

Reciprocating Heat Reclaim Units

60-Hertz CONTENTS

| | Page | | Page |
|---------------------------------------------------|------|-------------------------------------------|-------|
| INSTALLATION | 1 | Check Compressor Protection Devices | 7 |
| Step 1 — Inspect the Shipment | 1 | CIRCUIT BREAKER | 7 |
| Step 2 — Rig and Place the Unit | 1 | DISCHARGE TEMPERATURE | |
| RIGGING | 1 | THERMOSTAT | 7 |
| PLACEMENT | 1 | CRANKCASE HEATER | 7 |
| Step 3 — Check Compressor Mounting & | | TIME GUARD® CONTROL | 7 |
| Connections | 1,2 | FOUR FUNCTION TIMER | 8 |
| SERVICE ACCESS | 3 | OIL PRESSURE SAFETY SWITCH (OPS) .. | 8 |
| Step 4 — Make Piping Connections | 3 | Check Unit Safety Devices | 8 |
| CONDENSER DESCRIPTION | 3 | SAFETY THERMOSTAT | 8 |
| TOWER CONDENSER PIPING | 3 | HIGH-PRESSURE SWITCH | 9 |
| HEAT RECLAIM CONDENSER PIPING .. | 3 | LOW-PRESSURE SWITCH | 9 |
| COOLER DESCRIPTION | 4 | Check Capacity Control System | 9 |
| COOLER PIPING | 4 | DESCRIPTION | 9 |
| Step 5 — Make Electrical Connections | 4 | 4-STEP TEMPERATURE CONTROLLER .. | 9 |
| ELECTRICAL BOX, CONTROL SECTION .. | 5 | DESIGN SETPOINT ADJUSTMENT | 10 |
| ELECTRICAL BOX, POWER SECTION .. | 5 | CYLINDER UNLOADING SYSTEM | 10 |
| START-UP AND SERVICE | 5 | UNIT OPERATION | 11 |
| INITIAL CHECK | 5 | Control Power | 11 |
| Check Refrigerant Charge | 6 | Control Sequence | 11 |
| LIQUID CHARGING METHOD | 6 | Stoppage and Restart | 11 |
| Check Oil Charge | 6 | SERVICING THE COOLER | 11,12 |
| TO ADD OIL | 6 | Tube Plugging | 12 |
| TO REMOVE OIL | 6 | Retubing | 12 |
| START-UP AND OPERATION CHECKS | 6 | Tightening Cooler Head Bolts | 12 |
| Check Refrigerant Feed Components | 7 | GASKET PREPARATION | 12 |
| THERMOSTATIC EXPANSION VALVE .. | 7 | BOLT TORQUES | 12 |
| FILTER-DRIER | 7 | BOLT TIGHTENING SEQUENCE | 13 |
| MOISTURE-LIQUID INDICATOR | 7 | TROUBLESHOOTING GUIDE | 14,15 |
| LIQUID-LINE SERVICE VALVE | 7 | | |
| PRESSURE RELIEF DEVICES | 7 | | |

INSTALLATION

Step 1 — Inspect the Shipment

Inspect the unit for damage or missing parts. If damage is detected, or if shipment is incomplete, file a claim immediately with the shipping company.

Step 2 — Rig and Place the Unit

RIGGING

On each end of the cooler, a steel loop is provided for the preferred method of lifting the unit. *Use spreader bars to keep cables away from the compressor enclosure and control box.* If unit is to be moved by fork truck, use the following methods:

1. From the front or rear, lift under the cooler rails. Unit can be either on or off the skid.
2. When moving from the ends, *leave the unit on the skid.* Lift from under the skid.

If unit is to be dragged or rolled into final position, leave it on the skid; *apply force only to the skid, not the unit.* When rolling, use a minimum of 3 rollers.

PLACEMENT

When the unit is in final position, remove the skid, level the unit with a spirit level and bolt to the floor or pad.

These units are not suitable for unprotected outdoor use.

Carrier recommends that these units be located in the basement or on the ground floor. However, if it is necessary to locate the unit on an upper floor, be sure the structure has been designed to support the weight. If necessary, add structural support to the floor. Also, be sure the surface for installation is level. Refer to Fig. 1 for space requirements and Table 1 for weight distribution.

Only electrical power connections and water connections for condensers and cooler are required for installation.

Step 3 — Check Compressor Mounting and Connections — As shipped, compressor is held down by special self-locking bolts and plain lock washers. After unit is installed, remove the self-

UNIT DIMENSIONS (ft.-in.)

| DIMENSION | 30H | | | DIMENSION | 30H | | |
|----------------------|-----|------------|------------|--------------------------|-----|------------|------------|
| | 040 | 050,060 | | | 040 | 050,060 | |
| LENGTH | | | | LOC. CHILLED WATER CONN. | | | |
| Basic Unit | A | 8 - 1-7/16 | 8 - 7 | Inlet | G | 1 - 6 | 1 - 11-1/2 |
| With Cond. Manifolds | A' | 9 - 1-3/4 | 9 - 2-1/8 | Outlet | H | 0 - 11 1/2 | 1 - 5 |
| WIDTH | B | 2 - 11-3/8 | 2 - 11-3/8 | SPACE FOR COOLER TUBE | | | |
| HEIGHT | C | 6 - 7-3/16 | 6 - 7-3/16 | REMOVAL (Either End) | J | 7 - 6 | 9 - 0 |
| BETWEEN MTG HOLES | | | | LOC. COOLER DRAIN | K | 1 - 2-1/4 | 1 - 8-1/2 |
| Length | D | 4 - 6-1/2 | 4 - 6-1/2 | | | | |
| Width | E | 2 - 1 | 2 - 1 | | | | |
| BETWEEN LIFT ANGLES | F | 6 - 11-1/2 | 6 - 11 | | | | |

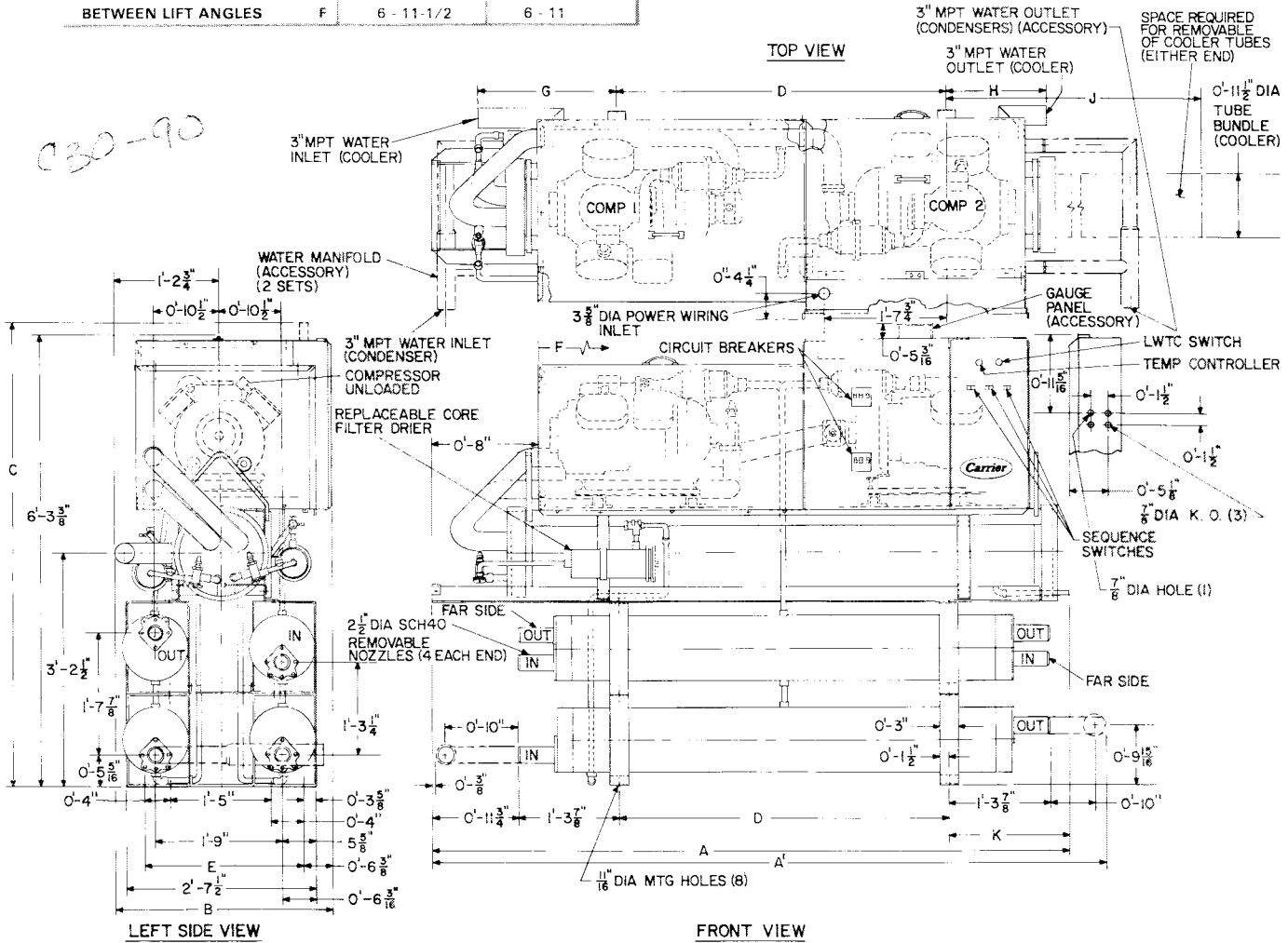
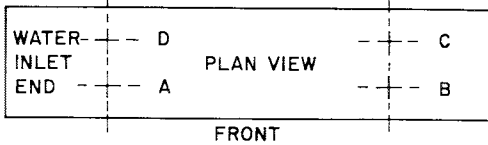


