Carrier
HEATING & COOLING

# 30GB040-200, 30GT225-280 Flotronic™ II Reciprocating Liquid Chillers

# Controls, Operation and Troubleshooting

## 50 and 60 Hz with Microprocessor Controls and Electronic Expansion Valves

### CONTENTS



## 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 and service. There may be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.

**⚠ WARNING**

This unit uses a microprocessor-based electronic control system. *Do not* use jumpers or other tools to short out components, 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.

## GENERAL

IMPORTANT: This publication contains controls, operation and troubleshooting data for 30GB040-200 and 30GT225-280 Flotronic™ II chillers.

30GB and 30GT circuits are identified as circuits A and B, and compressors are identified as A1-A4 in circuit A, and B1-B4 in circuit B.

Use this guide in conjunction with separate Installation Instructions booklet packaged with the unit.

The 30GB,GT Flotronic™ II chillers feature microprocessor-based electronic controls and an electronic expansion valve (EXV) in *each* refrigeration circuit.


Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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The Flotronic™ II control system cycles compressor unloaders and/or compressors to maintain the selected leaving water temperature set point. It automatically positions the EXV to maintain the specified refrigerant superheat entering the compressor cylinders. It also cycles condenser fans on and off to maintain suitable head pressure for each circuit. Safeties are continuously monitored to prevent the unit from operating under unsafe conditions. A scheduling function, programmed by the user, controls the unit occupied/unoccupied schedule. The control also operates a Test program that allows the operator to check output signals and ensure components are operable.

The control system consists of a processor module (PSIO), a low voltage relay module (DSIO-LV), 2 electronic expansion valves (EXV), an EXV driver module (DSIO-EXV), a 6-pack relay board, a keyboard and display module (also called HSIO or LID), plus thermistors on 30GB units, and transducers plus thermistors on 30GT units, to provide inputs to the microprocessor. An options module (SIO) is used to provide additional functions. This module is standard on 30GB models and an accessory on 30GT models.

## MAJOR SYSTEM COMPONENTS

**Processor Module —** This module contains the operating software, and controls the operation of the machine. It continuously monitors information received from the various transducers and/or thermistors and communicates with the relay module and 6-pack relay board to increase or decrease the active stages of capacity. The processor module also controls the EXV driver module, commanding it to open or close each EXV in order to maintain the proper superheat entering the cylinders of each lead compressor. Information is transmitted between the processor module and the relay module, the EXV driver module and the keyboard and display module through a 3-wire communications bus. When used, the options module is also connected to the communications bus.

For the 30GT chillers only, the processor monitors system pressure by means of six transducers, 3 in each lead compressor. Compressor suction pressure, discharge pressure, and oil pressure are sensed. If the processor senses high discharge pressure or low suction pressure, it immediately shuts down all compressors in the affected circuit. During operation, if low oil pressure is sensed for longer than one minute, all compressors in the affected circuit are shut down. At start-up the oil pressure signal is ignored for two minutes. If shutdown occurs due to any of these pressure faults, the circuit is locked out and the appropriate fault code is displayed.

**Low Voltage Relay Module —** This module closes contacts to energize compressor unloaders and/or compressors. It also senses the status of the safeties for compressors A1, A2, B3, B4 and transmits this information to the processor.

**Electronic Expansion Valve Module —** This module receives signals from the processor and operates the electronic expansion valves. It also monitors the status of the safeties for compressors B1, B2, A3, A4 and transmits this information to the processor.

**Options Module —** This module allows the use of Flotronic™ II features such as dual set point, remote reset, demand limit and accessory unloaders. The options module also allows for reset and demand limit to be activated from a remote 4-20 mA signal.

The options module is installed at the factory on the 30GB chillers when the Flotronic™ II option is ordered. It is offered as an accessory on the 30GT chillers and must be field installed. For more details on installation and configuration of each feature offered, see separate Accessory Options Module Installation Instructions.

**Keyboard and Display Module** (also called HSIO or LID) — See Fig 1. This device consists of a keyboard with 6 function keys, 5 operative keys, 12 numeric keys, and an alphanumeric 8-character LCD. Key usage is explained in Keyboard and Display Module section (functions and subfunctions).

**Control Switch —** Control of the chiller is defined by the position of the LOCAL/STOP/CCN switch. This is a 3-position manual switch that allows the chiller to be (1) put under the control of its own Flotronic™ II controls, (2) manually stopped, or (3) put under the control of a Carrier Comfort Network (CCN). Switch allows unit operation as shown in Table 1.

**Table 1 — LOCAL/STOP/CCN Switch Positions and Operation**

| SWITCH POSITION | UNIT OPERATION | CONFIGURATION AND SET POINT CONTROL | |
|---|---|---|---|
| | | Keypad Control | CCN Control |
| STOP | Unit Cannot Run | Read/Write | Read Only |
| LOCAL | Unit Can Run | Read/Limited Write | Read Only |
| CCN Stop — | Unit Cannot Run | Read Only | Read/Write |
| Run — | Unit Can Run | Read Only | Read/Limited Write |

In the LOCAL position, the chiller is under local control and responds to the scheduling configuration and set point data input at its own local interface device (keyboard and display module).

In the CCN position, the chiller is under remote control and responds only to CCN network commands. The occupied/unoccupied conditions are defined by the network. All keyboard and display functions can be read at the chiller regardless of position of the switch.

CCN **run or stop** condition is established by a command from the CCN network. It is not possible to force outputs by the CCN network, except that an emergency stop command shuts down the chiller immediately and causes "ALARM 52" to be displayed.

**Electronic Expansion Valve (EXV) —** The microprocessor controls the electronic expansion valve through the EXV driver module. Inside the expansion valve is a linear actuator stepper motor.

30GB040-200 — To control the stepper motor's position, the thermistor in the cooler and the thermistor in the lead compressor in each circuit are used to maintain 20 degrees F (11.1 degrees C) superheat. Because the compressor sensor is after the compressor motor, which adds approximately 15 degrees F (8.3 degrees C) superheat, the 20 degrees F (11.1 degrees C) control temperature results in 0 to 5 degrees F (2.8 degrees C) superheat leaving the cooler. This assures maximum cooler performance.

30GT225-280 — The lead compressor in each circuit has a thermistor and a pressure transducer located in the suction manifold after the compressor motor. The thermistor measures the temperature of the superheated gas entering the compressor cylinders. The pressure transducer measures the refrigerant pressure in the suction manifold. The microprocessor converts the pressure reading to a saturated temperature. The difference between the temperature of the superheated gas and the saturation temperature is the superheat. The microprocessor controls the position of the electronic expansion valve stepper motor to maintain 29 degrees F (16 degrees C) superheat.

At initial unit start-up, the EXV position is at zero. After that, the microprocessor keeps accurate track of the valve position in order to use this information as input for the other control functions. The control monitors the superheat and the rate of change of superheat to control the position of the valve. The valve stroke is very large, which results in very accurate control of the superheat.

**Sensors —** The Flotronic™ II chiller control system gathers information from sensors to control the operation of the chiller. The 30GB040-200 uses 8 thermistors to monitor system temperatures at various points within the chiller. The 30GT225-280 uses 6 pressure transducers and four thermistors to monitor system pressures and temperatures at various points within the chiller. Sensors are listed in Table 2 and locations shown in Fig. 10 - 13.

**Table 2 — Thermistor and Transducer Locations**

| THERMISTORS — 30GB040-200 | |
|---|---|
| **Sensor** | **Location** |
| **T1** | Cooler Leaving Water Temp |
| **T2** | Cooler Entering Water Temp. |
| **T3** | Saturated Condensing Temp. Circuit A |
| **T4** | Saturated Condensing Temp. Circuit B |
| **T5** | Cooler Saturated Suction Temp. Circuit A |
| **T6** | Cooler Saturated Suction Temp. Circuit B |
| **T7** | Compr Suction Gas Temp. Circuit A |
| **T8** | Compr. Suction Gas Temp Circuit B |
| **T10** | Reset Temperature Sensor (Accessory) |
| **PRESSURE TRANSDUCERS 30GT225-280** | |
| **Sensor** | **Location** |
| **DPT-A** | Compr A1 Discharge Pressure |
| **SPT-A** | Compr A1 Suction Pressure |
| **OPT-A** | Compr A1 Net Oil Pressure |
| **DPT-B** | Compr. B1 Discharge Pressure |
| **SPT-B** | Compr. B1 Suction Pressure |
| **OPT-B** | Compr. B1 Net Oil Pressure |
| **Thermistors** | |
| **T1** | Cooler Leaving Water Temp. |
| **T2** | Cooler Entering Water Temp. |
| **T7** | Compr Suction Gas Temp. Circuit A |
| **T8** | Compr. Suction Gas Temp. Circuit B |
| **T10** | Reset Temperature Sensor (Accessory) |

## OPERATION DATA

**Capacity Control —** The control system cycles compressor to give capacity control steps as shown in Table 3. The unit controls leaving chilled water temperature. Entering water temperature is used by the microprocessor in determining the optimum time to add or subtract steps of capacity, but is not a control set point.

The chilled water temperature set point can be automatically reset by the return temperature reset or space and outside air temperature reset features. It can also be reset from an external 4 - 20 mA signal or from a network signal.

## Table 3 – Capacity Control Steps

| UNIT 30GB | CONTROL STEPS | % DISPLACEMENT | LOADING SEQUENCE A | | | | LOADING SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 040 Standard (One Unloader) | 1 | 25 0 | 1 | 2 | A1* | — | — | — | — | — |
| | 2 | 50.0 | 1 | 4 | A1 | — | — | — | — | — |
| | 3 | 75.0 | 2 | 6 | A1* | B1 | — | — | — | — |
| | 4 | 100 0 | 2 | 8 | A1 | B1 | — | — | — | — |
| 040 Accessory Unloader Added to Compressor No. B1 | 1 | 25.0 | 1 | 2 | A1* | — | 1 | 2 | — | B1* |
| | 2 | 50.0 | 1 | 4 | A1 | — | 1 | 4 | — | B1 |
| | 3 | 75.0 | 2 | 6 | A1 | B1* | 2 | 6 | A1* | B1 |
| | 4 | 100.0 | 2 | 8 | A1 | B1 | 2 | 8 | A1 | B1 |
| 045, 046 Standard (One Unloader) | 1 | 20.0 | 1 | 2 | A1* | — | — | — | — | — |
| | 2 | 40.0 | 1 | 4 | A1 | — | — | — | — | — |
| | 3 | 80 0 | 2 | 8 | A1* | B1 | — | — | — | — |
| | 4 | 100.0 | 2 | 10 | A1 | B1 | — | — | — | — |
| 045, 046 Accessory Unloader Added to Compressor No. B1 | | A / B | | | | | | | | |
| | 1 | 20.0 / 40.0 | 1 | 2 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 40.0 / 60 0 | 1 | 4 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 60.0 / — | 2 | 6 | A1* | B1* | — | — | — | — |
| | 4 | 80.0 | 2 | 8 | A1* | B1 | 2 | 8 | A1 | B1* |
| | 5 | 100.0 | 2 | 10 | A1 | B1 | 2 | 10 | A1 | B1 |
| 050, 055 (60 Hz) Standard (One Unloader) | 1 | 33.3 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 50.0 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 83.3 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 100.0 | 2 | 12 | A1 | B1 | — | — | — | — |
| 050, 055 (60 Hz) Accessory Unloader Added to Compressor No. B1 | 1 | 33.3 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 50.0 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 66.6 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 83.3 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 100 0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| 055 (50 Hz), 060 Standard (One Unloader) | 1 | 28.7 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 43.1 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 85 6 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 100 0 | 2 | 12 | A1 | B1 | — | — | — | — |
| 055 (50 Hz), 060 Accessory Unloader Added to Compressor No. B1 | | A / B | | | | | | | | |
| | 1 | 28.7 / 37.9 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 43.1 / 56.8 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 66.6 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 85.6 | 2 | 10 | A1* | B1 | 2 | 10 | A1* | B1 |
| | 5 | 100.0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| 070 (60 Hz) Standard (One Unloader) | 1 | 25.0 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 37.5 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 62 5 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 75.0 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 87.5 | 3 | 14 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 100.0 | 3 | 16 | A1, A2 | B1 | — | — | — | — |
| 070 (60 Hz) Accessory Unloader Added to Compressor No. B1 | 1 | 25.0 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 37.5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 50 0 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 62 5 | 2 | 10 | A1 | B1 | 2 | 10 | A1 | B1* |
| | 5 | 75 0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 87.5 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1,A2 | B1* |
| | 7 | 100.0 | 3 | 16 | A1,A2 | B1 | 3 | 16 | A1,A2 | B1 |
| 070 (50 Hz), 075, 080 Standard (One Unloader) | 1 | 22.2 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 33 3 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 55 5 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 66.6 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 88 8 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 100.0 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| 070 (50 Hz), 075, 080 Accessory Unloader Added to Compressor No. B1 | 1 | 22 2 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 33 3 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 44 4 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 55.5 | 2 | 10 | A1 | B1* | 2 | 10 | A1 | B1* |
| | 5 | 66 6 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 77.7 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1*,A2 | B1* |
| | 7 | 88.8 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1*,A2 | B1 |
| | 8 | 100.0 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1,A2 | B1 |
| 090 (60 Hz), 100 Standard | 1 | 25.0 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 50 0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 75 0 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 100 0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| 090 (50 Hz) Standard | 1 | 21 5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 50.0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 71.5 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A2 | B1,B2 |
| | 4 | 100 0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |

*Unloaded compressor.

## Table 3 – Capacity Control Steps (cont)

| UNIT 30GB | CONTROL STEPS | % DISPLACEMENT | LOADING SEQUENCE A | | | | LOADING SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 090 (60 Hz), 100 Accessory Unloader Added to Compressor No. A1 | 1 | 16 6 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 25 0 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 41 6 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 50 0 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 66 6 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 75 0 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 91.6 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 100.0 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| 090 (50 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 14.3 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 21.5 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 35.9 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 43.1 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 64.3 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 71.5 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 92.8 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 100.0 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| 090 (60 Hz), 100 Accessory Unloaders Added to Compressors A1 and B1 | 1 | 16.6 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 25 0 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 33 3 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 41 6 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 50.0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 58.3 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1* | B1*,B2 |
| | 7 | 66.6 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1 | B1*,B2 |
| | 8 | 75.0 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 9 | 83 3 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 91.6 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1*,A2 | B1,B2 |
| | 11 | 100.0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| 090 (50 Hz) Accessory Unloaders Added to Compressors A1 and B1 | 1 | 14.3 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 21.5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 28.7 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 35.9 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 43 1 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 57.1 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1* | B1*,B2 |
| | 7 | 64 3 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1 | B1*,B2 |
| | 8 | 71.5 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 9 | 85.6 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 92.8 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1*,A2 | B1,B2 |
| | 11 | 100.0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |

When there are three or more compressors per refrigeration circuit, the Flotronic™ II control is programmed to randomly start the lag compressors. For simplicity, only one lag compressor starting sequence will be shown for the 30GB110 through 30GB200 and the 30GT225 through 30GT280

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 110 Standard | 1 | A 18.8 \| B 21.7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 40 5 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | A 59.4 \| B 62 3 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 81 1 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 100 0 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2,A3 | B1,B2 |
| 110 Accessory Unloader Added to Compressor No. A1 | 1 | 12.5 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 18.8 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 34.2 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 40.5 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 53.1 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 59.4 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 74.8 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 81 1 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 93 7 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 100 0 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| 110 Accessory Unloaders Added to Compressors A1 and B1 | 1 | A 12.5 \| B 14.4 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 18.8 \| 21.7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 27.0 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 33.3 | 2 | 10 | A1 | B1* | 2 | 10 | A1 | B1* |
| | 5 | 40.5 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 45.8 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1*,A2 | B1* |
| | 7 | 53 1 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1*,A2 | B1 |
| | 8 | 59.4 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1,A2 | B1 |
| | 9 | 67 6 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 73.9 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1,A2 | B1*,B2 |
| | 11 | 81.1 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 86.4 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2,A3 | B1*,B2 |
| | 13 | 93.7 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1*,A2,A3 | B1,B2 |
| | 14 | 100.0 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2,A3 | B1,B2 |

*Unloaded compressor.

## Table 3 – Capacity Control Steps (cont)

| UNIT 30GB | CONTROL STEPS | % DISPLACEMENT | LOADING SEQUENCE A | | | | LOADING SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 125 (60 Hz) Standard | 1 | 20 0 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 40.0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 60.0 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 80.0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 100 0 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2,A3 | B1,B2 |
| 125 (50 Hz) Standard | | A \| B | | | | | | | |
| | 1 | 22 1 \| 16.7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 38 9 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | | A \| B | | | | | | | | |
| | 3 | 61.0 \| 55.7 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 77.8 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 100.0 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2,A3 | B1,B2 |
| 125 (60 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 13.3 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 20 0 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 33 3 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 40 0 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 53 3 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 60 0 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 73 3 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 80 0 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 93.3 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 100 0 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| 125 (50 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 14.7 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 22.1 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 31.5 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 38.9 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 53.6 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 61.0 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 70.4 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 77.8 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 92.6 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 100 0 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| 125 (60 Hz) Accessory Unloaders Added to Compressors A1 and B1 | 1 | 14 7 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 22 1 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 26.6 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 31.5 | 2 | 10 | A1 | B1* | 2 | 10 | A1 | B1* |
| | 5 | 38.9 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 46 6 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1*,A2 | B1* |
| | 7 | 53.6 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1*,A2 | B1 |
| | 8 | 61.0 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1,A2 | B1 |
| | 9 | 66.6 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 70 4 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1,A2 | B1*,B2 |
| | 11 | 77.8 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 86.6 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2,A3 | B1*,B2 |
| | 13 | 92.6 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1*,A2,A3 | B1,B2 |
| | 14 | 100.0 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2,A3 | B1,B2 |
| 125 (50 Hz) Accessory Unloaders Added to Compressors A1 and B1 | 1 | 11.1 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 16 7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 22.3 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 27.9 | 2 | 10 | A1 | B1* | 2 | 10 | A1 | B1* |
| | 5 | 33 5 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 44 5 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1*,A2 | B1* |
| | 7 | 50.1 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1*,A2 | B1 |
| | 8 | 55.7 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1,A2 | B1 |
| | 9 | 66.6 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 72.2 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1,A2 | B1*,B2 |
| | 11 | 77 8 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 88 8 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2,A3 | B1*,B2 |
| | 13 | 94 4 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1*,A2,A3 | B1,B2 |
| | 14 | 100 0 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2,A3 | B1,B2 |
| 150 (60 Hz) Standard | 1 | 16 6 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 33 3 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 50.0 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 66.6 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 83.3 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 100.0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| 150 (50 Hz) Standard | 1 | 13.7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 27 4 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 45.6 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 63.7 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 81 8 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 100 0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |

*Unloaded compressor.

## Table 3 – Capacity Control Steps (cont)

| UNIT 30GB | CONTROL STEPS | % DISPLACEMENT | LOADING SEQUENCE A | | | | LOADING SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 150 (60 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 11.1 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 16.6 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 27 7 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 33.3 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 44 4 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 50.0 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 61 1 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 66 6 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 77.7 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 83.3 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| | 11 | 94.4 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 12 | 100.0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | — | — | — | — |
| 150 (50 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 9.1 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 13 7 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 22 8 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 27.4 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 41.0 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 45.6 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 59.1 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 63.7 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 77 2 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 81 8 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| | 11 | 95.4 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 12 | 100.0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | — | — | — | — |
| 150 (60 Hz) Accessory Unloaders Added to Compressors A1 and B1 | 1 | 11.1 | 1 | 4 | A1* | | 1 | 4 | — | B1* |
| | 2 | 16.6 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 22 2 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 27.7 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 33.3 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 38.8 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1* | B1*,B2 |
| | 7 | 44.4 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1 | B1*,B2 |
| | 8 | 50.0 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 9 | 55.5 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 61.1 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1*,A2 | B1,B2 |
| | 11 | 66.6 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 72.2 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2 | B1*,B2,B3 |
| | 13 | 77 7 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1,A2 | B1*,B2,B3 |
| | 14 | 83 3 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 15 | 88.8 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 |
| | 16 | 94.4 | 6 | 34 | A1,A2,A3 | B1*,B2,B3 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 |
| | 17 | 100.0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| 150 (50 Hz) Accessory Unloaders Added to Compressors A1 and B1 | 1 | 9 1 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 13 7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 18.3 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 22 8 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 27 4 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 36 4 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1* | B1*,B2 |
| | 7 | 41.0 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1 | B1*,B2 |
| | 8 | 45.6 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 9 | 54.5 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 59 1 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1*,A2 | B1,B2 |
| | 11 | 63.7 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 72 7 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2 | B1*,B2,B3 |
| | 13 | 77 2 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1,A2 | B1*,B2,B3 |
| | 14 | 81 8 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 15 | 90 8 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 |
| | 16 | 95.4 | 6 | 34 | A1,A2,A3 | B1*,B2,B3 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 |
| | 17 | 100.0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| 175 (60 Hz) Standard | 1 | 14 2 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 28 5 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 42 8 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 57 1 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 71 4 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 85.7 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 100 0 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 |
| 175 (50 Hz) Standard | 1 | 11 6 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 23.2 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 38.6 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 53.9 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 69.3 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 84.6 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 100.0 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 |

*Unloaded compressor.

## Table 3 — Capacity Control Steps (cont)

| UNIT 30GB | CONTROL STEPS | % DISPLACEMENT | CONTROL SEQUENCE A | | | | CONTROL SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 200 (60 Hz) Standard<br><br>Unloaders cannot be added to the 30GB175 and 200 | 1 | 12.5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 25.0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 37.5 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 50 0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 62 5 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 75.0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 87.5 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 8 | 100 0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |
| 200 (50 Hz) Standard<br><br>Unloaders cannot be added to the 30GB175 and 200 | 1 | 10.0 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 20.1 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 33 4 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 46 7 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 60.0 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 73 3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 86.6 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 8 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |
| 30GT | | | | | | | | | | |
| 225 (60 Hz) Standard | 1 | 11.5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 23 1 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 34.7 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 46 2 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 57 8 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 69 4 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 84 7 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 8 | 100 0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |
| 225 (50 Hz) Standard | 1 | A 9.7 \| B 12.8 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 22.6 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 35.5 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 48.4 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 61.3 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 74.2 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 87.1 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 8 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |
| 225 (60 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 7.7 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 11.5 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 19.2 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 23.1 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 30.8 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 34 7 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 42.4 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 46.2 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 54.0 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 57.8 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| | 11 | 65.5 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 12 | 69.4 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 13 | 80.8 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 14 | 84 7 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 15 | 96 1 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |
| | 16 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |
| 225 (50 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 6 5 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 9 7 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 19.4 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 22.6 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 32.2 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 35.5 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 45.1 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 48.4 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 58.0 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 61.3 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| | 11 | 70 9 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 12 | 74.2 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 13 | 83.8 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 14 | 87 1 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 15 | 96.7 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |
| | 16 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |

*Unloaded compressor

## Table 3 – Capacity Control Steps (cont)

| UNIT 30GT | CONTROL STEPS | % DISPLACEMENT | LOADING SEQUENCE A | | | | LOADING SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 225 (60 Hz) Accessory Unloaders Added to Compressors A1 and B1 | 1 | 7.7 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 11.5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 15 4 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 19 2 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 23.1 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 27.0 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1* | B1*,B2 |
| | 7 | 30.8 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1 | B1*,B2 |
| | 8 | 34.7 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 9 | 38.5 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 42.4 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1*,A2 | B1,B2 |
| | 11 | 46.2 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 50.1 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2 | B1*,B2,B3 |
| | 13 | 54.0 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1,A2 | B1*,B2,B3 |
| | 14 | 57.8 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 15 | 61.7 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 |
| | 16 | 65.5 | 6 | 34 | A1,A2,A3 | B1*,B2,B3 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 |
| | 17 | 69 4 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 18 | 77 0 | 7 | 38 | A1*,A2,A3,A4 | B1*,B2,B3 | 7 | 38 | A1*,A2,A3 | B1*,B2,B3,B4 |
| | 19 | 80 8 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | 7 | 40 | A1,A2,A3 | B1*,B2,B3,B4 |
| | 20 | 84 7 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 21 | 92 2 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 |
| | 22 | 96 1 | 8 | 46 | A1,A2,A3,A4 | B1*,B2,B3,B4 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 |
| | 23 | 100 0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |
| 225 (50 Hz) Accessory Unloaders Added to Compressors A1 and B1 | | A \| B | | | | | | | | |
| | 1 | 6 5 \| 8 5 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 9 7 \| 12.8 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 15.1 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 18.3 | 2 | 10 | A1 | B1* | 2 | 10 | A1 | B1* |
| | 5 | 22.6 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 27.9 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1*,A2 | B1* |
| | 7 | 32.2 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1*,A2 | B1 |
| | 8 | 35.5 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1,A2 | B1 |
| | 9 | 40.8 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 44.1 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1,A2 | B1*,B2 |
| | 11 | 48 4 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 53.7 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2,A3 | B1*,B2 |
| | 13 | 58 0 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1*,A2,A3 | B1,B2 |
| | 14 | 61 3 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2,A3 | B1,B2 |
| | 15 | 66.6 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 |
| | 16 | 70.9 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 |
| | 17 | 74.2 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 18 | 79.5 | 7 | 38 | A1*,A2,A3,A4 | B1*,B2,B3 | 7 | 38 | A1*,A2,A3,A4 | B1*,B2,B3 |
| | 19 | 83.8 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 |
| | 20 | 87.1 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 |
| | 21 | 92.4 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 |
| | 22 | 96.7 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 |
| | 23 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |
| 250 (60 Hz) Standard | 1 | 10.7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 21.5 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 32.3 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 43.1 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 57 3 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 71 5 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 85.7 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 8 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |
| 250 (50 Hz) 280 (60 Hz) Standard | 1 | 12.5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 2 | 25.0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 3 | 37.5 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 4 | 50.0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 5 | 62.5 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 6 | 75 0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 7 | 87 5 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 |
| | 8 | 100 0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |

*Unloaded compressor.

## Table 3 – Capacity Control Steps (cont)

| UNIT 30GT | CONTROL STEPS | % DISPLACEMENT | LOADING SEQUENCE A | | | | LOADING SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 250 (60 Hz) Accessory Unloader Added to Compressor No. A1 | 1 | 7.1 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 10 7 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 17.9 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 21.5 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 28.7 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 32 3 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 39 5 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 43 1 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 53 7 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 57.3 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| | 11 | 67 9 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 12 | 71 5 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 13 | 82 1 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 14 | 85 7 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 15 | 96 4 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |
| | 16 | 100 0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |
| 250 (50 Hz), 280 Accessory Unloader Added to Compressor No. A1 | 1 | 8.3 | 1 | 4 | A1* | — | — | — | — | — |
| | 2 | 12.5 | 1 | 6 | A1 | — | — | — | — | — |
| | 3 | 20.8 | 2 | 10 | A1* | B1 | — | — | — | — |
| | 4 | 25.0 | 2 | 12 | A1 | B1 | — | — | — | — |
| | 5 | 33.3 | 3 | 16 | A1*,A2 | B1 | — | — | — | — |
| | 6 | 37.5 | 3 | 18 | A1,A2 | B1 | — | — | — | — |
| | 7 | 45.8 | 4 | 22 | A1*,A2 | B1,B2 | — | — | — | — |
| | 8 | 50.0 | 4 | 24 | A1,A2 | B1,B2 | — | — | — | — |
| | 9 | 58 3 | 5 | 28 | A1*,A2,A3 | B1,B2 | — | — | — | — |
| | 10 | 62 5 | 5 | 30 | A1,A2,A3 | B1,B2 | — | — | — | — |
| | 11 | 70 8 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 12 | 75 0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | — | — | — | — |
| | 13 | 83 3 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 14 | 87 5 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | — | — | — | — |
| | 15 | 95 8 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |
| | 16 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | — | — | — | — |
| 250 (60 Hz) Accessory Unloaders Added to Compressors A1 and B1 | 1 | 7 1 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 10.7 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 14.3 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 17.9 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 21.5 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 25.1 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1* | B1*,B2 |
| | 7 | 28.7 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1 | B1*,B2 |
| | 8 | 32.3 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 9 | 35.9 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 39.5 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1*,A2 | B1,B2 |
| | 11 | 43.1 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 50.1 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2 | B1*,B2,B3 |
| | 13 | 53 7 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1,A2 | B1*,B2,B3 |
| | 14 | 57 3 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 15 | 64 3 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 |
| | 16 | 67.9 | 6 | 34 | A1,A2,A3 | B1*,B2,B3 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 |
| | 17 | 71.5 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 18 | 78 5 | 7 | 38 | A1*,A2,A3,A4 | B1*,B2,B3 | 7 | 38 | A1*,A2,A3 | B1*,B2,B3,B4 |
| | 19 | 82.1 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | 7 | 40 | A1,A2,A3 | B1*,B2,B3,B4 |
| | 20 | 85 7 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 21 | 92.8 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 |
| | 22 | 96.4 | 8 | 46 | A1,A2,A3,A4 | B1*,B2,B3,B4 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 |
| | 23 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |

*Unloaded compressor.

