



30GT080-110 Flotronic™ Reciprocating Liquid Chillers

Installation, Start-Up and Service Instructions

50 and 60 Hz

CONTENTS

	Page
SAFETY CONSIDERATIONS	1
INTRODUCTION	1
INSTALLATION	2-15
Step 1 — Rig and Place the Unit	2
Step 2 — Check Compressor Mounting	2
Step 3 — Check Water and Drain Piping Connections	2
• PREPARATION FOR YEAR-ROUND OPERATION	
• PREPARATION FOR WINTER SHUTDOWN	
Step 4 — Make Electrical Connections	2
• FIELD POWER CONNECTIONS	
• FIELD CONTROL POWER CONNECTIONS	
Step 5 — Install Accessories	11
• ELECTRICAL	
• LOW-AMBIENT OPERATION	
• HOT GAS BYPASS	
• MISCELLANEOUS ACCESSORIES	
PRE-START-UP	16-22
System Check (Steps 1 - 10)	16
Quick Test (Step 11)	16-21
START-UP AND OPERATION	22-24
Digital Display Action	22
Actual Start-Up	22
Operating Limitations	22
Operation Sequence	23
Start-Up Checklist	4 Page Insert, CL-1 - CL-4
SERVICE	25-35
Diagnostics and Troubleshooting	25
Refrigerant Circuit	25
Electronic Components	25
Compressors	26
Cooler	26
Condenser Coils	29
Condenser Fans	29
Refrigerant Feed Components	29
Thermistors	31
Safety Devices	32
Relief Devices	33
Other Safeties	33

IMPORTANT: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with these instructions may cause radio interference. It has been tested and found to comply with the limits of a Class A computing device as defined by FCC regulations, Subpart J of Part 15, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

SAFETY CONSIDERATIONS

Installing, starting up, and servicing this equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start-up, and service this equipment.

Untrained personnel can perform basic maintenance functions, such as cleaning coils. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature, and on tags, stickers and labels attached to the equipment.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging and setting bulky equipment.



ELECTRIC SHOCK HAZARD.

Open all remote disconnects before servicing this equipment.

INTRODUCTION

These instructions cover installation, start-up and service of 30GT080-110 Flotronic liquid chillers with electronic controls and units with factory-installed options (FIOP).

Chillers are equipped with electronic expansion valves and FIOP units have the conventional thermostatic expansion valves and liquid line solenoid valves. Differences in Quick Test procedures and operation sequence should be carefully noted when following these instructions.

Inspect the unit upon arrival for damage. If damage is found, file a claim right away with the shipping company. When considering location for the unit, be sure to consult National Electrical Code (NEC, U.S.A.) and local code requirements. Allow sufficient space for airflow, wiring, piping, and service. See Fig. 1, 2, and 3. Be sure surface beneath the unit is level, and capable of supporting the operating weight of the unit. See Tables 1 - 5.

INSTALLATION

Step 1 — Rig and Place the Unit — These units are designed for overhead rigging and *it is important that this method be used*. Holes are provided in frame base channels, marked for rigging (see rigging label on unit). It is recommended that field-supplied 2-in. pipes be passed through these holes, extending beyond frame enough to attach cables or chains on both sides. Use spreader bars to keep cables or chains clear of unit sides. As further protection for the coil faces, plywood sheets may be placed against sides of unit, behind cables or chains. Run cables or chains to a central suspension point so that angle from horizontal is not less than 45 degrees. Raise and set unit down carefully. See Table 1 for centers of gravity.

⚠ CAUTION

Do not use forklift on these units.

For shipping, some domestic units and all export units are mounted on wooden skid under entire base of unit. Skid can be removed before unit is moved to installation site. *Lift the unit from above to remove skid*. See Table 1 for centers of gravity. On export units, the top skid can be used as the spreader bars. If the unit is shipped with coil protection, it must be removed before start-up. The shipping bag for export units must be removed before start-up. On export units with a full crate, the crate sides must be removed to aid in rigging.

If overhead rigging is not available, the unit can be moved on rollers or dragged. When unit is moved on rollers, the unit skid, if equipped, must be removed. To lift the unit, use jacks at the rigging points. Use a minimum of 3 rollers to distribute the load. If the unit is to be dragged, lift the unit as described above, and place unit on a pad. *Apply moving force to the pad, and not the unit*. When in its final location, raise the unit and remove the pad. Then level the unit to ensure proper oil equalization between compressors, and bolt unit at positions shown in Fig. 1, 2, and 3.

Step 2 — Check Compressor Mounting —

Compressors are mounted on rails. Each rail is mounted on springs, one at each end, and one between the two compressors, when applicable. For shipping, the rails are secured to the frame base at each support. Before start-up, loosen the hold-down bolts so that the compressor rails float freely. See Fig. 4 and 5 for views of compressor mounting.

Step 3 — Cooler Water and Drain Piping Connections —

When facing cooler-side of unit, inlet (return) water connection is on the right, nearest the control box. Outlet (supply) water connection is on the left. The cooler has water-side Victaulic-type connections (follow con-

nection directions as provided by the coupling manufacturer). If accessory grilles have been added, holes must be cut in grilles for field piping and insulation.

Although cooler has an air vent, it is recommended that field-supplied air vents be installed in system to facilitate servicing. Field-supplied shut-off valves should also be installed to facilitate servicing and flow balancing. Locate valves in return and supply cooler water lines as close to the chiller as possible. Locate air vents at highest point of the cooler water system.

Upon completion of the field piping installation, in areas where the piping is exposed to 32 F (0° C) or below ambient temperatures, freeze-up protection is recommended using ethylene glycol or electric heater tapes. Heat tapes should have a rating for area ambient temperatures, and be covered with a suitable thickness of closed-cell insulation. Route power for the heater tapes from a separate fused disconnect. Mount the disconnect within a line of sight as prescribed by local or NEC codes. Identify disconnect as heater tape power source, with warning that power must not be turned off except when servicing the unit.

IMPORTANT: Before starting unit, be sure all of the air has been purged from the system.

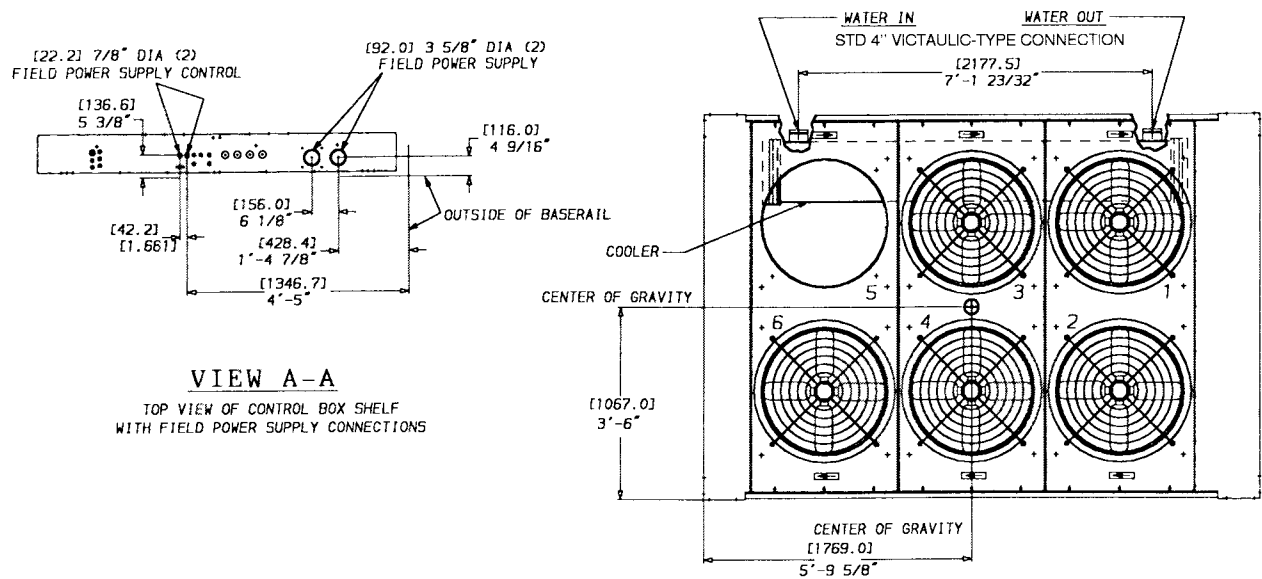
A drain connection is located at leaving (supply)-water end of cooler. See Fig. 1, 2, and 3.

PREPARATION FOR YEAR-ROUND OPERATION — If unit is to operate all year round, add sufficient ethylene glycol to the cooler water to prevent freeze-up under cold operating conditions. Consult local water authority on characteristics of area water, and a recommended inhibitor for the cooler water loop.

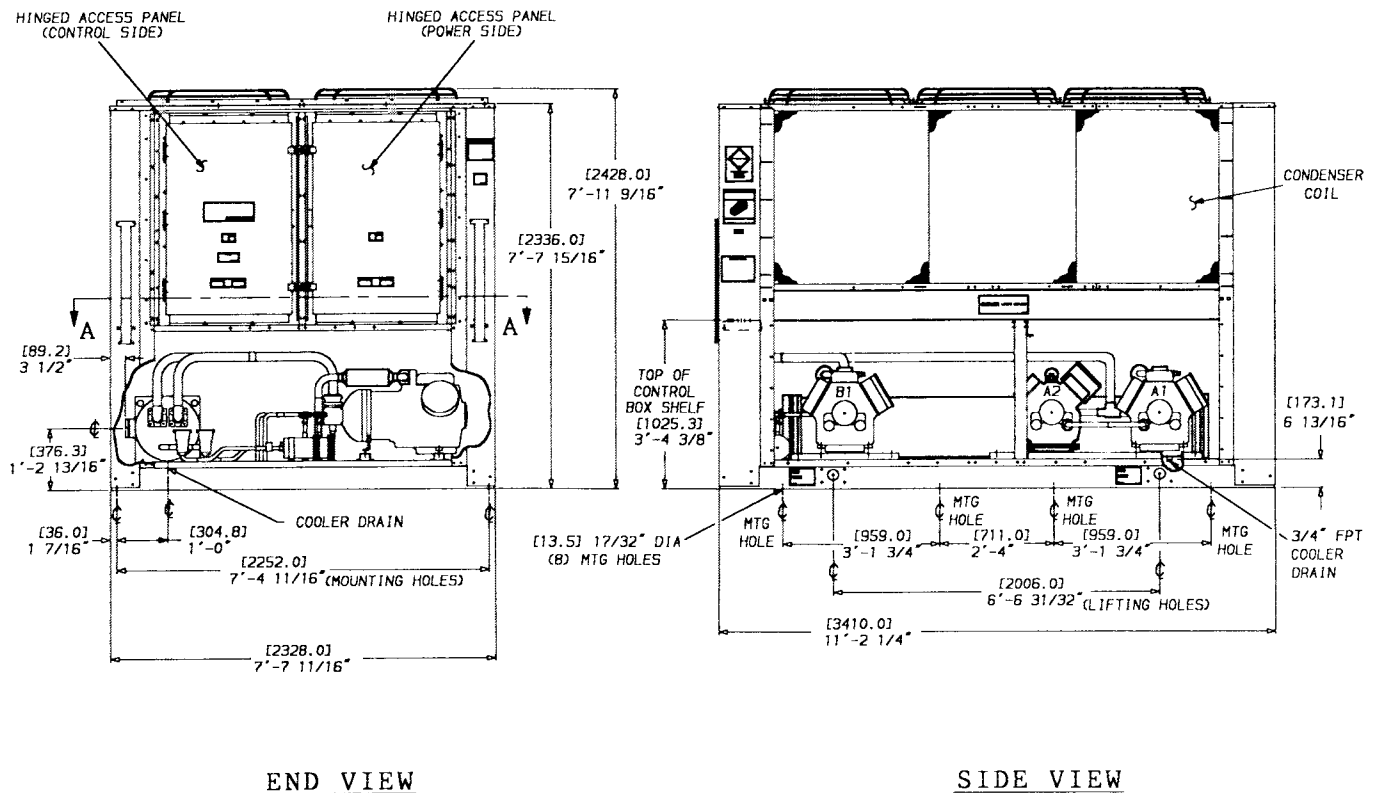
PREPARATION FOR WINTER SHUTDOWN — *Do not shut off control power disconnect during off-season shutdown.*

At end of cooling season, drain the water from the system. Replace the drain plug and add 2 gallons (8 liters) of ethylene glycol to the cooler to prevent freezing of any remaining water in system. Glycol can be added through the vent on top of cooler. Open one of the thermistor connections to allow air to escape the vessel, and the glycol to enter. At the beginning of the next cooling season, refill cooler and add recommended inhibitor.

Step 4 — Make Electrical Connections — The electrical characteristics of the available power supply must agree with the unit nameplate rating. Supply voltage must be within the limits shown. The control box is divided into field power side on the right, and control power supply on the left.



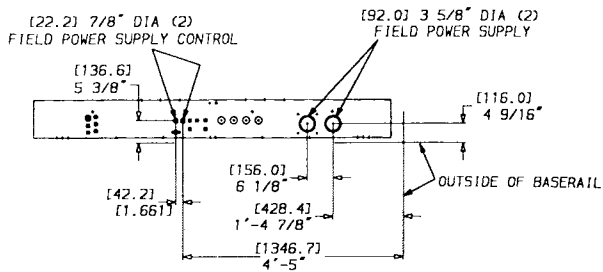
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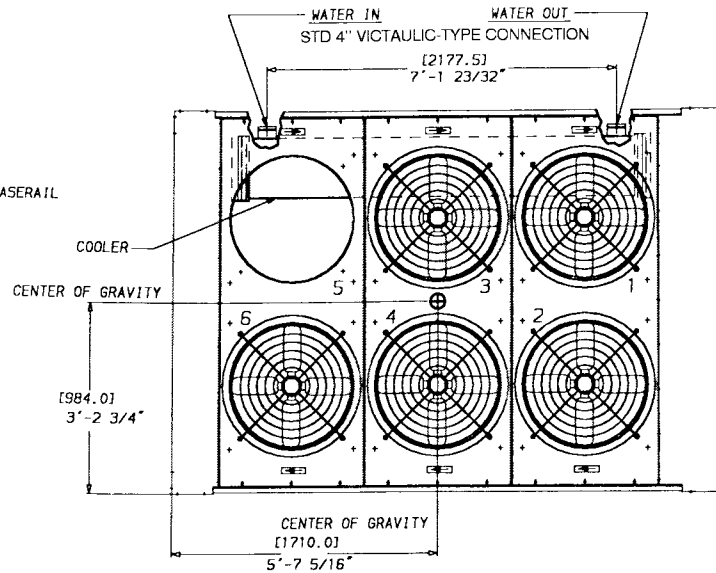
NOTES:

- Unit must have clearances for airflow as follows:
TOP — Do not restrict in any way
ENDS — 5 ft [1524 mm]
SIDES — 6 ft [1829 mm]
- Dimensions in [] are millimeters.

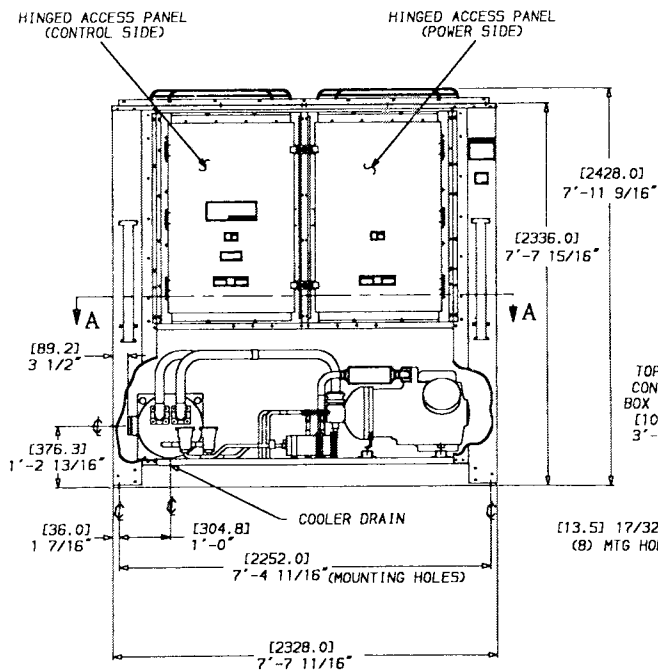
Fig. 1 — Dimensions; 30GT080



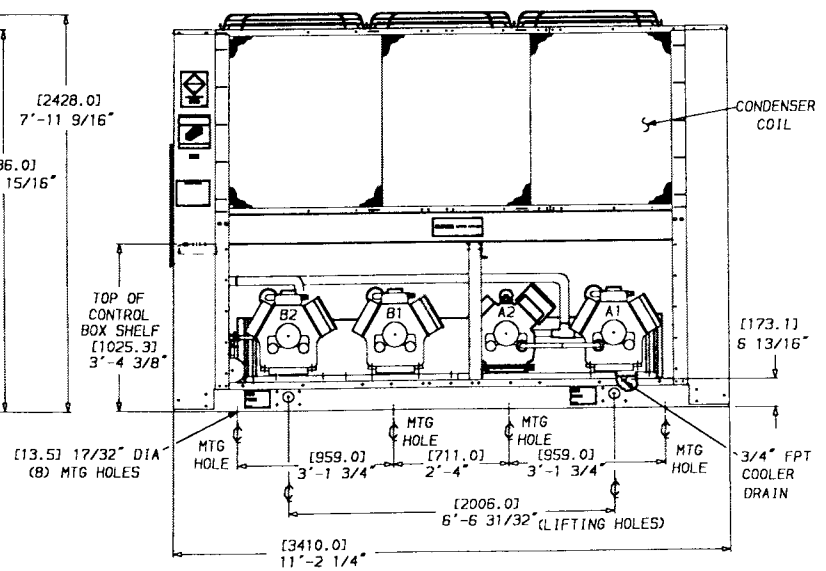
VIEW A-A
TOP VIEW OF CONTROL BOX SHELF
WITH FIELD POWER SUPPLY CONNECTIONS



TOP VIEW



END VIEW

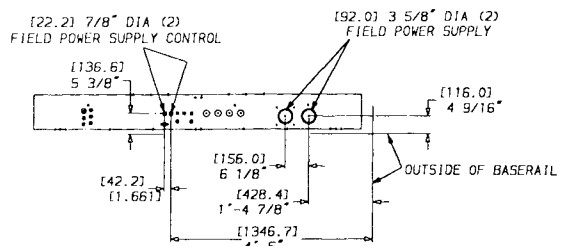


SIDE VIEW

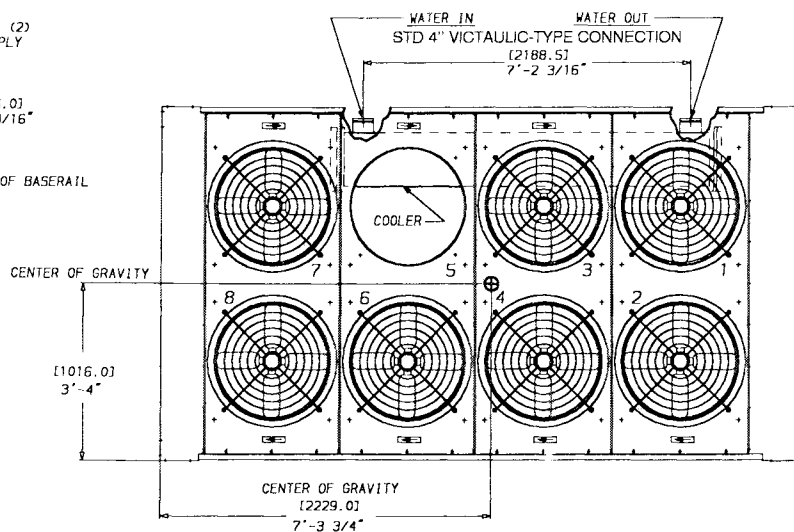
NOTES:

1. Unit must have clearances for airflow as follows:
TOP — Do not restrict in any way
ENDS — 5 ft [1524 mm]
SIDES — 6 ft [1829 mm]
2. Dimensions in [] are millimeters.

