



Product Data

30HR,HS Model E Reciprocating Liquid Chillers

Nominal Capacities:
70 to 160 Tons (250 to 560 kW)

Quality Assurance



Certificate No FM 21837

Approvals:

ISO 9002

EN 29002

BS5750 PART 2

ANSI/ASQC Q92

Performance Assurance



Rated in accordance with
ARI Standard 590-92.

The Flotronic™ Plus Chiller Combines These Extra-Performance Features for Increased Energy Savings:

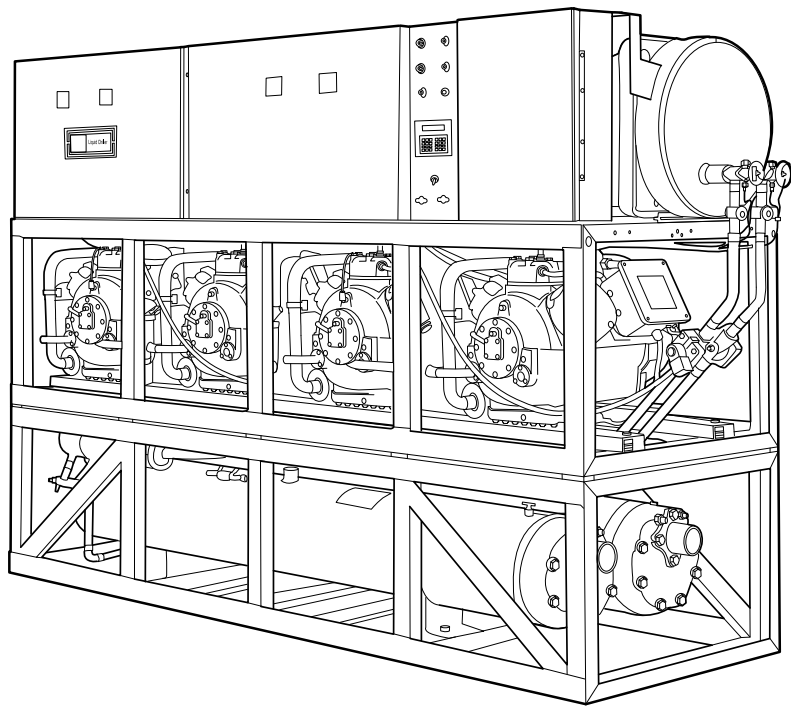
- microprocessor-based control system
- electronic expansion valve
- increased part-load efficiency
- multiple compressors — extra capacity steps

Features/Benefits

30HR,HS units are designed for easy installation and maintenance

Starting with installation, these machines keep costs low. Each is completely factory engineered and assembled to ensure a perfectly balanced refrigeration system that can be installed with minimal field labor. Only external fluid and power connections need to be completed at the jobsite to make the fluid-cooled (30HR) units operational. Condenserless (30HS) units require the addition of a remote condenser.

The 30HR model is a packaged unit complete with cooler, condensers, compressors, controls, refrigerant and oil charge, and internal piping and wiring. The 30HS unit is a condenserless version of the basic 30HR, shipped with a holding charge of refrigerant and specially designed for applications with remote fluid- or air-cooled, or evaporative type, condensers. All the easy-rigging 30H series chillers are extremely trim and compact. They can pass easily through standard doorways, and require minimal floor space on the job.





Additional features ensure smooth, trouble-free operation. Compressors are mounted on heavy-duty spring vibration isolators to minimize potentially damaging vibration transmission to the building structure. Sound-deadening mufflers dampen hot gas pulsations. Servicing is made easy by bolted, readily-accessible semi-hermetic compressors that can be removed with minimal field labor when adjustments or repairs are needed.

Flotronic™ Plus control system regulates the refrigerant cycle for optimum efficiency

The 30HR,HS Flotronic Plus chillers feature an electronic expansion valve (EXV) operated by a microprocessor-based control system. The system monitors safety functions and controls unit capacity to maintain leaving chilled fluid temperature. The microprocessor controls loading and unloading of compressors to match changing cooling load requirements.

The control system consists of a control box with a keypad and display module, an EXV for each refrigeration circuit, and thermistors (temperature sensors) which provide analog inputs to the microprocessor. The control also operates a quick test program to check input and output signals to and from the microprocessor.

The 30HR,HS control system is self contained and can operate on a stand-alone basis if desired.

Components

The control box — All the microprocessor-based controls required to optimize chiller operation and protect it against unsafe conditions are contained in the control box. This includes the processor module, relay module, EXV driver module, keypad and display module, relays, and transformers. The box has a hinged door for ready access.

The EXV driver — The driver positions the EXVs (based on commands from the microprocessor) and monitors the status of the oil and refrigerant pressure switches.

The keypad and display module — This module consists of a keypad with 11 function keys and 12 numeric keys (0 to 9, ., -) and an alphanumeric 8-character liquid crystal display. The module allows the operator to perform the following functions:

- read and change set point
- configure unit

- run quick test unit checkout
- observe diagnostic information
- schedule chiller operation

Control features

Leaving fluid temperature control with return compensation —

The rate at which the compressors are turned on will depend on the difference between the actual leaving fluid temperature and the set point, the rate of change of leaving fluid temperature, the return fluid temperature, and the number of compressor stages on. The control is primarily from leaving fluid temperature, and the other factors are used as compensation. Because the control operates from leaving fluid, the chiller is independent of cooling gpm (L/s). It is a true droopless control.

Return temperature reset — The control system is capable of handling leaving fluid temperature reset based on return cooler temperature. Because the change in temperature through the cooler is a measure of the building load, the return temperature reset is in effect an average building load reset method. All sensors required to activate return reset are standard with the unit.

Space and outdoor-air temperature reset — Space temperature reset and outdoor-air temperature reset allow for the reset of the leaving fluid temperature based on an external temperature sensor. (Accessory thermistor required.)

Energy management system reset — Many energy management systems have the capability to transmit a 4 to 20 mA signal in proportion to the desired leaving chilled-fluid set point. The Flotronic Plus chillers have the ability to recognize a proportioned signal to establish the reset condition (field-installed components are required).

Remote alarm — Upon initialization of an alarm condition, an internal contact will close to activate a signal suitable for remote alarm activation.

Load shed (demand limit) — A 2-step demand limit can be programmed through the Flotronic Plus controls. The control limits total power draw of the unit by controlling the number of steps of capacity operating during the demand limiting period.

Pulldown control — Pulldown control is used to minimize compressor usage and reduce the peak kW that occurs at start-up, when the cooler fluid temperature is very warm but the load is small. When activated, this feature limits the pulldown rate to 1° F (.56° C) per minute.

Unit checkout (quick test) — The quick test feature allows determination of the status (on or off) of various Flotronic Plus control components (i.e., solenoid valves, compressors, and unloaders). When the unit is in standby mode, these steps will energize these components and indicate whether or not the components are operational.

Diagnostics — The Flotronic Plus control system features extensive self-diagnostics as standard. The display will show a 2-digit diagnostic code, and will scroll an explanation of the code for failures that cause the unit to shut down, terminate a reset option, or use a default value as set point.

Time schedule — The Flotronic Plus control system has an integral function that allows scheduling of the circulating pump and chiller operation for up to 8 occupied/unoccupied periods per schedule, with 7 different schedule days.

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Increased part-load performance reduces operating costs

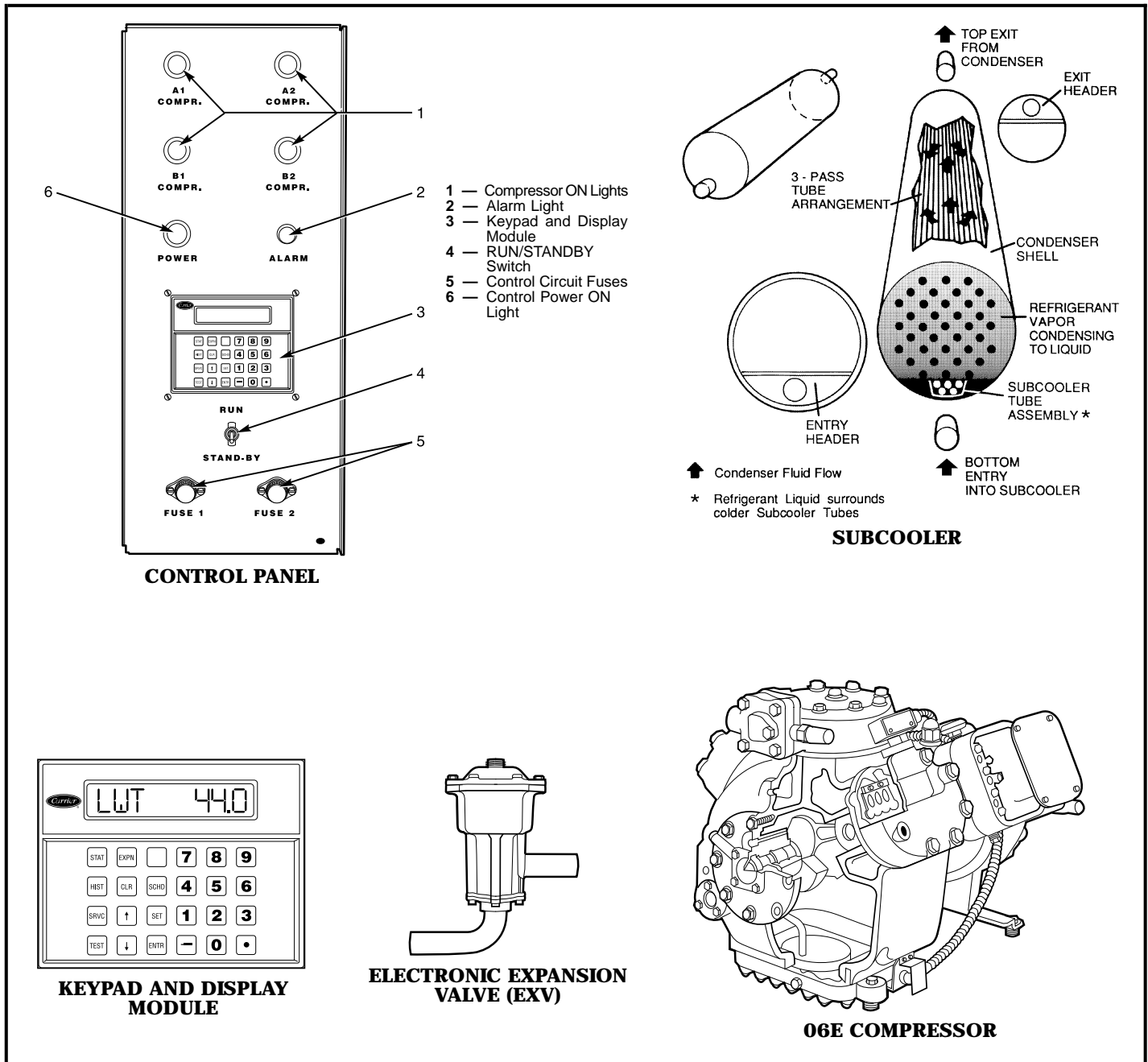
Multiple compressors — Multiple compressors on a refrigerant circuit further enhance part-load efficiency. This allows compressor to operate fully loaded with 100% of cooler and condenser surface active at

50% unit capacity, optimizing evaporating and condensing temperatures. Since the chiller normally works at part load for 97% of its operating time, a substantial reduction in operating cost can be realized.

Suction cutoff unloading — Unloading on 06E compressors eliminates unnecessary pumping of refrigerant

gases during unloader operation. This substantially reduces part-load power consumption.

Liquid refrigerant subcooling — Integral subcooler uses coldest condenser fluid to increase system capacity without extra horsepower.



Features/Benefits (cont)



Safety features provide protection and increase reliability

Auto. lead/lag control — Control balances operating hours between refrigerant circuits.

Standby protection — If a malfunction or safety cutout occurs, these 2-circuit chillers have the capability for standby operation. This benefit is especially desirable in commercial applications where even brief equipment shutdowns can be extremely costly.

Electronic expansion valve (EXV) — The EXV is controlled to maintain approximately 20 F (11 C) refrigerant superheat entering the compressor cylinders. (Ordinary thermostatic expansion valves typically operate at 45 F [25 C] superheat entering compressor cylinders.) Precise superheat control is obtained through actuation of the 760-step, long-stroke, 3/4-in. (19 mm) valve positioner to ensure optimized refrigerant metering. The accurate refrigerant

metering provided by the EXV reduces compressor motor temperature and extends motor life.

Filter drier — Refrigerant circuits are kept free of harmful moisture and contaminants by a factory-installed filter drier.

Crankcase heater — The compressor crankcase heater protects the compressors against refrigerant migration and oil dilution.

Moisture-indicating sight glass — Easy-to-read color indicator immediately shows moisture content of refrigerant system.

Oil pressure safety switch — Safety switch shuts compressor(s) off if the oil pressure drops below a safe operating point.

Protection against single-phasing — Manual reset, magnetic trip circuit breakers protect the compressor motors against both overload and single-phasing, and eliminate potential problems before they become service headaches.

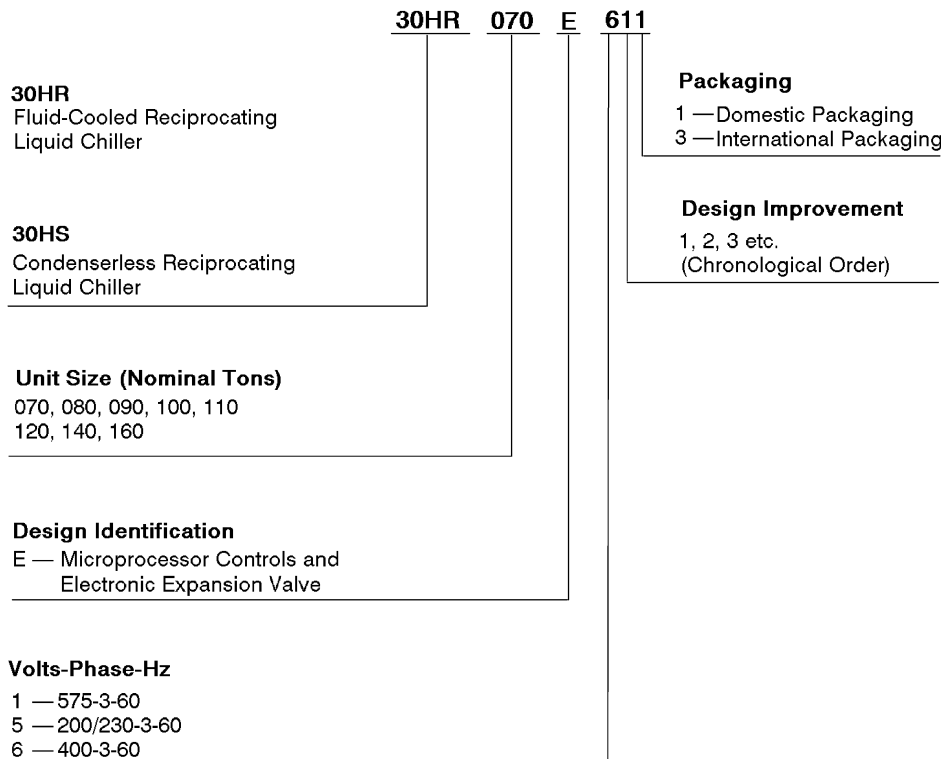
Motor overtemperature protection — Servicing dollars are saved because the compressor motors are thoroughly protected against overheating by quick-sensing elements.

Other safeties — Additional safeties include: Loss of refrigerant charge protection, low fluid flow protection, low chilled fluid temperature protection, low and high superheat protection, low oil protection for each compressor circuit, and low control voltage (to unit) protection.

Thermistors — Six thermistors are used for temperature sensing inputs to microprocessor (a seventh may be used as a remote temperature sensor for space or outdoor-air temperature reset):

- Cooler leaving and entering (return) chilled fluid temperature control
- Cooler saturation temperatures — Circuit A and Circuit B
- Return gas temperatures entering compressor cylinder — Circuit A and Circuit B
- Remote temperature sensor (accessory)

Model number nomenclature



These units are listed with Underwriters' Laboratories (UL) and Canadian Standards Association (CSA), and these pressure vessels have ASME (American Society of Mechanical Engineers) certification.



UNDERWRITERS' LABORATORIES



ASME 'U' STAMP



CANADIAN STANDARDS ASSOCIATION

NOTE: Refrigerant 134a is not available for these units.

