Carrier®

HEATING & COOLING

Packaged Hermetic Centrifugal Liquid Chiller

D-1000 Series

19DK

50, 60 Hz
150-450 Tons
500-1600 kW

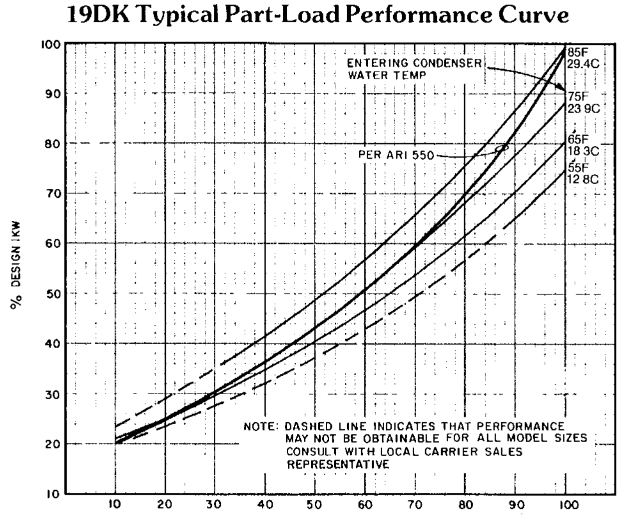
Product Data

Table of contents

Features

- Mix-matching of compressor, motor and unishell to meet specific requirements improves full and part-load performance.
- Single-stage compressor is compact and efficient; reduces operating costs under all load conditions.
- Compressor design allows operation at lower condensing water temperatures — even when the load dips to 10% of design.
- Movable inlet guide vanes open and close to maintain chilled water temperature control by varying refrigerant flow.
- Advanced Dynapoise transmission design is completely self-aligning; assures full uniform contact of gear teeth under all operating conditions.
- Hermetic design provides more efficient performance at part load. Keeps motor free of dirt and moisture. No need for costly ventilation or insulation.
- Atomized refrigerant sprayed over rotor and stator maintains correct motor temperature.
- High performance opti-therm tubes reduce energy usage External fins improve refrigerant-side heat transfer. Internal enhancement improves water-side heat transfer.
- Optional marine water boxes are available for cooler or condenser for easy tube cleaning and servicing.
- Multiple-pass arrangements maintain efficient velocities and provide better heat transfer.
- Thermal economizer subcools liquid refrigerant to increase refrigeration effect and reduce compressor power consumption.
- Automatic thermal purge removes air, water and noncondensables from refrigerant system. Keeps head pressure low for stable operation; indicates air and water leaks.
- Oil pump lubrication package directs oil to various compressor bearings. Flanges make it easier to service oil pumps, motor, cooler, and filter. Microprocessor control provides reliable pre-start lubrication and post-shutdown oil pump operation.
- Microprocessor control system is self-diagnostic; ensures reliable operation. Soft loading at start-up saves energy. Pre-alarm override capability prevents nuisance shutdowns. Programmable options include chilled water reset and power demand limit.
- Low load chilled water recycle control minimizes the number of compressor cycles and reduces motor current draw while maintaining chilled water within 5 degrees of set point.

19DK Typical Part-Load Performance Curve



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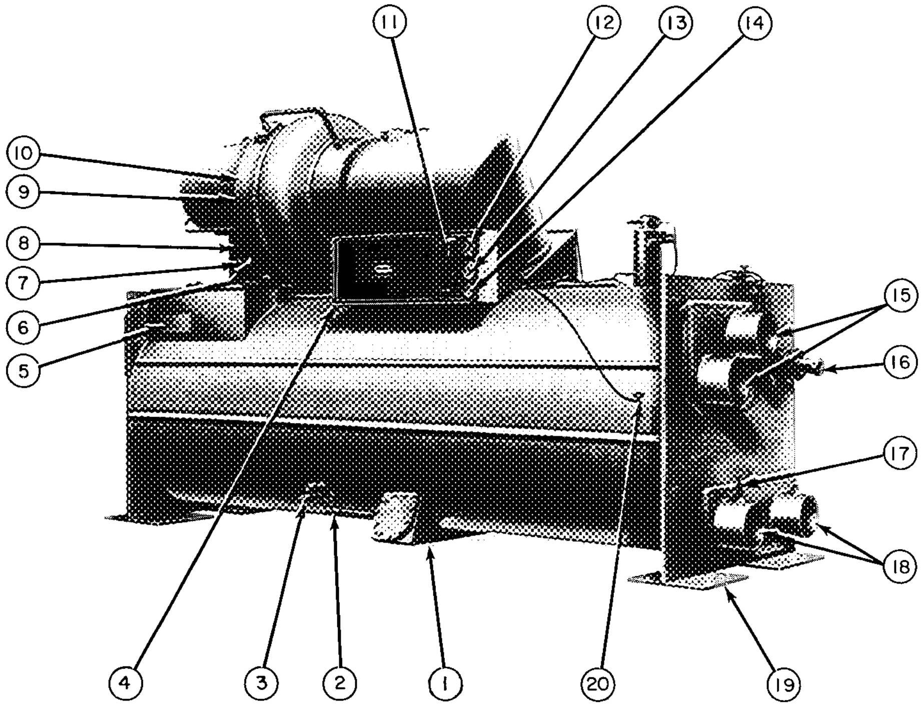
Hermetic Centrifugal Liquid Chiller

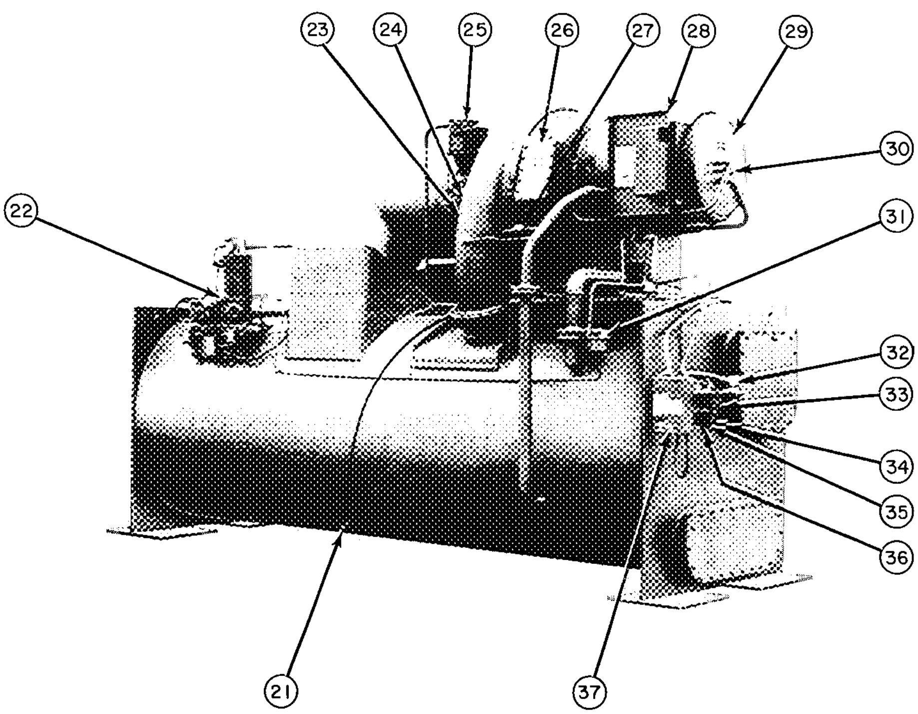
Machine components

FRONT VIEW



1 — Flow Valve Chamber
2 — Cooler Charging Valve
3 — Refrigerant Level Sight Glasses
4 — Field Wiring Knockouts
5 — Machine Informative Plate
6 — Oil Reservoir Temperature Gage
7 — Oil Heater and Thermostat Terminal Box
8 — Oil Level Sight Glass
9 — Return-Oil Temperature Gage (Hidden)
10 — Compressor Nameplate (Hidden)
11 — Microprocessor Control Panel
12 — Condenser Pressure Gage
13 — Cooler Pressure Gage
14 — Oil Pump Differential Pressure Gage
15 — Condenser Water Nozzles
16 — Safety Relief Device
17 — Chilled Water Control Sensor
18 — Cooler Water Nozzles
19 — Support Plates
20 — Condenser Refrigerant Temperature Sensor