Fig. 2 — Dimensions; 30GT090

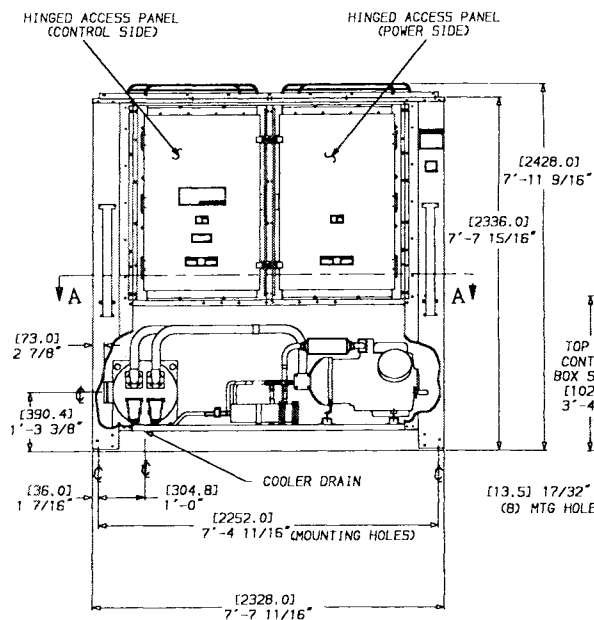


VIEW A-A
TOP VIEW OF CONTROL BOX SHELF
WITH FIELD POWER SUPPLY CONNECTIONS

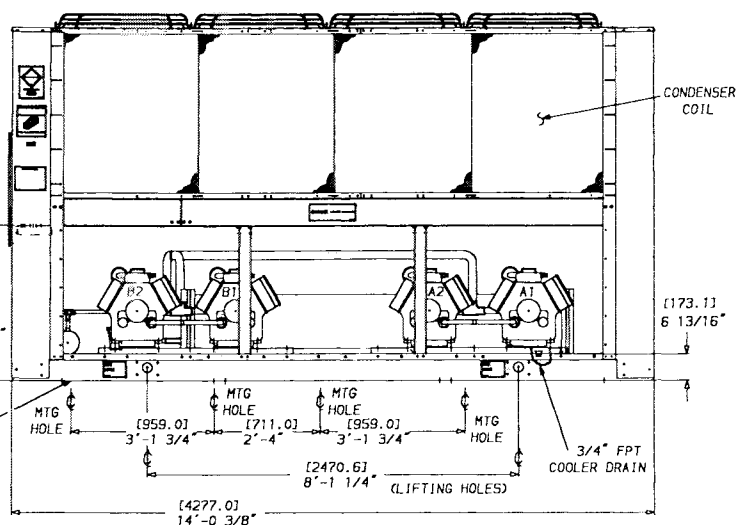


TOP VIEW

C 30-386



END VIEW



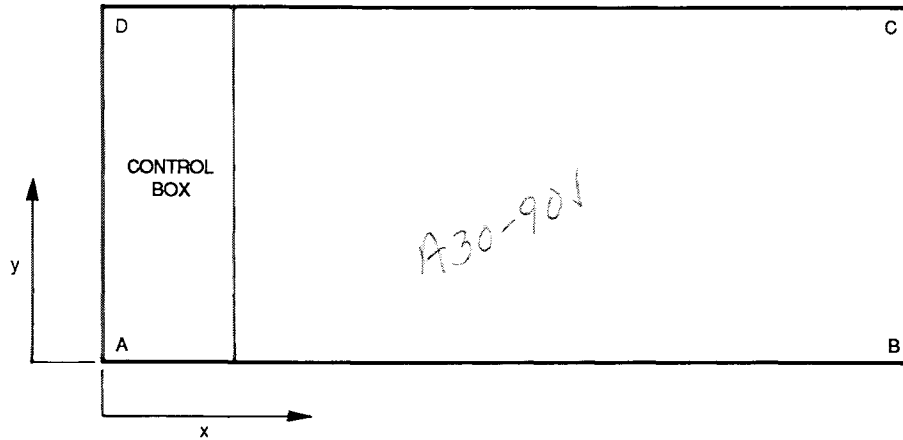
SIDE VIEW

NOTES:

- Unit must have clearances for airflow as follows:
TOP — Do not restrict in any way
ENDS — 5 ft [1524 mm]
SIDES — 6 ft [1829 mm]
- Dimensions in [] are millimeters.

Fig. 3 — Dimensions; 30GT100, 110

Table 1 – Mounting Weights (Approximate)



60 HZ

UNIT SIZE	CONDENSER COIL	lb				kg			
		A	B	C	D	A	B	C	D
080	C-AL	1624	1690	1666	1650	738	768	757	750
	C-C	1797	1880	1847	1831	817	854	840	832
090	C-AL	1817	1793	1720	1685	826	815	782	766
	C-C	1997	1970	1893	1880	908	895	860	855
100	C-AL	2185	2185	2120	2120	993	993	964	964
	C-C	2420	2420	2360	2360	1100	1100	1073	1073
110	C-AL	2191	2217	2136	2116	996	1007	970	962
	C-C	2428	2454	2374	2354	1104	1115	1079	1070

50 HZ

UNIT SIZE	CONDENSER COIL	lb				kg			
		A	B	C	D	A	B	C	D
080	C-AL	1650	1730	1680	1660	750	786	764	755
	C-C	1830	1910	1863	1842	832	868	847	837
090	C-AL	1833	1864	1724	1714	833	847	784	779
	C-C	2014	2040	1907	1899	915	927	867	863
100	C-AL	2222	2222	2133	2133	1010	1010	970	970
	C-C	2460	2460	2370	2370	1118	1118	1077	1077
110	C-AL	2271	2271	2149	2149	1032	1032	976	976
	C-C	2508	2508	2387	2387	1140	1140	1085	1085

LEGEND

C-AL — Copper Tubing — Aluminum Fins
C-C — Copper Tubing — Copper Fins

RIGGING CENTER OF GRAVITY

UNIT SIZE	080		090		100		110	
	in.	mm	in.	mm	in.	mm	in.	mm
X Dimension	69 ⁹ / ₁₆	1768	67 ⁵ / ₁₆	1710	87 ⁵ / ₁₆	2218	87 ³ / ₄	2229
Y Dimension	42	1067	38 ³ / ₄	984	40	1016	39 ¹ / ₂	1002

Table 2 — Physical Data — 60 Hz, English

UNIT SIZE		080	090	100	110
APPROX OPERATING WEIGHT — lb	C-AL	6,630	7,015	8,610	8,660
	C-C	7,355	7,740	9,560	9,610
REFRIGERANT CHARGE — lb					
R-22	Ckt A	78/15	78/15	98/20	98/20
	Ckt B	78/15	78/15	105/20	105/20
Total/Over Clear Glass					
COMPRESSORS, Type...rpm		Reciprocating, Semi-Hermetic...1750			
06E*	(No.) Ckt A	(1) 6275, (1) A250	(1) 6265, (1) A250	(1) 6265, (1) F275	(1) 6265, (1) F299
	(No.) Ckt B	(1) 6299	(1) 6265, (1) F265	(1) 6265, (1) F275	(1) 6265, (1) F275
Oil Charge — Compressor/pt		06E250/17	06E265/21	06E275/21	06E299/19
Capacity Control Steps		6	8	8	8
% Cap.	Ckt A	56	47	50	54
	Ckt B	44	53	50	46
Minimum Step Capacity (%)		22	18	15	14
CONDENSER FANS — Type		Propeller, Direct Drive			
Fan Speed — rpm		1140	1140	1140	1140
No. Blades...Diameter — in.		4...30	4...30	4...30	4...30
No. Fans...Total kW		6...9.4	6...9.4	8...12.7	8...12.7
Total Airflow — cfm		57,000	57,000	76,000	76,000
CONDENSER COILS — Type		Vertical and Horizontal, Plate Fin, Enhanced Tubing			
Tubes (Copper), OD — in.		0.375	0.375	0.375	0.375
Fins/in.		17	17	17	17
No. Rows — Ckt A or B		3	3	3	3
Face Area sq ft — Ckt A and B Total		128.3	128.3	168	168
Max Working Pressure Refrigerant — psig		450			
COOLER — No. ...Type		1...Direct Expansion, Shell and Tube			
No. Refrigerant Circuits		2	2	2	2
Net Water Volume — Gal. (includes nozzles)		24.5	24.5	30.3	30.3
Max Working Pressure					
Refrigerant Side/Water Side — psig					
Standard Cooler		278/300			
Australian Code Cooler		207/150			
WATER CONNECTIONS — in.		Cooler Inlet and Outlet; Victaulic Type			
Inlet and Outlet		4	4	5	5
Drain		¾ NPT			

LEGEND

C-AL — Copper Tubing — Aluminum Fins Condenser Coil
C-C — Copper Tubing — Copper Fins Condenser Coil
OD — Outside Diameter

*A or F prefix designates no unloader.
6 prefix designates one electric unloader.
06E250 compressors have 4 cylinders; all others have 6.

NOTE: Facing the compressors, Circuit A is on the right and Circuit B is on the left.

Table 3 – Physical Data – 50 Hz, English

UNIT SIZE		080	090	100	110
APPROX OPERATING WEIGHT – lb	C-AL	6,720	7,135	8,710	8,840
	C-C	7,445	7,860	9,660	9,790
REFRIGERANT CHARGE – lb					
R-22	Ckt A	78/15	78/15	98/20	98/20
	Ckt B	78/15	78/15	105/20	105/20
Total/Over Clear Glass					
COMPRESSORS, Type...rpm		Reciprocating, Semi-Hermetic...1450			
06E*	(No.) Ckt A	(1) 6265, (1) F299	(1) 6265, (1) F299	(1) 6265, (1) F299	(1) 6299, (1) F299
	(No.) Ckt B	(1) 6299	(1) 6265, (1) F275	(1) 6265, (1) F299	(1) 6299, (1) F299
Oil Charge – Compressor/pt		06E250/17	06E265/21	06E275/21	06E299/19
Capacity Control Steps		6	8	8	8
% Cap.	Ckt A	62	54	50	50
	Ckt B	38	46	50	50
Minimum Step Capacity (%)		16	14	13	17
CONDENSER FANS – Type		Propeller, Direct Drive			
Fan Speed – rpm		950	950	950	950
No. Blades...Diameter – in.		6...30	6...30	6...30	6...30
No. Fans...Total kW		6...9.4	6...9.4	8...12.7	8...12.7
Total Airflow – cfm		57,000	57,000	76,000	76,000
CONDENSER COILS – Type		Vertical and Horizontal, Plate Fin, Enhanced Tubing			
Tubes (Copper), OD – in.		0.375	0.375	0.375	0.375
Fins/in.		17	17	17	17
No. Rows – Ckt A or B		3	3	3	3
Face Area sq ft – Ckt A and B Total		128.3	128.3	168	168
Max Working Pressure Refrigerant – psig		450			
COOLER – No. ...Type		1...Direct Expansion, Shell and Tube			
No. Refrigerant Circuits		2	2	2	2
Net Water Volume – Gal. (includes nozzles)		24.5	24.5	30.3	30.3
Max Working Pressure					
Refrigerant Side/Water Side – psig					
Standard Cooler		278/300			
Australian Code Cooler		207/150			
WATER CONNECTIONS – in.		Cooler Inlet and Outlet; Victaulic Type			
Inlet and Outlet		4	4	5	5
Drain		¾ NPT			

LEGEND

C-AL – Copper Tubing – Aluminum Fins Condenser Coil
C-C – Copper Tubing – Copper Fins Condenser Coil
OD – Outside Diameter

*A or F prefix designates no unloader.

6 prefix designates one electric unloader.

06E250 compressors have 4 cylinders; all others have 6.

NOTE: Facing the compressors, Circuit A is on the right and Circuit B is on the left.

Table 4 – Physical Data – 60 Hz, SI

UNIT SIZE		080	090	100	110
APPROX OPERATING WEIGHT – kg	C-AL	3013	3189	3914	3935
	C-C	3343	3518	4346	4368
REFRIGERANT CHARGE – kg					
R-22	Ckt A	35.4/6.8	35.4/6.8	44.5/9.1	44.5/9.1
	Ckt B	35.4/6.8	35.4/6.8	47.7/9.1	47.7/9.1
COMPRESSORS, Type...r/s		Reciprocating, Semi-Hermetic...29.2			
06E*	(No.) Ckt A	(1) 6275, (1) A250	(1) 6265, (1) A250	(1) 6265, (1) F275	(1) 6265, (1) F299
	(No.) Ckt B	(1) 6299	(1) 6265, (1) F265	(1) 6265, (1) F275	(1) 6265, (1) F275
Oil Charge – Compressor/L		06E250/8.0	06E265/9.9	06E275/9.9	06E299/9.0
Capacity Control Steps		6	8	8	8
% Cap.	Ckt A	56	47	50	54
	Ckt B	44	53	50	46
Minimum Step Capacity (%)		22	18	15	14
CONDENSER FANS – Type		Propeller, Direct Drive			
Fan Speed – r/s		19	19	19	19
No. Blades...Diameter – mm		4...762	4...762	4...762	4...762
No. Fans...Total kW		6...9.4	6...9.4	8...12.7	8...12.7
Total Airflow – L/s		26 898	26 898	35 864	35 864
CONDENSER COILS – Type		Vertical and Horizontal, Plate Fin, Enhanced Tubing			
Tubes (Copper), OD – mm		9.53	9.53	9.53	9.53
Fins/m		669	669	669	669
No. Rows – Ckt A or B		3	3	3	3
Face Area m ² – Ckt A and B Total		11.92	11.92	15.61	15.61
Max Working Pressure Refrigerant – kPa		3103			
COOLER – No. ...Type		1...Direct Expansion, Shell and Tube			
No. Refrigerant Circuits		2	2	2	2
Net Water Volume – L (includes nozzles)		92.9	92.9	114.6	114.6
Max Working Pressure					
Refrigerant Side/Water Side – kPa					
Standard Cooler		1916/2068			
Australian Code Cooler		1430/1034			
WATER CONNECTIONS – in.		Cooler Inlet and Outlet; Victaulic-Type			
Inlet and Outlet		4	4	5	5
Drain		¾ NPT			

LEGEND

C-AL – Copper Tubing – Aluminum Fins Condenser Coil
C-C – Copper Tubing – Copper Fins Condenser Coil
OD – Outside Diameter

*A or F prefix designates no unloader.
6 prefix designates one electric unloader.
06E250 compressors have 4 cylinders; all others have 6.

NOTE: Facing the compressors, Circuit A is on the right and Circuit B is on the left.

Table 5 – Physical Data – 50 Hz, SI

UNIT SIZE		080	090	100	110
APPROX OPERATING WEIGHT – kg	C-AL	3055	3243	3960	4018
	C-C	3384	3573	4390	4450
REFRIGERANT CHARGE – kg					
R-22	Ckt A	35.4/6.8	35.4/6.8	44.5/9.1	44.5/9.1
	Ckt B	35.4/6.8	35.4/6.8	47.7/9.1	47.7/9.1
COMPRESSORS, Type...r/s		Reciprocating, Semi-Hermetic...24.2			
06E*	(No.) Ckt A	(1) 6265, (1) F299	(1) 6265, (1) F299	(1) 6265, (1) F299	(1) 6299, (1) F299
	(No.) Ckt B	(1) 6299	(1) 6265, (1) F275	(1) 6265, (1) F299	(1) 6299, (1) F299
Oil Charge – Compressor/L		06E250/8.0	06E265/9.9	06E275/9.9	06E299/9.0
Capacity Control Steps		6	8	8	8
% Cap.	Ckt A	62	54	50	50
	Ckt B	38	46	50	50
Minimum Step Capacity (%)		16	14	13	17
CONDENSER FANS – Type		Propeller, Direct Drive			
Fan Speed – r/s		15.8	15.8	15.8	15.8
No. Blades...Diameter – mm		6...762	6...762	6...762	6...762
No. Fans...Total kW		6...9.4	6...9.4	8...12.7	8...12.7
Total Airflow – L/s		26 898	26 898	35 864	35 864
CONDENSER COILS – Type		Vertical and Horizontal, Plate Fin, Enhanced Tubing			
Tubes (Copper), OD – mm		9.53	9.53	9.53	9.53
Fins/m		669	669	669	669
No. Rows – Ckt A or B		3	3	3	3
Face Area m ² – Ckt A and B Total		11.92	11.92	15.61	15.61
Max Working Pressure Refrigerant – kPa		3103			
COOLER – No. ...Type		1...Direct Expansion, Shell and Tube			
No. Refrigerant Circuits		2	2	2	2
Net Water Volume – L (includes nozzles)		92.9	92.9	114.6	114.6
Max Working Pressure					
Refrigerant Side/Water Side – kPa					
Standard Cooler		1916/2068			
Australian Code Cooler		1430/1034			
WATER CONNECTIONS – in.		Cooler Inlet and Outlet; Victaulic-Type			
Inlet and Outlet		4	4	5	5
Drain		¾ NPT			

LEGEND

C-AL – Copper Tubing – Aluminum Fins Condenser Coil
C-C – Copper Tubing – Copper Fins Condenser Coil
OD – Outside Diameter

*A or F prefix designates no unloader.
6 prefix designates one electric unloader.
06E250 compressors have 4 cylinders; all others have 6.

NOTE: Facing the compressors, Circuit A is on the right and Circuit B is on the left.

30-273

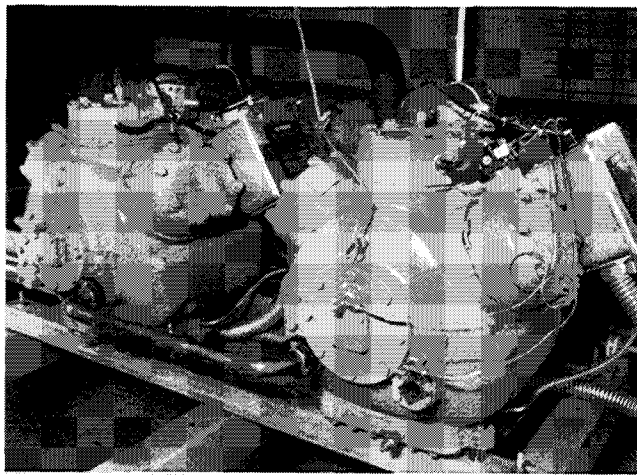


Fig. 4 – Compressor Mounting View

30-274

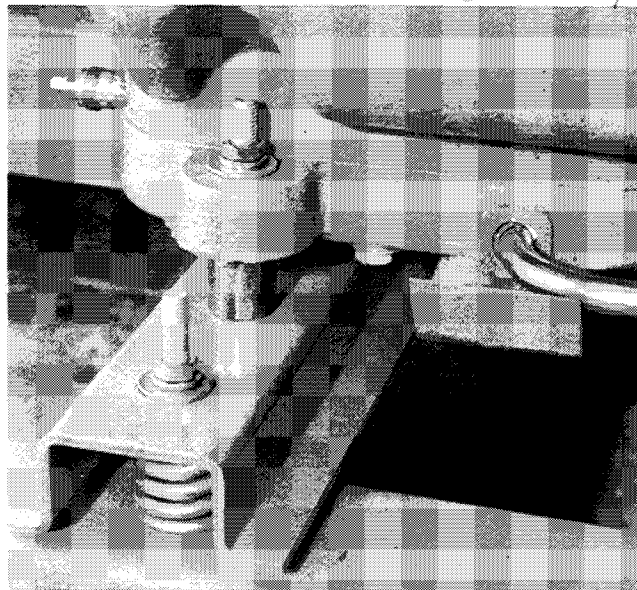


Fig. 5 – Compressor Mounting Bolts

FIELD POWER CONNECTIONS (See Fig. 6.) — All power wiring must comply with applicable local and national codes. Install field-supplied, branch circuit fused disconnect(s) of a type that can be locked OFF or OPEN. Disconnect(s) must be located within sight from and readily accessible from unit in compliance with NEC Article 440-14. See Tables 6 - 9 for unit electrical data.

All field power enters the unit through the control box at the left end when facing the compressors. An access hole is under the control box. All units have a single location for power connection to simplify the field power wiring. Maximum wire size that the unit terminal block will accept is 500 kcmil. Unit may use copper, copper-clad aluminum, or aluminum conductors at all voltages, except 30GT110 346-3-50 units and 30GT110 380/415-3-50 part wind units.

For 208/230-3-60 units, larger than 500 kcmil conductors are required. Power must be supplied by 6 parallel conductors for these units.

FIELD CONTROL POWER CONNECTIONS (See Fig. 7.) — For 208/230-, 460- and 575-3-60 units: If the accessory transformer is not used, provide a single-phase power source

for the control circuit, through a field-supplied fused disconnect per NEC. This conductor *must be copper only*. Control power enters the control box through a 7/8-in. (22.2-mm) conduit connection located on the right side of the control section. For 380-3-60, and 346- and 380/415-3-50 units: Control circuit voltage is taken from the line voltage, therefore, no additional power supply is required. If a separate power source is required, follow these instructions, and disconnect the wires between the control and power terminal blocks.

Units with a power supply of 208/230-, 460- and 575-3-60 require 115-1-60 control circuit power. Units with a power supply of 380-3-60 have 230-1-60 control circuit power, which is taken from the unit's power supply voltage. Units with a power supply of 346- or 380/415-3-50 have 230-1-50 control circuit power, which is also taken from the unit's power supply voltage. For control circuit current draw, see Table 7.

