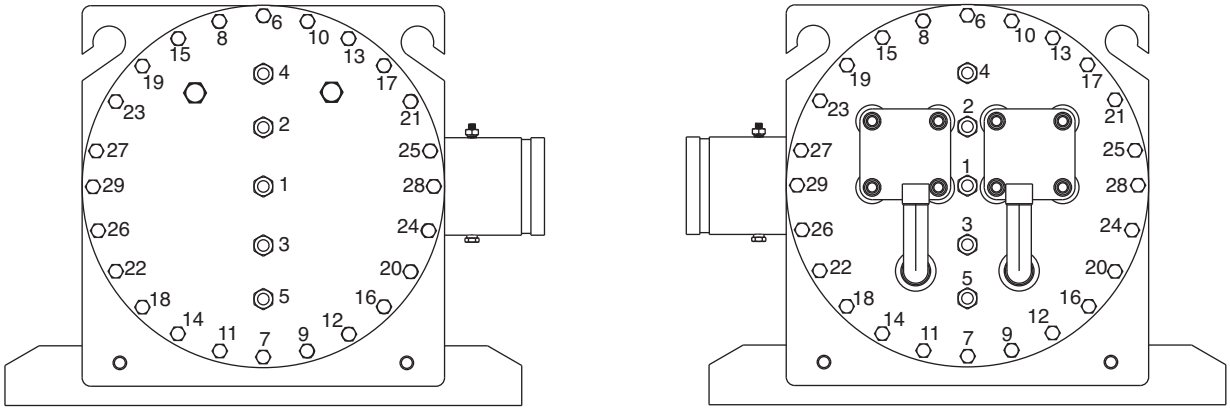


Fig. 29 — Bolt Tightening Sequence, 30RB080-100

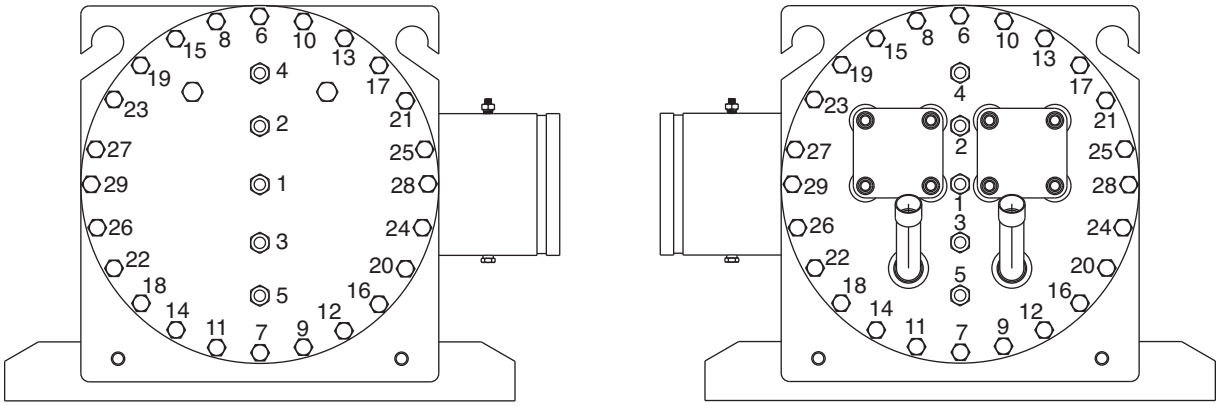


Fig. 30 — Bolt Tightening Sequence, 30RB110-130

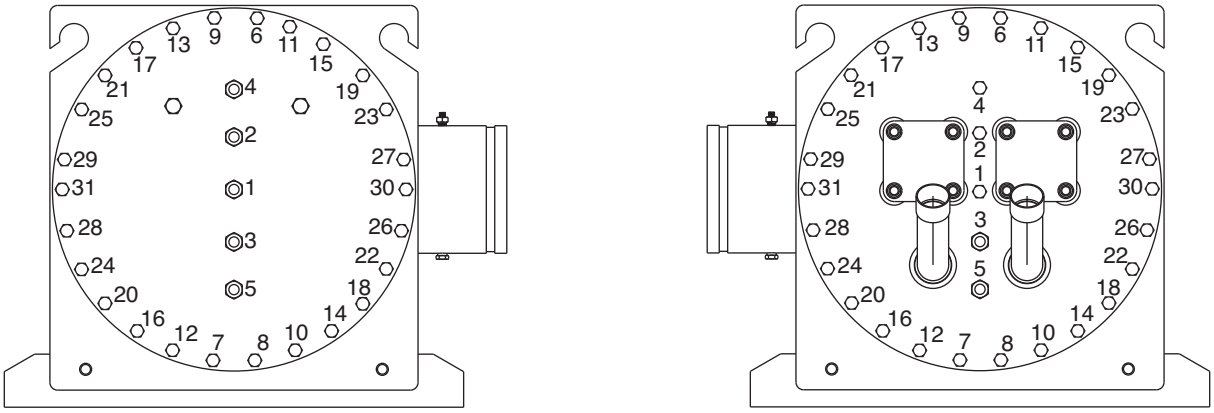


Fig. 31 — Bolt Tightening Sequence, 30RB150-190, 315A/B, 345A/B, 360A/B, 390A/B

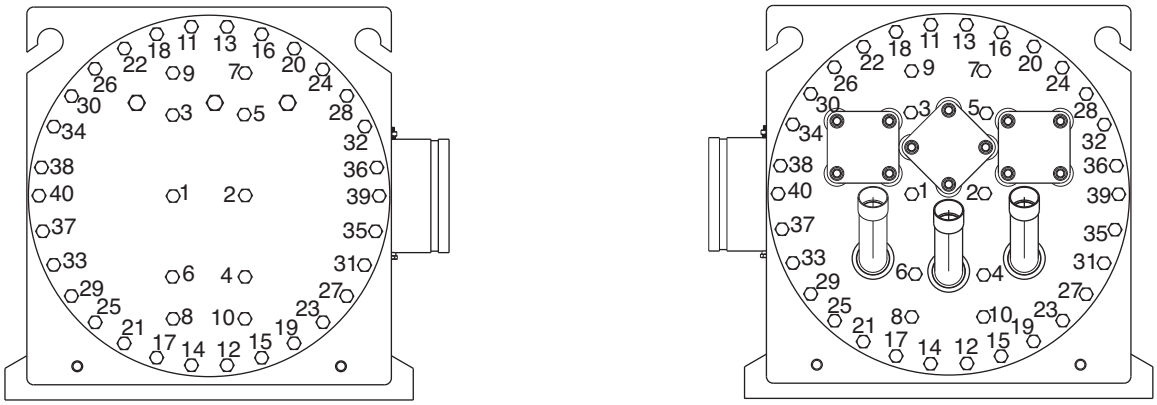


Fig. 32 — Bolt Tightening Sequence, 30RB210-300

Totaline Environmentally Sound Coil Cleaner Application Equipment

- $2^1/_2$ gallon garden sprayer
- water rinse with low velocity spray nozzle.

⚠ CAUTION

Harsh chemicals, household bleach or acid or basic cleaners should not be used to clean outdoor or indoor coils of any kind. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the Totaline® environmentally sound coil cleaner as described on page 53.

⚠ CAUTION

High velocity water from a pressure washer, garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdown may occur.

Totaline Environmentally Sound Coil Cleaner Application Instructions

1. Remove any foreign objects or debris attached to the coil face or trapped within the mounting frame or brackets.
2. Put on personal protective equipment including safety glasses and/or face shield, waterproof clothing and gloves. It is recommended to use full coverage clothing.
3. Remove all surface loaded fibers and dirt with a vacuum cleaner as described above.
4. Thoroughly wet finned surfaces with clean water and a low velocity garden hose, being careful not to bend fins.
5. Mix Totaline environmentally sound coil cleaner in a $2^1/_2$ gallon garden sprayer according to the instructions included with the cleaner. The optimum solution temperature is 100 F.

NOTE: Do NOT USE water in excess of 130 F, as the enzymatic activity will be destroyed.

6. Thoroughly apply Totaline environmentally sound coil cleaner solution to all coil surfaces including finned area, tube sheets and coil headers.
7. Hold garden sprayer nozzle close to finned areas and apply cleaner with a vertical, up-and-down motion. Avoid spraying in horizontal pattern to minimize potential for fin damage.
8. Ensure cleaner thoroughly penetrates deep into finned areas.
9. Interior and exterior finned areas must be thoroughly cleaned.
10. Finned surfaces should remain wet with cleaning solution for 10 minutes.
11. Ensure surfaces are not allowed to dry before rinsing. Reapplying cleaner as needed to ensure 10-minute saturation is achieved.
12. Thoroughly rinse all surfaces with low velocity clean water using downward rinsing motion of water spray nozzle. Protect fins from damage from the spray nozzle.

MCHX (Microchannel Heat Exchanger) Condenser Coil Maintenance and Cleaning Recommendations — Routine cleaning of coil surfaces is essential to maintain proper operation of the unit. Elimination of contamination and removal of harmful residues will greatly increase the life of the coil and extend the life of the unit. The following steps should be taken to clean MCHX condenser coils:

⚠ CAUTION

Do not apply any chemical cleaners to MCHX condenser coils. These cleaners can accelerate corrosion and damage the coil.

1. Remove any foreign objects or debris attached to the coil face or trapped within the mounting frame and brackets.
2. Put on personal protective equipment including safety glasses and/or face shield, waterproof clothing and gloves. It is recommended to use full coverage clothing.
3. Start high pressure water sprayer and purge any soap or industrial cleaners from sprayer before cleaning condenser coils. Only clean potable water is authorized for cleaning condenser coils.
4. Clean condenser face by spraying the coil steady and uniformly from top to bottom while directing the spray straight toward the coil. Do not exceed 900 psig or 30 degree angle. The nozzle must be at least 12 in. from the coil face. Reduce pressure and use caution to prevent damage to air centers.