Physical data — English



30HR,HS UNIT AND COMPRESSOR

UNIT 30HR,HS SIZE		070	080	090	100	110	120	140	160	
APPROXIMATE OPERATING WEIGHT (lb)*	HR	4760	4945	5070	6436	6575	6714	7355	7775	
	HS	3305	3360	3420	4360	4420	4480	5065	5175	
REFRIGERANT (R-22) OPERATING CHG (lb)†	HR	104	119	129	138	146	154	172	192	
	HS	15.3	15.3	15.3	21.0	21.0	21.0	27.0	27.0	
COMPRESSOR 06E** (Reciprocating, Semi-Hermetic, 1750 rpm)	HR	Ckt A	2150 A150	6175 A150	6175 F175	6175 A150	6175 F175	6175 F175	6299 F175	6299 F299
		Ckt B	6175	6175	6175	6175 A150	6175 A150	6175 F175	6299 F175	6299 F299
	HS	Ckt A	2250 A250	6275 A250	6275 F275	6275 A250	6275 F275	6275 F275	6299 F275	6299 F299
		Ckt B	6275	6275	6275	6275 A250	6275 A250	6275 F275	6299 F275	6299 F299
Capacity Control Steps (see page 31)		6	6	6	8	8	8	8	8	
Circuit Split, % Capacity	Ckt A	57	62.5	67	50	55	50	50	50	
	Ckt B	43	37.5	33	50	45	50	50	50	
CONDENSER PART NO. 09RP---										
HR	Ckt A	043	054	070	054	070	070	070	084	
	Ckt B	033	033	033	054	054	070	070	084	
REFRIGERANT CONN. (in. ODM)										
Liquid Line	Ckt A	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	
	Ckt B	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	
Discharge Line	Ckt A	1 5/8	1 5/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	
	Ckt B	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	

LEGEND

ODM — Outside Diameter Male

*Includes refrigerant operating charge.

†The 30HR unit is shipped with full operating charge; 30HS unit is shipped with holding charge only (cooler operating charge shown — condenser and interconnecting piping charge must be added for total system charge).

**Prefix (no. of unloaders): A, F = none; 2, 6 = one.

Physical data — English (cont)



COOLER

30HR,HS SIZE	070,080,090	100,110,120	140,160
COOLER PART NO. 10HA401---	664	684	704
DIMENSIONS			
OD (ft-in.)	1-3/4	1- 4	1-4
Length (ft-in.)*	6-9	6-11	9-0
NET FLUID VOLUME (gal.)†	21.7	40.4	52.4
REFRIGERANT CIRCUITS	2	2	2
MAXIMUM DESIGN WORKING PRESSURE (psig)			
Refrigerant Side	235	235	235
Fluid (Shell) Side	300	300	300
FLUID CONN. (in.)			
Inlet and Outlet	4**	5**	6**
Drain	3/4 FPT	3/4 MPT	3/4 MPT

*Between tube sheets.

†Includes nozzles.

**Victaulic-type water connections.

CONDENSER

CONDENSER PART NO. 09RP---	033	043	054	070	084
DIMENSIONS					
OD (in.)	10 ³ / ₄	12 ³ / ₄	12 ³ / ₄	12 ³ / ₄	14
Length (in.)*	67 ¹ / ₂	77	83 ³ / ₈	95 ¹ / ₄	83
NET FLUID VOLUME (gal.)	5.7	8.5	9.9	11.4	13.7
FLUID CONN. — in. diameter†					
Inlet IPS**	2 ¹ / ₂	3	3	3	2 ¹ / ₂ ††
Outlet IPS**	2 ¹ / ₂	3	3	3	4
FLUID PASSES	3	3	3	3	3 or 6
MAXIMUM DESIGN WORKING PRESSURE (psig)	Refrigerant Side — 385 Fluid Side — 250				

LEGEND

IPS — Iron Pipe Size

OD — Outside Diameter

*Between tube sheets.

†On part no. 084 condensers, data is for 3-pass only. For 6-pass, inlet and outlet connections are 2¹/₂ inches.

**Field welded (flange with weld stub provided for all connections).

††The 09RP084 has 2 inlet connections.

NOTES:

1. The 2¹/₂-in. and 3-in. condenser connections are equipped with slip-on flanges bolted to the condensers and designed for field welding of field-supplied 2¹/₂-in. and 3-in. schedule 40 pipe.

The 4-in. condenser connections are equipped with welding neck flanges bolted to the condensers and designed for field welding of field-supplied 4-in. schedule 40 pipe.

2. Standard 30HR,HS160 unit is supplied with 3-pass condensers. To convert from 3 to 6 pass, proceed as follows:
 - a. Remove 4-in. outlet flanges.
 - b. Cover 4-in. (09RP084) 3-pass condenser water outlets with blind flanges (field supplied).
3. Water outlet and inlet connections are rated according to ANSI/ASME B 16.5 (American National Standards Institute/American Society of Mechanical Engineers) latest revision.

Physical data —SI



30HR,HS UNIT AND COMPRESSOR

UNIT 30HR,HS SIZE		070	080	090	100	110	120	140	160	
APPROXIMATE OPERATING WEIGHT (kg)*	HR	2159	2243	2300	2919	2982	3045	3336	3527	
	HS	1499	1524	1551	1978	2005	2032	2297	2347	
REFRIGERANT (R-22) OPERATING CHG (kg)†	HR	47	54	59	63	66	70	78	87	
	HS	6.9	6.9	6.9	9.5	9.5	9.5	12.2	12.2	
COMPRESSOR 06E** (Reciprocating, Semi-Hermetic, 29.2 r/s)	HR	Ckt A	2150 A150	6175 A150	6175 F175	6175 A150	6175 F175	6175 F175	6299 F175	6299 F299
		Ckt B	6175	6175	6175	6175	A150	6175 F175	6299 F175	6299 F299
	HS	Ckt A	2250 A250	6275 A250	6275 F275	6275 A250	6275 F275	6275 F275	6299 F275	6299 F299
		Ckt B	6275	6275	6275	6275	A250	6275 F275	6299 F275	6299 F299
Capacity Control Steps (see page 31)		6	6	6	8	8	8	8	8	
Circuit Split, % Capacity	Ckt A	57	62.5	67	50	55	50	50	50	
	Ckt B	43	37.5	33	50	45	50	50	50	
CONDENSER PART NO. 09RP---										
HR	Ckt A	043	054	070	054	070	070	070	084	
	Ckt B	033	033	033	054	054	070	070	084	
REFRIGERANT CONN. (in. ODM)										
Liquid Line	Ckt A	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	
	Ckt B	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	
Discharge Line	Ckt A	1 5/8	1 5/8	2 1/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8	
	Ckt B	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	

LEGEND

ODM — Outside Diameter Male

*Includes refrigerant operating charge.

†The 30HR unit is shipped with full operating charge; 30HS unit is shipped with holding charge only (cooler operating charge shown — condenser and interconnecting piping charge must be added for total system charge).

**Prefix (no. of unloaders): A, F = none; 2, 6 = one.

Physical data — SI (cont)



COOLER

30HR,HS SIZE	070,080,090	100,110,120	140,160
COOLER PART NO. 40HA401---	664	684	704
DIMENSIONS			
OD (mm)	324	406	406
Length (mm)*	2057	2108	2743
NET WATER VOLUME (L)†	82.1	152.9	198.3
REFRIGERANT CIRCUITS	2	2	2
MAXIMUM DESIGN WORKING PRESSURE (kPa)			
Refrigerant Side	1620	1620	1620
Fluid (Shell) Side	2068	2068	2068
FLUID CONN. (in.)			
Inlet and Outlet	4**	5**	6**
Drain	¾ FPT	¾ MPT	¾ MPT

*Between tube sheets.

†Includes nozzles.

**Victaulic-type water connections.

CONDENSER

CONDENSER PART NO. 09RP---	033	043	054	070	084
DIMENSIONS					
OD (mm)	273	324	324	324	356
Length (mm)*	1715	1956	2118	2419	2108
NET FLUID VOLUME (L)	21.6	32.2	37.5	43.1	51.9
FLUID CONN. — in. diameter†					
Inlet IPS**	2½	3	3	3	2½††
Outlet IPS**	2½	3	3	3	4
FLUID PASSES	3	3	3	3	3 or 6
MAXIMUM DESIGN WORKING PRESSURE (kPa)	Refrigerant Side — 2654 Fluid Side — 1724				

LEGEND

IPS — Iron Pipe Size

OD — Outside Diameter

*Between tube sheets.

†On part no. 084 condensers, data is for 3-pass only. For 6-pass, inlet and outlet connections are 2½ inches.

**Field welded (flange with weld stub provided for all connections).

††The 09RP084 has 2 inlet connections.

NOTES:

- The 2½-in. and 3-in. condenser connections are equipped with slip-on flanges bolted to the condensers and designed for field welding of field-supplied 2½-in. and 3-in. schedule 40 pipe.
The 4-in. condenser connections are equipped with welding neck flanges bolted to the condensers and designed for field welding of field-supplied 4-in. schedule 40 pipe.
- Standard 30HR,HS160 unit is supplied with 3-pass condensers. To convert from 3 to 6 pass, proceed as follows:
 - Remove 4-in. outlet flanges.
 - Cover 4-in. (09RP084) 3-pass condenser fluid outlet with blind flanges (field supplied).
- Water outlet and inlet connections are rated according to ANSI/ASME B 16.5 (American National Standards Institute/American Society of Mechanical Engineers) latest revision.

Accessories (field installed)



Condenser manifold package — This accessory is available for all 30HR models except the size 160 unit. The manifold provides common fluid inlet and outlet connections and consists of 2 steel manifolds, each in 2 sections. Field welding is required.

Control circuit transformer — Field installed transformer provides 115-v control circuit power if separate control power source is not available.

Remote reset thermistor — Enables control for space and outdoor-air temperature reset.

Unit sound enclosure panels — These panels, with fiberglass insulation, completely enclose the compressor and condenser sections.

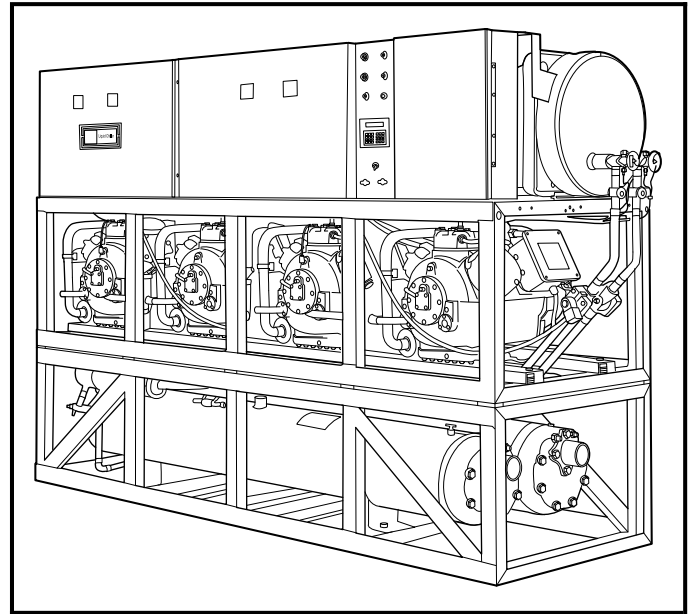
Gage panel package — One package is required per unit. Package includes one suction pressure gage and one discharge pressure gage per circuit mounted on a common panel. Each gage is equipped with a shutoff valve.

Temperature reset — Leaving fluid temperature reset accessory board may be installed in chiller to provide reset of LCWT (leaving chilled fluid temperature) in constant fluid flow systems. Three reset control options are: from return-fluid temperature, space temperature, and outdoor-air temperature.

Demand limit control — This control provides 2 demand limit steps: 1) between 50% and 100% of maximum compressor displacement; or 2) between 0% and 49% displacement. The external switching device determines when to limit unit capacity.

Chilled Fluid Flow Switch — Although low fluid flow detection is provided by the unit internal control devices, this accessory is available for field installation for redundant protection.

Oil-pressure safety switch — Standard on condenserless (30HS) models, accessory on fluid-cooled (30HR) models. Switch protects compressors against loss of oil pressure in the event of a loss of lubricating oil. One switch package is needed for each lead compressor.



Base unit dimensions — 30HR, HS070-090



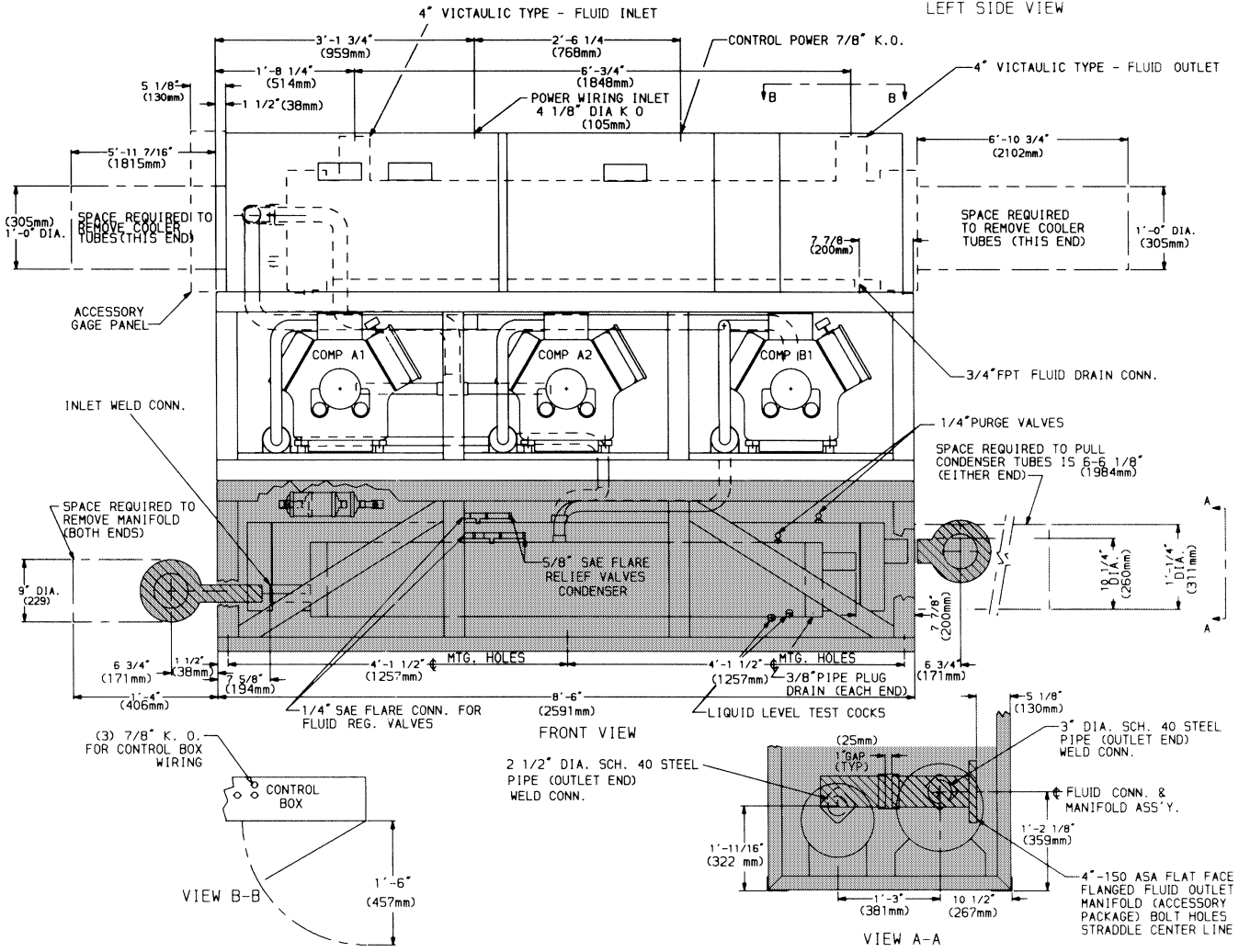
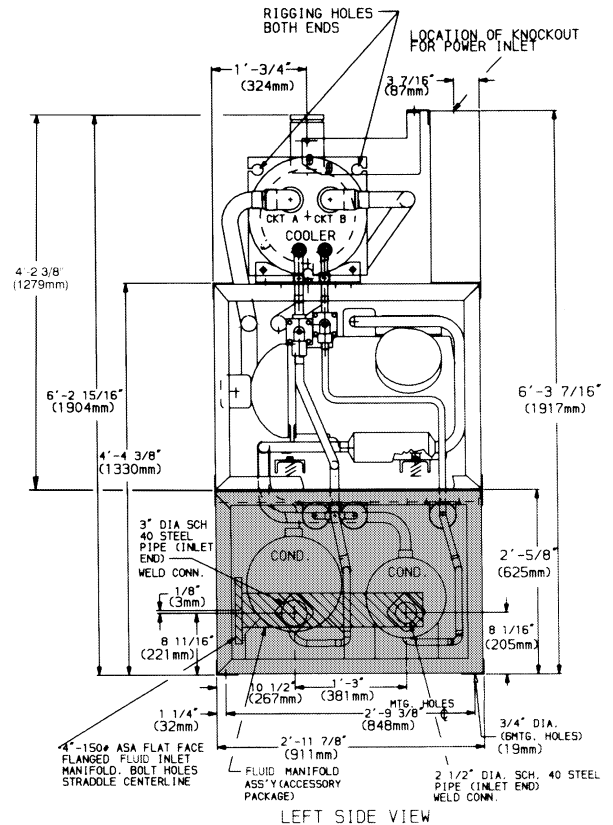
CONDENSER SECTION — 30HR ONLY

LEGEND

- American Standards Association
- ASA** — American Standards Association
- COMP** — Compressor
- COND** — Condenser
- CONN** — Connection
- KO** — Knockout
- MTG** — Mounting
- REG** — Regulatory
- SAE** — Society of Automotive Engineers (U.S.A.)
- SCH 40** — Schedule 40 Pipe

NOTES:

1. Allow 24 in. in front of unit to fully open electric panel door.
2. Shaded piping indicates accessory manifold fluid package available with weld connections for connections to stub of condenser fluid connections. Sleeve coupling permits customer adjustment before welding.