Control circuit power draw includes the compressor crankcase heaters at 180 watts each, the 8 cooler heaters (if equipped) at 210 watts each, and the electronic board heater at 120 watts.

⚠ CAUTION

Crankcase heaters, cooler heaters and board heater are all wired into the control circuit ahead of the control circuit switch. Therefore, they are always active even if the control circuit switch is OFF.

An interlock circuit for external safeties, such as the Chilled Water Flow Switch (CWFS), Remote On-Off, and Chilled Water Pump Interlock (CWPI) is provided between terminals TB6-3 and TB6-4 for field use. To use this circuit, remove the factory jumper and install the switches.

Step 5 — Install Accessories

ELECTRICAL — A number of electrical accessories are available to provide the following optional features (for details, refer to the Controls and Troubleshooting book):

- Accessory temperature reset board and accessory thermistor (used for any of the following types of temperature reset):
 - Return water temperature reset
 - Space temperature reset (requires accessory thermistor)
 - Outside air temperature reset (requires accessory thermistor)
- Chilled water flow switch

LOW-AMBIENT OPERATION — If operating temperatures below 0° F (-18 C) are expected, refer to separate installation instructions for low-ambient operation, Motormaster® III control.

HOT GAS BYPASS — Hot gas bypass usually is *not* recommended because it results in application of equipment out of its normal design application range. However, if its use is required, the appropriate hot gas bypass package may be used. For installation details, refer to separate instructions supplied with the accessory package.

MISCELLANEOUS ACCESSORIES — For applications requiring special accessories, the following packages are available: Condenser Hail Guard, Gage Panel, Sound Reduction Kit and Security Grille Package.

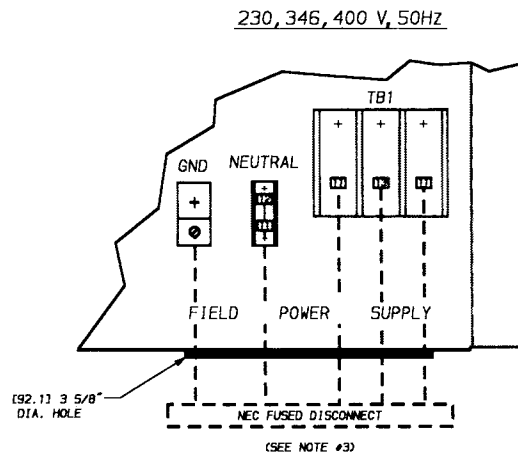
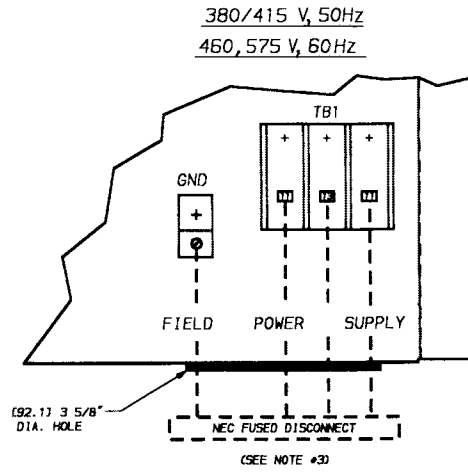
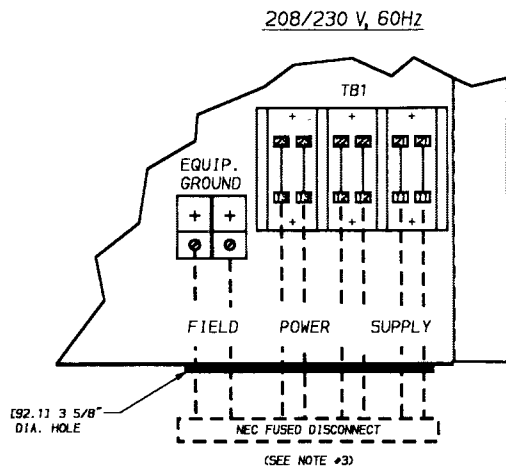
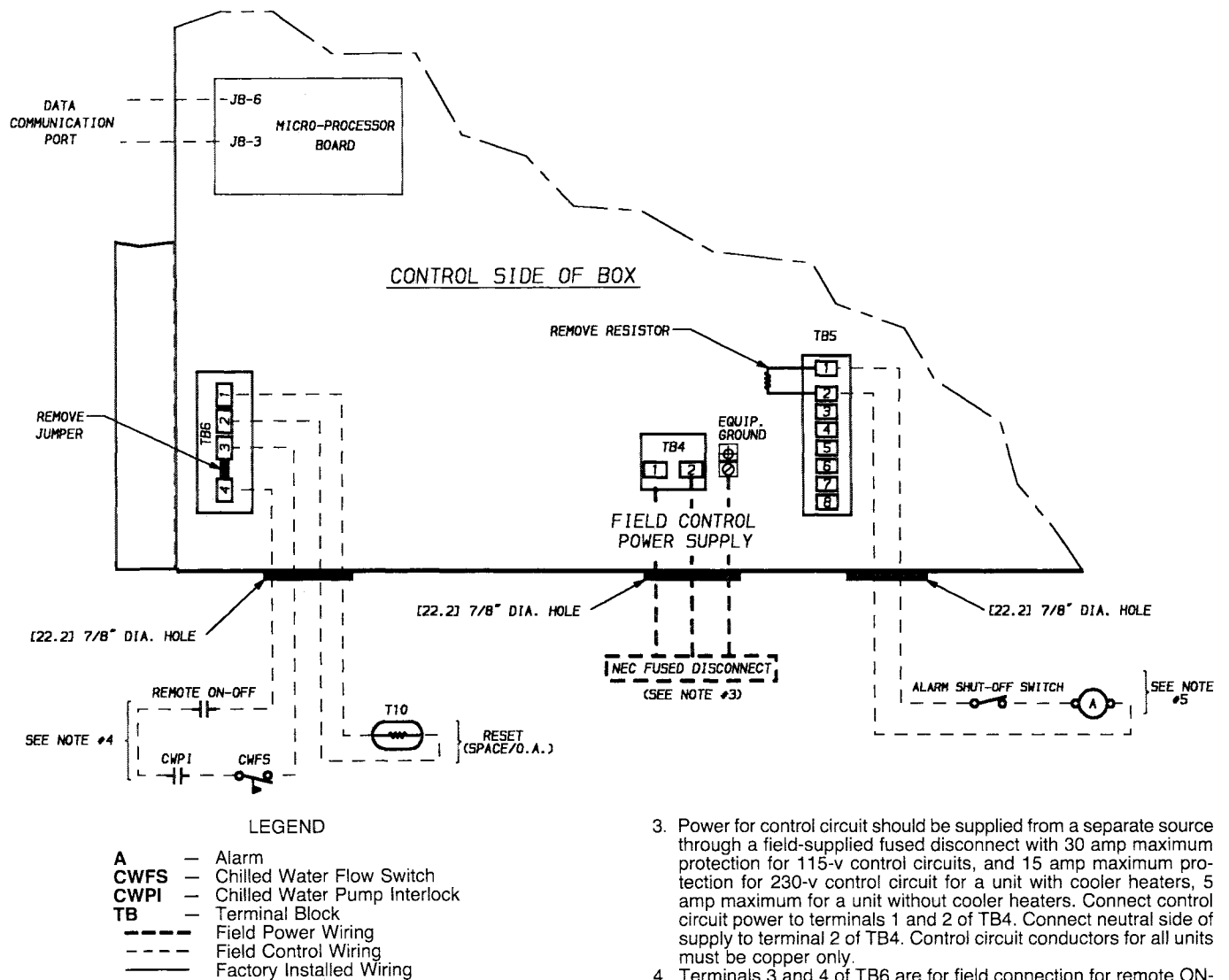


Fig. 6 — Field Power Wiring Connections

A 30-910



NOTES FOR FIG. 6 AND 7:

1. Factory wiring is in accordance with National Electrical Code (NEC, U.S.A.). Field modifications or additions must be in compliance with all applicable codes.
2. Wiring for main field power supply must be rated 75 C minimum, use copper, copper clad aluminum, or aluminum conductors for all units, except use copper conductors only for the 30GT110 346-v unit, and the 30GT110 380/415-v part wind start unit.

3. Power for control circuit should be supplied from a separate source through a field-supplied fused disconnect with 30 amp maximum protection for 115-v control circuits, and 15 amp maximum protection for 230-v control circuit for a unit with cooler heaters, 5 amp maximum for a unit without cooler heaters. Connect control circuit power to terminals 1 and 2 of TB4. Connect neutral side of supply to terminal 2 of TB4. Control circuit conductors for all units must be copper only.
4. Terminals 3 and 4 of TB6 are for field connection for remote ON-OFF control. The contacts must be rated for dry circuit application capable of reliably switching a 5 vdc, .5 mA load. Remove jumper between 3 and 4 of TB6 if remote ON-OFF is installed.
5. The maximum load allowed for the remote alarm circuit is 75 va sealed, 360 va inrush at 115- or 230-v, depending on model. Remove resistor across terminals 1 and 2 of TB5 when using remote alarm.
6. Dimensions in [] are millimeters.

Fig. 7 — Field Control Power Wiring

A30-911

Table 6 – Unit Electrical Data

UNIT SIZE	VOLTAGE			MCA		MOCP		ICF	
	Nameplate	Supplied*		XL	PW	XL	PW	XL	PW
		Min	Max						
080	208/230-3-60	187	253	391.3	391.3	500	500	896.9	620.9
	460-3-60	414	506	179.5	183.4	225	250	442.8	305.4
	575-3-60	518	633	160.9	149.2	200	200	365.6	246.9
	380-3-60	342	418	209.1	209.9	250	250	492.6	339.5
	346-3-50	325	380	250.1	250.1	300	300	—	379.8
	380/415-3-50	342	440	208.7	215.8	250	250	472.0	292.9
090	208/230-3-60	187	253	392.2	392.2	450	450	722.3	547.9
	460-3-60	414	506	192.7	195.6	225	225	361.2	273.5
	575-3-60	518	633	168.0	156.9	200	175	286.2	213.2
	380-3-60	342	418	205.9	202.6	250	225	396.0	294.5
	346-3-50	325	380	269.3	269.3	300	300	—	399.0
	380/415-3-50	342	440	233.7	241.4	250	300	497.0	363.5
100	208/230-3-60	187	253	462.3	462.3	500	500	835.2	633.2
	460-3-60	414	506	214.3	221.2	250	250	408.8	312.3
	575-3-60	518	633	191.1	168.9	225	200	289.4	233.1
	380-3-60	342	418	240.5	242.1	250	250	454.8	342.8
	346-3-50	325	380	303.8	303.8	350	350	—	433.5
	380/415-3-50	342	440	258.3	266.6	300	300	521.6	388.7
110	208/230-3-60	187	253	513.6	513.6	600	600	1019.2	743.2
	460-3-60	414	506	237.5	245.2	300	300	500.8	367.3
	575-3-60	518	633	212.0	194.5	250	225	416.6	292.1
	380-3-60	342	418	273.3	274.1	350	350	556.8	403.8
	346-3-50	325	380	373.0	373.0	450	450	—	502.7
	380/415-3-50	342	440	301.9	312.8	350	350	565.2	434.7

Table 7 – Control Circuit

UNIT POWER V-Ph-Hz	CONTROL POWER			AMPS
	V-Ph-Hz	Min	Max	
208/230-3-60	115-1-60	104	127	30
460-3-60	115-1-60	104	127	30
575-3-60	115-1-60	104	127	30
380-3-60	230-1-60	207	254	15/5**
346-3-50	230-1-50	198	254	15/5**
380/415-3-50	230-1-50	198	254	15/5**

LEGEND AND NOTES FOR ELECTRICAL DATA FOR TABLES 6 - 9

LEGEND

FLA	— Full Load Amps (Fan Motors)
ICF	— Maximum Instantaneous Current Flow during starting (the point in the starting sequence where the sum of the LRA for the starting compressor, plus the total RLA for all running compressors, plus the total FLA for all running fan motors is maximum)
kW	— Total condenser fan motor power input
LRA	— Locked Rotor Amps
MCA	— Minimum Circuit Amps (for wire sizing) — complies with NEC Section 430-24
MOCP	— Maximum Overcurrent Protective Device Amps
NEC	— National Electrical Code, U.S.A.
PW	— Part Wind
RLA	— Rated Load Amps (Compressors)
XL	— Across-the-Line

*Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is voltage, 2%; amps, 10%.

**First value is for chiller with cooler heater. Second value (if applicable) is for chiller without cooler heater.

NOTES:

1. All units have single point primary power connection. Main power must be supplied from a field-supplied disconnect.
2. The unit control circuit power (115 v, 1-ph for 208/230-, 460-, and 575-v units; 230 v, 1-ph for all other voltages) must be supplied from a separate source, through a field-supplied disconnect. The control circuit transformer accessory may be applied to power from primary unit power.
3. Crankcase and cooler heaters are wired into the control circuit so they are always operable as long as the control circuit power supply disconnect is on, even if any safety device is open or the unit ON-OFF circuit switch is off.
4. Units have the following power wiring terminal blocks and parallel conductors:

UNIT SIZE	VOLTAGE	TERMINAL BLOCKS	PARALLEL CONDUCTORS
080 to 110	208/230	1	6
	460	1	3
	575	1	3
	380	1	3
	346	1	3
	380/415	1	3

5. Maximum incoming wire size for each terminal block is 500 kcmil.
6. Power draw of control circuits includes both crankcase heaters (where used) and cooler heaters. Each compressor has a crankcase heater which draws 180 watts of power. Units ordered with cooler heater option have 8 cooler heaters, 210 w each, and a 120-w circuit board heater.

Table 8 – Compressor Electrical Data

UNIT SIZE	NAMEPLATE VOLTAGE	COMPRESSOR NUMBERS							
		A1		A2		B1		B2	
		RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA
080	208/230-3-60	106.4	506	67.9	345	147.7	690	—	—
	460-3-60	46.8	253	34.6	173	65.4	345	—	—
	575-3-60	40.4	176	28.8	120	57.1	276	—	—
	380-3-60	52.6	280	34.6	191	78.8	382	—	—
	346-3-50	44.9	247	79.5	382	79.5	382	—	—
	380/415-3-50	43.6	223	65.4	345	65.4	345	—	—
080-PW	208/230-3-60	106.4	304	67.9	207	147.4	414	—	—
	460-3-60	48.7	152	33.3	104	67.9	207	—	—
	575-3-60	33.3	106	28.2	72	53.8	165	—	—
	380-3-60	53.8	168	33.3	115	79.5	229	—	—
	346-3-50	44.9	148	79.5	229	79.5	229	—	—
	380/415-3-50	44.9	134	67.9	207	67.9	207	—	—
090	208/230-3-60	89.7	446	67.9	345	89.7	446	89.7	446
	460-3-60	43.6	223	34.6	173	43.6	223	43.6	223
	575-3-60	36.5	164	28.8	120	36.5	164	36.5	164
	380-3-60	45.5	247	34.6	191	45.5	247	45.5	247
	346-3-50	44.9	247	79.5	382	44.9	247	53.8	280
	380/415-3-50	43.6	223	65.4	345	43.6	223	46.8	280
090-PW	208/230-3-60	89.7	268	67.9	207	89.7	268	89.7	268
	460-3-60	44.9	134	33.3	104	44.9	134	44.9	134
	575-3-60	33.3	98	28.2	72	33.3	98	33.3	98
	380-3-60	44.9	148	33.3	115	44.9	148	44.9	148
	346-3-50	44.9	148	79.5	229	44.9	148	53.8	168
	380/415-3-50	43.6	134	67.9	207	44.9	134	48.7	152
100	208/230-3-60	89.7	446	106.4	506	89.7	446	106.4	506
	460-3-60	43.6	223	46.8	253	43.6	223	46.8	253
	575-3-60	36.5	164	40.4	176	36.5	164	40.4	176
	380-3-60	45.5	247	52.6	280	45.5	247	52.6	280
	346-3-50	44.9	247	79.5	382	44.9	247	79.5	382
	380/415-3-50	43.6	223	65.4	345	43.6	223	65.4	345
100-PW	208/230-3-60	89.7	268	106.4	304	89.7	268	106.4	304
	460-3-60	44.9	134	48.7	152	44.9	134	48.7	152
	575-3-60	33.3	98	33.3	106	33.3	98	33.3	106
	380-3-60	44.9	148	53.8	168	44.9	148	53.3	168
	346-3-50	44.9	148	79.5	229	44.9	148	79.5	229
	380/415-3-50	44.9	134	67.9	207	44.9	134	67.9	207
110	208/230-3-60	89.7	446	147.4	690	89.7	446	106.4	506
	460-3-60	43.6	223	65.4	345	43.6	223	46.8	253
	575-3-60	36.5	164	57.1	276	36.5	164	40.4	176
	380-3-60	45.5	247	78.8	382	45.5	247	52.6	280
	346-3-50	79.5	382	79.5	229	79.5	382	79.5	382
	380/415-3-50	65.4	345	65.4	207	65.4	345	65.4	345
110-PW	208/230-3-60	89.7	268	147.4	414	89.7	268	106.4	304
	460-3-60	44.9	134	67.9	207	44.9	134	48.7	152
	575-3-60	33.3	98	53.8	165	33.3	98	33.3	106
	380-3-60	44.9	148	79.5	229	44.9	148	53.8	168
	346-3-50	79.5	229	79.5	229	79.5	229	79.5	229
	380/415-3-50	67.9	207	67.9	207	67.9	207	67.9	207

Table 9 – Condenser Fan Electrical Data

UNIT SIZE	NAMEPLATE VOLTAGE	CONDENSER FAN				
		No.	Hp	kW	FLA (ea)	LRA (ea)
080	208/230-3-60	6	1	.746	(4) 5.4, (2) 5.5	(4) 31.6, (2) 30.0
	460-3-60				(4) 2.7, (2) 2.8	(4) 31.6, (2) 30.0
	575-3-60				(6) 3.4	(6) 30.0
	380-3-60				(6) 3.9	(6) 20.9
	346-3-50				(6) 4.4	(6) 20.9
	380/415-3-50				(6) 3.0	(6) 30.0
090	208/230-3-60	6	1	.746	(4) 5.4, (2) 5.5	(4) 31.6, (2) 30.0
	460-3-60				(4) 2.7, (2) 2.8	(4) 31.6, (2) 30.0
	575-3-60				(6) 3.4	(6) 30.0
	380-3-60				(6) 3.9	(6) 20.9
	346-3-50				(6) 4.4	(6) 20.9
	380/415-3-50				(6) 3.0	(6) 30.0
100	208/230-3-60	8	1	.746	(6) 5.4, (2) 5.5	(6) 31.6, (2) 30.0
	460-3-60				(6) 2.7, (2) 2.8	(6) 31.6, (2) 30.0
	575-3-60				(8) 3.4	(8) 30.0
	380-3-60				(8) 3.9	(8) 20.9
	346-3-50				(8) 4.4	(8) 20.9
	380/415-3-50				(8) 3.0	(8) 30.0
110	208/230-3-60	8	1	.746	(6) 5.4, (2) 5.5	(6) 31.6, (2) 30.0
	460-3-60				(6) 2.7, (2) 2.8	(6) 31.6, (2) 30.0
	575-3-60				(8) 3.4	(8) 30.0
	380-3-60				(8) 3.9	(8) 20.9
	346-3-50				(8) 4.4	(8) 20.9
	380/415-3-50				(8) 3.0	(8) 30.0

PRE-START-UP

IMPORTANT: Before beginning Pre-Start-Up or Start-Up, review Start-Up Checklist for Flotronic™ Chiller Systems at center of this publication. The Checklist assures proper start-up of a unit, and provides a record of unit condition, application requirements, system information, and operation at initial start-up.

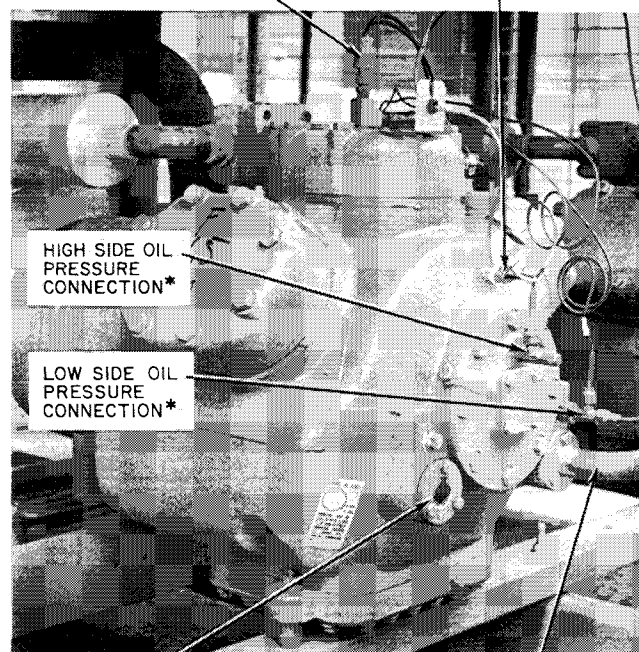
Do not attempt to start the chiller until following checks have been completed.

