Carrier
HEATING & COOLING

REPLACED BY 30GT-34SI
DATE 5/94

r015-035 Chillers

Installa uctions

30-213

SAFETY CONSIDERATIONS

Installing, starting up **and** servicing air conditioning 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 (Fig. 1).

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.
- Keep quenching cloth and fire extinguisher nearby when brazing.
- Use care in handling, rigging and setting bulky equipment.
- See Table I for Physical Data.

ELECTRIC SHOCK HAZARD
Open all remote disconnects before servicing this equipment.

Rigging — Preferred method is with spreader bars from above the unit. Use 2-in. (50 mm) O.D. pipe or hooks in lifting holes. Rig with 4 cables and spreader bars. All panels must be in place when rigging. See rigging label on unit for details concerning shipping weights, distance between lifting holes, center of gravity and spreader bar dimensions. See Fig. 2.

If overhead rigging is not possible, place chiller on skid or pad for rolling or dragging. When rolling, use minimum 3 rollers. When dragging, pull the pad. Do not *apply* force *to the unit.* When in final position, raise from above to lift unit off pad.

⚠ CAUTION

All panels must be in place when rigging. Do not fork units if no skid is supplied. If unit has skid, truck from sides only.

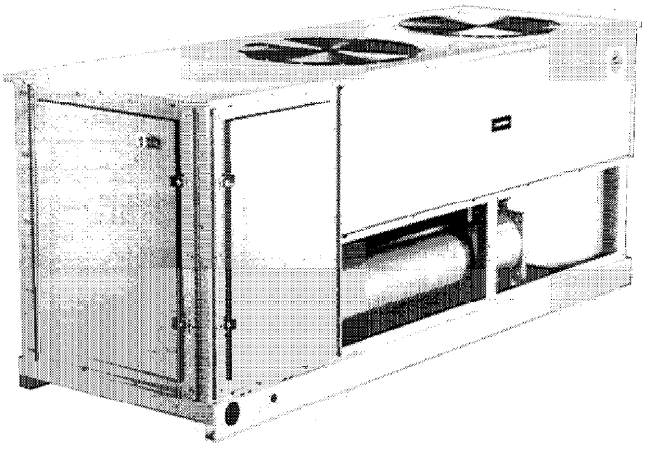
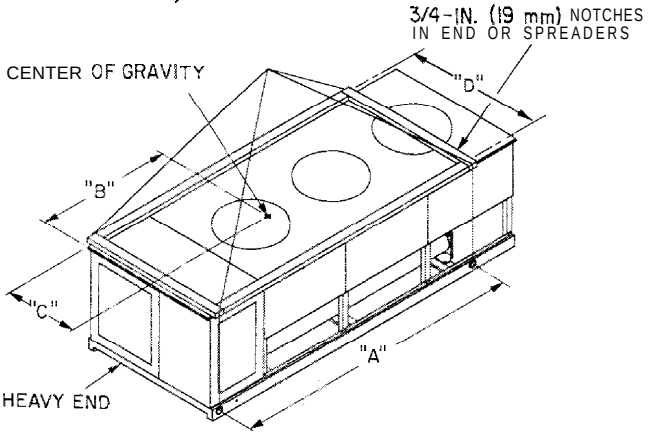


Fig. 1 — Model 30GT (015, 020 shown)

A30-617



MODEL 30GT	MAX. SHIP. WT		LIFTING HOLES "A"		CENTER OF GRAVITY "B"		CENTER OF GRAVITY "C"		"D"	
	Lb	Kgs	in.	mm	in.	mm	in.	mm	in.	mm
015	1876	851	94.0	2388	48.0	1219	23.0	583	49.5	1256
020	2031	921	94.0	2388	47.5	1207	23.0	583	49.5	1256
025	2415	1095	94.0	2388	51.0	1295	34.5	876	73.5	1867
030	2606	1182	94.0	2388	51.0	1295	34.5	876	73.5	1867
035	3365	1526	127.0	3225	66.5	1689	35.5	901	73.5	1867

Fig. 2 — Wigging with Spreader Bars (Field Supplied)

Table 1A — Physical Data — 60 Hertz

UNIT 30GT	015	020	025	030	035
COMPRESSOR			Reciprocating, Semi-Hermetic		
No. ...Type	1...06DG537	1...06E2250	1...06E7265	1...06E7275	1...06E7299
No. Cyls (ea)...Speed, Rpm (r/s)	6...1750 (29)	4...1750 (29)		6...1750 (29)	
Capacity Steps	3	2		3	
Oil Charge*, Pt (L)	10 (4.7)	14 (6.6)	19 (9)	19 (9)	19 (9)
REFRIGERANT CHG, R-22					
Total/Over Clear Glass, lb (kg)	25.0 (11.3)/5.0 (2.3)	31.0 (14.1)/7.0 (3.2)	43.0 (19.5)/12.0 (5.4)	47.0 (21.3)/14.0 (6.4)	57.0 (25.9)/8.0 (3.6)
CONDENSER FANS, Type			Propeller Type, Direct Driven		
No. ...Diameter, in. (mm)			2...30 (762)		3...30 (762)
Total Airflow, Cfm (L/s)	10,600 (5,000)		15,700 (7,400)		23,700 (11,200)
Speed, Rpm (r/s)			1140 (19)		
CONDENSER COIL, Type			Horizontal, Plate Fin		
Rows...Fins/in. (Fin Spacing mm)	2...19 (1.34)	3...17 (1.49)	2...19 (1.34)	3...17 (1.49)	
Total Face Area, sq ft (m^2)	23.5 (2.18)		39.2 (3.64)		58.4 (5.43)
COOLER			Shell and Tube, Direct Expansion		
Net Water Volume, gal. (L)	6.8 (25.7)		9.9 (37.5)		12.8 (48.4)
Maximum Design Working Pressure psig (kPa)			Refrigerant Side — 235 (1620) Water Side — 150 (1034)		
WATER CONNECTIONS, in.					
Inlet and Outlet			2 FPT		2½ FPT
Drain			¾ MPT		

*See Oil Charge for Carrier-approved oil.

Table 1B — Physical Data — 50 Hertz

UNIT 30GT	015	020	025	030
COMPRESSOR		Reciprocating, Semi-Hermetic		
No. ...Type	1...06E2250	1...06E7265	1...06E7275	1...06E7299
No. Cyls (ea)...Speed, Rpm (r/s)	4...1450 (24.2)		6...1450 (24.2)	
Capacity Steps	2		3	
Oil Charge*, Pt (L)	14 (6.6)		19 (9)	
REFRIGERANT CHG, R-22				
Total/Over Clear Glass, lb (kg)	26.0 (11.8)/6.0 (2.7)	35.0 (15.9)/8.0 (3.6)	42.0 (19.1)/12.0 (5.4)	49.0 (22.2)/14.0 (6.4)
CONDENSER FANS, Type		Propeller Type, Direct Driven		
No. ...Diameter, in. (mm)		2...30 (762)		
Total Airflow, Cfm (L/s)	10,600 (5,000)		15,700 (7,400)	
Speed, Rpm (r/s)		950 715.8,		
CONDENSER COIL, Type		Horizontal, Plate Fin		
Rows...Fins/in. (Fin Spacing mm)	2...19 (1.34)	3...17 (1.49)	2...19 (1.34)	3...17 (1.49)
Total Face Area, sq ft (m^2)	23.5 (2.18)		39.2 (3.64)	
COOLER		Shell and Tube, Direct Expansion		
Net Water Volume, gal. (L)	6.8 (25.7)		9.9 (37.5)	
Maximum Design Working Pressure psig (kPa)		Refrigerant Side — 235 (1620) Water Side — 140 (1034)		
WATER CONNECTIONS, in.				
Inlet and Outlet		2 FPT		
Drain		¾ MPT		

*See Oil Charge for Carrier-approved oil.

A30-233 (A)

Placing Unit — There must be 4ft (1220 mm) for service and for unrestricted airflow on all sides of unit, and a minimum of 8ft (2440mm) clear air space above unit. Provide ample room for servicing cooler. For cooler removal see clearance dimensions in Fig. 5, 6, 7. For multiple units, allow 8ft separation between units for airflow and service.

Mounting Unit — When unit is in proper location, use of mounting holes in base rails is recommended for securing unit to supporting structure, or for mounting unit on vibration isolators if required. See Fig. 5, 6, 7. Fasteners for mounting unit are field supplied. Be sure to mount unit level to ensure proper oil return to compressors.

Compressor Mounting — As shipped, compressor is held down by 4 bolts. After unit is installed loosen each bolt until the snubber washer can be moved with finger pressure. See Fig. 3.

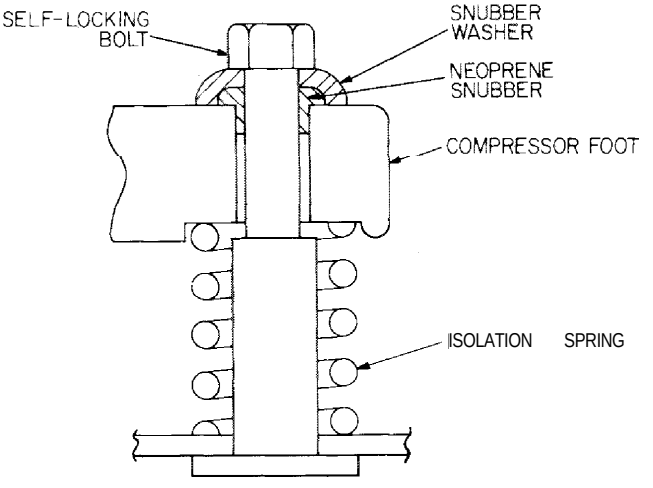


Fig. 3 — **Compressor Mounting**

Chilled Water and Drain Piping — Facing the cooler side of the unit, the return water connection is on the left and the leaving water connection is on the right. See Fig. 4, 5, 6, 7. A means of venting air from the high point of the field-installed piping should be provided. After field piping is complete, in area where piping is exposed to low ambient temperatures (32F or below), freeze-up protection is recommended using ethylene glycol or electric heat tapes. Heat tapes should possess a rating for area ambients and covered with a suitable thickness of closed cell insulation. Route power for heating tapes from a separate fused disconnect. Identify disconnect as heat tape power source with warning that power must not be turned off except when unit is being serviced.

30-214

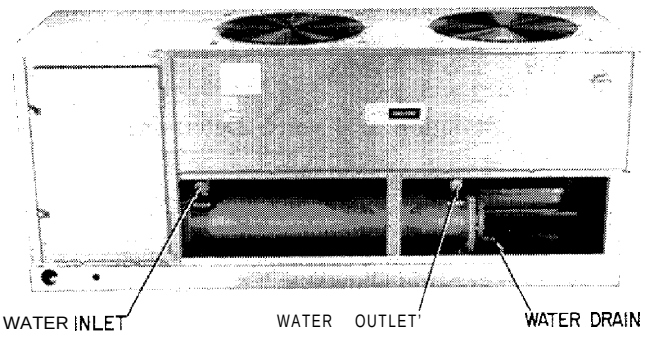


Fig. 4 — Water Connection Locations

The cooler drain connection is at the opposite end from the compressor (see Fig. 5, 6, 7). Insulate the drain piping, similar to the chilled water piping, for at least one foot (305 mm) from cooler.

PREPARATION FOR YEAR-ROUND OPERATION — If unit is on year-round operation, add sufficient ethylene glycol to chilled water to prevent freezing under operating ambient conditions. Consult local water authority on characteristics of area water and add a recommended inhibitor to the chilled water.

PREPARATION FOR WINTER SI-IIJTDOWN *Do not shut off control power disconnect during off-season shutdown.* At end of cooling season, drain water from system. Replace drain plug and put 2 gallons (8 liters) of ethylene glycol in cooler to prevent freezing of residual water. Remove plug on top of leaving chilled water nozzle to add glycol. At beginning of next chilling season, refill cooler and add recommended inhibitor.

Power Supply — Electrical characteristics of available power supply must agree with unit nameplate rating. Supply voltage must be within limits shown in Table 2.

IMPORTANT: Operating unit on improper supply voltage, or with excessive phase imbalance, constitutes abuse and may affect Carrier warranty. See Unbalanced 3-Phase Supply Voltage, page 4.