## Table 3 — Capacity Control Steps (cont)

| UNIT 30GT | CONTROL STEPS | % DISPLACEMENT | LOADING SEQUENCE A | | | | LOADING SEQUENCE B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Operating | | | | Operating | | | |
| | | | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B | Qty of Compr | No. of Cyl | Compr No. Circuit A | Compr No. Circuit B |
| 250 (50 Hz), 280 Accessory Unloaders Added to Compressors A1 and B1 | 1 | 8 3 | 1 | 4 | A1* | — | 1 | 4 | — | B1* |
| | 2 | 12 5 | 1 | 6 | A1 | — | 1 | 6 | — | B1 |
| | 3 | 16 6 | 2 | 8 | A1* | B1* | 2 | 8 | A1* | B1* |
| | 4 | 20.8 | 2 | 10 | A1 | B1* | 2 | 10 | A1* | B1 |
| | 5 | 25.0 | 2 | 12 | A1 | B1 | 2 | 12 | A1 | B1 |
| | 6 | 29.1 | 3 | 14 | A1*,A2 | B1* | 3 | 14 | A1* | B1*,B2 |
| | 7 | 33.3 | 3 | 16 | A1*,A2 | B1 | 3 | 16 | A1 | B1*,B2 |
| | 8 | 37.5 | 3 | 18 | A1,A2 | B1 | 3 | 18 | A1 | B1,B2 |
| | 9 | 41.6 | 4 | 20 | A1*,A2 | B1*,B2 | 4 | 20 | A1*,A2 | B1*,B2 |
| | 10 | 45.8 | 4 | 22 | A1,A2 | B1*,B2 | 4 | 22 | A1*,A2 | B1,B2 |
| | 11 | 50.0 | 4 | 24 | A1,A2 | B1,B2 | 4 | 24 | A1,A2 | B1,B2 |
| | 12 | 54.1 | 5 | 26 | A1*,A2,A3 | B1*,B2 | 5 | 26 | A1*,A2 | B1*,B2,B3 |
| | 13 | 58.3 | 5 | 28 | A1*,A2,A3 | B1,B2 | 5 | 28 | A1,A2 | B1*,B2,B3 |
| | 14 | 62.5 | 5 | 30 | A1,A2,A3 | B1,B2 | 5 | 30 | A1,A2 | B1,B2,B3 |
| | 15 | 66.6 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 | 6 | 32 | A1*,A2,A3 | B1*,B2,B3 |
| | 16 | 70.8 | 6 | 34 | A1,A2,A3 | B1*,B2,B3 | 6 | 34 | A1*,A2,A3 | B1,B2,B3 |
| | 17 | 75.0 | 6 | 36 | A1,A2,A3 | B1,B2,B3 | 6 | 36 | A1,A2,A3 | B1,B2,B3 |
| | 18 | 79 1 | 7 | 38 | A1*,A2,A3,A4 | B1*,B2,B3 | 7 | 38 | A1*,A2,A3 | B1*,B2,B3,B4 |
| | 19 | 83.3 | 7 | 40 | A1*,A2,A3,A4 | B1,B2,B3 | 7 | 40 | A1,A2,A3 | B1*,B2,B3,B4 |
| | 20 | 87.5 | 7 | 42 | A1,A2,A3,A4 | B1,B2,B3 | 7 | 42 | A1,A2,A3 | B1,B2,B3,B4 |
| | 21 | 91.6 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 | 8 | 44 | A1*,A2,A3,A4 | B1*,B2,B3,B4 |
| | 22 | 95.8 | 8 | 46 | A1,A2,A3,A4 | B1*,B2,B3,B4 | 8 | 46 | A1*,A2,A3,A4 | B1,B2,B3,B4 |
| | 23 | 100.0 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 | 8 | 48 | A1,A2,A3,A4 | B1,B2,B3,B4 |

*Unloaded compressor.

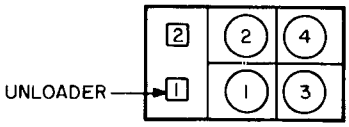
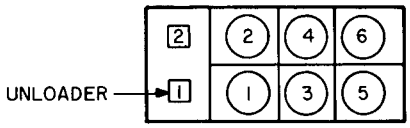
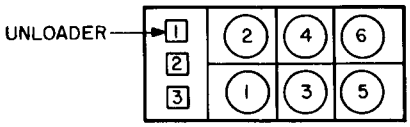
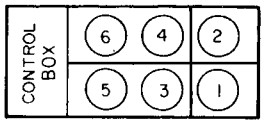
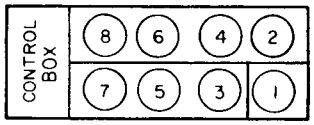
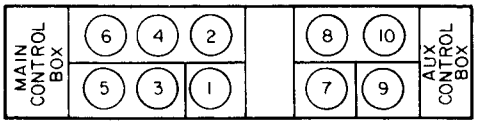
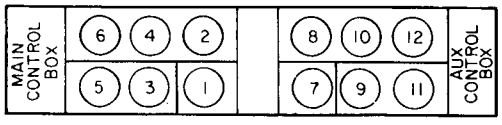
**Head Pressure Control —** The microprocessor controls the condenser fans in order to maintain the lowest condensing temperature possible, thus the highest unit efficiency. Instead of using the conventional head pressure control methods, the fans are controlled by the position of the electronic expansion valves and suction superheat.

As the condensing temperature drops, the electronic expansion valve opens to maintain the proper suction superheat. Once the electronic expansion valve is fully open, if the condensing temperature continues to drop, the suction superheat begins to rise. Once the suction superheat is greater than 40°F (22.2°C), a fan stage is removed after 2 minutes.

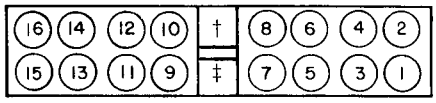
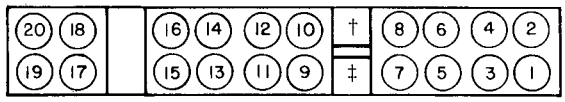
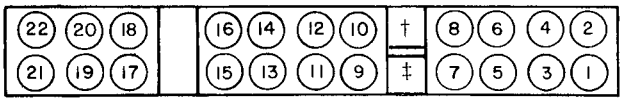
As the condensing temperature rises, the electronic expansion valve closes to maintain the proper suction superheat. Once the electronic expansion valve has closed to 39.5% open (300 steps open), a fan stage is added after 2 minutes.

During start-up, all the condenser fans are started when the condensing temperature reaches 95 F (35 C) to prevent excessive discharge pressure during pulldown. See Table 4 for condenser fan sequence of operation.

## Table 4 – Condenser Fan Sequence

| FAN ARRANGEMENT | FAN NO. | FAN CONTACTOR | CONTROLLED BY |
|---|---|---|---|
| **30GB040,046** □ – COMPRESSOR   | 1 | FC1 | Compressor No A1 |
| | 2 | FC2 | Compressor No. B1 |
| | 3, 4 | FC3 | First Stage of Microprocessor |
| **30GB045,050,055,060** □ – COMPRESSOR   | 1 | FC1 | Compressor No. A1 |
| | 2 | FC2 | Compressor No. B1 |
| | 3, 4 | FC3 | First Stage of Microprocessor |
| | 5, 6 | FC4 | Second Stage of Microprocessor |
| **30GB070** □ – COMPRESSOR   | 1, 2 | FC1 | Compressor No. A1 |
| | 1, 2 | FC2 | Compressor No. B1 |
| | 3, 4 | FC3 | First Stage of Microprocessor |
| | 5, 6 | FC4 | Second Stage of Microprocessor |
| **30GB075,080**   | 1 | FC1 | Compressor No. A1 |
| | 2 | FC4 | Compressor No. B1 |
| | 3, 5 | FC2 | First Stage of Microprocessor |
| | 4, 6 | FC3 | Second Stage of Microprocessor |
| **30GB090, 100**   | 1 | FC1 FC4 | Compressor No. A1 or B1 |
| | 3, 5, 7 | FC2 | First Stage of Microprocessor |
| | 2, 4, 6, 8 | FC3 | Second Stage of Microprocessor |
| **30GB110,125**   | 1 | FC1 | Compressor No. A1 |
| | 7 | FC4 | Compressor No. B1 |
| | 3, 5, 9 | FC2 FC5 | First Stage of Microprocessor |
| | 2, 4, 6, 8, 10 | FC3 FC6 | Second Stage of Microprocessor |
| **30GB150,175,200**   | 1 | FC1 | Compressor No. A1 |
| | 7 | FC4 | Compressor No. B1 |
| | 3, 5, 9, 11 | FC2 FC5 | First Stage of Microprocessor |
| | 2, 4, 6, 8, 10, 12 | FC3 FC6 | Second Stage of Microprocessor |

## Table 4 — Condenser Fan Sequence (cont)

| FAN ARRANGEMENT | FAN NO. (CKT) | FAN CONTACTOR | CONTROLLED BY |
|---|---|---|---|
| **30GT225** | 7, 8 (A) | FC1 | Compressor A1 |
| | 9, 10 (B) | FC4 | Compressor B1 |
| | 5, 6 (A) | FC2 | First Stage of Microprocessor |
| | 11, 12 (B) | FC5 | |
|   | 1, 2, 3, 4 (5, 6 Off) (A) | FC3 | Second Stage of Microprocessor |
| | 13, 14, 15, 16 (11, 12 Off) (B) | FC6 | |
| | 1, 2, 3, 4, 5, 6 (A) | FC2 FC3 | Third Stage of Microprocessor |
| | 11, 12, 13, 14, 15, 16 (B) | FC5 FC6 | |
| **30GT250 — (60 Hz)** | 7, 8, 10 (A) | FC1 | Compressor A1 |
| | 9, 17, 18 (B) | FC4 | Compressor B1 |
| | 5, 6 (A) | FC2 | First Stage of Microprocessor |
|   | 11, 12, 19 (B) | FC5 | |
| | 1, 2, 3, 4, 13, 14, 15, 16, 20 (A) | FC3 FC6 FC7 | Second Stage of Microprocessor |
| | 1, 2, 3, 4, 13, 14, 15, 16, 20 (B) | FC3 FC6 FC7 | |
| **30GT280 AND 30GT250 — 50 Hz** | 7, 8, 10 (A) | FC1 | Compressor A1 |
| | 9, 17, 18 (B) | FC4 | Compressor B1 |
| | 5, 6 (A) | FC2 | First Stage of Microprocessor |
|   | 11, 12, 19, 20 (B) | FC5 | |
| | 1, 2, 3, 4, 13, 14, 15, 16, 21, 22 (A) | FC3 FC6 FC7 | Second Stage of Microprocessor |
| | 1, 2, 3, 4, 13, 14, 15, 16, 21, 22 (B) | FC3 FC6 FC7 | |

†Control box ‡ Power box.

**Pumpout —** When the lead compressor in each circuit is started or stopped, that circuit goes through a pumpout cycle to purge the cooler and refrigerant suction lines of refrigerant. The method of controlling the pumpout cycle is different between the 30GB and the 30GT units.

30GB — The solenoid valve (if used) opens immediately upon starting the lead compressor. However, the electronic expansion valve remains in the closed position for 10 seconds. After 10 seconds, the EXV opens gradually to provide a controlled start-up to prevent liquid flood-back to the compressor. If the lead compressor has been shut down for less than 15 minutes, the pumpout cycle is omitted at start-up.

At shutdown, the pumpout cycle begins when the electronic expansion valve has been driven closed to a position of less than 35% (266 steps open) open. The compressor then continues to run for 10 seconds before shutting down. When the compressor shuts down, the solenoid valve (if used) closes and the EXV continues to move until fully closed.

30GT — The pumpout cycle starts immediately upon starting the lead compressor and continues until the saturated suction temperature is 20 degrees F (11.1 degrees C) below the saturated suction temperature at start-up or is 10 degrees F (5.5 degrees C) below the cooler leaving fluid temperature. At this point, the EXV starts to open and continues to open gradually to provide a controlled start-up to prevent liquid flood-back to the compressor.

At shut down, the pumpout cycle continues until the saturated suction temperature for that circuit is 20 degrees F (11.1 degrees C) below the saturated suction temperature when pumpout is initiated. At that point, the compressor shuts down and the EXV continues to move until fully closed.

**Keyboard and Display Module** (Also called HSIO or LID) — The only function of this module is to allow the operator to communicate with the processor. It is used to enter configurations and set points and to read data, perform tests and set schedules. This device consists of a keyboard with 6 function keys, 5 operative keys, 12 numeric keys (0 to 9, • and −), and an alphanumeric 8-character LCD. See Fig. 1. See Table 5 for key usage.

ACCESSING FUNCTIONS AND SUBFUNCTIONS — See Tables 5, 6, and 7. Table 6 shows the 6 functions (identified by name) and the subfunctions (identified by number).

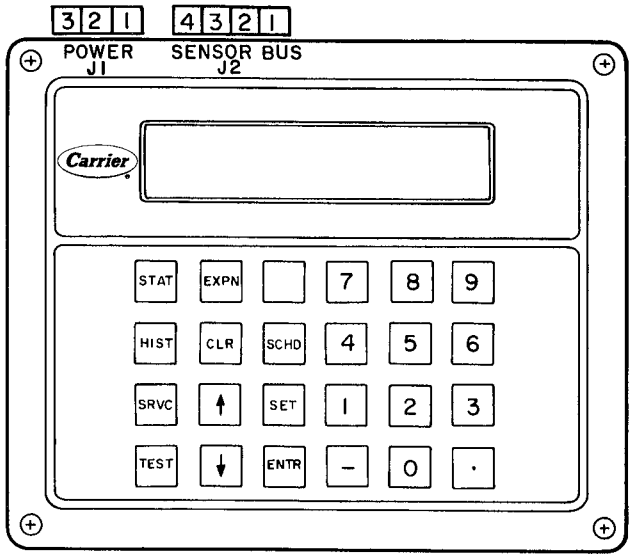



**Fig. 1 — Keyboard and Display Module**

**Table 5 — Keyboard and Display Module Usage**

| FUNCTION KEYS | USE |
|---|---|
| STAT | STATUS — For displaying diagnostic codes and current operating information about the machine. |
| TEST | TEST — For checking inputs and outputs for proper operation. |
| HIST | HISTORY — For displaying run time, cycles and previous alarms |
| SRVC | SERVICE — For entering specific unit configuration information. |
| SET | SET POINT — For entering operating set points and day/time information |
| SCHD | SCHEDULE — For entering Occupied/ Unoccupied schedules for unit operation |
| **OPERATIVE KEYS** | |
| EXPN | EXPAND — For displaying a non-abbreviated expansion of the display. |
| CLR | CLEAR — For clearing the screen of all displays. |
| ↑ | UP ARROW — For returning to previous display position. |
| ↓ | DOWN ARROW — For advancing to next display position. |
| ENTR | ENTER — For entering data |

## Table 6 — Functions and Subfunctions

| SUBFUNCTIONS NO. | FUNCTIONS | | | | | |
|---|---|---|---|---|---|---|
| | Status [STAT] | Test [TEST] | Service [SRVC] | Set Point [SET] | Schedule [SCHD] | History [HIST] |
| 1 | Rotating Display | Test of Outputs | Log on and Log off | System (Chilled Water) | Occupied Mode Override | Run Time |
| 2 | Alarm Displays | Test of Compressors and Unloaders | Software Version | Reset | Schedule Type | Starts |
| 3 | Operating Mode Displays | — | Factory Configuration | Demand Limit | Period 1 | Alarms |
| 4 | Capacity Stages | — | Field Configuration | Time | Period 2 | — |
| 5 | Current Operating Set Points | — | Service Configuration | — | Period 3 | — |
| 6 | System Temperatures | — | — | — | Period 4 | — |
| 7 | System Pressures | — | — | — | Period 5 | — |
| 8 | Analog | — | — | — | Period 6 | — |
| 9 | Inputs | — | — | — | Period 7 | — |
| 10 | Outputs | — | — | — | Period 8 | — |
| 11 | — | — | — | — | HOLIDAYS | — |

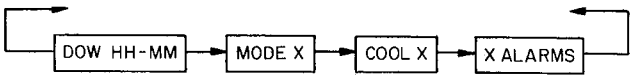
## Table 7 — Accessing Functions and Subfunctions

| OPERATION | KEYBOARD ENTRY | DISPLAY RESPONSE | DESCRIPTION |
|---|---|---|---|
| To access a function, press subfunction no. and function name key. Display shows subfunction group. | [2] [SET] | RESET | Reset Set Points |
| To move to other elements, scroll up or down using arrow keys. NOTE: These displays do not show if control is not configured for reset. | [↓] | CRST2xx | Cooling Max Reset xx |
| | [↓] | CREF2xx | Cooling Max Reference xx |
| | [↓] | CRST1xx | Cooling Min Reference xx |
| | [↓] | CREF1xx | Cooling Min Reference xx |
| When the last element in a subfunction has been displayed, the first element is repeated. | [↓] | RESET | Reset Set |
| | [↓] | CRST2xx | Cooling Max Reset xx |
| To move to next subfunction it is not necessary to use subfunction no. Press function name key to advance display through all subfunctions within a function and then back to the first. | [SET] | DEMAND | Demand Set Points |
| | [SET] | TIME | Current Time and Day of Week |
| | [SET] | SET | Unit Set Points |
| To move to another function, either depress function name key for desired function (display shows the first subfunction). | [STAT] | X ALARMS | Rotating Display |
| or<br>Access a specific subfunction by using the subfunction number and the function name key | [4] [STAT] | STAGE | Capacity Stages |

SUMMARY DISPLAY — When keyboard has not been used for 10 minutes, display automatically switches to the rotating summary display. This display has 4 parts, listed below, which appear in continuous rotating sequence.

| DISPLAY | EXPANSION |
|---|---|
| **TUE 15:45** | TODAY IS TUE, TIME IS 15:45 (3:45 PM) |
| **CLOCK ON** | UNIT IS ON VIA CLOCK SCHEDULE |
| **COOL 1** | NUMBER OF STAGES IS 1 |
| **2 ALARMS** | 2 ALARMS DETECTED |

AUTOMATIC DISPLAY OPERATION/DEFAULT DISPLAY — In this mode the keyboard displays the current time (24-hour format), current operating modes, cooling capacity stages, and total number of alarms.




The default display is displayed every 2 seconds if there has been no manual input from the keyboard for 10 minutes. To return to automatic display at any time [1] [STAT] can be entered.

KEYBOARD OPERATING INSTRUCTIONS (Refer to Keyboard Directory, Table 8.)

1. White keys on left side of keyboard are shown and operated in these instructions according to the following example: keyboard entry [1] [SRVC] means press the [1], then the white key marked [SRVC].
2. The standard display uses abbreviations. Expanded information scrolls through the display whenever [EXPN] key is pressed.
3. All functions are made up of a group of subfunctions. To enter a subfunction, first press subfunction number desired. Then press the function key in which the subfunction resides. To move within that subfunction, press the up [↑] or down [↓] arrow. For example, a [6] [STAT] enters the Temperature Information subfunction.
4. At any time, another subfunction may be entered by simply entering the subfunction number, then the function key.
5. Prior to starting unit, check leaving fluid set point for correct setting. Refer to Set Point Function Information.
6. Depending on chiller model (30GB, 30GT) and configuration, all displays may not be shown. All displays are shown unless marked with one of the following symbols.

   *Must be configured. †30GB only. **30GT only

   For additional unit start-up procedures, see separate Installation, Start-Up and Service Instructions supplied with unit.

## Table 8 – Keyboard Directory

| STATUS | | | |
|---|---|---|---|
| **SUBFUNCTION** | **KEYBOARD ENTRY** | **DISPLAY** | **COMMENT** |
| **1 AUTOMATIC DISPLAY** | 1 STAT | Refer to Automatic Display Operation. See previous page. | |
| **2 ALARMS** | 2 STAT | X ALARMS | Number of Tripped Alarms |
| | ↓ | ALARM X | Displays Tripped Alarms |
| | ↓ | ALARM X | |
| | ↓ | ALARM X | |
| | ↓ | ALARM X | |
| | ↓ | ALARM X | |
| **3 MODES** | 3 STAT | X MODES | Number of Modes in Effect |
| | ↓ | MODE X | Displays Mode in Effect |
| | ↓ | MODE X | |
| | ↓ | MODE X | |
| | ↓ | MODE X | |
| **4 STAGE** | 4 STAT | STAGE | Capacity Staging Information |
| | ↓ | STAGE X | Number of Requested Stages |
| | ↓ | CAPT X | Percent of Total Capacity |
| | ↓ | CAPA X | Percent Circuit A Capacity |
| | ↓ | CAPB X | Percent Circuit B Capacity |
| | ↓ | *LMT X | Demand Limit Set Point |
| | ↓ | *LOAD X | Load Limit Set Point |
| | ↓ | CIRA X | Circuit A Compressor Relay Status |
| | ↓ | CIRB X | Circuit B Compressor Relay Status |
| | ↓ | SMZ X | Load/Unload Factor for Compressors<br>Factor = 1 Unloader Factor = 0.6 |
| **5 SET POINT** | 5 STAT | SET POINT | Fluid Set Point Information |
| | ↓ | SP X | Set Point |
| | ↓ | MSP X | Modified Set Point = Set Point + Reset |
| | ↓ | TW X | Cooler Leaving Fluid Temp |
| **6 TEMPERATURE** | 6 STAT | TEMPS | Temperature Information |
| | ↓ | EWT X | Cooler Entering Fluid Temp |
| | ↓ | LWT X | Cooler Leaving Fluid Temp |
| | ↓ | SCTA X | Circuit A Saturated Condenser Temp |
| | ↓ | SSTA X | Circuit A Saturated Suction Temp |
| | ↓ | CTA X | Compressor A1 Suction Temp |
| | ↓ | SHA X | Circuit A Suction Superheat |

## Table 8 Keyboard Directory (cont)

| STATUS (cont) | | | |
|---|---|---|---|
| **SUBFUNCTION** | **KEYBOARD ENTRY** | **DISPLAY** | **COMMENT** |
| **6 TEMPERATURE (cont)** | ↓ | SCTB X | Circuit B Saturated Condenser Temp |
| | ↓ | SSTB X | Circuit B Saturated Suction Temp |
| | ↓ | CTB X | Compressor B1 Suction Temp |
| | ↓ | SHB X | Circuit B Suction Superheat |
| | ↓ | *RST X | Reset Temperature |
| **7 PRESSURE** | 7 STAT | PRESSURE | Refrigerant System Pressure (psig) |
| | ↓ | †NONE | None Available |
| | ↓ | **DPA X | Circuit A Discharge Pressure |
| | ↓ | **SPA X | Circuit A Suction Pressure |
| | ↓ | **XXXX | Circuit A Discharge/Suction |
| | ↓ | **OPA X | Circuit A Oil Pressure Differential |
| | ↓ | **DPB X | Circuit B Discharge Pressure |
| | ↓ | **SPB X | Circuit B Suction Pressure |
| | ↓ | **XXXX | Circuit B Discharge/Suction |
| | ↓ | **OPB X | Circuit B Oil Pressure Differential |
| **8 ANALOG** | 8 STAT | ANALOG | Status of Analog Inputs |
| | ↓ | †NONE | None Available |
| | ↓ | *REF X | Transducer Supply Voltage |
| | ↓ | *LMT X | Demand 4-20 mA Signal |
| | ↓ | *RST X | Reset 420 mA Signal |
| **9 INPUTS** | 9 STAT | INPUT | Status of Switch Inputs |
| | ↓ | *SPW X | Dual Set Point Switch |
| | ↓ | *OPSA X | Oil Pressure Switch 1 |
| | ↓ | *OPSB X | Oil Pressure Switch 2 |
| | ↓ | *DL1 X | Demand Limit Switch 1 |
| | ↓ | *DL2 X | Demand Limit Switch 2 |

## Table 8 — Keyboard Directory (cont)

### STATUS (cont)

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **10 OUTPUTS** | 10 STAT | OUTPUTS | Status of Outputs |
| | ↓ | ALMR X | Alarm Relay K3 |
| | ↓ | FRA1 X | Fan Relay K1 |
| | ↓ | FRA2 X | Fan Relay K2 |
| | ↓ | **FRB1 X | Fan Relay K4 |
| | ↓ | **FRB2 X | Fan Relay K5 |
| | ↓ | *CHWP X | Cooler Water Pump Relay K6 |
| | ↓ | *ULA1 X | Unloader A1 |
| | ↓ | *ULA2 X | Unloader A2 |
| | ↓ | *ULB1 X | Unloader B1 |
| | ↓ | *ULB2 X | Unloader B2 |
| | ↓ | EXVA X | EXVA Percent Open |
| | ↓ | EXVB X | EXVB Percent Open |
| | ↓ | *HGBA X | Hot Gas Bypass Relay Circuit A |
| | ↓ | *HGBB X | Hot Gas Bypass Relay Circuit B |
| | ↓ | *MMA X | Motormaster® A Output Percent |
| | ↓ | *MMB X | Motormaster B Output Percent |

### TEST

To use Test function, LOCAL/STOP/CCN switch must be in STOP position. To operate a test, scroll to desired test Then, press ENTR to start test Press ↓ to stop test.

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **1 OUTPUTS** | 1 TEST | OUTPUTS | Test Outputs |
| | ↓ | 8.8.8.8.8.8.8.8 | Display Check |
| | ↓ | ALMR X | Energize Alarm Relay K3 |
| | ↓ | FRA1 X | Energize Fan Relay A1 K1 |
| | ↓ | FRA2 X | Energize Fan Relay A2 K2 |
| | ↓ | FRB1 X | Energize Fan Relay B1 K4 |
| | ↓ | FRB2 X | Energize Fan Relay B2 K5 |
| | ↓ | *CHWP X | Energize Cooler Water Pump K6 |
| | ↓ | EXVA X | Enter Desired EXVA Position |
| | ↓ | EXVB X | Enter Desired EXVB Position |
| | ↓ | *HGBRA X | Energize Hot Gas Bypass Relay A |
| | ↓ | *HGBRB X | Energize Hot Gas Bypass Relay B |
| | ↓ | *MMA X | Enter Desired Motormaster® A Output Signal |
| | ↓ | *MMB X | Enter Desired Motormaster B Output Signal |

## Table 8 – Keyboard Directory (cont)

### TEST (cont)

**⚠ WARNING**

During compressor test, compressors start and run for 10 seconds. Compressor service valves and liquid line valves must be open. Energize crankcase heaters 24 hours prior to performing compressor tests.

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **2 COMPRESSORS** | 2 TEST | COMP | Compressor and Unloader Test |
| | ↓ | CPA1 X | Test Comp A1 |
| | ↓ | *CPA2 X | Test Comp A2 |
| | ↓ | *CPA3 X | Test Comp A3 |
| | ↓ | *CPA4 X | Test Comp A4 |
| | ↓ | CPB1 X | Test Comp B1 |
| | ↓ | *CPB2 X | Test Comp B2 |
| | ↓ | *CPB3 X | Test Comp B3 |
| | ↓ | *CPB4 X | Test Comp B4 |
| | ↓ | *ULA1 X | Energize Unloader A1 |
| | ↓ | *ULA2 X | Energize Unloader A2 |
| | ↓ | *ULB1 X | Energize Unloader B1 |
| | ↓ | *ULB2 X | Energize Unloader B2 |

### SCHEDULE

The Schedule function key SCHD is used to configure the unit's occupancy schedule. The clock select subfunction can be used for Unoccupied shutdown or Unoccupied setback depending on the cooling set point control configuration. The Schedule function described is for clock 1, which is the internal clock Password required for all subfunctions except override.

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **1 OVERRIDE** | 1 SCHD | OVRD X | Number of Override Hrs (0 - 4 Hrs) |
| Example, to extend current Occupied mode for 3 hrs, press: | | | |
| | 3 ENTR | OVRD 3 | Extended Occupied Time |
| **2 CLOCK SELECT** | 2 SCHD | CLOCK XX | Type of Clock Control<br>0 = No Clock, 1 = Clock 1 (Internal) |

## Table 8 – Keyboard Directory (cont)

### SCHEDULE (cont)

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **3 PERIOD 1** | 3 SCHD | PERIOD 1 | Period 1 Time Schedule |
| **Yes = Schedule Operational for that day** | ↓ | OCC HH.MM | Occupied Time |
| | ↓ | UNO HH.MM | Unoccupied Time |
| | ↓ | MON X | Monday Flag |
| | ↓ | TUE X | Tuesday Flag |
| | ↓ | WED X | Wednesday Flag |
| | ↓ | THU X | Thursday Flag |
| | ↓ | FRI X | Friday Flag |
| | ↓ | SAT X | Saturday Flag |
| | ↓ | SUN X | Sunday Flag |
| | ↓ | HOL X | Holiday Flag |
| To toggle between inputs (Yes/No) Press: | – ENTR | | |
| **4 PERIOD 2** | 4 SCHD | PERIOD 2 | Period 2 Time Schedule |
| **10 PERIOD 8** | 10 SCHD | PERIOD 8 | Period 8 Time Schedule |
| **11 HOLIDAYS** | 11 SCHD | HOLIDAYS | Define Calendar Holidays |
| | ↓ | DAT MM DD | Holiday Date 1 |
| **New = Unassigned Holiday Date** | ↓ | | |
| | ↓ | | |
| | ↓ | DAT MM.DD.NN | Holiday Date 30 |

Example: To enter July 4th holiday press: 07.04.01 ENTR Display shows Jul 04 For further information on the Schedule function and its operation refer to Schedule Function section in this guide.