System Check

1. Check all auxiliary components, such as the chilled water circulating pump, air handling equipment, or other equipment to which the chiller supplies liquid. Consult manufacturer's instructions. If the unit has field-installed accessories, be sure all are properly installed and wired correctly. Refer to unit wiring diagrams.
2. Backseat (open) compressor suction and discharge shut-off valves. Close valves one turn to allow refrigerant pressure to reach the test gages.
3. Open liquid line service valves.
4. Fill the chiller water circuit with clean water (with recommended inhibitor added) or other noncorrosive fluid to be cooled. Bleed all air out of high points of system. An air vent is included with the cooler. If outdoor temperatures are expected to be below 32 F (0° C), sufficient ethylene glycol should be added to the chiller water circuit to prevent possible freeze-up.
5. Check tightness of all electrical connections.
6. Oil should be visible in the compressor sight glass. See Fig. 8. An acceptable oil level in the compressor is from $\frac{1}{8}$ to $\frac{3}{8}$ of sight glass. Adjust the oil level as required. No oil should be removed unless the crankcase heater has been energized for at least 24 hours. See Service section, Compressors, for Carrier-approved oils.
7. Electrical power source must agree with unit nameplate.
8. *Crankcase heaters must be firmly locked into compressors, and must be on for 24 hours prior to start-up.*
9. Fan motors are 3 phase. Check rotation of fans during the Quick Test (see below). Fan rotation is clockwise as viewed from top of unit. If fan is not turning clockwise, reverse 2 of the power wires.
10. Check compressor suspension. Mounting rails must be floating freely on the springs.
11. Perform Quick Test to verify proper settings.

HIGH-PRESSURE SWITCH
(EACH COMPRESSOR)

30-179
THERMISTOR*
REFRIGERANT TEMPERATURE
ENTERING CYLINDERS



SIGHT GLASS
(EACH COMPRESSOR)

EQUALIZER

*Lead compressor only.

**Fig. 8 — Compressor Connections
(Lead Compressor Shown)**

Quick Test (See Fig. 9 and Table 10.) — Both main power and control circuit power must be on.

The Quick Test program utilizes a 2-digit LED display (Fig. 9) on set point board to show status of all input and output signals to microprocessor control. Display action and Quick Test procedure are described as follows:

The Quick Test is a 42-step program that provides a means of checking all input and output signals of microprocessor control prior to unit start-up. Check ensures that all control options, thermistors and status switches are in proper working order.

To initiate the Quick Test program, first turn unit control switch to the ON position. When a **20** appears in display, immediately press display button *once*. An **88** will appear in display and alarm light will be energized; this indicates that microprocessor in control system is ready to run Quick Test program.

IMPORTANT: Do not allow unit control circuit to remain energized with **20** showing in display for more than 2 minutes. If display button is not pressed within this time, control will attempt to start unit.

For each step of the 42-step program, display button must be pressed *twice*. On first press, step number is displayed; second press initiates required action, and code as shown in Table 10 is displayed.

NOTE: Step number is a numeral followed by a decimal point (a 2-digit number has a decimal point after *each* numeral). Action code number is one or 2 digits with no decimal point(s).

IMPORTANT: Once Quick Test is initiated, display button must be pressed at least once every 10 minutes for control to remain in Quick Test mode. If button is not pressed within this time, control will attempt to start unit.

To recheck any step in Quick Test, control must be recycled by turning unit control circuit switch off for a few seconds, then on again. Restart Quick Test program as described above and proceed through Quick Test steps. Press display button *twice* for each step until step to be rechecked is reached.

The Quick Test program is divided into 3 sections as described below and shown in Table 10. For more detailed information refer to Controls and Troubleshooting publication.

A. QUICK TEST STEPS 1 - 15: UNIT CONFIGURATION — Microprocessor in unit control system is programmed by 2 switch assemblies located on processor board (Fig. 9). Configuration header is factory set and cannot be changed in the field. The DIP switch assembly contains 8 microswitches that must be set in accordance with various options and accessories selected by customer. As shipped from factory, all DIP switches except those controlling pull-down option (switch no. 3) and those controlling compressor unloaders (switch no. 7) are in OFF position. Switch no. 8 is OFF for water units, and ON for brine units. All DIP switches should be checked and set to proper position for options selected during Quick Test.

DIP switch assembly, functions and display codes are shown in Fig. 9 and in Table 11. Refer to Controls and Troubleshooting publication for details.

B. QUICK TEST STEPS 16 - 30; THERMISTORS AND SET POINT POTENTIOMETERS — In these steps, microprocessor checks resistance values of all sensors and set point potentiometers to ensure they are functional and set within proper range for unit configuration.

Nominal resistance values for all sensors range from 363,000 to 216 ohms. Normal display code for good sensors and potentiometers is **1**. Display code **0** indicates a faulty potentiometer, thermistor or wiring. A **0** display will indicate a particular option is not being used, i.e., demand limit not installed.

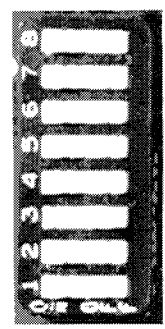
Tables 10 and 12 show set point potentiometer function location, and Quick Test display codes.

C. OUTPUT RELAYS, STEPS 31 - 42 — These Quick Test steps allow microprocessor to check output signals from relay boards in unit control system. In addition, operation of all condenser fans and compressors is checked at each step.

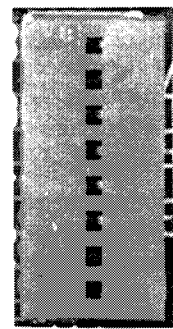
Normal display code for steps **3.1** through **3.4** is **1**. In steps **3.5** through **4.2**, when appropriate, each compressor is started and allowed to run for approximately 10 seconds. At start-up **0** will appear, followed by a **1** in a few seconds. At end of 10-second test, code **0** returns to display indicating that test step has been successfully completed. Code **1** indicated that compressor protection circuit (CPCS) was tested.

Fan and compressor operating sequence for Quick Test steps **3.1** through **4.2** are shown in Table 10 and Fig. 10.

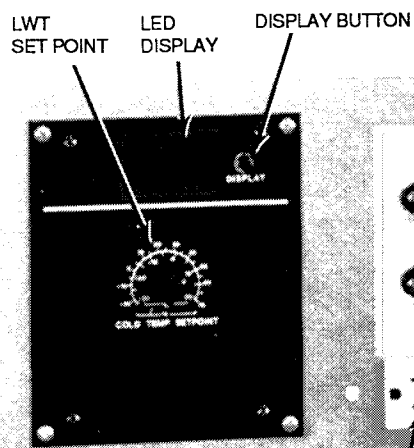
If Quick Test steps do not operate as described, a defect exists in one or more of the following; relay being tested; electronic control; unit wiring. Refer to Controls and Troubleshooting publication for additional information.



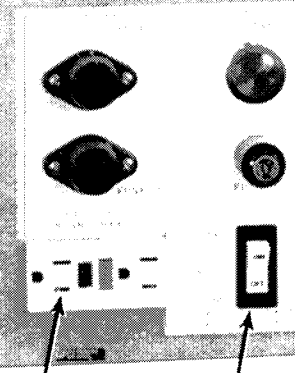
DIP SWITCH ASSEMBLY



CONFIGURATION HEADER

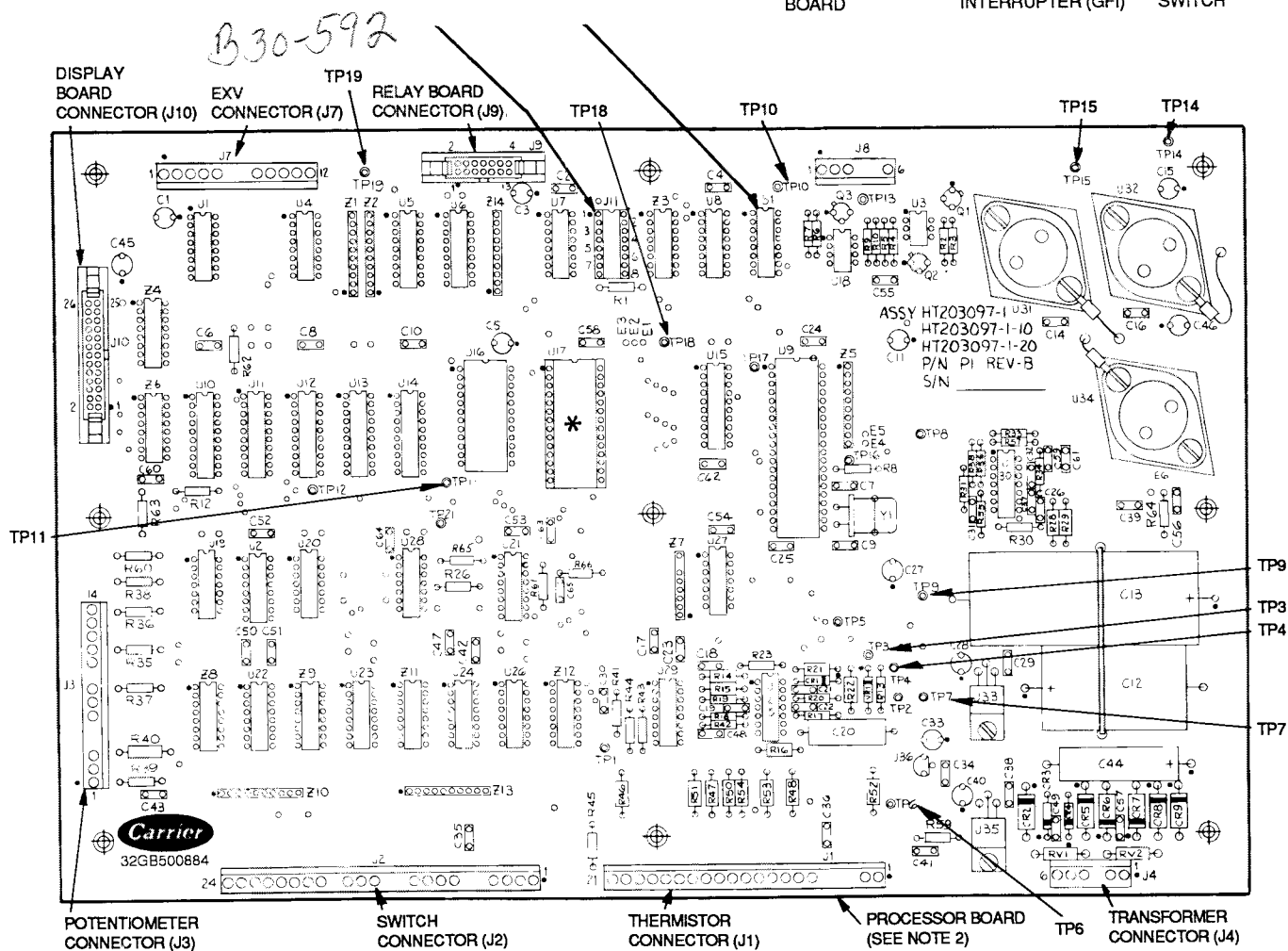


DISPLAY BOARD



GROUND FAULT
INTERRUPTER (GFI)

CONTROL CIRCUIT
SWITCH



*EPROM HT207101-1-10

NOTE: Do not remove label covering EPROM. Removal causes program to be erased.

NOTES:

- NOTES:**
1. Refer to Controls and Troubleshooting publication for details.
 2. Processor Board is inverted from position shown when installed in unit.

Fig. 9 – Center of Flotronic™ Control System

START-UP CHECKLIST FOR FLOTRONIC CHILLER SYSTEMS

(Remove and use for job file)

A. Preliminary Information

JOB NAME _____

LOCATION _____

INSTALLING CONTRACTOR _____

DISTRIBUTOR _____

START-UP PERFORMED BY _____

EQUIPMENT: Chiller: MODEL # _____ SERIAL # _____

COMPRESSORS:

CIRCUIT #A

1) M# _____

S# _____

MTR# _____

2) M# _____

S# _____

MTR# _____

CIRCUIT #B

1) M# _____

S# _____

MTR# _____

2) M# _____

S# _____

MTR# _____

COOLER:

MODEL # _____

MANUFACTURED BY _____

SERIAL # _____

DATE _____

TYPE OF EXPANSION VALVES (check one):

EXV _____

TXV _____

AIR HANDLING EQUIPMENT:

MANUFACTURER _____

MODEL # _____ SERIAL # _____

ADDITIONAL AIR HANDLING UNITS AND ACCESSORIES _____

B. Preliminary Equipment Check (YES or NO)

IS THERE ANY SHIPPING DAMAGE? _____ IF SO, WHERE _____

WILL THIS DAMAGE PREVENT UNIT START-UP? _____

ASSURE COMPRESSOR BASE RAIL ISOLATORS HAVE ALL BEEN PROPERLY ADJUSTED. _____

CHECK POWER SUPPLY. DOES IT AGREE WITH UNIT? _____

HAS THE CIRCUIT PROTECTION BEEN SIZED AND INSTALLED PROPERLY? (refer to Installation Instructions) _____

ARE THE POWER WIRES TO THE UNIT SIZED AND INSTALLED PROPERLY? (refer to Installation Instructions) _____

HAS THE GROUND WIRE BEEN CONNECTED? _____

ARE ALL TERMINALS TIGHT? _____

B. Preliminary Equipment Check (cont)

CHECK AIR SYSTEMS (YES or NO)

ARE ALL AIR HANDLERS OPERATING? (refer to air handling equipment Installation and Start-Up Instructions) _____

ARE ALL CHILLED WATER VALVES OPEN? _____

IS THE WATER PIPING CONNECTED PROPERLY? _____

HAS ALL AIR BEEN VENTED FROM THE COOLER LOOP? _____

IS THE CHILLED WATER PUMP (CWP) OPERATING? _____

IS THE CWP ROTATION CORRECT? _____

CWP MOTOR AMPERAGE: Rated _____ Actual _____

C. Unit Start-Up (insert check mark as each item is completed)

HAS THE CHILLER BEEN PROPERLY INTERLOCKED WITH THE AUXILIARY CONTACTS OF THE CHILLED WATER PUMP STARTER? _____

ASSURE THAT THE UNIT IS SUPPLIED WITH CORRECT CONTROL VOLTAGE POWER.

_____ 115- AND 230- (380*-v) V (60 Hz) UNITS _____ 230* V (50 Hz) UNITS *(Export Units)

ASSURE CRANKCASE HEATERS HAVE BEEN ENERGIZED FOR A MINIMUM OF **24 HOURS** PRIOR TO START-UP.
ASSURE COMPRESSOR OIL LEVEL IS CORRECT. _____

ASSURE BOTH LIQUID LINE SERVICE VALVES ARE BACKSEATED. _____

ASSURE **ALL** COMPRESSOR DISCHARGE SERVICE VALVES ARE BACKSEATED. _____

ASSURE **ALL** COMPRESSOR SUCTION SERVICE VALVES ARE BACKSEATED. _____

LOOSEN COMPRESSOR SHIPPING HOLD-DOWN BOLTS. _____

LEAK CHECK **THOROUGHLY**: ALL COMPRESSORS, CONDENSER MANIFOLDS AND HEADERS, EXVs, TXVs, SOLENOID VALVES, FILTER DRIERS, FUSIBLE PLUGS, THERMISTORS, AND COOLER HEADS, WITH GE H-10-B ELECTRONIC LEAK DETECTOR. _____

LOCATE, REPAIR, AND REPORT ANY R-22 LEAKS. _____

CHECK VOLTAGE IMBALANCE: AB _____ AC _____ BC _____

AB + AC + BC (divided by 3) = AVERAGE VOLTAGE = _____ V

MAXIMUM DEVIATION FROM AVERAGE VOLTAGE = _____

VOLTAGE IMBALANCE = $\frac{(\text{MAX. DEVIATION})}{\text{AVERAGE VOLTAGE}} \times 100 = \text{_____ \% VOLTAGE IMBALANCE}$

IF OVER 2% VOLTAGE IMBALANCE, DO NOT ATTEMPT TO START CHILLER!
CALL LOCAL POWER COMPANY FOR ASSISTANCE.

ASSURE THAT INCOMING POWER VOLTAGE TO CHILLER MODULES IS WITHIN RATED UNIT VOLTAGE RANGE. _____

SYSTEM WATER VOLUME IN LOOP: TYPE SYSTEM:

AIR CONDITIONING — MINIMUM 3 GAL. PER NOMINAL TON = _____ GAL.

PROCESS COOLING — MINIMUM 6 GAL. PER NOMINAL TON = _____ GAL.

C. Unit Start-Up (cont)

CHECK PRESSURE DROP ACROSS COOLER.

WATER ENTERING COOLER: _____ PSIG (kPa)

WATER LEAVING COOLER: _____ PSIG (kPa)

(PSIG DIFFERENCE) x 2.31 = FT OF WATER PRESSURE DROP = _____

PLOT COOLER PRESSURE DROP ON PERFORMANCE DATA CHART (LOCATED IN PRODUCT DATA LITERATURE) TO DETERMINE TOTAL GPM (L/s).

TOTAL GPM (L/s) = _____

UNIT'S RATED MIN GPM (L/s) = _____

GPM (L/s) PER TON = _____

UNIT'S RATED MIN PRESSURE DROP = _____
(Refer to product data literature.)

JOB'S SPECIFIED GPM (L/s) (if available) _____

*IF UNIT HAS LOW WATER FLOW, FIND SOURCE OF PROBLEM: CHECK WATER PIPING, IN-LINE WATER STRAINER, SHUT-OFF VALVES, CWP ROTATION, ETC.

COOLER LOOP PROTECTION IF REQUIRED:

GALLONS (LITERS) OF BRINE ADDED. _____

PIPING INCLUDES ELECTRIC TAPE HEATERS. _____

VISUALLY CHECK PROCESSOR BOARD FOR THE FOLLOWING:

ASSURE ALL DIP SWITCHES ARE PROPERLY SET. _____

INSPECT ALL THERMISTORS AND EXV CABLES FOR POSSIBLE CROSSED WIRES. _____

INSPECT ALL RIBBON CABLES AND PIN CONNECTORS FOR TIGHTNESS. _____

INSPECT RELAY BOARDS AND DISPLAY SET POINT BOARD CONNECTIONS FOR TIGHTNESS. _____

CHECK DIP SWITCH POSITIONS:

ON	OFF	ON	OFF
1 _____	_____	5 _____	_____
2 _____	_____	6 _____	_____
3 _____	_____	7 _____	_____
4 _____	_____	8 _____	_____

TO START THE CHILLER: (insert check mark as each item is completed)

TURN THE START/STOP SWITCH TO "START". _____

THE SETPOINT BOARD'S "LED" SHOULD DISPLAY NUMBER "20". _____

PUSH THE DISPLAY BUTTON ONCE TO ENTER QUICK TEST MODE. _____

SET POINT BOARD SHOULD DISPLAY NUMBER "88". _____

FOLLOW THE CONTROLS AND TROUBLESHOOTING QUICK TEST INSTRUCTIONS. BE SURE TO CHECK FOR PROPER FAN ROTATION ON QUICK TEST STEPS 3.1 AND 3.2.

QUICK TEST NUMBER READOUTS — INDICATE RESULTS BELOW:

STEPS #	1 _____	8 _____	15 _____	22 _____	29 _____	36 _____
	2 _____	9 _____	16 _____	23 _____	30 _____	37 _____
	3 _____	10 _____	17 _____	24 _____	31 _____	38 _____
	4 _____	11 _____	18 _____	25 _____	32 _____	39 _____
	5 _____	12 _____	19 _____	26 _____	33 _____	40 _____
	6 _____	13 _____	20 _____	27 _____	34 _____	41 _____
	7 _____	14 _____	21 _____	28 _____	35 _____	42 _____

C. Unit Start-Up (cont)

MEASURE THE FOLLOWING: MEASURE WHILE MACHINE IS IN STABLE OPERATING CONDITION.

	CIRCUIT #A	CIRCUIT #B
OIL PRESSURE		
SUCTION PRESSURE		
SUCTION LINE TEMP		
DISCHARGE PRESSURE		
DISCHARGE LINE TEMP		

TXV UNITS ONLY: CHECK AND ADJUST SUPERHEAT.