⚠ CAUTION

Excessive water pressure will fracture the braze between air centers and refrigerant tubes.

Condenser Fans — A formed metal mount bolted to the fan deck supports each fan and motor assembly. A shroud and a wire guard provide protection from the rotating fan. The exposed end of fan motor shaft is protected from weather by

grease. If fan motor must be removed for service or replacement, be sure to regrease fan shaft and reinstall fan guard. The fan motor has a step in the motor shaft. For proper performance, fan should be positioned such that it is securely seated on this step. Tighten the bolt to 12 to 15 ft-lb (16 to 20 N-m).

IMPORTANT: Check for proper fan rotation (counterclockwise viewed from above). If necessary, switch any 2 power leads to reverse fan rotation.

Refrigerant Circuit

LEAK TESTING — Units are shipped with complete operating charge of refrigerant R-410A (see Physical Data tables supplied in the 30RB Installation Instructions) and should be under sufficient pressure to conduct a leak test. If there is no pressure in the system, introduce enough nitrogen to search for the leak. Repair the leak using good refrigeration practices. After leaks are repaired, system must be evacuated and dehydrated.

REFRIGERANT CHARGE — Refer to Physical Data tables supplied in the 30RB Installation Instructions). Immediately ahead of filter drier in each circuit is a factory-installed liquid line service valve. Each filter drier has a $^1/_4$-in. Schrader connection for charging liquid refrigerant.

Charging with Unit Off and Evacuated — Close liquid line service valve before charging. Weigh in charge shown on unit nameplate. Open liquid line service valve; start unit and allow it to run several minutes fully loaded. Check for a clear sight glass. Be sure clear condition is liquid and not vapor.

Charging with Unit Running — If charge is to be added while unit is operating, all condenser fans and compressors must be operating. It may be necessary to block condenser coils at low ambient temperatures to raise condensing pressure to approximately 450 psig (3102 kPa) to turn all condenser fans on. Do not totally block a coil to do this. Partially block all coils in uniform pattern. Charge each circuit until sight glass shows clear liquid, and has a liquid line temperature of 103 F (39 C).

IMPORTANT: When adjusting refrigerant charge, circulate fluid through cooler continuously to prevent freezing and possible damage to the cooler. Do not overcharge, and never charge liquid into the low-pressure side of system.

Safety Devices — Chillers contain many safety devices and protection logic built into electronic control. Following is a brief summary of major safeties.

COMPRESSOR PROTECTION

Circuit Breaker — Each compressor is equipped with one molded case circuit breaker to provide short circuit protection. Do not bypass or increase size of a breaker to correct problems. Determine cause for trouble and correct before resetting breaker. Circuit breaker current rating is listed on individual circuit breakers.

A high-pressure switch with a trip pressure of 641 psig (4419 kPa) is mounted on the discharge line of each circuit. Switch is wired in series with the SPM modules of all compressors in the circuit. If switch opens, the SPM opens all compressor contactors in the circuit and all compressors are locked off. See the table below for high pressure switch protection.

DEVICE	CUT-OUT	CUT-IN
High Pressure Switch	641 ± 10 psi (4420 ± 70 kPa)	493 ± 29 psi (3400 ± 200 kPa)

CRANKCASE HEATERS — Each compressor has a 56-w crankcase heater to prevent absorption of liquid refrigerant by oil in crankcase when compressor is not running. Heater power source is control power transformer.

IMPORTANT: Never open any switch or disconnect that deenergizes crankcase heaters unless unit is being serviced or is to be shut down for a prolonged period. After a prolonged shutdown or service, energize crankcase heaters for 24 hours before starting unit.

Relief Devices — Fusible plugs are located in each circuit to protect against damage from excessive pressures.

HIGH-SIDE PROTECTION — One device is located between condenser and filter drier; a second is on filter drier.

These are both designed to relieve pressure on a temperature rise to approximately 210 F (99 C).

LOW-SIDE PROTECTION — A device is located on suction line and is designed to relieve pressure on a temperature rise to approximately 170 F (77 C).

Some local building codes require that relieved gases be removed. This connection will allow conformance to this requirement.

Compressors

⚠ WARNING

Do not supply power to unit with compressor cover removed. Failure to follow this warning can cause a fire resulting in personal injury or death.

⚠ WARNING

Exercise extreme caution when reading compressor currents when high-voltage power is on. Correct any of the problems described below before installing and running a replacement compressor. Wear safety glasses and gloves when handling refrigerants. Failure to follow this warning can cause a fire, resulting personal injury or death.

⚠ CAUTION

Do not manually operate contactors. Serious damage to the machine may result.

COMPRESSOR REPLACEMENT — To change out a faulty compressor, refer to the compressor replacement procedure included with the new compressor.

OIL CHARGE — All units are factory charged with polyol ester (POE) oil to $^7/_8$ sight glass. Acceptable oil level for each compressor is $^3/_4$ to $^7/_8$ full in the sight glass.

⚠ CAUTION

The compressor in a Puron® system uses a polyol ester (POE) oil. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all necessary precautions to avoid exposure of the oil to the atmosphere.

When additional oil or a complete charge is required it must meet the following specifications:

- Manufacturer . . . . . .ICI Emkarate RL 32H
- Oil Type. . . . . Inhibited polyol ester-based synthetic compressor lubricant.
- ISO Viscosity Grade 32

Do not reuse drained oil or any oil that has been exposed to the atmosphere.

SYSTEM BURNOUT CLEANUP PROCEDURE — Some compressor electrical failures can cause the motor to burn. When this occurs, byproducts such as sludge, carbon, and acids contaminate the system. There are 2 classifications of motor burnouts, mild and severe. Test the oil for acidity using a POE oil acid test kit to determine the severity of the burnout.

In a mild burnout, there is little or no detectable odor. Compressor oil is clear or slightly discolored. An acid test of the oil will be negative. This type of failure is treated the same as a mechanical failure. The liquid line filter drier or core should be replaced.

In a severe burnout, there is a strong, pungent, rotten egg odor. Compressor oil is very dark. Evidence of burning may be present in the tubing connected to the compressor. An acid test of the oil will be positive. The following steps should be taken before restarting any compressors in the circuit.

1. Isolate compressors and recover refrigerant from compressor section.
2. Remove oil from all compressors in the circuit. An oil drain plug is provided on each compressor. Pressurize the low side of the compressor circuit with nitrogen. Less than 10 psig (68.9 kPa) should be adequate. This will help in the removal of the oil from the compressor sump. Dispose of contaminated oil as per local codes and regulations.
3. Replace failed compressor as outlined under compressor replacement procedure.
4. Recharge the circuit with fresh oil. The circuit oil charge information is supplied in the 30RB Installation Instructions. Oil level should be approximately $^{7}/_{8}$ sight glass.
5. Install activated carbon (burnout) filter drier/core.
6. Leak check, evacuate and recharge refrigerant circuit.
7. Operate compressors. Check filter drier pressure drop periodically. Replace cores if pressure drop exceeds 4 psig (27.6 kPa).

Perform additional acid test after 24 hours of operation. Change liquid line filter drier/core if necessary. Replace with standard filter drier/core once circuit is clean. Use the Carrier Standard Service Techniques Manual as a reference source.

MAINTENANCE

Recommended Maintenance Schedule — The following are only recommended guidelines. Jobsite conditions may dictate that maintenance schedule is performed more often than recommended.

Routine:

For machines with e-coat condenser coils:
- Periodic clean water rinse, especially in coastal and industrial applications.

Every month:
- Check condenser coils for debris, clean as necessary following recommended guidelines.
- Check moisture indicating sight glass for possible refrigerant loss and presence of moisture.

Every 3 months (for all machines):
- Check refrigerant charge.
- Check all refrigerant joints and valves for refrigerant leaks, repair as necessary.
- Check chilled water flow switch operation.
- Check condenser coils for debris, clean as necessary following recommended guidelines.
- Check sight glass moisture indicator for moisture.
- Check all condenser fans for proper operation.
- Check compressor oil level.
- Check crankcase heater operation.
- Inspect pump seal, if equipped with a hydronic pump package.

Every 12 months (for all machines):
- Check all electrical connections, tighten as necessary.
- Inspect all contactors and relays, replace as necessary.
- Check accuracy of thermistors, replace if greater than ±2° F (1.2° C) variance from calibrated thermometer.
- Check accuracy of transducers, replace if greater than ±5 psi (34.47 kPa) variance.
- Check to be sure that the proper concentration of antifreeze is present in the chilled water loop, if applicable.
- Verify that the chilled water loop is properly treated.
- Check refrigerant filter driers for excessive pressure drop, replace as necessary.
- Check chilled water strainers, clean as necessary.
- Check cooler heater operation, if equipped.
- Check pump heater operation, if equipped.
- Check condition of condenser fan blades and that they are securely fastened to the motor shaft.
- Perform Service Test to confirm operation of all components.

Check for excessive cooler approach (Leaving Chilled Water Temperature – Saturated Suction Temperature) which may indicate fouling. Clean cooler vessel if necessary.

TROUBLESHOOTING

See Table 40 for an abbreviated list of symptoms, possible causes and possible remedies.

Alarms and Alerts — The integral control system constantly monitors the unit and generates warnings when abnormal or fault conditions occur. Alarms may cause either a circuit (Alert) or the whole machine (Alarm) to shutdown. Alarms and Alerts are assigned codes as described in Fig. 33. The alarm/alert indicator LED on the scrolling marquee or Navigator™ module is illuminated when any alarm or alert condition is present. If an Alert is active, the Alarm Indicator LED will blink. If an Alarm is active, the Alarm Indicator LED will remain on. Currently active Alerts and Alarms can be found in ***Alarms→ALRM→ALM1*** to ***ALM5***.