REAR VIEW



21 — Cooler Refrigerant Temperature Sensor
22 — Purge Assembly
23 — Discharge Temperature Sensor (Hidden)
24 — Vane Seal Oiler
25 — Guide Vane Actuator
26 — Compressor Access Plate
27 — Inlet Volute Drain Strainer
28 — Compressor Terminal Box (less cover)
29 — Motor End Cover
30 — Motor Rotation Sight Glass
31 — Refrigerant Filter
32 — Oil Cooler Solenoid Valve and Plug Valve
33 — Oil Pump, Cooler and Filter Assembly
34 — Oil Cooler Drain Plug
35 — Oil Charging Valve
36 — Oil Pressure Regulating Valve (Factory Set)
37 — Oil Pump Starter, Factory Installed

Selection procedure

This example represents the machine selected to satisfy a 380 ton (1336 kW) at 44 F (6.7 C) leaving chilled water and 85 F (29.4 C) entering condenser water condition. (See selection example.)

Selection data note

The Selection Data tables list typical combinations of heat exchanger, compressor size, motor size and compressor power input (IKW) that efficiently deliver the desired refrigeration capacity at specified condenser and cooler leaving water temperatures.

Selections have been made at commonly used design conditions of 2-pass cooler and condenser, 0 0005 fouling factor and 10 F water temperature rise (0.000088 fouling factor and 5.6 C temperature rise for SI tables) in accordance with ARI Standard 550-83 for centrifugal chillers.

To simulate evaporator fouling conditions other than standard ARI conditions, reduce the design leaving water temperature 2 degrees for each 0.0005 $ft^2 \cdot °F \cdot h/Btu$ above 0.0005 (one degree for each 0.000088 $m^2 \cdot °C/W$ above 0.000088). To simulate condenser fouling conditions other than standard ARI conditions, increase the design leaving water temperature 2.5°F for each 0.0005 $ft^2 \cdot °F \cdot h/Btu$ above 0.0005 (1.25°C for every 0.000088 $m^2 \cdot °C/W$ above 0.000088) Since the following example uses 0.0005 (0.000088), no temperature adjustment is needed.

For rapid selection of chillers operating at other than the listed capacities, use the following procedure:

I Establish design conditions.

Example:

Required Capacity	380 tons
Leaving Chilled Water Temperature (LCWT)	44 F
Entering Condenser Water Temperature (ERWT)	85 F
Chilled Water Temperature Rise or Gpm*	15 F
Condenser Water Temperature Rise or Gpm*	1140 Gpm
Pressure Drop Limitations	
Cooler	30 ft
Condenser	30 ft
Power Limitation	260 IKW
Electrical Characteristics	460/3/60
Marine Type Water Box Required for Condenser	

*Flow/Rise calculation:

	English	SI
Cooler:	tons = (Gpm x Rise)/24	kW = (L/s x Rise)/ 239
Condenser:	tons = (Gpm x Rise)/29	kW = (L/s x Rise)/ 290

For this selection example:
Calculate cooler gpm using given tons and temperature rise:

$$608\ \text{Gpm} = \frac{380 \times 24}{15}$$

Calculate condenser temperature rise using given tons and gpm:

$$9\ 7°\ \text{rise} = \frac{380 \times 29}{1140}$$

II Make preliminary selection of heat exchangers at a capacity equal to or higher than required capacity.

Using example, enter Selection Data tables. A size 73 unishell produces 400 tons at 44 F cooler LCWT and 95 F condenser LRWT.

III Determine number of passes for selected heat exchangers:

Enter Pressure Drop curve.

At 608 gpm, size 73 unishell, the pressure drop for a 3-pass cooler with standard water boxes is 26 feet. At 1140 gpm, the pressure drop for a 2-pass condenser with marine type water box is 25 feet.

IV Adjust leaving water temperatures for number of passes and for temperature rise:

Enter Pass-Rise Temperature Adjustment table and find:

At 3-pass and 15 F rise (cooler) there is a +2.0 adjustment required. At 2-pass and 9.7 F rise (condenser) there is no adjustment required.

For cases where temperature adjustment is required, you may find it necessary to round off to the next most severe condition.

> Higher rise chilled water applications are increasing in popularity due to the savings realized — not only in chiller operating cost, but also in pumping cost. Higher rises are more compatible with coil performance, and make possible the use of smaller size pipe, pump and fittings, for first-cost savings.

V Make final selection of heat exchanger and compressor.

In this example, no condenser adjustment is necessary, but a +2.0 cooler temperature adjustment is required. Enter the Selection Data tables using 46 F adjusted cooler LCWT and 95 F adjusted condenser LRWT. The 73 unishell will produce 417 tons, with a size 354 compressor, using 280 IKW.

VI Adjust power input (IKW) if the required capacity is less than the capacity of the selected unit.

Multiply the power input of the selected unit by the required capacity divided by selected unit capacity.

Required IKW

$$280\ \text{IKW} \times \frac{380\ \text{tons required}}{417\ \text{tons selected unit}} = 255\ \text{IKW}$$

Selection procedure (cont)

VII **Make motor selection** — From the Electrical Data table, choose the motor with a maximum IKW that exceeds the required IKW

Max IKW of size CM motor = 265
Required IKW (step VI) = 255
Use size CM motor.

Note restrictions on motor-voltage and motor-compressor combinations in the Electrical Data section before finalizing motor selection.

VIII **Establish electrical data** for selected motor

If supply voltage is same as design center voltage, obtain the rated load amperage (RLA), locked rotor amperage (LRA) and overload trip amperage (OLTA) directly from the Electrical Data tables.

RLA = 1.44 x IKW = 1.44 x 255 = 367
OLTA = 1.08 x RLA = 1.08 x 367 = 396
LRA Delta = 1757

If supply voltage is different from design center voltage, adjust the amperage as indicated in the Electrical Data note.

It is recommended that any selection be verified using Carrier's Computer Selection Service through your local Carrier office. In addition, maximum tonnage for any of the listed component combinations, selections for other than the listed components, selections at other than the listed conditions, or selections requiring lower input kW per ton can be obtained.

Pass-Rise Temperature Adjustment (F/C*)

WATER TEMP RISE		COOLER PASSES				CONDENSER PASSES			
F	C	1	2	3	4	1	2	3	4
5	2.8	-2 0	+0 5	+1 5	+2 0	+2 0	0	-1 0	-1 5
6	3.4	-2 5	+0 5	+1 5	+2 0	+2 5	0	-1 0	-1 5
8	4.4	-2 5	0	+1 5	+2 5	+3 0	0	-1 0	-1 5
10	5.6	-3 5	0	+1 5	+2 5	+3 5	0	-1 5	-2 0
12	6.7	-5 0	0	+1 5	+2 5	+4 0	0	-1 5	-2 0
14	7.8	-6 0	0	+2 0	+3 0	+4 5	0	-1 5	-2 5
15	8.3	-6 0	-0 5	+2 0	+3 0	+4 5	0	-1 5	-2 5
20	11.1	–	-0 5	+2 0	+3 5	+5 5	0	-2 0	-3 0
25	13.9	–	-0 5	+2 5	+4 0	+6 0	0	-2 5	-3 5

*Factors shown are for °F When working in °C, convert factors by dividing by 1 8

Selection data

Model Number Description

19DK 73 354 CM

- CM — Motor Size (MR)
- 354 — Compressor Size (CR)
- 73 — Unishell Size (UN)
- 19DK — Model Description

1 List chiller model in first 4 code number positions
2. Obtain unishell or heat exchanger size from step V of the Selection Procedure and enter in positions 5 and 6
3 Obtain compressor size from step V of the Selection Procedure and enter in positions 7, 8 and 9
4 Obtain motor size from step VII of the Selection Procedure and enter in positions 10 and 11