USING A DC VOLT-METER AND VOLTAGE VS. TEMPERATURE CHART: MEASURE THE VOLTAGE AT THE J-1 THERMISTOR CONNECTIONS ON THE PROCESSOR BOARD WHILE THE UNIT IS OPERATING. INDICATE THE CORRESPONDING VOLTAGE AND TEMPERATURE FOR EACH THERMISTOR:

T-1 = _____ VDC = _____
T-2 = _____ VDC = _____
T-3 = _____ VDC = _____
T-4 = _____ VDC = _____
T-5 = _____ VDC = _____
T-6 = _____ VDC = _____
T-7 = _____ VDC = _____
T-8 = _____ VDC = _____

NOTES:

[illegible]

Table 10 — Quick Test 88
SECTION A. — Configuration and Switch Check

QUICK TEST STEP NO.	NORMAL DISPLAY	STEP DESCRIPTION	HEADER POSITION OR CONTROL SWITCH
1	00	Type Unit — Air-Cooled Chiller	Configuration Header: 1 and 2
2	3 or 4	No. of Compressors 3 = 080 4 = 090-110	Configuration Header: 3, 4, and 5
3	2	No. of Unloaders	DIP Switches 6 and 7
4	0 or 1	0 = Water 1 = Brine*	DIP Switch 8
5	1 or 0	1 = EXV 0 = TXV	Configuration Header: 6
6	50 or 60	50 = 50 Hz 60 = 60 Hz	Configuration Header: 7
7	0 or 1	0 = External Reset 1 = Return Water Reset	DIP Switch 1
8	0 or 1	0 = Reset Disabled 1 = Reset Enabled	DIP Switch 2
9	0 or 1	0 = Pulldown Disabled 1 = Pulldown Enabled	DIP Switch 3
10	0 or 1	0 = Demand Limit Disabled 1 = Demand Limit Enabled	DIP Switch 5
11	0 or 1	0 = Remote On/Off — Switch/Jumper Open 1 = Remote On/Off — Switch/Jumper Closed	TB6-3 and TB6-4
12	0 or 1	0 = Loss-of-Charge Switch A Open 1 = Loss-of-Charge Switch A Closed	Circuit A Loss-of-Charge Switch
13	0 or 1	0 = Loss-of-Charge Switch B Open 1 = Loss-of-Charge Switch B Closed	Circuit B Loss-of-Charge Switch
14	0 or 1	0 = Low Oil Pressure Switch A Open 1 = Low Oil Pressure Switch A Closed	Circuit A Low Oil Pressure Switch
15	0 or 1	0 = Low Oil Pressure Switch B Open 1 = Low Oil Pressure Switch B Closed	Circuit B Low Oil Pressure Switch

*Do not change select switch to brine on units that do not have modifications for brine. Special modifications are required. Contact Carrier for details.

Table 10 – Quick Test 88 (cont)
SECTION B. – Thermistor and Potentiometer Checkout

QUICK TEST STEP NO.	NORMAL DISPLAY	STEP DESCRIPTION	THERMISTOR OR POTENTIOMETER
1.6.	1	1 – Thermistor OK 0 – Thermistor Faulty	T1 – Cooler Leaving Water Thermistor
1.7.	1	1 – Thermistor OK 0 – Thermistor Faulty	T2 – Cooler Entering Water Thermistor
1.8.	1	1 – Thermistor OK 0 – Thermistor Faulty	T3 – Saturated Condensing Thermistor, Circuit A
1.9.	1	1 – Thermistor OK 0 – Thermistor Faulty	T4 – Saturated Condensing Thermistor, Circuit B
2.0.	1 or 0	1 † – Thermistor OK 0 – Thermistor Faulty or Not Used	T5 – Cooler Thermistor, Circuit A (EXV Units)
2.1.	1 or 0	1 † – Thermistor OK 0 – Thermistor Faulty or Not Used	T6 – Cooler Thermistor, Circuit B (EXV Units)
2.2.	1 or 0	1 † – Thermistor OK 0 – Thermistor Faulty or Not Used	T7 – Compressor Thermistor, Circuit B (EXV Units)
2.3.	1 or 0	1 † – Thermistor OK 0 – Thermistor Faulty or Not Used	T8 – Compressor Thermistor, Circuit B (EXV Units)
2.4.	1 or 0	1 – Thermistor OK 0 – Thermistor Faulty or Not Used	T10 – Accessory Remote Thermistor
2.5.	1	1 – Potentiometer OK 0 – Potentiometer Faulty	P1 – Leaving Fluid Set Point Potentiometer
2.6.	0	No Significance	—
2.7.	1 or 0	1 – Potentiometer OK 0 – Potentiometer Faulty or Option Not Used	P3 – Accessory Reset Limit Potentiometer
2.8.	1 or 0	1 – Potentiometer(s) OK 0 – Potentiometer(s) Faulty or Option Not Used	P4 – Accessory Demand Limit Potentiometer(s)
2.9.	1 or 0	1 – Potentiometer OK 0 – Potentiometer Faulty or Option Not Used	P5 – Accessory Reset Ratio Potentiometer
3.0.	1 or 0	1 – Potentiometer OK 0 – Potentiometer Faulty or Option Not Used	P6 – Accessory Reset Set Point Potentiometer

†Display is 1 for Flotronic™ EXV units only.

Display is 0 for Flotronic FLOP units (with TXV).

Table 10 – Quick Test **88** (cont)
SECTION C. – Output Relay Check

QUICK TEST STEP NO.	NORMAL DISPLAY	STEP DESCRIPTION	RELAY NO.
3.1	1	Energize First Stage of Condenser Fans 080, 090 – OFM3, OFM4 100, 110 – OFM3, OFM4	K11
3.2	1	Energize Second Stage of Condenser Fans 080, 090 – OFM5, OFM6 100, 110 – OFM5, OFM6, OFM7, OFM8	K12
3.3	1	Energize Liquid Line Solenoid Valve (TXV only), Circuit A	K9
3.4	1	Energize Liquid Line Solenoid Valve (TXV only), Circuit B	K10
3.5	0 → 1 → 0 **	Energize Compressor A1, and OFM1	K1
3.6	0 → 1 → 0 **	Energize Compressor A2	K2
3.7	0	No Action	K3
3.8	0	Energize Unloader A1	K4
3.9	0 → 1 → 0 **	Energize Compressor B1, and OFM2	K5
4.0	0 → 1 → 0 ** 0	Energize Compressor B2 No Action (080)	K6
4.1	0	No Action	K7
4.2	0	Energize Unloader B1	K8

Compressors will be energized for 10 seconds. **0 indicates open CPCS module contacts;
1 indicates closed CPCS module contacts.

FAN ARRANGEMENT	FAN NO.	CONTROLLED BY	
		During Quick Test*	Normal Control
30GT080,090 	1	3.5.	Compressor No. A1
	2	3.9.	Compressor No. B1
	3,4	3.1.	First Stage of Condenser Fans
	5,6	3.2.	Second Stage of Condenser Fans
30GT100,110 	1	3.5.	Compressor No. A1
	2	3.9.	Compressor No. B1
	3,4	3.1.	First Stage of Condenser Fans
	5,6,7,8	3.2.	Second Stage of Condenser Fans

*Quick Test display numbers.

Fig. 10 – Condenser Fan Sequence

Table 11 – DIP Switch Functions

DIP SWITCH NO.	SELECTED FUNCTION*
1	Type of Reset
2	Reset
3	Pull Down Limit
4	Not Used
5	Demand Limit
6	1 Unloader
7	2 Unloaders
8	Brine

*Refer to Table 10, Quick Test steps 3 through 10.

Table 12 – Potentiometer Locations

POTENTIOMETER	LOCATION
Leaving Water Set Point	Set Point Board (Standard)
Reset Limit Set Point	Accessory Board (Option)
Reset Ratio Set Point	Accessory Board ((Option)
Reset Temp Set Point	Accessory Board (Option)

START-UP AND OPERATION

NOTE: Refer to Start-Up Checklist at center of publication, which can be easily removed if necessary.

Digital Display Action — The electronic control system uses a 2-digit LED display located on display set point board (see Fig. 9) to show operational information and diagnostic codes.

When control ON-OFF switch is turned on, display shows **20** for 2 minutes to indicate control is in initialization mode. Electronic expansion valve will be closed as part of initialization sequence. This does not occur on FIOP units, where a conventional thermostatic expansion valve is used.

After a 2-minute period, display turns off and unit is allowed to start. If button is pressed after the **20** has been removed from display, operational status codes or diagnostic information will be shown as long as button is held in. Code numbers on display will have following significance:

CODE NUMBER	OPERATIONAL STATUS
0-12	Capacity stage
20-26	Operational information
51-87	Overload information

Under normal operation, only stage number will be displayed. If an operational status code or an overload code is displayed, the display will rotate every 2 seconds and will display up to 3 numbers. Overload information will take priority over all other codes and the alarm light will be energized. The codes will be stored by the microprocessor as long as board is energized.

IMPORTANT: The memory is cleared when control power is removed.

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

1. Be sure all service valves are open. The unit is shipped from the factory with the suction, discharge and liquid line service valves closed.
2. Set leaving water temperature. No cooling range adjustment is necessary.
3. If accessory reset boards are used, set potentiometers properly. Refer to Controls and Troubleshooting book for details.
4. Start chilled water pump.

5. Turn ON-OFF switch to ON. The display will read **20**. During this time the machine will check all potentiometers and thermistors for valid readings. In approximately 2 minutes, the **20** reading will not be displayed, and the machine will be operational.

Allow the unit to operate and confirm that everything is functioning properly. Check the leaving water temperature and be sure that it agrees with the set point potentiometer P1. If the temperature setting does not agree, the set point can be compensated by shifting the control point slightly. If temperature reset is in effect, the leaving water temperature may not agree with the set point.

Table 13 – Temperature Limits

TEMPERATURES	F	C
Maximum Ambient Temp	125	52
Minimum Ambient Temp	0	-18
Maximum Cooler EWT*	95	35
Maximum Cooler LWT	70	21
Minimum Cooler LWT	40	4.5

EWT — Entering Water Temp

LWT — Leaving Water Temp

*For sustained operation, it is recommended that EWT *NOT* exceed 85 F (29.4 C).

Operating Limitations

TEMPERATURES (See Table 13.) — If unit is to be used in an area with high solar radiation, mounted position should be such that control box is not exposed to direct solar radiation.

Low-Ambient Operation — If operating temperatures below 0° F (-18° C) are expected, refer to separate installation instructions for low-ambient operation/Motormaster® III control. Contact your Carrier representative for details.

High Cooler LCWT — During start-up with leaving water temperatures above approximately 60 F (16 C), expansion valves (EXV and FIOP TXV) will limit suction pressure to approximately 90 psig (620 kPa) to avoid overloading compressor.

Low Cooler LCWT — Application of chillers for brine duty within 39.9 F to 34 F (4.4 C to 1.1 C) temperature range is possible with proper field change of control configuration. This requires that DIP switch #8 (brine switch) of S1 on the processor board be set to ON. See Tables 10 and 11.

⚠ WARNING

Do not operate with leaving water temperature below 34 F (1.1 C). Application in the range 34 F to 15 F (1 C to -9.4 C) requires chiller with factory modification for brine duty.

Contact your Carrier representative for details.

VOLTAGE

Main Power Supply — Minimum and maximum acceptable supply voltages are listed in Table 6.

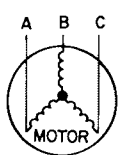
Unbalanced 3-Phase Supply Voltage

Never operate a motor where a phase imbalance between phases is greater than 2%. To determine % voltage imbalance:

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

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

Example: Supply voltage is 240-3-60.



motor

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

1. Determine average voltage:

$$\begin{aligned} \text{Average voltage} &= \frac{243 + 236 + 238}{3} \\ &= \frac{717}{3} = 239 \text{ v} \end{aligned}$$

2. Determine maximum deviation from average voltage:

(AB) 243 - 239 = 4 v
(BC) 239 - 236 = 3 v
(AC) 239 - 238 = 1 v

Maximum deviation is 4 v.

3. Determine % voltage imbalance:

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

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

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

Control Circuit Power — Electronic control includes logic to detect low control circuit voltage. Acceptable voltage range is shown in Table 7.

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

FLOW RATE REQUIREMENTS — Standard chillers should be applied with nominal flow rates approximating those listed in Table 14. Higher or lower flow rates are permissible to obtain lower or higher temperature rises. Minimum flow rates *must be exceeded* to assure turbulent flow and proper heat transfer in the cooler.

⚠ WARNING

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

Consult application data and job design requirements to determine flow rate requirements for particular installation.

Table 14 — Nominal and Minimum Cooler Water Flow Rates

UNIT SIZE	NOMINAL FLOW RATE*		MINIMUM FLOW RATE (See Notes)	
	Gpm	L/s	Gpm	L/s
080	192	12.11	59.5	3.75
090	216	13.62	59.5	3.75
100	240	15.14	72.7	4.59
110	264	16.65	72.7	4.59

LEGEND

ARI — Air Conditioning and Refrigeration Institute
Gpm — Gallons per minute (U.S.)
kPa — Kilopascals
L/s — Liters per second
PD — Pressure Drop

*Nominal flow rates required at ARI conditions 44 F (7 C) leaving water temperature, 54 F (12 C) entering water temperature, 95 F (35 C) ambient. Fouling factor .00025 (.044).

APPLICATION	V	N
Normal Air Conditioning	3	3.25
Process Type Cooling	6	6.5
Low Ambient Unit Operation	6	6.5

NOTES:

1. Minimum flow based on 1.0 fps (0.30 m/s) velocity in cooler without special cooler baffling.
2. Minimum Loop Volumes:
Gallons = V x ARI Cap. (tons)
Liters = N x ARI Cap. (kW)

Operation Sequence — During unit off cycle, crankcase heaters are energized. If ambient temperature is below 36 F (2 C), cooler heaters and a microprocessor board heater are also energized.

When control ON-OFF switch is turned to ON, control first goes through a 2-minute initialization period, during which the display will continuously show **20**. Ninety (90) seconds after **20** leaves display, control begins to bring on compressors. Rate at which compressors are started depends on leaving chilled water temperature and rate of change of leaving water temperature.

On standard units, an automatic lead-lag feature in control system determines by random selection either circuit A or B to start first.

At first call for cooling, microprocessor starts first compressor, deenergizes crankcase heater and starts one condenser fan.

UNITS WITH ELECTRONIC EXPANSION VALVE (EXV) — EXV remains closed for 10 seconds to purge cooler and suction line of any liquid refrigerant that may have migrated to these areas during off period. After 10 seconds, expansion valve starts to open. As more cooling is required, control brings on additional stages of capacity. Loading sequence for compressors is shown in Table 15. Automatic lead-lag control is provided on all units.

UNITS WITH STANDARD THERMOSTATIC EXPANSION VALVE (TXV) — Liquid line solenoid valve is not energized for first 10 seconds of compressor operation. This is called pre-pumpout cycle.

Microprocessor determines how rapidly capacity stages are added or subtracted, based on deviation from leaving chilled water temperature set point and rate of change of leaving water temperature. If water temperature is very warm and pulldown option is being used, microprocessor limits rate of temperature drop of leaving water to 1° F (0.56° C) per minute to avoid high peak kW charges. If the capacity is being limited by pulldown, the control display shows a

24 when the display button is pressed. Once capacity has been satisfied, the unit will start to shut down.

UNITS WITH EXV — Lag compressor will shut down, and lead compressor will continue to run. After lag compressor has shut down, the EXV is signaled to close. Lead compressor remains on until EXV is less than 300 steps open, and the saturated suction temperature is less than 25 F (-4 C) as sensed by cooler thermistor T5 or T6, or one minute has elapsed.

UNITS WITH TXV — Lag compressor will be shut down and lead compressor continues to run for 10 seconds to purge cooler of any refrigerant.

LOAD SHED — If load shed option is being used, control limits maximum capacity to load shed input value. Refer to Controls and Troubleshooting publication for details. If capacity is limited by a load shed signal, display shows a **22** when display button is pressed.

ALL UNITS — If temperature reset is being used, microprocessor adjusts leaving water temperature to obtain greater part-load efficiency. Refer to Controls and Troubleshooting book for details. If leaving water temperature is being reset, display shows a **21** when the display button is pressed.

For head pressure control:

UNITS WITH EXV — Microprocessor also controls electronic expansion valve (EXV) to maintain a superheat of 30° F (16.7° C) entering compressor cylinders.

Microprocessor control also cycles condenser fans on and off to maintain an adequate pressure differential across expansion valves. Fans are controlled by position of EXV and saturated condensing temperature thermistors. When expansion valve is fully open and superheat is greater than 40° F (22° C), fan stages are removed; when the valve is approximately half open, fan stages are added. This allows unit to run at very low condensing temperatures at part load. Thus chiller has very high part-load EERs. Fan sequence is shown in Fig. 10.

UNIT WITH TXV — Thermostatic expansion valves, one for each refrigerant circuit, are factory set to maintain 8 to 10° F (5° to 6° C) superheat of vapor leaving cooler to control flow of liquid refrigerant into cooler. Superheat can be reset but should be done only if necessary.

Logic to cycle microprocessor-controlled fans is based on saturated condensing temperature only. This temperature is sensed by thermistors T3 and T4 (Fig. 11 and 12). The microprocessor will turn on an additional stage of fans when either of coil thermistors (T3 or T4) is greater than 113 F (45 C) and will turn off a fan stage when T3 and T4 are both below 73 F (23 C). Between each change in fan stage, control will wait one minute to allow head pressure to stabilize unless either T3 or T4 is greater than 125 F (52 C), in which case all microprocessor-controlled fans will come on immediately.

Condenser fan sequence is shown in Fig. 10.

REMOTE ON-OFF — When it is required to control the starting and stopping of the chiller from a remote location, such as a time clock, the remote ON-OFF feature is used. See Fig. 6 for wiring information. If the chiller is being held "OFF" by the remote ON-OFF switch, a **26** appears in the display when the display button is pressed.

REMOTE ALARM — See Fig. 7 for remote alarm field wiring. Remove the resistor across terminals **1** and **2** on TB5 when remote alarm is being used.

Table 15 — Capacity Control Steps

UNIT SIZE	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
080 (60 Hz)	1	22	A1*	29	B1*
	2	52	A1*,B1*	52	A1*,B1*
	3	67	A1*, B1	63	A1,B1*
	4	78	A1,B1	78	A1,B1
	5	89	A1*,A2,B1	89	A1*,A2,B1
	6	100	A1,A2,B1	100	A1,A2,B1
080 (50 Hz)	1	16	A1*	25	B1*
	2	42	A1*,B1*	42	A1*,B1*
	3	54	A1*,B1	50	A1,B1*
	4	62	A1,B1	62	A1,B1
	5	92	A1*,A2,B1	92	A1*,A2,B1
	6	100	A1,A2,B1	100	A1,A2,B1
090 (60 Hz)	1	18	A1*	18	B1*
	2	35	A1*,B1*	35	A1*,B1*
	3	44	A1*,B1	44	A1,B1*
	4	53	A1,B1	53	A1,B1
	5	65	A1*,A2,B1	71	A1,B1*,B2
	6	73	A1,A2,B1	80	A1,B1,B2
	7	91	A1*,A2,B1,B2	91	A1,A2,B1*,B2
	8	100	A1,A2,B1,B2	100	A1,A2,B1,B2
090 (50 Hz)	1	14	A1*	14	B1*
	2	29	A1*,B1*	29	A1*,B1*
	3	36	A1*,B1	36	A1,B1*
	4	43	A1,B1	43	A1,B1
	5	68	A1*,A2,B1	60	A1,B1*,B2
	6	75	A1,A2,B1	67	A1,B1,B2
	7	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	8	100	A1,A2,B1,B2	100	A1,A2,B1,B2
100 (60 Hz)	1	15	A1*	15	B1*
	2	31	A1*,B1*	31	A1*,B1*
	3	39	A1*,B1	39	A1,B1*
	4	46	A1,B1	46	A1,B1
	5	65	A1*,A2,B1	65	A1,B1*,B2
	6	73	A1,A2,B1	73	A1,B1,B2
	7	92	A1*,A2,B1,B2	92	A1,A2,B1*,B2
	8	100	A1,A2,B1,B2	100	A1,A2,B1,B2
100 (50 Hz)	1	13	A1*	13	B1*
	2	26	A1*,B1*	26	A1*,B1*
	3	33	A1*,B1	33	A1,B1*
	4	40	A1,B1	40	A1,B1
	5	63	A1*,A2,B1	63	A1,B1*,B2
	6	70	A1,A2,B1	70	A1,B1,B2
	7	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	8	100	A1,A2,B1,B2	100	A1,A2,B1,B2
110 (60 Hz)	1	14	A1*	14	B1*
	2	29	A1*,B1*	29	A1*,B1*
	3	36	A1*,B1	36	A1,B1*
	4	43	A1,B1	43	A1,B1
	5	68	A1*,A2,B1	60	A1,B1*,B2
	6	75	A1,A2,B1	67	A1,B1,B2
	7	93	A1*,A2,B1,B2	93	A1,A2,B1*,B2
	8	100	A1,A2,B1,B2	100	A1,A2,B1,B2
110 (50 Hz)	1	17	A1	17	B1*
	2	33	A1*,B1*	33	A1*,B1*
	3	42	A1*,B1	42	A1,B1*
	4	50	A1,B1	50	A1,B1
	5	67	A1*,A2,B1	67	A1,B1*,B2
	6	75	A1,A2,B1	75	A1,B1,B2
	7	92	A1*,A2,B1,B2	92	A1,A2,B1*,B2
	8	100	A1,A2,B1,B2	100	A1,A2,B1,B2

*Compressor unloaded.