The controller generates two types of alarms. Automatic reset alarms will reset without any intervention if the condition that caused the alarm corrects itself. Manual reset alarms require the service technician to check for the alarm cause and reset the alarm. The following method must be followed to reset manual alarms:

Before resetting any alarm, first determine the cause of the alarm and correct it. Enter the Alarms mode indicated by the LED on the side of the scrolling marquee display. Press ENTER and sub-mode ***Alarm→R.ALM*** (Reset All Current Alarms) is displayed. Press ENTER . The control will prompt the user for a password, by displaying PASS and WORD. Press ENTER to display 1111. Press ENTER for each character. The default password is 0111. Use the arrow keys to change each individual character. Use the up or down arrow keys to toggle the display to **YES** and press ENTER . The alarms will be reset. Indicator light will be turned off when switched correctly. Do not reset the chiller at random without first investigating and correcting the cause(s) of the failure.

Each alarm is described by a three or four-digit code. The first one or two digits indicate the alarm source and are listed below. The last two digits pinpoint the problem. See Table 41.

Table 40 — Troubleshooting

SYMPTOM	POSSIBLE CAUSE	POSSIBLE REMEDY
Unit Does Not Run	Check for power to unit	• Check overcurrent protection device. • Check non-fused disconnect (if equipped). • Restore power to unit.
	Low refrigerant charge	Check for leak and add refrigerant.
	Wrong or incorrect unit configuration	Check unit configuration.
	Active alarm	Check Alarm status. See separate Alarm and follow troubleshooting instructions.
	Active operating mode	Check for Operating Modes. See Operating Modes and follow troubleshooting instructions. Check capacity control overrides.
Unit Operates too Long or Continuously	Low refrigerant charge	Check for leak and add refrigerant.
	Compressor or control contacts welded	Replace contactor or relay.
	Air in chilled water loop	Purge water loop.
	Non-condensables in refrigerant circuit.	Remove refrigerant and recharge.
	Inoperative EXV	• Check EXV, clean or replace. • Check EXV cable, replace if necessary. • Check EXV board for output signal.
Circuit Does Not Run	Active alarm	Check Alarm status. See separate Alarm and follow troubleshooting instructions.
	Active operating mode	Check for Operating Modes. See Operating Modes and follow troubleshooting instructions.
Circuit Does Not Load	Active alarm	Check Alarm status. See separate Alarm and follow troubleshooting instructions.
	Active operating mode	Check for Operating Modes. See Operating Modes and follow troubleshooting instructions.
	Low saturated suction temperature	See Operating Modes 21, 22 and 23.
	High circuit suction superheat	The circuit capacity is not allowed increase if circuit superheat is greater than 36 F (20 C). See Alarms P.08, P.09 and P.10 for potential causes.
	Low suction superheat	The circuit capacity is not allowed to increase if the circuit superheat is less than 5 F (2.8 C). See Alarms P.11, P.12 and P.13 for potential causes.
Compressor Does Not Run	Active alarm	Check Alarm status. See separate Alarm and follow troubleshooting instructions.
	Active operating mode	Check for Operating Modes. See Operating Modes and follow troubleshooting instructions.
	Inoperative compressor contactor	• Check control wiring. • Check scroll protection module. • Check contactor operation, replace if necessary.
Chilled Water Pump is ON, but the Machine is OFF	Cooler freeze protection	Chilled water loop temperature too low. Check cooler heater.

Table 41 — Alarm Codes

PREFIX CODE	SUFFIX CODE	DESCRIPTION	REASON FOR ALARM	ACTION TAKEN BY CONTROL	RESET TYPE	PROBABLE CAUSE
A1 A2 A3 A4 B1 B2 B3 B4 C1 C2 C3 C4	**.01**	Compressor nn Motor Temperature Too High	Compressor Motor Sensor PTC resistance is greater than 4.5k Ω.	Circuit shut down or not allowed to start	Manual	Compressor failure, wiring error, operation outside of limits, improper refrigerant charge
	.02	Compressor nn Crankcase Heater Failure	Crankcase heater current not detected when required or detected when not required.	Circuit shut down or not allowed to start	Manual	Wiring error, failed crankcase heater, failed SPM.
	.03	Compressor nn High Pressure Switch	High Pressure Switch open.	Circuit shut down or not allowed to start	Manual	Wiring error, closed/ restricted discharge valve, improper refrigerant charge, dirty condenser coils, failed outdoor fan motor, discharge pressure transducer inaccuracy
	.04	Compressor nn Motor Sensor PTC Out of Range	Compressor Motor Sensor PTC resistance is less than 50 Ω or greater than 17k Ω.	Circuit shut down or not allowed to start	Manual	Wiring error, operation outside of limits, compressor failure, improper refrigerant charge
	.05	Compressor nn Power Reset	24-VAC power lost to SPM board.	Compressor shut down or not allowed to start	Automatic	Low voltage from main power supply.
	.06	Compressor nn Low Control Voltage Alert	24-VAC power to SPM board too low.	Compressor shut down or not allowed to start	Automatic	Low voltage from main power supply.

See legend on page 59.

Table 41 — Alarm Codes (cont)

PREFIX CODE	SUFFIX CODE	DESCRIPTION	REASON FOR ALARM	ACTION TAKEN BY CONTROL	RESET TYPE	PROBABLE CAUSE
Co	.A1	Loss of Communication with Compressor Board A1	No communication with SPM	Affected compressor is shut down	Automatic	Wrong SPM address, wrong unit configuration, wiring error, power loss to SPM.
	.A2	Loss of Communication with Compressor Board A2				
	.A3	Loss of Communication with Compressor Board A3				
	.A4	Loss of Communication with Compressor Board A4				
	.B1	Loss of Communication with Compressor Board B1				
	.B2	Loss of Communication with Compressor Board B2				
	.B3	Loss of Communication with Compressor Board B3				
	.B4	Loss of Communication with Compressor Board B4				
	.C1	Loss of Communication with Compressor Board C1				
	.C2	Loss of Communication with Compressor Board C2				
	.C3	Loss of Communication with Compressor Board C3				
	.C4	Loss of Communication with Compressor Board C4				
	.E1	Loss of Communication with EXV Board Number 1	No communication with EXV1	Circuit A & B shut down or not allowed to start	Automatic	Wrong module address, wrong unit configuration, wiring error, power loss to module
	.E2	Loss of Communication with EXV Board Number 2	No communication with EXV2	Circuit C shut down or not allowed to start		
	.F1	Loss of Communication with Fan Board Number 1	No communication with Fan Board 1	Circuit A & B shut down or not allowed to start (060-150, 210-250) Circuit A shut down or not allowed to start (160-190, 275-300)	Automatic	Wrong module address, wrong unit configuration, wiring error, power loss to module
	.F2	Loss of Communication with Fan Board Number 2	No communication with Fan Board 2	Circuit B shut down or not allowed to start (160-190, 275-300)		
	.F3	Loss of Communication with Fan Board Number 3	No communication with Fan Board 3	Circuit C shut down or not allowed to start (210-300)		
	.O1	Loss of Communication with Free Cooling Board	No communication with Free Cooling Board	None	Automatic	Configuration error.
	.O2	Loss of Communication with Electrical Heaters Board	No communication with Electrical Heaters Board			
	.O3	Loss of Communication with Energy Management Board	No communication with Energy Management Board	Disable or not allow EMM Functions (3-Step and 4-20 mA Demand Limit, 4-20 mA and Space Temperature Reset, Occupancy Override, and Ice Build)	Automatic	Wrong module address, wrong unit configuration, wiring error, power loss to module
	.O4	Loss of Communication with Heat Reclaim Board	No communication with Heat Reclaim Board	Unit shall return to the standard air cooled mode	Automatic	Wrong module address, wrong unit configuration, wiring error, power loss to module

LEGEND

EMM — Energy Management Module
EWT — Entering Water Temperature
EXV — Electronic Expansion Valve
HR — Heat Reclaim
LWT — Leaving Water Temperature
MOP — Maximum Operating Pressure
OAT — Outdoor Air Temperature
PTC — Positive Temperature Coefficient
SCT — Saturated Condensing Temperature
SPM — Scroll Protection Module
SST — Saturated Suction Temperature

Table 41 — Alarm Codes (cont)