Base unit dimensions — 30HR, HS100-120



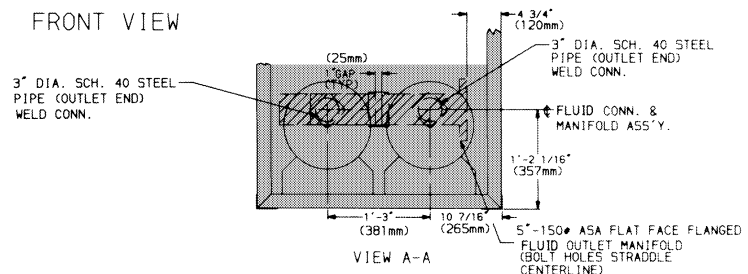
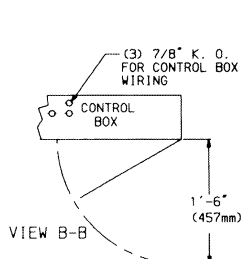
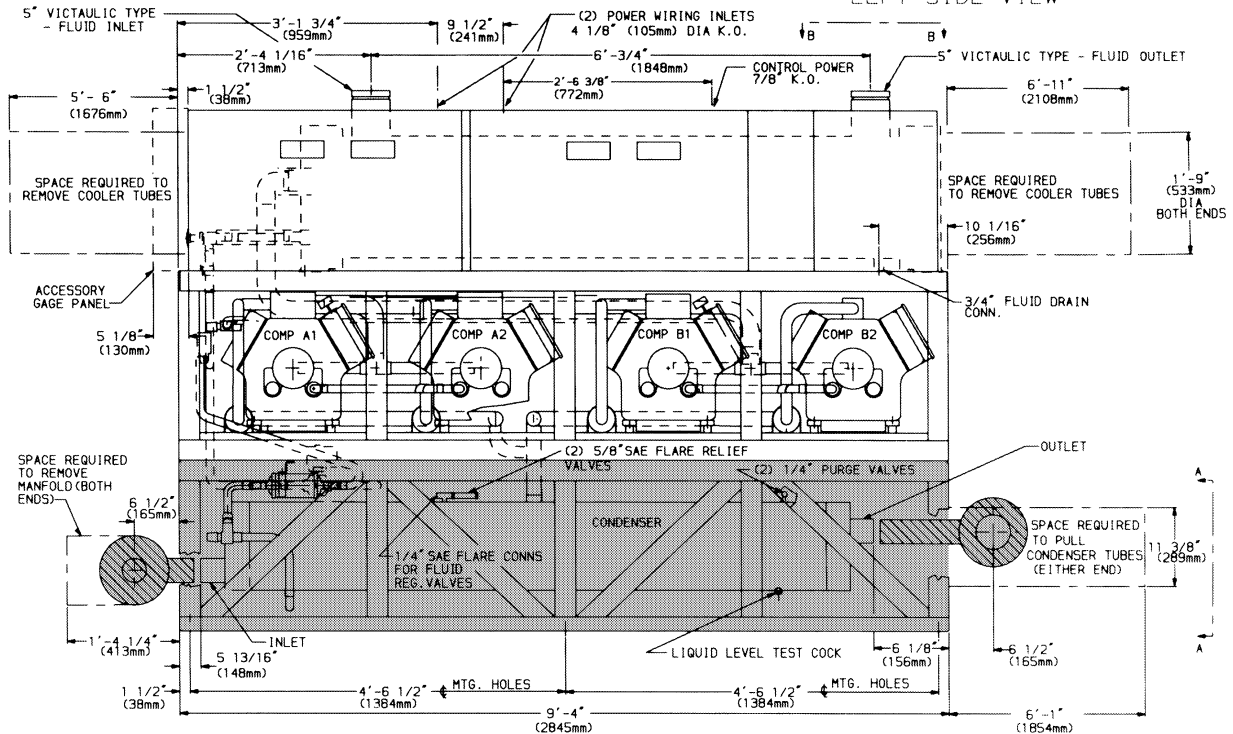
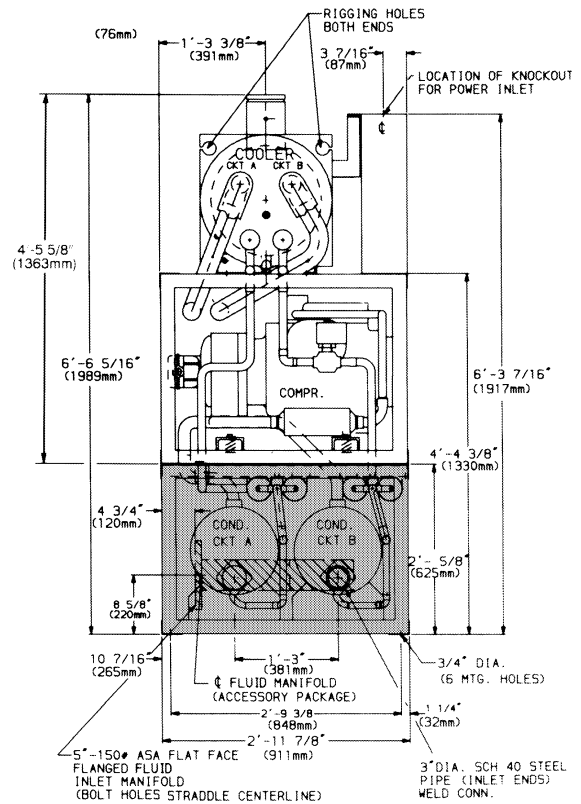
CONDENSER SECTION — 30HR ONLY

LEGEND

- ASA — American Standards Association
- COMP — Compressor
- COND — Condenser
- CONN — Connection
- KO — Knockout
- MTG — Mounting
- REG — Regulatory
- SAE — Society of Automotive Engineers (U.S.A.)
- SCH 40 — Schedule 40 Pipe

NOTES:

1. Allow 24 in. in front of unit to fully open electric panel door.
2. Shaded piping indicates accessory manifold fluid package available with weld connections for connections to stub of condenser fluid connections. Sleeve coupling permits customer adjustment before welding.



Base unit dimensions — 30HR, HS140, 160



DIMENSIONS

UNIT 30HR, HS	"A"		"B"		"C"		"D"		"E"		"F"		"G"		"H"	
	Ft.-in.	mm	Ft.-in.	mm	Ft.-in.	mm	Ft.-in.	mm	Ft.-in.	mm	Ft.-in.	mm	Ft.-in.	mm	Ft.-in.	mm
140	1-2 ⁵ / ₈	371	0-10 ¹ / ₁₆	265	0-8 ¹ / ₁₆	224	1-2 ¹ / ₈	359	0-3	76	1-2 ¹ / ₈	359	0-3	76	0-5 ¹ / ₈	146
160	1-4	406	0-9 ¹ / ₁₆	240	0-7 ⁷ / ₁₆	193	1-3 ³ / ₈	397	0-3	76	0-11 ¹ / ₂	295	0-4	102	0-6 ⁵ / ₁₆	160

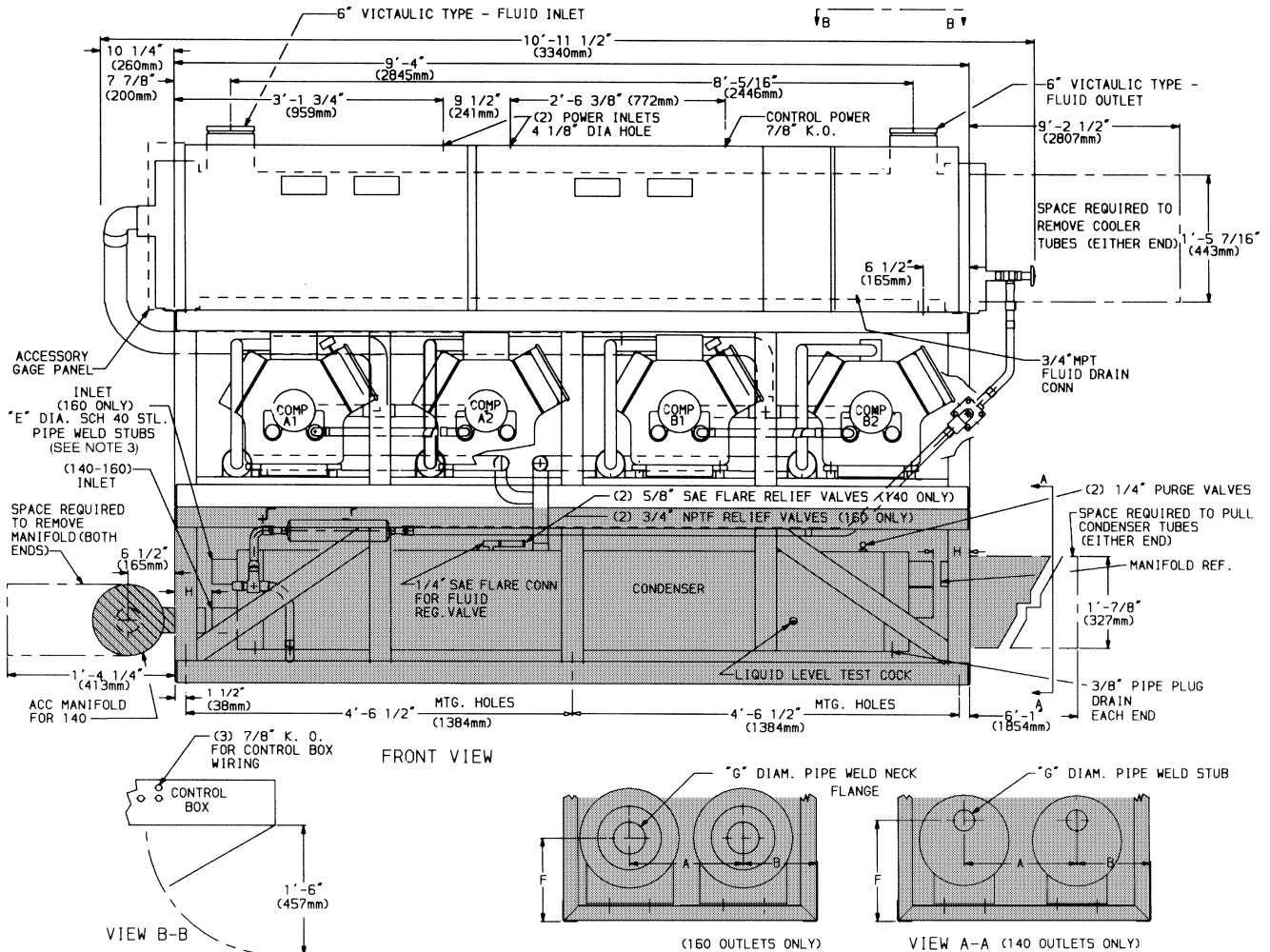
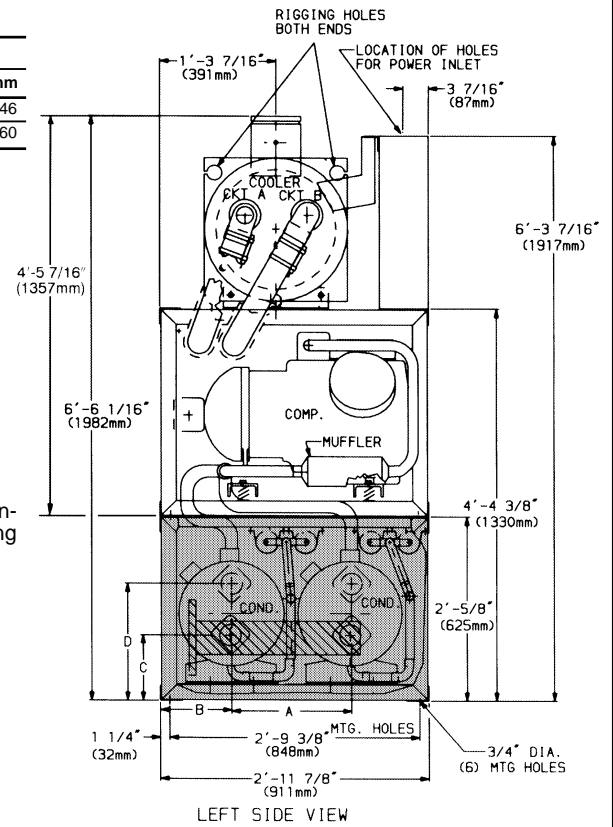
CONDENSER SECTION — 30HR ONLY

LEGEND

- ASA — American Standards Association
- COMP — Compressor
- COND — Condenser
- CONN — Connection
- KO — Knockout
- MTG — Mounting
- REG — Regulatory
- SAE — Society of Automotive Engineers (U.S.A.)
- SCH 40 — Schedule 40 Pipe

NOTES:

- Allow 24 in. in front of unit to fully open electric panel door.
- Shaded piping indicates accessory manifold fluid package available with weld connections for connections to stub of condenser fluid connections. Sleeve coupling permits customer adjustment before welding.
- A total of 4 condenser inlet connections are required for the 30HR160.



Application data



Leveling unit

To assure proper oil return, be sure that unit is level, particularly in its major lengthwise dimension, as compressor oil return piping runs in that direction.

Determine prior to installation if any special treatment is required to assure a level installation.

Cooler fluid temperature

1. *Maximum* leaving chilled fluid temperature (LCWT) is 70 F (21 C). Unit can start and pull down with up to 95 F (35 C) entering fluid temperature due to MOP (maximum operating pressure) feature of the expansion valve. For sustained operation, it is recommended that entering fluid temperature not exceed 85 F (29 C).
2. *Minimum* LCWT is 40 F (4 C) for standard units. Special order medium temperature brine units must be ordered for operation with leaving fluid temperatures in the range of 39 to 15 F (4 to -9 C). For ratings below 40 F (4 C) LCWT, contact your local Carrier representative.

Condenser fluid temperature

1. *Maximum* leaving condenser fluid temperature is 104 F (40 C) on all 30HR models (except 30HR160, which has a maximum temperature of 120 F [49 C]).
2. *Minimum* entering condenser fluid temperature without condenser flow regulation is 70 F (21 C).

MINIMUM COOLER AND CONDENSER FLUID FLOW RATES AND MINIMUM LOOP VOLUME

UNIT 30HR,HS	MINIMUM FLOW				MINIMUM VOLUME†	
	Cooler		Condenser*		Gal.	L
	Gpm	L/s	Gpm	L/s		
070	95	5.99	110	6.94	208	787.3
080	95	5.99	115	7.26	232	878.1
090	95	5.99	124	7.82	257	972.7
100	135	8.52	128	8.08	294	1112.8
110	135	8.52	138	8.71	315	1192.3
120	135	8.52	150	9.46	336	1271.8
140	156	9.84	150	9.46	405	1532.9
160	156	9.84	243	15.30	449	1699.5

LEGEND

ARI — Air Conditioning and Refrigeration Institute (U.S.A.)

N — Liters per kW

V — Gallons per ton

*Applicable to 30HR units only.

†Minimum system fluid volumes:

Gallons = V x ARI Capacity in Tons

Liters = N x ARI Capacity in kW

(Based on Normal Air Conditioning value)

APPLICATION	V	N
Normal Air Conditioning	3	3.25
Process Type Cooling	6 to 10	6.5 to 10.8
Low Ambient Operation	6 to 10	6.5 to 10.8

NOTE: Minimum condenser fluid flow based on 3 ft/sec (0.9 m/s) to minimize condenser fouling. Flow rates below 3 ft/sec (0.9 m/s) may require more frequent tube cleaning.