NOTE: The microprocessor selects loading sequence A or B, which in turn determines the compressor circuit that is energized first. This evens out operating hours on each circuit over an extended period of time.

SERVICE



ELECTRIC SHOCK HAZARD.

Turn off all power to unit before servicing. The ON-OFF switch on control panel does *not* shut off control power; *use field disconnect.*

Diagnostics and Troubleshooting — Refer to Controls and Troubleshooting book.

For field service use, a factory-installed Ground Fault Interrupter (GFI) convenience outlet is provided in the 208/230-, 460- and 575-v units. The GFI is rated for 15 amps. However, in units with active cooler heaters, only 5 amps are available.

Refrigerant Circuit

LEAK TESTING — Units are shipped with complete operating charge of refrigerant R-22 (see Tables 2 - 5) and should be under sufficient pressure to conduct a leak test. If there is no pressure in the system, introduce enough refrigerant to search for the leak. Repair the leak using good refrigeration practices. After leaks are repaired, system must be evacuated and dehydrated.

DEHYDRATION — Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, Sections 6 and 7 for details. *Do not use compressor to evacuate system.*

REFRIGERANT CHARGE (Refer to Tables 2 - 5) — Immediately ahead of filter drier in each circuit is a factory-installed liquid line service valve. On each valve is a 1/4-in. Schrader connection for charging liquid refrigerant.

Charging with Unit Off and Evacuated — Close liquid line service valve before charging. Weigh in charge shown on unit nameplate (also in Tables 2 - 5). Open liquid line service valve; start unit and allow it to run several minutes fully loaded. Check for a clear sight glass. Be sure clear condition is liquid and not vapor.

Charging with Unit Running — If charge is to be added while unit is operating, it will be necessary to have all condenser fans and compressors operating. It may be necessary to block condenser coils at low ambient temperatures to raise condensing pressure to approximately 280 psig (1931 kPa) to turn all condenser fans on. Do not totally block a coil to do this. Randomly block all coils in uniform pattern. Charge each circuit until sight glass shows clear liquid, then weigh in amount over a clear sight glass as listed in Tables 2 - 5.

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

Electronic Components

CONTROL COMPONENTS — Unit uses an advanced electronic control system that normally will not require service. For details on controls refer to Controls and Troubleshooting book.

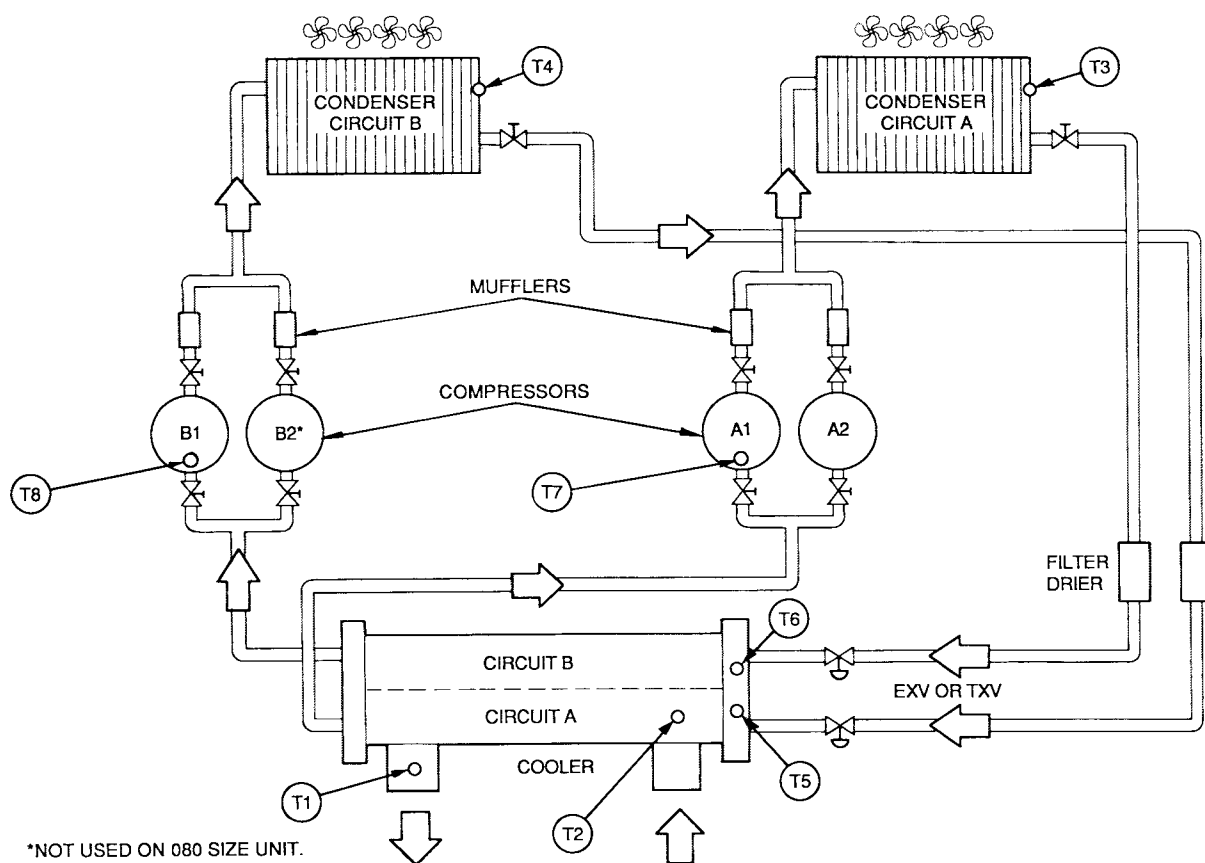


Fig. 11 — Thermistor Locations

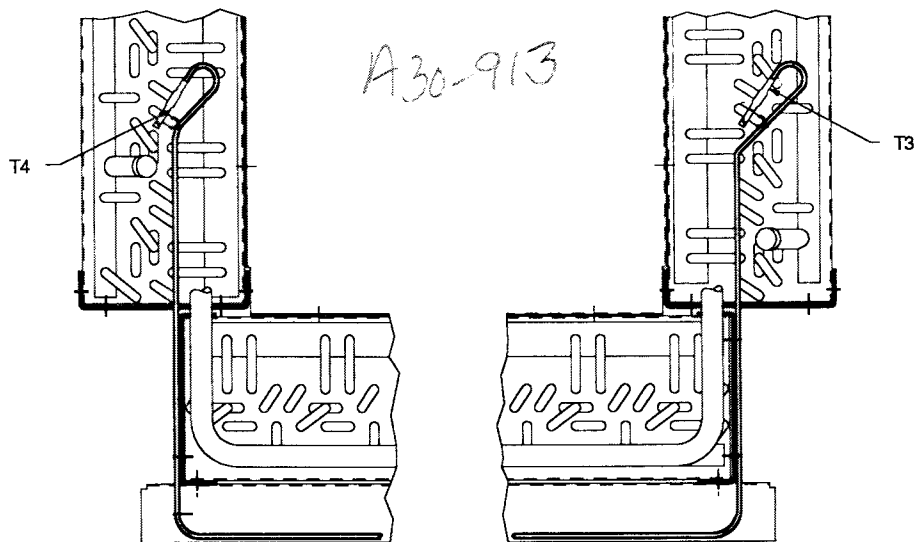


Fig. 12 — Thermistor T3 and T4 Locations

UNIT CONTROL BOX — Viewed facing compressors, main control box is at left end of unit. All incoming power enters through main box. Control box contains power components and electronic controls. Outer panels are hinged and latched for easy opening. Remove screws to remove inner panels. Outer panels can be held open for service and inspection by using door retainer on each panel. Remove bottom pin from door retainer assembly, swing retainer out horizontally, engage pin in one of the retainer ears and the hinge assembly.

Compressors — If lead compressor on either refrigerant circuit becomes inoperative for any reason, circuit is locked off and *cannot* be operated due to features built in the electronic control system. *Do not attempt to bypass controls to force other compressors in circuit to run.*

COMPRESSOR REMOVAL — Access to the pump end of the compressor is from the compressor side of the unit. Access to the motor end of the compressor is from the inside of the unit. All compressors can be removed from the compressor side of the unit.

IMPORTANT: All compressor mounting hardware and support brackets removed during servicing must be reinstalled prior to start-up.

Following the installation of the new compressor:
Tighten discharge valves to —

	Compressor(s)
20 - 25 ft-lbs (27 - 34 N-m)	06E250
80 - 90 ft-lbs (109 - 122 N-m)	06E265,275,299

Tighten suction valves to —

80 - 90 ft-lbs (109 - 122 N-m)	06E250
90 - 120 ft-lbs (122 - 163 N-m)	06E265,275,299

Tighten the following fittings to —

60 ft-lbs (81 N-m)	Discharge Gas Thermostat
120 in.-lbs (13.5 N-m)	High Pressure Switch
120 in.-lbs (13.5 N-m)	Loss of Charge Switch

OIL CHARGE (Refer to Tables 2 - 5.) — All units are factory charged with oil. Acceptable oil level for each compressor is from 1/8 to 3/8 of sight glass (see Fig. 8).

When additional oil or a complete charge is required, use only Carrier-approved compressor oil.

Approved oils are:

Petroleum Specialties, Inc. — Cryol 150 (factory oil charge)
Texaco, Inc. — Capella WF-32
Witco Chemical Co. — Suniso 3GS

COMPRESSOR	OIL REQUIRED	
	Pts	L
06E250	17	8.0
06E265	21	9.9
06E275	21	9.9
06E299	19	9.0

Do not reuse drained oil and do not use any oil that has been exposed to atmosphere.

Cooler — The cooler is easily accessible from the cooler side of the unit. The refrigerant feed components are accessible from the control box end of the unit.

COOLER REMOVAL — Cooler can be removed from the cooler side of the unit as follows:

1. To ensure the refrigerant is in the condenser, follow this procedure:
 - a. Open the circuit breakers for the lag compressors (A2 and B2), and close the discharge valves for these compressors.
 - b. After the lag compressor has shut down, close the liquid line service valve for one circuit. Allow the lead compressor to pump down that circuit until it reaches approximately 10 - 15 psig (68.8 - 103.2 kPa).
 - c. As soon as the system reaches that pressure, shut down the lead compressor by opening the compressor circuit breaker, then quickly close the discharge service valve for that compressor.
 - d. Repeat the procedure for the other circuit.

⚠ WARNING

Do not close the discharge valve of an operating compressor. Severe damage to the compressor can result.

⚠ CAUTION

Open and tag all electrical disconnects before any work begins. Keep in mind that cooler is heavy and both water-side and refrigerant-side may be under pressure.

2. Close the shutoff valves, if installed, in the cooler fluid lines, and remove the cooler fluid piping.
3. Open the air vent at the top of the cooler, and open the drain on the bottom of the cooler near the leaving fluid outlet, to drain the cooler. Both the drain and the air vent are located on the leaving fluid end of cooler. See Fig. 13.
4. Disconnect the conduit and cooler heater wires, if equipped. Remove all thermistors from the cooler, being sure to label all thermistors as they are removed. Thermistors T1 and T2 are immersed directly in the fluid. T5 and T6 thermistors are friction-fit well-type thermistors. See Fig. 13.
5. Remove the insulation on the refrigerant connection end of the cooler.
6. Unbolt the suction flanges from the cooler head. Save the bolts for installation later.
7. Remove the liquid lines by breaking the silver-soldered joints at the cooler liquid line nozzles.
8. Remove the two vertical supports under the condenser coil, in front of the cooler. *Provide temporary support as needed.* Save all screws for reinstallation later.
9. Remove the screws in the cooler feet. Slide the cooler slightly to the left to clear the refrigerant tubing. Save all screws. Remove the cooler carefully.

REPLACING COOLER — To replace cooler, reverse the above procedure. Use new gaskets for the suction line flanges. The suction flange is a 4-bolt pattern. See Carrier specified parts for replacement part number. Use compressor oil to aid in gasket sealing. Tighten the suction flange bolts to 70 -

90 ft-lb (94 - 122 N-m). Use adhesive to reinstall the cooler insulation. Reinstall the thermistors. See Thermistors, page 31. Apply pipe sealant to the 1/4-in. NPT threads on the replacement coupling for the water-side and install it in place of the original. *Do not use the packing nut to tighten the coupling. Damage to the ferrules will result.* Install the cooler heater and conduit (if equipped), and connect the wires as shown in the schematic. Connect the chilled water lines. Be sure to purge the fluid side of air before starting unit.

SERVICING THE COOLER — When cooler heads and partition plates are removed, tube sheets are exposed showing ends of tubes.

⚠ CAUTION

Certain tubes in the 10HB coolers cannot be removed. Eight tubes in the bundle are secured inside the cooler to the baffles and *cannot be removed*. These tubes are marked by a dimple on the tube sheet. See Fig. 14. *If any of these tubes have developed a leak, plug the tube(s) as described under Tube Plugging.*

Tube Plugging — A leaky tube can be plugged until retubing can be done. The number of tubes plugged determines how soon cooler *must* be retubed. Tubes plugged in the following locations will affect the performance of the unit: Any tube in the area, particularly the tube that thermistor T2 is adjacent to, will affect unit reliability. Thermistor T2 is used in the freeze protection algorithm for the controller. If several tubes require plugging, check with your local Carrier representative to find out how number and location can affect unit capacity.

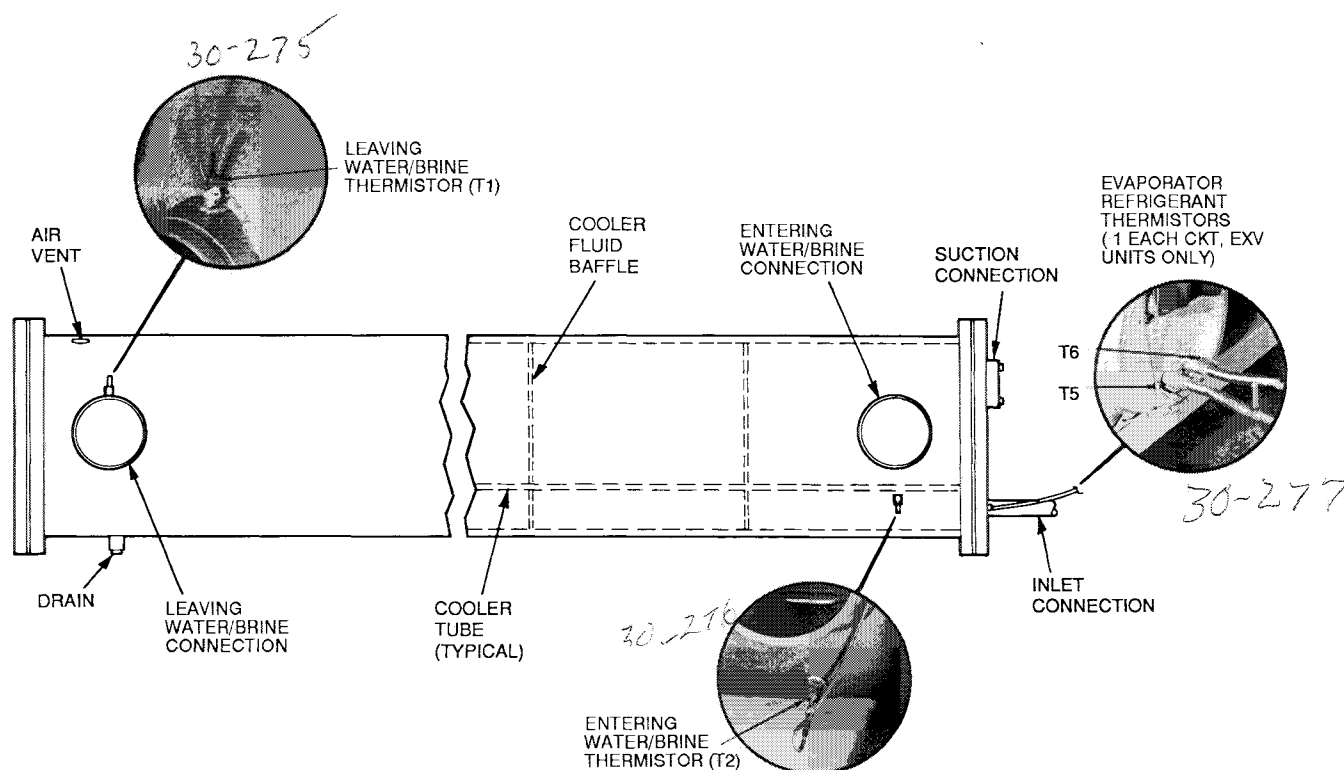


Fig. 13 — Cooler Thermistor Locations

Figure 15 shows an Elliott tube plug and a cross-sectional view of a plug in place.

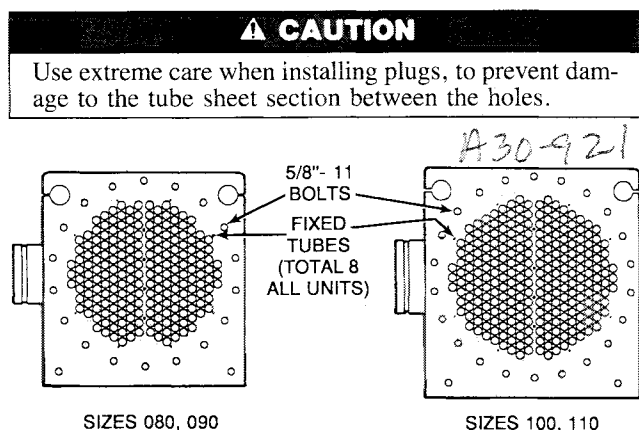


Fig. 14 — Typical Tube Sheets, Cover Off (Non-Removable Tubes)

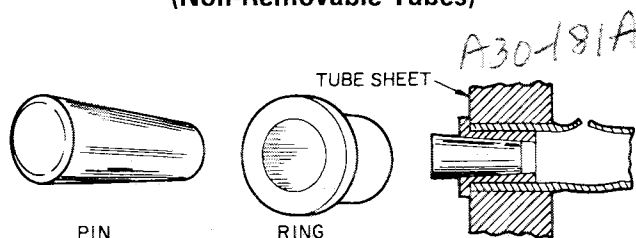


Fig. 15 — Elliott Tube Plug

Table 16 — Plugs

COMPONENTS FOR PLUGGING	PART NUMBER
For Tubes	
Brass Pin	853103-500*
Brass Ring	853002-570*
For Holes without Tubes	
Brass Pin	853103-1*
Brass Ring	853002-631*
Loctite	No. 675†
Locquic	"N"†

*Order directly from: Elliott Tube Company,
Dayton, Ohio

†Can be obtained locally.

Retubing (See Table 16.) — When retubing is to be done, obtain service of qualified personnel experienced in boiler maintenance and repair. Most standard procedures can be followed when retubing the 10HB coolers. An 8% crush is recommended when rolling replacement tubes into the tube

sheet. An 8% crush can be achieved by setting the torque on the gun at 48 - 50 in.-lbs (5.4 - 5.6 N-m).

The following Elliott Co. tube rolling tools are required:

B3400 Expander Assembly
B3401 Cage
B3405 Mandrel
B3408 Rolls

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

Tube information:

	in.	mm
• Tube sheet hole diameter	0.631	16.03
• Tube OD	0.625	15.87
• Tube ID after rolling (includes expansion due to clearance)	0.581 to 0.588	14.76 to 14.94

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

Tightening Cooler Head Bolts

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

5/8-in. Diameter Perimeter Bolts 150 - 170 ft-lbs
(201 - 228 N-m)
1/2-in. Diameter Flange Bolts 70 - 90 ft-lbs
(94 - 121 N-m)

1. Install all bolts finger tight.
2. Bolt tightening sequence is outlined in Fig. 16. Follow the numbering sequence so that pressure is evenly applied to gasket.
3. Apply torque in one-third steps until required torque is reached. Load *all* bolts to each one-third step before proceeding to next one-third step.
4. No less than one hour later, retighten all bolts to required torque values.
5. After refrigerant is restored to system, check for refrigerant leaks with soap solution or Halide device.
6. Replace cooler insulation.