Power Wiring All power wiring must comply with applicable local and national codes. Install field-supplied branch circuit fused disconnect(s) per NEC (National Electrical Code, U.S.) of a type that can be locked OFF or OPEN. Disconnect(s) must be within sight from and readily accessible from unit in compliance with NEC Article 440- 14.

GENERAL WIRING NOTES

1. The 115-1-60 or 230-1-50 control circuit power must be from a separate source, through a field-supplied fused disconnect rated at 7 amps.
2. Crankcase and cooler heaters are wired in the control circuit so they are always operable as long as control power supply disconnect is on, even if any safety device is open or unit stop-start switch is off. Heaters are wired ahead of stop-start switch. They are protected by 7-amp fuse in control power supply disconnect.
3. *The control circuit field supply disconnect should never be open except when unit is being serviced or is to be down for aprotongedperiod in which case cooler should be drained. When operation is resumed, crankcase heater should be energized for 24 hours before start-up.*
4. Power entry is at one end only.
5. Maximum field wire sizes allowed by lugs on terminal block are:

   350 MCM for Models 30GT030, 035 (208/230-3-60) and 30GT030 (230-3-50).

   2/0 AWG for all other models.
6. Terminals for field power supply are suitable for copper, copper-clad aluminum or aluminum conductors. Insulation must be rated 167 F (75 C) minimum.

FIELD CONNECTIONS

1. Main Power — Bring wires from the fused disconnect switch through hole in bottom rail of unit to control box (Fig. 5, 6, 7) and connect to terminals 11, ❑, 13 on line side of terminal block TB1 (see Fig. 8).

2. Control Power — Bring separate source power (115-1-60 or 230-1-50) into unit as shown in Fig. 5, 6, 7. This supplies power for control circuit, compressor crankcase heater and cooler heater. Connect incoming wires to TB2 in unit control box (L1 to 1 and L2 to 7. Neutral side must be connected to terminal 7. In the auxiliary power supply a field-supplied disconnect with 7-amp circuit protection must be provided to accommodate crankcase heater and cooler heater cable.

   To comply with NEC Article 440-14, the disconnect must be located within sight from and readily accessible from unit.

IMPORTANT: To ensure power to the heaters, make sure auxiliary power to unit is always on (except for servicing or prolonged shutdown).

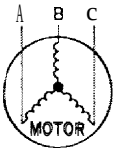
A toggle switch (marked SW on the label diagram) allows the control circuit to be manually disconnected when necessary. This switch does not affect the crankcase heater and cooler heater cable.

3. Control Circuit Interlocks — An accessory flow switch may be installed in the chilled water line to prevent unit from running when water is not circulating through the cooler. This switch (no. HR81LG005) is available as an accessory from Service Parts Center, or equivalent can be field supplied. Also, it is recommended that auxiliary contacts for the chilled water pump starter be installed in the control circuit as additional protection against unit operation when pump is not running. These items should be electrically interlocked in the control circuit, between terminals 4 and 6 (for flow switch), and 5 and 6 (for auxiliary contacts) on TB2. See Fig. 8 for field wiring.

Unbalanced 3-Phase Supply Voltage — Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the % voltage imbalance:

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

Example: Supply voltage is 240-3-60.



AB = 243 volts
BC = 236 volts
AC = 238 volts

$$\text{Average Voltage} = \frac{243 + 236 + 238}{3} = 239 \text{ volts}$$

Determine maximum deviation from average voltage:

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

Maximum deviation is 4 volts. Determine % voltage imbalance:

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

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

IMPORTANT: Contact your local electric utility company immediately if the supply voltage phase imbalance is more than 2%.

C30-292

NOTES:

1. THERE MUST BE [1220 mm] 4 FT FOR SERVICE AND FOR UNRESTRICTED AIRFLOW ON ALL SIDES OF UNIT.
2. THERE MUST BE MINIMUM [2440 mm] 8 FT CLEAR AIR SPACE ABOVE UNIT.
3. THE APPROXIMATE OPERATING WEIGHT OF THE UNIT IS:

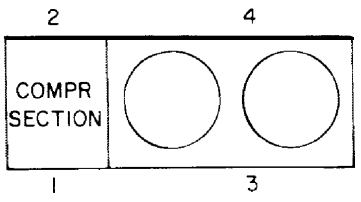
60 HZ

UNIT	WT LBS	WT KG
30GT015	1640	744
30GT015C	1732	786
30GT020	1821	826
30GT020C	1945	882

50 HZ

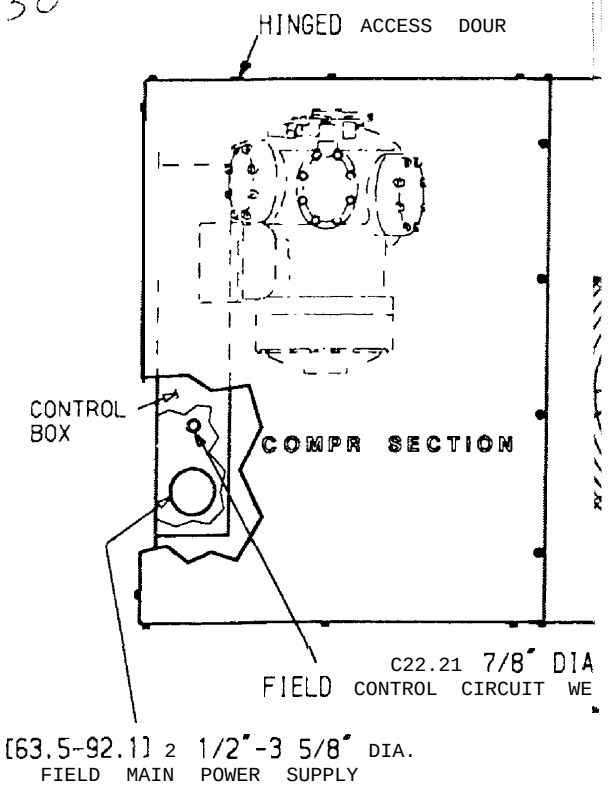
UNIT	WT LBS	WT KG
30GT015	1741	790
30GT015C	1833	831
30GT020	1864	846
30GT020C	1988	902

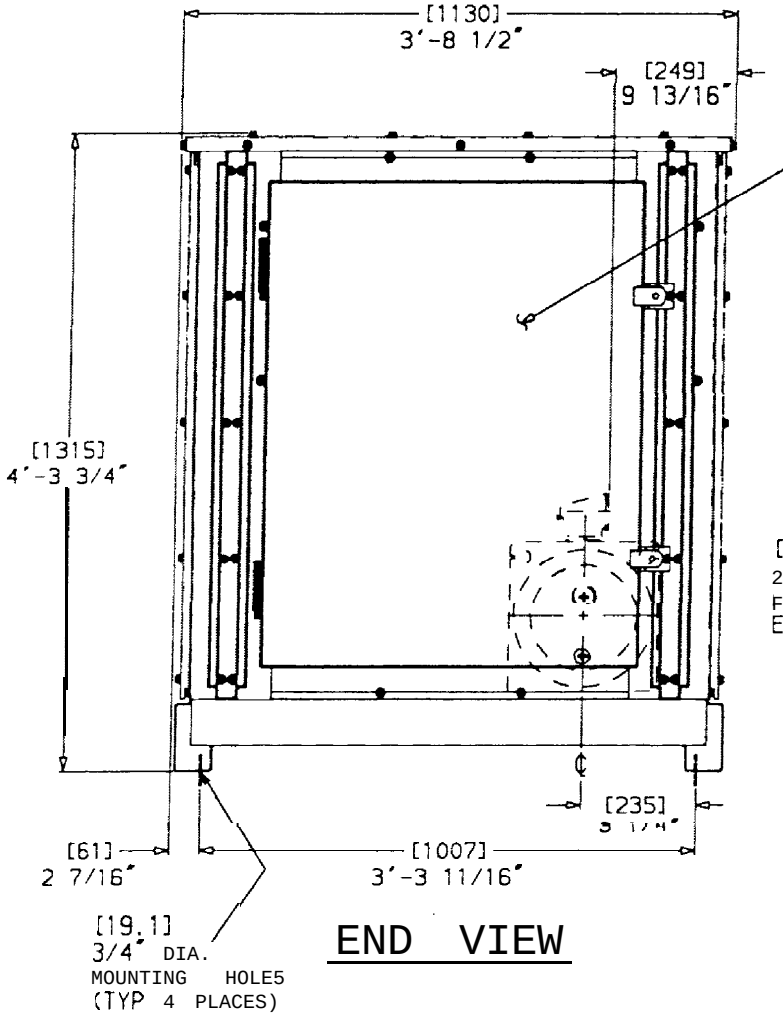
NOTE: "C" INDICATES COPPER COIL.



APPROX. OPER. WT (lb) AT SUPPORT POINTS

60 Hz	1	2	3	4	Tot.
015	510	376	434	320	1640
015C	539	397	458	338	1732
020	574	423	474	350	1821
020C	613	451	507	374	1945
50 Hz					
015	542	399	461	339	1741
015C	571	420	485	357	1833
020	587	433	486	358	1864
020C	626	462	518	382	1988





END VIEW

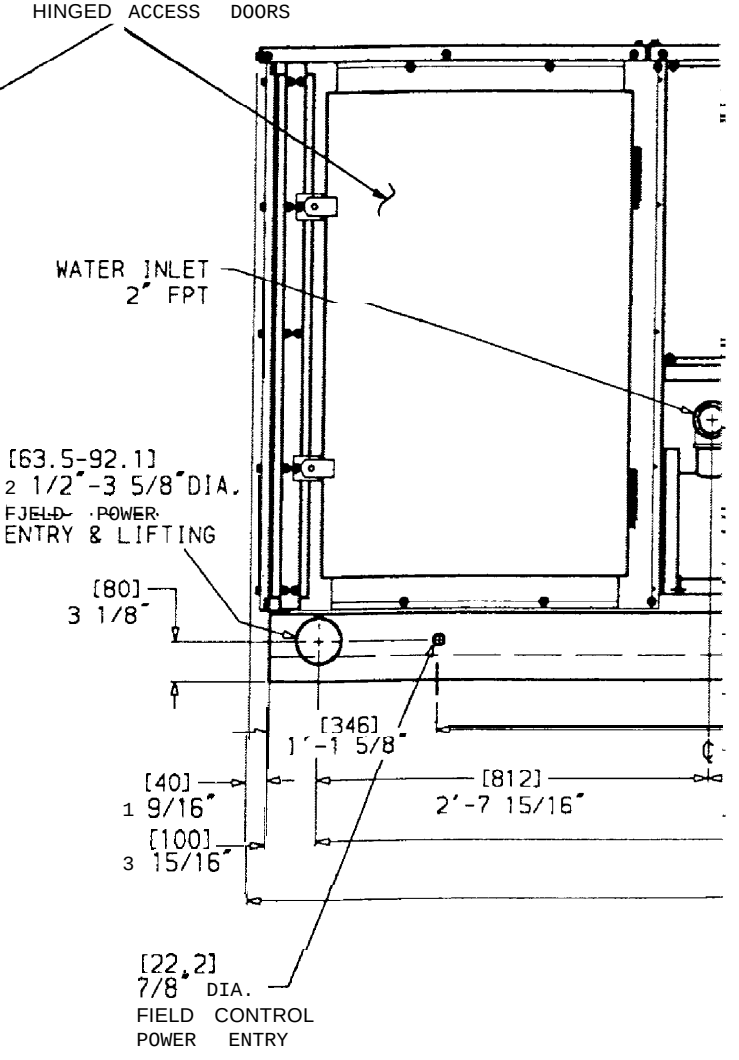
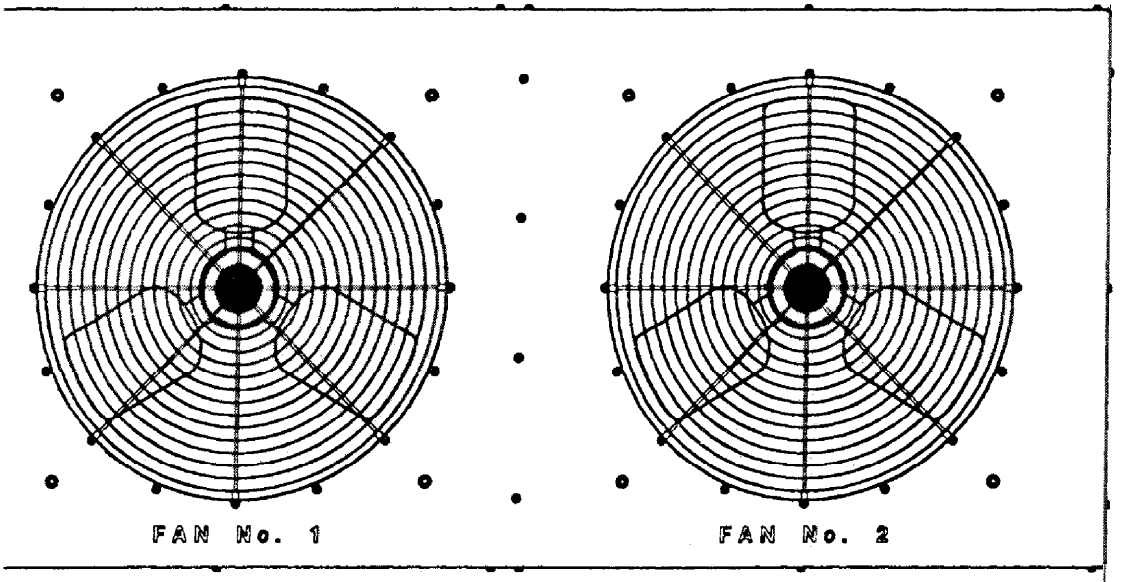