### SERVICE

To view and modify configurations, the password must be entered under the log on subfunction.

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **1 LOG ON** | 1 SRVC | LOG ON | Enter Password/Disable Password Protection |
| | 1 1 1 1 ENTR | LOGGEDON | Logged On |
| At this time configurations may be modified. When finished viewing and/or modifying configurations, log out as follows: | | | |
| | ↓ | LOG OFF | Disable Password Protection |
| | ENTR | EXIT LOG | Logged Off/Enable Password Protection |
| **2 VERSION** | 2 SRVC | VERSION | Software Information |
| | ↓ | XXXXXXXX | Version No. of Software (CESRXX) |
| | ↓ | X | Language Options |

## Table 8 – Keyboard Directory (cont)

### SERVICE (cont)

The next 3 subfunctions provide the ability to modify configurations. Refer to separate Installation, Start-Up, and Service Instructions supplied with unit for further information on changing configurations

To change a configuration enter the new configuration and press [ENTR] while on the correct configuration

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **3 FACTORY CFG** | 3 SRVC | FACT CFG | Factory Configuration Codes |
| | ↓ | X | Configuration Code 1 |
| | ↓ | X | Configuration Code 2 |
| | ↓ | X | Configuration Code 3 |
| | ↓ | X | Configuration Code 4 |
| | ↓ | X | Configuration Code 5 |
| | ↓ | X | Configuration Code 6 |
| **4 FIELD CFG** | 4 SRVC | FLD CFG | Adjustable Field Configuration |
| | ↓ | ENO X | CCN Element Address |
| | ↓ | BUS X | CCN Bus Number |
| | ↓ | BAUD X | CCN Baud Rate |
| | ↓ | FLUID X | Cooler Fluid Select |
| | ↓ | UNITS X | Display Unit Select |
| | ↓ | LANG X | Display Language Select |
| | ↓ | NULA X | No. Circuit A Unloaders |
| | ↓ | NULB X | No. Circuit B Unloader |
| | ↓ | HGB X | Hot Gas Bypass Select |
| | ↓ | SEQT X | Loading Sequence Select |
| | ↓ | SEQF X | Lead/Lag Sequence Select |
| | ↓ | OPS X | Oil Pressure Switch Select |
| | ↓ | HEADT X | Head Pressure Control Type |
| | ↓ | HEADM X | Head Pressure Control Method |
| | ↓ | MM X | Motormaster® Select |
| | ↓ | CSPTYP X | Cooling Set Point Control Select |
| | ↓ | CRTYP X | Cooling Reset Control Select |
| | ↓ | ERTYP X | External Reset Sensor Select |
| | ↓ | LSTYP X | Demand Limit Control Select |
| | ↓ | RAMP X | Ramp Load Select |
| | ↓ | LOCK X | Cooler Pump Interlock Select |
| | ↓ | CPC X | Cooler Pump Control Select |
| **5 SERVICE CFG** | 5 SRVC | SRV CFG | Service Configurations |
| | ↓ | X | Configuration Code 7 |
| | ↓ | X | Configuration Code 8 |
| | ↓ | REFRIG X | Refrigerant |
| | ↓ | TDTYP X | Pressure Transducer Select |
| | ↓ | OPS X | Oil Transducer Set Point |
| | ↓ | LPS X | Low Pressure Set Point |
| | ↓ | FANTYP X | Fan Staging Select |
| | ↓ | SH X | EXV Superheat Set Point |
| | ↓ | MOP X | EXV MOP Set Point |

## HISTORY

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **1 RUN TIME** | 1 HIST | RUN TIME | Run Time Information |
| | ↓ | HR X | Total Hrs Unit Has a Comp Operating |
| | ↓ | HRA X | Cir A Run Time |
| | ↓ | HRB X | Cir B Run Time |
| **2 STARTS** | 2 HIST | STARTS | Starts Information |
| | ↓ | CY X | Cycles from Stage 0 to Stage 1 |
| | ↓ | CYA X | Cir A Starts |
| | ↓ | CYB X | Cir B Starts |
| **3 ALARM HISTORY** | 3 HIST | ALRMHIST | Last 5 Alarms |
| | ↓ | ALARM X | Alarm Description |
| | ↓ | ALARM X | |
| | ↓ | ALARM X | |
| | ↓ | ALARM X | |
| | ↓ | ALARM X | |

## SET POINT

To read a set point go to proper subfunction and read desired set point. To change a set point, enter new set point value, then press ENTR. LOCAL/STOP/CCN switch must be in LOCAL or STOP position.

| SUBFUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| **1 SET POINTS** | 1 SET | SET POINT | Unit Set Point |
| | ↓ | CSP1 X | Chiller Fluid Set Point 1 |
| | ↓ | CSP2 X | Chiller Fluid Set Point 2 |
| | ↓ | HSPA X | Head Pressure Set Point Circuit A |
| | ↓ | HSPB X | Head Pressure Set Point Circuit B |
| | ↓ | CRAMP X | Pulldown Limit |
| **2 RESET SET POINTS** | 2 SET | RESET | Reset Set Points |
| | ↓ | *CRST2 X | Cooling Max Reset |
| | ↓ | *CREF2 X | Max Reset Occurs at X mA or Degree |
| | ↓ | *CRST1 X | Cooling Min Reset |
| | ↓ | *CREF1 X | Min Reset Occurs at X mA or Degree |
| **3 DEMAND SET POINTS** | 3 SET | DEMAND | Demand Set Points |
| | ↓ | *DLS1 X | Demand Switch 1 Set Point |
| | ↓ | *DLS2 X | Demand Switch 2 Set Point |
| | ↓ | *DMAX X | 4-20 mA Max Demand Limit |
| | ↓ | *RMAX X | Max Demand Limit Occurs at X mA |
| | ↓ | *DMIN X | 4-20 mA Min Demand Limit |
| | ↓ | *RMIN X | Min Demand Limit Occurs at X mA |
| | ↓ | *SHED X | CCN Loadshed Amount |
| **4 DATE AND TIME** | 4 SET | DATE.TIME | Date, Time and Day of Week |
| | ↓ | DAY.HR.MIN | Day 1 = Mon, 2 = Tues. 7 = Sun<br>Hours are displayed in 24-hr time. Decimal point serves as colon. |
| | ↓ | MM DD YR | Month Day Year. When entering date enter a decimal point between entries Each entry must be two numbers. |

STATUS FUNCTION — This function shows the rotating display, current status of alarm (diagnostic) codes, capacity stages, operating modes, chilled water set point, all measured system temperatures and pressures, superheat values, pressure switch positions, analog inputs, switch inputs. These subfunctions are defined on pages 24 and 25.

[1] [STAT] (Rotating Display)

[2] [STAT] (Alarms) — Alarms are messages that one or more faults have been detected. Each fault is assigned a code number which is reported with the alarm. See Table 9 for code definitions. The codes indicate failures that cause the unit to shut down, terminate an option (such as reset) or result in the use of a default value as set point.

Up to 5 alarm codes can be stored at once. To view them in sequence, press [2] [STAT] to enter the alarm displays and then press [↓] to move to the individual alarm displays. Press [EXPN] after a code has been displayed. The meaning of the code scrolls across the screen. See Example 1.

### Example 1 — Reading Alarm Codes

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| | TUE 12:45<br>MODE 26<br>0 STAGES<br>2 ALARMS | Keyboard has not been used for at least 10 minutes Alternating summary display appears on screen |
| [2] [STAT] | 2 ALARMS | 2 alarms detected |
| [↓] | ALARM 9 | First alarm code |
| [EXPN] | COOLER LEAVING FLUID THERMISTOR FAILURE | Explanation of alarm code |
| [↓] | ALARM 42 | Second alarm code Cooler freeze protection |
| [EXPN] | COOLER FREEZE PROTECTION | Explanation of alarm code |

When a diagnostic (alarm) code is stored in the display and the machine automatically resets, the code is deleted. Codes for safeties which do not automatically reset are not deleted until the problem is corrected and the machine is switched to STOP, then back to LOCAL or CCN.

[3] [STAT] (Modes) — The operating mode codes are displayed to indicate the operating status of the unit at a given time. See Table 9.

### Table 9 — Operational and Mode Display Codes

The operating modes are displayed by name or code number, to indicate the operating status of the unit at a given time. The modes are:

| CODE | DESCRIPTION |
|---|---|
| LOCAL # OFF | Unit is off LOCAL/STOP/CCN switch is in OFF position, or LOCAL/STOP/CCN switch may be in LOCAL position with external ON/OFF switch in OFF position. |
| CCN OFF | Unit is off due to CCN network command. LOCAL/STOP/CCN switch is in CCN position. |
| CLOCK # OFF | Unit is off due to internal clock schedule LOCAL/STOP/CCN switch is in LOCAL position. |
| LOCAL ON | Unit is on. LOCAL/STOP/CCN switch is in LOCAL position. If external ON/OFF switch is used, it will be in ON position. |
| CCN ON | Unit is on due to CCN command LOCAL/STOP/CCN switch is in CCN position. |
| CLOCK ON | Unit is on due to internal clock schedule or Occupied override function LOCAL/STOP/CCN switch is in LOCAL position. |
| MODE 7 | Dual set point is in effect. In this mode, unit continues to run in Unoccupied condition, but leaving water set point is automatically increased to a higher level (CSP2 set point is in SET function) |
| MODE 8 | Temperature reset is in effect. In this mode, unit is using temperature reset to adjust leaving water set point upward, and unit is currently controlling to the modified set point. The set point can be modified based on return water, outside air temperature or space temperature. |
| MODE 9 | Demand Limit is in effect. This indicates that capacity of unit is being limited by Demand Limit control option. Because of this limitation, unit may not be able to produce the desired leaving water temperature. |
| MODE 10 | Load limit is in effect. This indicates that capacity of a system of units is being limited by a CCN Loadshed command Due to this limitation, unit may not be able to produce the desired leaving water temperature |
| MODE 11 | Not applicable |
| MODE 12 | Ramp load (pulldown) limiting is in effect. In this mode, the rate at which leaving water temperature is dropped is limited to a predetermined value to prevent compressor overloading. See CRAMP set point in the SET function. The pulldown limit can be modified, if desired, to any rate from .2°F to 2°F ( 1° to 1°C)/minute |
| MODE 13 | Timed override is in effect. This is a 1 to 4 hour temporary override of the programmed schedule, forcing unit to Occupied mode. Override can be implemented with unit under LOCAL or CCN control. Override expires after each use. |
| MODE 14 | Low cooler suction protection is in effect In this mode, unit capacity is reduced if cooler saturated suction temperature is 20 F (11 C) degrees or more below leaving water temperature, and leaving water temperature is less than 32 F (0°C) If these conditions persist beyond ten minutes, circuit is shut down and fault code 44 or 45 is displayed. |

To enter the MODES subfunction, depress [3] [STAT] and use the [↓] key to determine if more than one mode applies. See Example 2 to read current mode with expansion.

### Example 2 — Reading Current Operating Modes

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| | TUE 15:45<br>LOCAL ON<br>COOL 1<br>0 ALARMS | Keyboard has not been used for at least 10 minutes. Rotating summary display appears on screen |
| 3 STAT | 2 MODES | There are 2 modes currently in effect |
| ↓ | LOCAL ON | Unit is on by remote on/off switch |
| ↓ | MODE 8 | Temperature reset is in effect |

4 STAT (Stages) — This subfunction displays the capacity stage number, from 1 to 23. See Table 3 for compressor loading sequence. To enter the STAGES subfunction, depress 4 STAT and use the ↓ to display the stage number. Additional ↓ provides the following information:

- Percent of total unit capacity being utilized.
- Percent of each circuit capacity being utilized.
- Demand limit set point in effect (can be any value between 0% and 100%).
- Load limit set point in effect. This is a CCN function for controlling operation of multiple units between 0% and 100% of total capacity of all units combined.
- Status of each compressor relay. When a compressor is on, the number of that compressor is displayed. If a compressor is off, a 0 is displayed. Example: In a given circuit, if compressors 1 and 3 are running, and 2 and 4 are not running, 1030 is displayed for that circuit.
- Load/Unload factor for compressors. This factor is an indication of when a step of capacity is added or subtracted. Its value can range from slightly less than −1.0 to slightly more than +1.0. When load/unload factor reaches +1.0, a compressor is added. When the load/unload factor reaches −1.0, a compressor is subtracted. If compressor unloaders are used, at −.6 a compressor is unloaded and at +.6, a compressor is loaded up.

5 STAT (Set Point) — This subfunction displays leaving water temperature and leaving chilled water set point If unit is programmed for dual set point, the chilled water set point currently in effect (either Occupied or Unoccupied) is displayed. If reset is in effect, the unit operates to the modified chilled water set point. This means the leaving water temperature may not equal the chilled water set point. The modified chilled water set point can also be displayed in the Status function. To enter the set point subfunction, depress 5 STAT and use the ↓ to display modified leaving chilled water set point followed by leaving water set point and actual cooler leaving fluid temperature.

6 STAT (Temperature) — The temperature subfunction displays the readings at temperature sensing thermistors. To read a temperature, enter 6 STAT, then scroll to desired temperature using the ↓ key See Keyboard Directory for the order of readouts.

7 STAT (Pressure) — This subfunction displays suction, discharge and net oil pressure at lead compressor of each circuit of 30GT units.

8 STAT (Analog Inputs) — This subfunction displays analog inputs, if any. Enter 8 STAT, then use the ↓. The transducer supply voltage, 4-20 mA reset signal can be displayed. This is useful for problem diagnosis as preliminary to the Test function.

9 STAT (Switch Inputs) — This subfunction displays status (ON/OFF) of input switch where applicable. Status of dual set point switch, and demand limit switch 1 and 2 can be displayed. This is useful for problem diagnosis as preliminary to the Test Function

10 STAT This function displays ON/OFF status of alarm relay, all fan relays and chilled water pump relay. It also displays ON/OFF status of compressor unloaders (if used). The position of each EXV (in percent open) can be displayed.

TEST FUNCTION — The Test function operates the diagnostic program. To initiate Test function, the LOCAL/STOP/CCN switch must be in STOP position. When Test function is initiated, the local alarm light is on.

To reach a particular test, enter its subfunction number, then scroll to desired test with the ↓ key. A test is started by pressing ENTR. A test is terminated by pressing the ↓ or ↑ or ENTR. Pressing the ↓ key after a test has started advances system to next test, whether current test is operating or has timed out. Once in the next step, you may start test by pressing ENTR or advance past it by pressing ↓.

While the unit is in Test, you may leave Test function and access another display or function by depressing appropriate keys. However, a component that is operating when another function is accessed remains operating. You must re-enter Test function and use the ↓ key to shut down the component. Components with a timed operating limit time out normally even if another function is accessed.

Keyboard entry 1 TEST allows the operator to make the following checks by using ↓:

- LID display check. Proper display is 8.8.8.8.8.8.8.8 .
- Operation of remote alarm.
- Operation of condenser fans.
- Operation of chilled water pump.
- Operation of EXV's. To drive EXV fully open, enter 1 0 0 (100% open). To drive EXV fully closed, enter . (0% open).

Keyboard entry 2 TEST accesses the compressor and compressor unloader operational tests.

**⚠ WARNING**

During compressor operational tests, compressor starts and runs for 10 seconds. Compressor service valves and liquid line valves must be open. Energize crankcase heaters 24 hours prior to performing compressor tests.

Since Test function checks only certain outputs, it is good practice to also check all inputs and outputs accessible through the Status function. These are located at 8 STAT, 9 STAT, and 10 STAT (see Keyboard Directory). If keyboard is not used for 10 minutes, unit automatically leaves Test function and resumes rotating display. See Example 3.

### Example 3 – Using Test Function

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| 2 TEST | COMP | Factory/field test of compressors subfunction of test function |
| ↓ | CPA 1 OFF | Circuit A, Compressor 1A test |
| ENTR | CPA 1 ON | Pressing ENTR starts the test: when the compressor should be running the display shows CPA 1 on |
| | CPA 1 OFF | If the test is allowed to time out (10 seconds) the display will show CPA1 Off |
| ↓ | CPA 2 OFF | Pressing the down arrow key advances the system to Circuit A, compressor 2 test |

NOTE: Once a compressor has been run using the TEST function, it is not allowed to run again for 30 seconds

HISTORY FUNCTION — Keystrokes 1 HIST and subsequent ↓ keystrokes display total unit run time and total run time for each circuit.

Keystrokes 2 HIST and subsequent ↓ keystrokes display total unit starts and the total starts for each circuit.

Keystrokes 3 HIST and subsequent ↓ keystrokes display the last five alarms along with a description of each alarm.

SET POINT FUNCTION — Set points are entered through the keyboard. Set points can be changed within the upper and lower limits, which are fixed. The ranges are listed below.

**Chilled Water Set Point**

Water:
38 to 70 F (3.3 to 21 C)

Brine:
15 to 70 F (−9.4 to 21 C)

**Pulldown Set Point**

0.2 to 2.0 degrees F (.11 to 1.1 degrees C)/min

**Reset Set Points**

Maximum Reset Range:
0 to 20 degrees F (0 to 11 degrees C)

Maximum Reset Reference Range:
Return Fluid Reset 0 to 20 degrees F (0 to 11 degrees C)
External Temperature Reset 20 to 125 degrees F (11 to 69 degrees C)
External Signal Reset 4 to 20 mA

Minimum Reset Reference Range:
Return Fluid Reset 0 to 20 degrees F (0 to 11 degrees C)
External Temperature Reset 20 to 125 degrees F (11 to 69 degrees C)
External Signal Reset 4 to 20 mA

**Demand Limit Set Points**

Switch Input:
Step 1 — 0 to 100% Capacity Reduction
Step 2 — 0 to 100% Capacity Reduction

External Signal:
Maximum Demand Limit 4 to 20 mA
Minimum Demand Limit 4 to 20 mA

Set points are grouped in subfunctions as follows:

1 SET Displays chiller water, and cooling ramp set points.

a. The first value shown is the Occupied chilled water set point.

b. The next value displayed depends on how the Schedule function has been programmed. (See pages 32-34.) If dual set point has been selected, the next set point after ↓ has been pressed is the Unoccupied chilled water set point. If single set point or inactive schedule has been selected in the Schedule function, then when ↓ is depressed the display shows the modified chilled water set point.

c. The final value displayed when the ↓ is depressed is the cooling ramp loading rate. This is the maximum rate at which the leaving chilled water is allowed to drop, and can be field set from 0.2 to 2.0 degrees F (.11 to 1.1 degrees C)/minute. This value is not displayed unless the function is enabled (see Adjustable Field Configurations page 32).

Reading and Changing Set Points — Example 4 shows how to read and change the chilled water set point. Other set points can be changed by following the same procedure. Refer to Keyboard Directory for the sequence of display of set points in each subfunction.

### Example 4 – Reading and Changing Chilled Water Set Point

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| 1 SET | SET POINT | System set points |
| ↓ | CSP1 44 0 | Present Occupied chilled water set point is 44 0 F |
| 4 2 ENTR | CSP1 42.0 | Key in 42 and press the ENTR key. Display shows new Occupied chilled water set point is 42.0 F |
| ↓ | CSP2 44 0 | Present Unoccupied chilled water set point is 44.0 F |
| 5 0 ENTR | CSP2 50 0 | Key in 50 and press the ENTR key. Display shows new Unoccupied chilled water set point is 50 0 F |
| 2 SET | RESET | Displays the maximum reset and minimum reset set points The minimum and maximum reference reset set points can also be displayed. These set points are not accessible when reset type has been configured for NONE in the Service function |

Temperature Reset Based on Return Water Temperature — The control system is capable of providing leaving water temperature reset based on return water temperature. Because the temperature difference between leaving water temperature and return water temperature is a measure of the building load, return water temperature reset is essentially an average building load reset method.

Under normal operation, the chiller maintains a constant leaving water temperature approximately equal to chilled water set point. As building load drops from 100% down to 0%, entering cooler water temperature drops in proportion to load. Thus, temperature drop across the cooler drops from a typical 10 degrees F (5.5 degrees C) at full load to a theoretical 0 degrees F (−18 degrees C) at no load. See Fig. 2.

At partial load, leaving chilled water temperature may be lower than required If this is allowed to increase (reset), the efficiency of the chiller increases. Amount of reset can be defined as a function of cooler temperature drop, as shown in Fig. 2. This is a simple linear function that requires four pieces of input data for the Set function:

1. **Maximum Reset Amount (CRST2)** — allowable range 0 to 20 degrees F (0 to 11 degrees C). This is maximum amount leaving chilled water set point is to be increased.
2. **Maximum Reset Reference (CREF2)** — allowable range 0 to 20 degrees F (0 to 11 degrees C). This is the cooler temperature drop at which reset reaches its maximum value.
3. **Minimum Reset Amount (CRST1)** — allowable range 0 to 20 degrees F (0 to 11 degrees C). This is minimum amount leaving chilled water set point is to be increased when reset is initiated.
4. **Minimum Reset Reference (CREF1)** — allowable range 0 to 20 degrees F (0 to 11 degrees C). This is the cooler temperature drop at which reset is at its minimum value. (Reset begins here.)

**NOTE:** Reset set points are not accessible unless the reset function is enabled first. This is done as a field configuration. Select one of the three choices for type of reset: Return Fluid Reset, External Temperature Reset, or 4-20 mA External Signal Reset.

If dual set point control is enabled, the amount of reset is applied to whichever set point is in effect at the time.

Example 5 demonstrates how to activate reset. Assume that reset is to be based on return water temperature, the desired reset range is to be 2 to 10 degrees F (1 to 5.5 degrees C) and full load is a 10-degree F (5.5-degree C) drop across the cooler. See Fig. 2.

Activating reset based on external temperature or 4-20 mA signal is done the same way, except the reference set point range is 20 to 125 degrees F (11 to 69 degrees C), or 4 to 20 mA depending on which method was selected at the field configuration step.

**Example 5 — Using Return Water Temperature Reset**

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| 4 SRVC | FLD CFG | Field configuration subfunction of Service function |
| ↓ | CSPTYP X | Scroll past single/dual |
| ↓ | CRTYP 0 | Display shows no reset type has been selected |
| 1 ENTR | CRTYP 1 | Return water temperature is selected and activated |
| 1 SET | SET POINT | System set points |
| ↓ | CPS1 44.0 | Present Occupied chilled water set point |
| 4 5 . 6 ENTR | CPS1 45 6 | Enter new chilled water set point |
| 2 SET | RESET | Reset set points |
| ↓ | CRST2 0 0 | Cooling maximum reset is 0 degrees F |
| 1 0 ENTR | CRST2 10 0 | Cooling maximum reset is 10 degrees F |
| ↓ | CREF2 0 0 | Cooling maximum reset reference is 0 degrees F |
| 1 ENTR | CREF2 1 0 | Cooling maximum reset reference is 1 degree F |
| ↓ | CRST1 0 0 | Cooling minimum reset is 0 degrees F |
| 2 ENTR | CRST1 2 0 | Cooling minimum reset is 2 degrees F |
| ↓ | CREF1 0 0 | Cooling minimum reset reference is 0 degrees F |
| 8 ENTR | CREF1 8 0 | Cooling minimum reset reference is 8 degrees F |

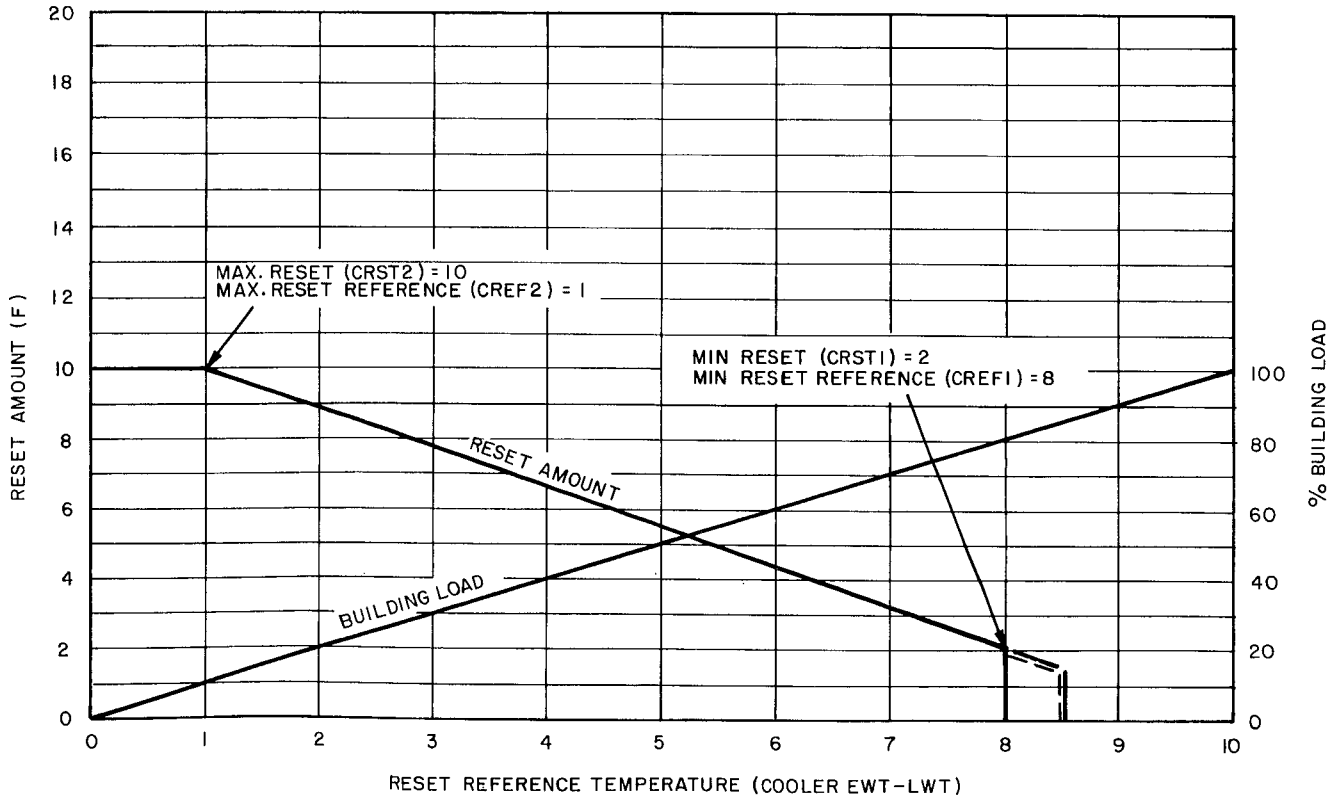



**Fig. 2 — Cooling Return Water Reset**

Temperature Reset Based on External Temperature — If desired, temperature reset can be based on an external temperature, such as space or outdoor air temperature. This requires a thermistor (T10, Part No. 30GB660002) located in the space or outside air and wired to terminals as follows:

**30GB040-060** — Terminals 1 and 2 of TB3
**30GB070** — Terminals 1 and 2 of TB5
**30GB075-200** — Terminals 4 and 5 of TB8
**30GB225-280** — Terminals 5 and 6 of TB11

At the field configuration step, select external temperature reset by entering [2] when CRTYP 0 appears. Then enter set points as described previously in Example 5. See Fig. 3.

Temperature Reset Based on 4-20 mA Signal — If desired, temperature reset can be based on a 4-20 mA signal. For proper connections, refer to Field Wiring section in this guide.

At the field configuration step, select 4-20 mA reset by entering [3] when CRTYP 0 appears. Then enter set points as described previously in example 5. See Fig. 4.

### Example 6 — Changing Reset Type

To change type of reset, first log on as shown in Table 10 and Example 6 below. Also refer to Set Point Function section, page 26, for information on entering reset set points using reset feature.

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| [4] [SRVC] | FLD CFG | Field configuration subfunction of Service function |
| [↓] | CSPTYP 0 | Scroll past single cooling set point |
| [↓] | CRTYP 0 | No reset has been selected |
| [1] [ENTR] | CRTYP 1 | Return water temperature reset is selected and activated |
| [2] [ENTR] | CRTYP 2 | Reset type is changed to space or outside air temperature reset and activated |
| [3] [ENTR] | CRTYP 3 | Reset type is changed to 4-20 mA Signal Reset and activated |
| [.] [ENTR] | CRTYP 0 | Reset is deactivated |

Demand Limit, 2-Stage Switch Control — This control has been designed to accept demand limit signals from a building load shedding control. The Demand Limit function provides for 2 capacity steps. The keyboard is used to set the 2 demand limit set points, which range from 100 to 0% of capacity. Capacity steps are controlled by 2 field-supplied relay contacts connected to the designated chiller terminals. See Field Wiring section.