Fig. 1 — Unit Dimensions (30H050,060 shown)

Table 1 — Weight Distribution (lb)

| UNIT 30H | APPROXIMATE OPERATING WT | APPROXIMATE LOAD AT EACH MTG HOLE (A, B, C, D) |
|----------|--------------------------|------------------------------------------------|
| 040 | 3930 | 983 |
| 050 | 4310 | 1078 |
| 060 | 4440 | 1110 |

LOCATION OF MOUNTING HOLES:



locking bolts one at a time and reassemble with flanged washers and neoprene snubbers as shown in Fig. 2. Special flanged washers and neoprene snubbers are shipped in a cloth bag tied to one of the compressor feet. Tighten all 4 bolts. Then loosen each until the flanged washer can be moved sideways with finger pressure.

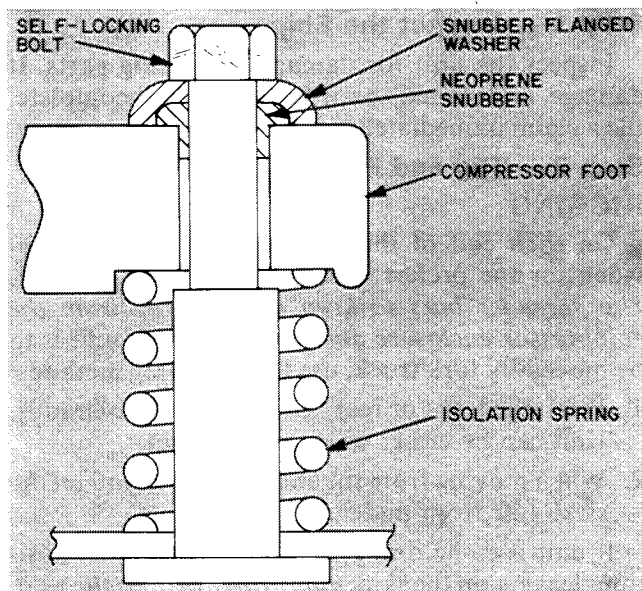


Fig. 2 — Compressor Mounting

Table 2 — Physical Data

COMPLETE UNIT

| UNIT 30H | | 040 | 050 | 060 |
|--------------------------------|---------------|------|------|------|
| APPROX OPER WT (lb) | | 3930 | 4310 | 4440 |
| REFRIG CHG, R-22 (lb) | Ckt 1 | 52 | 62 | 62 |
| | Ckt 2 | 52 | 52 | 62 |
| COMPRESSOR 06E | Ckt 1 | B250 | J275 | J275 |
| | Ckt 2 | B250 | B250 | J275 |
| Cylinders/Compressor | Ckt 1 | 4 | 6 | 6 |
| | Ckt 2 | 4 | 4 | 6 |
| Unloaders/Compressor | Ckt 1 | 1 | 1 | 1 |
| | Ckt 2 | 1 | 1 | 1 |
| Oil Chg Per Compressor (pt) | Ckt 1 | 14 | 19 | 19 |
| | Ckt 2 | 14 | 14 | 19 |
| Capacity Control Steps | | 4 | 4 | 4 |
| TOWER COND, 09RP | Ckt 1 | 022 | 027 | 027 |
| | Ckt 2 | 022 | 022 | 027 |
| HEAT RECLAIM COND, 09RP | Ckt 1 | | 022 | |
| | Ckt 2 | | 022 | |
| MAX DESIGN WORK. PRESS. (psig) | | | | |
| Cooler | { Water Side | | 150 | |
| | { Refrig Side | | 235 | |
| Tower Condensers | { Water Side | | 250 | |
| | { Refrig Side | | 385 | |

COOLER

| | | | |
|----------------------------------------|--------------|-----------------------|----------|
| COOLER, 10HA400 | | 144 | 154 |
| UNIT 30H | | 040 | 050, 060 |
| SHELL, Net Volume (gal.) | | 13.1 | 15.2 |
| TUBES | | Copper, Internal Fins | |
| OD x Wall Thickness (in.) | | 5/8 x 0.025 | |
| Number | | 129 | 129 |
| Length (in.) | | 74.5 | 85.5 |
| Effective Outside Surface Area (sq ft) | | 126.6 | 146.0 |
| REFRIG CIRCUITS | | 2 | 2 |
| CONNECTIONS (in.) | | | |
| Water | { In and Out | 3 | 3 |
| | { Drain | 3/4 | 3/4 |
| Refrig | { Liquid | 1.125 | 1.125 |
| | { Suction | 1.625 | 2.125 |

CONDENSERS

| | | | |
|----------------------------|----------------|-----------------------|-------|
| CONDENSER 09RP (See Note) | | 022 | 027 |
| TUBES | | Copper, Internal Fins | |
| OD (in.) | | 3/4 | |
| Wall Thickness (in.) | | | |
| Plain End | | .042 | |
| Finned Section | | .028 | |
| Length (in.) | | 70-5/32 | |
| Fins/in. | | 40 | |
| Number Tubes* | | 36 | 44 |
| Surface Area (sq ft) | { Inside | 32.9 | 40.2 |
| | { Outside | 133.6 | 163.4 |
| NO. WATER PASSES | | 3 | |
| CONNECTIONS (in.) | | | |
| Water | { Inlet (IPS) | 2-1/2 | |
| | { Outlet (IPS) | 2-1/2 | |
| Relief Valve Outlet† (SAE) | | 5/8 | |
| Liquid Outlet (ODF) | † | 7/8 | |
| Hot Gas (ODF) | | 1-3/8 | |

*In Tower condensers, 5 of the tubes are in subcooling section.
†Not on Heat Reclaim Condensers.

NOTE: Heat Reclaim Condensers same as Tower Condensers except where noted. The bottom outlet of each Heat Reclaim Condenser is same size as Hot Gas connection.

CAUTION: Be sure interconnecting piping and electrical conduits are suspended free of contact with any adjacent walls and be sure unit capillaries are not rubbing against anything.

SERVICE ACCESS

Remove the combination top and back cover over each compressor. Servicing can be performed from either top or back. For rear access, allow approximately 3 ft of clear space behind unit.

Step 4 — Make Piping Connections

CONDENSER DESCRIPTION

In the 4-condenser bundle, the lower 2 are Tower and the upper 2 are Heat Reclaim. All are shell and tube type with removable heads for easy tube servicing. Each Tower condenser has an internal sub-cooler designed to provide 12 F to 15 F total liquid subcooling at average tower water conditions. The Heat Reclaim condensers do not require subcooling, therefore, the subcooler baffling is removed. For further condenser data, refer to Table 2 — Physical Data.

TOWER CONDENSER PIPING

Provide means for draining system in winter and for maintenance.

IMPORTANT: Condenser water must enter at the bottom for proper operation of the internal subcooler, which is in the bottom of the condenser (Fig. 1).