PREFIX CODE	SUFFIX CODE	DESCRIPTION	REASON FOR ALARM	ACTION TAKEN BY CONTROL	RESET TYPE	PROBABLE CAUSE
Ct	.01	Circuit A Welded Contactor Failure	Controls determine compressor is still running when circuit should be off	EXV, fan control, and pump operate as normal to save compressor until high pressure, freeze, or flow failure condiions occur	Manual	One or more circuit compressor contactors welded closed.
	.02	Circuit B Welded Contactor Failure	Controls determine compressor is still running when circuit should be off	EXV, fan control, and pump operate as normal to save compressor until high pressure, freeze, or flow failure condiions occur	Manual	One or more circuit compressor contactors welded closed.
	.03	Circuit C Welded Contactor Failure	Controls determine compressor is still running when circuit should be off	EXV, fan control, and pump operate as normal to save compressor until high pressure, freeze, or flow failure condiions occur	Manual	One or more circuit compressor contactors welded closed.
FC	.n0	Initial Factory Configuration Required	No configuration	Unit not allowed to start	Automatic	Configuration error. Password may default to 0113.
	.nn	Illegal Configuration	Wrong or incompatible configuration data	Unit not allowed to start	Automatic	Configuration error.
MC	.nn	Master Chiller Configuration Error	Wrong or incompatible configuration data	Unit not allowed to start in Master-Slave Control	Automatic	Configuration error. Refer to Table 43.
P	.01	Water Exchanger Freeze Protection	Entering or Leaving Thermistor sensed a temperature at or below freeze point.	Unit shut down or not allowed to start. Chilled Water Pump will be started	Automatic, first occurrence in 24 hours, Manual, if multiple alarms within 24 hours	Faulty thermistor, faulty wiring, low water flow rate, low loop volume, or freeze conditions.
	.05	Circuit A Low Suction Temperature	Low Saturated Suction Temperatures sensed for a period of time.	Circuit shut down	Automatic, first occurrence in 24 hours, Manual, if multiple alarms within 24 hours	Faulty transducer, faulty wiring, low water flow rate, low loop volume, fouled cooler, or freeze conditions.
	.06	Circuit B Low Suction Temperature				
	.07	Circuit C Low Suction Temperature				
	.08	Circuit A High Superheat	EXV>98%, Suction Superheat >54 F (30.0 C) and SST<MOP for more than 5 minutes	Circuit shut down	Manual	Faulty transducer, faulty thermistor, faulty wiring, faulty EXV, low refrigerant charge, plugged or restricted liquid line.
	.09	Circuit B High Superheat				
	.10	Circuit C High Superheat				
	.11	Circuit A Low Superheat	EXV ≤5% and Suction Superheat is less than the superheat setting by at least 5 F (2.8 C) or SST>Maximum Operating Pressure for more than 5 minutes	Circuit shut down	Automatic, first occurrence in 24 hours, Manual, if multiple alarms within 24 hours	Faulty transducer, faulty thermistor, faulty wiring, faulty EXV, or incorrect configuration.
	.12	Circuit B Low Superheat				
	.13	Circuit C Low Superheat				
	.14	Cooler Interlock Failure	Cooler Pump Interlock circuit opens (consists of chilled water flow system and chilled water pump interlock)	Unit shut down or not allowed to start	Automatic if stage=0, Manual if stage>0.	Low Water Flow, faulty wiring or contacts, faulty water flow switch, or chilled water pump problem. Remote lockout if unit is equipped with an EMM.

LEGEND

EMM — Energy Management Module
EWT — Entering Water Temperature
EXV — Electronic Expansion Valve
HR — Heat Reclaim
LWT — Leaving Water Temperature
MOP — Maximum Operating Pressure
OAT — Outdoor Air Temperature
PTC — Positive Temperature Coefficient
SCT — Saturated Condensing Temperature
SPM — Scroll Protection Module
SST — Saturated Suction Temperature

Table 41 — Alarm Codes (cont)

PREFIX CODE	SUFFIX CODE	DESCRIPTION	REASON FOR ALARM	ACTION TAKEN BY CONTROL	RESET TYPE	PROBABLE CAUSE
P	.15	Condenser Flow Switch Failure	—	None	Manual	Configuration error.
	.16	Compressor A1 Not Started or Pressure not Established	Compressor differential (Discharge-Suction) did not increase by 10 psig (69 kPa) in 2 minutes	Circuit shut down	Manual	No power to the compressor, faulty compressor contactor, low control voltage, faulty discharge or suction pressure transducers, wiring error, improper electrical phasing.
	.17	Compressor A2 Not Started or Pressure not Established				
	.18	Compressor A3 Not Started or Pressure not Established				
	.19	Compressor A4 Not Started or Pressure not Established				
	.20	Compressor B1 Not Started or Pressure not Established				
	.21	Compressor B2 Not Started or Pressure not Established				
	.22	Compressor B3 Not Started or Pressure not Established				
	.23	Compressor B4 Not Started or Pressure not Established				
	.24	Compressor C1 Not Started or Pressure not Established				
	.25	Compressor C2 Not Started or Pressure not Established				
	.26	Compressor C3 Not Started or Pressure not Established				
	.27	Compressor C4 Not Started or Pressure not Established				
	.28	Electrical Box Thermostat Failure	Improper phasing detected by the reverse rotation board	Unit not allowed to start	Automatic	Check power phasing, improper wiring, or faulty detection board.
	.29	Loss of Communication with System Manager	Loss of communication with an external control device for more than 2 minutes	Unit changes to stand alone operation	Automatic	Faulty communication wiring, no power supply to the external controller.
	.30	Master/Slave Communication Failure	Communication between the master and slave machines has been lost.	Units operate as stand alone machines	Automatic	Faulty communication wiring, no power or control power to the main base board to either module.
	.31	Unit is in Emergency Stop	Emergency Stop command has been received.	Unit shuts down or not allowed to start.	Automatic	Carrier Comfort Network® Emergency Stop Command received.
	.32	Cooler Pump 1 Fault	Pump Interlock status does not match pump status.	Unit shuts down. If available, another pump will start.	Manual	Faulty contacts, wiring error, or low control voltage.
	.33	Cooler Pump 2 Fault				
	.34	Circuit A Reclaim Operation Failure	Circuit A Reclaim Operation Failure	Reclaim operation failure due to high SCT	The affected circuit shall return to air cooled mode	Manual
	.35	Circuit B Reclaim Operation Failure	Circuit B Reclaim Operation Failure			
	.37	Circuit A Repeated High Discharge Gas Overrides	Multiple capacity overrides due to high saturated discharge temperatures	Circuit shut down	Automatic	Condenser air recirculation, dirty or plugged condenser coils, inaccurate discharge transducer, faulty condenser fan,
	.38	Circuit B Repeated High Discharge Gas Overrides				
	.39	Circuit C Repeated High Discharge Gas Overrides				
	.40	Circuit A Repeated Low Suction Temperature Overrides	Multiple capacity overrides due to low saturated suction temperatures	Circuit shut down	Manual	Low water flow, low loop volume, fouled cooler, low refrigerant charge, unit not configured for brine with glycol in cooler.
	.41	Circuit B Repeated Low Suction Temperature Overrides				
	.42	Circuit C Repeated Low Suction Temperature Overrides				
	.97	Water Exchanger Temperature Sensors Swapped	Control detects EWT below LWT for 1 minute	Unit shuts down	Manual	Wiring error. EWT and LWT sensors swapped.

LEGEND

EMM — Energy Management Module
EWT — Entering Water Temperature
EXV — Electronic Expansion Valve
HR — Heat Reclaim
LWT — Leaving Water Temperature
MOP — Maximum Operating Pressure
OAT — Outdoor Air Temperature
PTC — Positive Temperature Coefficient
SCT — Saturated Condensing Temperature
SPM — Scroll Protection Module
SST — Saturated Suction Temperature

Table 41 — Alarm Codes (cont)

PREFIX CODE	SUFFIX CODE	DESCRIPTION	REASON FOR ALARM	ACTION TAKEN BY CONTROL	RESET TYPE	PROBABLE CAUSE
Pr	.01	Circuit A Discharge Transducer	Measured voltage is 0 vdc	Circuit shut down or not allowed to start.	Automatic	Faulty transducer, wiring error, failed Main Base Board or Fan Board 3. Compressor circuit breaker tripped.
	.02	Circuit B Discharge Transducer				
	.03	Circuit C Discharge Transducer				
	.04	Circuit A Suction Transducer				
	.05	Circuit B Suction Transducer				
	.06	Circuit C Suction Transducer				
	.07	Circuit A Reclaim Pumpdown Pressure Transducer		The affected circuit shall return to air cooled mode	Automatic	Faulty transducer, wiring error, failed EMM HR board.
	.08	Circuit B Reclaim Pumpdown Pressure Transducer				
Sr	.nn	Service Maintenance Alert	Field programmed elapsed time has expired for maintenance item	None	Manual	Maintenance required (see Table 44).
th	.01	Water Exchanger Entering Fluid Thermistor Failure	Temperature measured by the controller is less than -40 F (-40 C) or greater than 240 F (115.6 C)	Unit will be shut down or not allowed to start.	Automatic	Faulty thermistor, wiring error, failed Main Base Board.
	.02	Water Exchanger Leaving Fluid Thermistor Failure				
	.03	Circuit A Defrost Thermistor Failure		None	Automatic	Configuration error.
	.04	Circuit B Defrost Thermistor Failure				
	.08	Reclaim Condenser Entering Thermistor		Unit shall return to the standard air cooled mode.	Automatic	Faulty thermistor, wiring error, failed EMM HR board.
	.09	Reclaim Condenser Leaving Thermistor		None		
	.10	OAT Thermistor Failure		Unit is shut down or not allowed to start. Cooler/ Pump heaters are energized	Automatic	Faulty thermistor, wiring error, failed Main Base Board.
	.11	Master/Slave Common Fluid Thermistor		Dual Chiller deactivated. Master and Slave machines operate in stand alone mode		
	.12	Circuit A Suction Gas Thermistor	Temperature measured by the controller is less than -40 F (-40 C) or greater than 240 F (115.6 C)	Circuit shut down	Automatic	Faulty thermistor, wiring error, failed Main Base Board or EXV Board
	.13	Circuit B Suction Gas Thermistor		Circuit shut down		
	.14	Circuit C Suction Gas Thermistor		Circuit shut down		
	.18	Circuit A Condenser Subcooling Liquid Thermistor		Unit shall return to the standard air cooled mode.	Automatic	Faulty thermistor, wiring error, failed EMM HR board.
	.19	Circuit B Condenser Subcooling Liquid Thermistor				
	.21	Space Temperature Sensor Failure		Temperature Reset based on Space Temperature disabled		Faulty thermistor, wiring error, failed Main Base Board.