→ Selection tables — English

19DK44 UNISHELL (125 NOMINAL TONS)

ADJ LVG COND WATER TEMP (F)		ADJ LVG CHILLED WATER TEMP (F) 42	44	46
90	Tons	131	134	138
	IKW	101	100	95
	CR	114	114	113
95	Tons	121	125	131
	IKW	100	98	100
	CR	115	114	114
100	Tons	112	118	121
	IKW	101	101	100
	CR	116	115	115

19DK55 UNISHELL (200 NOMINAL TONS)

ADJ LVG COND WATER TEMP (F)		ADJ LVG CHILLED WATER TEMP (F) 42	44	46
90	Tons	209	215	228
	IKW	147	148	145
	CR	174	174	173
95	Tons	195	200	210
	IKW	149	143	148
	CR	175	174	174
100	Tons	179	190	200
	IKW	148	149	149
	CR	176	175	174

19DK63 UNISHELL (300 NOMINAL TONS)

ADJ LVG COND WATER TEMP (F)		ADJ LVG CHILLED WATER TEMP (F) 42	44	46
90	Tons	331	341	344
	IKW	230	232	214
	CR	284	284	283
95	Tons	293	300	333
	IKW	217	209	231
	CR	285	284	284
100	Tons	285	294	309
	IKW	230	232	232
	CR	286	286	285

19DK73 UNISHELL (400 NOMINAL TONS)

ADJ LVG COND WATER TEMP (F)		ADJ LVG CHILLED WATER TEMP (F) 42	44	46
90	Tons	412	425	436
	IKW	278	280	263
	CR	354	354	353
95	Tons	385	400	417
	IKW	279	275	280
	CR	355	354	354
100	Tons	354	375	391
	IKW	277	279	277
	CR	356	355	354

19DK78 UNISHELL (450 NOMINAL TONS)

ADJ LVG COND WATER TEMP (F)		ADJ LVG CHILLED WATER TEMP (F) 42	44	46
90	Tons	459	471	491
	IKW	307	306	292
	CR	404	404	403
95	Tons	425	450	463
	IKW	306	306	307
	CR	405	404	404
100	Tons	390	411	436
	IKW	305	304	306
	CR	406	405	404

Tons — Cooling Capacity (Tons)
IKW — Motor Input Power (Kilowatts)
CR — Compressor Model

Selection tables — SI

19DK44 UNISHELL (450 NOMINAL kW)

ADJ LVG COND WATER TEMP (C)		ADJ LVG CHILLED WATER TEMP (C) 5	6	7
33	kW	475	496	510
	IKW	107	109	110
	CR	124	124	124
35	kW	457	450	492
	IKW	109	101	110
	CR	125	124	124
38	kW	411	433	443
	IKW	110	109	110
	CR	127	126	126

19DK55 UNISHELL (700 NOMINAL kW)

ADJ LVG COND WATER TEMP (C)		ADJ LVG CHILLED WATER TEMP (C) 5	6	7
33	kW	714	732	753
	IKW	147	147	148
	CR	174	174	174
35	kW	682	700	728
	IKW	147	146	149
	CR	174	174	174
38	kW	622	651	665
	IKW	149	148	147
	CR	176	175	175

19DK63 UNISHELL (1000 NOMINAL kW)

ADJ LVG COND WATER TEMP (C)		ADJ LVG CHILLED WATER TEMP (C) 5	6	7
33	kW	1041	1062	1094
	IKW	208	207	208
	CR	284	284	284
35	kW	978	1000	1052
	IKW	209	202	208
	CR	285	284	284
38	kW	872	911	935
	IKW	209	207	208
	CR	287	286	286

19DK73 UNISHELL (1400 NOMINAL kW)

ADJ LVG COND WATER TEMP (C)		ADJ LVG CHILLED WATER TEMP (C) 5	6	7
33	kW	1386	1456	1526
	IKW	271	280	290
	CR	354	354	354
35	kW	1358	1400	1484
	IKW	285	288	292
	CR	355	355	354
38	kW	1308	1358	1414
	IKW	301	307	303
	CR	356	356	355

19DK78 UNISHELL (1600 NOMINAL kW)

ADJ LVG COND WATER TEMP (C)		ADJ LVG CHILLED WATER TEMP (C) 5	6	7
33	kW	1572	1656	1727
	IKW	317	329	339
	CR	405	405	405
35	kW	1544	1600	1685
	IKW	335	328	341
	CR	406	405	405
38	kW	1445	1512	1586
	IKW	330	340	338
	CR	406	406	405

kW — Cooling Capacity (Kilowatts)
IKW — Motor Input Power (Kilowatts)
CR — Compressor Model

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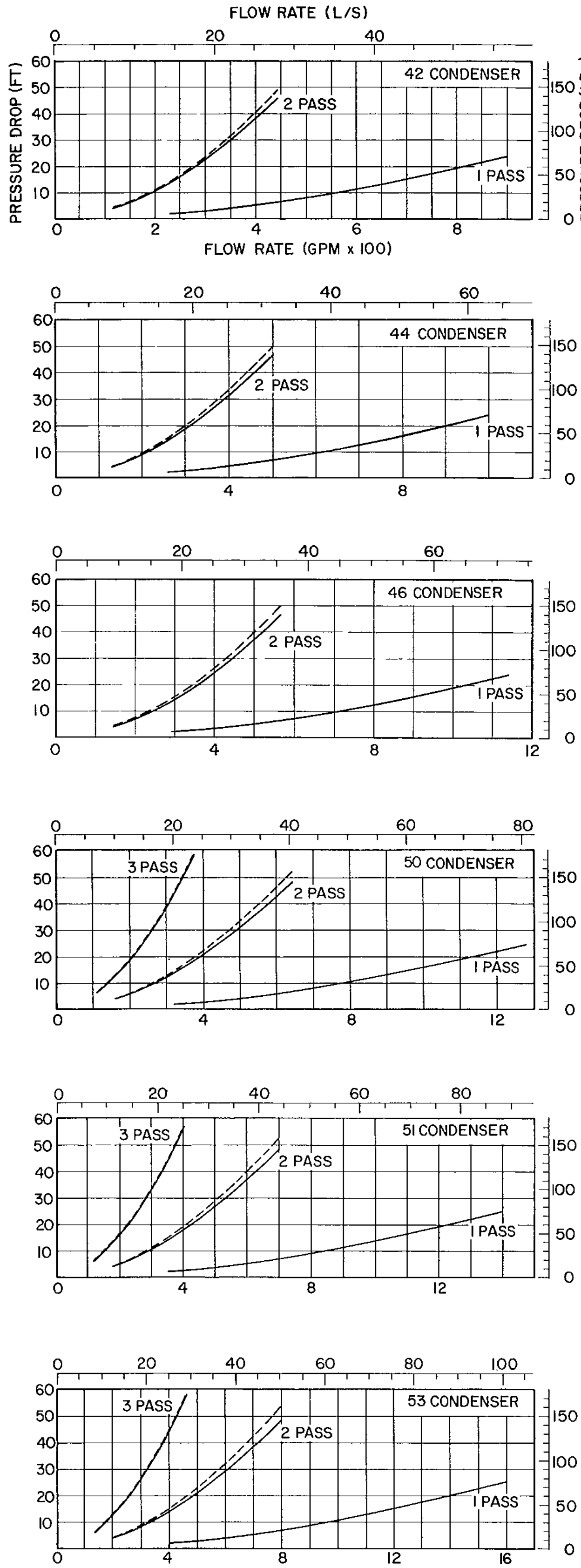
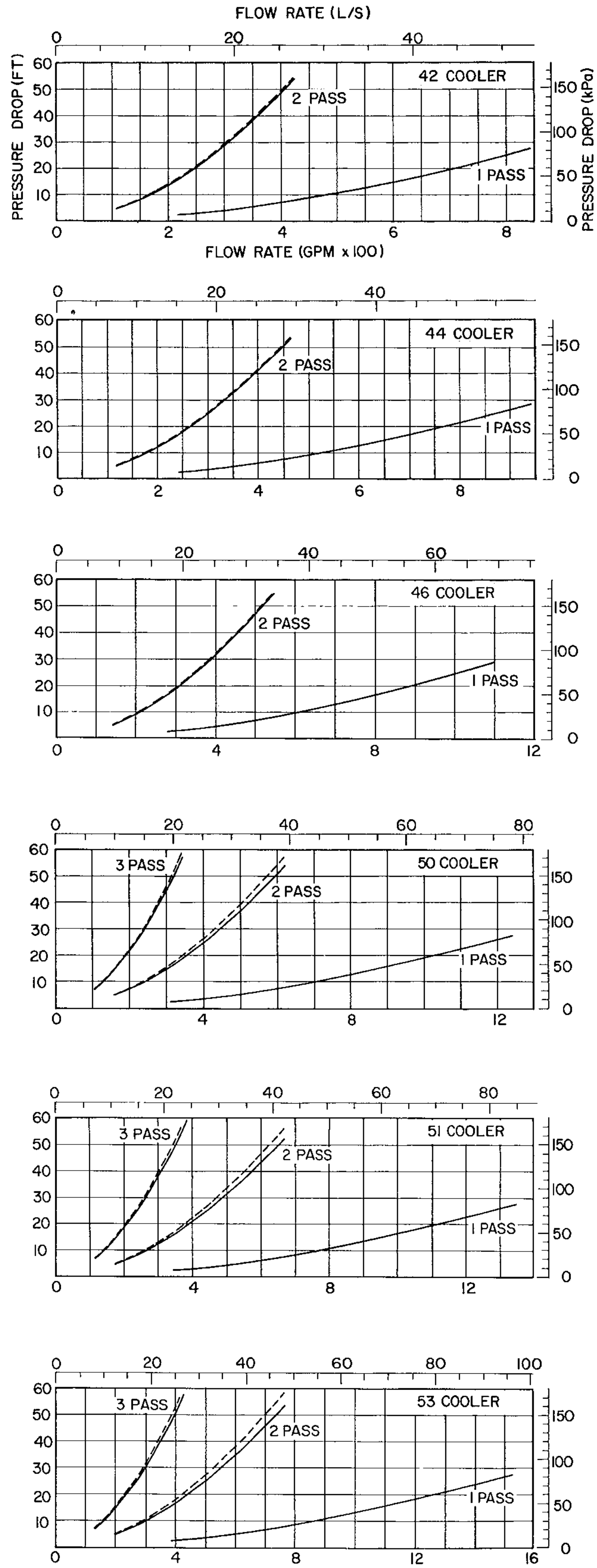
Unishell Condenser