To use Demand Limit, first enable Loadshed, then enter demand limit set points. See Example 7. Closing the first stage demand limit contact puts unit on the first demand limit level, that is, the unit does not exceed the percentage

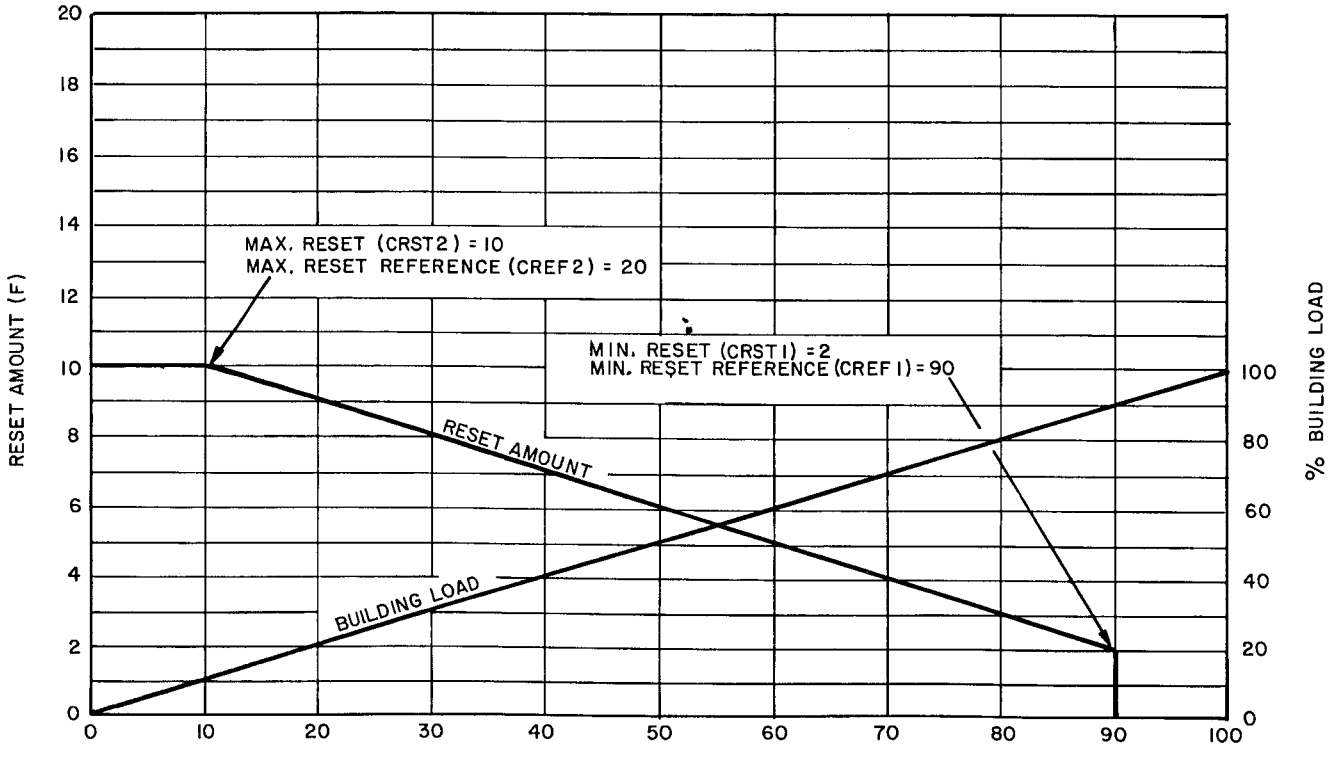



**Fig. 3 — Cooling External Temperature Reset**

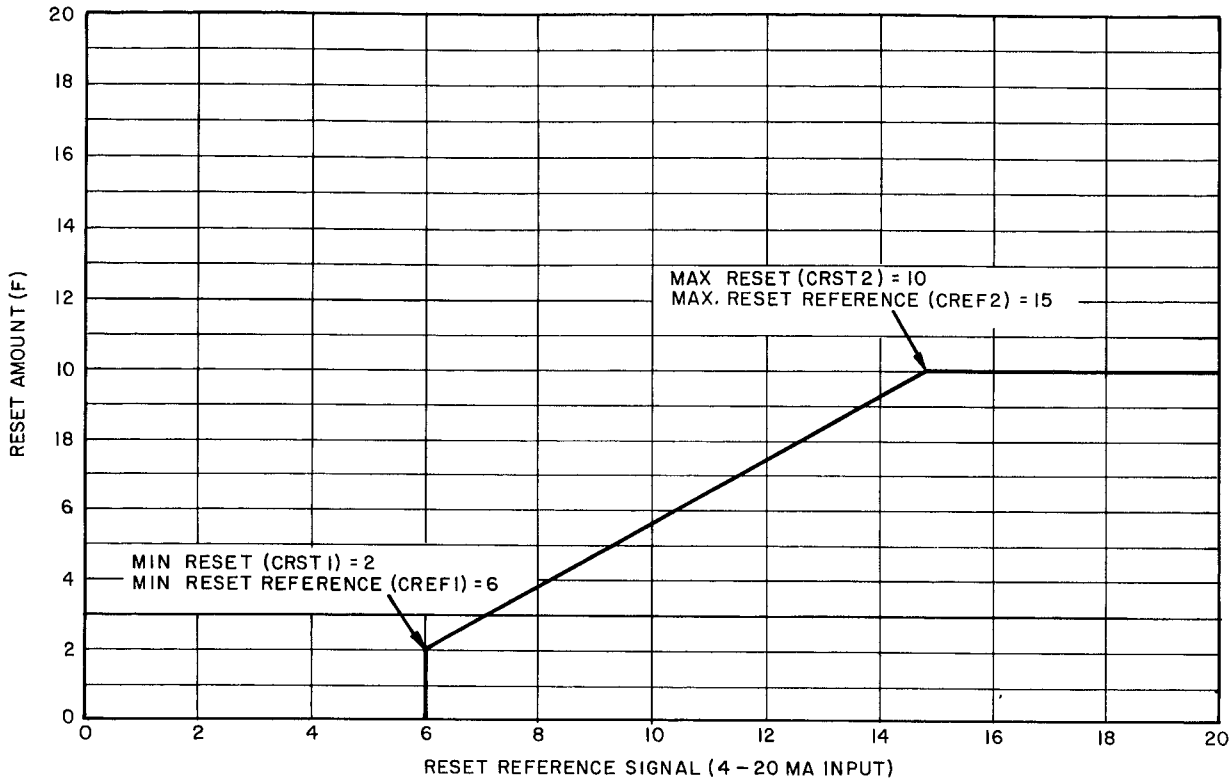



**Fig. 4 — 4-20 mA Cooling Temperature Reset**

of capacity entered as demand limit stage 1. Closing contacts on second-stage demand limit relay prevents unit from exceeding capacity entered as demand limit stage 2. The demand limit stage that is set to the lowest demand takes priority if both demand limit inputs are closed.

The Demand Limit function must be enabled in order to function and may be turned off when its operation is not desired. The demand limit relays can, in off condition, remain connected without affecting machine operation.

### Example 7 — Using Demand Limit (First Log On as Shown in Table 10)

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| 4 SRVC | FLD CFG | Field configuration subfunction of Service function |
| ↓ | ERTYP 0 | Scroll past other elements in the subfunction |
| ↓ | LSTYP 0 | Loadshed is not enabled |
| 1 ENTR | LSTYP 1 | Loadshed is now enabled for 2-stage switch control |
| 3 SET | DEMAND | Demand Limit set points subfunction of Set Point function |
| ↓ | DLS1 100 | Loadshed 1 currently set at 100% |
| 6 0 ENTR | DLS1 60 | Loadshed reset to 60% |
| ↓ | DLS2 100 | Loadshed 2 currently set at 100% |
| 4 0 ENTR | DLS2 40 | Loadshed 2 reset to 40% |

### To Disable Demand Limit:

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| 4 SRVC | FLD CFG | Field configuration subfunction of Service function |
| ↓ | ERTYP 0 | Scroll past other elements in the subfunction |
| ↓ | LSTYP 1 | Loadshed is enabled for 2-stage switch control |
| . ENTR | LSTYP 0 | Loadshed is now disabled |

NOTE: Select 3 for CCN load limiting.
Select 4 for CCN demand limiting.

Demand Limit, 4-20 mA Signal — The controls can also accept a 4-20 mA signal for load shedding. Input for the signal are terminals 3 and 4 of TB10 on 30GB and terminals 3 and 4 of TB7 on 30GT. At field configuration step, select 4-20 mA loadshed by entering 2 when the LSTYP 0 display appears. See Example 7A. Then enter set points as follows. In this example, set points are coordinates of the demand limit curve shown in Fig. 5.

## Example 7A — Using Demand Limit (4-20 mA) (First Log On As Shown in Table 10)

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| 4 SRVC | FLD CFG | Field configuration subfunction of Service function |
| ↓ | ERTYP 0 | Scroll past other elements in the subfunction |
| ↓ | LSTYP 0 | Loadshed is not enabled |
| 1 ENTR | LSTYP 2 | Loadshed is now enabled for 4-20 mA signal control |
| 3 SET | DEMAND | Demand Limit set points |
| ↓ | DMAX 100 | Maximum Demand Limit is 100% |
| 9 0 ENTR | DMAX 90 | Maximum Demand Limit is 90% |
| ↓ | RMAX 20 | Maximum Demand Limit reference is 20 mA |
| 1 5 ENTR | RMAX 15 | Maximum Demand Limit reference is 15 mA |
| ↓ | DMIN 0 | Minimum Demand Limit is 0% |
| 2 0 ENTR | DMIN 20 | Minimum Demand Limit is 20% |
| ↓ | RMIN 4 | Minimum Demand Limit reference is 4 mA |
| 6 ENTR | RMIN 6 | Minimum Demand Limit reference is 6 mA |

Reading and Changing Time Display — Time is entered and displayed in 24-hour time. The day of the week is entered as a number.

1 = Mon, 2 = Tue, 7 = Sun, etc.

[.] Key is used as the colon when entering time. See Example 8.

## Example 8 — Setting Time of Day and Day of Week

| KEYBOARD ENTRY | DISPLAY RESPONSE | COMMENTS |
|---|---|---|
| 4 SET | TIME | Time display subfunction of Set Point Function |
| ↓ | MON 16 00 | Current setting is Monday, 4:00 p m |
| 2 . 1 3 . 0 5 ENTR | TUE 13 05 | New setting of Tuesday, 1:05 p m is entered and displayed |
| ↓ | JAN 01 90 | Current date is Jan 1, 1990 |
| 4 . 1 5 . 9 0 ENTR | APR 15 90 | New setting April 15, 1990 is entered and displayed |

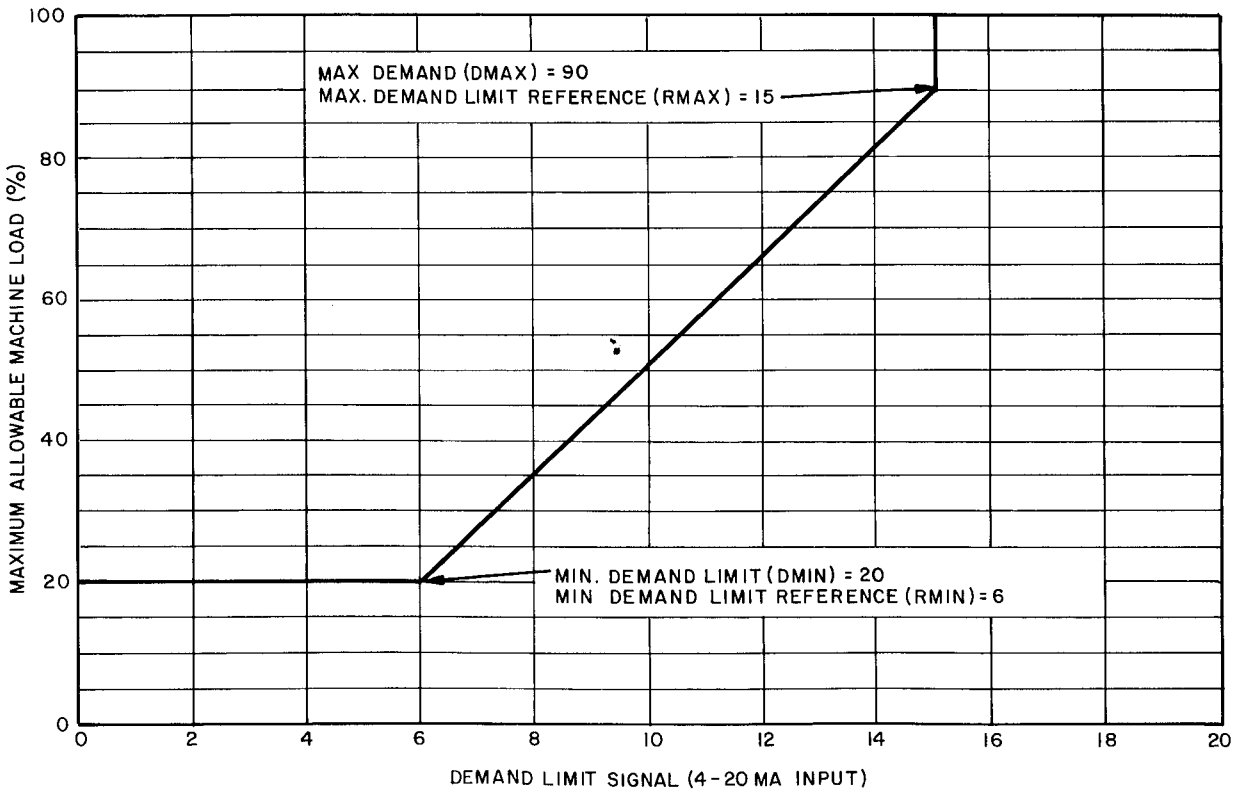



**Fig. 5 — 4-20 mA Demand Limiting**

SERVICE FUNCTION — This function allows the technician to view, as well as input configuration data. Factory configuration data, field configuration data and service configuration data may be viewed or entered through the keyboard and display module. See the Keyboard Directory (Table 8) for a complete listing of configurable items. Whenever a Processor Module is replaced in the field, the complete list of configuration codes must be entered.

Logging On/Logging Off — The Service function is password protected. Therefore, to gain entry to this function, this password must be entered. [1][1][1][1][ENTR] allows the technician to view, change or enter configuration codes. To log off, perform the following keystrokes: [1][SRVC][↓][ENTR]. The Service function is again password protected.

Software Information — [2][SRVC][↓] displays the version number of the software that resides in the Processor Module. A second [↓] displays the language options that are available in the field configuration group.

The [1][SRVC] and [2][SRVC] subfunctions are summarized in Table 10.

### Table 10 — Service Function

To view and modify configurations, the password must be entered under the log on subfunction.

| SUB-FUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|---|
| 1 Log On | [1][SRVC] | PASSWORD | Enter Password/ Disable Password |
| | [1][1][1][1][ENTR] | LOGGED ON | Logged On |

NOTE: At this time configurations may be modified. When finished viewing and/or modifying configurations, log out as follows:

| | | | |
|---|---|---|---|
| | [1][SRVC] | LOGGED ON | |
| | [↓] | LOG OFF | Disable Password Protection |
| | [ENTR] | EXIT LOG | Logged Off/ Enable Password Protection |
| 2 Version | [2][SRVC] | VERSION | Software Information |
| | [↓] | XXXXXXXX | Version No. of Software |
| | [↓] | X | Language Options |

Factory Configuration Codes — [3][SRVC] allows entry into the factory configuration subfunction. Under this subfunction, there are six groups of configuration codes that are downloaded at factory. Each group is made up of eight digits. If Processor Module is replaced in the field, these six groups of configuration codes must be entered through the keyboard and display module. Factory configuration codes (groups 1 through 6) that apply to the particular 30GB or 30GT Flotronic™ II chiller being serviced are found on a label located inside the control box cover. See Table 11 for a summary of factory configuration subfunction keystrokes.

### Table 11 — Factory Configuration Keystrokes

To change a configuration enter the new configuration and press [ENTR] while on the correct configuration.

| SUB-FUNCTION | KEYBOARD ENTRY | DISPLAY | COMMENTS |
|---|---|---|---|
| 3 FACTORY CFG | [3][SRVC] | FACT CFG | FACTORY CONFIGURATION CODES |
| | [↓] | XXXXXXXX | Configuration Code 1 |
| | [↓] | XXXXXXXX | Configuration Code 2 |
| | [↓] | XXXXXXXX | Configuration Code 3 |
| | [↓] | XXXXXXXX | Configuration Code 4 |
| | [↓] | XXXXXXXX | Configuration Code 5 |
| | [↓] | XXXXXXXX | Configuration Code 6 |
| 5 SERVICE CFG | [5][SRVC] | SRV CFG | SERVICE CONFIGURATION CODES |
| | [↓] | XXXXXXXX | Configuration Code 7 |
| | [↓] | XXXXXXXX | Configuration Code 8 |

## Table 12 — Adjustable Field Configurations

| FIELD CONFIGURATION ITEM AND CODES | FACTORY CONFIGURATION CODE | SERVICE REPLACEMENT CODE |
|---|---|---|
| CCN element address (entered by CCN Technician) | 001 | 001 |
| CCN Buss Number (Entered by CCN Technician) | 000 | 000 |
| CCN Baud Rate (Entered by CCN Technician) | 9600 | 9600 |
| Cooler Fluid Select<br>1 = Water (38 to 70 F [3.3 to 21 C] Set Point)<br>2 = Medium Brine (15 to 70 F [−9 to 21 C] Set Point) | 1 = Standard Models<br>2 = Brine Models | 1 |
| Display Unit Select<br>0 = English<br>1 = Metric SI | 0 | 0 |
| Display Language Select<br>1 = English | 1 | 1 |
| No. Circuit A Unloaders<br>0 = No Unloaders<br>1 = One Unloader<br>2 = Two Unloaders | 0 = 30GB090-200; 30GT225-280<br>1 = 30GB040-080 | 0 |
| No. Circuit B Unloaders<br>0 = No Unloaders<br>1 = One Unloader<br>2 = Two Unloaders | 0 | 0 |
| Hot Gas Bypass Select<br>0 = No Valve | 0 | 0 |
| Loading Sequence Select<br>1 = Equal Circuit Loading<br>2 = Staged Circuit Loading | 1 | 1 |
| Lead/Lag Sequence Select<br>1 = Automatic | 1 | 1 |
| Oil Pressure Switch Select<br>0 = Not Used<br>1 = Used | 0 = 30GT225-280<br>1 = 30GB040-200 | 0 |
| Head Pressure Control Type<br>0 = Not Used<br>1 = Air Cooled | 1 | 0 |
| Head Pressure Control Method<br>1 = EXV Controlled | 1 | 1 |
| Motormaster® Select<br>0 = None (Staged Fans Only)<br>2 = Motormaster (1 Phase) With Indirect Control | 0 = Standard Models<br>2 = Brine Models | 0 |
| Cooling Set Point Control Select<br>0 = Single Set Point Control<br>1 = External Switch Controlled Set Point<br>2 = Clock Controlled Set Point | 0 | 0 |
| Cooling Reset Control Select<br>0 = No Reset<br>1 = Return Fluid Reset<br>2 = External Temperature Reset<br>3 = 4-20 mA Controlled Reset | 0 | 0 |
| External Reset Sensor Select<br>0 = Thermistor Connected to Options Module<br>1 = Obtained Through CCN | 0 | 0 |
| Demand Limit Control Select<br>0 = No Demand Limiting<br>1 = Two External Switch Inputs<br>2 = External 4-20 mA Input<br>3 = CCN Load Limiting (Multi-Unit)<br>4 = CCN Loadshed Interface | 0 | 0 |
| Ramp Load Select (Pulldown Control)<br>0 = Disabled<br>1 = Enabled | 1 | 0 |
| Cooler Pump Interlock Select<br>0 = No Interlock<br>1 = With Interlock | 1 | 0 |
| Cooler Pump Control Select<br>0 = Not Controlled<br>1 = ON/OFF Controlled | 1 | 0 |

Adjustable Field Configurations — After logging on, keystrokes [4] [SRVC] allow entry into this subfunction. The subfunction allows operation of the chiller to be customized to meet the particular needs of the application. The chiller comes from the factory preconfigured to meet needs of most applications. Each item should be checked to determine which configuration alternative best meets the needs of a particular application. See Table 12 for factory loaded configuration codes and alternative configurations.

If Processor Module is replaced, service replacement module is preloaded with configuration codes. Each configuration code must be checked and, if necessary, reconfigured to meet needs of the application. See Table 12 for pre-loaded service replacement configuration codes.

Service Configuration Codes — [5] [SRVC] allows entry into the service configuration subfunction. The first two items under this subfunction are two groups of eight digits each of configuration codes that are downloaded at the factory. If Processor Module is replaced in the field, the two groups of configuration codes must be entered through the keyboard and display module. The two groups of configuration codes (groups 7 and 8) that apply to the 30GB or 30GT unit being serviced can be found on a label inside the control box cover. See Table 11 for keystroke information to enter configuration codes 7 and 8.

SCHEDULE FUNCTION — This function provides a means to automatically switch chiller from an Occupied mode to Unoccupied mode. When using Schedule function, chilled water pump relay must be used to switch chilled water pump on and off. Connections for chilled water pump relay are: 30GB Models, Terminals 1 and 2 on TB12 - 30GT Models, Terminals 3 and 4 on TB5. The chilled water pump relay starts chilled water pump but compressors do not run until remote chilled water pump interlock contacts are closed and leaving chilled water temperature is above set point. If a remote chilled water pump interlock is not used, the first compressor starts (upon a call for cooling) approximately one minute after chilled water pump is turned on.

The Schedule function can be programmed for inactive, single set point, or dual set point operation.

When schedule is configured for inactive, chilled water pump relay remains energized continuously but is not used since chiller is usually controlled by remote chilled water pump interlock contacts.

When unit is configured for single set point operation, chilled water pump relay is energized whenever chiller is in Occupied mode regardless of whether chiller is running. When chiller is in Unoccupied mode, chilled water pump relay is not energized.

When unit is configured for dual set point, chilled water pump relay is energized continuously, in both Occupied and Unoccupied modes. Occupied mode places Occupied chilled water set point into effect; Unoccupied mode places Unoccupied chilled water set point into effect.

The schedule consists of from one to 8 Occupied time periods, set by the operator. These time periods can be flagged to be in effect or not in effect on each day of the week. The day begins at 00.00 and ends at 24.00. The machine is in Unoccupied mode unless a scheduled time period is in effect. If an Occupied period is to extend past midnight, it must be programmed in the following manner: Occupied period must end at 24:00 hours (midnight); a new Occupied period must be programmed to begin at 00:00 hours.

The time schedule can be overridden to keep unit in Occupied mode for one, 2, 3 or 4 hours on a one-time basis. See Example 9.

All subfunctions of Schedule function are password protected except the override subfunction, [1] [SCHD]. Password entry into subfunctions [2] [SCHD] through [1] [1] [SCHD], is done through Service function. See page 31, logging on/ logging off.

Figure 6 shows a schedule for an office building with the chiller operating on a single set point schedule. The schedule is based on building occupancy with a 3-hour off-peak cool-down period from midnight to 3 a.m. following the weekend shutdown. To learn how this sample schedule would be programmed, see Example 9.

NOTE: This schedule was designed to illustrate the programming of the schedule function and is not intended as a recommended schedule for chiller operation.

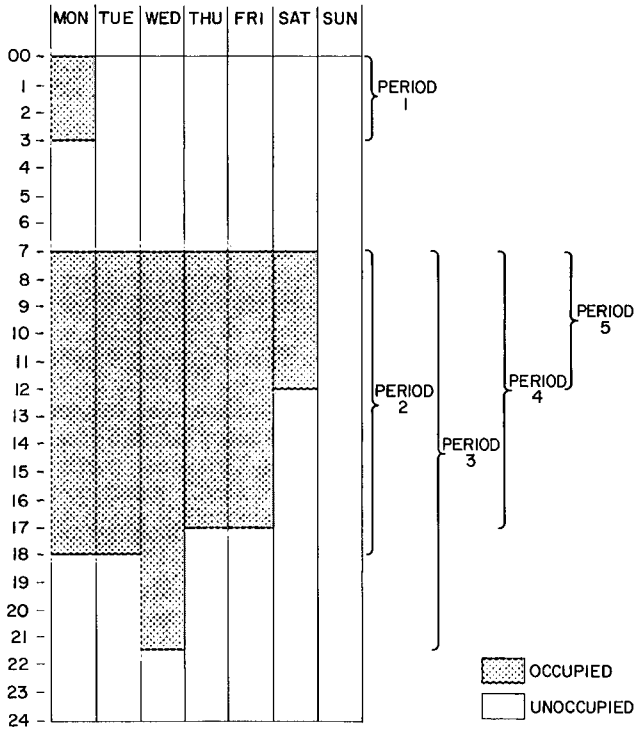



**Fig. 6 — Sample Time Schedule**

## Example 9 — Using the Schedule Function

| KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|
| [1] [SCHD] | OVRD 0 | No schedule override in effect |
| [3] [ENTR] | OVRD 3 | 3 Hours override in effect |
| [.] [0] [ENTR] | OVRD 0 | Override cancelled |
| [2] [SCHD] | CLOCK 0 | Schedule function is inactive |
| [1] [ENTR] | CLOCK 1 | Schedule function is enabled through local unit clock |
| [6] [5] [ENTR] | CLOCK 65 | Schedule function is enabled through CCN clock 65 |
| **PROGRAMMING PERIOD 1:** | | |
| [3] [SCHD] | PERIOD 1 | Define schedule period 1 Start of Occupied time |
| [↓] | OCC 00 00 | For this example, first period should start here (at midnight) so no entry is needed |
| [↓] | UNO 00 00 | Start of Unoccupied time (end of period) For this example, period 1 should end at 3:00 am |
| [3] [.] [0] [0] [ENTR] | UNO 3 00 | Period 1 ends at 3:00 am |
| [↓] | MON NO | Monday is now flagged for period 1 To put period 1 into effect on Monday, Monday must be flagged yes |
| [1] [ENTR] | MON YES | Monday is now flagged for period 1 to be in effect |
| [↓] | TUE YES | For this example, period 1 is to be in effect on Monday only. All other days must be checked to be sure that they are flagged no If any day is flagged yes, change to no |
| [.] [ENTR] | TUE NO | Tuesday is now flagged no for period 1 |
| **PROGRAMMING PERIOD 2:** | | |
| [4] [SCHD] | PERIOD 2 | Define schedule period 2 |
| [↓] | OCC 00 00 | Start of Occupied time |
| [7] [.] [0] [0] [ENTR] | OCC 7 00 | Occupied time will start at 7:00 a m |
| [↓] | UNO 00 00 | Start of Unoccupied time (end of period) for this example, period 2 should end at 18:00 (6:00 pm) |
| [1] [8] [.] [0] [0] [ENTR] | UNO 18 00 | Period 2 ends at 18:00 (6:00 pm) |
| [↓] | MON NO | Monday is now flagged no for period 2 To put period 2 into effect on Monday, Monday must be flagged yes |
| [1] [ENTR] | MON YES | Monday is now flagged for period 2 to be in effect |
| [↓] | TUE NO | Tuesay is now flagged no for period 2. To put period 2 into effect on Tuesday, Tuesday must be flagged yes |
| [1] [ENTR] | TUE YES | Tuesday is now flagged for period 2 to be in effect |
| [↓] | WED YES | For this example, period 2 is to be in effect only on Monday and Tuesday All other days must be checked to be sure that they are flagged no If a day is flagged yes, change to no |
| [.] [ENTR] | WED NO | Wednesday is now flagged no for period 2 |

*Example 9 continued next page.*

## Example 9 — Using the Schedule Function (cont)

| KEYBOARD ENTRY | DISPLAY | COMMENT |
|---|---|---|
| **PROGRAMMING PERIOD 3:** | | |
| 5 SCHD | PERIOD 3 | Define Schedule Period 3 |
| ↓ | OCC 00 00 | Start of Occupied Time |
| 7 . 0 0 ENTR | OCC 7 00 | Occupied time will start at 7:00 am |
| ↓ | UNO 00 00 | Start of Unoccupied time (end of period 3) for this example, period 3 should end at 21:30 (9:30 pm) |
| 2 1 . 3 0 ENTR | UNO 21 30 | Period 3 ends at 21:30 (9:30 pm) |
| ↓ | MON NO | Check to be sure that Monday and Tuesday are flagged no for period 3 |
| ↓ | TUE NO | |
| ↓ | WED NO | Wednesday is flagged no, change to yes |
| 1 ENTR | WED YES | Wednesday is now flagged yes for period 3 |
| ↓ | THUR NO | Check to be sure that all other days are flagged no |
| ↓ | FRI NO | |
| ↓ | SAT NO | |
| ↓ | SUN NO | |

Period 4 and 5 can be programmed in the same manner, flagging Thursday and Friday yes for period 4 and Saturday yes for period 5. For this example, periods 6, 7 and 8 are not used: they should be programmed OCC 00.00, UNO 00.00.