LEGEND

EMM — Energy Management Module
EWT — Entering Water Temperature
EXV — Electronic Expansion Valve
HR — Heat Reclaim
LWT — Leaving Water Temperature
MOP — Maximum Operating Pressure
OAT — Outdoor Air Temperature
PTC — Positive Temperature Coefficient
SCT — Saturated Condensing Temperature
SPM — Scroll Protection Module
SST — Saturated Suction Temperature

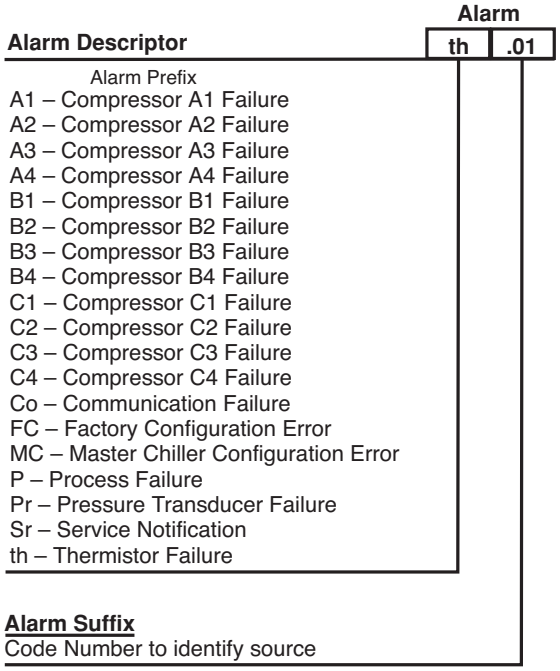


Fig. 33 — Alarm Description

DIAGNOSTIC ALARM CODES AND POSSIBLE CAUSES

Motor Temperature Too High

A1.01 — Compressor A1
A2.01 — Compressor A2
A3.01 — Compressor A3
A4.01 — Compressor A4
B1.01 — Compressor B1
B2.01 — Compressor B2
B3.01 — Compressor B3
B4.01 — Compressor B4
C1.01 — Compressor C1
C2.01 — Compressor C2
C3.01 — Compressor C3
C4.01 — Compressor C4

Criteria for Trip — The alarm criterion is checked whether the compressor is ON or OFF. This alarm will be generated if the scroll protection module (SPM) detects a compressor motor PTC (positive temperature coefficient) resistance greater than 4.5 kΩ, indicating that the motor temperature is too high.

Action to be Taken — The circuit shuts down immediately or is not allowed to start.

Reset Method — Manual. PTC resistance must be less than 2.5 kΩ.

Possible Causes — If this condition is encountered, check the following items:
- Check for a PTC thermistor failure.
- Check for a compressor motor failure.
- Check for a wiring error.
- Check wiring terminations for corrosion.
- Check for operation outside of the limits.
- Check for condenser air recirculation.
- Check the circuit for proper charge.
- Check the EXV for proper operation.
- Check the EXV input devices, pressure transducer and temperature for accuracy.
- Check the liquid line filter drier for a restriction.

Crankcase Heater Failure

A1.02 — Compressor A1
A2.02 — Compressor A2
A3.02 — Compressor A3
A4.02 — Compressor A4
B1.02 — Compressor B1
B2.02 — Compressor B2
B3.02 — Compressor B3
B4.02 — Compressor B4
C1.02 — Compressor C1
C2.02 — Compressor C2
C3.02 — Compressor C3
C4.02 — Compressor C4

Criteria for Trip — The alarm criteria are checked whether the compressor is ON or OFF. The scroll protection module (SPM) monitors crankcase heater current draw. This family of alarms is generated if one of the following criteria is detected:

1. The SPM fails to detect a crankcase current draw of at least 0.5 amps while the crankcase heater is ON.
2. The SPM detects a crankcase current draw of at least 0.5 amps while the crankcase heater is OFF. The current is sensed internally on the SPM.

Action to be Taken — If a fault is detected, the affected compressor will be shut down or not allowed to start.

Reset Method — Manual

Possible Causes — If this condition is encountered, check the following items:
- Check the wiring to the crankcase heater.
- Check the crankcase heater for operation.
- Check the SPM crankcase heater output operation.
- Confirm unit configuration.

High Pressure Switch

A1.03 — Compressor A1
A2.03 — Compressor A2
A3.03 — Compressor A3
A4.03 — Compressor A4
B1.03 — Compressor B1
B2.03 — Compressor B2
B3.03 — Compressor B3
B4.03 — Compressor B4
C1.03 — Compressor C1
C2.03 — Compressor C2
C3.03 — Compressor C3
C4.03 — Compressor C4

Criteria for Trip — The alarm criterion is checked whether the circuit is ON or OFF. This alarm will be generated if the circuit high pressure switch (HPS) opens. The scroll protection module (SPM) monitors the HPS. The 30RB units employ one HPS for each circuit. The HPS signal is connected to all of the SPM modules of the circuit.

Action to be Taken — The circuit shuts down immediately or is not allowed to start.

Reset Method — Manual

Possible Causes — If this condition is encountered, check the following items:
- Check the wiring of the high pressure switch circuit. Be sure the HPS is connected to all of the SPM boards in the circuit.
- Check the maximum condensing temperature (MCT) for the proper setting.
- Check for noncondensables in the refrigerant circuit.
- Check for condenser air re-circulation.
- Check for the proper refrigerant charge (overcharged).
- Check for operation beyond the limit of the machine.
- Check the condenser coils for debris or restriction.
- Check the condenser fans and motors for proper rotation and operation.
- Check the discharge service valve to be sure that it is open. A closed or restricted valve is a potential high pressure trip.
- Check the discharge pressure transducer for accuracy.
- Confirm unit configuration.

Motor Sensor PTC Out of Range

A1.04 — Compressor A1
A2.04 — Compressor A2
A3.04 — Compressor A3
A4.04 — Compressor A4
B1.04 — Compressor B1
B2.04 — Compressor B2
B3.04 — Compressor B3
B4.04 — Compressor B4
C1.04 — Compressor C1
C2.04 — Compressor C2
C3.04 — Compressor C3
C4.04 — Compressor C4

Criteria for Trip — The alarm criterion is checked whether the circuit is ON or OFF. The scroll protection module (SPM) monitors the compressor motor temperature. This alarm will be generated if the motor sensor PTC in the compressor resistance is less than 50 Ω or greater than 17 kΩ.

Action to be Taken — The circuit shuts down immediately or not allowed to start.

Reset Method — Manual

Possible Causes — If this condition is encountered, check the following items:

- Check the sensor wiring to the scroll compressor protection module (SPM).
- Check for a faulty SPM.
- Check for a compressor failure.
- Check for noncondensables in the refrigerant circuit.
- Check for condenser air re-circulation.
- Check for the proper refrigerant charge (overcharged).
- Check for operation beyond the limit of the machine.
- Check the condenser coils for debris or restriction.
- Check the condenser fans and motors for proper rotation and operation.
- Check the discharge service valve to be sure that it is open.
- Check the discharge pressure transducer for accuracy.
- Confirm unit configuration.

SPM Board Power Reset

A1.05 – Compressor A1
A2.05 – Compressor A2
A3.05 – Compressor A3
A4.05 – Compressor A4
B1.05 – Compressor B1
B2.05 – Compressor B2
B3.05 – Compressor B3
B4.05 – Compressor B4
C1.05 – Compressor C1
C2.05 – Compressor C2
C3.05 – Compressor C3
C4.05 – Compressor C4

Criteria for Trip — The alarm criterion is checked whether the compressor is ON or OFF. The scroll protection module (SPM) monitors the 24 vac at the compressor through the high pressure switch input channel. This alarm will be generated if the main base board receives a signal from the SPM board indicating that the compressor went through a power cycle.

Action to be Taken — The compressor is shut down immediately or not allowed to start.

Reset Method — Automatic

Possible Causes — If this condition is encountered, check the following items:

- Check the voltage from the main three phase power supply
- Check the 24 vac wiring connections to the scroll compressor protection module (SPM)
- Check for a faulty SPM.

SPM Board Low Control Voltage Alert

A1.06 – Compressor A1
A2.06 – Compressor A2
A3.06 – Compressor A3
A4.06 – Compressor A4
B1.06 – Compressor B1
B2.06 – Compressor B2
B3.06 – Compressor B3
B4.06 – Compressor B4
C1.06 – Compressor C1
C2.06 – Compressor C2
C3.06 – Compressor C3
C4.06 – Compressor C4

Criteria for Trip — The alarm criterion is checked whether the compressor is ON or OFF. The scroll protection module (SPM) monitors the 24 vac at the compressor through the high pressure switch input channel. This alarm will be generated if the main base board receives a signal from the SPM board indicating that the 24 vac level was lower than the allowed minimum threshold.

Action to be Taken — The compressor is shut down immediately or not allowed to start as to prevent any contactor chattering/welding from occurring.

Reset Method — Automatic

Possible Causes — If this condition is encountered, check the following items:

- Check the voltage from the main three phase power supply.
- Check the 24 vac wiring connections to the scroll compressor protection module (SPM).
- Check for a faulty SPM.

Loss of Communication with Compressor

Co.A1 — Board A1
Co.A2 — Board A2
Co.A3 — Board A3
Co.A4 — Board A4
Co.B1 — Board B1
Co.B2 — Board B2
Co.B3 — Board B3
Co.B4 — Board B4
Co.C1 — Board C1
Co.C2 — Board C2
Co.C3 — Board C3
Co.C4 — Board C4

Criteria for Trip — The alarm criterion is tested whether the unit is ON or OFF. If communication with the scroll compressor protection module (SPM) is lost for a period of 10 seconds, the alarm will be generated.

Action to be Taken — The affected compressor will be shut down.

Reset Method — Automatic, if communication is established, the compressor, if called for will start normally.

Possible Causes — If this condition is encountered, check the following items:

- Check the power supply to the affected SPM.
- Check the address of the SPM to be sure that it is correct.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Confirm unit configuration.

Co.E1— Loss of Communication with EXV Board Number 1

Criteria for Trip — The alarm criterion is tested whether the unit is ON or OFF. If communication with EXV1 is lost for a period of 10 seconds, the alarm will be triggered.

Action to be Taken — If running, Circuit A and B will shut down normally. If Circuit A or Circuit B is not operating, it will not be allowed to start.

Reset Method — Automatic, if communication is established, the unit will start normally.