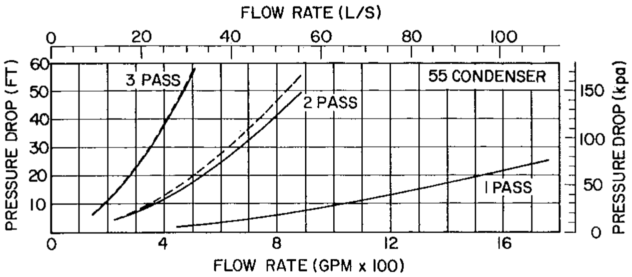


Unishell Cooler

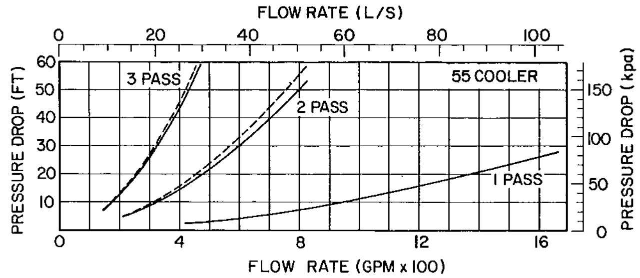


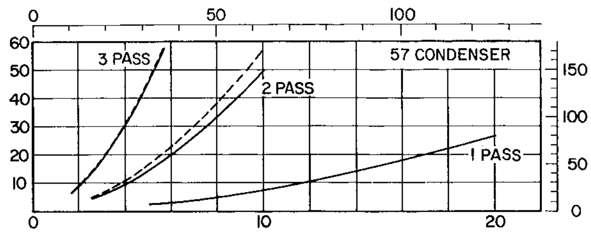
NOTE: Solid lines show pressure drop with standard water box Dashed lines show pressure drop with marine water box option