Water supply lines should be sized according to the required flow rate for operation at design conditions (not necessarily connection size). Use flexible connections to reduce vibration transmission.

A cooling tower bypass valve is usually used to regulate the temperature of the water entering the condensers. This may be controlled by sensing either outdoor air temperature or temperature of water leaving the Heat Reclaim condensers. For further information on Systems Controls, refer to the Engineering Guide for Reciprocating Chiller Heat Reclaim Systems.

HEAT RECLAIM CONDENSER PIPING

Normally, the piping is for series water flow thru the condensers. Piping to and from the condensers is connected to the heating system of the building. Piping for parallel water flow thru the condensers is used only when the cooling load is constant at all times. For further piping information, refer to the Engineering Guide for Reciprocating Chiller Heat Reclaim Systems.

Figure 1 shows connections for series piping thru the Heat Reclaim condensers.

CAUTION: Retighten all condenser head bolts before filling system with water. Torque bolts to 150-170 lb-ft.

Water leaving condenser is under pressure and should not be connected directly into sewer lines. Check local codes. A 3/8-in. drain plug is located in the head at each end of the condenser.

Refer to Pressure Relief Devices concerning connections for these components.

COOLER DESCRIPTION

The cooler is a direct-expansion type with removable heads and is partitioned for multi-pass refrigerant flow. The water flow across the tube bundle is directed by baffles designed for minimum water-pressure drop. The tubes have integral internal fins for maximum heat transfer efficiency.

Viewed from the front of the unit, the chilled water enters (returns) at the left end of the cooler and leaves at the right end. The sensing bulb for the factory-set water temperature controller is located in the return-water nozzle; the return-water temperature being the control point. The sensor for the low water-temperature cutout is located in the leaving water nozzle.

The cooler is insulated with a flexible, closed-cell plastic foam insulation of suitable thickness. Water vapor cannot penetrate the cellular structure to condense either within the cells or on the cooler shell. Thus, the insulation itself is a vapor barrier. Because of the toughness of the insulation, a protective sheet metal covering is not necessary.

The standard cooler can be used for all glycol brines down to -20 F. However, for calcium or sodium chloride brines, it is important that the proper inhibitors be carefully selected for protection of the copper tubes. Refer to publications of the Calcium Institute or the Mutual Chemical Division of Allied Chemical Corporation for information on corrosion control in calcium or sodium chloride systems.

COOLER PIPING

Plan piping for minimum number of changes in elevation. Install manual or automatic vent valve at high points in line. Maintain system pressure by using a pressure tank or combination relief and reducing valve.

See Carrier System Design Manual, Part 3, Piping Design, for chilled water piping details.

Install thermometers in entering and leaving water lines. Provide drain connections at all low points to permit complete drainage of system. Connect shutoff valve to drain line before operating unit. Install shutoff valves near entering and leaving water connections. Use flexible connections to reduce vibration transmission.

Insulate piping *after leak testing* to prevent heat transfer and sweating. Cover insulation with moisture seal.

Step 5 — Make Electrical Connections

All field wiring must conform with local code requirements. Control circuit is 115 volts on all 60-Hertz units. Accessory transformer package is available to allow 115 volts to be taken directly from unit terminal block (see Fig. 3). Installation instructions are furnished with the accessory package. Control power may also be supplied from a separate source thru a 15-amp fused disconnect.

Inside the control box, provision is made to connect the ground wire which must be installed with each field power supply.

All units are factory supplied with across-the-line start at all voltages.

Refer to Table 4 for electrical data on individual compressors and complete units and compressor usage.

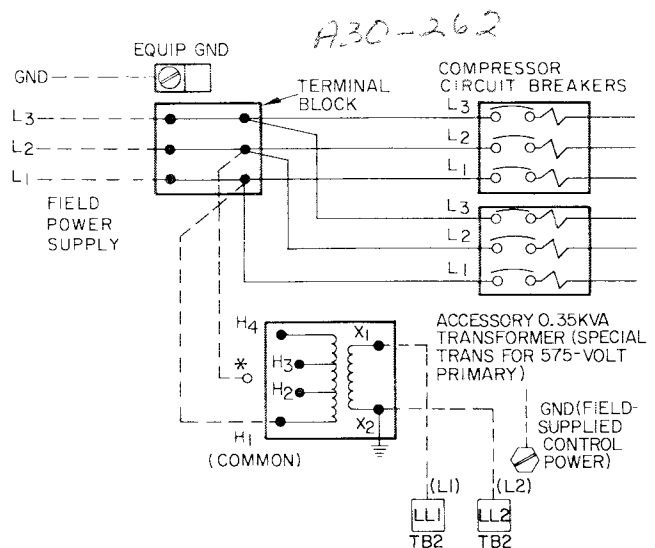
LABEL DIAGRAMS

The applicable Label Diagrams for the 30H040, 050,060 Heat Reclaim units are the same as for the standard 30HK040,050,060 units.

Table 3 — Unit Voltage and Model Number

| UNIT 30H | VOLTS | | | |
|-------------|--------|-----|-----|-----|
| | 200 | 230 | 460 | 575 |
| | Model* | | | |
| 040 | 420 | 520 | 620 | 120 |
| 050 | 420 | 520 | 620 | 120 |
| 060 | 420 | 520 | 620 | 120 |

*Last 3 digits of complete model number.



WHEN CONTROL CIRCUIT POWER IS FROM SEPARATE SOURCE INCOMING WIRES ARE CONNECTED DIRECTLY TO TERMINALS LL1 AND LL2 ON TB2. LL2 MUST BE CONNECTED TO NEUTRAL (GROUND) POTENTIAL.

CB — Circuit Breaker
EQUIP GND — Equipment Ground
TB — Terminal Board

*Appropriate transformer terminal depends on unit voltage. Instructions with accessory transformer package. H2 = 200 v; H3 = 230 v; H4 = 460 v.

NOTE: For grounding 115-volt control circuit when transformer is used, see instructions with accessory transformer package.

Fig. 3 — Wiring Schematic — Unit and Control Power Supply

Table 4 — Electrical Data; 3-Phase, 60-Hertz

COMPLETE UNIT

| VOLTS | Nameplate | | 200 | | 230 | | 460 | | 575 | | 06E COMPR USAGE† | | |
|---------|---------------|------|---------------|-----|---------------|-----|---------------|-----|---------------|---------|------------------|------|------|
| | Supply Range* | | 180-229 | | 207-264 | | 414-528 | | 518-660 | | | | |
| UNIT 30 | MKW | MCA | Max Fuse Amps | MCA | Max Fuse Amps | MCA | Max Fuse Amps | MCA | Max Fuse Amps | Circuit | | | |
| | | | | | | | | | | 1 (L) | 2 (R) | | |
| H | 040 | 50.4 | 194 | 250 | 167 | 225 | 110 | 84 | 110 | 68 | 90 | B250 | B250 |
| | 050 | 61.1 | 230 | 300 | 207 | 300 | 150 | 104 | 150 | 84 | 125 | J275 | B250 |
| | 060 | 71.8 | 259 | 350 | 239 | 300 | 150 | 120 | 150 | 97 | 125 | J275 | J275 |

INDIVIDUAL COMPRESSORS

| UNIT 30 | COMPR 06E | KW | 200 V | | | 230 V | | | 460 V | | | 575 V | | | |
|---------|-----------|---------|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|-----|-----|----|
| | | | RLA | LRA | MTA | RLA | LRA | MTA | RLA | LRA | MTA | RLA | LRA | MTA | |
| H | 040 | 250 (2) | 25.2 | 86 | 345 | 60 | 74 | 300 | 102 | 37 | 150 | 50 | 30 | 120 | 42 |
| | 050 | 275 (L) | 35.9 | 115 | 506 | 80 | 106 | 440 | 72 | 53 | 220 | 73 | 43 | 176 | 58 |
| | | 250 (R) | 25.2 | 86 | 345 | 60 | 74 | 300 | 102 | 37 | 150 | 50 | 30 | 120 | 42 |
| | 060 | 275 (2) | 35.9 | 115 | 506 | 80 | 106 | 440 | 72 | 53 | 220 | 73 | 43 | 176 | 58 |

6-Pole Breakers; values shown are for each 3-pole section.
KW — Maximum Power Input (compressor)
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps. Complies with National Electrical Code (NEC), Section 430-24.
MKW — Unit Power Input at operating conditions of 50 F Leaving Chilled Water Temperature (44 F Saturated Suction Temperature) and 145 F Saturated Discharge Temperature.