Possible Causes — If this condition is encountered, check the following items:
- Check the power supply to EXV1.
- Check the address of the EXV1 to be sure that it is correct.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Confirm unit configuration.

Co.E2 — Loss of Communication with EXV Board Number 2

Criteria for Trip — The alarm criterion is tested whether the unit is ON or OFF, on 30RB210-300 units only.

Action to be Taken — If communication with EXV Board 2 is lost for a period of 10 seconds, the alarm will be triggered. If running, Circuit C will shut down normally. If Circuit C is not running, it will not be allowed to start.

Reset Method — Automatic, if communication is established, the unit will start normally.

Possible Causes — If this condition is encountered, check the following items:
- Check the power supply to EXV Board 2.
- Check the address of the EXV Board 2 to be sure that it is correct.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Confirm unit configuration.

Co.F1 — Loss of Communication with Fan Board Number 1

Criteria for Trip — The criterion is tested whether the unit is ON or OFF. If communication with Fan Board 1 is lost for a period of 10 seconds, the alarm will be triggered.

Action to be Taken — For 30RB060-150 and 30RB210-250, Circuit A and B will shut down normally if they are running. For 30RB160-190 and 30RB275-300, Circuit A will shut down normally if it is running. If the circuit or circuits controlled by the board are not running, then they will not be allowed to start.

Reset Method — Automatic, if communication is established, the unit will start normally.

Possible Causes — If this condition is encountered, check the following items:
- Check the power supply to Fan Board 1.
- Check the address of the Fan Board 1 to be sure that it is correct.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Confirm unit configuration.

Co.F2 — Loss of Communication with Fan Board Number 2

Criteria for Trip — The criterion is tested whether the unit is ON or OFF and on 30RB160-190, 275, and 300 only.

Action to be Taken — If communication with Fan Board 2 is lost for a period of 10 seconds, the alarm will be triggered. If running, Circuit B will shut down normally for 30RB160-190, 275 and 300. If Circuit B is not running for 30RB160-190, 275 and 300, then it will not be allowed to start.

Reset Method — Automatic, if communication is established, the unit will start normally.

Possible Causes — If this condition is encountered, check the following items:
- Check the power supply to Fan Board 2.
- Check the address of the Fan Board 2 to be sure that it is correct.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Confirm unit configuration.

Co.F3 — Loss of Communication with Fan Board Number 3

Criteria for Trip — The criterion is tested whether the unit is ON or OFF, and on 30RB210-300 machines only. If communication with Fan Board 3 is lost for a period of 10 seconds, the alarm will be triggered.

Action to be Taken — If running, Circuit C will shut down normally for 30RB210-300. If the circuit is not running for 30RB210-300, then it will not be allowed to start.

Reset Method — Automatic, if communication is established, the unit will start normally.

Possible Causes — If this condition is encountered, check the following items:
- Check the power supply to Fan Board 3.
- Check the address of the Fan Board 3 to be sure that it is correct.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Confirm unit configuration.

Co.O1 — Loss of Communication with Free Cooling Board

Criteria for Trip — This alarm is for a free cooling machine only. This feature is not supported for a cooling only machine.

Action to be Taken — None

Reset Method — Automatic

Possible Causes — If this condition is encountered, confirm unit configuration.

Co.O2 — Loss of Communication with Electrical Heaters Board

Criteria for Trip — This alarm is for a heat pump machines only. This feature is not supported for a cooling only machine.

Action to be Taken — None

Reset Method — Automatic

Possible Causes — If this condition is encountered, confirm unit configuration.

Co.O3 — Loss of Communication with Energy Management Board

Criteria for Trip — The criterion is tested whether the unit is ON or OFF and when a function that requires the energy management module (EMM) is configured. If communication with the EMM is lost for a period of 10 seconds, the alarm will be triggered.

Action to be Taken — If any function controlled by the EMM (3-Step and 4-20 mA Demand Limit, 4-20 mA and Space Temperature Reset, Occupancy Override, and Ice Build) is active, that function will be terminated. If an EMM function is programmed, and communication is lost, the function will not be allowed to start.

Reset Method — Automatic, if communication is established, the functions will be enabled.

Possible Causes — If this condition is encountered, check the following items:
- Check configuration to see if the EMM is installed, (***Configuration→UNIT→EMM***). If (***EMM=YES***), check for a control option that requires the EMM that may be enabled. Correct configuration if not correct.
- Check the power supply to EMM.
- Check the address of the EMM to be sure that it is correct.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Check unit configuration to be sure that no options that require the EMM are enabled.

Co.O4 — Loss of Communication with Heat Reclaim Board

Criteria for Trip — This alarm is tested whether the unit is ON or OFF and when the unit is configured for Heat Reclaim. If communication with the heat reclaim board is lost for a period of 10 seconds, the alarm will be triggered.

Action to be Taken — The unit will return to the air cooled mode.

Reset Method — Automatic, when communication is established, the functions will be enabled.

Possible Causes — If this condition is encountered, check the following items:
- Check the power supply to heat reclaim board.
- Check the Local Equipment Network (LEN) wiring to be sure that it is connected properly.
- Check unit configuration to be sure that Heat Reclaim is enabled and unit does NOT contain the Heat Reclaim option.

Welded Contactor Failure

Ct.01 – Circuit A
Ct.02 – Circuit B
Ct.03 – Circuit C

Criteria For Trip — This alarm is tested for when the circuit is off (all compressors switched to off). The algorithm will evaluate saturated suction and saturated condensing temperatures to determine if the compressor is still running even though it has been commanded off.

Action to be Taken

1. Unit capacity will go to and remain at 0%. The EXV, fan control, and cooler pump will continue their normal operation.
2. If a high pressure, cooler flow, or cooler freeze failure occurs, then circuit operation is disabled. The critical alarm relay will be energized in order to shut off the main power supply.

Reset Method — Reset is manual.

FC.n0 — Initial Factory Configuration Required

Criteria for Trip — The criterion is tested whether the unit is ON or OFF. The alarm will be generated if the ***Configuration →UNIT→TONS*=0**.

Action to be Taken — The unit is not allowed to start.

Reset Method — Automatic after factory configuration is complete. The configuration must be manually completed. The password may default to 0113.

Possible Causes — If this condition is encountered, confirm the unit configuration.

FC.nn — Illegal Configuration

Criteria for Trip — The criterion is tested whether the unit is ON or OFF. The alarm will be generated if the one of the following configuration errors is detected by the control. The "nn" refers to the error code listed in Table 42.

Table 42 — Illegal Configuration Alarm Code

FC ERROR CODE	DESCRIPTION
01	Unit size is unknown.
02	Reclaim option selected for Heat Pump machine.
03	Hot Gas Bypass configured for a Heat Pump machine.
04	Number of Fans controlled by Motormaster® control is greater than expected.

Action to be Taken — The unit is not allowed to start.

Reset Method — Automatic after factory reconfiguration is completed. A power cycle may be required.

Possible Causes — If this condition is encountered, confirm the unit configuration.

MC.nn — Master Chiller Configuration Error

Criteria for Trip — The criterion is tested whether the unit is ON or OFF. The units must be configured as a Master and Slave machine (***Configuration →RSET→MSSL*=1** and ***Configuration →RSET→MSSL*=2**), and one of the following configuration errors has been found. The "nn" refers to the error code listed in Table 43.

Action to be Taken — Unit not allowed to start in Master Slave control.

Reset Method — Automatic

Possible Causes — If this condition is encountered, confirm proper configuration.

P.01 — Water Exchanger Freeze Protection

Criteria for Trip — The alarm criteria are checked whether the unit is ON or OFF. If the entering or leaving water thermistor senses a temperature at the freeze point or less, the alarm will be generated. For a fresh water system (***Configuration →SERV→FLUD*=1**), the freeze point is 34 F (1.1 C). For medium temperature brine systems (***Configuration →SERV→FLUD*=2**), the freeze point is Brine Freeze Set Point (***Configuration→SERV→LOSP***).

Action to be Taken — Unit shut down or not allowed to start. Chilled water pump will be started.

Reset Method — Automatic, first occurrence in 24 hours if LWT rises to 6° F (3° C) above set point. Manual, if more than one occurrence in 24 hours.

Possible Causes — If this condition is encountered, check the following items:
- Check the entering and leaving fluid thermistors for accuracy.
- Check the water flow rate.
- Check loop volume. Low loop volume at nominal flow rates can in extreme cases bypass cold water to the cooler.
- Check for freezing conditions.
- Check heater tape and other freeze protection items for proper operation.
- Check glycol concentration and adjust ***LOSP*** accordingly.
- If the Leaving Water Set Point is above 40 F (4.4 C) and there is glycol in the loop, consider using the Medium Temperature Brine option (***Configuration →SERV→FLUD*=2**) to utilize the brine freeze point instead of 34 F (1.1 C).

Low Suction Temperature

P.05 — Circuit A
P.06 — Circuit B
P.07 — Circuit C

Criteria for Trip — The criteria are tested whether the circuit is ON. This alarm is generated if one of the following criteria is met:
- If the circuit Saturated Suction Temperature is below –13 F (–25 C) for more than 30 seconds.
- If the circuit Saturated Suction Temperature is below –22 F (–30 C) for more than 8 seconds.
- If the circuit Saturated Suction Temperature is below –40 F (–40 C) for more than 3 seconds.

Action to be Taken — The circuit is shut down immediately.

Prior to the alarm trip, the control will take action to avoid the alarm. See Operating Modes 21, 22 and 23 on page 48.

- *Reset Method* — Automatic, first occurrence in 24 hours. Manual, if more than one occurrence in 24 hours.