Cooler and fluid-cooled condenser temperature rise

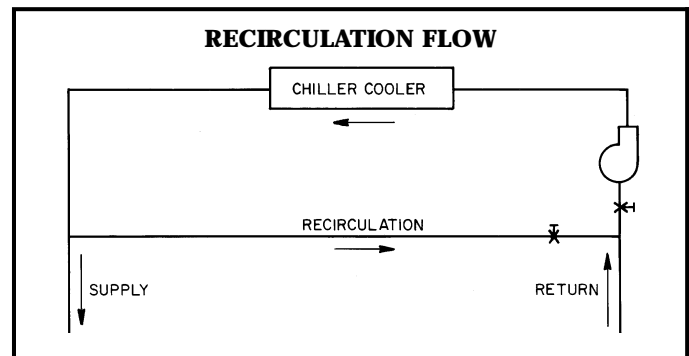
Ratings and performance data in this publication are for a cooling temperature rise of 10° F (5.6° C). Units may be operated at a different temperature rise, provided flow limits are not exceeded and corrections to capacity, etc., are

made. For minimum flow rates, see Minimum Cooler and Condenser Fluid Flow Rates and Minimum Loop Volume table on this page. High flow rate is limited by pressure drop that can be tolerated. If another temperature rise is used, apply LCWT correction as given in Selection Procedure section on page 17.

Minimum cooler flow — This value (maximum cooler temperature rise) for standard units is shown in Minimum Cooler and Condenser Fluid Flow Rates and Minimum Loop Volume table. When gpm (L/s) required is lower (or rise is higher), follow recommendations below:

- a. Multiple smaller chillers may be applied in series, each providing a portion of the design temperature rise.
- b. Chilled fluid may be recirculated to raise flow rate. However, mixed temperature entering cooler must be maintained at a minimum of at least 5° F (2.8° C) above the leaving chilled fluid temperature.
- c. Special cooler baffling is required to allow minimum flow rate to be reduced 12%.

NOTE: Recirculation flow is shown below.

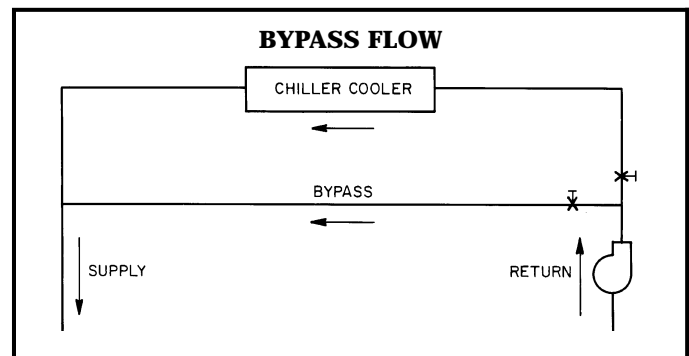


Maximum cooler flow (> 5 gpm/ton or < 5° F rise [$> 0.09 \text{ L/s} \cdot \text{kW}$ or $< 2.7^\circ \text{ C rise}$)] — The rise results in practical maximum pressure drop through cooler.

Return fluid may bypass the cooler to keep pressure drop through cooler within acceptable limits. This permits a higher ΔT with lower fluid flow through cooler and mixing after the cooler.

Special cooler baffling is available by special order, to permit a cooler flow rate increase of 10%.

NOTE: Bypass flow is shown below.



Application data (cont)



Minimum fluid-cooled condenser flow — This value (maximum rise) is shown in Minimum Cooler and Condenser Fluid Flow Rates and Minimum Loop Volume table on page 13. Condensers may be piped in series. Ensure leaving fluid temperature does not exceed 104 F (40 C).

Variable cooler flow rates — These rates may be applied to standard chillers. However, the unit will attempt to maintain a constant leaving chilled fluid temperature. In such cases, minimum flow must be in excess of minimum flow given in the Minimum Cooler and Condenser Fluid Flow Rates and Minimum Loop Volume table, and flow rate must change in steps of less than 10% per minute. Apply 6 gal per ton (6.5 L per kW) fluid loop volume minimum if flow rate changes more rapidly.

Chilled fluid loop volume — The volume in circulation must equal or exceed 3 gal per nominal ton of cooling (3.25 L per kW) for temperature stability and accuracy in normal air conditioning applications. See Minimum Cooler and Condenser Fluid Flow Rates and Minimum Loop Volume table on page 13. (For example, a 30HR100 would require 294 gal [1112.8 L] in circulation in system loop — see Minimum Cooler and Condenser Fluid Flow Rates and Minimum Loop Volume table on page 13.) For process jobs where accuracy is vital, or for operation at ambient temperature below 32 F (0° C) with low unit loading conditions, there should be from 6 to 10 gal. per ton (6.5 to 10.8 L per kW). To achieve this volume, it is often necessary to install a tank in the loop. Tank should be baffled to ensure there is no stratification, and that water (or brine) entering tank is adequately mixed with liquid in the tank.

NOTE: Tank installation is shown below.

Fouling factor — The fouling factor used to calculate tabulated ratings was $0.00025 \text{ ft}^2 \cdot \text{hr} \cdot \text{F}/\text{Btu}$ ($0.000044 \text{ m}^2 \cdot \text{K}/\text{W}$). As fouling factor is increased, unit capacity decreases and compressor power increases. Standard ratings should be corrected using following multipliers:

FOULING FACTOR CORRECTION

FOULING FACTOR		COOLER		CONDENSER	
English	SI	Cap.	Power	Cap.	Power
0.0005	0.000088	0.995	1.000	0.990	1.005
0.001	0.000176	0.980	1.000	0.969	1.033
0.002	0.000352	—	—	0.908	1.098

Rating tables are based on 10° F (5.6° C) ΔT in the cooler and 0.00025 $\text{ft}^2 \cdot \text{hr} \cdot \text{F}/\text{Btu}$ ($0.000044 \text{ m}^2 \cdot \text{K}/\text{W}$) fouling factor in both cooler and condenser. Also, 10° F (5.6° C) ΔT in condenser for 3-pass parallel, 20° F (11.1° C) ΔT for 6-pass parallel, and 40° F (22.2° C) ΔT for 6-pass series circuiting arrangements.

PERFORMANCE CORRECTIONS

1. Corrected Cooling Capacity = Rated Cooling Capacity x all correction factors.
2. Corrected Compressor Power Input = Rated Power Input x all correction factors.

Cooler and fluid-cooled condenser freeze protection

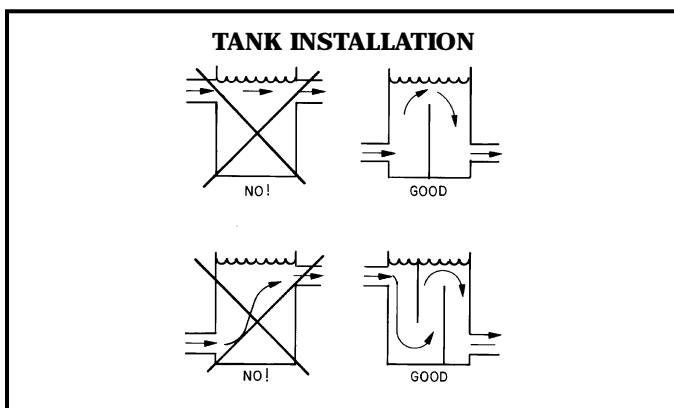
If chiller or fluid lines are in an area where ambient conditions fall below 32 F (0° C), it is recommended that an antifreeze solution be added to protect the unit and fluid piping to a temperature 15° F (8.3° C) below the lowest anticipated temperature. Corrections to performance as indicated in Capacity Correction and Selection Procedure sections on pages 15 and 17 must be applied.

Use only antifreeze solutions approved for heat exchanger duty. Use of automotive antifreezes is not recommended because of the fouling that can occur once their relatively short-lived inhibitor breaks down.

If not protected with an antifreeze solution, draining cooler and outdoor piping is recommended if system is not to be used during freezing weather conditions.

30HS condenser requirements

1. Ensure each refrigerant circuit has its own head pressure control.
2. Condenser must provide 15° F (8.3° C) subcooling, a maximum of 40° F (22.2° C) difference between saturated condensing temperature and outdoor ambient temperature (to prevent overload at high ambient temperatures), and a minimum of 20° F (11.1° C) difference (to assure subcooling).
3. Do not manifold independent refrigerant circuits into a single condenser.
4. Condenser should not be located more than 50 ft (15 m) below chiller to maintain subcooling.
5. Design discharge and liquid piping according to Carrier System Design Manual.



Oversizing chillers

Oversizing chillers by more than 15% at design conditions must be avoided as the system operating efficiency would be adversely affected (resulting in greater and/or excessive electrical demand and cycling of compressors). When future expansion of equipment is anticipated, install a single chiller to meet present load requirements, and install a second chiller to meet the additional load demand.

It is also recommended that the installation of 2 smaller chillers be considered where operation at minimum load is critical. The operation of a smaller chiller loaded to a greater percent of minimum is preferred to operating a single chiller at or near its minimum recommended value.

Hot gas bypass should not be used as a means to allow oversizing chillers. Hot gas bypass should be given consideration where substantial operating time is anticipated below the minimum unloading step.

Multiple chillers

Where chiller capacities required are greater than can be furnished by a 30H chiller, or where standby capability is desired, chillers may be installed in *parallel*. Units of equal size help to ensure balanced fluid flows. Where a large temperature drop (> 25° F [13.9° C]) is desired, chillers may be installed in *series*. **Fluid temperature sensors need not be moved for multiple chiller operation.**

Part-wind start

Part-wind start is not generally required on 30H chillers due to use of multiple small compressors allowing smaller electrical load increments, but it is available if required. Maximum instantaneous current flow (see ICF in Electrical Data table on page 29) should be used in determining need.

Vibration isolation

Compressors are spring isolated. External vibration isolation is not generally required.

Strainers

For 30HR units, a strainer with a minimum of 20 mesh should be installed in both the cooler and condenser fluid inlet lines just ahead of the cooler and condenser, and as close to the cooler and condenser as possible. For 30HS units, this recommendation applies only to the cooler.

Capacity correction (antifreeze)

If unit or fluid lines connected to the unit are in an area where ambient temperature falls below 32 F (0° C), it is strongly recommended that antifreeze (or other suitable brine) be used in the chilled fluid circuit. Unit performance data must be corrected as shown in the following example (using inhibited ethylene glycol solution):

EXAMPLE — ENGLISH

I Determine concentration of inhibited ethylene glycol (EG) solution required to protect the system to 0° F (at zero flow).

From Solution Crystallization Point correction curve on page 16: 35% EG concentration is required for solution crystallization at 0° F.

Consider the 30HR080 unit selected in the Selection Procedure section on page 17.

II Correct unit capacity.

On Capacity Correction curve on page 16, read 0.965 correction factor at 35% concentration.

$$\begin{aligned} \text{Corrected Capacity} &= 0.965 \times \text{Rated Capacity} \\ &= 0.965 \times 77.2 \\ &= 74.5 \text{ Tons} \end{aligned}$$

III Correct cooler water flow rate (Gpm).

On Cooler Flow Correction curve on page 16, read 1.112 correction factor at 35% concentration.

$$\begin{aligned} \text{Cooler Water Flow} &= \frac{\text{Tons} \times 24}{\Delta T} = \frac{74.5 \times 24}{10} \\ \text{(at corrected capacity)} &= 178.8 \text{ Gpm} \end{aligned}$$

$$\text{Cooler Water Flow (35\% EG)} = 1.112 \times 178.8 = 198.8 \text{ Gpm}$$

IV Correct cooler pressure drop.

On Cooler Pressure Drop Correction curve on page 18, read 1.28 correction factor at 35% concentration.

On Cooler Pressure Drop curve, (page 19) for 198.8 gpm of water, Pressure Drop = 12.1 ft of water.

$$\begin{aligned} \text{For 35\% EG solution,} \\ \text{Pressure Drop} &= 1.28 \times 12.1 \\ &= 15.5 \text{ ft of water} \end{aligned}$$

V Correct compressor power input (kW).

On Power Correction curve on page 16, read 0.988 correction factor at 35% concentration.

$$\begin{aligned} \text{Corrected Power Input} &= 0.988 \times 68.6 \\ &= 67.8 \text{ kW} \end{aligned}$$

Application data (cont)



EXAMPLE — SI

I Determine concentration of inhibited ethylene glycol (EG) solution required to protect the system to -17.8 C (at zero flow).

From Solution Crystallization Point correction curve at right: 35% EG concentration is required for solution crystallization at -17.8 C.

Consider the 30HR080 unit selected in the Selection Procedure section on page 17.

II Correct unit capacity.

On Capacity Correction curve at right, read 0.965 correction factor at 35% concentration.

$$\begin{aligned} \text{Corrected Capacity} &= 0.965 \times \text{Rated Capacity} \\ &= 0.965 \times 273.1 \\ &= 263.4 \text{ kW} \end{aligned}$$

III Correct cooler water flow rate (L/s).

On Cooler Flow Correction curve at right, read 1.112 correction factor at 35% concentration.

$$\begin{aligned} \text{Cooler Water Flow} &= \frac{\text{kW} \times .239}{\Delta T} \\ \text{(at corrected capacity)} &= \frac{263.4 \times .239}{5.6} \\ &= 11.2 \text{ L/s} \end{aligned}$$

$$\begin{aligned} \text{Cooler Water Flow} &= 1.112 \times 11.2 = 12.5 \text{ L/s} \\ \text{(35\% EG)} & \end{aligned}$$

IV Correct cooler pressure drop.

On Cooler Pressure Drop Correction curve at right, read 1.28 correction factor at 35% concentration.

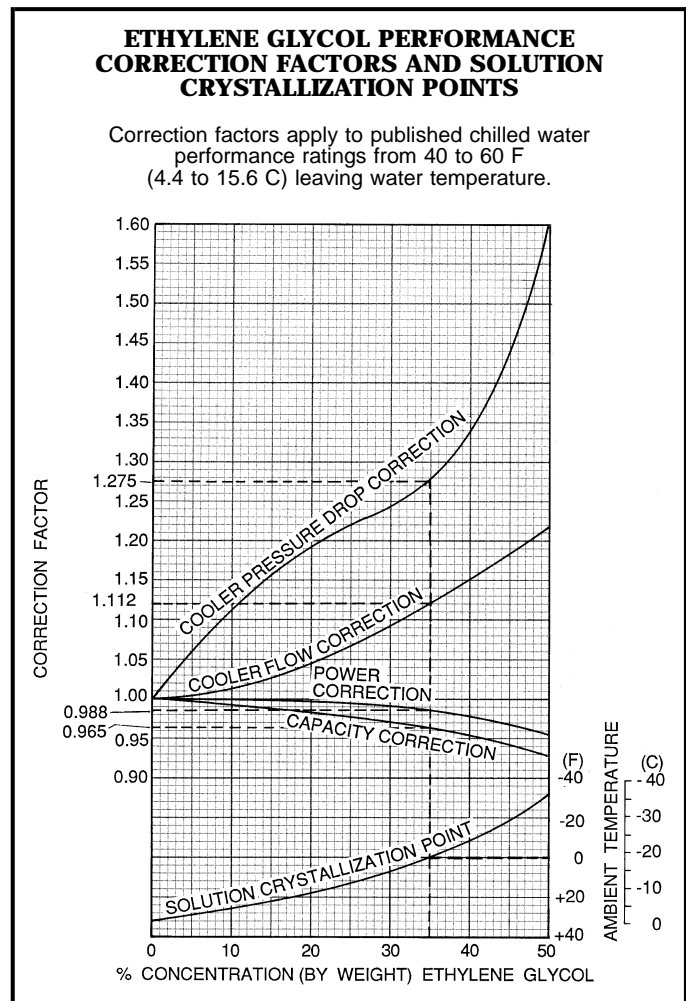
On Cooler Pressure Drop curve (page 19), for 12.5 L/s of water, Pressure Drop = 36.4 kPa.

$$\begin{aligned} \text{For 35\% EG solution,} \\ \text{Pressure Drop} &= 1.28 \times 36.4 \\ &= 46.6 \text{ kPa} \end{aligned}$$

V Correct compressor power input (kW).

On Power Correction curve at right, read 0.988 correction factor at 35% concentration.

$$\begin{aligned} \text{Corrected Power Input} &= 0.988 \times 69.6 \\ &= 68.8 \text{ kW} \end{aligned}$$



Selection procedure (with example)



ENGLISH

NOTE: Contact your local Carrier representative for a computer selection (based on the Reciprocating Chiller Selection program of Carrier's electronic catalog), or follow the procedure below.