Fig. 5 — Dimensional Dra

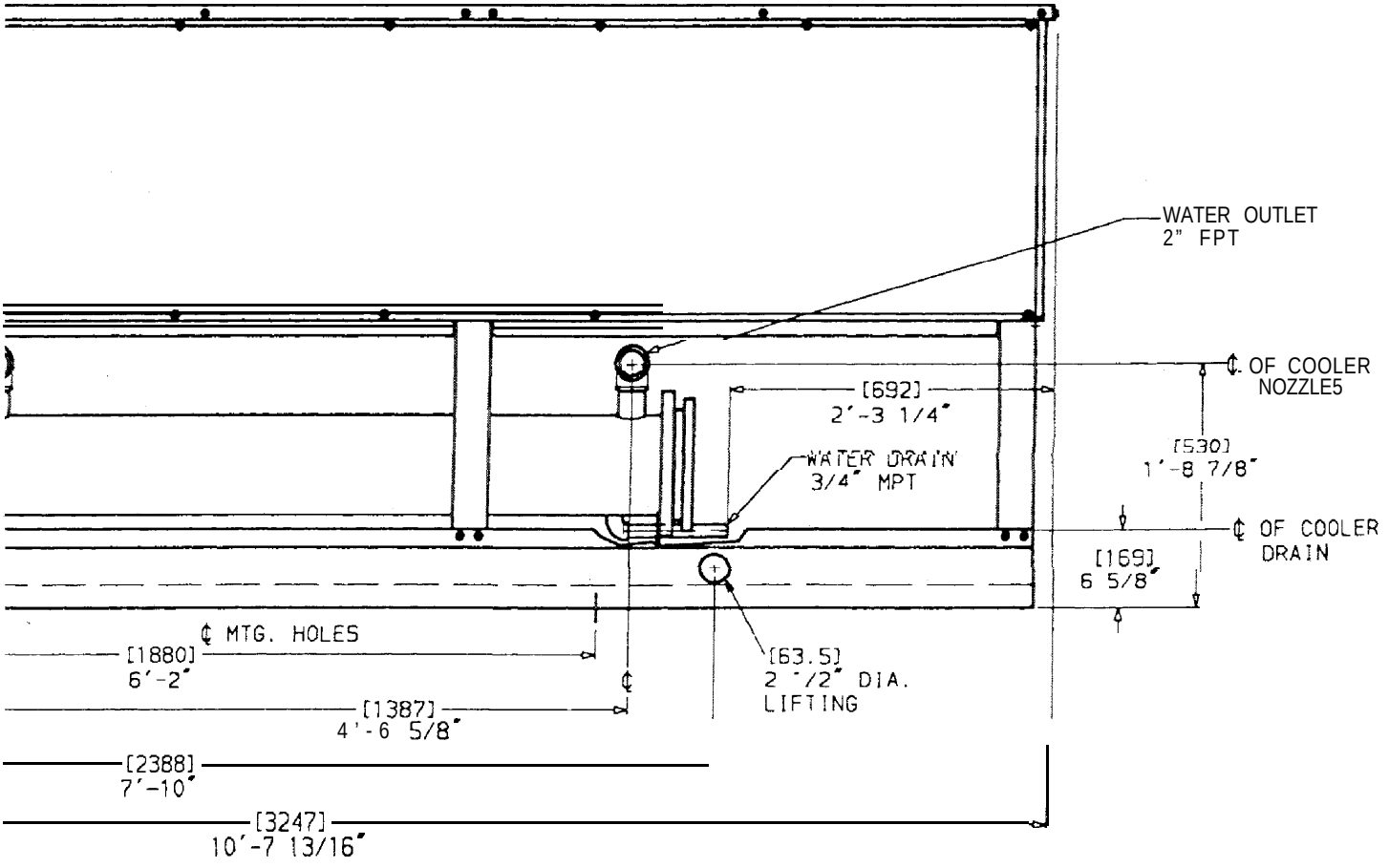


RING

TOP VIEW

[1626]
5'-4"
MIN. CLEARANCE FOR
COOLER REMOVAL

AIRFLOW THRU
CONDENSER



SIDE VIEW

30GT506095	REV A

wing, **30GT015,** 020

NOTES:

1. THERE MUST BE [1220 mm] 4 FT FOR SERVICE AND FOR UNRESTRICTED AIRFLOW ON ALL SIDES OF UNIT.
2. THERE MUST BE MINIMUM [2440 mm] 8 FT CLEAR AIR SPACE ABOVE UNIT.
3. THE APPROXIMATE OPERATING WEIGHT OF THE UNIT IS:

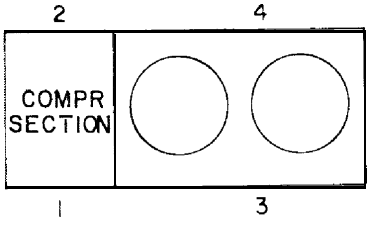
60 HZ

UNIT	WT LBS	WT KG
30GT025	2170	984
30GT025C	2324	1054
30GT030	2268	1029
30GT030C	2474	1122

50 HZ

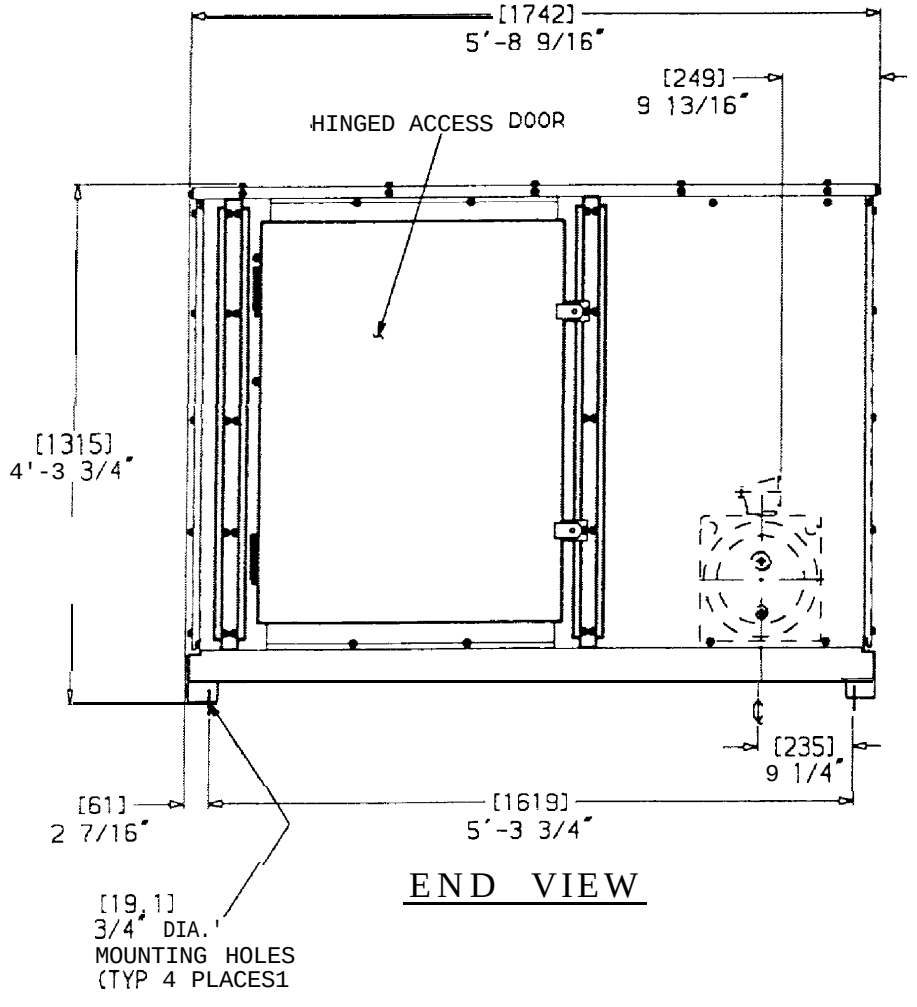
UNIT	WT LBS	WT KG
30GT025	2193	995
30GT025C	2347	1065
30GT030	2332	1058
30GT030C	2538	1151

NOTE: "C" INDICATES COPPER COIL.



APPROX. OPER. WT (lb) AT SUPPORT POINTS

60 Hz	1	2	3	4	Tot.
025	584	501	584	501	2170
025C	626	536	626	536	2324
030	611	523	611	523	2268
030C	666	571	666	571	2474
50 Hz					
025	590	507	590	506	2193
025C	632	542	632	541	2347
030	628	538	628	538	2332
030C	683	586	683	586	2538