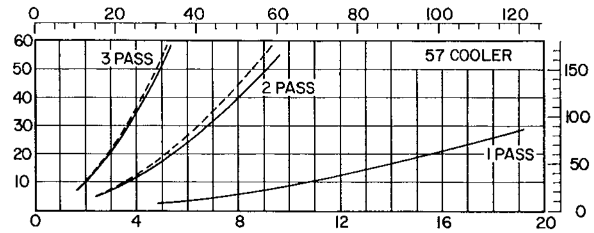
Unishell Condenser

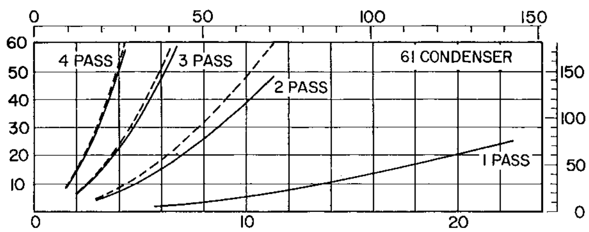


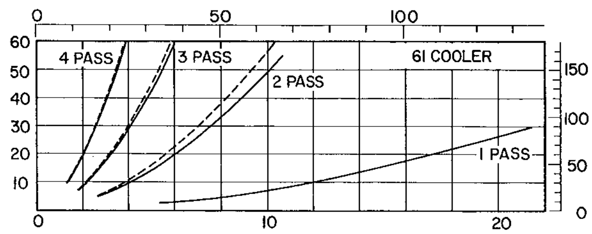
Unishell Cooler

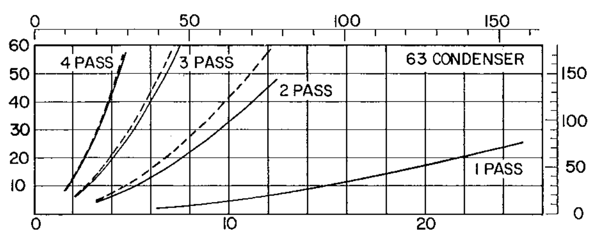


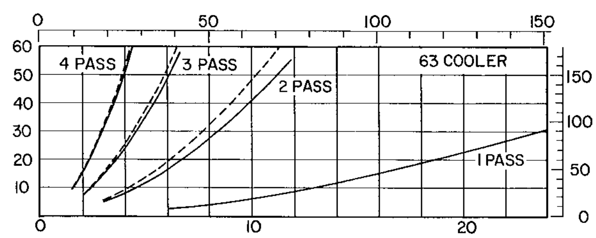


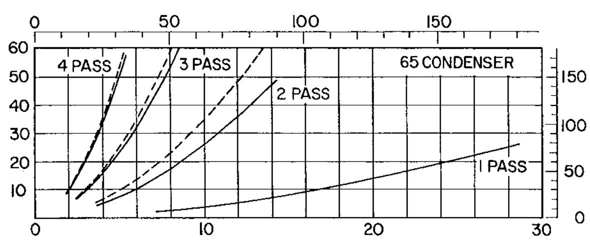


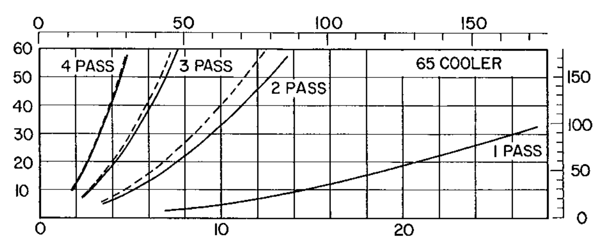


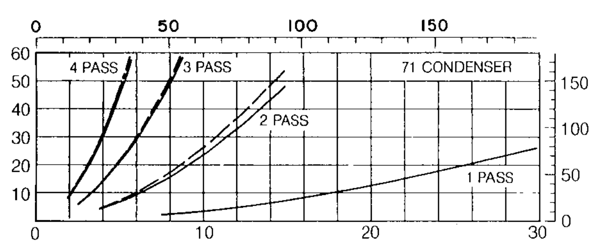


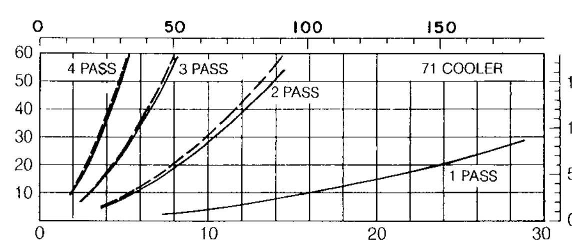












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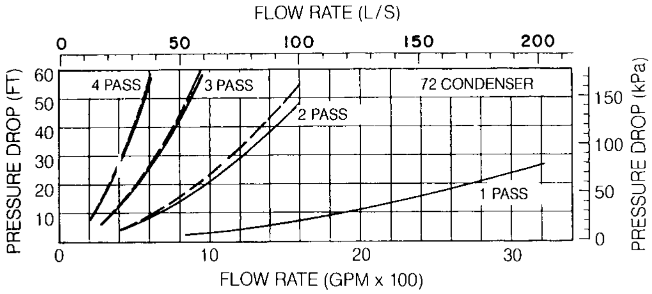
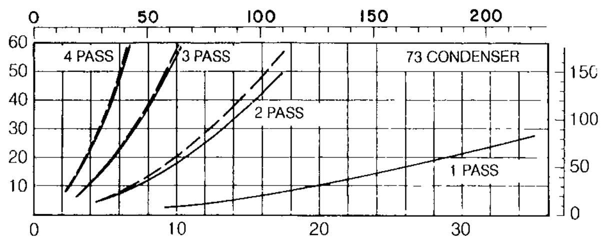
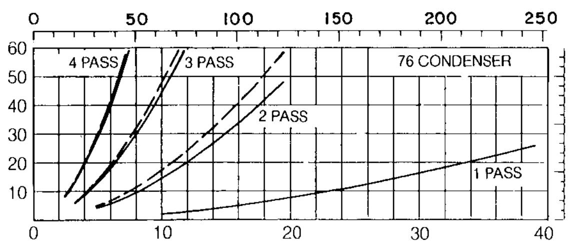
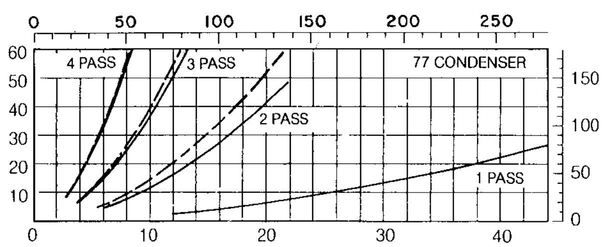
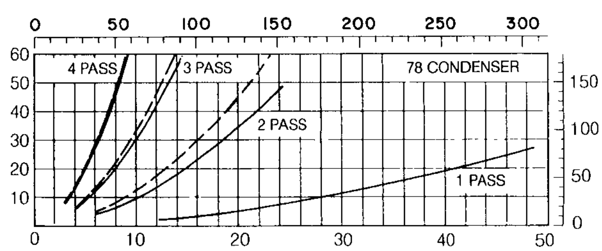
Unishell Condenser



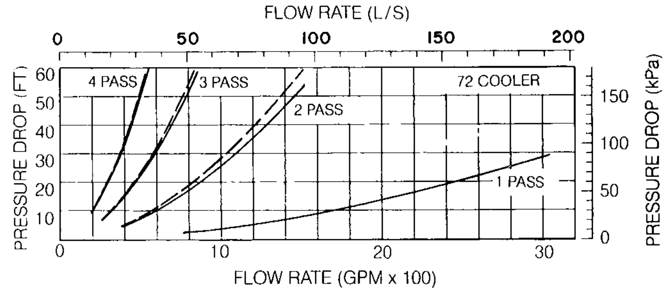


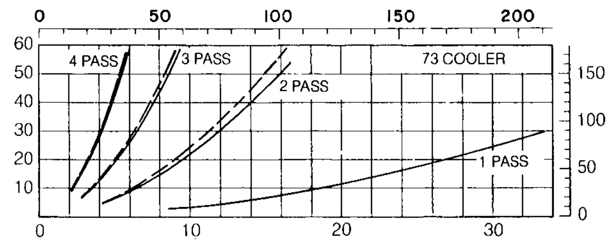


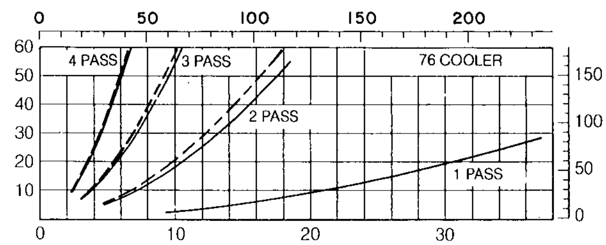


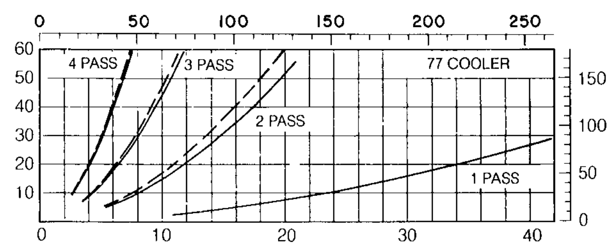


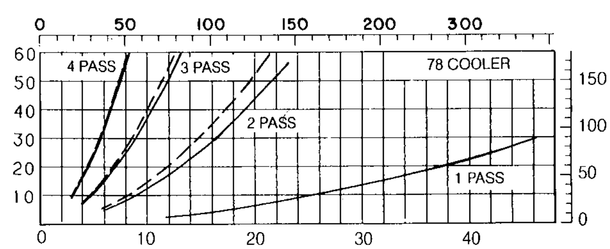
Unishell Cooler











NOTE: Solid lines show pressure drop with standard water box Dashed lines show pressure drop with marine water box option

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Hermetic Centrifugal Liquid Chiller