I Determine unit size and operating conditions required to meet given capacity at given conditions.

Given:

Capacity	77 Tons
Leaving Chilled Water Temp (LCWT)	44 F
Cooler Water Temp Rise	10° F
Entering Condenser Water Temp	85 F
Condenser Water Temp Rise	10° F
Fouling Factor (Cooler and Condenser)	.00025

NOTE: For other than 10° F temperature rise, data corrections must be made; also, on some units a change of controls is necessary.

FOR HR (Fluid-Cooled Condenser):

Enter the Performance data table on page 21 at 44 F LCWT and 85 F Condenser Entering Water Temperature. Read down the capacity column to a capacity that equals or exceeds the given capacity. Read across to obtain the operating conditions required to obtain the listed capacity. Use cooler and condenser pressure drop curves to determine the respective pressure drops. Final unit selection should be based on present and future job requirements and the economics of the job.

FOR 30HS (Condenserless):

Use same method. For remote condenser data, refer to appropriate Carrier condenser Product Data literature.

Contact your local Carrier representative for a computer selection of chiller system combinations with Carrier air-cooled condensers other than those shown in Performance Data tables.

II From Performance Data table and pressure drop curves, determine operating data for selected unit.

Unit	30HR080
Capacity	77.2 tons
Compressor Motor Power Input	68.6 kW
Cooler Water Flow	185 gpm
Cooler Pressure Drop	10.6 ft
Condenser Water Flow	229.3 gpm
Condenser Pressure Drop	10.0 ft

SI

NOTE: Contact your local Carrier representative for a computer selection (based on the Reciprocating Chiller Selection program of Carrier's electronic catalog), or follow the procedure below.

I Determine unit size and operating conditions required to meet given capacity at given conditions.

Given:

Capacity	270 kW
Leaving Chilled Water Temp (LCWT)	7 C
Cooler Water Temp Rise	5.6° C
Entering Condenser Water Temp	30 C
Condenser Water Temp Rise	5.6° C
Fouling Factor (Cooler and Condenser)	.044

NOTE: For other than 5.6° C temperature rise, data corrections must be made; also, on some units a change of controls is necessary.

FOR 30HR (Fluid-Cooled Condenser):

Enter the Performance Data table on page 25 at 7 C LCWT and 30 C Condenser Entering Water Temperature. Read down the capacity column to a capacity that equals or exceeds the given capacity. Read across to obtain the operating conditions required to obtain the listed capacity. Use cooler and condenser pressure drop curves to determine the respective pressure drops. Final unit selection should be based on present and future job requirements and the economics of the job.

FOR 30HS (Condenserless):

Use same method. For remote condenser data, refer to appropriate Carrier condenser Product Data literature.

Contact your local Carrier representative for a computer selection of chiller system combinations with Carrier air-cooled condensers other than those shown in Performance Data tables.

II From Performance Data table and pressure drop curves, determine operating data for selected unit.

Unit	30HR080
Capacity	273.0 kW
Compressor Motor Power Input	69.6 kW
Cooler Water Flow	11.6 L/s
Cooler Pressure Drop	31.5 kPa
Condenser Water Flow	14.5 L/s
Condenser Pressure Drop	29.8 kPa

Performance data



Ratings

Performance Data tables for 30HR fluid-cooled condenser models appear on pages 21 and 25. Ratings for 30HS condenserless models appear on pages 22 and 26. Ratings for 30HS condenserless models in combination with air-cooled condensers appear on pages 23-24, and 27-28. Ratings data beyond limits shown and/or brine ratings are available in Carrier Application Data publications.

1. All performance data is based on:
 - a. Cooler water temperature rise of 10° F (5.6° C). When more accuracy is desired, correct LCWT by amount determined from LCWT Correction curve below before entering Performance Data tables.
 - b. Cooler fouling factor of .00025 (.000044) (same for condenser on 30HR).
 - c. 10° F (5.6° C) subcooling (30HS).
 - d. Refrigerant 22.

2. When corrected LCWT is used, cooler pressure drop must also be corrected for the new LCWT:
 - a. Enter Performance Data table at corrected LCWT. By interpolation, determine corrected Capacity (tons or kW), saturated discharge temperature (in Performance Data tables on pages 21 and 25 for 30HS condenserless units), and kW (compressor motor power input at rated voltage).
 - b. Calculate:

$$\text{corrected gpm} = \frac{\text{corrected capacity (tons)} \times 24}{\text{temperature rise (°F)}}$$

$$\text{corrected L/s} = \frac{\text{corrected capacity (kW)} \times .239}{\text{temperature rise (°C)}}$$
 - c. Enter Cooler Pressure Drop curve at corrected gpm (L/s) and find pressure drop.

Where cooler water temperature rise is less than 7° F (3.9° C), the high flow rate will normally be accomplished by excessive pressure drop. In these cases, contact your local Carrier representative for selection of a cooler with suitable baffle spacing.

Combining 30HS units with remote condensers which have greater than (less than) the 10° F (5.6° C) subcooling in the ratings increases (decreases) system capacity. To adjust capacity, multiply capacity ratings by 0.96; then adjust this result upward by 0.4% for each degree F (0.7% for each degree C) of available subcooling.

30HS ARI (Air Conditioning and Refrigeration Institute, U.S.A.) ratings are based on:

- Leaving chilled water temperature of 44 F (6.7 C).
- Entering cooler water temperature of 54 F (12.2 C).
- Saturated discharge temperature of 120 F (48.9 C).

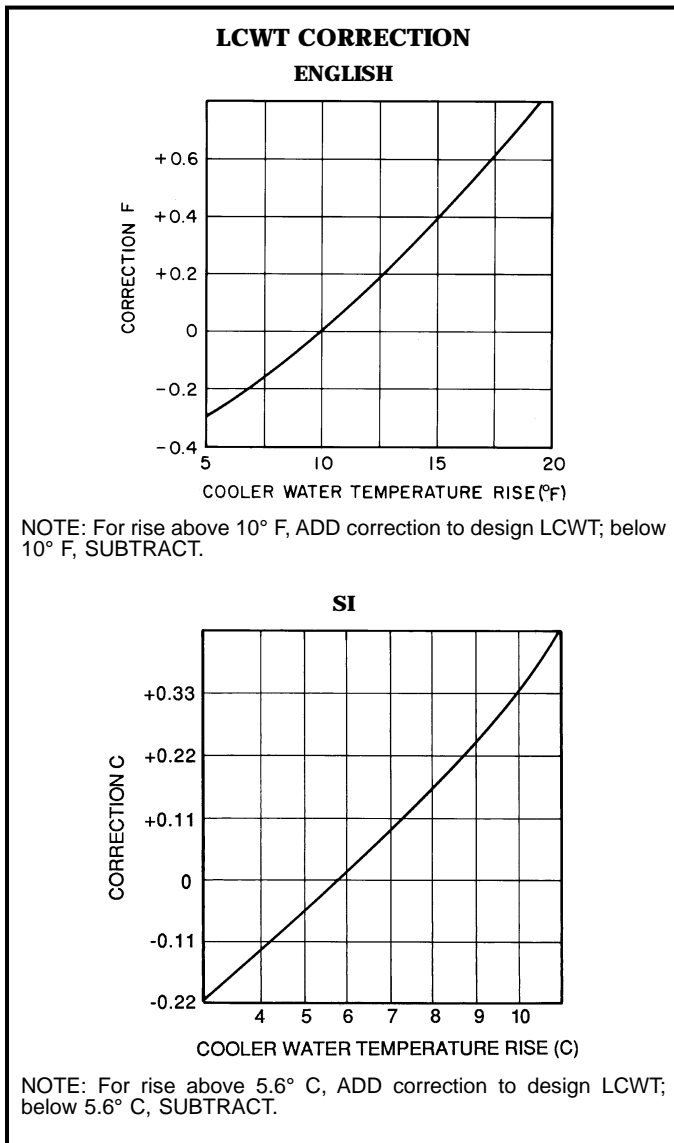
30HR ARI ratings are based on:

- Leaving chilled water temperature of 44 F (6.7 C).
- Entering cooler water temperature of 54 F (12.2 C).
- Entering condenser water temperature of 85 F (29.4 C).
- Condenser flow of 3 gpm per ton (0.054 L/s per kW).

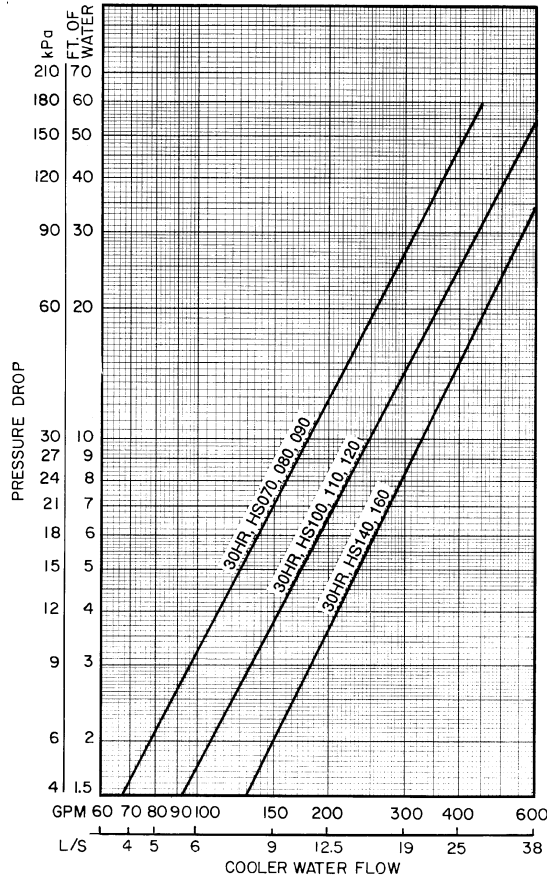
Performance data for 30HS chillers in combination with remote air-cooled condensers includes the following system combinations:

CHILLER	AIR-COOLED CONDENSER	CHILLER	AIR-COOLED CONDENSER
30HS070	09DK044/09DK034	30HS110	(2) 09DK064
30HS080	09DK054/09DK034	30HS120	(2) 09DK064
30HS090	09DK064/09DK034	30HS140	(2) 09DK084
30HS100	(2) 09DK054	30HS160	(2) 09DK094

NOTE: Numbers in () are quantities.

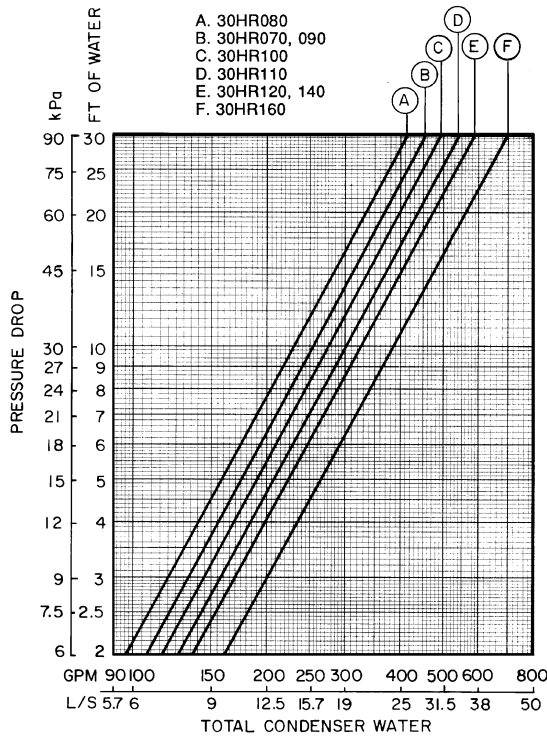


COOLER PRESSURE DROP



NOTE: Ft of water = 2.31 x change in psig.

CONDENSER PRESSURE DROP



NOTE: Ft of water = 2.31 x change in psig.

Performance data (cont)



ARI RATINGS

UNIT 30	CAPACITY		INPUT POWER (kW)	COOLER FLOW		COOLER PRESSURE DROP		CONDENSER FLOW		CONDENSER PRESSURE DROP		EER	IPLV
	Tons	kW		Gpm	L/s	Ft of Water	kPa	Gpm	L/s	Ft of Water	kPa		
HR070	69.4	244.1	60.1	166.3	10.49	8.6	25.7	208.2	13.14	7.0	20.9	13.9	17.5
HR080	77.2	271.5	68.6	185.1	11.68	10.6	31.7	231.6	14.61	10.2	30.5	13.5	17.1
HR090	85.5	300.7	77.4	204.9	12.93	12.9	38.5	256.5	16.18	9.8	29.3	13.3	17.3
HR100	98.0	344.7	85.4	234.8	14.81	9.0	26.9	294.0	18.55	11.5	34.3	13.8	18.4
HR110	105.0	369.3	93.8	251.6	15.87	10.3	30.8	315.0	19.87	10.8	32.2	13.4	18.3
HR120	112.0	393.9	102.3	268.6	16.95	11.7	34.9	336.0	21.20	10.3	30.8	13.1	18.2
HR140	135.0	474.8	126.0	323.7	20.42	9.4	28.1	405.0	25.55	14.4	43.0	12.9	16.3
HR160	149.8	526.8	141.6	359.2	22.66	11.6	34.6	449.4	28.35	10.4	31.1	12.7	16.4

LEGEND

EER — Energy Efficiency Ratio (Capacity [Btuh] ÷ Input Power [W])
IPLV — Integrated Part-Load Value



Rated in accordance with ARI Standard 590-92.

NOTES:

- Rated in accordance with ARI Standard 590-92 at standard rating conditions.
- Standard rating conditions are as follows:
 Cooler Conditions:
 Leaving water temperature: 44 F (6.7 C)
 Entering water temperature: 54 F (12.2 C)
 Condenser Conditions:
 Entering water temperature: 85 F (29.4 C)
 Flow: 3 gpm per ton (0.054 L/s per kW)
 Fouling Factor (Cooler and Condenser): 0.00025 hr-sq ft-F per Btuh (0.000044 m² x C per W)
- IPLV is a single number part-load efficiency value calculated from 100, 75, 50, and 25% system full-load efficiency values and corrected for a typical building air-conditioning application.
- All data in this table is certified in accordance with ARI Standard 590-92 as represented in the Reciprocating Chiller Selection Program (E-Cat) version 2.13.

Performance data 30HS/Air-Cooled Condenser Combinations — English



Performance data for 30HS chillers in combination with remote air-cooled condensers includes the following system combinations:

CHILLER	AIR-COOLED CONDENSER	CHILLER	AIR-COOLED CONDENSER
30HS070	09DK044/09DK034	30HS110	(2) 09DK064
30HS080	09DK054/09DK034	30HS120	(2) 09DK064
30HS090	09DK064/09DK034	30HS140	(2) 09DK084
30HS100	(2) 09DK054	30HS160	(2) 09DK094

NOTE: Numbers in () indicate quantity.