END VIEW

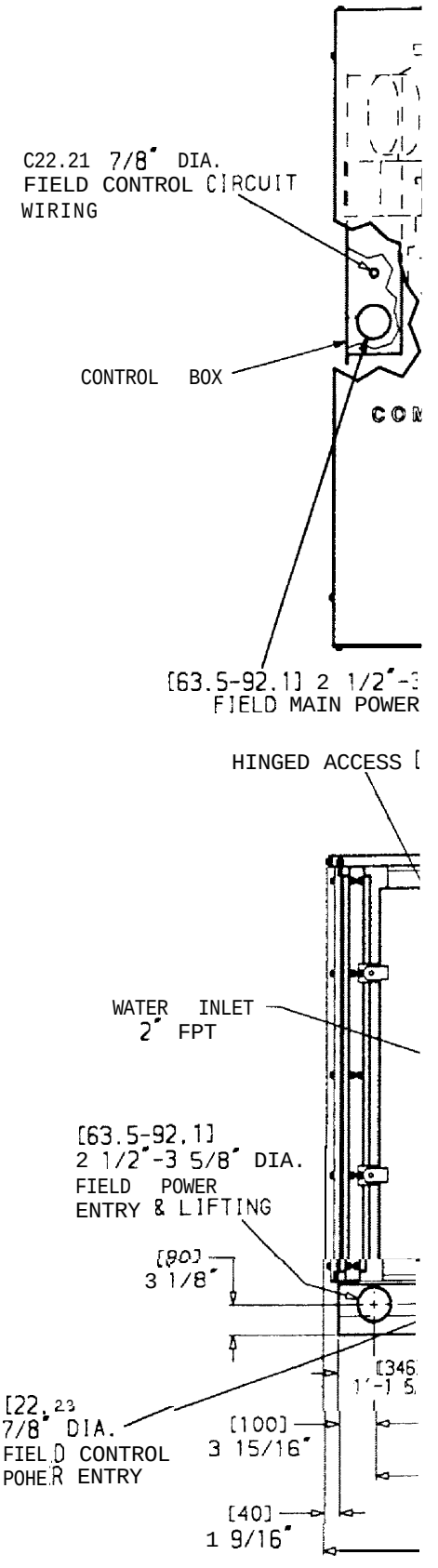
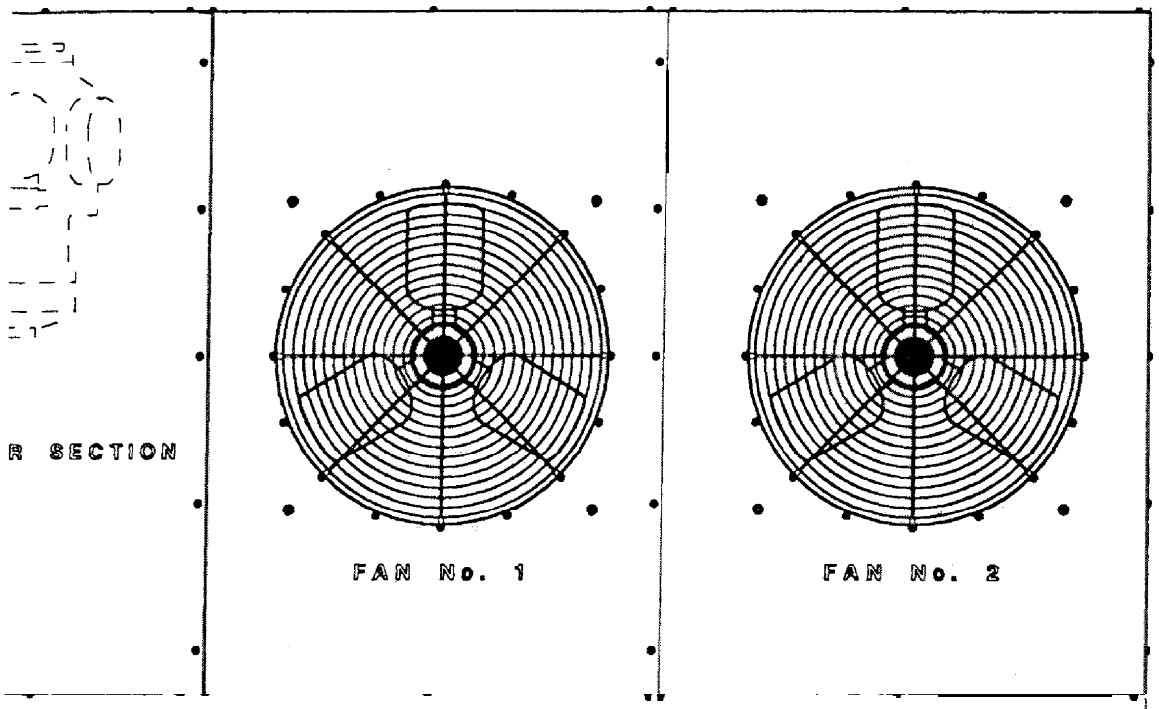


Fig. 6 — Dimensi

C30-293

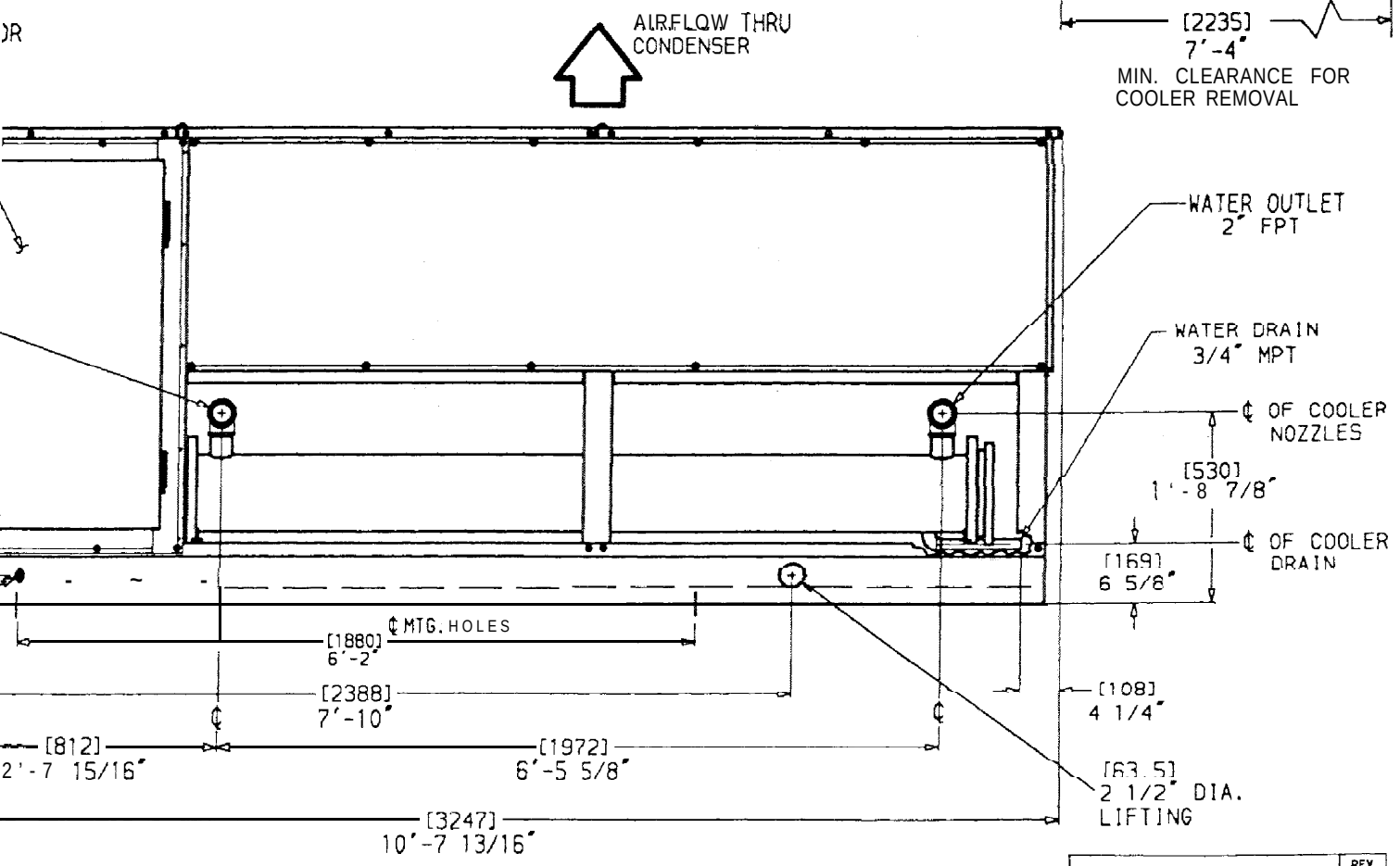
HINGED ACCESS DOOR



5/8" DIA.
UPPLY

OR

TOP VIEW



SIDE VIEW

30GT506096	REV A

al Drawing, 30GT025, 030

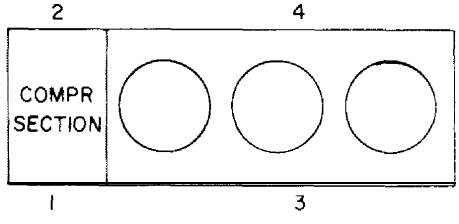
C30-294

NOTES:
1. THERE MUST BE [1220 mm] 4 FT FOR SERVICE AND FOR UNRESTRICTED AIRFLOW ON ALL SIDES OF UNIT.
2. THERE MUST BE MINIMUM [2440 mm] 8 FT CLEAR AIR SPACE ABOVE UNIT.
3. THE APPROXIMATE OPERATING WEIGHT OF THE UNIT IS:

60 HZ

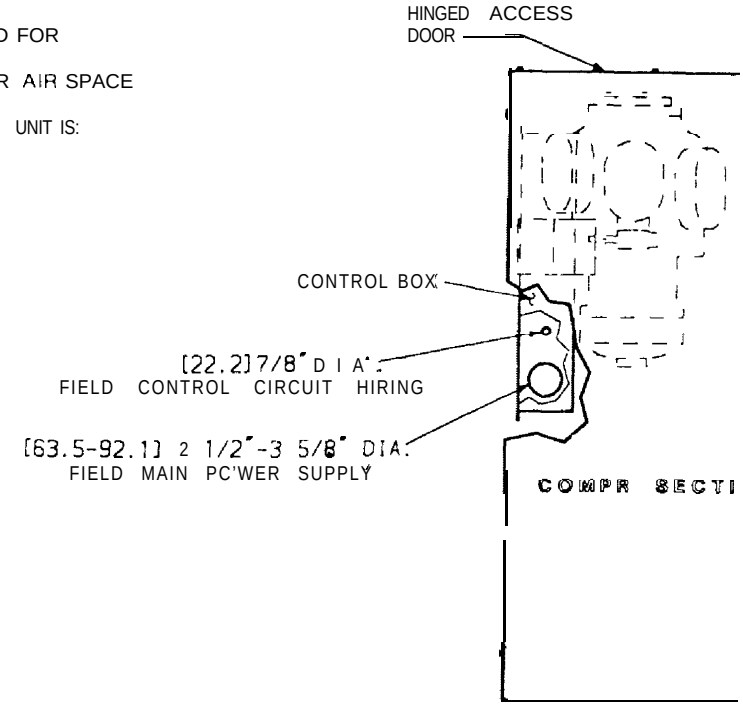
UNIT	WT LBS	WT KG
30GT035	2965	1345
30GT035C	3273	1485

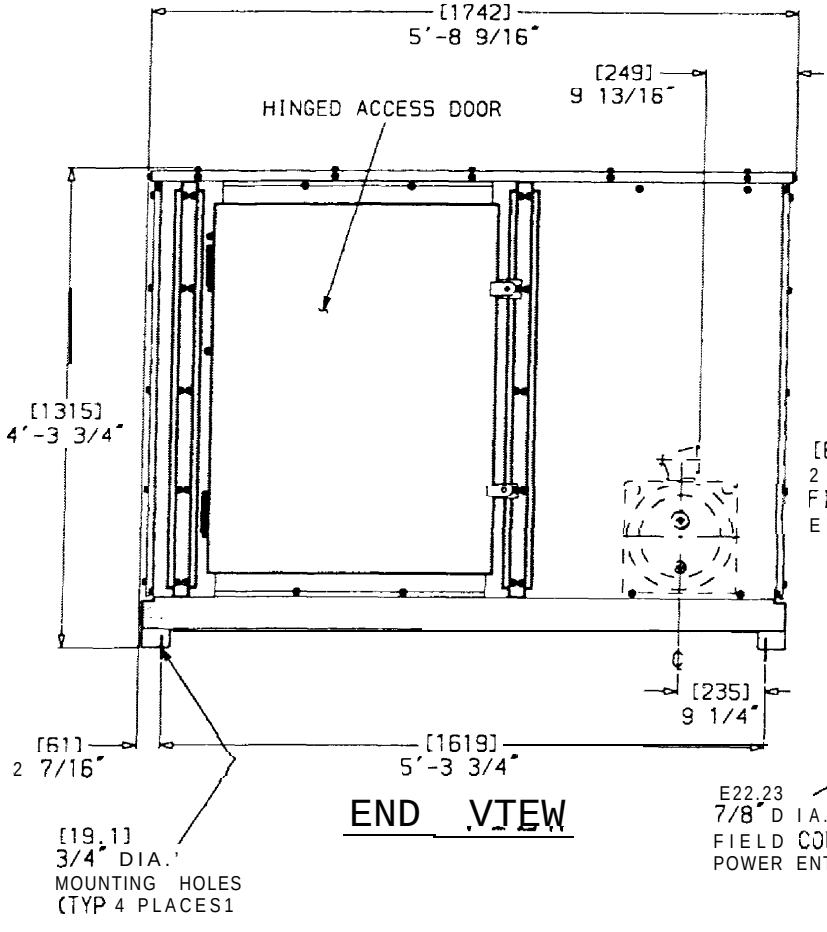
NOTE: "C" INDICATES COPPER COIL.