MTA — Must Trip Amps (Factory-installed circuit breaker)
RLA — Rated Load Amps
 *Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the range limits shown.
 †Prefix: B, J = 1 electric unloader.

ELECTRICAL BOX CONTROL SECTION

Inside this section are: relays, high- and low-pressure cut-outs, low water-temperature cut-out, timer, terminal strips and a 4-step temperature controller. On the outside (control panel) are: control circuit ON-OFF switch, partial load switch, compressor transfer switch, compressor run light, safety trip lights and control circuit fuse. The control panel is hinged to provide easy access to the controls inside.

ELECTRICAL BOX, POWER SECTION

The main electrical power supply is brought in

thru the top of the electrical box, on the left-hand side (see Fig. 1). The hole is suitable for accommodating 3-in. conduit. Pressure-lug connections on the terminal block are suitable for copper, copper-clad aluminum or aluminum wire.

In this section are: main power terminal block, compressor circuit breakers with calibrated magnetic trip (for compressor motor overload and locked rotor protection) and compressor motor contactors. The panel over this section is secured with screws as a safety measure against casual entry for purposes other than service.

START-UP AND SERVICE

WARNING: Shut off all power to the unit before proceeding with any service work.

INITIAL CHECK

Do not start the liquid chiller even momentarily until the following steps have been completed.

1. Check all auxiliary components such as chilled liquid circulating pump, cooling tower if used, air handling equipment, or other equipment to which the chiller supplies liquid. Consult the manufacturer's instructions.
2. Check safety thermostat. See Safety Thermostat.
3. Determine if there is a refrigerant charge in the system. See Check Refrigerant Charge.
4. Backseat (open) compressor suction and discharge shutoff valves.

5. Open liquid line shutoff valves.
6. Fill chilled liquid circuit completely with clean water or other noncorrosive fluid to be cooled. Bleed all air out of high points of system.
7. Fill cooling tower for condenser cooling water.
8. Set temperature controller.
9. Check tightness of all electrical connections.
10. Check compressor oil (should be visible in bull's-eye). Refer to Check Oil Charge.
11. Be sure crankcase of each compressor is warm (heaters should be on for 24 hours before starting compressors).
12. Be sure compressors are floating freely. See INSTALLATION, Step 3.

Check Refrigerant Charge

IMPORTANT: Do not open liquid valve or compressor discharge valve until it is determined that there is a charge in the remainder of the system. A positive pressure will indicate a charge in the system.

The units are shipped with a full refrigerant charge (see Table 2). However, if it is necessary to add refrigerant, the unit should be operated for some time at full capacity and then charge can be added until the sight glass is clear of bubbles. For maximum liquid subcooling, the liquid level should be up to the liquid level test cock located on the shell, near the end, of each tower condenser. This usually requires additional refrigerant charge beyond the amount to clear the sight glass (see LIQUID CHARGING METHOD).

If there is no refrigerant vapor pressure in the system, the entire system must be leak tested. After repair of leaks, the system must be evacuated before recharging. See Standard Service Techniques Manual, Chapter 1, Refrigerants, for leak testing, evacuation and charging procedures.

CAUTION: When adjusting refrigerant charge, circulate water thru the condenser and cooler at all times to prevent freezing. Freezing damage is considered abuse and is not covered by Carrier warranty.

The liquid charging method is recommended for complete charging or when additional charge is required.

LIQUID CHARGING METHOD

CAUTION: Be careful not to overcharge system. Overcharging results in higher discharge pressure with higher cooling water consumption, possible compressor damage, higher power consumption.

Charge thru 1/4-in. flare connection on liquid line shutoff valve. *Never charge liquid into the low-pressure side of the system.*

1. Frontseat (close) liquid line shutoff valve.
2. Connect a refrigerant cylinder loosely to charging valve connection. Purge charging line and tighten connections.
3. Open liquid line shutoff valve.
4. If system has been dehydrated and is under vacuum, break vacuum with refrigerant (gas charge). Build up system pressure to 58 psi for R-22 (32 F). Invert refrigerant cylinder so that liquid refrigerant will be charged.
5. a. For complete charge, see "Charging" in Standard Service Techniques Manual, Chapter 1, Refrigerants. Follow Charging By Weight procedure. (When charge is nearly full, complete process by observing sight glass for clear liquid flow.)

- b. For complete charge where refrigerant cylinder cannot be weighed, or for adding refrigerant, follow the procedure Charging By Sight Glass in the manual.

6. To ensure maximum subcooler performance, check liquid level in tower condensers by means of test cock located on each condenser shell near right end tube sheet. Liquid discharge from test cock indicates fully charged subcooler.

Check Oil Charge — All units are factory charged with oil. If oil is visible in sight glass, check the unit for operating readiness as described in the section, Initial Check; then start compressor. Observe level and add oil, if required, to bring level in crankcase 1/8 to 3/8 of bull's-eye during steady operation. To add or remove oil, see Standard Service Techniques Manual, Chapter 1, Refrigerants.

Use only Carrier approved compressor oil. Do not reuse drained oil or use any oil that has been exposed to atmosphere.

Approved compressor oils:

| | |
|------------------------|---------------------------------------------------------|
| <i>Sun Oil Co.</i> | <i>Suniso 3GS</i> |
| <i>Texaco, Inc.</i> | <i>Capella BI</i> |
| <i>E.I. DuPont Co.</i> | <i>DuPont Synthetic Refrigeration Oil, 150 SSU only</i> |

TO ADD OIL

Close suction shutoff valve and pump down crankcase to 2 psig (low-pressure cutout must be bypassed with a jumper). Wait a few minutes and repeat as needed until pressure remains at 2 psig. Close discharge shutoff valve. Remove oil fill plug above bull's-eye, add oil thru plug hole and replace plug. Reopen suction and discharge valves. Run compressor for about 20 minutes and check the oil level.

TO REMOVE OIL

Pump down compressor to 2 psig. Close suction and discharge valves. Loosen the 1/4-in. pipe plug in compressor base and allow the oil to seep out past the threads of the plug. *The crankcase will be under slight pressure. Be careful not to remove the plug; the entire oil charge may be lost.* Small amounts of oil can be removed thru oil pump discharge connection while compressor is running.

START-UP AND OPERATION CHECKS

Start-up should be performed only under supervision of experienced refrigeration mechanic. Be sure crankcase heaters have been energized for 24 hours.

1. Open all system valves that may have been closed during or after charging.
2. Check air-handling equipment, chilled water and condenser water pumps, and any other equipment connected to chiller.
3. Start unit by firmly pushing ON button.
4. Check all controls for proper operation.

5. Check leaving chilled water temperature to see that it remains well above freezing.
6. Recheck compressor oil level (see Check Oil Charge).
7. Be sure unit is fully charged (see Check Refrigerant Charge).

Check Refrigerant Feed Components

THERMOSTATIC EXPANSION VALVE (TXV)

One valve for each refrigerant circuit is used to control the flow of refrigerant. The valve is activated by a temperature sensing bulb clamped to the suction line. The valve is factory-set to maintain a superheat of 8 F to 10 F. *Do not change setting unless absolutely necessary.*

FILTER-DRIER (replaceable core type)

The function of the filter-drier is to maintain a clean, dry system. The moisture indicator (below) can indicate any need to change the filter-drier.

MOISTURE-LIQUID INDICATOR

The indicator is located immediately ahead of the TXV to provide a constant indication of the moisture content of the refrigerant. It also provides a sight glass for refrigerant liquid. Clear flow of liquid refrigerant indicates sufficient charge in the system. Bubbles indicate under-charged system or presence of noncondensables. Moisture in the system, measured in parts per million (ppm), will change color of indicator.

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

At the first sign of moisture in the system, change the filter-drier. The color *BLUE* indicates a safe, dry condition and *PINK* shows that a dangerous moisture level is present. The first sign of moisture would be a *LIGHT VIOLET* color.

LIQUID LINE SERVICE VALVE

This valve provides a refrigerant charging port and, in combination with the compressor discharge service valve, allows the refrigerant to be pumped into the high side.

PRESSURE RELIEF DEVICES

A high-side pressure-relief valve is factory installed on each tower condenser. The valve is set to open at a maximum pressure of 385 psig (maximum design working pressure of the condenser).

Additional pressure-relief valves, properly selected, must be field installed to protect field-installed high side equipment as may be required by applicable codes.