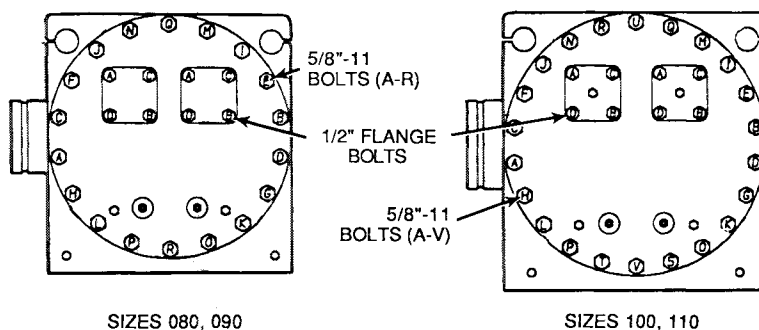


Fig. 16 — Cooler Head Bolt Tightening Sequence (Typical Tube Sheet)

Condenser Coils

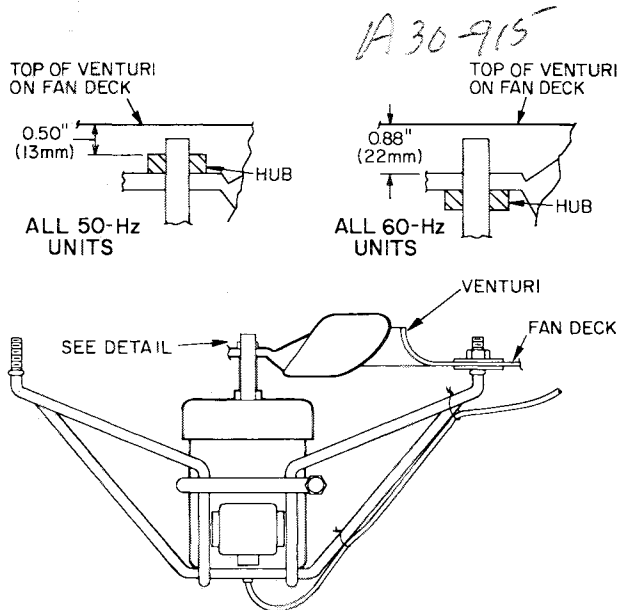
COIL CLEANING — Clean coils with a vacuum cleaner, fresh water, compressed air or a bristle brush (not wire). Units installed in corrosive environments should have coil cleaning as part of a planned maintenance schedule. In this type of application, all accumulations of dirt should be cleaned off the coil.

⚠ CAUTION

Do not use high-pressure water or air — fin damage may result.

Condenser Fans — Each fan is supported by a formed wire mount bolted to fan deck and covered with a wire guard. The exposed end of fan motor shaft is protected from weather by grease. If fan motor must be removed for service or replacement, be sure to regrease fan shaft, and reinstall fan guard. For proper performance, fan should be $\frac{7}{8}$ in. (22 mm) below top of venturi on the fan deck to top of the fan hub for 60 Hz units, and $\frac{1}{2}$ in. (13 mm) for 50 Hz units. Tighten set screws to 15 ± 1 ft-lbs (20 ± 1.3 N-m). Figure 17 shows proper position of mounted fan.

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



NOTE: Fan rotation is clockwise as viewed from top of unit.

Fig. 17 — Condenser Fan Adjustment

Refrigerant Feed Components — Each circuit has all necessary refrigerant controls.

ELECTRONIC EXPANSION VALVE (EXV) — A cut-away drawing of valve is shown in Fig. 18.

High-pressure liquid refrigerant enters valve through bottom. A series of calibrated slots have been machined in side of orifice assembly. A 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 and modulates orifice size. Sleeve is moved by a linear stepper motor. Stepper motor moves in increments and is controlled directly by processor board. As stepper motor rotates, motion is transferred into linear movement by lead screw. Through stepper motor and lead screw, 760 discrete steps of motion are obtained. The large number of steps and long stroke results in very accurate control of re-

frigerant flow. The valve orifice begins to be exposed at 160 steps. Since there is not a tight seal with the orifice and the sleeve, the minimum position for operation is 60 steps.

Control of valve is by microprocessor. Two thermistor temperature sensors are used to determine superheat. One thermistor is located in cooler and other is located in passage between compressor motor and cylinders. The difference between the 2 temperatures controls superheat. On a normal TXV and EXV system, superheat leaving evaporator is normally 10°F (5.6°C) and motor then adds approximately 15°F - 20°F (8°C - 11°C) resulting in approximately 30°F (16.7°C) superheat entering cylinders.

Because EXVs are controlled by processor board, it is possible to track valve position. By this means, head pressure is controlled and unit is protected against loss of charge and a faulty valve. During initial start-up, EXV is fully closed. After initialization period, valve position is tracked by processor by constantly observing amount of valve movement.

The EXV is also used to limit cooler saturated suction temperature to 55°F (13°C). This makes it possible for chiller to start at higher cooler fluid temperatures without overloading compressor. This is commonly referred to as MOP (maximum operating pressure).

If it appears that electronic expansion valve is not properly controlling operating suction pressure or superheat, there are a number of checks that can be made using Quick Test and initialization features built into the microprocessor control. See Controls and Troubleshooting book.

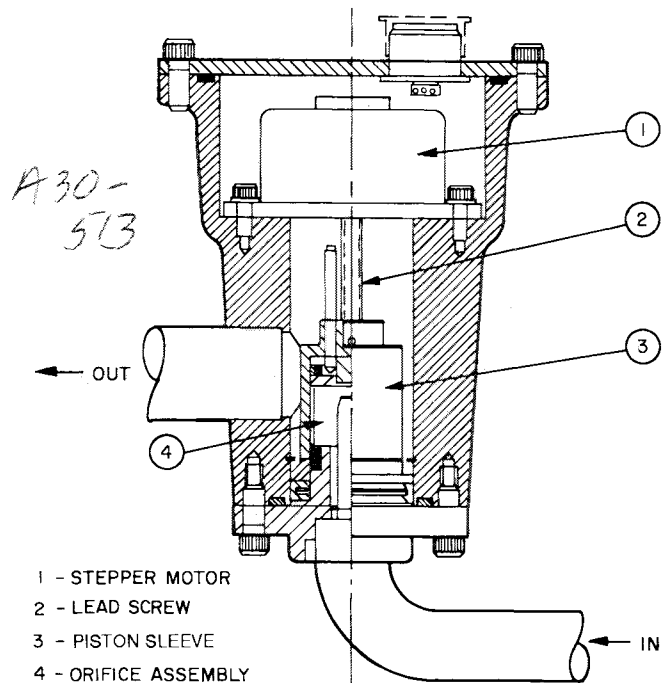


Fig. 18 — Electronic Expansion Valve

Follow steps below to diagnose and correct EXV problems.

Step 1 — Check Processor EXV Outputs — Check EXV output signals at appropriate terminals on J4 terminal strip, as follows:

Turn power OFF. Connect positive test lead of meter to terminal 8 on connector J7 (see Fig. 19). Set meter for approximately 20 vdc. Turn power ON, but do not enter Quick Test mode. For first 50 seconds valve motor windings will be alternately energized to close valve in circuit 1. During this time, connect negative test lead to terminals 9, 10, 11, and 12 in succession. Voltage should rise and fall at each pin. If it remains constant at a voltage or at 0 v, remove connector and recheck. If problem is still there, replace pro-

cessor board. If it is no longer there, expansion valve should be checked.

Turn power OFF and connect positive lead to terminal 1 on connector J7. Turn power ON. After 50 seconds, motor windings in circuit 2 valve will begin to be energized. During this time, connect negative test lead to terminals 2, 3, 4, and 5. Voltage should rise and fall at each pin. If it remains constant at a voltage or at 0 v, remove connector and recheck. If problem is still there, replace processor board. If it is no longer there, expansion valve should be checked.

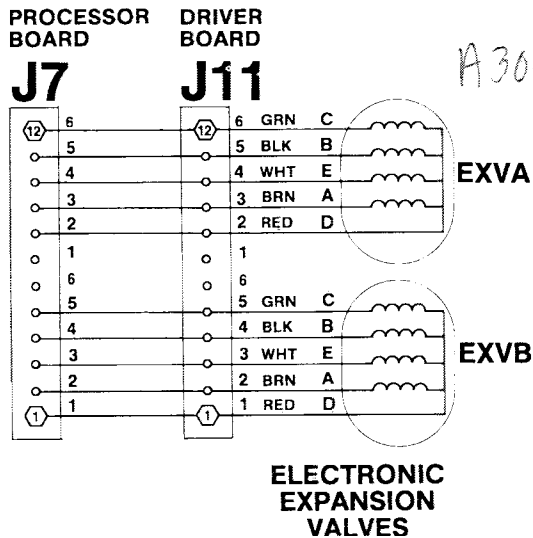


Fig. 19 — Printed-Circuit Board Connector

Step 2 — Check EXV Wiring — Check wiring to electronic expansion valves from J7 terminal strip on processor board (see Fig. 19).

1. Check color coding and wire connections. Make sure they are connected to correct terminals at J7 and EXV plug connections.
2. Check for continuity and tight connection at all pin terminals.
3. Check plug connections at J7 and at EXVs. Be sure EXV connections are not crossed.

Step 3 — Check Resistance of EXV Motor Windings — Remove plug at J7 terminal strip and check resistance between common lead (red wire, terminal D) and remaining leads A, B, C, and E. Resistance should be 25 ohms $\pm$ 2 ohms.

Step 4 — Check Thermistors that Control EXV — Check thermistors that control processor output voltage pulses to EXVs. Circuit no. A thermistors are T5 and T7, circuit no. B thermistors are T6 and T8. Refer to Fig. 11 for location.

1. Use Quick Test steps 2.0. through 2.3. to determine if thermistors are shorted or open.
2. Check thermistor calibration at a known temperature by measuring actual resistance and comparing value measured with values listed in Tables 18 and 19.
3. Make sure that thermistor leads are connected to proper pin terminals at J1 terminal strip on processor board and that thermistor probes are located in proper position in refrigerant circuit (Fig. 11 and 13).

When above checks have been completed, actual operation of EXV can be checked by using procedures outlined in Step 5. During Quick Test steps 3.5. and 3.9., each EXV is opened approximately 250 steps by processor. This Quick Test feature, along with initialization mode **20** can be used to verify proper valve operation.

Step 5 — Check Operation of the EXV — Use following procedure to check actual operation of electronic expansion valves.

1. Close liquid line service valve for circuit to be checked and run through appropriate Quick Test step 3.5. or 3.9. to pump down low side of system. Repeat Quick Test step 3 times to ensure all refrigerant has been pumped from low side and that EXV has been driven fully open (760 steps).

NOTE: Do not use control ON-OFF switch to recycle control during this step, and be sure to allow compressors to run full 10 seconds at each step.

2. Turn OFF control circuit switch and compressor circuit breaker(s). Close compressor service valves and remove any remaining refrigerant from low side of system.
3. Remove screws holding top cover of EXV. Carefully remove top cover, using caution to avoid damage to the O-ring seal and motor leads. If EXV plug was disconnected during this process, reconnect it after the cover is removed.
4. Note position of lead screw (see Fig. 18). If valve has responded properly to processor signals in Step 5.1 above, valve should be fully open and lead screw should protrude approximately $\frac{1}{4}$ in. (6 mm) to $\frac{3}{4}$ in. (19 mm) above top of motor.
5. Recycle control by turning control circuit switch to ON position. This puts control in initialization mode **20**. During first 100 seconds of initialization mode, each valve is driven to fully closed position (760 steps) by processor. With cover lifted off EXV valve body, observe operation of valve motor and lead screw. The motor should turn in the counterclockwise (CCW) direction and lead screw should move down into motor hub until valve is fully closed. Lead screw movement should be smooth and uniform from full open to fully closed position.
6. When test has been completed, carefully reassemble expansion valve. Be careful not to damage motor or O-ring when reassembling valve. Open compressor service valves and close compressor circuit breakers. Open liquid line service valve. Turn control circuit switch to ON, and allow unit to operate. Verify proper operation of unit.

This process of opening and closing EXV can be repeated by repeating Quick Test steps 3.5. or 3.9. and recycling control as described in preceding steps. If valve does not operate as described when properly connected to processor and receiving correct signals, it should be replaced.

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), stuck liquid line solenoid valve(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. Clean or replace valve if necessary.

NOTE: Frosting of valve is normal during Quick Test steps 3.5. and 3.9. and at initial start-up. Frost should dissipate after a 5- to 10-minute operation of 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. Superheat control built into valve is *not* adjustable.

NOTE: The EXV orifice is a screw-in type and may be removed for inspection and cleaning. Once the top cover has been removed, the EXV motor may be taken out by removing the 2 cap screws securing motor to valve body. Pull motor, lead screw, and the slide assembly up off the orifice assembly. See Fig. 18. A slot has been cut in top of orifice assembly to facilitate removal using a large screwdriver. Turn orifice assembly counterclockwise to remove.

When cleaning or reinstalling orifice assembly, care must be taken not to damage orifice assembly seals. The bottom seal acts as a liquid shut-off, replacing a liquid line solenoid valve.

Reassembly of valve is made easier by screwing the slide and lead screw assembly out of the motor. Align hole in top of slide with the guide pin in orifice assembly and gently push slide and lead screw onto orifice assembly about half way. Screw motor onto lead screw and secure EXV motor with cap screws. Care must be taken not to twist or pull on wires from EXV motor to valve cover pin connections. Check EXV operation in Quick Step steps outlined on page 30.

THERMOSTATIC EXPANSION VALVE (TXV) — The FIOP chiller is equipped with conventional thermostatic expansion valve, one per circuit. This control system necessitates use of a liquid line solenoid valve. TXV is factory set to maintain 8° - 10° F (4.4° - 5.6° C) superheat of vapor leaving cooler by controlling flow of refrigerant into cooler. *Superheat can be reset but should be done only if absolutely necessary.*

When TXV is used, thermistors T5, T6, T7, T8 are eliminated (see Fig. 11).

TXV also incorporates an MOP feature to limit cooler suction to 55 F (13 C), making it possible for compressor to start at higher cooler water temperatures without overloading.

MOISTURE-LIQUID INDICATOR — Clear flow of liquid refrigerant indicates sufficient charge in system. Bubbles in the sight glass indicate undercharged system or presence of noncondensables. Moisture in system measured in parts per million (ppm), changes color of indicator: *Green — moisture is below 45 ppm; yellow-green (chartreuse) — 45 to 130 ppm (caution); yellow (wet) — above 130 ppm.* Change filter drier cores at first sign of moisture in system.

IMPORTANT: Unit must be in operation at least 12 hours before moisture indicator can give an accurate reading. With unit running, indicating element must be in contact with liquid refrigerant to give true reading.

FILTER DRIER — Whenever moisture-liquid indicator shows presence of moisture, replace filter drier cores (see below). Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants for details on servicing filter driers.

UNIT SIZES	CORES/DRIER
080,090	One Each Circuit
100,110	Two Each Circuit

LIQUID LINE SOLENOID VALVE — All units have a liquid line solenoid valve to prevent liquid refrigerant migration to low side of system during the off cycle.

LIQUID LINE SERVICE VALVE — This valve is located immediately ahead of filter drier, provided with a 1/4-in. Schrader connection for field charging. In combination with compressor discharge service valve, each circuit can be pumped down into the high side for servicing.

Thermistors — Electronic control uses 4 - 9 thermistors to sense temperatures used to control the operation of chiller.

SENSOR	TEMPERATURE
T1	Cooler Leaving Fluid
T2	Cooler Entering Fluid
T3	Saturated Condensing Temperature — Circuit A
T4	Saturated Condensing Temperature — Circuit B
T5*	Evaporator Refrigerant Temperature — Circuit A
T6*	Evaporator Refrigerant Temperature — Circuit B
T7*	Compressor Return Gas Temperature — Circuit A
T8*	Compressor Return Gas Temperature — Circuit B
T10	Remote Temperature Sensor (Accessory)

*Not used on FIOP units with TXV.

All thermistors are identical in their temperature vs resistance and voltage drop performance. Resistances at various temperatures are listed in Table 18 or 19.

LOCATION — General locations of thermistor sensors are shown in Fig. 11.

Cooler Leaving Fluid Sensor, T1, is located in the leaving water nozzle. The probe is immersed directly in the water. Connection is made through a 1/4-in. coupling (Fig. 20). Actual location is shown in Fig. 11 and 13.

Cooler Entering Fluid Sensor, T2, is located in the cooler shell in first baffle space, in close proximity to tube bundle. The 1/4-in. coupling is used (Fig. 20). Actual location is shown in Fig. 11 and 13.

Saturated Condensing Temperature Sensors, T3 and T4, are each clamped to outside of a return bend on condenser coil. Exact locations for all units are shown in Fig. 11 and 12.

Evaporator Refrigerant Sensors, T5 and T6, are located next to refrigerant inlet in cooler head. Thermistors are well-type thermistors. Typical location is shown in Fig. 11 and 13. (Not used on FIOP units.)

Compressor Return Gas Temperature Sensors, T7 and T8, are located in lead compressor in each circuit in a suction passage between motor and cylinders above oil pump. They are well-type thermistors. Location is shown in Fig. 11. (Not used on FIOP units.)

Remote Sensor, T10, is an accessory sensor and is mounted remotely from unit. It is used for outside air or space temperature reset.

⚠ CAUTION

Sensors T1 and T2 are installed directly in the fluid circuit. Relieve all pressure or drain fluid before removing.

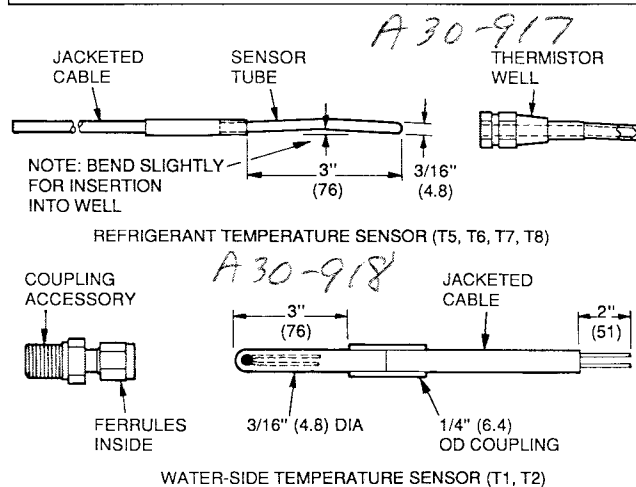


Fig. 20 — Thermistors

To troubleshoot a sensor, refer to separate Controls and Troubleshooting guide.

TO REPLACE SENSORS T1 AND T2 (Cooler):

1. Remove and discard original sensor and coupling. Do not disassemble new coupling. Install assembly as received.
2. Apply pipe sealant to 1/4-in. NPT threads on replacement coupling, and install in place of original. Do not use the packing nut to tighten coupling. Damage to ferrules will result.
3. Insert thermistor T1 into coupling body to its full depth. Thermistor T2 (entering fluid temperature) should not be touching an internal refrigerant tube, but should be close enough to sense a freeze condition. Recommended distance is 1/8 in. (3.2 mm) from cooler tube. Tighten packing nut finger tight to position ferrules, then tighten 1/4 turns more using a back-up wrench. Ferrules are now attached to the sensor, which can be withdrawn from coupling for service.

TO REPLACE THERMISTORS T5, T6, T7 AND T8 (EXV Units Only): Add a small amount of thermal conductive grease to thermistor well. Thermistors are friction-fit thermistors, which must be slipped into receivers located in the cooler head for T5 or T6, and in the compressor pump end for T7 or T8.

THERMISTORS T3 AND T4 are located on header end of condenser coil. They are clamped on a return bend.

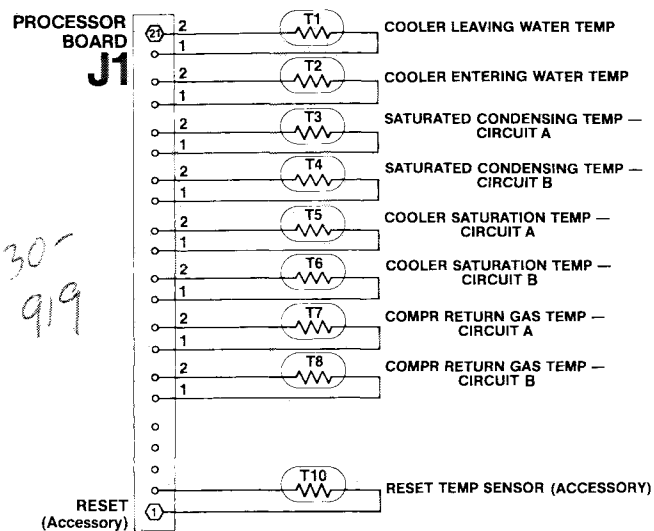
THERMISTOR/TEMPERATURE SENSOR CHECK — A high quality digital volt-ohmmeter is required to perform this check.