APPROX. OPER. WT (lb) AT SUPPORT POINTS

60 Hz	1	2	3	4	Tot.
035	822	661	822	660	2965
035C	907	730	907	729	3273





END VIEW

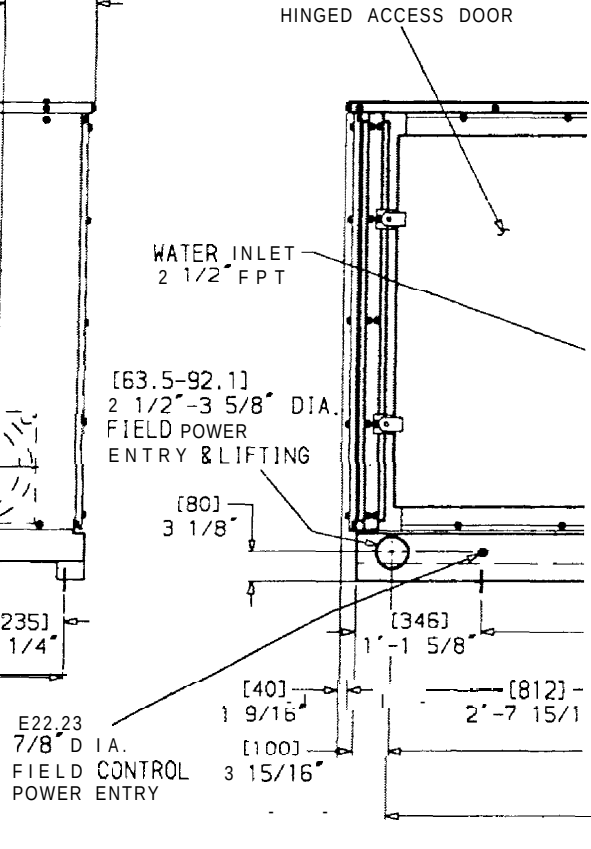
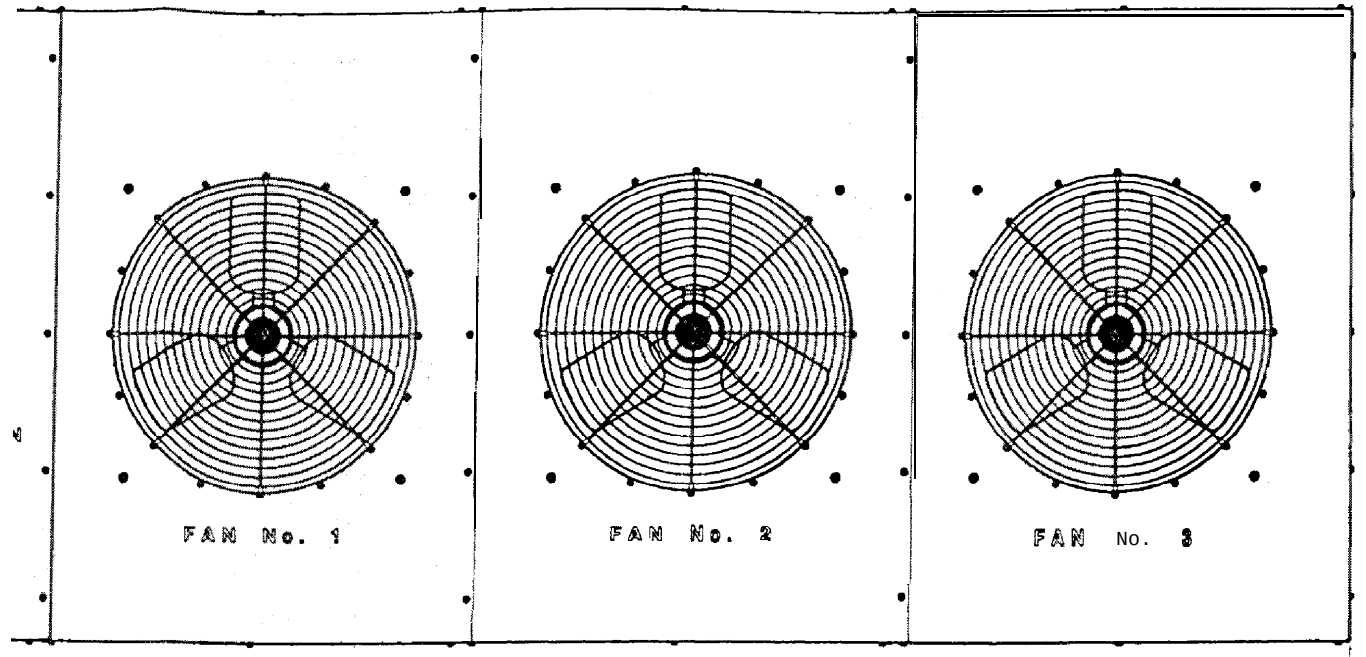


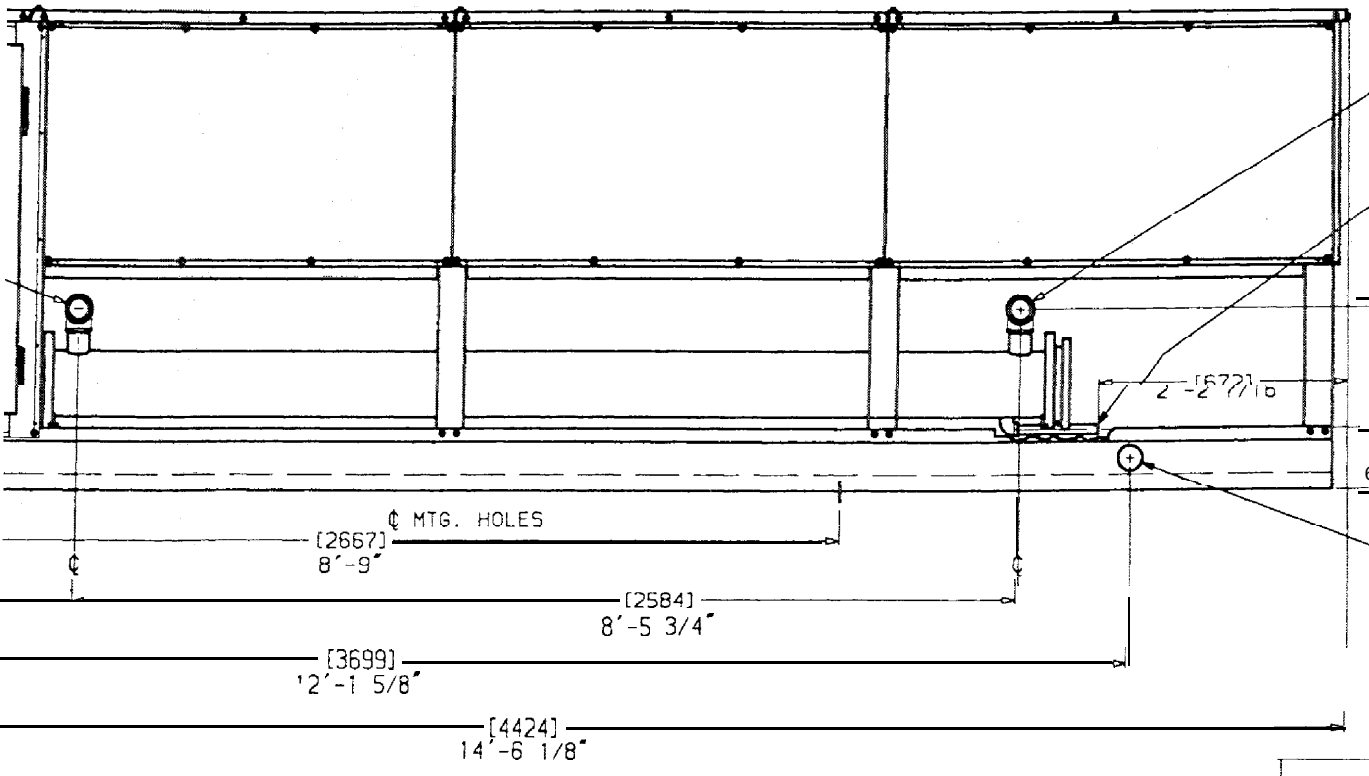
Fig. 7 –



TOP VIEW

[2845]
9'-4"
MIN. CLEARANCE FOR COOLER REMOVAL

AIRFLOW THRU CONDENSER



SIDE VIEW

30GT506097	REV A

Dimensional Drawing, 30GT035

Table 2 — Electrical Data

60 HERTZ

MODEL 30GT		UNIT								COMPRESSOR		FAN MOTORS†		CONTROL CIRCUIT	
		Volts	Ph	Hz	Supplied* Min	Supplied* Max	MCA	MOCP (Fuse)	ICF	RLA	LRA	FLA (ea)	Qty	Volts-Ph-Hz	Amps
015	500	208/230	3	60	187	254	76.9	125	269.6	55.8	266	3.6	2	115-1-60	7
	200	380	3	60	342	418	42.9	70	148.4	28.9	145	3.4	2	220-1-60	7
	600	460	3	60	414	508	35.7	60	121.8	25.7	120	1.8	2	115-1-60	7
	100	575	3	60	518	632	29.6	45	98.4	19.9	96	2.4	2	115-1-60	7
020	500	208/230	3	60	187	254	92.1	150	348.6	68	345	3.6	2	115-1-60	7
	200	380	3	60	342	418	50.1	80	194.4	34.6	191	3.4	2	220-1-60	7
	600	460	3	60	414	508	46.9	80	174.8	34.7	173	1.8	2	115-1-60	7
	100	575	3	60	518	632	40.9	60	122.4	28.9	120	2.4	2	115-1-60	7
025	500	208/230	3	60	187	254	124.6	200	452.2	89.8	446	6.2	2	115-1-60	7
	200	380	3	60	342	418	63.7	100	250.4	45.5	247	3.4	2	220-1-60	7
	600	460	3	60	414	508	60.7	100	226.1	43.6	223	3.1	2	115-1-60	7
	100	575	3	60	518	632	50.5	80	166.4	36.5	164	2.4	2	115-1-60	7
030	500	208/230	3	60	187	254	145.5	250	512.2	106	506	6.2	2	115-1-60	7
	200	380	3	60	342	418	72.5	125	283.4	52.6	280	3.4	2	220-1-60	7
	600	460	3	60	414	508	68.7	110	256.1	50	253	3.1	2	115-1-60	7
	100	575	3	60	518	632	52.9	90	178.4	38.5	176	2.4	2	115-1-60	7
035	500	208/230	3	60	187	254	203.0	350	702.4	147	690	6.2	3	115-1-60	7
	200	380	3	60	342	418	109.6	175	388.8	79.5	382	3.4	3	220-1-60	7
	600	460	3	60	414	508	91.0	150	351.2	65.4	345	3.1	3	115-1-60	7
	100	575	3	60	418	632	78.6	125	280.8	57.1	276	2.4	3	115-1-60	7