30HS UNIT SIZE	LCWT (F)	CONDENSER ENTERING AIR TEMPERATURE (F)														
		85.0			95.0			105.0			115.0			125.0		
		Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)
070	40.0	62.1	61.7	148.6	58.1	65.7	139.1	54.1	69.2	129.5	50.0	72.3	119.6	—	—	—
080		68.9	70.7	164.9	64.7	75.1	154.9	60.4	79.0	144.6	56.0	82.4	134.1	—	—	—
090		76.6	79.5	183.5	72.1	84.4	172.7	67.5	88.8	161.7	62.9	92.6	150.5	—	—	—
100		87.6	89.4	209.6	82.4	95.3	197.4	77.3	100.6	185.0	71.9	105.3	172.2	—	—	—
110		93.5	99.5	223.9	88.2	105.6	211.1	82.7	111.0	198.1	—	—	—	—	—	—
120		101.3	105.9	242.4	95.8	112.6	229.3	90.2	118.7	215.8	84.4	124.2	202.0	—	—	—
140		123.1	127.0	294.6	116.2	134.8	278.2	109.2	141.9	261.4	102.2	148.4	244.6	—	—	—
160	142.2	139.6	340.4	134.7	148.8	322.4	127.1	157.3	304.2	119.4	165.2	285.8	111.8	172.5	267.5	
070	42.0	64.7	62.9	154.9	60.6	67.1	145.2	56.5	70.8	135.3	52.3	74.1	125.3	—	—	—
080		71.7	72.1	171.8	67.4	76.7	161.5	63.0	80.9	150.9	58.5	84.5	140.3	—	—	—
090		79.7	81.1	191.0	75.1	86.2	179.9	70.4	90.8	168.7	65.6	94.9	157.2	—	—	—
100		90.8	91.0	217.4	85.6	97.1	205.1	80.3	102.6	192.3	74.9	107.6	179.4	—	—	—
110		96.9	101.4	232.1	91.5	107.7	219.1	85.9	113.4	205.8	—	—	—	—	—	—
120		104.9	107.7	251.3	99.3	114.7	237.8	93.6	121.2	224.1	87.7	126.9	210.0	—	—	—
140		127.7	129.4	305.9	120.7	137.5	289.2	113.6	145.0	272.2	106.4	151.7	254.8	—	—	—
160	147.6	141.9	353.6	139.9	151.5	335.1	132.1	160.4	316.4	124.3	168.7	297.7	116.3	176.3	278.7	
070	44.0	67.3	64.1	161.4	63.2	68.5	151.5	59.0	72.4	141.3	54.7	75.9	131.0	—	—	—
080		74.6	73.5	178.7	70.2	78.3	168.2	65.7	82.7	157.4	61.1	86.5	146.5	—	—	—
090		82.8	82.6	198.6	78.1	88.0	187.3	73.3	92.8	175.8	68.4	97.1	164.0	—	—	—
100		94.1	92.6	225.5	88.8	98.9	212.8	83.4	104.7	199.8	—	—	—	—	—	—
110		100.3	103.2	240.5	94.8	109.8	227.3	89.2	115.8	213.7	—	—	—	—	—	—
120		108.6	109.6	260.3	102.8	116.8	246.5	97.0	123.5	232.5	91.0	129.6	218.2	—	—	—
140		132.5	131.7	317.6	125.3	140.2	300.4	118.0	148.0	283.0	110.7	155.1	265.3	—	—	—
160	153.1	144.2	367.0	145.2	154.1	348.0	137.2	163.4	328.9	129.2	172.1	309.6	—	—	—	
070	46.0	70.0	65.4	167.9	65.8	69.9	157.8	61.5	74.0	147.4	57.1	77.7	136.9	—	—	—
080		77.5	74.9	185.8	73.0	79.9	175.1	68.4	84.5	164.0	—	—	—	—	—	—
090		86.0	84.2	206.4	81.2	89.8	194.8	76.3	94.8	183.0	71.3	99.4	171.0	—	—	—
100		97.4	94.2	233.7	92.0	100.8	220.7	86.5	106.8	207.4	—	—	—	—	—	—
110		103.8	105.1	249.1	98.3	112.0	235.7	92.5	118.2	221.9	—	—	—	—	—	—
120		112.3	111.5	269.5	106.5	119.0	255.4	100.5	125.9	241.0	—	—	—	—	—	—
140		137.4	134.0	329.5	130.0	142.9	311.8	122.5	151.0	294.0	115.0	158.5	275.9	—	—	—
160	158.8	146.5	380.9	150.6	156.8	361.2	142.4	166.5	341.6	134.2	175.5	321.8	—	—	—	

Performance data 30HS/Air-Cooled Condenser Combinations — English (cont)



30HS UNIT SIZE	LCWT (F)	CONDENSER ENTERING AIR TEMPERATURE (F)														
		85.0			95.0			105.0			115.0			125.0		
		Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)	Cap. (Tons)	Input kW	Cooler Flow Rate (Gpm)
070	48.0	72.8	66.6	174.7	68.4	71.3	164.3	64.0	75.6	153.7	—	—	—	—	—	—
080		80.5	76.3	193.1	75.9	81.5	182.0	71.2	86.3	170.8	—	—	—	—	—	—
090		89.3	85.7	214.4	84.4	91.6	202.5	79.4	96.9	190.4	—	—	—	—	—	—
100		100.9	95.9	242.1	95.3	102.6	228.8	89.7	108.9	215.3	—	—	—	—	—	—
110		107.5	107.0	257.9	101.7	114.1	244.1	95.8	120.6	229.9	—	—	—	—	—	—
120		116.1	113.3	278.7	110.2	121.1	264.5	104.1	128.3	249.7	—	—	—	—	—	—
140		142.4	136.4	341.8	134.8	145.6	323.5	127.2	154.1	305.2	—	—	—	—	—	—
160	164.5	148.8	394.8	156.1	159.5	374.7	147.7	169.6	354.5	139.3	179.0	334.3	—	—	—	
070	50.0	75.6	67.8	181.5	71.2	72.7	170.9	66.7	77.2	160.0	—	—	—	—	—	—
080		83.5	77.7	200.5	78.8	83.1	189.2	74.0	88.1	177.7	—	—	—	—	—	—
090		92.7	87.2	222.5	87.6	93.3	210.4	82.5	98.9	198.0	—	—	—	—	—	—
100		104.3	97.5	250.5	98.8	104.5	237.1	92.9	111.0	223.2	—	—	—	—	—	—
110		111.0	108.9	266.6	105.2	116.2	252.6	99.2	123.0	238.2	—	—	—	—	—	—
120		120.0	115.2	288.1	114.0	123.3	273.6	107.7	130.8	258.7	—	—	—	—	—	—
140		147.5	138.8	354.1	139.7	148.3	335.5	131.8	157.1	316.6	—	—	—	—	—	—
160	170.4	151.1	409.2	161.8	162.2	388.5	153.2	172.6	367.8	144.5	182.4	347.0	—	—	—	
070	55.0	82.8	70.9	199.0	78.2	76.3	187.9	73.4	81.3	176.5	—	—	—	—	—	—
080		91.3	81.3	219.5	86.4	87.2	207.6	81.3	92.7	195.4	—	—	—	—	—	—
090		101.3	91.2	243.4	96.0	97.8	230.6	90.5	104.0	217.6	—	—	—	—	—	—
100		113.3	101.6	272.3	107.4	109.2	258.2	101.3	116.4	243.6	—	—	—	—	—	—
110		120.3	113.7	289.1	114.2	121.7	274.5	—	—	—	—	—	—	—	—	—
120		129.9	119.9	312.2	123.5	128.7	296.9	117.0	136.9	281.3	—	—	—	—	—	—
140		160.7	145.0	386.2	152.4	155.3	366.3	—	—	—	—	—	—	—	—	—
160	185.5	156.8	445.9	176.4	168.9	424.1	167.4	180.3	402.2	158.0	191.0	379.8	—	—	—	
070	60.0	89.6	73.8	215.6	84.0	79.2	202.1	78.3	84.2	188.4	—	—	—	—	—	—
080		99.2	84.8	238.6	93.7	91.1	225.4	87.9	96.8	211.6	—	—	—	—	—	—
090		109.8	95.1	264.2	103.9	102.1	250.0	97.9	108.6	235.5	—	—	—	—	—	—
100		122.5	105.8	294.6	116.4	114.0	280.0	109.9	121.7	264.4	—	—	—	—	—	—
110		129.9	118.6	312.5	123.5	127.2	297.2	—	—	—	—	—	—	—	—	—
120		140.1	124.6	337.1	133.5	134.1	321.2	126.7	143.0	304.9	—	—	—	—	—	—
140		174.4	151.2	419.5	165.7	162.3	398.7	—	—	—	—	—	—	—	—	—
160	201.4	162.4	484.5	191.8	175.5	461.3	182.1	187.9	438.0	172.3	199.7	414.4	—	—	—	

LEGEND

- Cap. — Capacity
- kW — Compressor Motor Power Input at Rated Voltage
- LCWT — Leaving Chilled Water Temperature

Performance data 30HS/Air-Cooled Condenser Combinations — SI



Performance data for 30HS chillers in combination with remote air-cooled condensers includes the following system combinations:

CHILLER	AIR-COOLED CONDENSER	CHILLER	AIR-COOLED CONDENSER
30HS070	09DK044/09DK034	30HS110	(2) 09DK064
30HS080	09DK054/09DK034	30HS120	(2) 09DK064
30HS090	09DK064/09DK034	30HS140	(2) 09DK084
30HS100	(2) 09DK054	30HS160	(2) 09DK094

NOTE: Numbers in () indicate quantity.

30HS UNIT SIZE	LCWT (C)	CONDENSER ENTERING AIR TEMPERATURE (C)														
		30.0			35.0			40.0			45.0			50.0		
		Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)
070	4.0	213.4	61.6	9.2	201.0	65.1	8.6	188.3	68.3	8.1	175.4	71.0	7.5	—	—	—
080		237.0	70.6	10.2	223.7	74.5	9.6	210.3	78.0	9.0	196.7	81.0	8.4	—	—	—
090		263.7	79.4	11.3	249.6	83.7	10.7	235.2	87.6	10.1	220.5	91.0	9.5	—	—	—
100		301.6	89.4	12.9	285.6	94.5	12.3	269.4	99.3	11.6	252.6	103.5	10.8	—	—	—
110		322.2	99.4	13.8	305.6	104.7	13.1	288.5	109.6	12.4	271.1	113.9	11.6	—	—	—
120		349.3	105.9	15.0	332.1	111.8	14.3	314.3	117.2	13.5	296.2	122.1	12.7	—	—	—
140		423.9	126.8	18.2	402.4	133.7	17.3	380.4	140.0	16.3	358.5	145.8	15.4	—	—	—
160	490.0	139.6	21.0	466.4	147.7	20.0	442.6	155.3	19.0	418.6	162.3	18.0	394.7	168.9	16.9	
070	5.0	221.5	62.8	9.5	208.8	66.4	9.0	195.9	69.7	8.4	182.7	72.6	7.9	—	—	—
080		245.7	71.9	10.6	232.2	75.9	10.0	218.5	79.6	9.4	204.6	82.8	8.8	—	—	—
090		273.3	80.9	11.7	258.9	85.3	11.1	244.2	89.4	10.5	229.2	93.0	9.8	—	—	—
100		311.8	90.8	13.4	295.3	96.2	12.7	278.8	101.1	12.0	261.9	105.5	11.3	—	—	—
110		332.9	101.1	14.3	315.9	106.6	13.6	298.5	111.7	12.8	—	—	—	—	—	—
120		360.4	107.5	15.5	342.9	113.7	14.7	325.2	119.3	14.0	306.6	124.5	13.2	—	—	—
140		438.5	129.0	18.8	416.5	136.1	17.9	394.4	142.7	16.9	371.7	148.8	16.0	—	—	—
160	506.9	141.7	21.8	482.7	150.1	20.7	458.4	158.0	19.7	434.0	165.4	18.6	409.2	172.2	17.6	
070	6.0	229.7	63.9	9.9	216.8	67.7	9.3	203.6	71.1	8.8	190.2	74.2	8.2	—	—	—
080		254.7	73.2	10.9	240.9	77.4	10.4	226.9	81.2	9.8	212.7	84.6	9.1	—	—	—
090		283.1	82.3	12.2	268.3	86.9	11.5	253.3	91.2	10.9	238.1	95.0	10.2	—	—	—
100		322.2	92.3	13.8	305.4	97.8	13.1	288.4	102.9	12.4	271.3	107.6	11.7	—	—	—
110		343.7	102.8	14.8	326.4	108.5	14.0	308.7	113.8	13.3	—	—	—	—	—	—
120		372.0	109.2	16.0	354.2	115.6	15.2	335.8	121.5	14.4	317.3	126.9	13.6	—	—	—
140		453.4	131.1	19.5	430.9	138.5	18.5	408.3	145.4	17.6	385.1	151.7	16.6	—	—	—
160	524.0	143.8	22.5	499.3	152.5	21.5	474.4	160.7	20.4	449.4	168.4	19.3	424.1	175.5	18.2	
070	7.0	238.1	65.0	10.2	224.9	68.9	9.7	211.5	72.5	9.1	197.8	75.8	8.5	—	—	—
080		263.7	74.4	11.3	249.7	78.8	10.7	235.4	82.8	10.1	220.9	86.4	9.5	—	—	—
090		293.1	83.7	12.6	278.0	88.5	12.0	262.7	93.0	11.3	247.1	97.0	10.6	—	—	—
100		332.7	93.8	14.3	315.7	99.5	13.6	298.4	104.8	12.8	280.7	109.6	12.1	—	—	—
110		354.6	104.5	15.3	337.0	110.4	14.5	319.0	115.9	13.7	—	—	—	—	—	—
120		383.8	110.9	16.5	365.4	117.5	15.7	346.7	123.6	14.9	327.8	129.2	14.1	—	—	—
140		468.5	133.3	20.2	445.6	140.9	19.2	422.4	148.1	18.2	399.0	154.8	17.2	—	—	—
160	541.5	145.9	23.3	516.3	154.9	22.2	490.8	163.4	21.1	465.2	171.4	20.0	439.4	178.9	18.9	

Performance data 30HS/Air-Cooled Condenser Combinations — SI (cont)



30HS UNIT SIZE	LCWT (C)	CONDENSER ENTERING AIR TEMPERATURE (C)														
		30.0			35.0			40.0			45.0			50.0		
		Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)	Cap. (kW)	Input kW	Cooler Flow Rate (L/s)
070	8.0	246.7	66.1	10.6	233.2	70.2	10.0	219.5	73.9	9.4	205.6	77.4	8.8	—	—	—
080		273.0	75.7	11.7	258.7	80.2	11.1	244.1	84.4	10.5	229.3	88.2	9.9	—	—	—
090		303.2	85.1	13.0	287.9	90.1	12.4	272.2	94.8	11.7	256.3	99.0	11.0	—	—	—
100		343.2	95.2	14.8	326.0	101.2	14.0	308.5	106.7	13.3	290.5	111.7	12.5	—	—	—
110		365.9	106.2	15.7	348.0	112.4	15.0	329.7	118.1	14.2	—	—	—	—	—	—
120		395.7	112.6	17.0	377.1	119.4	16.2	358.1	125.8	15.4	338.5	131.6	14.6	—	—	—
140		484.0	135.4	20.8	460.5	143.4	19.8	436.8	150.8	18.8	412.9	157.7	17.8	—	—	—
160	559.5	148.1	24.1	533.4	157.4	23.0	507.5	166.2	21.8	481.3	174.4	20.7	454.9	182.2	19.6	
070	9.0	255.4	67.2	11.0	241.7	71.4	10.4	227.7	75.4	9.8	213.5	79.0	9.2	—	—	—
080		282.4	77.0	12.2	267.8	81.7	11.5	252.9	86.0	10.9	237.8	90.0	10.2	—	—	—
090		313.6	86.5	13.5	297.9	91.7	12.8	281.9	96.6	12.1	265.7	101.0	11.4	—	—	—
100		354.1	96.7	15.2	336.5	102.8	14.5	318.7	108.6	13.7	—	—	—	—	—	—
110		377.2	107.9	16.2	359.0	114.3	15.5	340.2	120.2	14.6	—	—	—	—	—	—
120		407.8	114.3	17.6	388.9	121.3	16.7	369.5	127.9	15.9	349.6	134.0	15.1	—	—	—
140		499.9	137.6	21.5	475.7	145.8	20.5	451.5	153.6	19.4	427.0	160.8	18.4	—	—	—
160	577.6	150.1	24.9	551.0	159.8	23.7	524.4	168.9	22.6	497.7	177.5	21.4	470.6	185.6	20.3	
070	10.0	264.4	68.3	11.4	250.3	72.7	10.8	236.0	76.8	10.2	221.5	80.5	9.5	—	—	—
080		292.0	78.3	12.6	277.1	83.1	11.9	261.9	87.7	11.3	—	—	—	—	—	—
090		324.1	87.9	14.0	308.1	93.3	13.3	291.8	98.4	12.6	275.3	103.0	11.9	—	—	—
100		365.0	98.2	15.7	347.3	104.5	15.0	329.1	110.4	14.2	—	—	—	—	—	—
110		388.4	109.7	16.7	369.9	116.2	15.9	351.0	122.4	15.1	—	—	—	—	—	—
120		419.9	116.0	18.1	400.8	123.3	17.3	381.1	130.0	16.4	—	—	—	—	—	—
140		516.0	139.8	22.2	491.4	148.3	21.2	466.5	156.3	20.1	—	—	—	—	—	—
160	596.4	152.2	25.7	569.0	162.2	24.5	541.7	171.6	23.3	514.4	180.5	22.2	486.7	188.9	21.0	
070	13.0	291.7	71.7	12.6	276.8	76.6	11.9	262.0	81.2	11.3	—	—	—	—	—	—
080		321.7	82.2	13.9	305.9	87.5	13.2	289.8	92.6	12.5	—	—	—	—	—	—
090		356.7	92.2	15.4	339.9	98.2	14.7	322.6	103.8	13.9	—	—	—	—	—	—
100		398.9	102.7	17.2	380.2	109.6	16.4	360.9	116.1	15.6	—	—	—	—	—	—
110		423.6	114.9	18.3	404.2	122.1	17.4	384.3	128.9	16.6	—	—	—	—	—	—
120		457.4	121.2	19.7	437.1	129.1	18.8	416.5	136.6	18.0	—	—	—	—	—	—
140		566.0	146.5	24.4	539.6	155.8	23.3	—	—	—	—	—	—	—	—	—
160	653.7	158.5	28.2	624.8	169.4	26.9	595.9	179.8	25.7	566.2	189.6	24.4	—	—	—	
070	16.0	313.4	74.4	13.5	295.6	79.2	12.8	277.6	83.7	12.0	—	—	—	—	—	—
080		349.9	85.8	15.1	331.2	91.3	14.3	311.7	96.3	13.5	—	—	—	—	—	—
090		387.6	96.2	16.7	368.8	102.6	15.9	349.6	108.6	15.1	—	—	—	—	—	—
100		433.9	107.3	18.7	414.5	114.8	17.9	389.6	121.0	16.8	—	—	—	—	—	—
110		460.2	120.3	19.9	439.6	128.0	19.0	—	—	—	—	—	—	—	—	—
120		496.4	126.4	21.4	475.3	135.0	20.5	453.7	143.1	19.6	—	—	—	—	—	—
140		619.0	153.4	26.7	587.7	163.0	25.4	—	—	—	—	—	—	—	—	—
160	714.0	164.7	30.8	683.6	176.6	29.5	652.4	187.9	28.2	621.2	198.8	26.8	—	—	—	