**NOTES:** When a day is flagged yes for 2 overlapping periods, Occupied time will take precedence over Unoccupied time. Occupied times can overlap in the schedule with no consequence.

To extend an Occupied mode beyond its normal termination for a one-time schedule override, program as shown below:

| | | |
|---|---|---|
| 1 SCHD | OVRD 0 | Override is set for 0, enter the number of hours of override desired |
| 3 ENTR | OVRD 3 | Unit will now remain in Occupied mode for an additional 3 hours |

Holiday Schedule — Keying 1 1 SCHD allows the scheduling of up to 30 holiday periods. All holidays are entered with numerical values. First, the month (01 to 12), then the day (01 to 31), then the duration of the holiday period in days.

Examples: July 24 is 07.04.01.
Dec 25 - 26 is 12.25.02

If any of the 30 holiday periods are not used, the display shows NEW.

The following example explains how the holiday schedule function works:

| ENTER | DISPLAY |
|---|---|
| 11 SCHD | HOLIDAY |
| ↓ | JAN01 02 (Includes JAN 1st and 2nd) |
| ↓ | APR17 01 (Includes APR 17th) |
| ↓ | MAY21 01(Includes MAY 21st) |
| ↓ | JUL03 01 (Includes JUL 3rd) |
| 7 . 0 4 . 0 1 ENTR | JUL04 01 (Includes JUL 4th) |
| ↓ | SEP07 01 (Includes SEP 7th) |
| ↓ | NOV26 02 (Includes NOV 26th and 27th) |
| ↓ | DEC24 02 (Includes DEC 24th and 25th) |
| ↓ | DEC30 02 (Includes DEC 30th and 31st) |
| ↓ | NEW |
| 5 . 2 5 . 0 1 ENTR | MAY25 01 (Includes MAY 25th) |
| ↓ | NEW |
| ↓ | NEW |
| ↓ | NEW |
| ↓ | NEW |
| ↓ | NEW (30TH HOLIDAY) |

NEW indicates a holiday that has not been assigned yet

## TROUBLESHOOTING

The Flotronic™ II control has many features to aid the technicians in troubleshooting a Flotronic II Chiller. By using keyboard and display module and Status function, actual operating conditions of the chiller are displayed while unit is running. Test function allows proper operation of compressors, compressor unloaders, fans, EXV's and other components to be checked while chiller is stopped. Service function displays how configurable items are configured. If an operating fault is detected, an alarm is generated and an alarm code(s) is displayed under the subfunction [2] [STAT], along with an explanation of the fault. Up to 5 current alarm codes are stored. For checking specific items, see Keyboard Directory.

**Checking Display Codes** — To determine how machine has been programmed to operate, check diagnostic information, [2] [STAT] and operating mode displays [3] [STAT]. If no display appears, follow procedures in Troubleshooting section, Control Modules. If display is working, continue as follows:

1. Note all alarm codes displayed, [2] [STAT].
2. Note all operating mode codes displayed, [3] [STAT].
3. Note leaving chilled water temperature set point in effect and current leaving water temperature, [5] [STAT].

   If machine is running, compare the "in effect" leaving water temperature set point with current water temperature. Remember, if reset is in effect, the values may be different because machine is operating to the modified chilled water set point. If current temperature is equal to set point, but set point is not the one desired, remember that if dual set point has been selected in the Schedule function, there are 2 set points to which the machine can be operating. Check the programming of Schedule function to see if Occupied or Unoccupied set point should be in effect.

**Unit Shutoff** — To shut unit off, move LOCAL/STOP/CCN Switch to STOP position. Any refrigeration circuit operating at this time continues to complete the pumpout cycle. Lag compressors stop immediately, lead compressors run to complete pumpout.

### Complete Unit Stoppage

Complete unit stoppage can be caused by any of the following conditions:

1. Cooling load satisfied
2. Remote ON/OFF contacts open
3. Programmed schedule
4. Emergency stop command from CCN
5. General power failure
6. Blown fuse in control power feed disconnect
7. Open control circuit fuse
8. LOCAL/STOP/CCN switch moved to STOP
9. Freeze protection trip
10. Low Flow protection trip
11. Open contacts in chilled water flow switch (optional)
12. Open contacts in any auxiliary interlock. Terminals that are jumpered from factory, are in series with control switch. Opening the circuit between these terminals places unit in STOP mode, similar to moving the control switch to STOP. Unit cannot start if these contacts are open. If they open while unit is running, unit pumps down and stops.
13. Cooler entering or leaving fluid thermistor failure
14. Low transducer supply voltage (GT)
15. Loss of communications between processor module and other control modules
16. Low refrigerant pressure (GT)

### Single Circuit Stoppage

Single circuit stoppage can be caused by the following:

1. Open contacts in lead compressor discharge gas thermostat
2. Open contacts in loss of charge switch (GB)
3. Low oil pressure in lead compressor
4. Open contacts in lead compressor high-pressure switch
5. Low refrigerant pressure (GT)
6. Thermistor failure
7. Transducer failure (GT)
8. Ground fault in lead compressor (GB)
9. Ground fault in any compressor in that circuit (GT)
10. High suction superheat
11. Low suction superheat
12. Loss of charge switch open (GB)
13. Lead compressor circuit breaker trip. Stoppage of one circuit by a safety device action does not affect other circuit. When a safety device trips on a lead compressor, circuit is shut down immediately and EXV closes.

### Lag Compressor Stoppage

Lag compressor stoppage can be caused by the following:

1. Open contacts in discharge gas thermostat
2. Open contacts in high-pressure switch
3. Compressor ground fault (GB)
4. Compressor circuit breaker trip
5. Not required to run to meet cooling load requirement

**⚠ CAUTION**

If stoppage occurs more than once as a result of any of the above safety devices, determine and correct the cause before attempting another restart.

### Restart Procedure

After cause for stoppage has been corrected, restart is either automatic or manual, depending on fault. Manual reset requires that LOCAL/STOP/CCN switch be moved to STOP, then back to original operating position. Some typical fault conditions are described below. For a complete list of fault conditions, codes, and reset type, see Table 13.

POWER FAILURE EXTERNAL TO THE UNIT — Unit restarts automatically when power is restored.

**Typical Stoppage Faults and Reset Types**

| | |
|---|---|
| Chilled Water, Low Flow | Manual reset |
| Chilled Water, Low Temperature | Auto reset first time, manual if repeat |
| Chilled Water Pump Interlock | Manual reset |
| Control Circuit Fuse Blown | Unit restarts automatically when power is restored |
| High Pressure Switch Open | Manual reset |
| Low Refrigerant Pressure | Auto reset first time, then manual if within same day |
| Low Oil Pressure | Manual reset |
| Discharge Gas Thermostat Open | Manual reset |

**Alarm Codes** — Following is a detailed description of each alarm code error and possible cause. Manual reset of an alarm is accomplished by moving LOCAL/STOP/CCN

Switch to STOP, then back to LOCAL or CCN. See Table 13 for listing of each alarm code.

**Code 0** No alarms exist

**Codes 1 - 8** Compressor failure

If DSIO relay module relay or control relay feedback switch opens during operation of a compressor, microprocessor detects this and stops compressor, energizes alarm light, and displays a code of 1 to 8 depending on the compressor. Compressor locks off; to reset, use manual reset method.

If lead compressor in a circuit shuts down, the other compressors in the circuit stop and lock off. Only the alarm mode for lead compressor is displayed.

The microprocessor is also programmed to indicate compressor failure if feedback terminal on DSIO J3 terminal strip receives voltage when compressor is not supposed to be on.

Following are possible causes of failure:

*High-Pressure Switch Open* — High-pressure switch for each compressor is wired in series with 24-v power that energizes compressor control relay. If high-pressure switch opens during operation compressor stops. This is detected by microprocessor through the feedback terminals.

*Discharge Gas Thermostat* — Discharge gas thermostat switch in each compressor is also wired in series with 24-v power that energizes control relay (CR). If switch opens during operation of compressor, the compressor stops and failure is detected through feedback terminals.

*DSIO Module Failure* — If a DSIO relay module relay fails open or closed, microprocessor detects this, locks compressor off and indicates an error.

*Wiring Errors* — If a wiring error exists causing CR or feedback switch not to function properly, microprocessor indicates an error.

*Processor (PSIO) Failure* — If hardware that monitors feedback switch fails, or processor fails to energize relay module relay to ON, an error may be indicated.

*Ground Fault Module (CGFA or CGFB) Open* — Module contacts are in lead compressor circuits, but ground fault could be in any compressor in affected circuit.

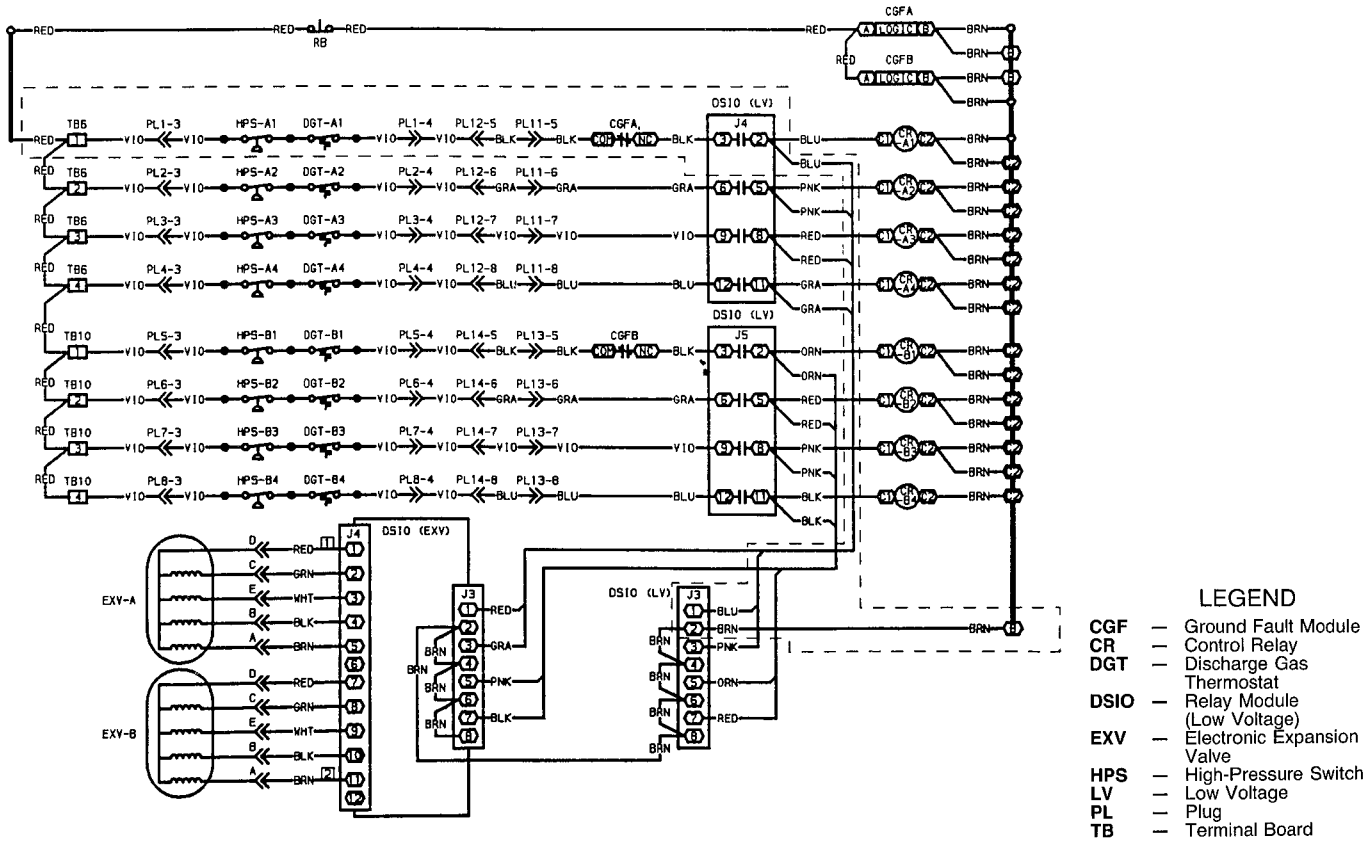
*Loss Of Charge Switch* — On 30GB units a loss of charge switch is used to detect low refrigerant pressure. Contacts of this switch are in each lead compressor circuit.

**NOTE:** The control does not detect circuit breaker failures. If a circuit breaker trips on lead compressor in a circuit, a low oil pressure failure is indicated. On the other compressors, no failure is indicated.

*Checkout Procedure (Codes 1 - 8)* — Shut off main power to unit. Turn on control power, then step through subfunction [2] [TEST] to proper compressor number (i.e. failure code 5 is compressor B1). Next, energize the step. If step works correctly, then failure code is caused by:

- HPS open
- DGT open
- Misplaced feedback wire from J4 and J5 terminals
- Ground wire and 24-v feeds reversed on one or more points on J3

**Compressor A1 Alarm Circuit** — Processor closes contacts between J4 terminals 2 and 3 to start compressor. See Fig. 7. Safeties shown to left of J4 must be closed in order for power to reach compressor control relay, and the feedback input terminals on J3.




LEGEND

| | | |
|---|---|---|
| **CGF** | — | Ground Fault Module |
| **CR** | — | Control Relay |
| **DGT** | — | Discharge Gas Thermostat |
| **DSIO** | — | Relay Module (Low Voltage) |
| **EXV** | — | Electronic Expansion Valve |
| **HPS** | — | High-Pressure Switch |
| **LV** | — | Low Voltage |
| **PL** | — | Plug |
| **TB** | — | Terminal Board |

**Fig. 7 — 24-V Safety Circuit Wiring**

Failure of power to terminal 1 on J3, when contacts J5 2 and 3 should be closed, causes a code 1 alarm.

Terminal 2 on J3 is the other leg of the compressor A1 feedback channel. It is connected to the 24-v ground.

**Code 9** Leaving water thermistor failure
**Code 10** Entering water thermistor failure

If temperature measured by these thermistors is outside range of −40 to 240 F (−40 to 116 C), unit shuts down after going through a normal pumpout. Reset is automatic if temperature returns within range, and unit start-up follows normal sequence. Cause of fault is usually a bad thermistor, wiring error or loose connection.

**Code 15** Circuit A Condensing Temperature Thermistor Failure (30GB)
**Code 16** Circuit B Condensing Temperature Thermistor Failure (30GB)

If temperature measured by these thermistors is outside range of −40 to 240 F (−40 to 116 C), affected circuit shuts down after going through a normal pumpout. Other circuit continues to run. Reset is automatic if temperature returns within range, and circuit start-up follows normal sequence. Cause of this fault is usually a bad thermistor, wiring error or loose connection.

**Code 17** Circuit A Cooler Refrigerant Temperature Failure (30GB)
**Code 18** Circuit B Cooler Refrigerant Temperature Failure (30GB)

If temperature measured by these thermistors is outside range of −40 to 240 F (−40 to 116 C), or if measured refrigerant temperature is greater than cooler leaving fluid temperature when chiller is running, affected circuit shuts down after going through a normal pumpout. Other circuit continues to run. Reset is automatic if temperature returns within range, and circuit start-up follows normal sequence. Cause of this fault is usually a bad thermistor, wiring error or loose connection.

**Code 19** Compressor A1 suction thermistor failure
**Code 20** Compressor B1 suction thermistor failure

If temperature measured by these thermistors is outside the range of −40 to 240 F (−40 to 116 C), affected circuit shuts down after going through a normal pumpout. Other circuit continues to run. Reset is automatic if temperature returns within range, and circuit start-up follows normal sequence. Cause of this fault is usually a bad thermistor, wiring error or loose connection.

**Code 21** Reset thermistor failure applies only to installations having external temperature reset.

If temperature measured by this thermistor is outside range of −40 to 240 F (−40 to 116 C), reset function is disabled and unit controls to normal set point. If temperature returns within range, reset function is automatically enabled. Cause of this fault is usually a bad thermistor, wiring error or loose connection.

**NOTE:** Codes 22 through 28 apply to 30GT only.

**Code 22** Compressor A1 discharge pressure transducer failure
**Code 23** Compressor B1 discharge pressure transducer failure
**Code 24** Compressor A1 suction pressure transducer failure
**Code 25** Compressor B1 suction pressure transducer failure
**Code 26** Compressor A1 oil pressure transducer failure
**Code 27** Compressor B1 oil pressure transducer failure

If output voltage of any of these transducers is greater than 5 volts, affected circuit shuts down without going through pumpout process. Other circuit continues to run. Reset is automatic if output voltage returns within range, and circuit start-up follows normal sequence. Cause of fault is usually a bad transducer or a wiring error.

**Code 28** Low transducer supply voltage

If transducer supply voltage is less than 4.5 volts or greater than 5.5 volts, unit shuts down without going through pumpout process. Reset is automatic if supply voltage returns within range, and circuit start-up follows normal sequence. Cause of fault is usually a faulty transformer, or primary voltage is out of range.

**Code 29** Chilled water pump interlock switch open (applies only if unit is configured for use with a chilled water pump interlock). Code can occur under any of these conditions:

1. Interlock switch fails to close within one minute after chilled water pump starts
2. Interlock switch opens during unit operation
3. Interlock voltage is detected, but unit is not configured for interlock
4. Interlock voltage is outside its valid range

If any of these conditions occur, all compressors are disabled and, if running, shutdown occurs without pumpout. Chilled water pump also shuts down. Reset is manual, with LOCAL/STOP/CCN Switch. Most probable cause of this fault is shutdown or failure of chilled water pump to start. Other possibilities are improper configuration or wiring errors

**Code 30** Reset input failure (4 to 20 mA)
**Code 31** Demand limit input failure (4 to 20 mA)

These codes apply only if unit is configured for these functions. If 4-20 mA signal is less than 2 or more than 22 mA, reset or Demand Limit function is disabled and unit functions normally. If mA signal returns within range, function is automatically enabled.

**Code 32** Loss of communication with compressor relay module (DISO-LV)
**Code 33** Loss of communication with EXV relay module (DSIO-EXV)

If communication is lost with either of these modules, unit shuts down without going through pumpout process. Reset is automatic when communication is restored and start-up follows normal sequence. Probable cause of fault is a loose plug, wiring error, or bad module.

**Code 34** Loss of communication with options board

This applies only if one or more of the following options are used:

- External temperature reset
- 4-20 mA temperature reset
- External switch controlled dual set point
- Switch controlled demand limit
- 4-20 mA demand limit
- Compressor unloaders

If communication is lost with options board, unit shuts down after going through normal pumpout. Reset is automatic when communication is restored, and start-up follows normal sequence. Probable cause of fault is a loose plug, wiring error, or defective options board.

**Code 36** Low refrigerant pressure, Circuit A (30GT)
**Code 37** Low refrigerant pressure, Circuit B (30GT)

If suction pressure transducer senses a pressure below set point for more than 5 minutes at start-up or more than 2 minutes during normal operation, affected circuit shuts down without going through the pumpout process. Reset is automatic when pressure reaches 10 psig above set point, if there have been no previous occurrences of this fault on the same day. If this is a repeat occurrence on same day, then reset is manual, with LOCAL/STOP/CCN Switch. Factory configured set point is 27 psig for standard chillers and 12 psig for brine chillers.

Possible causes of fault are low refrigerant charge, faulty EXV, plugged filter drier, or faulty transducer.

**Code 38** Failure to pump out, Circuit A (30GT)
**Code 39** Failure to pump out, Circuit B (30GT)

The pumpout process is terminated when saturated suction temperature is 20 degrees F (11 degrees C) below temperature at beginning of pumpout, or 10 degrees F (5.5 degrees C) below leaving water temperature. If neither is met within 3 minutes, circuit shuts down without pumpout. Reset is manual with LOCAL/STOP/CCN Switch, and start-up follows normal sequence.

**Code 40** Low oil pressure, Circuit A (30GT)
**Code 41** Low oil pressure, Circuit B (30GT)

If oil pressure differential is less than set point for more than 2 minutes at start-up, or more than 1 minute during normal operation, affected circuit shuts down without going through pumpout process. Reset is manual with LOCAL/STOP/CCN Switch, and start-up follows normal sequence. Factory configured differential oil pressure is 6 psig.

Possible causes of fault are faulty compressor, EXV, crankcase heater, or transducer; or refrigerant overcharge, or insufficient oil charge.

**Code 42** Cooler freeze protection

If cooler entering or leaving water temperature is below 34 F (1.1 C) for water or more than 8 degrees F (4.4 degrees C) below set point for brine, unit shuts down without pumpout. Chilled water pump continues to run if controlled by chiller controls. Reset is automatic when leaving water temperature reaches 6 degrees F (3 degrees C) above set point, providing there has been no prior occurrence of this fault the same day. If fault has occurred previously the same day, reset is manual with LOCAL/STOP/CCN Switch.

Possible causes of fault are low water flow or faulty thermistor.

**Code 43** Low water flow

If any compressors are operating and entering water temperature is 3 degrees F (1.7 degrees C) or more below leaving water temperature for more than one minute, unit shuts down without pumpout. Chilled water pump also shuts down. Reset is manual with LOCAL/STOP/CCN Switch, and start-up follows normal sequence.

This is a suitable method for sensing low water flow because entering water thermistor is in the cooler shell and responds quicker to compressor operation than the leaving water thermistor which is in the leaving water nozzle. Possible causes of fault are faulty chilled water pump, control or thermistor.

**Code 44** Low cooler suction temperature, Circuit A
**Code 45** Low cooler suction temperature, Circuit B

If saturated suction temperature is less than 32 F (0°C) and is 20 degrees F (11 degrees C) or more below leaving water temperature, mode 14 is displayed, unit continues to run, but additional compressors are not allowed to start. If condition persists for more than 10 minutes, fault code is displayed, and unit shuts down without pumpout. Reset is manual with LOCAL/STOP/CCN Switch, and start-up follows normal sequence.

Possible causes of fault are low refrigerant charge, plugged filter drier, faulty EXV or thermistor.

**Code 46** High suction superheat, Circuit A
**Code 47** High suction superheat, Circuit B

If EXV is full open, suction superheat is greater than 75 degrees F (42 degrees C) and saturated evaporator temperature is less than MOP (maximum operating pressure) for more than 5 minutes, unit shuts down after normal pumpout process. Reset is manual with LOCAL/STOP/CCN Switch, and start-up follows normal sequence.

Possible causes of fault are low refrigerant charge, plugged filter drier, faulty EXV or faulty thermistor.

**Code 48** Low suction superheat, Circuit A
**Code 49** Low suction superheat, Circuit B

If EXV is at minimum position, suction superheat is more than 10 degrees F (5.5 degrees C) below set point, and saturated evaporator temperature is greater than MOP (maximum operating pressure) for more than 5 minutes, affected circuit shuts down after going through pumpout process. Reset is manual with LOCAL/STOP/CCN Switch, and start-up follows normal sequence.

Possible causes of fault are faulty EXV or thermistor.

**Code 50** Illegal configuration

This fault indicates a configuration error. Unit is not allowed to start. Check all configuration data and set points and correct any errors.

**Code 51** Initial configuration required

This fault indicates factory configuration has not been done, and unit is not allowed to start. Refer to unit wiring labels for factory configuration codes. There are 8 groups of 8-digit numbers that must be entered. The first 6 groups must be entered under [3] [SRVC] subfunction. Groups 7 and 8 must be entered under [5] [SRVC] subfunction.

Simply enter each group, then press the [ENTR] key. Use the down arrow [↓] after each group to bring up the next empty screen. Unit should start after factory and field configurations are correctly entered.

The usual cause of this fault is replacement of the processor module. Refer to instructions accompanying the replacement module.

**Code 52** Emergency stop by CCN command. Unit goes through normal shutdown when this command is received, and goes through normal start-up when command is cancelled.

## Table 13 – Alarm Codes

| DISPLAY | DESCRIPTION | ACTION TAKEN BY CONTROL | CKT PUMPDOWN | RESET METHOD | PROBABLE CAUSE |
|---|---|---|---|---|---|
| 0 | No Alarms Exist | – | – | – | – |
| 1 | Compressor A1 Failure | Circuit A shut down | No | Manual | High pressure switch trip, or discharge gas thermostat trip, or wiring error |
| 2, 3, 4 | Compressor A2, A3 or A4 Failure | Compressor shut down | No | Manual | Codes 1 and 5 can be ground fault |
| 5 | Compressor B1 Failure | Circuit B shut down | No | Manual | At any compressor in that circuit codes 1 and 5 on 30GB units can be open loss of charge switch |
| 6, 7, 8 | Compressor B2, B3 or B4 Failure | Compressor shut down | Yes | Manual | |
| 9 | Leaving Water Thermistor Failure | Unit shut down | Yes | Auto | |
| 10 | Entering Water Thermistor Failure | Unit shut down | | | |
| 15 | Condenser Thermistor Failure Circuit A | Circuit A shut down | Yes | Auto | |
| 16 | Condenser Thermistor Failure Circuit B | Circuit B shut down | Yes | Auto | Thermistor failure or wiring error |
| 17 | Cooler Thermistor Failure Cilrcuit B | Circuit B shut down | Yes | Auto | |
| 18 | Cooler Thermistor Failure Circuit A | Circuit B shut down | Yes | Auto | |
| 19 | Compressor A1 Thermistor Failure | Circuit A shut down | Yes | Auto | |
| 20 | Compressor B1 Thermistor Failure | Circuit B shut down | Yes | Auto | |
| 21 | Reset Thermistor Failure | Normal set point used | No | Auto. | |
| 22 | Discharge Pressure Transducer Failure Circuit A | Circuit A shut down | Yes | Auto | |
| 23 | Discharge Pressure Transducer Failure Circuit B | Circuit B shut down | Yes | Auto | |
| 24 | Suction Pressure Transducer Failure Circuit A | Circuit A shut down | No | Auto | Transducer failure or wiring error (30GT ONLY) |
| 25 | Suction Pressure Transducer Failure Circuit B | Circuit B shut down | No | Auto | |
| 26 | Oil Pressure Transducer Failure Circuit A | Circuit A shut down | No | Auto | |
| 27 | Oil Pressure Transducer Failure Circuit B | Circuit B shut down | No | Auto | |
| 28 | Transducer supply voltage low | Unit shut down | No | Auto | Unit voltage low or transformer 5 faulty. |
| 29 | Interlock switch open | Unit shut down | No | Manual | Chilled water pump inoperative |
| 30 | 4-20 mA Reset Input Failure | Normal set point used | No | Auto | |
| 31 | 4-20 mA Demand Limit Failure | Demand limit ignored | No | Auto | |
| 32 | Loss of communication with DSIO-LV | Unit shut down | No | Auto | Wiring error or faulty module or improper address code |
| 33 | Loss of communication with DSIO-EXV | Unit shut down | No | Auto | |
| 34 | Loss of communication with Options Board | Unit shut down | Yes | Auto | |
| 35 | Not used | – | – | – | – |
| 36 | Low pressure Circuit A, faulty EXV, or plugged filter | Circuit A shut down | No | * | Low refrigerant charge Plugged filter drier |
| 37 | Low Pressure Circuit B | Circuit B shut down | No | * | Low refrigerant charge Plugged filter drier |
| 38 | Failure to pump down Circuit A | Circuit A shut down | No | Manual | Faulty EXV or transducer |
| 39 | Failure to pump down Circuit B | Circuit B shut down | No | Manual | Faulty EXV or transducer |
| 40 | Low oil pressure Circuit A | Circuit A shut down | No | Manual | Low oil level, faulty EXV, crankcase heater or Pressure Transducer |
| 41 | Low oil pressure Circuit B | Circuit B shut down | No | Manual | Low oil level, faulty EXV, crankcase heater or Pressure Transducer |
| 42 | Cooler Freeze Protection | Unit shut down | No | * | Low water flow or faulty thermistor |
| 43 | Low cooler water flow | Unit shut down | No | Manual | Chilled water pump failure or faulty thermistor |
| 44 | Low suction temperature Circuit A | Circuit A shut down after 10 min | No | Manual | Faulty EXV or thermistor. |
| 45 | Low suction temperature Circuit B | Circuit B shut down after 10 min | No | Manual | Faulty EXV or thermistor |
| 46 | High suction superheat Circuit A | Circuit A shut down | Yes | Manual | Low charge, faulty EXV or thermistor, or plugged filter drier. |
| 47 | High suction superheat Circuit B | Circuit B shut down | Yes | Manual | Low charge, faulty EXV or thermistor, or plugged filter drier |
| 48 | Low suction superheat Circuit A | Circuit A shut down | Yes | Manual | Faulty EXV or thermistor |
| 49 | Low suction superheat Circuit B | Circuit B shut down | Yes | Manual | Faulty EXV or thermistor |
| 50 | Illegal configuration | Unit cannot start | – | Manual | Configuration error |
| 51 | Initial configuration required | Unit cannot start | – | Manual | Configuration omitted |
| 52 | Emergency stop by CCN command | Unit shut down | Yes | CCN | Network command. |

*Reset automatic first time, manual if repeated same day.