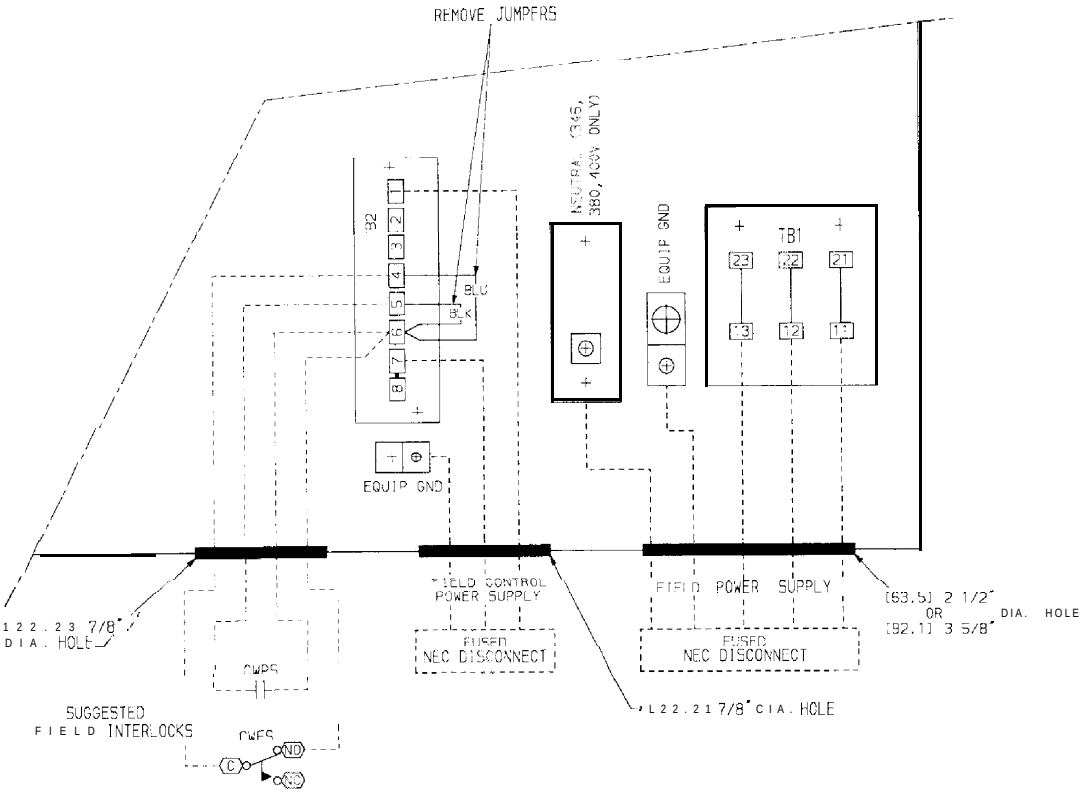
50 HERTZ

MODEL 30GT		UNIT								COMPRESSOR		FAN MOTORS†		CONTROL CIRCUIT	
		Volts	Ph	Hz	Supplied* Min	Supplied* Max	MCA	MOCP (Fuse)	ICF	RLA	LRA	FLA (ea)	Qty	Volts-Ph-Hz	Amps
015	800	230	3	50	198	254	82.5	125	253.6	60.3	250	3.6	2	230-1-50	7
	300	346	3	50	311	380	46.9	80	202.6	33.3	200	2.6	2	200/220-1-50	7
	900	400	3	50	342	400	50.2	80	176.4	34.7	173	3.4	2	230-1-50	7
020	800	230	3	50	198	254	103.4	175	345.6	76.9	342	3.6	2	230-1-50	7
	300	346	3	50	311	380	61.3	100	261.6	44.9	259	2.6	2	200/220-1-50	7
	900	400	3	50	342	400	61.3	100	226.4	43.6	223	3.4	2	230-1-50	7
025	800	230	3	50	198	254	114.6	200	369.6	85.9	366	3.6	2	230-1-50	7
	300	346	3	50	311	380	72.5	125	296.6	53.9	294	2.6	2	200/220-1-50	7
	900	400	3	50	342	400	69.3	110	256.4	50.0	253	3.4	2	230-1-50	7
030	800	230	3	50	198	254	138.6	225	548.6	105	545	3.6	2	230-1-50	7
	300	346	3	50	311	380	104.6	175	402.6	79.5	400	2.6	2	200/220-1-50	7
	900	400	3	50	342	400	88.6	150	348.4	65.4	345	3.4	2	230-1-50	7

FLA — Full Load Amps
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).
LRA — Locked Rotor Amps
M C A — Minimum Circuit Amps (complies with National Electrical Code [NEC], Section 430-24)
MOCP — Maximum Overcurrent Protection
RLA — Rated Load Amps

*Units are suitable for use on electrical systems where voltage supplied to unit terminals is not below or above listed minimum and maximum limits.
†All fans are protected by a single circuit breaker.

C30-295



NOTES:

1. FACTORY WIRING IS IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE IN E.C., US.) ANY FIELD MODIFICATIONS OR ADDITIONS MUST BE IN COMPLIANCE WITH ALL APPLICABLE CODES.
2. CONNECT SEPARATE SOURCE OF CONTROL POWER FROM FIELD SUPPLIED FUSED DISCONNECT TO TERMINALS 6 & 7. TB2 NEUTRAL SIDE MUST BE CONNECTED TO TERMINAL 7. THIS PROVIDES POWER FOR THE UNIT CONTROL CIRCUIT, COOLER HEATER AND COMPRESSOR CRANKCASE HEATER.
3. ALL FIELD INTERLOCK CONTACTS MUST HAVE VA RATING OF 63 VA PILOT DUTY PLUS CAPACITY REQUIRED FOR FIELD INSTALLED EQUIPMENT. REMOVE WIRE BETWEEN TERMINALS TB2-4 & 6 WHEN CHILLED WATER FLOW SWITCH IS FIELD-INSTALLED. REMOVE WIRE BETWEEN TERMINAL TB2-5 & 6 WHEN INSTALLING CHILLED WATER PUMP STARTER AUXILIARY INTERLOCK CONTACT.
4. FOR INTERNAL UNIT WIRING REFERENCE WIRING BOOK.
5. VOLTAGE REQUIREMENTS:

MAIN POWER	CONTROL POWER
208/230-3-60	115-1-60
460-3-60	115-1-60
575-3-60	115-1-60
380-3-60	220-1-60
230-3-50	230-1-50
346-3-50	200/220-1-50
400-3-50	230-1-50

LEGEND:

CWFS = CHILLED WATER FLOW SWITCH
CWPS CHILLED WATER PUMP STARTER AUXILIARY CONTACT
TB – TERMINAL BLOCK
------ FIELD POWER WIRING
------ FIELD CONTROL WIRING
——— FACTORY INSTALLED WIRING

30GT506098

Fig. 8 — Typical Wiring Schematic

START-UP

Initial Check — Do not attempt to start the liquid chiller, even momentarily, until the following steps have been completed.

1. Check all auxiliary components such as chilled Iiquid circulating pump, air handling equipment, or other equipment to which the chiller supplies liquid. Consult the manufacturer's instructions. If used, pump auxiliary contactor and flow switch interlocks must be properly installed (see Fig. 8, Typical Wiring Schematic).
2. Check chilled water safety thermostat. See Safety Thermostat (page 12) for adjustment.
3. Backseat (open) compressor suction and discharge shutoff valves. Close valves one turn to allow pressure to reach test gages.
4. Open liquid line valve.
5. Fill chilled liquid circuit with clean water (with recommended inhibitor added) to be cooled. Bleed all air out of high points of system.
5. Set temperature controller (see Multiple-Step Controller).
7. Check tightness of all electrical connections.
8. Compressor oil should be visible in sightglass (see Oil Charge).
9. Be sure there are no refrigerant leaks (see Leak Test and Dehydration).
10. Be sure unit is fully charged with refrigerant (see Refrigerant Charge).
11. Electrical power source must agree with nameplate rating.
12. Crankcase heater must be firmly locked into compressor crankcase. **Be** sure crankcase is warm (heater should be on for 24 hours before starting compressor).
13. Be sure compressor floats freely on the mounting springs. See Compressor Mounting section and Fig. 3 for loosening compressor bolts.

Leak Test and Dehydration — All 30GT units are shipped with complete operating charge of Refrigerant 22 (Table 1) and should be under sufficient pressure to conduct leak test after installation. If there is no system pressure, admit refrigerant until a pressure is observed and then proceed to test for leaks. After leaks are repaired, the system must be dehydrated. For leak testing and dehydration procedures, refer to Carrier Standard Service Techniques Manual, Chapter I, Refrigerants, Sections 6 and 7.

Refrigerant Charge — When additional or complete field charging is required, refer to Table I and use the Liquid Charging Method. Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, Section 8, for charging procedures.

Immediately ahead of the filter drier is a factory-installed liquid shutoff charging valve, A 1/4-in. flare connection is provided for field charging.

⚠ CAUTION

Never charge liquid into low-pressure side of system. Do not overcharge. During charging or removal of refrigerant, be sure water is continuously circulating through the cooler to prevent freezing.

Control Power Circuit — Switch 115-l-60 or 230-I-50 field disconnect to ON. The cooler heater is factory wired into the control circuit.

IMPORTANT: The compressor crankcase heater should be on as soon as auxiliary circuit is energized. Allow crankcase heater to operate at least 24 hours before starting unit, then close main power circuit breaker.

Actual Start-Up should be done only under supervision of a qualified refrigeration mechanic:

1. Open any compressor and system valves that were closed during charging.
2. Turn control circuit toggle switch to START.
3. Be sure all safety devices are satisfied.
4. Check to see that the leaving chilled water temperature agrees with the dial setting on the temperature controller. If it is not the same as the dial setting, the variation can be compensated by shifting the control point slightly to obtain the proper leaving chilled water temperature.

SERVICE

⚠ CAUTION

Turn off all power to unit before proceeding,

Access for Servicing (See Fig. 9)

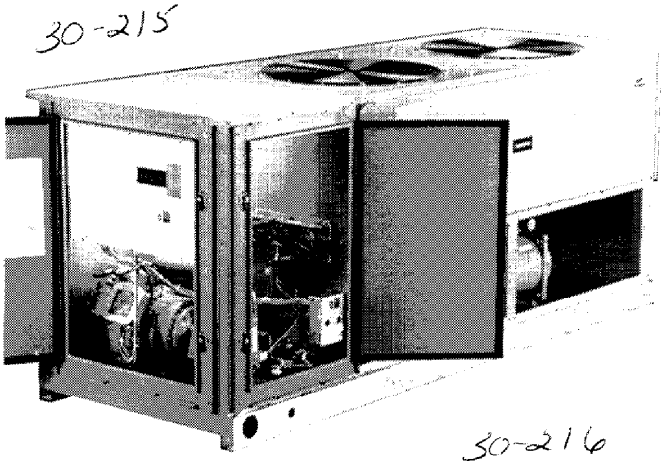
COMPRESSOR SECTION — The compressor compartment has 2 side doors and one front door for servicing, providing access to compressor, all components of the refrigeration system, electrical controls and control box. After opening front door an inner cover must be removed for access to control box.

The low water temperature cutout and water temperature control are located in the auxiliary control box behind the side access door on the cooler side. Both can be adjusted without removing auxiliary box cover.

CONDENSER SECTION — Condenser fan motors and fans can be serviced by removal of outlet grilles or side panels. If a fan motor is serviced, be sure the wire fan guard is in place over each fan before starting unit. See Fig, IO for proper fan adjustment. Tighten fan hub securely on motor shaft with setscrew which bears against the key. Be sure to replace Permagum and rubber cap over end of motor shaft to protect against moisture causing fan to rust on shaft.

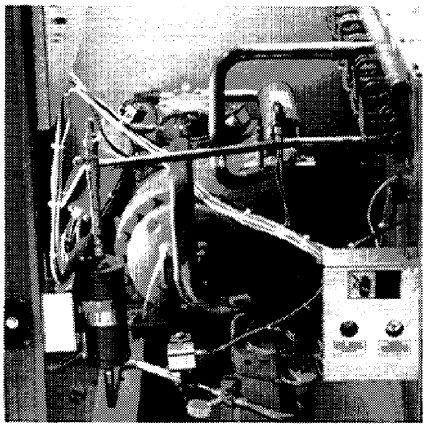
COOLER SECTION — The cooler can be serviced from the side or the end opposite the compressor compartment. To remove cooler tubes or entire cooler, see Fig. 5, 6, 7 for minimum clearance required. Cooler should be removed from end of unit.