A fusible plug is factory installed on each suction line for low-side protection. This plug will relieve on temperature rise to 170 F.

Most local codes require that a relief valve be vented directly to outdoors. *The vent line must not be smaller than the size of the relief valve outlet.*

Check Compressor Protection Devices

CIRCUIT BREAKER

Each compressor is protected against an over-current condition by a manual-reset calibrated-trip circuit breaker.

IMPORTANT: Do not bypass connections or increase the size of the breaker to correct trouble. Determine the cause and correct before resetting breaker.

DISCHARGE TEMPERATURE THERMOSTAT

A sensor in the discharge side of each compressor reacts to excessively high discharge gas temperature and shuts off the compressor. The high discharge gas temperature is a direct indication of an overtemperature condition in the motor windings.

CRANKCASE HEATER

The heater in each compressor prevents absorption of liquid refrigerant by the oil when the compressor is not operating.

CAUTION: The heater, which is held in place by a bracket, must be tight to prevent it from backing out of the crankcase. The heater will burn out if exposed to air for an extended time.

Each 125-watt electric heater is wired into the 115-volt control circuit thru the normally closed contacts of the control relay in such a way that it is energized only when the compressor is not operating.

CAUTION: Never open any switch or disconnect that will de-energize the crankcase heater unless the unit is being serviced or will be shut down for a prolonged period. After such service or prolonged shutdown, energize the crankcase heater for 24 hours before starting the compressor.

TIME GUARD® CONTROL

This control protects the compressor against short cycling (switch A on four-function timer).

FOUR FUNCTION TIMER

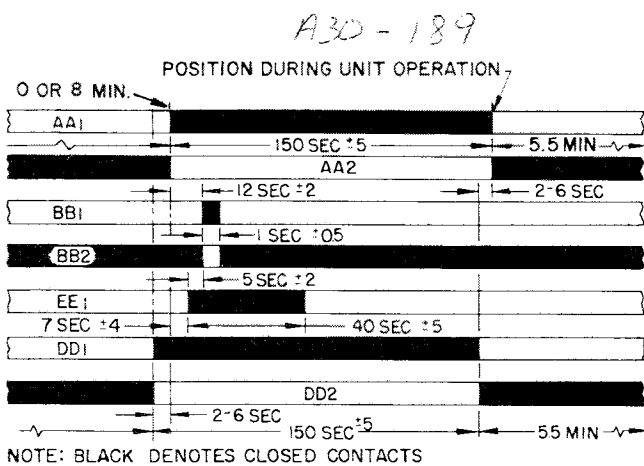
Refer to Fig. 4 — Timer Cycle. The functions are as follows:

Switch A (Contacts A-A1, A-A2) runs the timer motor. This provides a minimum of 5-1/2 minutes after the compressor stops before it can restart, to prevent short cycling (Time Guard® control).

Switch B (Contacts B-B1, B-B2) provides 1-second time delay for part-winding start and also provides a lock-out function.

Switch D (Contacts D-D1) provides a 2-1/2 minute bypass of the low-pressure switch at start-up to prevent nuisance trips under cold-start conditions.

Switch E (Contacts E-E1) provides a 35-second bypass of the oil safety switch (OPS) at compressor start-up (when OPS is used). If sufficient oil pressure does not build up in this time, the compressor stops.



OIL PRESSURE SAFETY SWITCH (OPS)

This control is available as an accessory. Refer to Fig. 5 for field wiring connections.

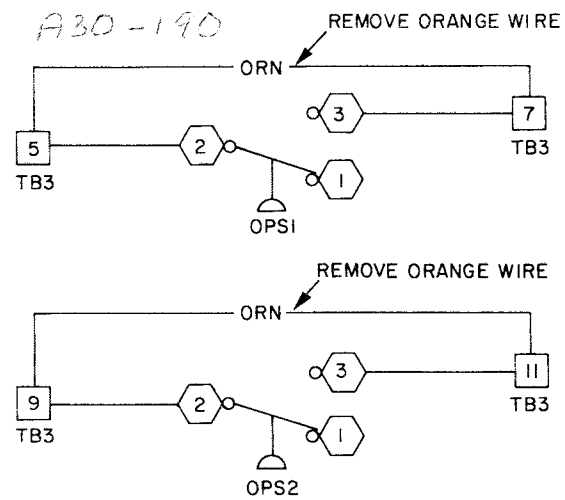
The pressure switch is factory set at the following pressures and should not be adjusted in the field:

| SWITCH POSITION | PRESSURE SETTING |
|-----------------|------------------|
| Close on rise | 9-12 psi diff |
| Open on fall | 4- 6 psi diff |

The oil pressure safety switch is wired in parallel with Switch E of the 4-function timer. This arrangement allows approximately 35 seconds for oil pressure to reach normal operating level after compressor start. If the oil safety switch does not close within 35 seconds, the compressor shuts down.

To restart the compressor, the control circuit ON-OFF switch must be pressed to OFF and then to ON. The timer will start and after approximately 5.5 minutes the compressor will start. If normal oil pressure is established within the next 35 seconds, the compressor continues to run. If, however, the oil pressure does not reach a safe level, the compressor stops at the end of the 35 seconds and locks out.

CAUTION: Do not attempt to restart the compressor for a second time until the problem has been determined and corrected.



OPS — Oil Pressure Safety Switch
TB — Terminal Board

Fig. 5 — Oil Pressure Safety Switch to Control Box Wiring Connections

Check Unit Safety Devices

SAFETY THERMOSTAT (Fig. 6)

This low water temperature cutout (LWTC) protects the unit against freeze-up due to operating malfunction. The sensing bulb is inserted into a well located in the *leaving* water nozzle. As installed, the standard control is factory set to open at 36 ± 2 F, breaking the control circuit and locking out the unit. The contacts remake at 5 ± 2 F above the cutout point, but the control circuit switch must be pressed to OFF and then to ON for unit restart. This action reenergizes the control circuit and starts the timer under Time Guard® control.

The thermostat is designed to cut out in a range down to -30 F, but to obtain this range, the low-limit stop tab on the underside of the dial must be either cut or bent. *Make this adjustment only if necessary* (when cooling glycols or brines).

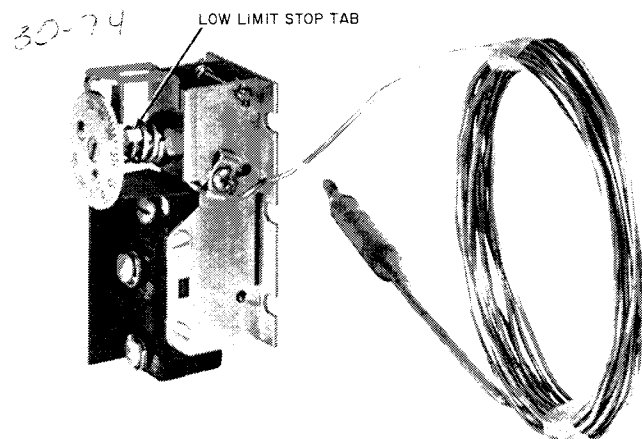


Fig. 6 — Safety Thermostat (No. HH22CC050 Shown)

HIGH-PRESSURE SWITCH (HPS)

The HPS settings are nonadjustable. Table 5 shows the factory settings for this switch.

If the HPS cuts out while the unit is in normal operation (2-1/2 minutes or more after compressor start-up), the compressor will stop and lock out. To restart the compressor, the ON-OFF control circuit switch must be manually pressed to OFF and then to ON. The timer will start, and after approximately 5.5 minutes, the compressor will start under Time Guard control. If the pressure has not dropped to the HPS cut-in point (see Table 5), the compressor will stop again immediately and again lock out. *No further attempts to restart should be made until the trouble is found and corrected.* Unless the control circuit switch is pressed to OFF at this time, the timer will continue to run for approximately 1-1/2 minutes and then stop.

If the control circuit switch is left at ON, the control circuit remains partially energized, including the timer relay. Consequently, if the pressure drops to the HPS cut-in point before restart, the compressor overtemperature protector (COP) light will come on. This should not be cause for alarm in this case since the light is functional only when the discharge temperature thermostat contacts open during normal unit operation.