→ Electrical data

MOTOR MODEL	MOTOR ELECTRICAL CHARACTERISTICS	Max IKW	60 HERTZ MOTORS Low Volts 208 v	230 v	380 v	460 v	575 v	High Volts Max IKW	2400 v	3300 v	4160 v	50 HERTZ MOTORS Low Volts Max IKW	230 v	346 v	400 v	High Volts Max IKW	3000 v	3300 v
AA	RLA per IKW		3.19	2.89	1.75	1.44	1.15		—	—	—		2.89	1.92	1.66		—	—
	LRA Star	94	548	394	238	197	161	—	—	—	—	92	378	230	217	—	—	—
	LRA Delta		1711	1230	744	615	502		—	—	—		1180	717	678		—	—
AB	RLA per IKW		3.23	2.92	1.77	1.46	1.17		—	—	—		2.92	1.94	1.68		—	—
	LRA Star	105	500	418	282	217	177	—	—	—	—	104	402	272	254	—	—	—
	LRA Delta		1561	1305	881	678	552		—	—	—		1255	851	794		—	—
AC	RLA per IKW		3.23	2.92	1.85	1.46	1.17		—	—	—		3.14	1.94	1.68		—	—
	LRA Star	115	567	498	331	249	193	—	—	—	—	114	562	331	259	—	—	—
	LRA Delta		1771	1556	1033	778	602		—	—	—		1757	1035	808		—	—
AD	RLA per IKW		3.23	2.92	1.77	1.46	1.17		—	—	—		2.89	1.92	1.66		—	—
	LRA Star	129	692	530	316	293	254	—	—	—	—	126	506	384	346	—	—	—
	LRA Delta		2161	1657	988	916	793		—	—	—		1581	1201	1083		—	—
AE	RLA per IKW		3.15	2.85	1.73	1.43	1.14		—	—	—		2.85	1.90	1.64		—	—
	LRA Star	144	720	667	369	333	273	—	—	—	—	143	578	406	356	—	—	—
	LRA Delta		2251	2083	1155	1042	853		—	—	—		1807	1268	1111		—	—
CA	RLA per IKW		—	—	—	—	—		0 286	0 208	0 165		—	—	—		0 221	0 201
	LRA Star	—	—	—	—	—	—	144	—	—	—	—	—	—	—	144	—	—
	LRA Delta		—	—	—	—	—		188	136	108		—	—	—		148	140
CB	RLA per IKW		3.23	2.92	1.92	1.46	1.21		0 277	0 201	0 160		2.82	1.87	1.74		0 221	0 201
	LRA Star	155	884	763	520	374	318	156	—	—	—	153	795	545	480	156	—	—
	LRA Delta		2762	2385	1626	1167	994		204	149	118		2485	1702	1501		156	150
CC	RLA per IKW		3.19	3.02	1.75	1.44	1.15		0 280	0 203	0 161		2.85	1.90	1.64		0 221	0 201
	LRA Star	171	1086	964	520	418	321	172	—	—	—	169	771	593	462	172	—	—
	LRA Delta		3392	3012	1626	1305	1004		226	164	130		2410	1852	1443		167	164
CD	RLA per IKW		3.15	2.85	1.83	1.43	1.14		0 273	0 199	0 158		2.82	1.87	1.62		0 219	0 199
	LRA Star	199	1182	1012	676	486	405	200	—	—	—	196	924	673	563	200	—	—
	LRA Delta		3692	3163	2112	1519	1265		265	192	153		2887	2102	1761		196	169
CE	RLA per IKW		3.30	2.85	1.73	1.43	1.14		0 273	0 199	0 158		2.85	1.90	1.64		0 219	0 199
	LRA Star	218	1451	1044	622	462	373	219	—	—	—	214	1165	780	665	219	—	—
	LRA Delta		4533	3263	1945	1443	1165		284	206	164		3640	2436	2078		214	197
CL	RLA per IKW		3.15	2.85	1.73	1.43	1.14		0 277	0 201	0 160		2.82	1.87	1.62		0 219	0 199
	LRA Star	242	1326	1173	749	546	398	243	—	—	—	237	1197	812	721	243	—	—
	LRA Delta		4143	3665	2340	1707	1245		320	233	185		3740	2536	2252		221	237
CM	RLA per IKW		3 19	2.89	1.75	1.44	1.15		0 273	0 199	0 158		2.79	1.85	1.60		0 219	0 199
	LRA Star	265	1403	1422	841	562	498	267	—	—	—	261	1542	833	730	267	—	—
	LRA Delta		4383	4443	2628	1757	1556		354	257	204		4819	2603	2280		258	262
CN	RLA per IKW		3.15	2.85	1.73	1.43	1.14		0 273	0 199	0 158		2.79	1.85	1.70		0 219	0 199
	LRA Star	292	1710	1333	865	663	610	295	—	—	—	289	1446	854	896	295	—	—
	LRA Delta		5344	4167	2704	2071	1908		392	285	226		4518	2670	2800		257	286
CP	RLA per IKW		3.12	2.82	1.71	1.41	1.13		0 273	0 199	0 158		2.82	1.87	1.62		0 219	0 199
	LRA Star	320	1671	1430	851	719	601	323	—	—	—	317	1534	1020	951	323	—	—
	LRA Delta		5223	4468	2659	2247	1878		421	306	243		4794	3187	2973		317	292
CQ	RLA per IKW		3.15	2.85	1.73	1.43	1.14		0 277	0 201	0 160		2.79	1.96	1.60		0 219	0 199
	LRA Star	356	1989	1639	948	1000	672	360	—	—	—	352	1542	1303	951	360	—	—
	LRA Delta		6214	5121	2963	3125	2098		474	345	273		4819	4071	2973		351	337

LEGEND

IKW — Compressor Power Input (Kilowatts)
LRA — Locked Rotor Amps
OLTA — Overload Trip Amps (= RLA x 1 08)
RLA — Rated Load Amps

NOTES: 1 Standard Voltages:

Volt	For Use on Supply Voltages — 60 Hz
208	200 to 208v systems
230	220 to 240v systems
380	360 to 400v systems
460	440 to 480v systems
575	550 to 600v systems
2400	2300 to 2500v systems
3300	3150 to 3450v systems
4160	4000 to 4300v systems

Volt	For Use on Supply Voltages — 50 Hz
230	220 to 240v systems
346	320 to 360v systems
400	380 to 415v systems
3000	2900 to 3100v systems
3300	3200 to 3400v systems

2 To establish electrical data for your selected voltage, if other than listed voltage, use the following formula:

$$\text{RLA} = \text{listed RLA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$\text{OLTA} = \text{listed OLTA} \times \frac{\text{listed voltage}}{\text{selected voltage}}$$

$$\text{LRA} = \text{listed LRA} \times \frac{\text{selected voltage}}{\text{listed voltage}}$$

EXAMPLE: Find the rated load amperage for a motor listed at 1 14 amps per kW input and 550 volts

$$\text{RLA} = 1\ 14 \times \frac{575}{550} = 1\ 19$$

ITEM	RATING HP	DESIGN CENTER VOLTAGE	SUPPLY V-PH-HZ	RLA	LRA
OIL PUMP 19DK	1/2	230	220/240-3-50	2 04	6 0
	1/2	410	380/440-3-50	1 0	6 0
	1/2	220	200/240-3-60	1 8	13 0
	1/2	460	440/480-3-60	95	6 5
	1/2	575	550/600-3-60	.76	4.73
PURGE PUMP 19DK	—	—	115-1-50/60	4 4	—

Control Transformer Requirements*

MODEL 19DK	
Control Circuit Inrush va Sealed va	 4630 1540
Oil Heater Inrush va Sealed va	 1000 —

*15-amp lighting circuit can be used instead of transformer

NOTES:
1 115-volt control supply requirements listed above provide for ESP options, 3 pilot relays, one 1CR relay and the purge unit
2 Oil heater must be on separate circuit providing continuous service

Compressor motor controllers

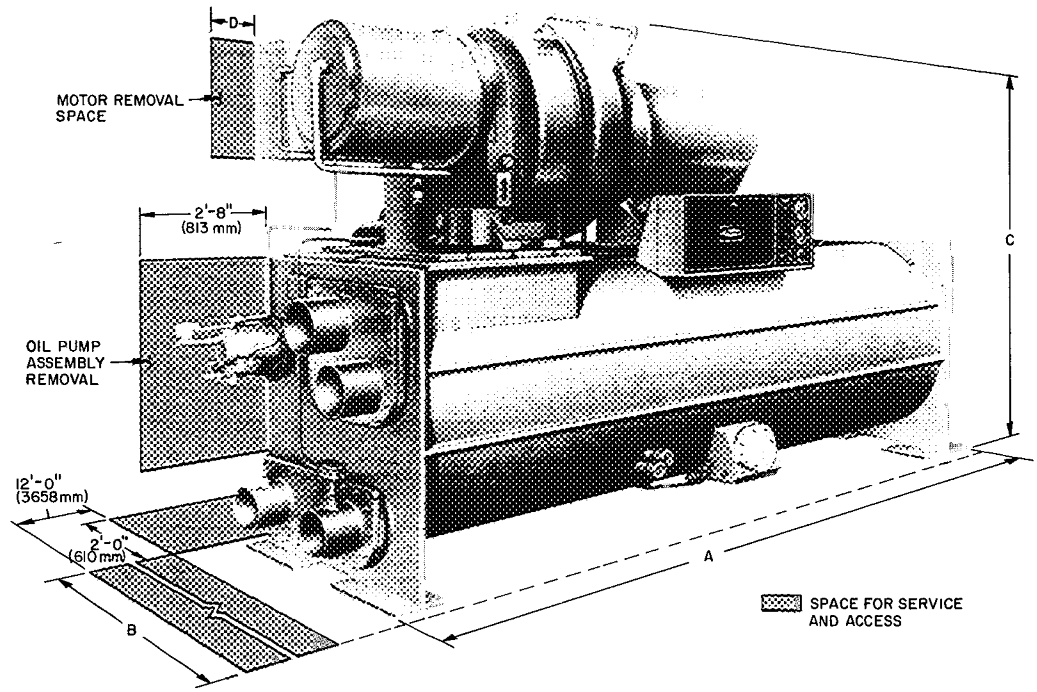
Compressor motors as well as controls and accessories require the use of starting equipment systems specifically designed for 19 Series chillers. Refer to Application Data, Starting Equipment publications or consult Carrier regarding design information for selection of controllers

Capacitors/power factors

Power factor considerations may indicate use of capacitors. Properly sized capacitors improve power factors especially at part load Contact Syracuse for further information on power factors.