1. Connect the digital voltmeter across the appropriate thermistor terminals at the J1 terminal strip on the processor board (see Fig. 21 and Fig. 9). Using the voltage reading obtained, read the sensor temperature from Table 18 or 19. To check thermistor accuracy, measure temperature at probe location with an accurate thermocouple-type temperature measuring instrument. Insulate thermocouple to avoid ambient temperatures from influencing reading. Temperature measured by thermocouple and temperature determined from thermistor voltage reading should be close, $\pm 5^\circ \text{F}$ (3°C) if care was taken in applying thermocouple and taking readings.
2. If a more accurate check is required, machine must be shut down, thermistor removed and checked at a known temperature (freezing point or boiling point of water) using either voltage drop measured across thermistor at the J1 terminals with unit in Quick Test mode **88** or by determining the resistance with chiller shut down and thermistor disconnected from J1.

Safety Devices — Chillers contain many safety devices and protection logic built into electronic control. Following is a brief summary of major safeties. For complete details refer to Controls and Troubleshooting book.

COMPRESSOR PROTECTION

Circuit Breaker — One manual reset calibrated-trip magnetic circuit breaker for each compressor protects against overcurrent. Do not bypass or increase size of a breaker to correct problems. Determine cause for trouble and correct before resetting breaker. Circuit breaker must-trip amps (MTA) are listed on individual circuit breakers, and on unit label diagrams.



T1-T8, T10, THERMISTORS

*Not used on FIOP unit with TXV.

Fig. 21 — Thermistor Connections to J1, Processor Board

Compressor Protection Board (CPCS) — Compressor protection board is used to control and protect compressors and crankcase heaters. Board provides following features:

- Compressor contactor control
- Crankcase heater control
- Ground current protection
- Status communication to processor board
- High-pressure protection
- High discharge gas temperature protection

One large relay is located on CPCS board that controls crankcase heater and compressor contactor; also, relay provides a set of contacts that microprocessor monitors to determine operating status of compressor. If processor board determines that compressor is not operating properly through signal contacts, control locks compressor off.

The CPCS module board contains logic that can detect if current-to-ground of any winding exceeds 2.5 amps; if so, compressor shuts down.

A high-pressure switch with a trip pressure of 426 ± 7 psig ($2,936 \pm 48$ kPa) is mounted on each compressor; switch setting is shown in Table 17. Switch is wired in series with the CPCS board. If switch opens, CPCS relay opens and processor detects it through signal contacts; compressor locks off.

A discharge gas thermostat (DGT) mounted in center head of compressor detects excessive discharge gas temperatures. The DGT is set to trip at $295 \pm 5^\circ \text{F}$ ($146 \pm 3^\circ \text{C}$) and to reset at minimum 235°F (113°C). Switch is wired in series with CPCS board.

If any of these switches open during operation, the compressor stops and the failure is detected by processor when signal contacts open. If lead compressor in either circuit is shut down by high pressure switch, discharge gas thermostat, ground current protector, loss of charge switch, or oil pressure switch, all compressors in the circuit are locked off.

LOW OIL PRESSURE PROTECTION — Lead compressor in each circuit is equipped with a switch to detect low oil pressure. Switch is connected directly to processor board. Switch is set to open at approximately 5 psig (35 kPa) and to close at 9 psig (62 kPa) maximum. If switch opens when compressor is running, processor board stops all compressors in circuit. During start-up, switch is bypassed for 2 minutes.

CRANKCASE HEATERS — Each compressor has a 180-w crankcase heater to prevent absorption of liquid refrigerant by oil in crankcase when compressor is not running. Heater power source is auxiliary control power, independent of main unit power. This assures compressor protection even when main unit power disconnect switch is off.

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

COOLER PROTECTION

Freeze Protection — Cooler is wrapped with heater cables as shown in Fig. 22, which are wired through an ambient temperature switch set at 36 F (2 C). Entire cooler is covered with closed-cell insulation, applied over heater cables. Heaters plus insulation protect cooler against low ambient temperature freeze-up to 0° F (-18 C).

IMPORTANT: If unit is installed in an area where ambient temperatures fall below 32 F (0° C), it is recommended that ethylene glycol or other suitable solution be used in chilled-liquid circuit.

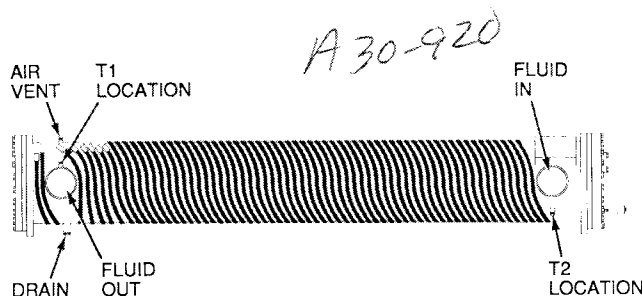


Fig. 22 — Cooler Heater Cables

Low Water Temperature — Microprocessor is programmed to shut chiller down if leaving water temperature drops below 35 F (1.7 C). When water temperature rises 6° F (3.3° C) above leaving water set point, safety resets and chiller restarts.

Loss of Water Flow Protection — Microprocessor contains internal logic that protects cooler against loss of cooler flow. Entering and leaving water temperature sensors in cooler detect a no-flow condition. Leaving sensor is located in leaving water nozzle and entering sensor is located in first cooler baffle space in close proximity to cooler tubes, as shown in Fig. 13. When there is no cooler flow and the compressors start, leaving water temperature does not change. However, entering water temperature drops rapidly as refrigerant enters cooler through EXV. Entering sensor detects this temperature drop and when entering temperature is 5° F (2.8° C) below leaving temperature, unit stops and is locked off.

Loss-of-Charge — A pressure switch connected to high side of each refrigerant circuit protects against total loss-of-charge. Switch settings are listed in Table 17. If switch is open, unit cannot start; if it opens during operation, unit locks out and cannot restart until switch is closed. Low charge is also monitored by the processor when an EXV is used.

Table 17 — Pressure Switch Settings, psig (kPa)

SWITCH	CUTOUT	CUT-IN
High Pressure	426 ± 7 (2936 ± 48)	320 ± 20 (2205 ± 138)
Loss-of-Charge	7 (48.2)	22 (151.6)

A low charge is detected by monitoring EXV position and superheat entering the compressor. If EXV is wide open, superheat is greater than 50° F (28° C) and saturated cooler suction is less than 55 F (13 C), circuit is stopped and locked off.

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

HIGH-SIDE PROTECTION — One device is located between condenser and filter drier; a second is on filter drier. These are both designed to relieve on a temperature rise to approximately 210 F (99 C).

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

Other Safeties — There are several other safeties that are provided by microprocessor control. For details refer to Controls and Troubleshooting book.

Table 18 – Sensor Temperature (°F) vs Resistance/Voltage Drop; Flotronic™

TEMPERATURE (F)	VOLTAGE DROP (V)	RESISTANCE (OHMS)	TEMPERATURE (F)	VOLTAGE DROP (V)	RESISTANCE (OHMS)	TEMPERATURE (F)	VOLTAGE DROP (V)	RESISTANCE (OHMS)
-25	4.684	98,010	63	2.581	7,091	151	0.655	1,007
-24	4.673	94,707	64	2.549	6,911	152	0.644	986
-23	4.662	91,522	65	2.517	6,735	153	0.634	965
-22	4.651	88,449	66	2.486	6,564	154	0.623	945
-21	4.640	85,485	67	2.454	6,399	155	0.613	925
-20	4.628	82,627	68	2.423	6,237	156	0.602	906
-19	4.616	79,871	69	2.391	6,081	157	0.592	887
-18	4.604	77,212	70	2.360	5,929	158	0.582	868
-17	4.591	74,648	71	2.329	5,781	159	0.573	850
-16	4.578	72,175	72	2.299	5,637	160	0.563	832
-15	4.565	69,790	73	2.268	5,497	161	0.554	815
-14	4.551	67,490	74	2.237	5,361	162	0.545	798
-13	4.537	65,272	75	2.207	5,229	163	0.536	782
-12	4.523	63,133	76	2.177	5,101	164	0.527	765
-11	4.509	61,070	77	2.147	4,976	165	0.518	749
-10	4.494	59,081	78	2.117	4,855	166	0.509	734
-9	4.479	57,162	79	2.088	4,737	167	0.501	719
-8	4.463	55,311	80	2.058	4,622	168	0.493	705
-7	4.448	53,526	81	2.029	4,511	169	0.484	690
-6	4.431	51,804	82	2.000	4,403	170	0.476	677
-5	4.415	50,143	83	1.972	4,298	171	0.468	663
-4	4.398	48,541	84	1.943	4,195	172	0.461	650
-3	4.381	46,996	85	1.915	4,096	173	0.453	638
-2	4.363	45,505	86	1.887	4,000	174	0.446	626
-1	4.345	44,066	87	1.859	3,906	175	0.438	614
0	4.327	42,678	88	1.832	3,814	176	0.431	602
1	4.308	41,339	89	1.805	3,726	177	0.424	591
2	4.289	40,047	90	1.778	3,640	178	0.417	581
3	4.270	38,800	91	1.751	3,556	179	0.410	570
4	4.250	37,596	92	1.725	3,474	180	0.403	560
5	4.230	36,435	93	1.699	3,395	181	0.397	551
6	4.209	35,313	94	1.673	3,318	182	0.390	542
7	4.188	34,231	95	1.647	3,243	183	0.384	533
8	4.167	33,185	96	1.622	3,170	184	0.378	524
9	4.145	32,176	97	1.597	3,099	185	0.371	516
10	4.123	31,201	98	1.572	3,031	186	0.365	508
11	4.101	30,260	99	1.548	2,964	187	0.360	501
12	4.078	29,351	100	1.523	2,898	188	0.354	494
13	4.055	28,472	101	1.500	2,835	189	0.348	487
14	4.032	27,624	102	1.476	2,773	190	0.342	480
15	4.008	26,804	103	1.453	2,713	191	0.337	473
16	3.984	26,011	104	1.430	2,655	192	0.332	467
17	3.959	25,245	105	1.407	2,598	193	0.326	461
18	3.934	24,505	106	1.385	2,542	194	0.321	456
19	3.909	23,789	107	1.362	2,488	195	0.316	450
20	3.883	23,096	108	1.341	2,436	196	0.311	444
21	3.858	22,427	109	1.319	2,385	197	0.306	439
22	3.831	21,779	110	1.298	2,335	198	0.301	434
23	3.805	21,153	111	1.277	2,286	199	0.297	429
24	3.778	20,547	112	1.256	2,238	200	0.292	424
25	3.751	19,960	113	1.236	2,192	201	0.288	419
26	3.723	19,392	114	1.216	2,147	202	0.283	415
27	3.696	18,843	115	1.196	2,103	203	0.279	410
28	3.668	18,311	116	1.176	2,060	204	0.274	405
29	3.639	17,796	117	1.157	2,018	205	0.270	401
30	3.611	17,297	118	1.138	1,977	206	0.266	396
31	3.582	16,814	119	1.120	1,937	207	0.262	391
32	3.553	16,346	120	1.101	1,898	208	0.258	386
33	3.523	15,892	121	1.083	1,860	209	0.254	382
34	3.494	15,453	122	1.065	1,822	210	0.250	377
35	3.464	15,027	123	1.048	1,786	211	0.247	372
36	3.434	14,614	124	1.030	1,750	212	0.243	366
37	3.404	14,214	125	1.013	1,715	213	0.239	361
38	3.373	13,826	126	0.997	1,680	214	0.236	356
39	3.343	13,449	127	0.980	1,647	215	0.232	350
40	3.312	13,084	128	0.964	1,614	216	0.229	344
41	3.281	12,730	129	0.948	1,582	217	0.225	338
42	3.250	12,387	130	0.932	1,550	218	0.222	332
43	3.219	12,053	131	0.917	1,519	219	0.219	325
44	3.187	11,730	132	0.902	1,489	220	0.215	318
45	3.156	11,416	133	0.887	1,459	221	0.212	311
46	3.124	11,111	134	0.872	1,430	222	0.209	304
47	3.093	10,816	135	0.857	1,401	223	0.206	297
48	3.061	10,529	136	0.843	1,373	224	0.203	289
49	3.029	10,250	137	0.829	1,345	225	0.200	282
50	2.997	9,979	138	0.815	1,318			
51	2.965	9,717	139	0.802	1,291			
52	2.933	9,461	140	0.788	1,265			
53	2.901	9,213	141	0.775	1,239			
54	2.869	8,973	142	0.762	1,214			
55	2.837	8,739	143	0.750	1,189			
56	2.805	8,511	144	0.737	1,165			
57	2.772	8,291	145	0.725	1,141			
58	2.740	8,076	146	0.713	1,118			
59	2.708	7,868	147	0.701	1,095			
60	2.676	7,665	148	0.689	1,072			
61	2.644	7,468	149	0.678	1,050			
62	2.612	7,277	150	0.666	1,028			

Table 19 – Sensor Temperature (°C) vs Resistance/Voltage Drop; Flotronic™

TEMPERATURE (C)	VOLTAGE DROP (V)	RESISTANCE (OHMS)	TEMPERATURE (C)	VOLTAGE DROP (V)	RESISTANCE (OHMS)	TEMPERATURE (C)	VOLTAGE DROP (V)	RESISTANCE (OHMS)
-32.0	4.690	100 049	16.0	2.651	7507	64.0	0.698	1090
-31.5	4.680	97 006	16.5	2.622	7334	64.5	0.688	1070
-31.0	4.671	94 061	17.0	2.593	7165	65.0	0.678	1050
-30.5	4.661	91 209	17.5	2.565	7000	65.5	0.667	1030
-30.0	4.651	88 449	18.0	2.536	6840	66.0	0.657	1011
-29.5	4.641	85 777	18.5	2.508	6683	66.5	0.648	992
-29.0	4.630	83 191	19.0	2.479	6531	67.0	0.638	973
-28.5	4.620	80 687	19.5	2.451	6382	67.5	0.628	955
-28.0	4.609	78 264	20.0	2.423	6237	68.0	0.619	937
-27.5	4.597	75 918	20.5	2.395	6096	68.5	0.609	919
-27.0	4.586	73 648	21.0	2.367	5959	69.0	0.600	902
-26.5	4.574	71 451	21.5	2.339	5825	69.5	0.591	885
-26.0	4.562	69 324	22.0	2.311	5694	70.0	0.582	868
-25.5	4.550	67 265	22.5	2.283	5566	70.5	0.574	852
-25.0	4.537	65 272	23.0	2.256	5442	71.0	0.565	836
-24.5	4.525	63 344	23.5	2.228	5321	71.5	0.557	820
-24.0	4.512	61 477	24.0	2.201	5203	72.0	0.548	805
-23.5	4.499	59 670	24.5	2.174	5088	72.5	0.540	790
-23.0	4.485	57 921	25.0	2.147	4976	73.0	0.532	775
-22.5	4.471	56 228	25.5	2.120	4867	73.5	0.524	761
-22.0	4.457	54 589	26.0	2.094	4760	74.0	0.516	746
-21.5	4.443	53 003	26.5	2.067	4656	74.5	0.508	733
-21.0	4.428	51 467	27.0	2.041	4555	75.0	0.501	719
-20.5	4.413	49 980	27.5	2.015	4457	75.5	0.493	706
-20.0	4.398	48 541	28.0	1.989	4360	76.0	0.486	693
-19.5	4.383	47 148	28.5	1.963	4267	76.5	0.479	681
-19.0	4.367	45 799	29.0	1.938	4175	77.0	0.472	669
-18.5	4.351	44 492	29.5	1.912	4086	77.5	0.465	657
-18.0	4.334	43 228	30.0	1.887	4000	78.0	0.458	645
-17.5	4.318	42 003	30.5	1.862	3915	78.5	0.451	634
-17.0	4.301	40 817	31.0	1.837	3832	79.0	0.444	623
-16.5	4.283	39 668	31.5	1.813	3752	79.5	0.437	613
-16.0	4.266	38 556	32.0	1.789	3674	80.0	0.431	602
-15.5	4.248	37 478	32.5	1.764	3597	80.5	0.425	592
-15.0	4.230	36 435	33.0	1.741	3523	81.0	0.418	583
-14.5	4.211	35 424	33.5	1.717	3450	81.5	0.412	573
-14.0	4.193	34 444	34.0	1.693	3379	82.0	0.406	564
-13.5	4.174	33 495	34.5	1.670	3310	82.5	0.400	556
-13.0	4.154	32 576	35.0	1.647	3243	83.0	0.394	547
-12.5	4.135	31 685	35.5	1.624	3177	83.5	0.388	539
-12.0	4.115	30 821	36.0	1.602	3113	84.0	0.383	531
-11.5	4.094	29 984	36.5	1.579	3051	84.5	0.377	524
-11.0	4.074	29 173	37.0	1.557	2990	85.0	0.371	516
-10.5	4.053	28 386	37.5	1.536	2931	85.5	0.366	509
-10.0	4.032	27 624	38.0	1.514	2873	86.0	0.361	502
- 9.5	4.010	26 884	38.5	1.492	2816	86.5	0.355	496
- 9.0	3.989	26 168	39.0	1.471	2761	87.0	0.350	489
- 8.5	3.967	25 472	39.5	1.450	2707	87.5	0.345	483
- 8.0	3.944	24 798	40.0	1.430	2655	88.0	0.340	477
- 7.5	3.922	24 144	40.5	1.409	2603	88.5	0.335	472
- 7.0	3.899	23 509	41.0	1.389	2553	89.0	0.331	466
- 6.5	3.876	22 893	41.5	1.369	2504	89.5	0.326	461
- 6.0	3.852	22 296	42.0	1.349	2457	90.0	0.321	456
- 5.5	3.829	21 716	42.5	1.330	2410	90.5	0.317	451
- 5.0	3.805	21 153	43.0	1.311	2364	91.0	0.312	446
- 4.5	3.781	20 606	43.5	1.292	2320	91.5	0.308	441
- 4.0	3.756	20 076	44.0	1.273	2276	92.0	0.303	436
- 3.5	3.732	19 561	44.5	1.254	2234	92.5	0.299	432
- 3.0	3.707	19 061	45.0	1.236	2192	93.0	0.295	427
- 2.5	3.682	18 575	45.5	1.218	2152	93.5	0.291	423
- 2.0	3.656	18 103	46.0	1.200	2112	94.0	0.287	419
- 1.5	3.631	17 645	46.5	1.182	2073	94.5	0.283	415
- 1.0	3.605	17 199	47.0	1.165	2035	95.0	0.279	410
- 0.5	3.579	16 766	47.5	1.148	1997	95.5	0.275	406
0.0	3.553	16 346	48.0	1.131	1961	96.0	0.271	402
0.5	3.526	15 937	48.5	1.114	1925	96.5	0.267	398
1.0	3.500	15 539	49.0	1.098	1890	97.0	0.264	393
1.5	3.473	15 153	49.5	1.081	1856	97.5	0.260	389
2.0	3.446	14 777	50.0	1.065	1822	98.0	0.257	385
2.5	3.419	14 412	50.5	1.049	1789	98.5	0.253	380
3.0	3.392	14 057	51.0	1.034	1757	99.0	0.250	376
3.5	3.364	13 711	51.5	1.019	1725	99.5	0.246	371
4.0	3.337	13 375	52.0	1.003	1694	100.0	0.243	367
4.5	3.309	13 048	52.5	0.988	1663	100.5	0.240	362
5.0	3.281	12 730	53.0	0.974	1634	101.0	0.236	357
5.5	3.253	12 420	53.5	0.959	1604	101.5	0.233	352
6.0	3.225	12 119	54.0	0.945	1575	102.0	0.230	346
6.5	3.197	11 826	54.5	0.931	1547	102.5	0.227	341
7.0	3.169	11 541	55.0	0.917	1519	103.0	0.224	335
7.5	3.140	11 263	55.5	0.903	1492	103.5	0.221	330
8.0	3.112	10 992	56.0	0.890	1465	104.0	0.218	324
8.5	3.083	10 729	56.5	0.876	1438	104.5	0.215	318
9.0	3.054	10 472	57.0	0.863	1412	105.0	0.212	312
9.5	3.026	10 223	57.5	0.850	1387	105.5	0.209	305
10.0	2.997	9 979	58.0	0.837	1362	106.0	0.206	299
10.5	2.968	9 742	58.5	0.825	1337	106.5	0.204	292
11.0	2.939	9 512	59.0	0.812	1313	107.0	0.201	285
11.5	2.911	9 287	59.5	0.800	1289			
12.0	2.882	9 068	60.0	0.788	1265			
12.5	2.853	8 855	60.5	0.776	1242			
13.0	2.824	8 647	61.0	0.765	1219			
13.5	2.795	8 444	61.5	0.753	1197			
14.0	2.766	8 247	62.0	0.742	1175			
14.5	2.737	8 055	62.5	0.731	1153			
15.0	2.708	7 868	63.0	0.720	1132			
15.5	2.680	7 685	63.5	0.709	1111			