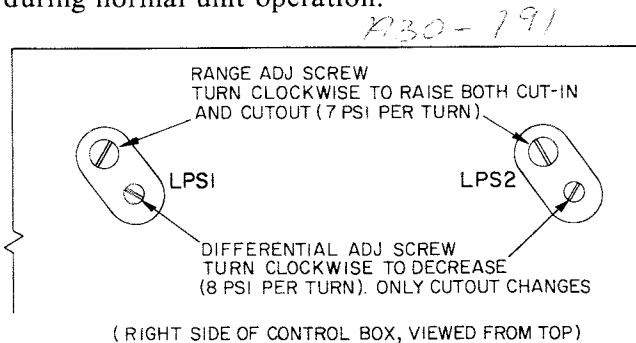


Fig. 7 — Low-Pressure Switch (LPS) Adjustment

Table 5 — Pressure Switch Specifications

| UNIT | 30H | | |
|----------------------------|------|---------------------|--------|
| PRESSURE RANGE (psig) | High | Fixed | |
| | Low | 10 to 90 Adjustable | |
| DIFFERENTIAL SETTING (psi) | High | 103 ±19 (Fixed) | |
| | Low | 13 to 50 Adjustable | |
| FACTORY SETTING (psig) | | Cutout | Cut-in |
| | High | 335 ±10 | — |
| | Low | 29 ±4 | 44 ±4 |
| | | | |

LOW-PRESSURE SWITCH (LPS)

The LPS is bypassed for 2-1/2 minutes after compressor start on all start-ups.

The LPS has an adjustable range from 10 to 90 psig and a differential of 13 to 50 psi. Table 5 shows the factory settings for this switch.

If the LPS cuts out while the unit is in normal operation (any time after 2-1/2 minutes from com-

pressor start-up), the timer starts and runs for approximately 5.5 minutes. The compressor then starts, bypassing the LPS for 2-1/2 minutes under Time Guard® control. If the LPS cut-in pressure is reached within the 2-1/2 minutes, the compressor continues to run; if the required pressure has not built up, the compressor stops at the end of the 2-1/2 minutes and locks out.

Further attempts to restart the unit must not be made until the trouble has been found and corrected. *The LPS contacts must be closed before the compressor can be restarted after lockout.*

Check Capacity Control System

DESCRIPTION

Capacity control is a system which loads and unloads compressor cylinders and starts and stops the compressors to maintain load requirements. The system includes a 4-step temperature controller and cylinder unloaders (see Table 2). Table 6 shows the capacity control steps.

Table 6 — Capacity Control Steps

| UNIT 30H | CONTR STEPS | SEQUENCE 1 | | | | SEQUENCE 2 | | | |
|----------|-------------|------------|----------|-------|-------|------------|----------|-------|-------|
| | | % Cap. | Oper Cyl | | | % Cap. | Oper Cyl | | |
| | | | Tot. | Ckt 1 | Ckt 2 | | Tot. | Ckt 1 | Ckt 2 |
| 040 | 1 | 25 | 2 | 2 | — | 25 | 2 | — | 2 |
| | 2 | 50 | 4 | 2 | 2 | 50 | 4 | 2 | 2 |
| | 3 | 75 | 6 | 4 | 2 | 75 | 6 | 2 | 4 |
| | 4 | 100 | 8 | 4 | 4 | 100 | 8 | 4 | 4 |
| 050 | 1 | 40 | 4 | 4 | — | 20 | 2 | — | 2 |
| | 2 | 60 | 6 | 4 | 2 | 60 | 6 | 4 | 2 |
| | 3 | 80 | 8 | 6 | 2 | 80 | 8 | 4 | 4 |
| | 4 | 100 | 10 | 6 | 4 | 100 | 10 | 6 | 4 |
| 060 | 1 | 33 | 4 | 4 | — | 33 | 4 | — | 4 |
| | 2 | 67 | 8 | 4 | 4 | 67 | 8 | 4 | 4 |
| | 3 | 83 | 10 | 6 | 4 | 83 | 10 | 4 | 6 |
| | 4 | 100 | 12 | 6 | 6 | 100 | 12 | 6 | 6 |

4-STEP TEMPERATURE CONTROLLER

This controller consists of 4 load switches actuated by pressures developed in a temperature-sensing bulb located in the return water line of the chilled water system. The controller is factory set to control from *return* water temperature thru a cooling range of 10 F. The sequence switches are factory calibrated and sealed and should not require any field changes.

IMPORTANT: If a different return-water cooling range or *leaving-water* control is specified, or if brine below 10 F is to be used, the controller must be changed. Consult local Carrier representative for proper control device.

The return water temperature at which the last step of capacity unloads is indicated by the leaving water temperature design setpoint on the adjustable dial (Fig. 8).

Example:

Design setpoint is at 44 F. On a reduction in load, the capacity of the unit will be reduced to zero when return water temperature drops to 44 F, and unit will cycle off.

WARNING: Any alteration of factory settings, except design setpoint, without Carrier authorization, may void the Carrier warranty.

DESIGN SETPOINT ADJUSTMENT

When unit is ready for operation, insert small screwdriver in adjusting slot (Fig. 8) and rotate to turn dial (dial may also be turned by hand). Rotate until the design setpoint for the installation appears directly under the pointer. Insert a thermometer in the *return* chilled water connection and allow the unit to run thru a cycle. At the instant the last step of capacity unloads (switch no. 1 opens), read the temperature. If it is not the same as the dial reading, the variation can be compensated by shifting the control point slightly.

CAUTION: Do not force the dial past the stop. This could cause loss of the control point and damage the instrument.

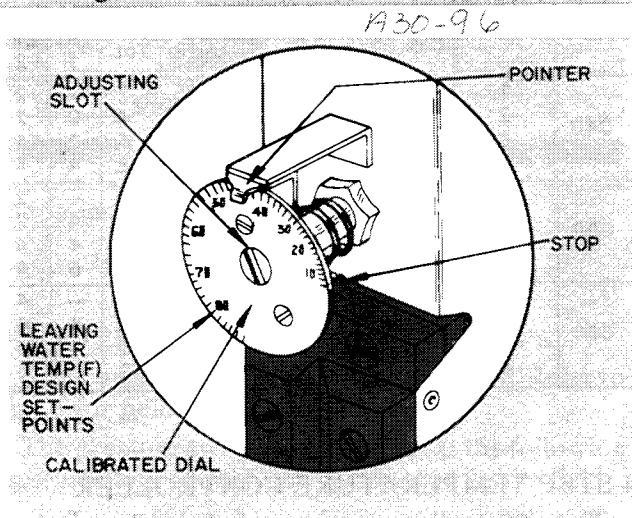


Fig. 8 — Setpoint Adjustment

CYLINDER UNLOADING SYSTEM

Each unloading device is of the cylinder head bypass type and unloads 2 cylinders when operating solenoid is energized. Cylinder unloaders are energized and de-energized by load switches in the temperature controller.

Steps under Cylinder Bank Loaded and Cylinder Bank Unloaded refer to numbered callouts on Fig. 9 and 10.

Cylinder Bank Loaded (Fig. 9)

1. With solenoid valve *not* energized, gas bypass port is closed by solenoid valve stem.
2. Discharge manifold pressure extends thru the strainer and bleed orifice into solenoid valve stem chamber and behind bypass piston.

3. Refrigerant pressure overcomes bypass valve spring pressure and forces piston forward closing the bypass from the discharge manifold to the suction manifold.
4. Cylinder bank discharge pressure forces open the discharge piston check valve. Refrigerant gas enters the discharge manifold.

As long as the solenoid valve is *not* energized, the cylinder bank will continue to operate fully loaded.

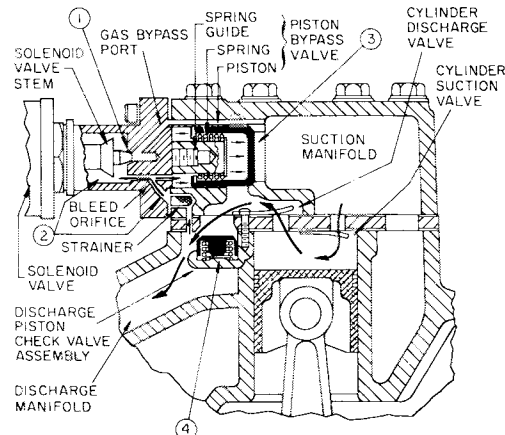


Fig. 9 — Cylinder Bank Loaded

Cylinder Bank Unloaded (Fig. 10)

1. When solenoid valve is energized, gas bypass port is opened by solenoid valve stem.
2. Discharge manifold pressure extends into solenoid valve stem chamber and behind bypass piston.
3. Open gas bypass port allows pressure to bleed into suction manifold causing reduction of pressure behind bypass piston.
4. When bypass valve spring pressure overcomes gas pressure behind piston, the piston moves back, opening bypass from discharge manifold to suction manifold.
5. Cylinder discharge pressure on face of check valve piston is reduced and discharge manifold pressure closes check valve. The cylinder bank is now isolated from discharge manifold.