19DK Hermetic Centrifugal Liquid Chiller

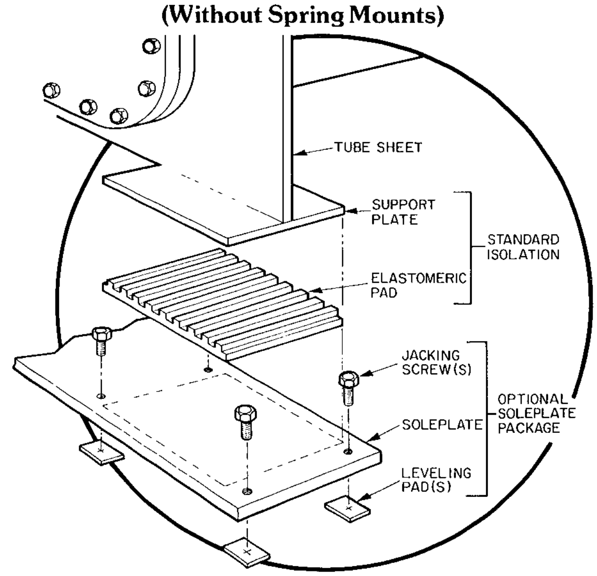
Dimensions



Recommended clearance: Allow 2'-0" (610 mm) minimum vertical and horizontal clearance

Certified Dimension Drawings available on request

Typical Isolation Assemblies (Without Spring Mounts)



Service Clearance for Motors

DESIGN CENTER VOLTAGES	SIZE			CLEARANCE D	
	Unishell	Compressor	Motor	ft-in.	mm
208,230,346, 380,400, 460,575	42 through 65	112 through 168	AA through AE	1-11	585
	50 through 78	172 through 258	AE		
			CB through CL	2-1	635
	61 through 78	282 through 408	CD through CQ		
2400,3000, 3300,4160	50 through 78	172 through 258	CA through CL	2-1	635
	61 through 78	282 through 408	CD through CQ		

NOTE: Service access should be provided per ANSI Standard B9 1, NFPA 70 (NEC) and local safety codes Clear space adequate for inspection, servicing and rigging of all major components of the chiller is required

UNISHELL SIZES 19DK	DIMENSIONS						NOZZLE SIZE (in.)							
	Length* A		Width B		Height C		Cooler Passes				Condenser Passes			
	ft-in.	mm	ft-in.	mm	ft-in.	mm	1	2	3	4	1	2	3	4
42,44,46	14-4	4369	3-8	1118	6-5	1956	6	4	—	—	8	6	—	—
50,51,53, 55,57	14-4	4369	3-8	1118	6-11	2108	8	6	6	—	8	6	4	—
61,63,65	14-4	4369	4-6	1372	8-1	2464	8	6	6	6	10	8	6	6
71,72,73	14-4	4369	5-0	1524	8-10	2692	10	8	8	6	10	8	6	6
76,77,78	14-6	4420	5-0	1524	8-10	2692	12	8	8	6	12	10	8	6

*Length shown is chiller with nozzles on drive end only For length with nozzles on both ends, add 2 in (51 mm)

Physical data

Compressor Weights*

COMPRESSOR SIZE	ASSEMBLY (Less Motor) lb	ASSEMBLY (Less Motor) kg
112 — 168	1460	662
172 — 258	2060	934
282 — 408	2910	1320

*Net weights may vary from those listed by ±5% depending upon casting process For total compressor weight, add applicable motor weight (see Motor Weight table)

Motor Compressor Combinations

MOTOR SIZE	USED WITH COMPRESSOR
AA through AD	112 through 168
AE	112 through 258
CA through CL	172 through 258
CD through CQ	282 through 408

Motor Weights*

MOTOR SIZE	TOTAL WEIGHT lb	TOTAL WEIGHT kg	ROTOR WEIGHT lb	ROTOR WEIGHT kg	MOTOR END BELL lb	MOTOR END BELL kg
AA	520	236	110	50		
AB	530	240	115	52	70	32
AC	540	245	120	54		
AD	580	263	130	59	70	32
AE	610	277	140	64	70	32
CA	920	417	170	77	90	41
CB	940	426	170	77		
CC	980	445	180	82	90	41
CD	1020	463	190	86		
CE	1060	481	200	91		
CL	1100	499	210	95	90	41
CM	1130	513	220	100		
CN	1190	540	230	104		
CP	1210	549	230	104	90	41
CQ	1240	562	240	109		

*Listed weights are for low-voltage (200 through 600-v) motors To calculate the weight of high-voltage motors, add 200 lb (91 kg) to size CA through CD total weight, and add 150 lb (68 kg) to size CE through CQ total weight

Machine and Heat Exchanger Weights

UNISHELL SIZE	MACHINE TOTAL WEIGHT Operating lb	Operating kg	Rigging lb	Rigging kg	MACHINE CHARGE Refrigerant* lb	Refrigerant* kg	Water lb	Water kg	HEAT EXCHANGER WEIGHT lb	kg	WATER BOX COVER Cooler lb	Cooler kg	Condenser lb	Condenser kg
42	9,136	4 144	8,276	3 754	500	227	360	163	6,126	2 779				
44	9,281	4 210	8,376	3 799	525	238	380	172	6,206	2 815	53	24	76	34
46	9,446	4 285	8,476	3 845	550	249	420	191	6,326	2 869				
50	10,961	4 972	9,856	4 471	575	261	530	240	6,556	2 974				
51	11,191	5 076	10,056	4 561	575	261	560	254	6,756	3 064				
53	11,456	5 196	10,256	4 652	600	272	600	272	6,956	3 155	73	33	76	34
55	11,716	5 314	10,456	4 743	625	283	635	288	7,156	3 246				
57	11,971	5 430	10,656	4 833	625	283	690	313	7,356	3 337				
61	15,412	6 990	13,652	6 192	775	352	985	447	9,352	4 242				
63	15,792	7 163	13,952	6 328	810	367	1,030	467	9,602	4,355	123	56	137	62
65	16,122	7 312	14,152	6 419	850	386	1,120	508	9,852	4 468				
71	17,693	8 025	15,578	7 066	975	442	1,140	517	11,278	5 115	138	63	137	62
72	17,953	8 143	15,778	7 157	985	447	1,190	540	11,478	5 206	138	63	137	62
73	18,338	8 318	16,078	7 293	1,010	458	1,250	567	11,678	5 297	138	63	137	62
76	19,078	8 653	16,578	7 519	1,100	499	1,400	635	12,348	5 601	208	94	268	122
77	19,648	8 912	17,978	7 701	1,150	522	1,520	689	12,698	5 760	208	94	268	122
78	20,108	9 121	17,278	7 837	1,200	544	1,630	739	13,058	5 923	208	94	268	122

***Refrigerant Charge** — The refrigerant weight listed is the charge required for optimum machine performance at nominal conditions of 44 F (7 C) leaving chilled water, 95 F (35 C) leaving condenser water and maximum machine tons The amount of refrigerant shipped with the machine exceeds the amount required at these conditions. Therefore, do not charge the full quantity without observing machine performance to determine the exact amount needed

19DK
Hermetic Centrifugal Liquid Chiller

Application data

Range of application

The 19DK refrigeration machine is designed for standard water chilling applications using Refrigerant-11.