## Electronic Expansion Valve

EXV OPERATION — These valves control the flow of liquid refrigerant into the cooler. They are operated by processor to maintain a specified superheat at lead compressor entering gas thermistor (located between compressor motor and cylinders). There is one EXV per circuit. See Fig. 8.

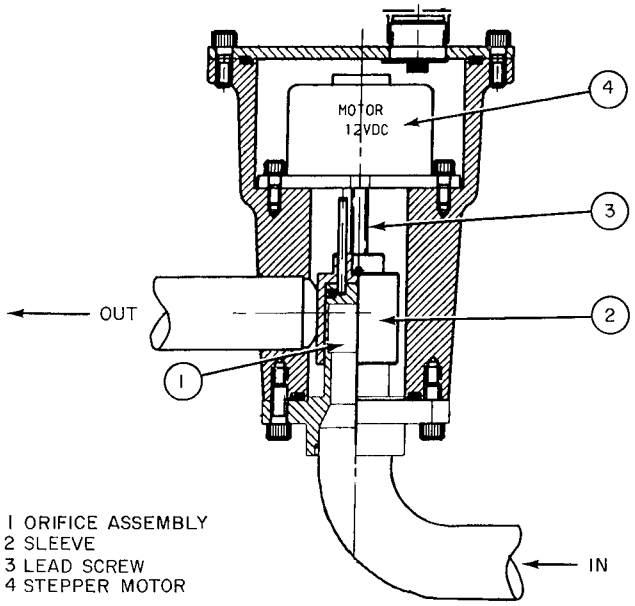



**Fig. 8 — Electronic Expansion Valve**

High-pressure liquid refrigerant enters valve through bottom. A series of calibrated slots are located in side of orifice assembly. As refrigerant passes through orifice, pressure drops and refrigerant changes to a 2-phase condition (liquid and vapor). To control refrigerant flow for different operating conditions, sleeve moves up and down over orifice, thereby changing orifice size. Sleeve is moved by a linear stepper motor. Stepper motor moves in increments and is controlled directly by processor module. As stepper motor rotates, motion is transferred into linear movement by lead screw. Through stepper motor and lead screws, 760 discrete steps of motion are obtained. The large number of steps and long stroke result in very accurate control of refrigerant flow.

The [10] [STAT] subfunction shows EXV valve position as a percent of full open. Position should change constantly while unit operates. If a valve stops moving for any reason (mechanical or electrical) other than a processor or thermistor failure, the processor continues to attempt to open or close the valve to correct the superheat. Once the calculated valve position reaches 145 (fully closed) or 760 (fully open) it remains there. If EXV position reading remains at 145 or 760, and the thermistors and pressure transducers are reading correctly, the EXV is not moving Follow EXV checkout procedure to determine cause.

The EXV is also used to limit cooler suction temperature to 55 F (13 C). This makes it possible for chiller to start at higher cooler water temperatures without overloading compressor. This is commonly referred to as MOP (maximum operating pressure), and serves as a load limiting device to prevent compressor motor overloading. This MOP or load limiting feature enables the 30G chillers to operate with up to 95 F (35 C) entering water temperatures during start-up and subsequent pull-down.

CHECKOUT PROCEDURE — Follow steps below to diagnose and correct EXV problems.

Step 1 — Check EXV Driver Outputs — Check EXV output signals at appropriate terminals on EXV driver module (see Fig. 9) as follows:

Connect positive test lead to terminal 1 on EXV driver. Set meter for approximately 20 vdc. Enter outputs subfunction of test function by pressing [1] [TEST], then advance to EXVA Test by pressing [↓] 8 times. Press [1] [0] [0] [ENTR] . The driver should drive the Circuit A EXV fully open During next several seconds connect negative test lead to pins 2, 3, 4 and 5 in succession. Voltage should rise and fall at each pin. If it remains constant at a voltage or at zero volts, remove connector to valve and recheck

Press [•] [ENTR] to close Circuit A EXV. If a problem still exists, replace EXV driver module. If voltage reading is correct, expansion valve should be checked. Next, test EXVB. Connect positive test lead to pin 7 and the negative test lead to pin 8, 9, 10, 11 in succession during EXVB Test.

Step 2 — Check EXV Wiring — Check wiring to electronic expansion valves from terminal strip on EXV driver. See Fig. 9

1. Check color coding and wire connections. Make sure they are connected to correct terminals at driver and EXV plug connections.
2. Check for continuity and tight connection at all pin terminals.
3. Check plug connections at driver and at EXV's to be sure EXV cables are not crossed.

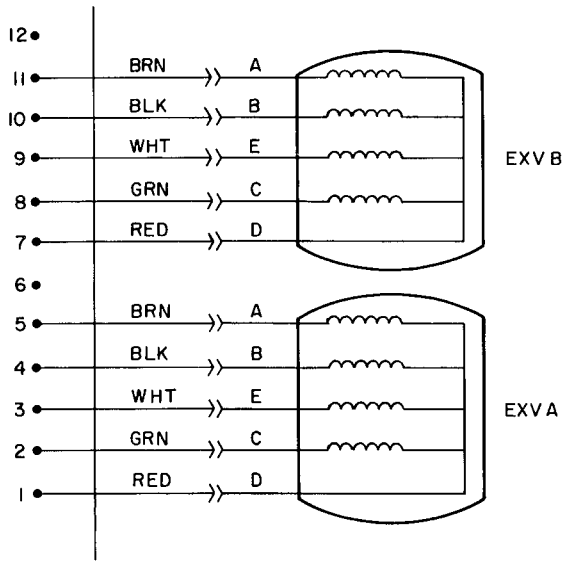



**Fig. 9 — EXV Cable Connections to EXV Driver Module, DSIO (EXV)**

Step 3 — Check Resistance of EXV Motor Windings — Remove plug at J4 terminal strip and check resistance between common lead (red wire, terminal D) and remaining leads, A, B, C and E (see Fig. 9). Resistance should be 25 ohms ± 2 ohms.

Control of valve is by microprocessor. In 30GB040-200, two thermistor temperature sensors are used to determine superheat. One thermistor is located in cooler and the other is located in lead compressor suction manifold after the motor. The difference between the two temperatures is a measurement of the superheat. In 30GT225-280, a thermistor and a pressure transducer located in lead compressor are

used to determine superheat. The thermistor measures temperature of the superheated gas entering the compressor cylinders. The pressure transducer measures refrigerant pressure in the suction manifold. The microprocessor converts pressure reading to a saturation temperature. The difference between temperature of superheated gas and saturation temperature is the superheat.

Because the EXV's are controlled by processor module, it is possible to track valve position. During initial start-up, EXV is fully closed. After start-up, valve position is tracked by processor by constantly observing amount of valve movement.

The processor keeps track of EXV position by counting the number of open and closed steps it has sent to each valve. It has no direct physical feedback of valve position. Whenever unit is switched from STOP to RUN, both valves are initialized, allowing the processor to send enough closing pulses to the valve to move it from fully open to fully closed, then reset the position counter to zero.

The EXV Test can be used to drive EXV to any desired position. When EXV opens, the metering slots are not uncovered until step 145. This is fully closed position when circuit is operating. The fully open position is 760 steps.

Step 4 — Check Thermistors and Pressure Transducers that Control EXV — Check thermistors and pressure transducers that control processor output voltage pulses to EXV's. See Fig. 10 for locations.

*30GB's*

Circuit A — Thermistors T5, T7
Circuit B — Thermistors T6, T8

*30GT's*

Circuit A — Thermistor T7, Pressure Transducer SPTA
Circuit B — Thermistor T8, Pressure Transducer SPTB

1. Use temperature subfunction of the Status function [6] [STAT] to determine if thermistors are reading correctly.
2. Check thermistor calibration at known temperature by measuring actual resistance and comparing value measured with values listed in Tables 14a and 14b.
3. Make sure thermistor leads are connected to proper pin terminals at J7 terminal strip on processor module and that thermistor probes are located in proper position in refrigerant circuit. See Fig. 11, 12, 13.
4. Use the pressure subfunction of the Status function [7] [STAT] to determine if pressure transducers are reading correctly. Connect a calibrated gage to lead compressor suction or discharge pressure connection to check transducer reading.
5. Make sure transducer leads are properly connected in junction box and at processor board. Check transformer 5 output. Check voltage transducer 5 vdc ± .2 v.

When above checks have been completed, check actual operation of EXV by using procedures outlined in Step 5.

Step 5 — Checking Operation of EXV

1. Close liquid line service valve of circuit to be checked, and run through the Test step (subfunction 2 of Test function) for lead compressor in that circuit to pump down low side of system. Repeat test step 3 times to ensure all refrigerant has been pumped from low side.

   **NOTE:** Be sure to allow compressors to run for the full pumpout period.

2. Turn off compressor circuit breaker(s). Close compressor discharge service valves and vent any remaining refrigerant from low side of system.
3. Remove screws holding top cover of EXV. Carefully remove top cover. If EXV plug was disconnected during this process, reconnect it after cover is removed.

**⚠ CAUTION**

When removing top cover, be careful to avoid damaging motor leads.

4. Enter appropriate EXV Test step for EXVA or EXVB in the outputs subfunction of the Test function [1] [TEST]. Press [1] [0] [0] [ENTR] to initiate test. With cover lifted off EXV valve body, observe operation of valve motor and lead screw. The motor should turn counterclockwise, and the lead screw should move up out of motor hub until valve is fully open. Lead screw movement should be smooth and uniform from fully closed to fully open position. Check open to closed operation by pressing [•] [ENTR].

   If valve is properly connected to processor and receiving correct signals, yet does not operate as described above, valve should be replaced.

   Operation of EXV valve is also checked without removing top cover. This method depends on operator's skill in determining whether or not valve is moving. To use this method, initiate EXV Test and open valve. Immediately grasp EXV valve body. As valve drives open, a soft, smooth pulse is felt for approximately 26 seconds as valve travels from fully closed to fully open. When valve reaches end of its opening stroke, a hard pulse is felt momentarily. Drive valve closed and a soft, smooth pulse is felt for the 26 seconds necessary for valve to travel from fully open to fully closed. When valve reaches end of its stroke, a hard pulse is again felt as valve overdrives by 50 steps. Valve should be driven through at least 2 complete cycles to be sure it is operating properly If a hard pulse is felt for the 26 second duration, valve is not moving and should be replaced.

   The EXV test can be repeated as required by entering any percentage from 0 ([•]) to 100 to initiate movement.

   If operating problems persist after reassembly, they may be due to out-of-calibration thermistor(s), or intermittent connections between processor board terminals and EXV plug. Recheck all wiring connections and voltage signals.

   Other possible causes of improper refrigerant flow control could be restrictions in liquid line. Check for plugged filter drier(s), or restricted metering slots in the EXV. Formation of ice or frost on lower body of electronic expansion valve is one symptom of restricted metering slots. However, frost or ice formation is normally expected when leaving fluid temperature from the cooler is below 40 F. Clean or replace valve if necessary.

   **NOTE:** Frosting of valve is normal during compressor Test steps and at initial start-up. Frost should dissipate after 5 to 10 minutes operation in a system that is operating properly. If valve is to be replaced, wrap valve with a wet cloth to prevent excessive heat from damaging internal components.

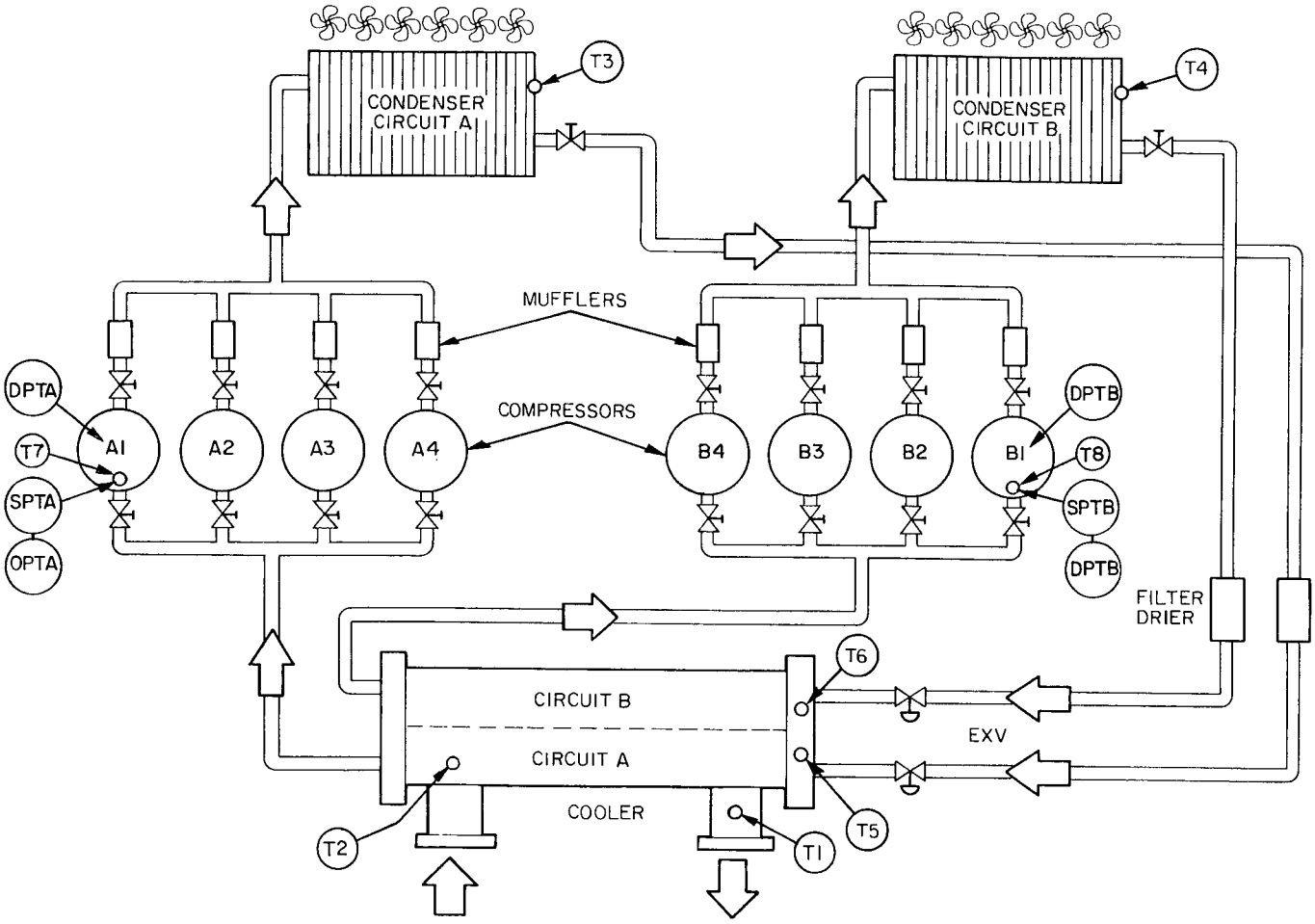



**Fig. 10 — Thermistor and Pressure Transducer Locations**

**Thermistors —** All thermistors are identical in their temperature vs. resistance performance. Resistance at various temperatures are listed in Tables 14a and 14b.

LOCATION — General location of thermistor sensors are shown in Fig. 10.

Cooler Leaving Water Thermistor (T1) — located in leaving water nozzle. The probe is immersed directly in the water. All thermistor connections are made through a ¼-in. coupling. See Fig. 14. Actual location is shown in Fig. 11 and 13.

Cooler Entering Water Thermistor (T2) — located in cooler shell in first baffle space near tube bundle. Actual location is shown in Fig. 11 and 13.

Cooler Saturated Suction Temperature Thermistors (T5 and T6) (30GB only) — located next to refrigerant inlet in cooler head. Thermistors are immersed directly into refrigerant. Typical location is shown in Fig. 11 and 13.

Compressor Suction Gas Temperature Thermistors (T7 and T8) — located in lead compressor in each circuit in suction passage between motor and cylinders, above oil pump. See Fig. 11.

THERMISTOR REPLACEMENT (T1, T2, T5, T6, T7, T8) (Compressor and Cooler)

**⚠ CAUTION**

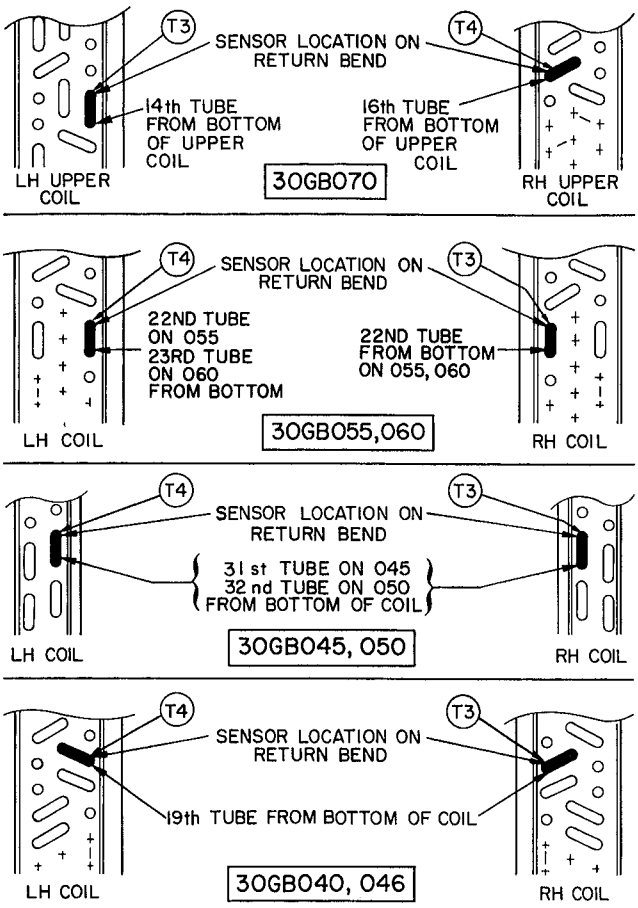
Thermistors are installed directly in refrigerant or water circuit. Relieve all refrigerant pressure or drain water before removing.

Proceed as follows (see Fig. 14):

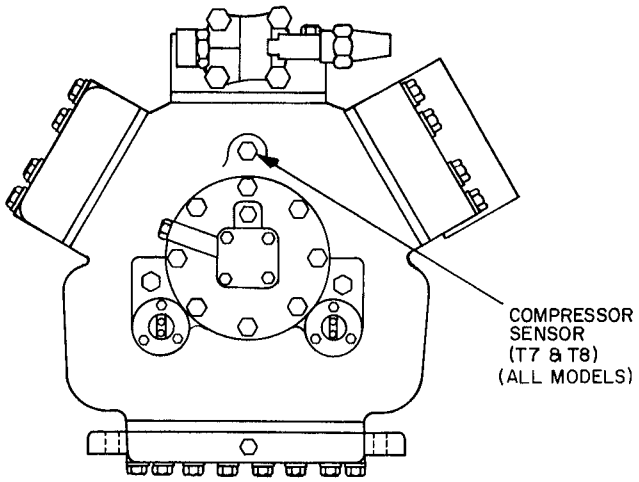
1. Remove and discard original thermistor and coupling.

**IMPORTANT:** Do not disassemble new coupling. Install as received.

2. Apply pipe sealant to ¼-in. NPT threads on replacement coupling and install in place of original. Do not use packing nut to tighten coupling. This damages ferrules (see Fig. 14).
3. Insert new thermistor in coupling body to its full depth. If thermistor bottoms out before full depth is reached, pull thermistor back out ⅛ in. before tightening packing nut. Hand tighten packing nut to position ferrules, then finish tightening 1¼ turns with a suitable tool. Ferrules are now attached to thermistor which can be withdrawn from coupling for unit servicing.




Compressor End — Headers Removed
CONDENSER COILS



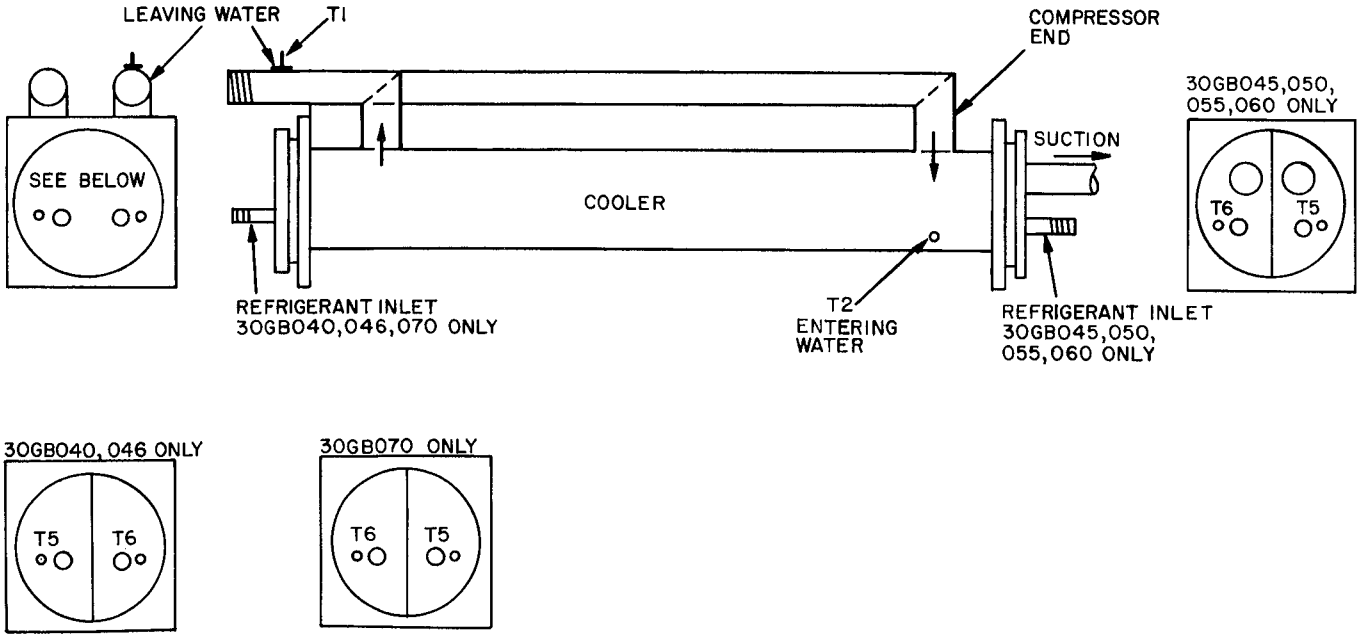
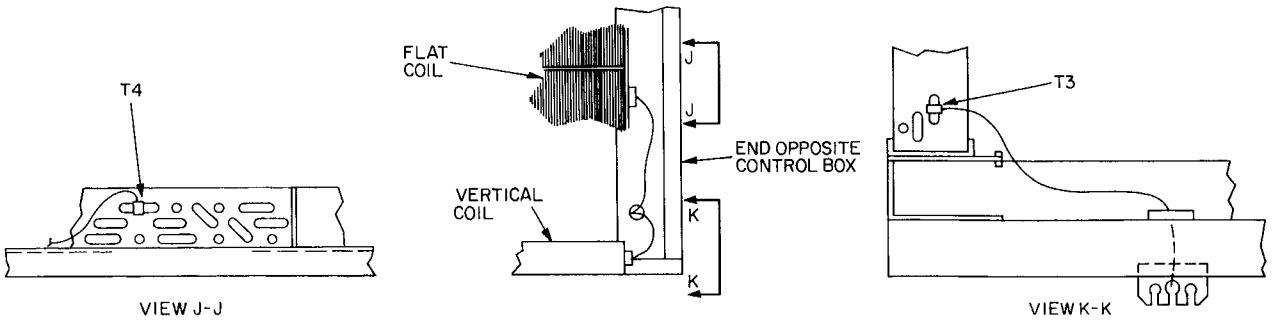
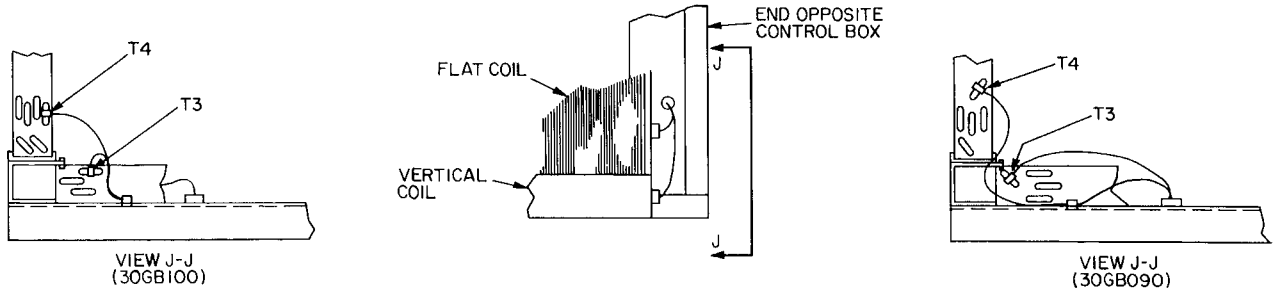