LEGEND

- Cap. — Capacity
- kW — Compressor Motor Power Input at Rated Voltage
- LCWT — Leaving Chilled Water Temperature

COMPLETE UNIT

VOLT-AGE	NOMINAL	208/230-3-60				460-3-60				575-3-60				06E COMPRESSOR USAGE†				
	Supply Range*	187-253				414-508				518-632				Circuit A		Circuit B		
UNIT 30	MkW	MCA	ICF	Rec Fuse Amps	MFA	MCA	ICF	Rec Fuse Amps	MFA	MCA	ICF	Rec Fuse Amps	MFA	A1	A2	B1	B2	
HR	070	73.4	218	503	250	300	101	249	125	125	93	188	110	125	2150	A150	6175	—
	080	82.3	244	529	300	300	114	262	125	150	105	200	125	125	6175	A150	6175	
	090	91.2	270	612	300	350	127	301	150	150	117	236	150	150	6175	F175	6175	
	100	103.8	161	529	200	225	140	262	150	175	129	200	150	150	6175	A150	6175	A150
	110	112.7	187 161	669	225 200	250 225	153	327	175	175	141	260	150	175	6175	F175	6175	A150
	120	121.6	187	695	225	250	166	340	200	200	153	272	175	175	6175	F175	6175	F175
	140	155.8	241	816	300	350	112	403	150	150	95	323	110	125	6299	F175	6299	F175
	160	190.0	284	1068	350	400	131	519	150	175	106	417	125	150	6299	F299	6299	F299
HS	070	84.7	271	579	300	350	113	282	125	150	102	203	125	125	2250	A250	6275	—
	080	95.3	298	606	350	350	128	297	150	150	113	214	125	150	6275	A250	6275	
	090	105.9	325	706	350	400	143	341	175	175	124	252	150	150	6275	F275	6275	
	100	120.0	198	618	225	250	157	297	175	200	140	223	150	175	6275	A250	6275	A250
	110	130.6	225 198	779	250 225	300 250	172	370	200	200	151	279	175	175	6275	F275	6275	A250
	120	141.2	225	806	250	300	187	385	200	225	162	290	175	175	6275	F275	6275	F275
	140	176.8	279	892	350	400	121	419	150	175	105	329	125	150	6299	F275	6299	F275
	160	212.4	322	1119	400	450	138	528	175	175	120	435	150	150	6299	F299	6299	F299

INDIVIDUAL COMPRESSORS

UNIT 30	COMPRESSOR		208/230-3-60			460-3-60			575-3-60		
	06E	kW	RLA	LRA	MTA	RLA	LRA	MTA	RLA	LRA	MTA
HR	150	21.5	57	283	88	26	142	40	24	98	33
	175	30.4	83	446	128	39	223	56	36	164	50
	299	47.5	126	690	196	58	345	90	47	276	73
HS	250	24.7	73	345	112	29	173	45	27	120	40
	275	35.3	100	506	156	44	253	68	38	176	57
	299	53.1	143	690	222	61	345	95	53	276	82

LEGEND AND NOTES

Two electrical power circuits are required. A separate entrance and a terminal block are provided for each circuit. Run 6 wires to unit from disconnect switch, 3 to each circuit.

For size 110 units, the upper value is circuit A and lower value is circuit B. For other size units, the value given is per electrical circuit.

For all unshaded areas: Only 1 power circuit is required, with a single entrance. Run 3 wires to unit, to a single terminal block.

ICF — Maximum Instantaneous Current Flow during starting (the point in the compressor starting sequence where the sum of the LRA for the starting compressor plus the RLA for all running compressors is maximum). *Not for wire sizing.*

kW — Maximum allowable power input (each compressor).

LRA — Locked Rotor Amps.

MCA — Minimum Circuit Amps (for wire sizing); complies with NEC, Section 430-24 (U.S.A. Standard).

MFA — Maximum Fuse Amps; 225% of largest compressor RLA plus 100% of remaining compressor RLA. Size down to the next standard fuse size.

MkW — Maximum unit power input.

MTA — Must Trip Amps (compressor circuit breaker).

NEC — National Electrical Code (U.S.A.).

Rec Fuse Amps — Recommended dual element fuse amps; 150% of largest compressor RLA plus 100% of remaining compressor RLA. Size up to next standard fuse size.

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 listed range limits.

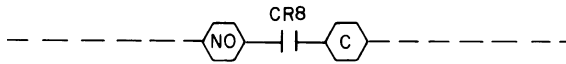
†Circuits and compressors are numbered from left to right when viewed from the front of the unit.

NOTES:

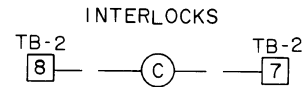
- Maximum incoming wire size for **208/230 v** is as follows:
Units 070-090 have one terminal block, 3 wires, 500 kcmil.
Units 100-160 have 2 terminal blocks, 3 wires per block, 500 kcmil.
- Maximum incoming wire size for **460 and 575 v** is as follows:
Wire size maximum is 500 kcmil for units 070-160.
Units 070-120 have one terminal block, 3 wires; units 140 and 160 have 2 terminal blocks, 3 wires per block.
- Across-the-start is standard at all voltages.
- Control circuit requires a separate-fused (15 amp), 115-v, single-ph, 60 Hz power supply, or accessory control power transformer.
- Control circuit MCA is 7.2 and control circuit MFA is 15.
- Compressor motors on all units are thermally protected by overtemperature sensors in the discharge side of the compressor.
- Maximum allowable phase imbalance is: volts 2%; amps 10%.
- Use copper, copper-clad aluminum, or aluminum conductors for field power wiring.



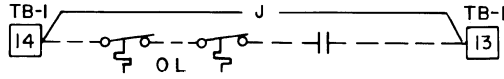
CHILLED FLUID PUMP RELAY



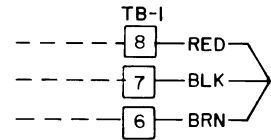
CONTACTOR COIL FOR CONDENSER FLUID PUMP OR FOR FAN MOTORS



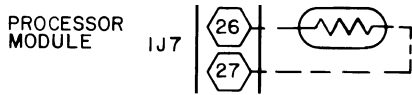
CHILLED FLUID PUMP STARTER AUXILIARY CONTACTS



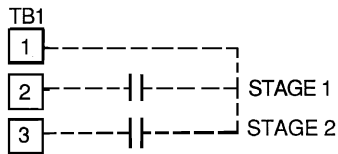
CONNECTIONS FOR EXTERNAL CARRIER COMFORT NETWORK (CCN) COMMUNICATIONS (RS485)



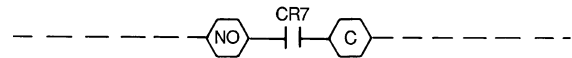
FIELD-SUPPLIED TEMPERATURE RESET



TWO-STAGE DEMAND LIMIT



REMOTE ALARM



LEGEND

- C — Common
- CR — Control Relay
- J — Jumper
- NO — Normally Open
- OL — Overload
- TB — Terminal Block
- - - - Field Wiring
- Factory Wiring

Control sequence

Standby — During unit off cycle when the RUN/STANDBY switch is in the STANDBY position, the crankcase heaters and the control system are energized.

NOTE: The control circuit power must be on at all times even when the main unit power is off.

Run — When the RUN/STANDBY switch is moved from STANDBY to RUN position, there will be a 1½ minute delay while the microprocessor monitors data. If in occupied mode, after 1½ minutes the chilled fluid pump will start. If there is a call for cooling, the first compressor will start unloaded. The first circuit to start may be circuit A or B due to the automatic and random lead/lag feature.

Capacity control sequence

On a call for cooling, the control system starts the initial compressor. The control will randomly select either circuit A or B. The liquid line solenoid valve remains closed for 10 seconds after the initial compressor on that refrigeration circuit starts (unless the compressor has run in the 15 minutes prior to the latest call for cooling). This permits a pumpout cycle at start-up to minimize refrigerant floodback to the compressor. If the compressor has run in the 15 minutes before the call for cooling, the pumpout cycle is eliminated.

After the pumpout, the liquid line solenoid valve and the EXV open.

The EXV will open gradually to provide a controlled start-up to prevent liquid floodback to the compressor. Also during this period, the oil pressure switch will be bypassed for one minute.

As additional cooling is required, the control system will ramp up through the capacity steps available until the load requirement is satisfied. As capacity steps are added, compressors are added, alternating between the lead and lag refrigerant circuits. The speed at which capacity is increased or decreased is controlled by the temperature deviation from the set point and the rate of change in the chilled fluid temperature.

When the second or lag refrigeration circuit is started, that circuit will go through a 10-second pumpout unless the circuit has been operating in the 15 minutes prior to this start.

Upon load reduction, the control system will unload the unit in the reverse order of loading until the capacity nearly matches the load. Each time the lead compressor in a circuit is cycled off, the liquid solenoid valve and EXV will be closed for 10 seconds prior to compressor shutdown to clear the cooler of liquid refrigerant.

To stop unit, move the RUN/STANDBY switch to the STANDBY position. Any refrigeration circuit that is operating at this time will continue to run for 10 seconds to complete the pumpout cycle.

CAPACITY CONTROL STEPS

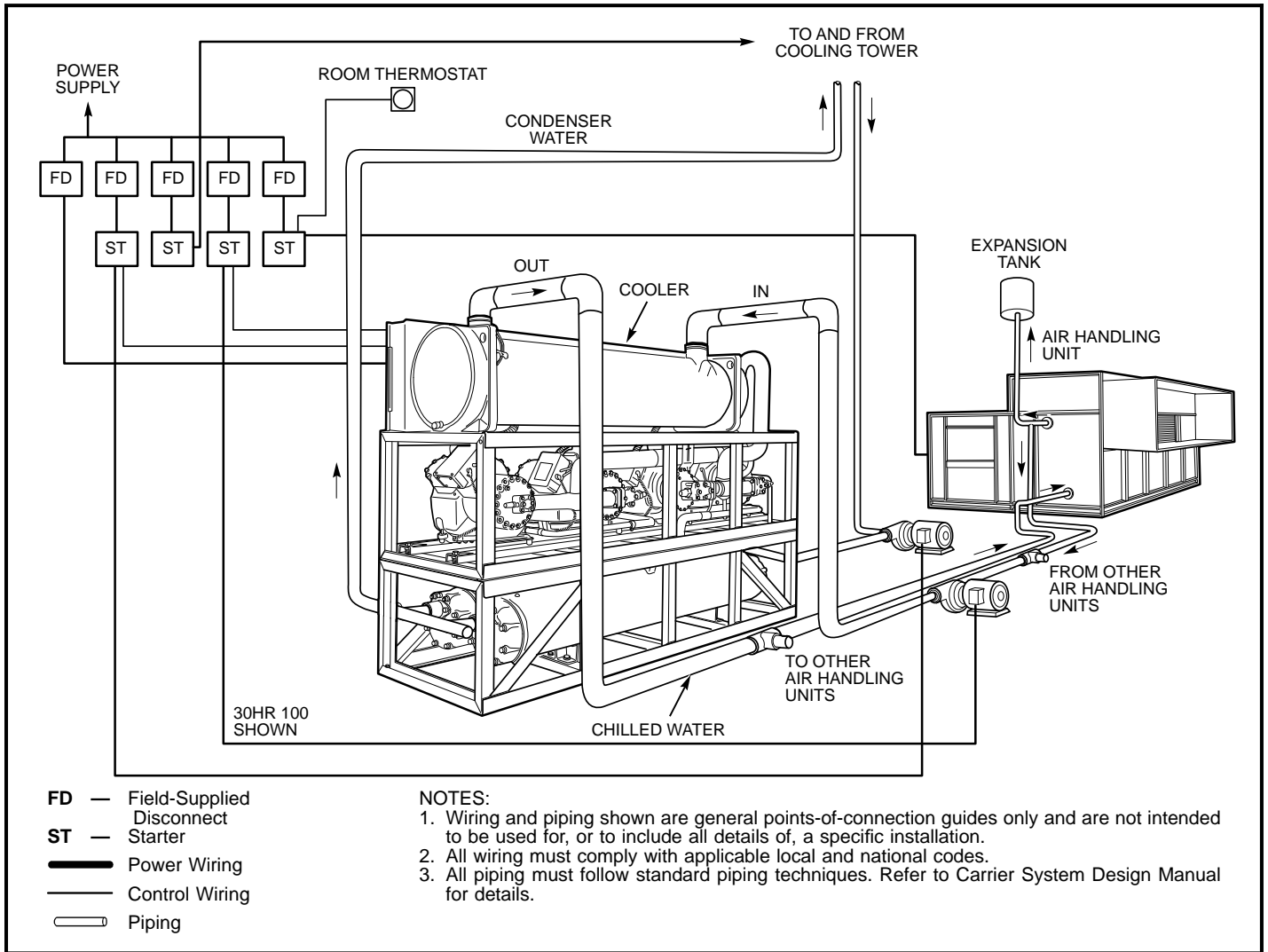
UNIT 30HR, 30HS	CONTR STEPS	SEQUENCE A								SEQUENCE B											
		% Disp.	Oper Cylinders								% Disp.	Oper Cylinders									
			Tot.	Ckt A				Ckt B				Tot.	Ckt A				Ckt B				
				Compr									Compr								
		A1		A2		B1		B2				A1		A2		B1		B2			
070	1	14.3	2	2	—	—	—	—	—	28.6	4	—	—	—	—	—	—	—	—		
	2	42.9	6	2	—	4	—	—	—	42.9	6	2	—	—	—	—	—	—	—		
	3	57.2	8	2	—	6	—	—	—	57.2	8	4	—	—	—	—	—	—	—		
	4	71.2	10	4	—	6	—	—	—	71.2	10	4	—	—	—	—	—	—	—		
	5	85.7	12	2	4	6	—	—	—	85.7	12	2	4	6	—	—	—	—	—		
	6	100.0	14	4	4	6	—	—	—	100.0	14	4	4	6	—	—	—	—	—		
080	1	25.0	4	4	—	—	—	—	—	25.0	4	—	—	—	—	—	—	—	—		
	2	50.0	8	4	—	4	—	—	—	50.0	8	4	—	—	—	—	—	—	—		
	3	62.5	10	4	—	6	—	—	—	62.5	10	6	—	—	—	—	—	—	—		
	4	75.0	12	6	—	6	—	—	—	75.0	12	6	—	—	—	—	—	—	—		
	5	87.5	14	4	4	6	—	—	—	87.5	14	4	4	6	—	—	—	—	—		
	6	100.0	16	6	4	6	—	—	—	100.0	16	6	4	6	—	—	—	—	—		
090	1	22.2	4	4	—	—	—	—	—	22.2	4	—	—	—	—	—	—	—	—		
	2	44.4	8	4	—	4	—	—	—	44.4	8	4	—	—	—	—	—	—	—		
	3	55.5	10	4	—	6	—	—	—	55.5	10	6	—	—	—	—	—	—	—		
	4	66.7	12	6	—	6	—	—	—	66.7	12	6	—	—	—	—	—	—	—		
	5	88.8	16	4	6	6	—	—	—	88.8	16	4	6	6	—	—	—	—	—		
	6	100.0	18	6	6	6	—	—	—	100.0	18	6	6	6	—	—	—	—	—		
100	1	20.0	4	4	—	—	—	—	—	20.0	4	—	—	—	—	—	—	—	—		
	2	40.0	8	4	—	4	—	—	—	40.0	8	4	—	—	—	—	—	—	—		
	3	50.0	10	4	—	6	—	—	—	50.0	10	6	—	—	—	—	—	—	—		
	4	60.0	12	6	—	6	—	—	—	60.0	12	6	—	—	—	—	—	—	—		
	5	70.0	14	4	4	6	—	—	—	70.0	14	6	—	—	—	—	—	—	—		
	6	80.0	16	6	4	6	—	—	—	80.0	16	6	—	—	—	—	—	—	—		
	7	90.0	18	4	4	6	4	—	—	90.0	18	6	4	4	—	—	—	—	—		
	8	100.0	20	6	4	6	4	—	—	100.0	20	6	4	6	4	—	—	—	—		
110	1	18.2	4	4	—	—	—	—	—	18.2	4	—	—	—	—	—	—	—	—		
	2	36.3	8	4	—	4	—	—	—	36.3	8	4	—	—	—	—	—	—	—		
	3	45.4	10	4	—	6	—	—	—	45.4	10	6	—	—	—	—	—	—	—		
	4	54.5	12	6	—	6	—	—	—	54.5	12	6	—	—	—	—	—	—	—		
	5	72.7	16	4	6	6	—	—	—	63.6	16	6	—	—	—	—	—	—	—		
	6	81.8	18	6	6	6	—	—	—	72.7	18	6	—	—	—	—	—	—	—		
	7	90.9	20	4	6	6	4	—	—	90.9	20	6	6	4	—	—	—	—	—		
	8	100.0	22	6	6	6	4	—	—	100.0	22	6	6	6	4	—	—	—	—		
120, 160	1	16.6	4	4	—	—	—	—	—	16.6	4	—	—	—	—	—	—	—	—		
	2	33.3	8	4	—	4	—	—	—	33.3	8	4	—	—	—	—	—	—	—		
	3	41.6	10	4	—	6	—	—	—	41.6	10	6	—	—	—	—	—	—	—		
	4	50.0	12	6	—	6	—	—	—	50.0	12	6	—	—	—	—	—	—	—		
	5	66.7	16	4	6	6	—	—	—	66.7	16	6	—	—	—	—	—	—	—		
	6	75.0	18	6	6	6	—	—	—	75.0	18	6	—	—	—	—	—	—	—		
	7	91.6	22	4	6	6	6	—	—	91.6	22	6	6	4	—	—	—	—	—		
	8	100.0	24	6	6	6	6	—	—	100.0	24	6	6	6	6	—	—	—	—		
140	1	19.0	4	4	—	—	—	—	—	19.0	4	—	—	—	—	—	—	—	—		
	2	38.0	8	4	—	4	—	—	—	38.0	8	4	—	—	—	—	—	—	—		
	3	47.6	10	4	—	6	—	—	—	47.6	10	6	—	—	—	—	—	—	—		
	4	57.0	12	6	—	6	—	—	—	57.0	12	6	—	—	—	—	—	—	—		
	5	69.0	16	4	6	6	—	—	—	69.0	16	6	—	—	—	—	—	—	—		
	6	78.6	18	6	6	6	—	—	—	78.6	18	6	—	—	—	—	—	—	—		
	7	90.4	22	4	6	6	6	—	—	90.4	22	6	6	4	—	—	—	—	—		
	8	100.0	24	6	6	6	6	—	—	100.0	24	6	6	6	6	—	—	—	—		