30-215



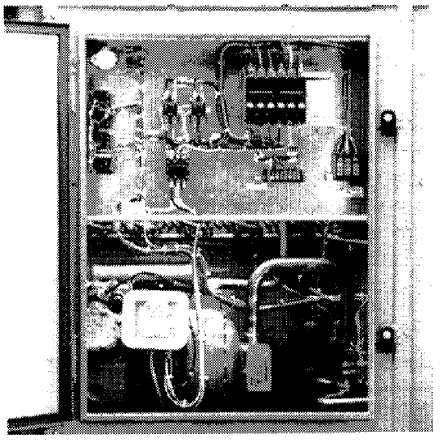
30-216

LEFT FRONT VIEW, COMPRESSOR END



COMPRESSOR END, LEFT FRONT ACCESS DOOR

30-217

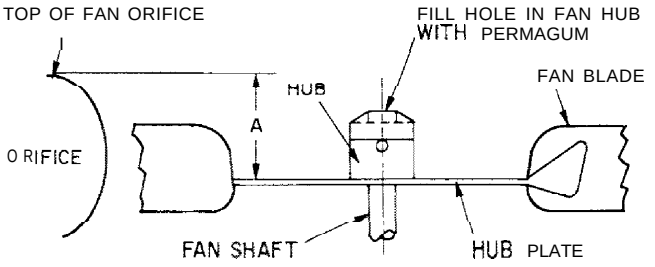


COMPRESSOR END, CONTROLS PANEL REMOVED

Fig. 9 — 30GT Unit with Access Panels Removed (30GT01 5,020 Shown)

Fan Adjustment (See Fig. 10)

A30-618



PROP LOCATION	"A" in. (mm)	
	Min	Max
60 Hz 30GT015 - 020	3.12 (79.2)	3.38 (85.9)
30GT025 - 030 30GT035	3.62 (91.9)	3.88 (98.6)
50 Hz 30GT015 - 020 30GT025 - 030	3.62 (91.9) 3.12 (79.2)	3.88 (98.6) 3.38 (85.9)

Fig. 10 — Location of Prop on Motor Shaft from Outside of Orifice Ring

Cooler Head Bolt Tightening

GASKET PREPARATION — When *reassembling,* use *new gaskets.* Compressed asbestos neoprene gaskets (Carrier Material Specification ZA00-24) are to be *momentarily* dipped in compressor oil prior to assembly. Gaskets are nut to be soaked in oil as gasket deterioration results. *Dipped gaskets are to be used within 30 minutes to prevent deterioration.*

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

I / Z-in. diameter flange bolts . . . . . 70 - 90 lb-ft (95 - *122* N-m)

BOLT TIGHTENING SEQUENCE (Fig. 1 I) The following is a recommended bolt tightening sequence:

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

Step 2 Repeat Step 1, tightening the bolts to the specified torque.

A30-243

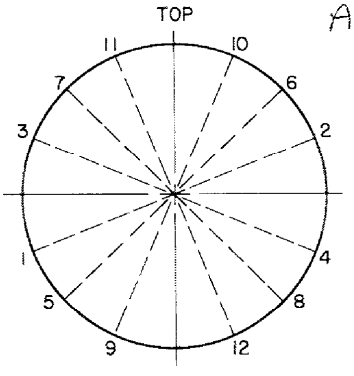


Fig. 11 — Tightening Sequence, Cooler Head Bolts

Oil Charge — Compressors are factory charged with oil as follows:

COMPRESSOR	AMOUNT pints (titers)
06DG537	10 (4.7)
06E2250	14 (6.6)
06E7265	19 (9.0)
06E7275	19 (9.0)
06E7299	19 (9.0)

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

Witco Chemical Corp. . . . . Suniso 3GS
Texaco, Inc. . . . . Capella WF-32
Shrieve Chemical Co. . . . . Zero1 150 (Synthetic)

IMPORTANT: Do not use drained oil or use oil that has been exposed to atmosphere. Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, for procedures to add or remove oil.

Thermostatic Expansion Valve is factory set to maintain 8 - 10 F (4.4 - 5.6 C) superheat of vapor leaving cooler to control flow of liquid refrigerant to cooler. Superheat can be reset but should be done only if absolutely necessary.

Liquid Line Solenoid Valve is interlocked with the water temperature controller (WTC) to shut off the flow of refrigerant to the cooler when the water temperature controller is satisfied. It is located immediately upstream of the thermostatic expansion valve. With single pumpout control, the compressor continues to run after WTC is satisfied and the refrigerant flow is shut off. This causes pumpout of refrigerant from the cooler and subsequent shutdown of the compressor on low-pressure control. The compressor does not restart until WTC again calls for cooling.

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

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

Filter Drier — Whenever the moisture-liquid indicator shows presence of moisture, replace filter drier. Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, for details on servicing filter driers.

Liquid Shutoff/Charging Valve is located immediately ahead of filter drier, provided with I/4-in. flare connection for field charging.

Compressor Protection

CIRCUIT BREAKER — Calibrated trip manual reset, ambient compensated, magnetic breaker protects against motor overload and locked rotor conditions.

DISCHARGE THERMOSTAT On 06D compressors, a sensor embedded in motor windings protects against overtemperature. A sensor in the discharge gas of 06E compressor reacts to excessively high discharge gas temperature and shuts off the compressor.

TIME GUARD@ control protects compressor against short cycling. See Sequence of Control (page 14).

CRANKCASE HEATER minimizes absorption of liquid refrigerant by oil in crankcase during brief or extended shutdown periods. Source of 115-volt, 60 Hz, or 230-volt, 50 Hz power is the auxiliary control power, independent of the main unit power. This assures compressor protection even when main unit power disconnect switch is off.

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

Cooler Freeze-Up Protection

HEATER CABLE — A heater cable is helically wound around the entire length of the cooler. A thermostat energizes the cable whenever the ambient temperature is 35 F (1.7 C) or lower. The cable is between the cooler and the insulation blanket around the cooler. The heater cable and the insulation protect the cooler down to -20 F (-29 C) ambient temperature.

Since the 115-l-60, or 230-I-50 auxiliary power source for the heater cable is separate from main power source, power to heater is assured even though the main unit power may be off.

⚠ CAUTION

Do not disconnect heater cable power when servicing compressor if ambient temperature is below 40 F (4.4 C). If power to the heater cable is cut off, or if unit is to be down for a prolonged period, drain the cooler.

SAFETY THERMOSTAT (Freezestat or Low Water Temperature Cutout) — The sensing bulb is located in the cooler nozzle at the chilled water end. To remove the sensing bulb, loosen the setscrew at the top of well and pull the bulb out. Before replacing the bulb, half fill the well with heat conductive compound (multi-service grease for high or low humidity conditions can be used). Then insert the bulb entirely into the well and tighten the setscrew. *Be sure the split collar is in the well recess.*

The thermostat is factory set to open at 36 ± 2 F (2.2 ± 1.1 C). It opens and locks out the compressor safety circuit. The compressor stops and the liquid line solenoid valve de-energizes. Manual reset is required to restart. The chilled water circulating pump continues to operate during lockout period.

WINTER SHUTDOWN — At the end of the cooling season, drain the water from the cooler (see drain location in Fig. 5, 6, 7). Replace the drain plug and put 2 gallons (8 L) of ethylene glycol in the cooler to prevent any residual water in the cooler from freezing. At the beginning of the next cooling season, refill the cooler and add the recommended inhibitor.

High-Pressure Switch has fixed, nonadjustable settings. Switch is mounted on the compressor.

TO CHECK

Open the condenser fan circuit breaker. Head pressure builds up until compressor shuts down. This should be at the cutout pressure in Table 3. Close condenser fan circuit breaker. After pressure drops to cut-in setting, reset control circuit by opening, then closing the control circuit switch. After control circuit is reset, the Time Guard@ timer cycles and in approximately 5.5 minutes the compressor restarts.

Low-Pressure Switch has fixed, nonadjustable settings. Switch is mounted on the compressor.

TO CHECK

Slowly close liquid shutoff valve and allow compressor to pump down. Do not allow compressor to pump down below 2 psig (13.8 kPa). Compressor should shut down when suction pressure drops to cutout pressure in Table 3, and should restart when pressure builds up to cut-in pressure shown.

Table 3 — Pressure Switch Settings, psig (kPa)

HIGH. PRESSURE		LOW PRESSURE	
Cutout	Cut-in	Cutout	Cut-in
426 ± 7 (2937 ± 48)	320 ± 20 (2206 ± 138)	27 ± 3 (186 ± 21)	44 ± 5 (303 ± 34)

Winter Start Control — Switch D in the 4-function timer bypasses low-pressure switch for 2-1/2 minutes on unit start-up.

Head Pressure Control reduces condensing capacity under low ambient temperature conditions.

FAN CYCLING — These 30GT units have standard provision for fully automatic intermediate-season head pressure control through condenser fan cycling. Fan no. 2 is cycled by a fan cycling pressure switch (FCPS) which responds to variation in discharge pressure. The pressure sensor is located in the liquid line of the refrigerant circuit. Fan no. 3 cycling is controlled by outdoor air temperature through an air temperature switch (ATS) (30GT035 units only).

The ATS is located in the lower divider panel between the compressor compartment and condenser section. Through a hole in the panel, the sensing element is exposed to air entering the no. 1 fan compartment. Fan no. 1 is non-cycling. Table 4 shows the operating settings of the fan cycling pressure switch and the air temperature switch.

Table 4 — Fan Cycling Controls

CONTROL BY	SWITCH OPENS	SWITCH CLOSES
Temp, F (C)	70 ± 3 (21 ± 1.7)	80 ± 3 (27 ± 1.7)
Pressure, psia (kPa)	160 ± 10 (1103 ± 69)	260 ± 15 (1793 ± 103)

NOTE: See Fig. 5, 6, 7 for fan arrangement.

Capacity Control System consists of a multiple-step water temperature controller, electric cylinder bank unloader(s) and liquid line solenoid valve. A hot gas bypass arrangement on the final step of unloading is factory supplied for models 30GT020 60 Hz and 30GT0 15 50 Hz. Factory-installed stubs are provided to facilitate field installation of hot gas bypass for all other units.

MULTIPLE-STEP CONTROLLER consists of load switches actuated by pressures developed ina temperature-sensing bulb located in the nozzle of the return water line of the chilled water system.

To remove the sensing bulb, loosen the setscrew at the top of well and pull the bulb out. Before replacing the bulb, half fill the well with heat conductive compound (multi-service grease for high or low humidity conditions can be used). Then insert the bulb entirely into the well and tighten the setscrew. Be *sure the split collar is in the well recess.*

The controller is factory set to control from *return* water temperature through a cooling range of IO F (5.6 C). The sequence switches are factory calibrated and sealed and should not require any field changes. Table 5 shows the factory-set temperature steps for the 2- and 3-step controllers.

The return water temperature at which the last step of capacity unloads is indicated by the leaving water temperature design set point on the adjustable dial (Fig. 12). Example: design set point is at 44 F (6.7 C). On a reduction in load, the capacity of the unit is reduced to zero when return water temperature drops to 44 F (6.7 C).

⚠ WARNING

Any alteration of factory settings, except design set point, without Carrier authorization, may void Carrier Warranty.

Design Set Point Adjustment — When unit is ready for operation. insert small screwdriver in adjusting slot (Fig. 12) and rotate to turn diaf (the dial may be turned by hand if desired).

fable 5 — Capacity Control Steps

UNIT 30GT	HERTZ	CONTROL STEPS	% CAP.	OPER CYL	TEMPERATURE, F (C)* Cut-in	Cutout
015	50	†	—	2	—	—
020	60	1	50	2	47.5 (8.6)	44‡ (6.7)
		2	100	4	53.5 (11.9)	50 (10.0)
015	60					
020	50	1	33	2	47.0 (8.3)	44‡ (6.7)
025	50/60	2	67	4	50.5 (10.3)	47.5 (8.6)
030		3	100	6	54.0 (12.2)	51 (10.6)
035	60					

*Return chilled water temperature.
†Uses hot gas bypass.
‡Design set point.

A30-96

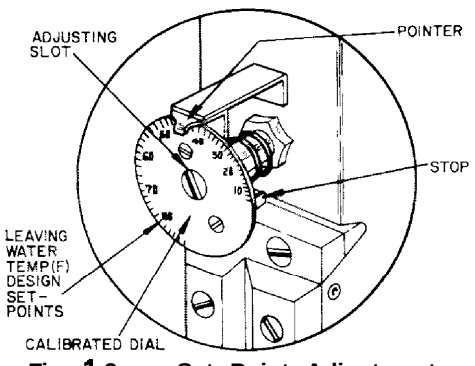


Fig. 12 — Set Point Adjustment

Rotate until the design set point for the installation appears directly under the pointer. Insert a thermometer in the *return* chilled water connection and allow the unit to run through 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.

HOT GAS BYPASS VALVE is factory-installed on Models 30GT015, 50 Hz and 30GT020, 60 Hz. It modulates flow of hot gas into refrigerant circuit in response to variations from preset suction pressure. **A** sudden decrease in suction pressure causes valve to admit more hot gas to restore the preset pressure level. The hut gas enters the refrigerant circuit through the connecting tube between the thermal expansion valve and the cooler. With hot gas bypass, the 30GT unit operates down to a lower load condition; the result is less frequent off-on cycling of the chiller.