Table 43 — Master/Slave Alarm Code

MC ERROR CODE	MASTER	SLAVE	DESCRIPTION
01	X	X	The master or slave water pump is not configured while the control of the lag unit pump is required (***lag_pump = 1***)
02	X		Master and slave units have the same network address.
03	X		There is no slave configured at the slave address
04	X		Slave ***pump_seq*** incorrect configuration
05	X		There is a conflict between the master and the slave LWT option: the master is configured for EWT control while the slave is configured for LWT control.
06	X		There is a conflict between the master and the slave LWT option: the master is configured for LWT control while the slave is configured for EWT control.
07	X		There is a conflict between the master and the slave pump option: the master is configured for lag pump control while the slave is not configured for lag pump control.
08	X		There is a conflict between the master and the slave pump option: the master is not configured for lag pump control while the slave is configured for lag pump control.
09	X	X	The slave chiller is in local or remote control (***chilstat = 3***)
10	X	X	The slave chiller is down due to fault (***chilstat = 5***)
11	X		The master chiller operating type is not Master: ***master_oper_typ*** and ***master_status = off***
12	X	X	No communication with slave.
13	X		Master and slave heat/cool status are not the same.

LEGEND
EWT — Entering Water Temperature
LWT — Leaving Water Temperature

Possible Causes — If this condition is encountered, check the following items:
- Check the sensor wiring to Main Base Board (P.05 and P.06) or Fan Board 3 (P.07).
- Check the board for a faulty channel.
- Check for a faulty transducer.
- Check cooler water flow.
- Check loop volume.
- Check EXV operation.
- Check for a liquid line refrigerant restriction, filter drier, service valve, etc.
- Check the refrigerant charge.
- If the Leaving Water Set Point is above 40 F (4.4 C) and there is glycol in the loop, consider using the Medium Temperature Brine option (***Configuration→SERV→FLUD=2***) to utilize the brine freeze point instead of 34 F (1.1 C).

High Superheat

P.08 — Circuit A
P.09 — Circuit B
P.10 — Circuit C

Criteria for Trip — The criteria are tested whether the circuit is ON. This alarm is generated if all of the following criteria are met:

1. The EXV position is equal to or greater than 98%.
2. The circuit's Suction Superheat (Suction Gas Temperature – Saturated Suction Temperature) is greater than 54 F (30.0 C).
3. The circuit's Saturated Suction Temperature is less than Maximum Operating Pressure (MOP) set point (***Configuration→SERV→MOP***) for more than 5 minutes.

Action to be Taken — The circuit is shut down normally.

Reset Method — Manual.

Possible Causes — If this condition is encountered, check the following items:
- Check the suction pressure transducer wiring to Main Base Board (P.08 and P.09) or Fan Board 3 (P.10).
- Check the board for a faulty channel.
- Check for a faulty transducer.
- Check the suction gas thermistor wiring to EXV Board 1 (P.08 and P.09) or to EXV Board 2 (P.10)
- Check the suction gas thermistor sensor for accuracy.
- Check for EXV Board 1 (P.08 and P.09) or EXV Board 2 (P.10) faulty channel.
- Check EXV operation.
- Check for a liquid line refrigerant restriction, filter drier, service valve, etc.
- Check the refrigerant charge.

Low Superheat

P.11 — Circuit A
P.12 — Circuit B
P.13 — Circuit C

Criteria for Trip — The criteria are tested whether the circuit is ON. This alarm is generated if the following criterion is met:

The EXV position is equal to or less than 5% and the circuit's Suction Superheat (Suction Gas Temperature – Saturated Suction Temperature) is less than the Suction Superheat Set Point (***Configuration→SERV→SHP.A***, ***Configuration→SERV→SHP.B***, or ***Configuration→SERV→SHP.C***) by at least 5° F (2.8° C) or the circuit Saturated Suction Temperature is greater than Maximum Operating Pressure (MOP) set point (***Configuration→SERV→MOP***) for more than 5 minutes.

Action to be Taken — The circuit is shut down normally.

Reset Method — Automatic, first occurrence in 24 hours. Manual, if more than one occurrence in 24 hours.

Possible Causes — If this condition is encountered, check the following items:
- Check the suction pressure transducer wiring to Main Base Board (P.11 and P.12) or Fan Board 3 (P.13).
- Check the board for a faulty channel.
- Check for a faulty transducer.
- Check the suction gas thermistor wiring to EXV Board 1 (P.08 and P.09) or to EXV Board 2 (P.10)
- Check the suction gas thermistor sensor for accuracy.
- Check for EXV Board 1 (P.11 and P.12) or EXV Board 2 (P.13) faulty channel.
- Check EXV operation.
- Confirm Maximum Operating Pressure Set Point.
- Check the refrigerant charge.

P.14 — Cooler Interlock Failure

Criteria for Trip — The criteria are tested whether the unit is ON or OFF. This algorithm monitors the cooler flow switch circuit, which may include field-installed cooler pump interlock (PMPI) contacts. The pump interlock and flow switch are wired in series, therefore either device can cause a

cooler interlock failure. This alarm is generated if one of the following criteria is met:

1. The circuit (flow switch and optional pump interlock installed at TB5-1 and 2) fails to close within the OFF to ON delay (***Configuration→OPTN→DELY***).
2. If the unit is the lag chiller under Master/Slave Control and the circuit fails to close within 1 minute after its pump is commanded ON.
3. The circuit opens while the machine is ON.
4. If the remote interlock switch is CLOSED while the machine is ON (units with EMM only).
5. If the machine is configured for Cooler Pump Control and the circuit does not open within 2 minutes.
6. The circuit fails to close within the OFF to ON delay when the cooler pump has been commanded ON for freeze protection.

Action to be Taken — The unit is shut down immediately, or not allowed to start.

Reset Method — Automatic, if the alarm occurs while the machine is at Stage 0 (no compressors ON). Manual reset if machine was at Stage 1 or greater.

Possible Causes — If this condition is encountered, check the following items:

- Check the chilled water flow switch operation.
- Check for water flow. Be sure all water isolation valves are open. Check the water strainer for a restriction.
- Check the interlock wiring circuit.
- Check for a power supply to the pump.
- Check for a control signal to the pump controller.
- Check the chilled water pump operation.
- Check the cooler pump contactor for proper operation.

P.15 — Condenser Flow Switch Failure

Criteria for Trip — Condenser flow switch has not closed within 1 minute after condenser pump output has energized or opens during normal operation. This alarm is for units with the heat reclaim option only.

Action to be Taken — The unit will return to the air cooled mode.

Reset Method — Manual.

Possible Causes — If this condition is encountered, check the following items:

- Check the condenser water flow switch operation.
- Check for low water flow. Be sure all water isolation valves are open.
- Check for plugged water strainer.
- Check the interlock wiring circuit.
- Check the power supply to the pump.
- Check for a control signal to the pump starter.
- Check the condenser water pump operation.
- Check the condenser pump contactor for proper operation.

Compressor Not Started or Pressure Not Established

P.16 — Compressor A1
P.17 — Compressor A2
P.18 — Compressor A3
P.19 — Compressor A4
P.20 — Compressor B1
P.21 — Compressor B2
P.22 — Compressor B3
P.23 — Compressor B4
P.24 — Compressor C1
P.25 — Compressor C2
P.26 — Compressor C3
P.27 — Compressor C4

Criteria for Trip — The criteria are tested whether the unit is ON or in Service Test. This algorithm monitors the pressure differential across the compressor to prove proper rotation of the compressor.

During normal operation with the start of a compressor, the discharge pressure for the circuit or the compressor differential (Discharge Pressure – Suction Pressure) must increase 10 psig (69 kPa) after 2 minutes. If this criterion is not met, the alarm is generated.

Action to be Taken — The circuit is shut down immediately.

Reset Method — Manual

Possible Causes — If this condition is encountered, check the following items:

- Check for power to the compressor.
- Check control voltage to the compressor contactor. On 208-volt systems, be sure the proper tap on TRAN1 is utilized.
- Check for proper electrical phasing of the unit power supply.
- Check the compressor contactor operation.
- Check the discharge and suction pressure transducers for accuracy.
- Check the wiring and location of the discharge and suction pressure transducers.

P.28 — Electrical Box Thermostat Failure/Reverse Rotation

Criteria for Trip — The criterion is tested whether the unit is ON. This alarm is generated if the signal is open.

Action to be Taken — The unit is not allowed to start.

Reset Method — Automatic, once the phasing is corrected.

Possible Causes — If this condition is encountered, check the following items:

- Check the power wiring for proper phasing.
- Check the sensor wiring to reverse rotation protection board.

P.29 — Loss of Communication with System Manager

Criteria for Trip — The criterion is tested whether the unit is ON or OFF. This alarm is generated if the System Manager had established communications with the machine and is lost for more than 2 minutes.

Action to be Taken — The action to be taken by the control depends on the configuration. If Auto Start when SM lost is enabled, (***Configuration→SERV→AU.SM***=**YES**), then the unit will force the CCN Chiller Start Stop (***Run Status →R.CCN→CH.SS***) to **ENBL** and clear all forced points from the System Manager. The unit will revert to stand-alone operation.

Reset Method — Automatic, once communication is re-established.

Possible Causes — If this condition is encountered, check the following items:

- Check communication wiring.
- Check the power supply to the System Manager and unit controls.

P.30 — Master/Slave Communication Failure

Criteria for Trip — The criterion is tested whether the units are ON or OFF and a Master and Slave machine has been configured, (***Configuration→RSET→MSSL***=**1** and ***Configuration →RSET→MSSL***=**2**). If communication is lost for more than 3 minutes, this alarm is generated.

Action to be Taken — Dual chiller control will be disabled and each unit will operate in Stand-Alone mode.

Reset Method — Automatic, once communication is re-established.

Possible Causes — If this condition is encountered, check the following items:

- Check the CCN wiring.
- Check for control power to each Main Base Board, Master and Slave.

- Confirm correct configuration.

P.31 — Unit is in Emergency Stop

Criteria for Trip — The criterion is tested whether the units are ON or OFF and the machine receives a Carrier Comfort Network® (CCN) command for an Emergency Stop.