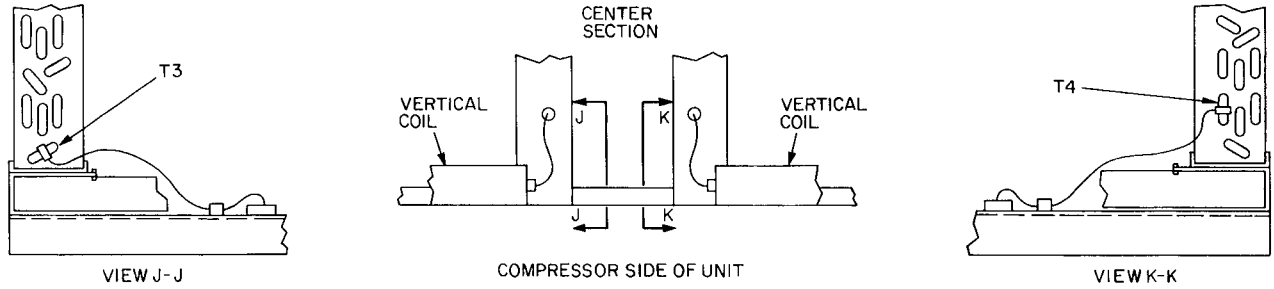

**Fig. 11 — Thermistor Locations; 30GB040-070**



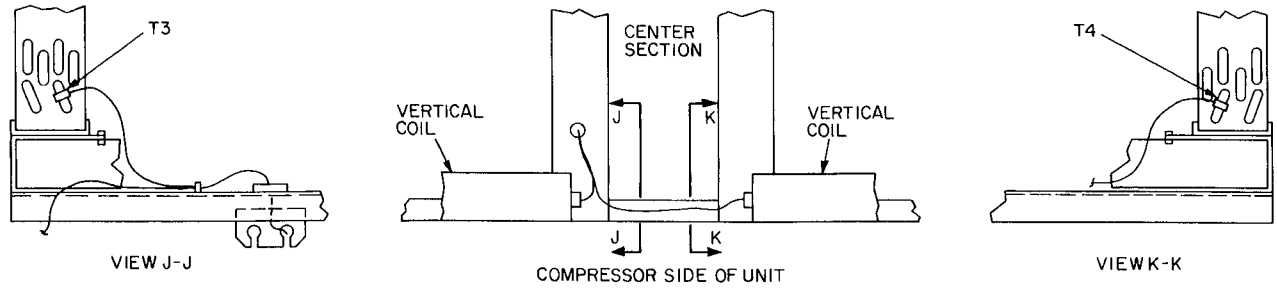

30GB075,080




30GB090,100




30GB110,125




30GB150,175,200

**Fig. 12 — Condenser Thermistor Locations**

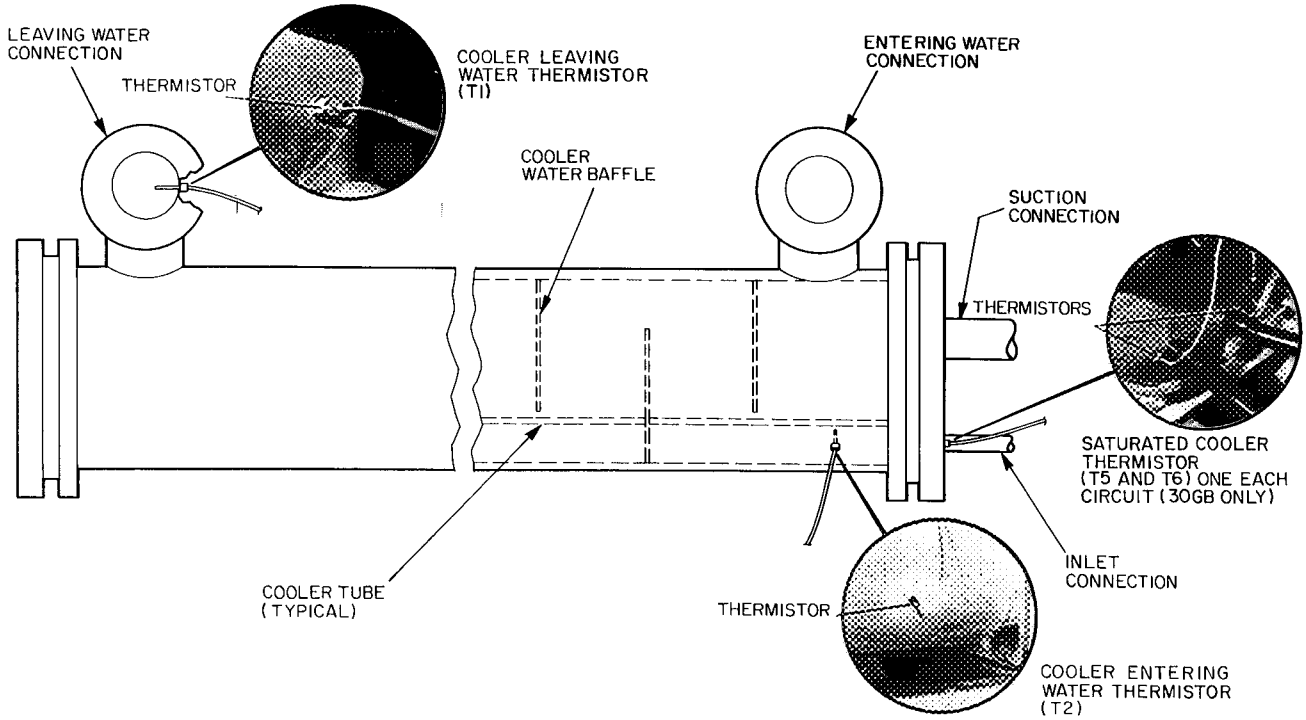



**Fig. 13 – Cooler Thermistor Locations; 30GB075-200, 30GT225-280**

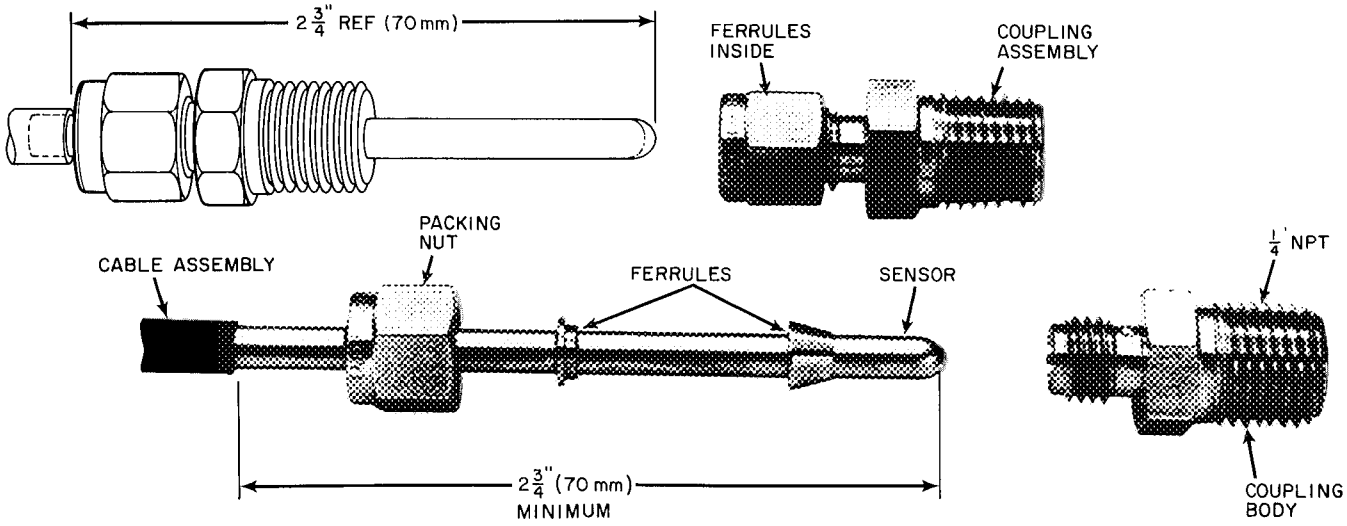



**Fig. 14 – Thermistor (Compressor and Cooler)**

## Table 14a – Thermistor Temperature (F) vs Resistance/Voltage Drop (English)

| TEMPERATURE (F) | VOLTAGE DROP (V) | RESISTANCE (OHMS) |
|---|---|---|
| -25.0 | 4.821 | 98010 |
| -24.0 | 4.818 | 94707 |
| -23.0 | 4 814 | 91522 |
| -22.0 | 4 806 | 88449 |
| -21.0 | 4.800 | 85486 |
| -20.0 | 4 793 | 82627 |
| -19.0 | 4 786 | 79871 |
| -18.0 | 4 779 | 77212 |
| -17.0 | 4 772 | 74648 |
| -16.0 | 4.764 | 72175 |
| -15.0 | 4 757 | 69790 |
| -14.0 | 4 749 | 67490 |
| -13.0 | 4 740 | 65272 |
| -12.0 | 4 734 | 63133 |
| -11.0 | 4 724 | 61070 |
| -10.0 | 4.715 | 59081 |
| -9.0 | 4.705 | 57162 |
| -8.0 | 4.696 | 55311 |
| -7.0 | 4.688 | 53526 |
| -6.0 | 4.676 | 51804 |
| -5.0 | 4 666 | 50143 |
| -4.0 | 4 657 | 48541 |
| -3.0 | 4 648 | 46996 |
| -2.0 | 4 636 | 45505 |
| -1.0 | 4.624 | 44066 |
| 0.0 | 4.613 | 42679 |
| 1.0 | 4 602 | 41339 |
| 2.0 | 4 592 | 40047 |
| 3.0 | 4 579 | 38800 |
| 4.0 | 4.567 | 37596 |
| 5.0 | 4.554 | 36435 |
| 6.0 | 4.540 | 35313 |
| 7.0 | 4 527 | 34231 |
| 8.0 | 4 514 | 33185 |
| 9.0 | 4.501 | 32176 |
| 10.0 | 4.487 | 31202 |
| 11.0 | 4.472 | 30260 |
| 12.0 | 4.457 | 29351 |
| 13.0 | 4.442 | 28473 |
| 14.0 | 4.427 | 27624 |
| 15.0 | 4 413 | 26804 |
| 16.0 | 4.397 | 26011 |
| 17.0 | 4 381 | 25245 |
| 18.0 | 4 366 | 24505 |
| 19.0 | 4.348 | 23789 |
| 20.0 | 4.330 | 23096 |
| 21.0 | 4 313 | 22427 |
| 22.0 | 4 295 | 21779 |
| 23.0 | 4 278 | 21153 |
| 24.0 | 4 258 | 20547 |
| 25.0 | 4.241 | 19960 |
| 26.0 | 4.223 | 19393 |
| 27.0 | 4.202 | 18843 |
| 28.0 | 4 184 | 18311 |
| 29.0 | 4 165 | 17796 |
| 30.0 | 4 145 | 17297 |
| 31.0 | 4.125 | 16814 |
| 32.0 | 4 103 | 16346 |
| 33.0 | 4 082 | 15892 |
| 34.0 | 4 059 | 15453 |
| 35.0 | 4 037 | 15027 |
| 36.0 | 4 017 | 14614 |
| 37.0 | 3 994 | 14214 |
| 38.0 | 3 968 | 13826 |
| 39.0 | 3.948 | 13449 |
| 40.0 | 3 927 | 13084 |
| 41.0 | 3.902 | 12730 |
| 42.0 | 3 878 | 12387 |
| 43.0 | 3 854 | 12053 |
| 44.0 | 3 828 | 11730 |
| 45.0 | 3 805 | 11416 |
| 46.0 | 3 781 | 11112 |
| 47.0 | 3.757 | 10816 |
| 48.0 | 3 729 | 10529 |
| 49.0 | 3 705 | 10250 |
| 50.0 | 3 679 | 9979 |
| 51.0 | 3.653 | 9717 |
| 52.0 | 3.627 | 9461 |
| 53.0 | 3 600 | 9213 |
| 54.0 | 3 575 | 8973 |
| 55.0 | 3.547 | 8739 |
| 56.0 | 3 520 | 8511 |
| 57.0 | 3 493 | 8291 |
| 58.0 | 3.464 | 8076 |
| 59.0 | 3 437 | 7868 |
| 60.0 | 3 409 | 7665 |
| 61.0 | 3 382 | 7468 |
| 62.0 | 3 353 | 7277 |
| 63.0 | 3.323 | 7091 |
| 64.0 | 3.295 | 6911 |
| 65.0 | 3.267 | 6735 |
| 66.0 | 3 238 | 6564 |
| 67.0 | 3 210 | 6399 |
| 68.0 | 3 181 | 6238 |
| 69.0 | 3 152 | 6081 |
| 70.0 | 3 123 | 5929 |
| 71 | 3 093 | 5781 |
| 72 | 3.064 | 5637 |
| 73 | 3.034 | 5497 |
| 74 | 3 005 | 5361 |
| 75 | 2.977 | 5229 |
| 76 | 2.947 | 5101 |
| 77 | 2 917 | 4976 |
| 78 | 2.884 | 4855 |
| 79 | 2 857 | 4737 |
| 80 | 2 827 | 4622 |
| 81 | 2 797 | 4511 |
| 82 | 2 766 | 4403 |
| 83 | 2 738 | 4298 |
| 84 | 2.708 | 4196 |
| 85 | 2 679 | 4096 |
| 86 | 2 650 | 4000 |
| 87 | 2 622 | 3906 |
| 88 | 2 593 | 3814 |
| 89 | 2 563 | 3726 |
| 90 | 2 533 | 3640 |
| 91 | 2.505 | 3556 |
| 92 | 2.476 | 3474 |
| 93 | 2 447 | 3395 |
| 94 | 2 417 | 3318 |
| 95 | 2.388 | 3243 |
| 96 | 2 360 | 3170 |
| 97 | 2.332 | 3099 |
| 98 | 2.305 | 3031 |
| 99 | 2.277 | 2964 |
| 100 | 2.251 | 2898 |
| 101 | 2 217 | 2835 |
| 102 | 2 189 | 2773 |
| 103 | 2.162 | 2713 |
| 104 | 2.136 | 2655 |
| 105 | 2.107 | 2597 |
| 106 | 2 080 | 2542 |
| 107 | 2 053 | 2488 |
| 108 | 2.028 | 2436 |
| 109 | 2 001 | 2385 |
| 110 | 1.973 | 2335 |
| 111 | 1 946 | 2286 |
| 112 | 1 919 | 2239 |
| 113 | 1 897 | 2192 |
| 114 | 1 870 | 2147 |
| 115 | 1 846 | 2103 |
| 116 | 1 822 | 2060 |
| 117 | 1 792 | 2018 |
| 118 | 1.771 | 1977 |
| 119 | 1.748 | 1937 |
| 120 | 1 724 | 1898 |
| 121 | 1 702 | 1860 |
| 122 | 1 676 | 1822 |
| 123 | 1 653 | 1786 |
| 124 | 1.630 | 1750 |
| 125 | 1.607 | 1715 |
| 126 | 1 585 | 1680 |
| 127 | 1 562 | 1647 |
| 128 | 1.538 | 1614 |
| 129 | 1 517 | 1582 |
| 130 | 1 496 | 1550 |
| 131 | 1.474 | 1519 |
| 132 | 1 453 | 1489 |
| 133 | 1.431 | 1459 |
| 134 | 1 408 | 1430 |
| 135 | 1 389 | 1401 |
| 136 | 1 369 | 1373 |
| 137 | 1 348 | 1345 |
| 138 | 1.327 | 1318 |
| 139 | 1.308 | 1291 |
| 140 | 1 291 | 1265 |
| 141 | 1 289 | 1240 |
| 142 | 1 269 | 1214 |
| 143 | 1 250 | 1190 |
| 144 | 1.230 | 1165 |
| 145 | 1.211 | 1141 |
| 146 | 1 192 | 1118 |
| 147 | 1 173 | 1095 |
| 148 | 1 155 | 1072 |
| 149 | 1 136 | 1050 |
| 150 | 1.118 | 1029 |
| 151 | 1 100 | 1007 |
| 152 | 1.082 | 986 |
| 153 | 1.064 | 965 |
| 154 | 1 047 | 945 |
| 155 | 1.029 | 925 |
| 156 | 1.012 | 906 |
| 157 | 0 995 | 887 |
| 158 | 0.978 | 868 |
| 159 | 0 962 | 850 |
| 160 | 0.945 | 832 |
| 161 | 0 929 | 815 |
| 162 | 0 914 | 798 |
| 163 | 0.898 | 782 |
| 164 | 0.883 | 765 |
| 165 | 0.868 | 750 |
| 166 | 0 853 | 734 |
| 167 | 0 838 | 719 |
| 168 | 0 824 | 705 |
| 169 | 0 810 | 690 |
| 170 | 0 797 | 677 |
| 171 | 0 783 | 663 |
| 172 | 0 770 | 650 |
| 173 | 0 758 | 638 |
| 174 | 0 745 | 626 |
| 175 | 0 734 | 614 |
| 176 | 0 722 | 602 |
| 177 | 0.710 | 591 |
| 178 | 0.700 | 581 |
| 179 | 0.689 | 570 |
| 180 | 0.678 | 561 |
| 181 | 0.668 | 551 |
| 182 | 0 659 | 542 |
| 183 | 0 649 | 533 |
| 184 | 0.640 | 524 |
| 185 | 0 632 | 516 |
| 186 | 0.623 | 508 |
| 187 | 0.615 | 501 |
| 188 | 0 607 | 494 |
| 189 | 0.600 | 487 |
| 190 | 0 592 | 480 |
| 191 | 0 585 | 473 |
| 192 | 0 579 | 467 |
| 193 | 0 572 | 461 |
| 194 | 0 566 | 456 |
| 195 | 0.560 | 450 |
| 196 | 0.554 | 445 |
| 197 | 0.548 | 439 |
| 198 | 0 542 | 434 |
| 199 | 0 537 | 429 |
| 200 | 0 531 | 424 |
| 201 | 0 526 | 419 |
| 202 | 0 520 | 415 |
| 203 | 0.515 | 410 |
| 204 | 0.510 | 405 |
| 205 | 0 505 | 401 |
| 206 | 0 499 | 396 |
| 207 | 0 494 | 391 |
| 208 | 0 488 | 386 |
| 209 | 0 483 | 382 |
| 210 | 0.477 | 377 |
| 211 | 0 471 | 372 |
| 212 | 0 465 | 367 |
| 213 | 0.459 | 361 |
| 214 | 0 453 | 356 |
| 215 | 0 446 | 350 |
| 216 | 0 439 | 344 |
| 217 | 0 432 | 338 |
| 218 | 0 425 | 332 |
| 219 | 0.417 | 325 |
| 220 | 0 409 | 318 |
| 221 | 0 401 | 311 |
| 222 | 0 393 | 304 |
| 223 | 0 384 | 297 |
| 224 | 0 375 | 289 |
| 225 | 0.366 | 282 |

## Table 14b – Thermistor (°C) vs Resistance/Voltage Drop (SI)

| TEMPERATURE (C) | VOLTAGE DROP (V) | RESISTANCE (Ohms) |
|---|---|---|
| −40 | 4.896 | 168 230 |
| −39 | 4.889 | 157 440 |
| −38 | 4.882 | 147 410 |
| −37 | 4 874 | 138 090 |
| −36 | 4 866 | 129 410 |
| −35 | 4.857 | 121 330 |
| −34 | 4.848 | 113 810 |
| −33 | 4.838 | 106 880 |
| −32 | 4.828 | 100 260 |
| −31 | 4.817 | 94 165 |
| −30 | 4.806 | 88 480 |
| −29 | 4 794 | 83 170 |
| −28 | 4 782 | 78 125 |
| −27 | 4.769 | 73 580 |
| −26 | 4.755 | 69 250 |
| −25 | 4.740 | 65 205 |
| −24 | 4 725 | 61 420 |
| −23 | 4 710 | 57 875 |
| −22 | 4 693 | 54 555 |
| −21 | 4.676 | 51 450 |
| −20 | 4 657 | 48 536 |
| −19 | 4.639 | 45 807 |
| −18 | 4.619 | 43 247 |
| −17 | 4 598 | 40 845 |
| −16 | 4 577 | 38 592 |
| −15 | 4.554 | 38 476 |
| −14 | 4 531 | 34 489 |
| −13 | 4.507 | 32 621 |
| −12 | 4.482 | 30 866 |
| −11 | 4.456 | 29 216 |
| −10 | 4.428 | 27 633 |
| −9 | 4.400 | 26 202 |
| −8 | 4.371 | 24 827 |
| −7 | 4.341 | 23 532 |
| −6 | 4 310 | 22 313 |
| −5 | 4.278 | 21 163 |
| −4 | 4.245 | 20 079 |
| −3 | 4.211 | 19 058 |
| −2 | 4.176 | 18 094 |
| −1 | 4.140 | 17 184 |
| 0 | 4.103 | 16 325 |
| 1 | 4.065 | 15 515 |
| 2 | 4.026 | 14 749 |
| 3 | 3 986 | 14 026 |
| 4 | 3.945 | 13 342 |
| 5 | 3 903 | 12 696 |
| 6 | 3 860 | 12 085 |
| 7 | 3.816 | 11 506 |
| 8 | 3.771 | 10 959 |
| 9 | 3.726 | 10 441 |
| 10 | 3.680 | 9 949 |
| 11 | 3.633 | 9 485 |
| 12 | 3 585 | 9 044 |
| 13 | 3.537 | 8 627 |
| 14 | 3 487 | 8 231 |
| 15 | 3.438 | 7 855 |
| 16 | 3.387 | 7 499 |
| 17 | 3.337 | 7 161 |
| 18 | 3.285 | 6 840 |
| 19 | 3.234 | 6 536 |
| 20 | 3.181 | 6 246 |
| 21 | 3.129 | 5 971 |
| 22 | 3.076 | 5 710 |
| 23 | 3.023 | 5 461 |
| 24 | 2.970 | 5 225 |
| 25 | 2.917 | 5 000 |
| 26 | 2.864 | 4 786 |
| 27 | 2 810 | 4 583 |
| 28 | 2.757 | 4 389 |
| 29 | 2.704 | 4 204 |
| 30 | 2.651 | 4 028 |
| 31 | 2.598 | 3 861 |
| 32 | 2.545 | 3 701 |
| 33 | 2.493 | 3 549 |
| 34 | 2.441 | 3 404 |
| 35 | 2 389 | 3 266 |
| 36 | 2 337 | 3 134 |
| 37 | 2 286 | 3 008 |
| 38 | 2.236 | 2 888 |
| 39 | 2.186 | 2 773 |
| 40 | 2 137 | 2 663 |
| 41 | 2 087 | 2 559 |
| 42 | 2 039 | 2 459 |
| 43 | 1.991 | 2 363 |

| TEMPERATURE (C) | VOLTAGE DROP (V) | RESISTANCE (Ohms) |
|---|---|---|
| 44 | 1 944 | 2 272 |
| 45 | 1 898 | 2 184 |
| 46 | 1 852 | 2 101 |
| 47 | 1 807 | 2 021 |
| 48 | 1 763 | 1 944 |
| 49 | 1.719 | 1 871 |
| 50 | 1 677 | 1 801 |
| 51 | 1.635 | 1 734 |
| 52 | 1 594 | 1 670 |
| 53 | 1.553 | 1 609 |
| 54 | 1 513 | 1 550 |
| 55 | 1 474 | 1 493 |
| 56 | 1.436 | 1 439 |
| 57 | 1.399 | 1 387 |
| 58 | 1.363 | 1 337 |
| 59 | 1.327 | 1 290 |
| 60 | 1.291 | 1 244 |
| 61 | 1.258 | 1 200 |
| 62 | 1.225 | 1 158 |
| 63 | 1.192 | 1 118 |
| 64 | 1.160 | 1 079 |
| 65 | 1.129 | 1 041 |
| 66 | 1.099 | 1 006 |
| 67 | 1.069 | 971 |
| 68 | 1 040 | 938 |
| 69 | 1.012 | 906 |
| 70 | 0.984 | 876 |
| 71 | 0.949 | 836 |
| 72 | 0.920 | 805 |
| 73 | 0.892 | 775 |
| 74 | 0.865 | 747 |
| 75 | 0.838 | 719 |
| 76 | 0.813 | 693 |
| 77 | 0.789 | 669 |
| 78 | 0.765 | 645 |
| 79 | 0.743 | 623 |
| 80 | 0.722 | 602 |
| 81 | 0.702 | 583 |
| 82 | 0.683 | 564 |
| 83 | 0.665 | 547 |
| 84 | 0.648 | 531 |
| 85 | 0.632 | 516 |
| 86 | 0.617 | 502 |
| 87 | 0.603 | 489 |
| 88 | 0.590 | 477 |
| 89 | 0.577 | 466 |
| 90 | 0.566 | 456 |
| 91 | 0.555 | 446 |
| 92 | 0.545 | 436 |
| 93 | 0.535 | 427 |
| 94 | 0.525 | 419 |
| 95 | 0.515 | 410 |
| 96 | 0.506 | 402 |
| 97 | 0.496 | 393 |
| 98 | 0.486 | 385 |
| 99 | 0.476 | 376 |
| 100 | 0.466 | 367 |
| 101 | 0.454 | 357 |
| 102 | 0.442 | 346 |
| 103 | 0.429 | 335 |
| 104 | 0.416 | 324 |
| 105 | 0 401 | 312 |
| 106 | 0.386 | 299 |
| 107 | 0 370 | 285 |

**Pressure Transducers (30GT) —** Two types of pressure transducers are used on 30GT chillers, a low pressure transducer and a high pressure transducer. The low pressure transducer is identified by a white dot on the body of the transducer, and the high pressure transducer by a red dot. See Fig. 15.

Three pressure transducers are mounted on each lead compressor, two low pressure transducers to monitor compressor suction pressure and oil pressure, and a high pressure transducer to monitor compressor discharge pressure (see Fig. 16 for exact locations on compressor). Each transducer is supplied with 5 vdc power from a rectifier which changes 24 vac to 5 vdc.

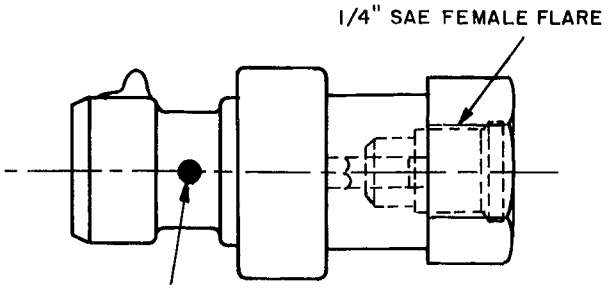



**Fig. 15 — Pressure Transducer**

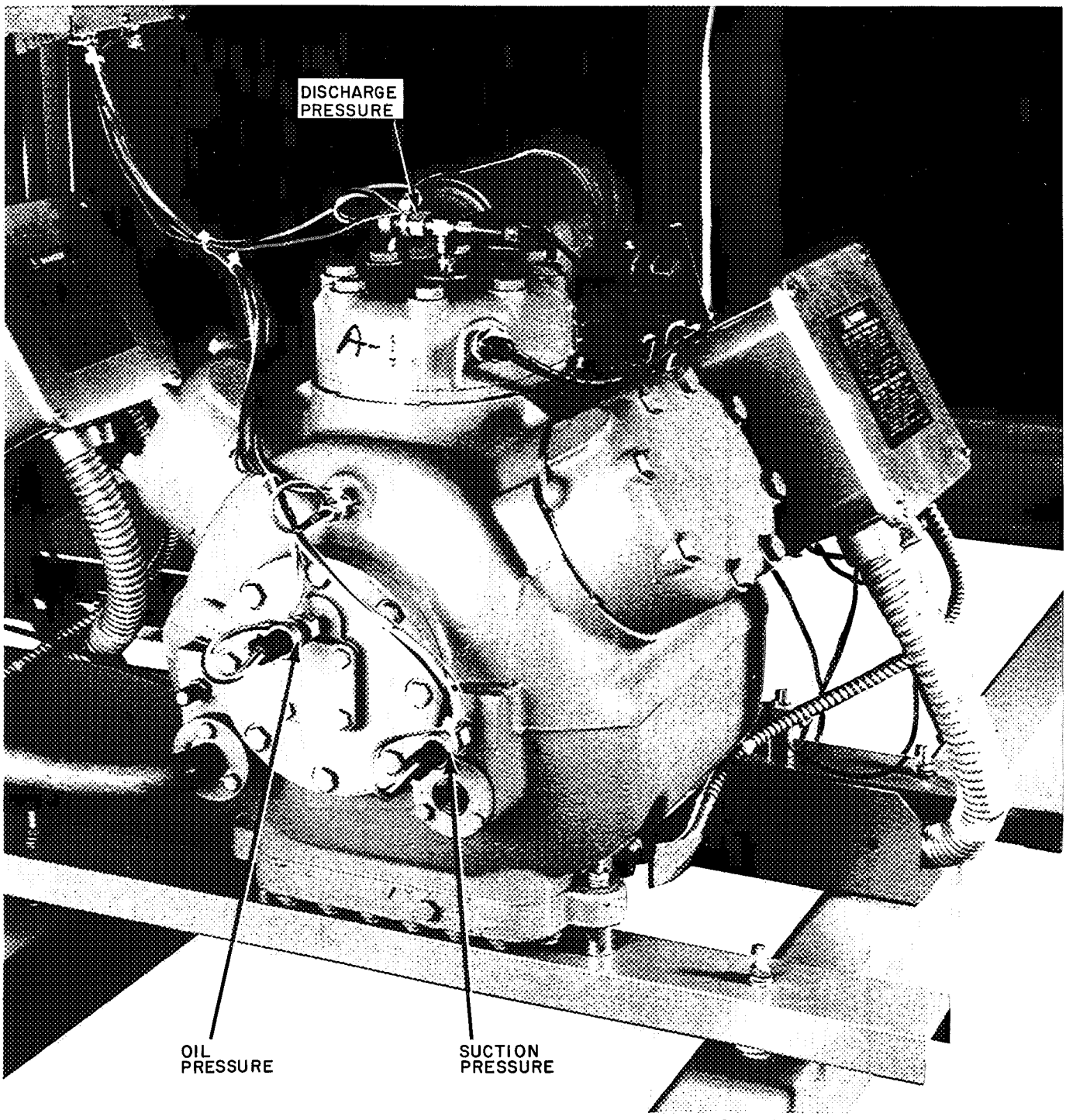



**Fig. 16 — Lead Compressor Transducer Locations (3)**

TROUBLESHOOTING — If transducer is suspected of being faulty, first check supply voltage to transducer. Supply voltage should be 5 vdc ± .2 v. If supply voltage is correct, compare pressure reading displayed on keyboard and display module against pressure shown on a calibrated pressure gage. If the two pressure readings are not reasonably close, replace pressure transducer.

TRANSDUCER REPLACEMENT

**⚠ CAUTION**

Transducers are installed directly in the refrigerant circuit. Relieve all refrigerant pressure before removing.

After relieving refrigerant pressure, disconnect transducer wiring at transducer by pulling up on locking tab while pulling weathertight connection plug from end of transducer. **Do not pull on transducer wires.** Unscrew transducer from ¼-in. male flare fitting. When installing new pressure transducer, do not use thread sealer. Thread sealer can plug transducer and render it inoperative. Insert weathertight wiring plug into end of transducer until locking tab snaps in place. Check for refrigerant leaks.

## Control Modules

**⚠ CAUTION**

Turn controller power off before servicing controls. This ensures safety and prevents damage to controller.

PROCESSOR MODULE (PSIO), OPTIONS MODULE (SIO), LOW-VOLTAGE RELAY MODULE (DSIO), AND EXV DRIVER MODULE (DSIO) — The PSIO, DSIO and SIO modules all perform continuous diagnostic evaluations of the condition of the hardware. Proper operation of these modules is indicated by LEDs (light emitting diodes) on the front surface of the DSIOs, and on the top horizontal surface of the PSIO.

RED LED — Blinking continuously at a 3 to 5-second rate indicates proper operation. Lighted continuously indicates a problem requiring replacement of module. Off continuously indicates power should be checked. If there is no input power, check fuses. If fuse is bad, check for shorted secondary of transformer, or for bad module.

GREEN LED — On a PSIO and SIO, this is the green LED closest to COMM connectors. The other green LED on module indicates external communications, when used. Green LED should always be blinking when power is on. It indicates modules are communicating properly. If green LED is not blinking, check red LED. If red LED is normal, check module address switches. See Fig. 17. Proper addresses are:

PSIO (Processor Module) — 01 (different when CCN connected)
DSIO (Relay Module) — 19
DSIO (EXV Driver Module) — 31
SIO (Options Module) — 59

If *all* modules indicate communication failure, check COMM plug on PSIO module for proper seating. If a good connection is assured and condition persists, replace PSIO module.