As long as solenoid valve is energized, cylinder bank will operate fully unloaded.

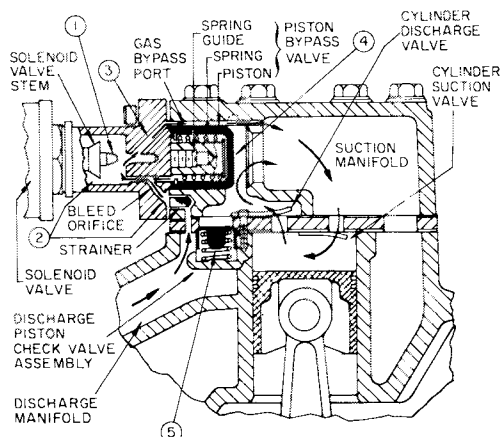


Fig. 10 — Cylinder Bank Unloaded

UNIT OPERATION

Control Power (115 volts) can be from a separate source, thru a 15-amp fused disconnect or can be taken from the main unit power source, thru a field-supplied transformer as shown on the wiring label.

Control Sequence — At initial start-up, assume all safety devices are satisfied and the chilled water temperature controller switches are all in position for maximum cooling capacity.

Close the compressor circuit breaker and press the control circuit ON-OFF switch to ON. Timer no. 1 starts and, depending on the position of the timer, compressor no. 1 starts in approximately 12 seconds to 8 minutes. At compressor start-up, the D-D1 contacts (see Four-Function Timer and Fig. 4) are closed, bypassing the low-pressure switch for 2-1/2 minutes. In addition, the E-E1 contacts are closed, bypassing the oil safety switch (if used) for approximately 35 seconds. Both these bypass functions are protection against the compressor continuing to run under conditions that could cause damage to the compressor. Barring any malfunction, when the timer contacts A-A2 close, approximately 2-1/2 minutes after start-up, timer no. 1 stops and timer no. 2 starts. In approximately 12 seconds to 8 minutes, compressor no. 2 starts. Timer no. 2 completes the same cycle as timer no. 1 and stops. Unit is now in normal operation, with both compressors running.

The temperature controller regulates the cooling capacity by loading and unloading compressor cylinders and stopping and starting the compressors under Time Guard® control, in response to load requirements.

Complete Unit Stoppage and Restart — After each possible cause for unit stoppage is a short description of the normal method of restart.

1. CONTROL POWER INTERRUPTION (INCLUDES BLOWN FUSE).

After power is restored, or fuse replaced, restart is automatic thru normal timer cycle.

2. CONTROL CIRCUIT ON-OFF SWITCH IS OPENED.

When the switch is opened, the timer motor starts automatically, runs for approximately 5-1/2 minutes and stops. To restart, press ON-OFF switch to ON. In approximately 12 seconds, compressor starts.

3. CONTACTS OF ANY AUXILIARY INTERLOCK ARE OPEN.

After trouble has been corrected, restart is automatic thru normal timer cycle.

4. LOW WATER TEMPERATURE CUTOFF CONTACTS ARE OPEN.

Allow water temperature to rise 5 F; then press control circuit ON-OFF switch to OFF and back to ON. This restarts the timer. Unit restarts automatically thru normal timer cycle.

5. CONTROL CIRCUIT FUSE BLOWS.

Check for possible cause; then replace fuse. Restart is automatic thru normal timer cycle.

6. CHILLED WATER FLOW STOPS.

Locate and correct cause. When water flow resumes, unit restart is automatic thru normal timer cycle.

Individual Compressor Stoppage and Restart

1. LOW-PRESSURE SWITCH (LPS) OPENS.

Reset and restart are automatic, thru normal timer cycle, unless refrigerant charge is very low or lost. In this case, increase the charge to normal level before restart.

2. HIGH-PRESSURE SWITCH (HPS) OPENS.

Press RESET button to reenergize the open circuit. Restart is thru normal timer cycle.

3. DISCHARGE TEMPERATURE SWITCH OPENS.

Press RESET button to reenergize the open circuit. Restart is thru normal timer cycle.

4. OIL PRESSURE SAFETY SWITCH OPENS.

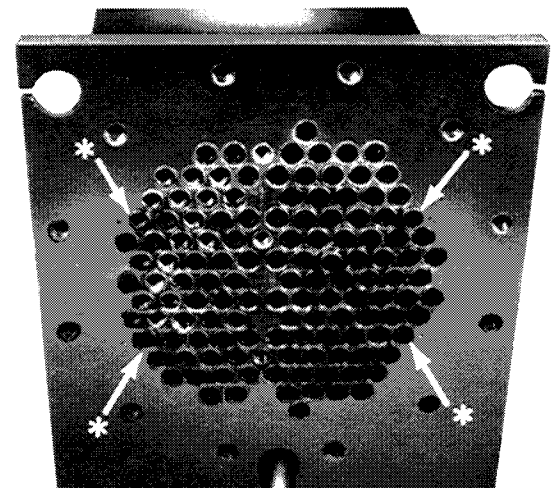
Press RESET button to reenergize the open circuit. Restart is thru normal timer cycle.

IMPORTANT: If stoppage by a safety device repeats once, do not attempt another restart until the cause is determined and corrected.

Refer also to the Troubleshooting section for additional information on unit malfunctions.

SERVICING THE COOLER

When the cooler heads and partition plates are removed, the tube sheets are exposed showing the ends of the tubes as seen in Fig. 11. Four tubes in the bundle are secured inside the cooler at the baffles and *cannot be removed*. These are identified on the tube sheets by a drill mark horizontally adjacent to each of the 4 tubes. *If leakage occurs in any of these 4 tubes, plug the tube as described under Tube Plugging.*



*Four fixed tubes (cannot be removed) identified by adjacent drill points.

Fig. 11 — Typical Tube Sheet

Tube Plugging — A leaky tube(s) can be plugged until retubing can be done. The number of plugged tubes determines how soon the cooler *must* be retubed. If several tubes require plugging, check with your local Carrier representative to find out how the number and location will affect unit capacity.

Figure 12 shows an Elliott tube plug and a cross-sectional view of a plug in place. Table 7 lists the components for plugging.

CAUTION: Use extreme care when installing plugs to prevent damaging the tube sheet sections between the holes.

Clean parts with Locquic "N" and apply a few drops of Loctite #75 to obtain a tight seal without using too much force to set the pin.

Usually plugs can be removed by heating the projecting end of the pin to approximately 1000 F and chilling quickly with water. Apply the heating flame to the side of the pin to prevent overheating the tube sheet.

Retubing (see Table 7) — When retubing is to be done, obtain the service of qualified personnel, experienced in boiler maintenance and repair. Most standard procedures can be followed, except that for the tubes in the 10HA coolers, a 5% crush is recommended in setting torque control (5/8-in. diameter tubes are used in these coolers).

Example:

- a. Tube sheet hole diameter 630 in.
- b. Tube OD 625 in.
- c. Clearance (a minus b) 005 in.
- d. Tube ID before rolling
(Use Elliott tube gage) 551 in.
- e. 5% of twice the wall thickness
(5% of b minus d) 004 in.
- f. Tube ID after rolling
(c + d + e) 560 in.

Table 7 — Plugs and Tubes

| UNIT 30H | 040 | 050, 060 |
|--------------------------------|-------------------------|-------------|
| COMPONENTS FOR PLUGGING | PART NUMBER | |
| | For Tubes | |
| | Brass Pin | 853103-500* |
| | Brass Ring | 853002-559* |
| | For Holes without Tubes | |
| Brass Pin | 853103-1* | |
| Brass Ring | 853002-631* | |
| Loctite | No. 75† | |
| Locquic | "N"† | |
| TUBE DATA | SPECIFICATION | |
| Part No. | 10HA501043 | 10HA501053 |
| Length (in.) | 74.50 | 85.50 |
| OD (in.) | 0.625 | 0.625 |
| Wall Thickness (in.) | | |
| Plain End | 0.037 | 0.037 |
| Finned Section | 0.025 | 0.025 |

*Order directly from Elliott Co.
Lagonda Operation
Springfield, Ohio

†Can be obtained locally.