Action to be Taken — Unit will stop, or not allowed to start.

Reset Method — Automatic, once a return to normal command is received.

Possible Causes — If this condition is encountered, check for CCN Emergency Stop command.

Cooler Pump Fault

P.32 — Pump 1 Fault
P.33 — Pump 2 Fault

Criteria for Trip — The criterion is tested whether the units are ON or OFF. This alarm will be generated if the cooler pump interlock opens. When starting the pump, the control must read an open circuit for 3 consecutive reads. If the pump is operating and the circuit opens, the alarm will be generated immediately.

Action to be Taken — The pump and machine will be shut down. If there is another pump available, the control will start that pump, restart the machine and clear the alarm. If no other pump is available, the unit will remain OFF.

Reset Method — Manual.

Possible Causes — If this condition is encountered, check the following items:

- Check the interlock wiring circuit.
- Check for a control signal to the pump controller.
- Check the cooler pump contactor for proper operation.
- Check control voltage for proper voltage. On 208-volt systems, be sure the proper tap on TRAN1 is utilized.

Reclaim Operation Failure

P.34 — Circuit A
P.35 — Circuit B

Criteria for Trip — Reclaim operation failure due to high SCT. This alarm is for units with the heat reclaim option only.

Action to be Taken — The affected circuit will return to air cooled mode.

Reset Method — Manual.

Possible Causes — If this condition is encountered, check the following items:

- Check for low water flow. Be sure all water isolation valves are open.
- Check for plugged water strainer.
- Check for fouled tubes in reclaim condenser.

Repeated High Discharge Gas Overrides

P.37 — Circuit A
P.38 — Circuit B
P.39 — Circuit C

Criteria for Trip — The criterion is tested when the circuit is ON. This alarm will be tripped if the circuit capacity is reduced more than 8 times in 30 minutes due to high discharge gas temperatures. If no override occurs in a 30-minute period, the counter is reset.

Action to be Taken — The affected circuit will be shut down.

Reset Method — Automatic, after 30 minutes. If the alarm is cleared via the Manual method, the counter will be reset to zero.

Possible Causes — If this condition is encountered, check the following items:

- Check the maximum condensing temperature (MCT) for the proper setting.
- Check for noncondensables in the refrigerant circuit.
- Check for condenser air re-circulation.
- Check for the proper refrigerant charge (overcharged).
- Check for operation beyond the limit of the machine.
- Check the condenser coils for debris or restriction.
- Check the condenser fans and motors for proper rotation and operation.
- Check the discharge service valve to be sure that it is open. Check the discharge pressure transducer for accuracy.
- Confirm unit configuration.

Repeated Low Suction Temperature Overrides

P.40 – Circuit A
P.41 – Circuit B
P.42 – Circuit C

Criteria for Trip — This alarm was added in software version 1.09. The criterion is active when circuit is ON. If the circuit's capacity is reduced more than 6 times by the Capacity Override 23 (Circuit A), 24 (Circuit B), or 25 (Circuit C) for the respective circuit, without at least 30 minutes elapsing between the capacity reductions, the alarm is triggered. If at least 30 minutes elapses without a reduction in capacity, the counter is reset to zero.

Action to be Taken — Circuit shut down.

Reset Method — Manual.

Possible Causes — If this condition is encountered, check the following items:

- Confirm unit configuration.
- Check EXV operation.
- Check for a liquid line refrigerant restriction, service valve partially closed, filter drier with excessive pressure drop.
- Check the refrigerant charge.
- Check suction pressure transducer accuracy.
- Check return gas thermistor accuracy.
- Check Circuit Superheat Set Point (***Configuration →SERV→SHP.A, SHP.B, or SHP.C***).
- Check if system contains antifreeze (***Configuration →SERV→FLUD*=2**).
- Check Brine Freeze Set Point (***Configuration →SERV→LOSP***) if an antifreeze solution is used.
- Check fluid flow rate.
- Check strainer for a restriction, clean if necessary.
- Check for cooler fouling.
- Check compressor oil level. If oil level is above the top of the sightglass, then oil may be logging in the cooler. Adjust oil level in compressor(s).

P.97 — Water Exchanger Temperature Sensors Swapped

Criteria for Trip — The alarm criterion is checked when the chiller is ON and one or more compressors is running. This alarm will be tripped if the entering water temperature is less than the leaving water temperature for more than 1 minute.

Action to be Taken — The chiller is shut down immediately.

Reset Method — Manual

Possible Causes — If this condition is encountered, check the following items:

- Check LWT and EWT wiring at main base board (connector J6, channels 1,2) .
- Check for a faulty entering or leaving water temperature sensor.
- Check cooler nozzles for proper water temperature sensor locations.

Discharge Transducer Failure

Pr.01 — Circuit A
Pr.02 — Circuit B
Pr.03 — Circuit C

Criteria for Trip — The criterion is tested whether the circuit is ON or OFF. This alarm is generated if the voltage as sensed by the MBB or FB3 is 0 vdc.

Action to be Taken — The circuit is shut down normally, or not allowed to start.

Reset Method — Automatic, once the transducer voltage is greater than 0 vdc.

Possible Causes — If this condition is encountered, check the following items:

- Check the sensor wiring to main base board (Pr.01 and Pr.02).
- Check the sensor wiring to Fan Board 3 (Pr.03).
- Check the board for a faulty channel.
- Check for a faulty transducer.
- Confirm unit configuration.

Suction Transducer Failure

Pr.04 — Circuit A
Pr.05 — Circuit B
Pr.06 — Circuit C

Criteria for Trip — The criteria are tested whether the circuit is ON or OFF. The alarm is generated if one of the following criteria is met:

1. This alarm is generated if the voltage as sensed by the MBB or FB3 is 0 vdc.
2. The circuit is ON in cooling mode and the saturated suction temperature for the circuit is greater than the referenced cooler leaving temperature (RCLT) for more than 60 seconds.

   RCLT = EWT – (EWT – LWT) * circuit running tons / total tons

Action to be Taken — The circuit is shut down immediately, or not allowed to start.

Reset Method — Automatic when the suction pressure reading is within the range except if it was tripped by criteria 2.

The reset will be manual if the alarm trips 3 times within a 24-hour period or if it has been tripped by criterea 2.

Possible Causes — If this condition is encountered, check the following items:

- Check for power to the compressor (i.e., circuit breaker, contactor operation).
- Check the sensor wiring to main base board (Pr.04 and Pr.05).
- Check the sensor wiring to Fan Board 3 (Pr.06).
- Check the board for a faulty channel.
- Check for a faulty transducer.
- Check for a faulty leaving water temperature sensor.
- Confirm unit configuration.
- Check EWT sensor.

Reclaim Pumpdown Pressure Transducer

Pr.07 — Circuit A
Pr.08 — Circuit B

Criteria for Trip — Tested when the unit is On or Off. This alarm is generated if the voltage as sensed by the heat reclaim board is 0 vdc. This alarm is for units with the heat reclaim option only.

Action to be Taken — The circuit will initiate a reclaim to air cooled changeover and stay in air cooled mode if it had been operating in reclaim mode.

Reset Method — Automatic when the transducer reading returns to normal.

Possible Causes — If this condition is encountered, check the following items:

- Check the sensor wiring to heat reclaim board.
- Check for a faulty transducer.
- Check the board for a faulty channel.
- Confirm unit configuration.

Sr.nn — Service Maintenance Alert

Criteria for Trip — This alert is tested whether the unit is ON or OFF and the Servicing Alert decisions listed under ***Time Clock→MCFG*** have been enabled. The alarm will be generated if the one of the following configuration errors is detected by the control. The "nn" refers to the error code listed in Table 44.

Action to be Taken — None.

Reset Method — Manual, after the service has been completed and ***Time Clock→MCFG→ RS.SV*** is reset for the alert.

Possible Causes — If this condition is encountered, confirm the machine's configuration.

Table 44 — Service Maintenance Alert Codes

CODE	DESCRIPTION
01	Circuit A Loss of Refrigerant Charge
02	Circuit B Loss of Refrigerant Charge
03	Circuit C Loss of Refrigerant Charge
04	Water Loop Size Warning
05	Air Exchanger Cleanliness Warning
06	Pump 1 Servicing Required
07	Pump 2 Servicing Required
08	Reclaim Pump Servicing Required
09	Water Filter Servicing Required

Water Exchanger Fluid Thermistor Failure

th.01 — Entering
th.02 — Leaving

Criteria for Trip — If the temperature as measured by the thermistor is outside of the range –40 F (–40 C) to 240 F (115.6 C).

Action to be Taken — The unit shuts down normally, or is not allowed to start.

Reset Method — Automatic, the alarm will reset once the thermistor reading is within the expected range.

Possible Causes — If this condition is encountered, check the following items:

- Check the sensor wiring to the main base board.
- Check the sensor for accuracy.

For thermistor descriptions, identifiers and connections, see Thermistors on page 71.

th.03 — Circuit A Defrost Thermistor Failure
th.04 — Circuit B Defrost Thermistor Failure

Criteria for Trip — This alarm is for a heat pump machine only. This feature is not supported for a cooling only machine.

Action to be Taken — None

Reset Method — Automatic

Possible Causes — If this condition is encountered, confirm the machine's configuration.

th.08 — Entering Condenser Reclaim Thermistor

Criteria for Trip — Tested when the unit is On or Off. This alarm is generated if the temperature measured by the sensor is outside the range of –40 F (–40 C) to 240 F (115.6 C). This alarm is for units with the heat reclaim option only.

Action to be Taken — The unit will return to the air cooled mode.

Reset Method — Automatic, the alarm will reset once the thermistor reading is within the expected range.

Possible Causes — If this condition is encountered, check the following items:

- Check the sensor wiring to the heat reclaim board.
- Check for a faulty thermistor.
- Check the board for a faulty channel.
- Confirm unit configuration.