If only DSIO or SIO module indicates communication failure, check COMM plug on that mode for proper seating. If a good connection is assured and condition persists, replace DSIO module.

All system operating intelligence rests in PSIO module (processor module), the module that controls unit. This module monitors conditions through input and output ports and through DSIO modules (low-voltage relay module and EXV driver module).

The machine operator communicates with microprocessor through keyboard and display module. Communication between PSIO and other modules is accomplished by a 3-wire sensor bus. These 3 wires run in parallel from module to module.

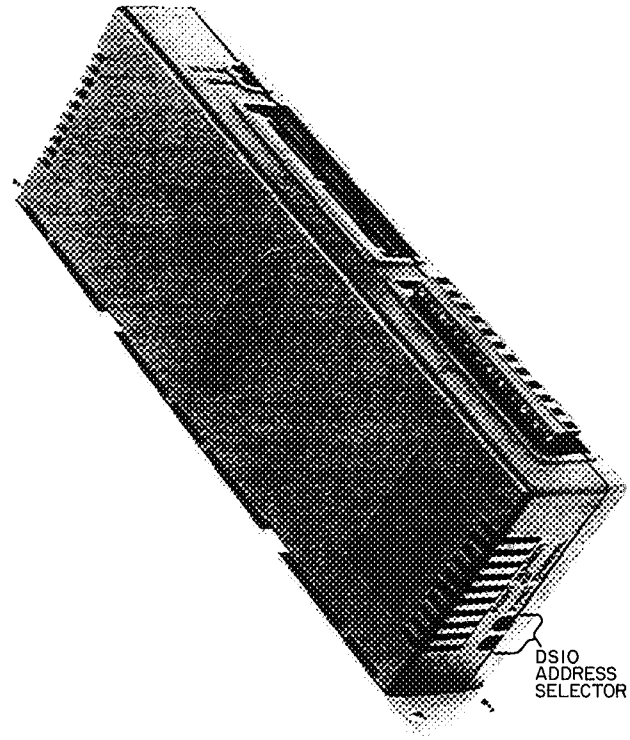



**Fig. 17 — Module Address Selector Switch Locations**

On sensor bus terminal strips, terminal 1 of PSIO module is connected to terminal 1 of each of the other modules. Terminals 2 and 3 are connected in the same manner. See Fig. 18. If a terminal 2 wire is connected to terminal 1, system does not work.

In Flotronic™ II Chillers, processor module, low-voltage relay module, and keyboard and display module are all powered from a common 21-vac power source which connects to terminals 1 and 2 of power input strip on each module. A

separate source of 21-vac power is used to power options module through terminals 1 and 2 on power input strip. A separate source of 12.5 vac power is used to power EXV driver module through terminals 1 and 2 on power input strip.

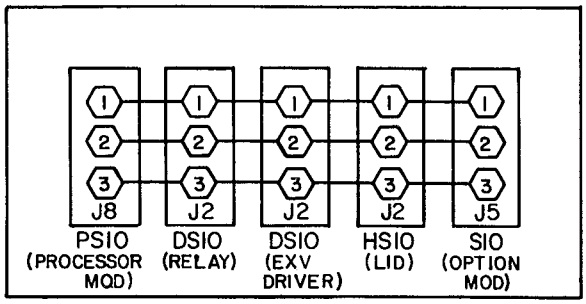



**Fig. 18 — Sensor Bus Wiring (Communications)**

PROCESSOR MODULE (PSIO) (Fig. 19)

Inputs — Each input channel has 3 terminals; only 2 of the terminals are used. Application of machine determines which terminals are used. Always refer to individual unit wiring for terminal numbers.

Outputs — Output is 24 vdc. There are 3 terminals, only 2 of which are used, depending on application. Refer to unit wiring diagram.

**NOTE:** Address switches (see Fig. 18) must be set at 01.

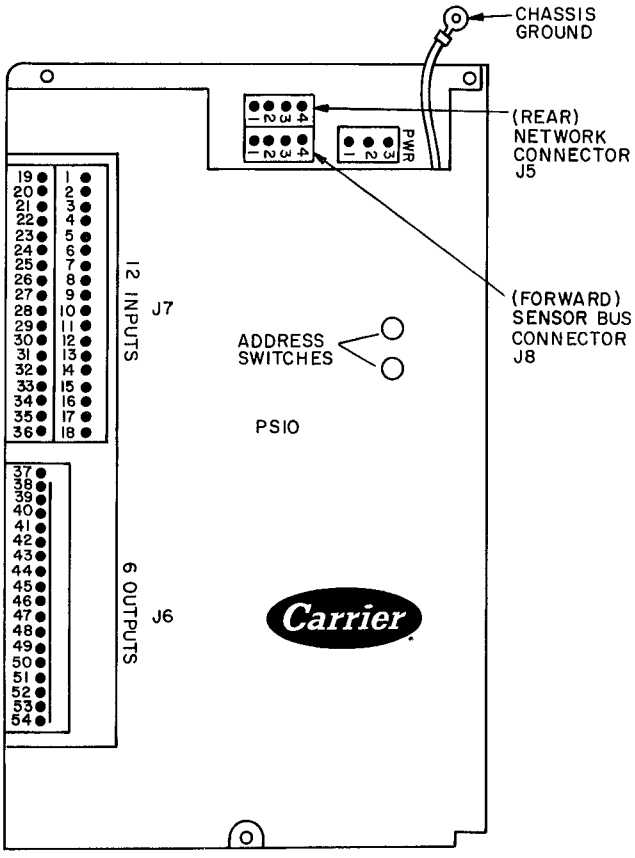



**Fig. 19 — Processor Module (PSIO)**

LOW VOLTAGE RELAY MODULE (DSIO) (Fig. 20)

Inputs — Inputs on strip J3 are discrete inputs (ON/OFF). When 24-vac are applied across the 2 terminals in a channel it reads as on ON signal. Zero volts read as an OFF signal.

Outputs — Terminal strips J4 and J5 are internal relays whose coils are powered-up and powered-off by a signal from microprocessor. The relays switch the circuit to which they are connected. No power is supplied to these connections by DSIO module.

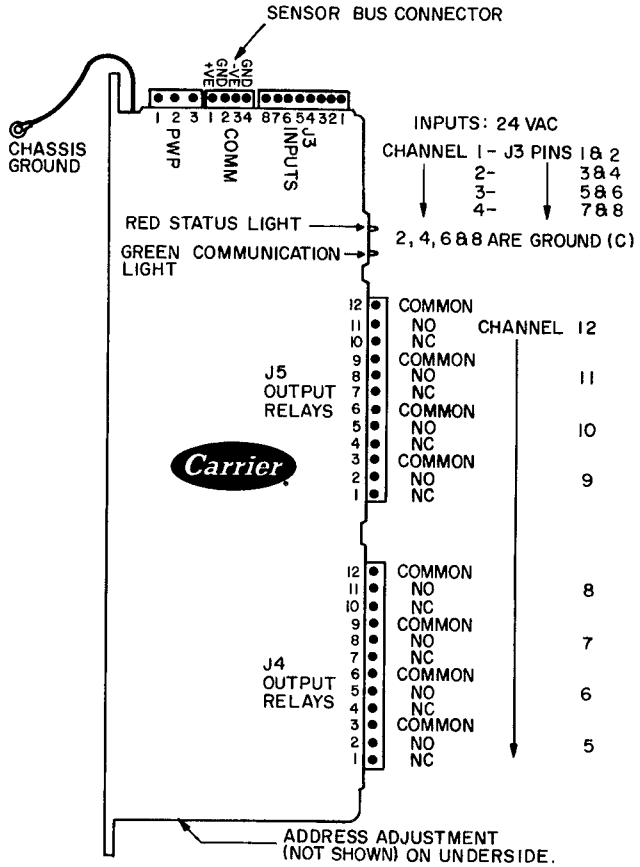



**Fig. 20 — Low Voltage Relay Module (DSIO)**

OPTIONS MODULE (SIO) (Fig. 21) — Options module allows the following features to be utilized:

1. Temperature Reset by outdoor air or space temperature. A remote thermistor (Part No. 30GB660002) is also required.

   NOTE: This accessory is *not* required for return water temperature reset.
2. Temperature Reset by remote 4-20 mA signal.
3. Demand Limit by remote 2-stage switch.
4. Demand Limit by remote 4-20 mA signal
5. Dual Set Point by remote switch.
6. Accessory Compressor Unloaders

Convenient terminal block connections are provided within chiller control box when using these features. See Field Wiring section of this guide, Fig. 22-32.

The options module is standard on 30GB040-200 chillers. On 30GT225-280 chillers it is an accessory and must be field installed (Part No. 30GT910076). For installation, refer to instructions supplied with the accessory package.

Remember to reconfigure the chiller for each feature selected (see Adjustable Field Configurations, page 32). For temperature reset, demand limit and dual set point, desired set points must be entered through keyboard and display module (see Set Point Function section of this guide).

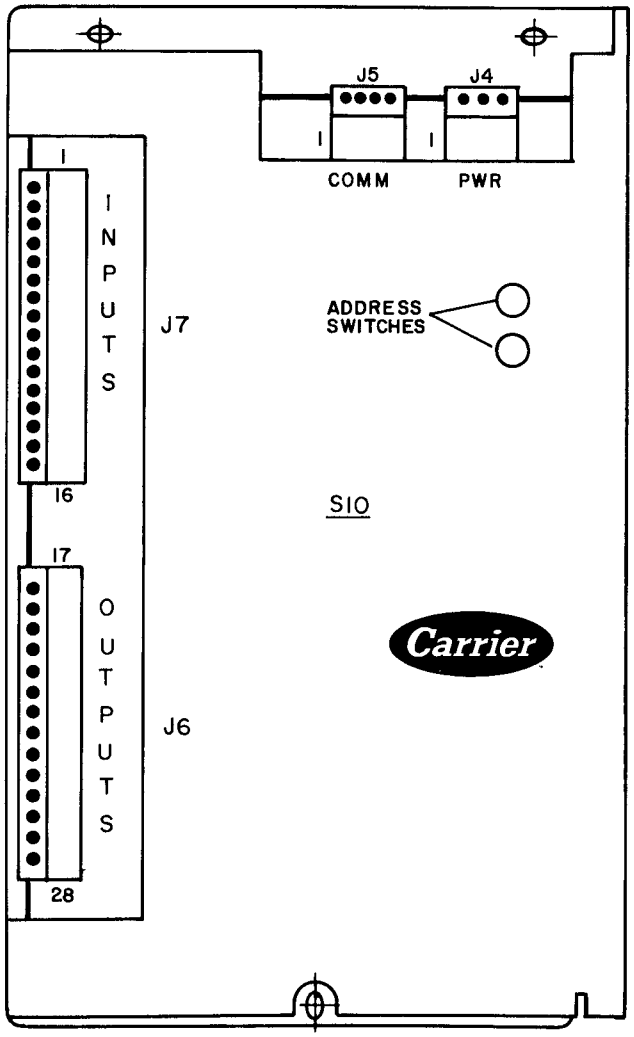



**Fig. 21 – Options Module (SIO)**

## TROUBLESHOOTING

| SYMPTOMS | CAUSE | REMEDY |
|---|---|---|
| **COMPRESSOR DOES NOT RUN** | Power line open | Reset circuit breaker. |
| | Control fuse open | Check control circuit for ground or short Replace fuse. |
| | Safety thermostat tripped (DGT) or High Pressure Switch (HPS) tripped | Move RUN/STOP/CCN switch to STOP then back to RUN or CCN. |
| | Tripped power breaker | Check the controls. Find cause of trip and reset breaker. |
| | Loose terminal connection | Check connections |
| | Improperly wired controls | Check wiring and rewire. |
| | Low line voltage | Check line voltage. Determine location of voltage drop and remedy deficiency. |
| | Compressor motor defective | Check motor winding for open or short. Replace compressor if necessary. |
| | Seized compressor | Replace compressor. |
| **COMPRESSOR CYCLES OFF ON LOW PRESSURE** | Loss of charge | Repair leak, recharge. |
| | Bad transducer | Replace transducer. |
| | Low refrigerant charge | Add refrigerant. |
| **COMPRESSOR SHUTS DOWN ON HIGH PRESSURE CONTROL** | High-pressure control erratic in action | Replace control. |
| | Compressor discharge valve partially closed | Open valve or replace if defective. |
| | Condenser fan(s) not operating | Check wiring. Repair or replace motor(s) if defective. |
| **UNIT OPERATES LONG OR CONTINUOUSLY** | Low refrigerant charge | Add refrigerant. |
| | Control contacts fused | Replace control. |
| | Partially plugged or plugged expansion valve or filter driver | Clean or replace. |
| | Defective insulation | Replace or repair. |
| | Service load | Keep doors and windows closed. |
| | Inefficient compressor | Check valves. Replace if necessary. |
| **SYSTEM NOISES** | Piping vibration | Support piping as required |
| | Expansion valve hissing | Add refrigerant. Check for plugged liquid line filter drier. |
| | Compressor noisy | Check valve plates for valve noise. Replace compressor (worn bearings). Check for loose compressor hold-down bolts. |
| **COMPRESSOR LOSES OIL** | Leak in system | Repair leak. |
| | Mechanical damage (blown piston or broken discharge valve) | Repair damage or replace compressor. |
| | Oil trapped in line | Check piping for oil traps. |
| | Crankcase heaters not energized during shutdown | Replace heaters, check wiring and crankcase heater relay contacts. |
| **FROSTED SUCTION LINE** | Expansion valve admitting excess refrigerant | Check cooler and compressor thermistors. Test EXV. |
| **HOT LIQUID LINE** | Shortage of refrigerant due to leak | Repair leak and recharge. |
| **FROSTED LIQUID LINE** | Shutoff valve partially closed or restricted | Open valve or remove restriction |
| **COMPRESSOR DOES NOT UNLOAD** | Burned out coil | Replace coil. |
| | Defective capacity control valve | Replace valve. |
| | Miswired solenoid | Rewire correctly. |
| | Weak, broken or wrong valve body spring | Replace spring |
| **COMPRESSOR DOES NOT LOAD** | Miswired solenoid | Rewire corrected. |
| | Defective capacity control valve | Replace valve. |
| | Plugged strainer (high side) | Clean or replace strainer. |
| | Stuck or damaged unloader piston or piston ring(s) | Clean or replace the necessary parts. |

## ACCESSORY UNLOADER INSTALLATION

Units 30GB090-200 do not provide unloaders as a standard offering. Units 30GB040-080 provide one unloader. It is possible to add one additional unloader to 30GB040-080, and one or 2 unloaders to 30GB090-150. One or 2 unloaders can also be added to 30GT225-280. Unloaders cannot be used on 30GB175, 200

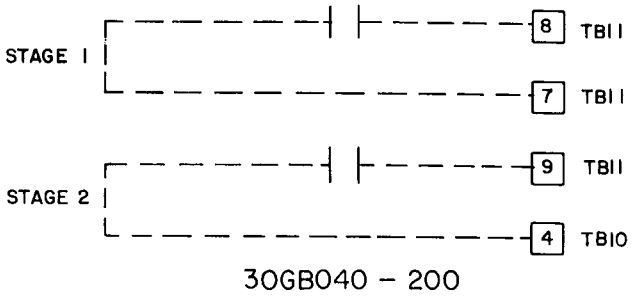
If unloaders are desired, an accessory unloader package is used. Package includes a suction cutoff unloader head package. In addition for 30GB units, a 24-v unloader coil should be ordered. The 115-v coil in unloader package can be used with 30GT units. Consult current Carrier price pages for appropriate part numbers.

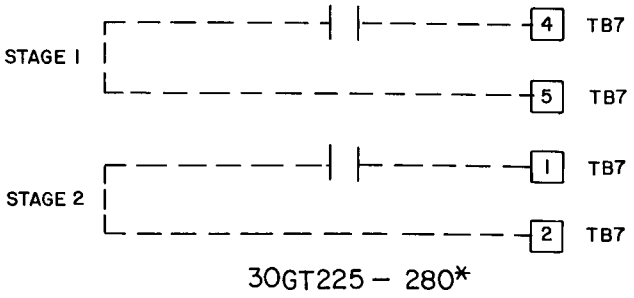
In order to apply accessory unloaders to 30GT chillers, accessory options module package (Part No. 30GT910076) must be used. All additional components and wiring required are included in this accessory package along with detailed instructions.

The first unloader must always be connected to lead compressor in circuit A and second unloader must be connected to lead compressor in circuit B. Use the following procedure to installer unloaders:

1. Using Test function, pump refrigerant charge for circuit affected into condenser.
2. Valve off all compressors in circuit and relieve pressure in circuit. Install unloader head using standard 06E compressor service procedures. Only suction cutoff unloaders can be used with Flotronic™ II control.
3. Evacuate compressor and bleed refrigerant into compressor. Check for leaks.
4. To simplify installation, unit has been prewired at factory. Two wires have been run to lead compressor junction box. For 30GB chillers, circuit A, connect unloader coil to pink wires in junction box of lead compressor. For 30GT chillers, circuit A, connect unloader coil to gray wires in junction box of lead compressors. In circuit B, 30GB and 30GT chillers, connect second unloader (if used) to gray wires in junction box of lead compressor.
5. Reconfigure chiller for correct number of unloaders in circuit A and circuit B. See the Adjustable Field Configurations section in this guide.
6. Before starting unit, check operation of unit and unloaders, using the Test function.
7 Start unit and confirm chiller operates properly.

## FIELD WIRING

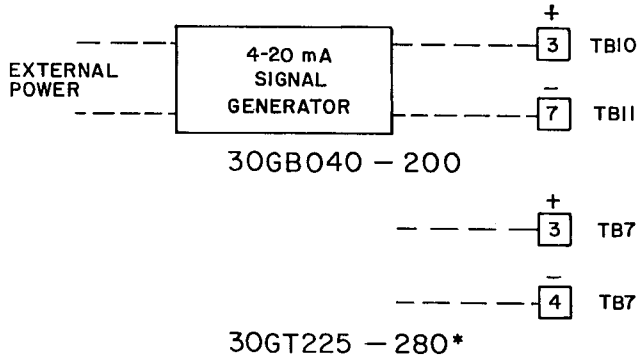



*Require accessory options module package.

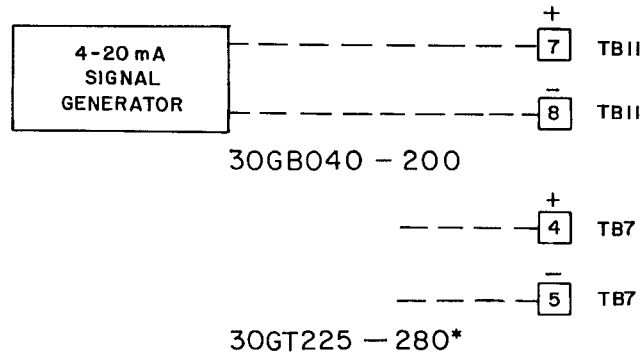
NOTE· Contacts must be rated for dry circuit application, capable of reliably switching a 5vdc, 1 mA to 20 mA load.

**Fig. 22 – Demand Limit – Two External Switch Inputs**



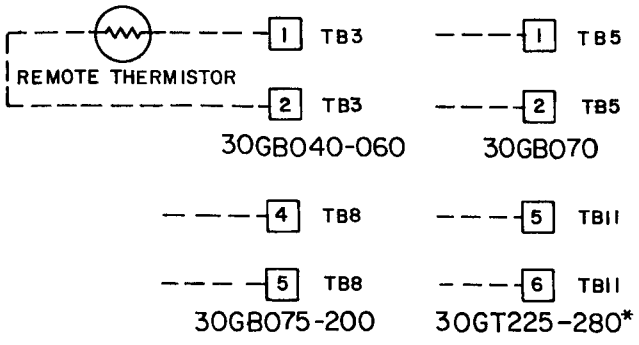

*Require accessory options module package.

**Fig. 23 – Demand Limit – 4-20 mA Signal (Externally Powered)**



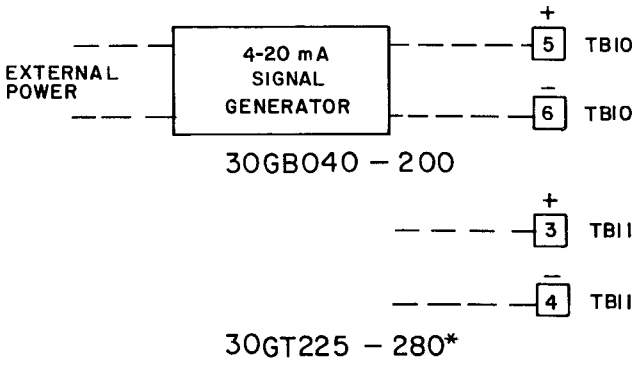

*Require accessory options module package

**Fig. 24 – Demand Limit – 4-20 mA Signal (Internally Powered)**



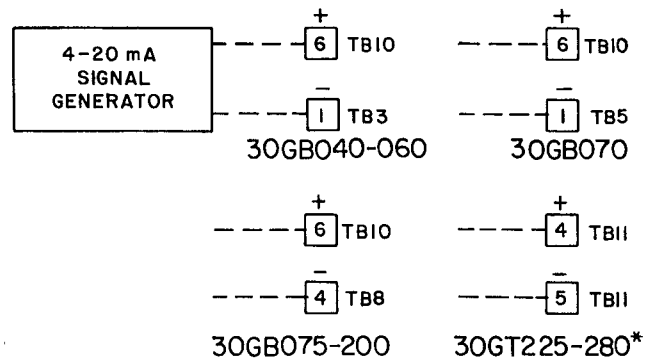

*Require accessory options module package.

**Fig. 25 – Remote Reset from Space or Outside Air Temperature**



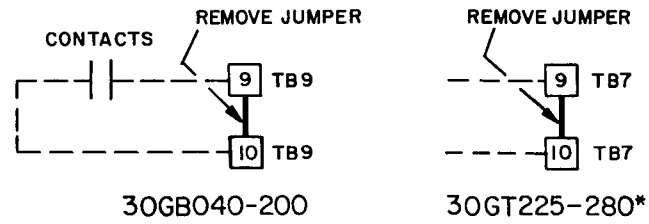

*Require accessory options module package.

**Fig. 26 – Remote Reset from 4-20 mA Signal (Externally Powered)**



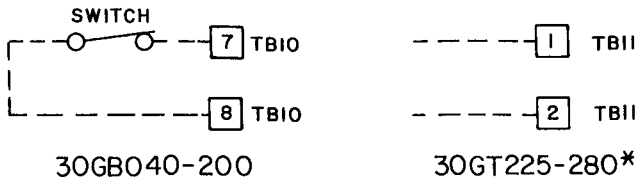

*Require accessory options module package.

**Fig. 27 – Remote Reset from 4-20 mA Signal (Internally Powered)**



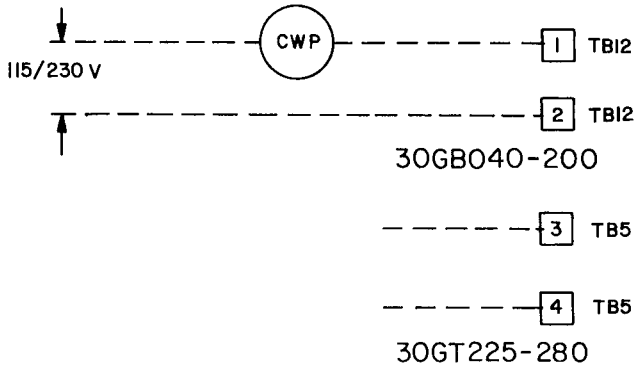

NOTE: Contacts must be rated for dry circuit application, capable of reliably switching a 5 vdc, 1 mA to 20 mA load.

**Fig. 28 – Remote On/Off**



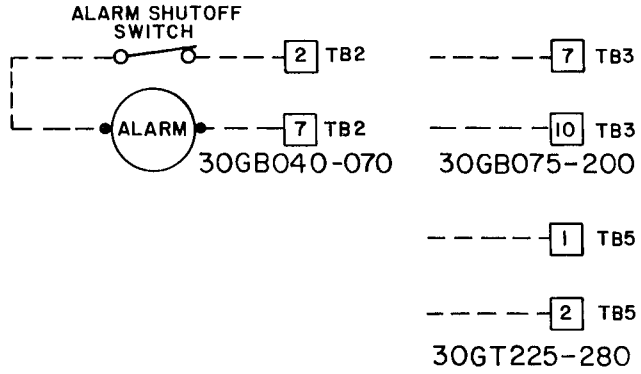

*Require accessory options module package.

**Fig. 29 – Remote Dual Set Point Control**



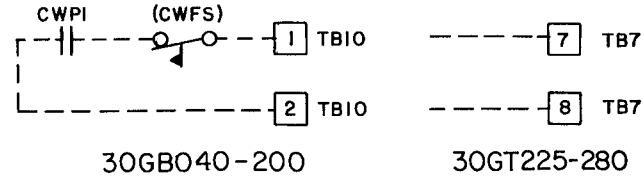

NOTE: The maximum load allowed for the chilled water pump circuit is 125 va sealed, 1250 va inrush at 115 or 230 volts

**Fig. 30 – Chilled Water Pump**




NOTE: The maximum load allowed for the alarm circuit is 125 va sealed, 1250 va inrush at 115 or 230 volts

**Fig. 31 – Remote Alarm**




**CWP1** – Chilled Water Pump Interlock
**CWFS** – Chilled Water Flow Switch (not required – low flow protection is provided by Flotronic™ II controls)

NOTE: Contacts must be rated for dry circuit application, capable of reliably switching a 5 vdc, 1 mA to 20 mA load.

**Fig. 32 – Interlocks**

## REPLACING DEFECTIVE PROCESSOR MODULE

The replacement part number is printed on a small label on front of the PSIO module. The model and serial numbers are printed on the unit nameplate located on an exterior corner post. The proper software and unit configuration data is factory installed by Carrier in the replacement module. Therefore, when ordering a replacement processor module (PSIO), specify complete replacement part number, *full* unit model number, and serial number. If these numbers are not provided, the replacement module order is configured instead as a generic Flotronic™ II replacement module. This requires reconfiguration of the order by the installer.

**⚠ CAUTION**

Electrical shock can cause personal injury. Disconnect all electrical power before servicing.

### Installation

1. Verify the existing PSIO module is defective, by using the procedure described in Troubleshooting section, Control Modules.
2. Refer to Start-Up Checklist for Flotronic™ II Chiller Systems (completed at time of original start-up) found in job folder. This information is needed later in this procedure. If checklist does not exist, fill out the [4] [SERVICE] and [5] [SERVICE] configuration code sections on a new checklist. Tailor the various options and configurations as needed for this particular installation.
3. Check that all power to unit is off. Carefully disconnect all wires from defective module by unplugging the six connectors. It is not necessary to remove any of the individual wires from the connectors. Remove the green ground wire.
4. Remove defective PSIO by removing its mounting screws with a Phillips screwdriver, and removing the module from the control box. Save the screws for later use.
5. Use a small screwdriver to set address switches S1 and S2 on the new PSIO module to exactly match the settings on the defective module.
6. Package the defective module in the carton of the new module for return to Carrier.
7. Mount the new module in the unit control box using a Phillips screwdriver and the screws saved in step 4 above.
8. Reinstall all 6 wire connectors and the green ground wire.
9. Carefully check all wiring connections before restoring power.
10. Verify the LOCAL/STOP/CCN switch is in STOP position.
11. Restore control power. Verify the red and green lights on top of PSIO and front of each DSIO module respond as described in Troubleshooting section, Control Modules. The keyboard and display module (HSIO or LID) should also begin its rotating display.
12. Using the keyboard and display module in [2] [SERVICE], verify the software version number matches the ER number shown on the PSIO label.
13. In [3] [SERVICE], verify that the 6 Factory Configuration Codes (CODE 1 through CODE 6) exactly match the codes listed for this unit model on the component arrangement label on the control box door. If they are different or are all zeros, reenter the 6 codes. If any changes are required, the PSIO display becomes blank and reconfigures itself after pressing the [ENTER] key while displaying CODE 6. The display returns in approximately 15 seconds.
14. In [4] [SERVICE], verify each item is configured as needed for this particular installation. Table 8 shows the factory configuration code default settings. Table 8 also shows the service replacement code default settings which are used if no model number was specified when ordering the replacement PSIO module It is strongly suggested that the Start-Up Checklist for Flotronic™ II Chiller Systems (completed at time of original start-up) be used at this time to verify and/or reprogram the various options and configurations required for this job.
15. After completing the configuration steps outlined above, restore main power and perform a unit test as described in [1] [TEST] and [2] [TEST] section of this book.
16. Complete this procedure and restore chiller to normal operation by returning the LOCAL/STOP/CCN switch to desired position.

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