LEGEND

Ckt	—	Circuit
Compr	—	Compressor
CONTR	—	Control
Disp.	—	Displacement
Oper	—	Operating
Tot	—	Total

NOTE: Circuits and compressors designated from left to right when viewed from front of unit.

Typical piping and wiring



Fluid-Cooled Reciprocating Liquid Chiller

HVAC Guide Specifications

Size Range: **70 to 160 Tons (250 to 560 kW)**

Carrier Model Number: **30HR070-160**

Part 1 — General

1.01 SYSTEM DESCRIPTION

- A. Electronically controlled reciprocating-type liquid chiller utilizing semi-hermetic type compressors.

1.02 QUALITY ASSURANCE

- A. Unit performance shall be rated in accordance with ARI Standard 590 (U.S.A.) at standard rating conditions.
- B. Unit construction shall comply with ASHRAE 15 latest revision safety standard, NEC, and applicable ASME codes (U.S.A.).
- C. Unit(s) shall be UL (U.S.A.) listed and CSA certified.
- D. Unit shall be certified in accordance with ISO 9002 manufacturing quality standard.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be shipped factory assembled with all refrigerant piping and control wiring factory installed.
- B. Unit shall be shipped pre-charged with a complete operating charge of R-22.
- C. Unit to be stored and handled according to manufacturer's recommendations.

Part 2 — Products

2.01 EQUIPMENT

A. General:

Factory-assembled, single-piece, liquid chiller consisting of motors, compressors, direct expansion cooler, condensers, initial oil and refrigerant operating charges, and all controls, safeties, and hardware required prior to start-up.

B. Compressor(s):

- 1. Reciprocating, serviceable, semi-hermetic type only.
- 2. Each compressor shall be equipped with an automatically reversible oil pump, operating oil charge, suction and discharge shutoff valves and oil sight glass.
- 3. Factory mounted on spring vibration isolators.
- 4. Motors shall be cooled by suction gas passing around motor windings and shall be thermally protected.
- 5. Each compressor shall be factory equipped with an insert-type crankcase heater to control oil dilution during shutdown.

- 6. Motor speed shall not exceed 1750 rpm (29.2 r/s).
- 7. Equipped with electrically-actuated suction cut-off cylinder unloaders.
- 8. Same manufacturer as chiller.

C. Cooler:

- 1. Shell-and-tube type with removable heads. Seamless copper tubes shall be rolled into tube sheets.
- 2. Single fluid pass type with multiple internal polypropylene baffles.
- 3. Design shall be dual independent, direct expansion, refrigerant circuit type.
- 4. Shell shall be insulated with 3/4-in. (19 mm) closed cell polyvinyl chloride foam insulation or suitable alternate.
- 5. Cooler shall be tested and stamped in accordance with ASME code (U.S.A.) for refrigerant side working pressure of 235 psig (1620 kPa). Cooler shall have a maximum fluid side working pressure of 300 psig (2068 kPa).

D. Condensers:

- 1. Two fluid-cooled shell-and-tube type with seamless integrally finned copper tubes and removable heads.
- 2. Design and construction shall provide positive sub-cooling of liquid refrigerant.
- 3. Each equipped with a pressure relief device, purge cock and liquid line shutoff valve.
- 4. Condensers shall be tested and stamped in accordance with ASME code (U.S.A.) for refrigerant side working pressure of no less than 385 psig (2654 kPa). Condenser shall have a maximum fluid side working pressure of 250 psig (1724 kPa).

E. Refrigerant Components:

Each refrigerant circuit shall include the following minimum components:

- 1. Hot gas muffler.
- 2. Moisture indicating sight glass.
- 3. Hermetic filter drier.
- 4. Maximum operating pressure type electronic expansion valve with a minimum of 760-step control and 3/4-in. (19 mm) variable refrigerant metering.
- 5. Liquid line solenoid valve.
- 6. Charging valve.
- 7. Discharge gas thermostat.
- 8. Close-fitting cellular foam insulation on all suction lines.

F. Controls, Safeties and Diagnostics:

1. Controls:

- a. Unit controls shall include the following minimum components:
 - 1) Microprocessor.
 - 2) Power and control circuit terminal blocks.
 - 3) RUN/STANDBY control power switch.
 - 4) Replaceable solid-state relay panel and electronic expansion valve control.
 - 5) Control panel with keypad and display module.
 - 6) Thermistors.
 - 7) External communication port.
- b. Capable of performing the following functions:
 - 1) Pumpout at beginning and end of every circuit cycle.
 - 2) Return temperature reset based on return cooler fluid temperature outdoor-air temperature, space temperature, or 4-20 mA signal.
 - 3) Scheduling of circulating pump and chiller operation for occupied/unoccupied periods.
 - 4) Capacity control based on leaving chilled fluid temperature and compensated by rate of change of return fluid temperature.
 - 5) Limit the chilled fluid temperature pull-down rate at start-up to 1° F (.56° C) per minute to prevent excessive demand spikes (charges) at start-up.
 - 6) Automatic lead/lag control of refrigerant circuits.
 - 7) Two-stage demand limiting from remote signal.
 - 8) Remote alarm activation.

2. Safeties:

- a. Unit shall be equipped with thermistors and all necessary components in conjunction with the control system to provide the unit with the following protections:
 - 1) Loss of refrigerant charge protection.
 - 2) Low fluid flow protection.
 - 3) Low chilled fluid temperature protection.
 - 4) Low and high superheat protection.
 - 5) Low oil protection for each compressor circuit.
 - 6) Low control voltage (to unit) protection.
- b. Compressors shall be equipped with the following manual reset type protections:
 - 1) Thermal overload.
 - 2) Pressure overload.

- 3) Electrical overload through the use of contactors and calibrated, ambient compensated, magnetic trip circuit breakers. Circuit breakers shall open all 3 phases in the event of either an overload in any one phase, or a single-phasing condition.

3. Diagnostics:

- a. Diagnostic display module shall be capable of indicating the safety lockout condition by displaying a code for which an explanation may be scrolled at the display. Protections included for display shall be:
 - 1) Compressor lockout.
 - 2) Loss of charge.
 - 3) Low fluid flow.
 - 4) Low oil pressure.
 - 5) Cooler freeze protection.
 - 6) High or low suction superheat.
 - 7) Thermistor malfunction.
- b. Unit control must also be capable of performing a run test to verify operation of every switch, thermistor, solenoid valve, unloader, and compressor before chiller is started.

G. Electrical Requirements:

1. Control voltage shall be 115-v, single-phase, separate power supply.
2. Unit shall be shipped with factory control and power wiring installed.
3. Each primary electrical power supply shall be connected at a single location.

H. Special Features:

Certain standard features are not applicable when the features designated by * are specified.

- * 1. Condenser manifold package (070-140), field welded.
- * 2. Control circuit transformer (115 v), field installed.
- * 3. Remote reset thermistor, field installed.
4. Unit sound enclosure panels, field installed.
5. Suction and discharge pressure gages with valves, field installed.
- * 6. Oil-pressure safety switch, field installed.
- * 7. Leaving chilled fluid temperature reset. LCWT shall be reset from occupied space, outdoor air, or return fluid temperature.
- * 8. Demand limit control. Unit shall be equipped with a 2-point demand limit control (0-49% and 50-100%) actuated remotely by an electronic signal.
9. Chilled fluid flow switch, field installed.

Condenserless Reciprocating Liquid Chiller

HVAC Guide Specifications

Size Range: **70 to 160 Tons (250 to 560 kW)**

Carrier Model Number: **30HS070-160**

Part 1 — General

1.01 SYSTEM DESCRIPTION

- A. Electronically controlled reciprocating-type liquid condenserless chiller utilizing semi-hermetic type compressors.

1.02 QUALITY ASSURANCE

- A. Unit performance shall be based on ARI Standard 590 (U.S.A.) at standard rating conditions.
- B. Unit construction shall comply with ASHRAE 15 latest revision safety standard, NEC, and applicable ASME codes (U.S.A.).
- C. Unit(s) shall be UL (U.S.A.) listed and CSA certified.
- D. Unit shall be certified in accordance with ISO 9002 manufacturing quality standard.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be shipped factory assembled with all refrigerant piping and control wiring factory installed.
- B. Unit shall be shipped pre-charged with a holding charge of R-22.
- C. Unit to be stored and handled according to manufacturer's recommendations.

Part 2 — Products

2.01 EQUIPMENT

A. General:

Factory-assembled, single-piece, liquid chiller consisting of motors, compressors, direct expansion cooler, initial oil operating charge, refrigerant holding charge, and all controls, safeties, and hardware required prior to start-up.

B. Compressors:

1. Reciprocating serviceable semi-hermetic type only.
2. Each compressor shall be equipped with an automatically reversible oil pump, operating oil charge, suction and discharge shutoff valves, and oil sight glass.
3. Factory mounted on spring vibration isolators.
4. Motors shall be cooled by suction gas passing around motor windings and shall be thermally protected.
5. Each compressor shall be factory equipped with an insert-type crankcase heater to control oil dilution during shutdown.
6. Motor speed shall not exceed 1750 rpm (29.2 r/s).
7. Equipped with electrically-actuated suction cut-off cylinder unloaders.
8. Same manufacturer as chiller.

C. Cooler:

1. Shell-and-tube type with removable heads. Seamless copper tubes shall be rolled into tube sheets.
2. Single fluid pass type with multiple internal polypropylene baffles.
3. Design shall be dual independent, direct expansion, refrigerant circuit type.
4. Shell shall be insulated with 3/4-in. (19 mm) closed cell polyvinyl chloride foam insulation or suitable alternate.
5. Cooler shall be tested and stamped in accordance with ASME code (U.S.A.) for refrigerant side working pressure of 235 psig (1620 kPa). Cooler shall have a maximum fluid-side working pressure of 300 psig (2068 kPa).

D. Condensers:

1. Remotely located type (normally air-cooled).
2. Design and construction shall provide positive sub-cooling of liquid refrigerant.

E. Refrigerant Components:

Each refrigerant circuit shall include the following minimum components:

1. Hot gas muffler.
2. Moisture indicating sight glass.
3. Hermetic filter drier.
4. Maximum operating pressure type electronic expansion valve with a minimum 760-step control with 3/4-in. (19 mm) variable refrigerant metering.
5. Liquid line solenoid valve.
6. Charging valve.
7. Discharge gas thermostat.
8. Close-fitting cellular foam insulation on all suction lines.

F. Controls, Safeties and Diagnostics:

1. Controls:

- a. Unit controls shall include the following minimum components:
 - 1) Microprocessor.
 - 2) Power and control circuit terminal blocks.
 - 3) RUN/STANDBY control power switch.
 - 4) Replaceable solid-state relay panel and electronic expansion valve control.
 - 5) Control panel with keypad and display module.
 - 6) Thermistors.
 - 7) External communication port.



- b. Capable of performing the following functions:
 - 1) Pumpout at beginning and end of every circuit cycle.
 - 2) Return temperature reset based on return cooler fluid temperature, outdoor-air temperature, space temperature, or 4-20 mA signal.
 - 3) Scheduling of circulating pump and chiller operation for occupied/unoccupied periods.
 - 4) Capacity control based on leaving chilled fluid temperature and compensated by rate of change of return fluid temperature.
 - 5) Limit the chilled fluid temperature pull-down rate at start-up to 1° F (.56° C) per minute to prevent excessive demand spikes (charges) at start-up.
 - 6) Automatic lead/lag control of refrigerant circuits.
 - 7) Two-stage demand limiting from remote signal.
 - 8) Remote alarm activation.
- 2. Safeties:
 - a. Unit shall be equipped with thermistors and all necessary components in conjunction with the control system to provide the unit with the following protections:
 - 1) Loss of refrigerant charge protection.
 - 2) Low fluid flow protection.
 - 3) Low chilled fluid temperature protection.
 - 4) Low and high superheat protection.
 - 5) Low oil protection for each compressor circuit.
 - 6) Low control voltage (to unit) protection.
 - b. Compressors shall be equipped with the following manual reset type protections:
 - 1) Thermal overload.
 - 2) Pressure overload.
 - 3) Electrical overload through the use of contactors and calibrated, ambient compensated, magnetic trip circuit breakers. Circuit breakers shall open all 3 phases in the event of either an overload in any one phase, or a single-phasing condition.
- 3. Diagnostics:
 - a. Diagnostic display module shall be capable of indicating the safety lockout condition by displaying a code for which an explanation may be scrolled at the display. Protections included for display shall be:
 - 1) Compressor lockout.
 - 2) Loss of charge.
 - 3) Low fluid flow.
 - 4) Low oil pressure.
 - 5) Cooler freeze protection.
 - 6) High or low suction superheat.
 - 7) Thermistor malfunction.
 - b. Unit control must also be capable of performing a run test to verify operation of every switch, thermistor, solenoid valve, unloader and compressor before chiller is started.
- G. Electrical Requirements:
 - 1. Control voltage shall be 115-v, single-phase, separate power supply.
 - 2. Unit shall be shipped with factory control and power wiring installed.
 - 3. Each primary electrical power supply shall be connected at a single location.
- H. Special Features:

Certain standard features are not applicable when the features designated by * are specified.

 - * 1. Control circuit transformer (115 v), field installed.
 - * 2. Remote reset thermistor, field installed.
 - 3. Unit sound enclosure panels, field installed.
 - 4. Suction and pressure gages and valves, field installed.
 - * 5. Leaving chilled fluid temperature reset. LCWT shall be reset from occupied space, outdoor air, or return fluid temperature.
 - * 6. Demand limit control. Unit shall be equipped with a 2-point demand limit control (0-49% and 50-100%) activated remotely by an electronic signal.
 - 7. Chilled fluid flow switch, field installed.