The bypass valve is factory set to begin opening when suction pressure drops to about 62 psig (427 kPa). This pressure corresponds to a chilled water controller set-point of approximately 44 F (6.7 C). If the chilled water set point is lower than 44F (6.7 C), it is necessary to decrease the bypass valve setting for proper operation. Conversely, for chilled water set points above 44F (6.7 C), the bypass valve setting must be increased. A change in condensing temperature also requires a change in bypass valve set point, As condensing temperature decreases, decrease the bypass valve ser point until it opens at desired conditions.

OPERATION

Refer to Control Circuit diagram on the unit, or in the Wiring Diagrams publication.

Timer Functions (See Fig. 13)

1. Switch A (contacts A-A l and A-A2) provides Time Guard® function. Start of compressor is delayed approximately 5.5 minutes after shutoff. The minimum rime between starts of compressor is 8 minutes.
2. Switch B (contacts B-Bl and B-B2) starts compressor.
3. Switch D (contacts D-Dl) bypasses the low-pressure switch (LPS) for 2.5 minutes at start-up for winter start control.

A30-98

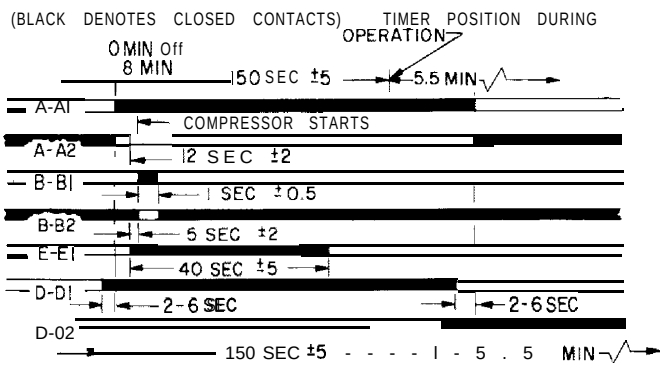


Fig. 13 — Timer Cycle

Sequence of Control — At start-up, with the water temperature controller (WTC) calling for cooling and all safety devices satisfied, the control circuit switch is closed. With minimal demand for cooling, only the first WTC switch is made. The timer motor starts, the liquid line solenoid valve opens, and condenser fan no. 1 starts. Fans no. 2 and 3 start if high side pressure is higher than 260 psig (I 793 kPa). After a delay by Time Guard of 12 seconds to approximately 8 minutes depending on the timer position, the compressor starts, unloaded. As cooling demand increases, unit capacity increases as follows:

UNITS WITH TWO-STEP CONTROLLER — The second WTC switch makes: the compressor loads and the unit is operating at full capacity.

UNITS WITH THREE-STEP CONTROLLER — The second WTC switch makes: one compressor unloader is de-energized increasing the capacity.

The third WTC switch makes: the second compressor unloader is de-energized increasing the unit to full capacity.

ALL UNITS — A pumpout relay (POR) in the control circuit is energized when WTC no. I switch makes. A set of normally open POR contacts close, completing a compressor control circuit which bypasses the WTC switches.

As cooling demand is satisfied, WTC switches break in descending sequence. The LLS valve closes, stopping the flow of liquid refrigerant to the cooler and subsequent suction gas to the compressor. After the last WTC switch breaks, the compressor continues to run because of the WTC switch bypass. With no refrigerant returning to the compressor, low side pumpout takes place and the compressor shuts down on low-pressure control. The compressor does not restart until the WTC again calls for cooling.

HOT GAS BYPASS (factory-installed on 30GT015 50 Hz, and 30GT020 60 Hz).

On the last step of capacity control (only WTC switch no. 1 is closed), the hot gas bypass valve is energized. This allows unit to operate at a lower load condition than is provided in the normal function of the WTC, with less frequent on-off cycling of the compressor.

Complete Unit Stoppage

CAUSES Interruption of supplied power, open control circuit switch (SW), open chilled water flow switch (CWFS), open contacts in auxiliary interlock (CWPS), open discharge thermostat (DGT) or compressor overtemperature protection (COTP, for 30GT0 15 60 Hz only), open high-pressure switch (HPS), open low water temperature cutout (LWTC).

RESTART — The unit recycles and restarts automatically under Time Guard@ control when power is restored, or when SW is closed or when contacts in CWFS or CWPS are closed.

Stoppage by DGT or COTP, HPS or LWTC requires manual resetting of the control circuit to restart the Time Guard timer. This is done by opening and closing the control circuit switch (SW).

After Stoppage by how-Pressure Switch (LPS)

— If LPS is not closed 2-1/2 minutes after compressor starts, the compressor stops and locks out and LPS must be closed before timer can recycle to restart the compressor.

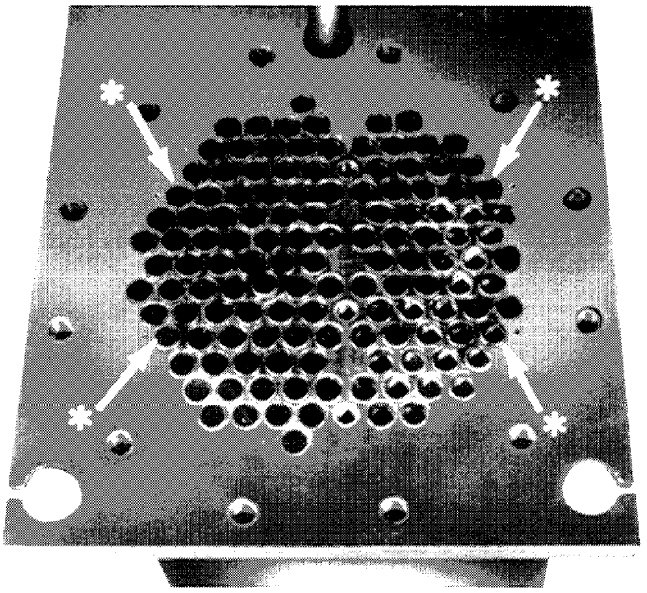
If LPS opens anytime during unit operation, compressor stops and timer starts. Compressor restarts in approximately 5.5 minutes. For 2-1/2 minutes, LPS is bypassed. If it has not closed by this time, the compressor stops and locks out. The compressor cannot restart until LPS is closed.

⚠ CAUTION

If unit or circuit stoppage 'occurs more than once due to any safety device, the trouble should be corrected before any attempt to restart.

Cooler Tubes — Plugging and Retubing — When the cooler heads and partition plates are removed, the tube sheets are exposed showing the ends of the tubes as seen in Fig. 14. 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. See Fig. 14. *If leaks occur in any of these 4 tubes, plug the tube(s) as described under Tube Plugging.*

30 - 79



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

Fig. 14 — 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 cooker *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 15 shows an Elliott tube plug and a cross-sectional view of a plug in place. Table 6 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 (540 C) and chilling quickly with water. Apply the heating flame to the side of the pin to prevent overheating the tube sheet.

A30 - 181

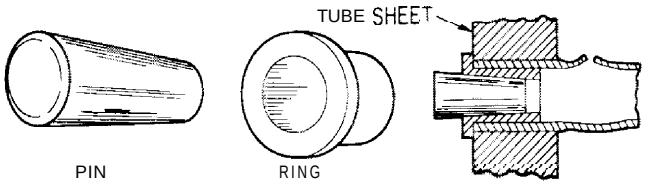


Fig. 15 Elliott Tube Plug

RETUBING (See Table 6) 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 30GT coolers, a 5% crush is recommended in setting torque (5/8-in. [15.87-mm] diameter tubes are used in the 30GT cooler).

Example:

a. Tube sheet hole diameter . . . . .0.630 in. (16.00 mm)
b. Tube OD . . . . . .0.625 in, (15.87 mm)
c. Clearance (a minus b) . . . . . .0.005 in. (0. 13 mm)
d. Tube ID before rolling
(use Elliott tube gage) . . . . . , . 0.549 in. (13.9 mm)
e. 5% of twice the wall thickness
(5% of b minus d) . . . . . , .0.004 in. (0.10 mm)
f. Tube ID after rolling
(c + d + e) . . . . . .0.558 in. (14.2 mm)

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

Table 6 — Tubes and Plugs

UNIT 30GT	015,020	025,030	035
TUBE DATA	SPECIFICATIONS		
Part No. 10HA50	1033	1053	1063
Length in. (mm)	62.5 (1588)	85.5 (2172)	109.5 (2781)
OD in. (mm)	0.625 (15.9)		
Wall Thickness, in. (mm)			
Plain End	0.038 (0.97)		
Finned Section	0.025 PJ.64')		
COMPONENTS FOR PLUGGING	PART NC?.		
For Tubes			
Brass Pin	853103-500†		
Brass Ring	853002-559†		
Fot Holes Without Tubes			
Brass Pin	853103†		
Brass Ring	853002-631 †		
Loctite	No. 75‡		
Locquic	"N"‡		

*Check with thickness gage (23 ga).
†Order directly from Elliott Company, Lagunda Operation, Springfield, Ohio.
‡Can be obtained locally.

TROUBLESHOOTING

SYMPTOM AND PROBABLE CAUSE	PROBABLE REMEDY
COMPRESSOR DOES NOT RUN	
1. Power tine open	1. Reset circuit breaker.
2. Control circuit stop-start switch is open	2. Reset switch.
3. Safety device tripped	3. Reset control circuit with stop-start switch.
4. Contactor stuck open	4. Replace contactor.
5. Loose terminat connection	5. Check connections.
6. Improperly wired controls	6. Check and rewire.
7. Seized compressor	7. Check motor winding for open or short. Replace compressor, if necessary.
8. Chilled water flow switch open	8. Check chilled water pump, check switch.
9. Low line voltage	9. Check tine voltage — determine location of voltage drop and remedy deficiency.
10. Compressor motor defective	IO. Check motor winding for open or short. Replace compressor, if necessary.
COMPRESSOR STOPS ON LOW-PRESSURE CONTROL	
1. Compressor suction shutoff valve partially closed	1. Open valve.
2. Low refrigerant charge	2. Add refrigerant.
3. Liquid line solenoid valve(s) fails to open	3. Check liquid line solenoid valve for proper operation. Replace if necessary.
COMPRESSOR STOPS ON HIGH-PRESSURE CONTROL	
1. Compressor discharge valve partialiy closed	1. Open valve or replace if defective.
2. Air in system	2. Purge system.
3. Condenser fan(s) not operating	3. Check motor wiring and repair or replace if defective.
UNIT OPERATES TOO LONG OR CONTINUOUSLY	
1. Low refrigerant charge	1. Add refrigerant.
2. Control contacts fused	2. Replace control.
3. Air in system	3. Purge system.
4. Partially plugged expansion valve or filter drier	4. Clean or replace.
SYSTEM IS NOISY	
1. Piping vibration	1. Support piping as required.
2. Compressor noisy	2. Check valve plates for valve noise. Replace compressor if bearings are worn.
COMPRESSOR LOSES OIL	
1. Leak in system	1. Repair leak.
2. Crankcase heaters not energized during shutdown	2. Check wiring and relays. Check heater and replace if defective.
FROSTED SUCTION LINE	
1. Expansion valve admitting excess refrigerant	1. Adjust expansion valve.
HOT LIQUID LINE	
1. Shortage of refrigerant due to leak.	1. Repair leak and recharge.
2. Expansion valve opens too wide	2. Adjust expansion valve.
FROSTED LIQUID LINE	
1. Restricted filter drier	1. Remove restriction or replace.
COMPRESSOR WILL NOT UNLOAD	
1. Burned-out coil	1. Replace coil.
2, Defective capacity control valve	2. Replace valve.
3. Miswired. solenoid	3. Rewire correctly.
4. Weak, broken or wrong valve body spring	4. Replace spring.
COMPRESSOR WILL NOT LOAD	
1. Miswired solenoid	1. Rewire correctly.
2. Defective capacity control valve	2. Replace valve.
3. Plugged strainer (high side)	3. Clean or replace strainer.
4. Stuck or damaged unloader piston or piston ring(s)	4. Clean or replace the necessary parts.