Tightening Cooler Head Bolts

GASKET PREPARATION

When reassembling, use new gaskets. Compressed asbestos/neoprene gaskets, Carrier Material Specification ZA00-24, are to be momentarily dipped in compressor break-in oil prior to assembly. Gaskets are *not* to be soaked in oil as gasket deterioration results. Dipped gaskets are to be used within 30 minutes to prevent deterioration.

BOLT TORQUES

The following torques are to be applied during the bolt tightening sequence described below:

- 5/8-in. diameter flange bolts . . . 150 - 170 lb-ft
- 1/2-in. diameter center-stud nuts and
- 1/2-in. diameter flange bolts 70 - 90 lb-ft

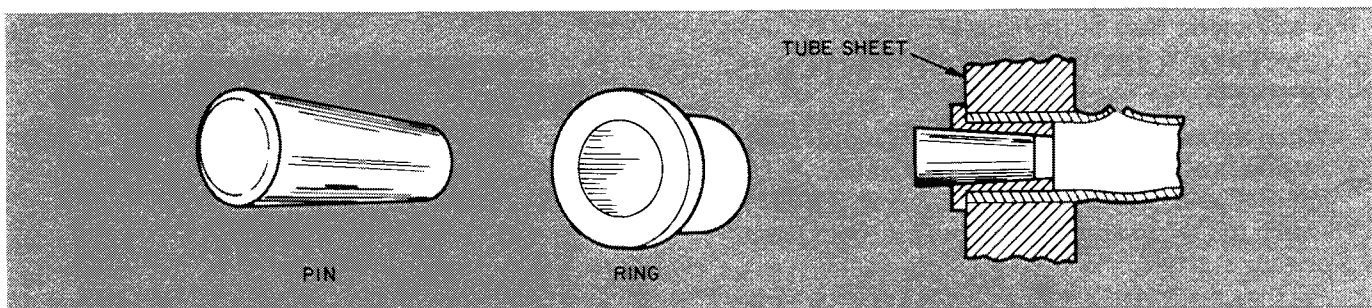


Fig. 12 — Elliott Tube Plug

P.30-153

BOLT TIGHTENING SEQUENCE (Fig. 13)

The following is a recommended bolt tightening sequence:

Step 1 — Tighten moderately (without torquing) all the flange bolts in the sequence shown.

Step 2 — Tighten moderately (without torquing) the hex nuts on the center studs (no specified sequence).

Step 3 — Repeat Step 1, tightening the bolts to the specified torque.

Step 4 — Repeat Step 2, tightening the nuts to the specified torque.

Step 5 — Not less than one hour later, retighten the center stud nuts to the specified torque.

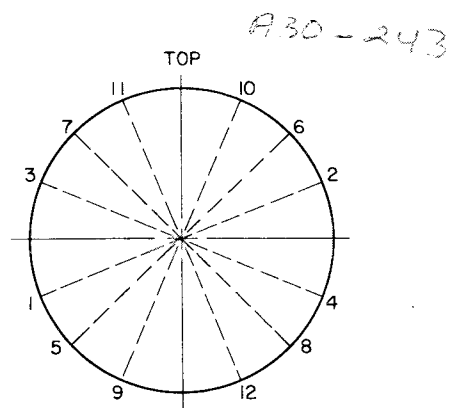


Fig. 13 — Bolt Tightening Sequence

TROUBLESHOOTING GUIDE

| SYMPTOMS | PROBABLE CAUSE | REMEDY |
|---------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Compressor does not run | Power line open | Check fused disconnect. Replace fuse if blown. |
| | Control circuit breaker tripped | Check control circuit for ground or short. Reset breaker. |
| | Safety tripped | Reset. |
| | Tripped power breaker | Check the controls. Find cause of trip and reset breaker. |
| | Condenser circulating pump not running | Power off — restart. |
| | | Pump binding — free pump. |
| | | Incorrect wiring — rewire. |
| | Loose terminal connection | Check connections. |
| | Improperly wired controls | Check wiring and rewire. |
| Low line voltage | Check line voltage — determine location of voltage drop and remedy deficiency. | |
| Compressor motor defective | Check motor winding for open or short. Replace compressor, if necessary. | |
| Seized compressor | Replace compressor. | |
| Compressor cycles on low-pressure control | Low-pressure control erratic in action | Raise differential setting. |
| | | Check capillary for pinches. |
| | | Replace control if defective. |
| | Compressor suction valve leaking | Replace valve plate. |
| Compressor suction shutoff valve partially closed | Open valve. | |
| Compressor loses oil | Low refrigerant charge | Add refrigerant. |
| | Leak in system | Repair leak. |
| | Mechanical damage (blown piston or broken discharge valve) | Repair damage or replace compressor. |
| | Oil trapped in line | Check piping for oil traps. |
| Frosted or sweating suction line | Crankcase heaters not energized during shutdown | Check wiring and crankcase heater relay. Replace heater if necessary. |
| | Expansion valve admitting excess refrigerant | Adjust expansion valve. Replace valve if defective. |
| Compressor cycles on low-pressure control | Plugged compressor suction strainer | Clean strainer or replace. |
| Compressor cycles on high-pressure control | High-pressure control erratic in action | Check capillary tube for pinches. Set control as required. |
| | Compressor discharge valve partially closed. | Open valve, or replace if defective. |
| | Air in system | Purge. |
| | Condenser scaled | Clean condenser. |
| | Condenser water pump or fans not operating | Start pump — repair or replace if defective. |
| Unit operates long or continuously. | Low refrigerant charge | Add refrigerant. |
| | Control contacts fused | Replace control. |
| | Air in system | Purge. |
| | Partially plugged or plugged expansion valve or strainer | Clean or replace. |
| | Defective insulation | Repair or replace. |
| | Service load too high | Keep doors and windows closed. |
| Inefficient compressor | Check valves, replace if necessary. | |

TROUBLESHOOTING GUIDE (Cont)

| SYMPTOM | PROBABLE CAUSE | REMEDY |
|----------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System noises | Piping vibration | Support piping as required. Check for loose pipe connectors. |
| | Expansion valve hissing | Add refrigerant. Check for plugged liquid line strainer. |
| | Compressor noisy | Check valve plates for valve noise. Replace compressor (worn bearings). Check for loose compressor hold-down bolts. |
| Chattering unloader | Stuck check valve in valve plate | Examine check valve components, clean or replace as necessary. |
| Freeze-up | Improper charging | Make sure that a full quantity of water is flowing thru the cooler while charging and that suction pressure in cooler is equal to or greater than that corresponding to 32 F (58 psig for Refrigerant 22). |
| | Improperly set safety thermostat | Check safety thermostat for proper setting at beginning of each season. |
| | Operating with safety thermostat bypassed | If thermostat was bypassed for checking, be sure it is back in the circuit before starting the unit. |
| | Improper circulation of chilled water | Use ample size cleanable strainer in the chilled water circuit. Make sure strainer is clean. It may sometimes be necessary to chemically treat the water to prevent formation of deposits. |
| | System not drained for winter shutdown | Be sure and remove drain plugs at end of cooling season. Blow out any residual water. Instead of draining, a suitable antifreeze may be added to the water. <i>Damage to the chiller due to freezing is considered abuse and is not covered by the warranty.</i> |
| Hot liquid line | Shortage of refrigerant due to leak | Repair leak and recharge. |
| | Expansion valve opens too wide | Adjust expansion valve. |
| Frosted liquid line | Receiver shutoff valve partially closed or restricted. | Open valve or remove restriction. |
| | Restricted filter-drier | Remove restriction or replace filter-drier core. |
| Compressor will not unload | Burned out coil | Replace coil. |
| | Leaky bypass piston | Clean or replace. |
| | Stuck needle valve | Clean. |
| | Miswired solenoid | Wire correctly. |
| | Plugged bypass port (low side) | Clean. |
| | Weak bypass piston spring | Replace. |
| Compressor will not load | Damaged bypass piston | Replace. |
| | Stuck needle valve | Clean. |
| | Miswired solenoid | Wire correctly. |
| | Plugged bypass port strainer (high side) | Clean. |
| High suction | Stuck check valve in valve plate | Examine check valve components, clean or replace as necessary. |

For replacement items use Carrier Specified Parts.

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

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