ASME stamping

All 19DK heat exchangers are constructed in accordance with the ANSI/ASHRAE 15-1978 Safety Code for Mechanical Refrigeration. This code, in turn, requires conformance with the ASME Code for Unfired Pressure Vessels wherever applicable

The heat exchangers have water-side volumes less than 120 gallons (454 L), and refrigerant-side design pressures of not more than 15 psig (103 kPa). The unit is, therefore, exempt from the ASME code requirements and is not stamped.

Design pressures

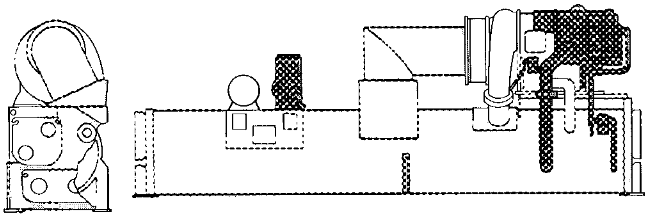
Design and test pressures for 19DK unishell heat exchangers are listed below.

Design and Test Pressures

PRESSURES	SHELL SIDE (Refrigerant)		TUBE SIDE (Water)	
	psi	kPa	psi	kPa
Design	15	103	150	1034
Hydrostatic Test	—		225	1551
Air Test	30	207	—	

Unishell Material Specifications

ITEM	MATERIAL	SPECIFICATION
Shell Water Box Shell Water Box Flange Water Box Cover Tube Sheet Tube Support Sheet	HR Steel	ASME SA285 Grade C
Tubes	Finned Copper	ASME SB359



STANDARD FACTORY INSULATION
EXTRA AVAILABLE FACTORY INSULATION

Insulation Requirements

UNISHELL SIZE	EXTRA INSULATION	
	ft²	m²
42-57	130	12 08
61-65	213	19 79
71-78	218	20.25

Insulation

Standard insulation — The compressor motor and purge condensing chamber are factory insulated The insulation applied at the factory is 3/4 in. (19.0 mm) thick and has a thermal conductivity K value of 0.28 Btu • in./hr • ft^2 • °F (0.0404 W/m • °C). Insulation conforms with UL Standard 94. Classification 94HBF.

Additional factory insulation (when ordered) — The suction elbow and the evaporator portion of the unishell are factory insulated if specified.

Insulation at jobsite — As indicated in Condensation vs Relative Humidity table, the factory insulation provides excellent protection against condensation under most operating conditions. If temperatures in the equipment area exceed the maximum design conditions, extra insulation is recommended and is available at customer request as shown in Insulation Requirements table.

If the cooler and the suction elbow are to be field insulated, obtain the approximate areas from Insulation drawing.

Insulation of water box covers is made only in the field and this area is not included in Insulation table When insulating the covers, allow for service access and removal of covers.

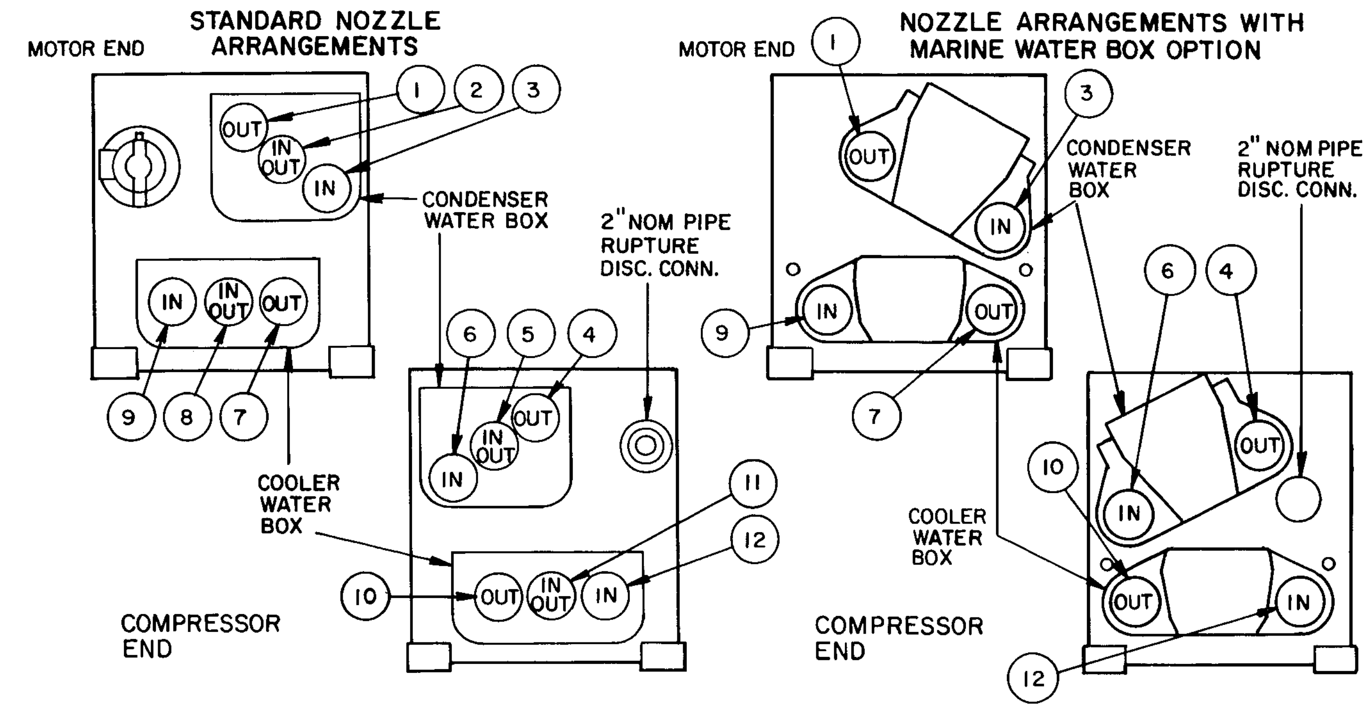
Condensation vs Relative Humidity*

AMOUNT OF CONDENSATION	ROOM DRY-BULB TEMP		
	80 F (27 C)	90 F (32 C)	100 F (38 C)
	%Relative Humidity		
None	80	76	70
Slight	87	84	77
Extensive	94	91	84

*These approximate figures are based on 35 F (1 7 C) saturated suction temperature A 2 F (1 1 C) change in saturated suction temperature changes the relative humidity values by 1% in the same direction

Application data (cont)

Nozzle Arrangements



COOLER NOZZLE NO.			ARR
Pass	In	Out	
1*	11	8	P
	8	11	Q
2	12	10	R
	9	7	S
3	12	7	T
	9	10	U
4†	12	10	H
	9	7	J

CONDENSER NOZZLE NO.			ARR
Pass	In	Out	
1*	2	5	W
	5	2	X
2	6	4	A
	3	1	B
3	3	4	C
	6	1	D
4†	6	4	E
	3	1	F

*1-pass not available for marine water box option
†4-pass available on 61 through 78 Size unishells only

Complete nozzle arrangement consists of the cooler arrangement followed by the condenser arrangement For example:

2-pass cooler with leaving nozzle Number 10	= arr R
1-pass condenser with leaving nozzle Number 2	= arr X
Complete nozzle arrangement	= RX

Vent and drain connections — With the exception of the cooler vent connection, located in the water box shell, all vent and drain connections are found in the water box covers. Connection size is 3/4-in. FPT.

Provide high points of the machine piping system with vents and the low points with drains. If shutoff valves are provided in the main water pipes near the unit, a minimum amount of system water is lost when the heat exchangers are drained. This reduces the time required for drainage and saves on the cost of re-treating the system water.

It is recommended that pressure gages be provided at points of entering and leaving water to measure pressure drop through the heat exchanger. Gages may be installed as shown in Pressure Gage Location table. Pressure gages installed at the vent and drain connections do not include nozzle pressure losses.

Use a reliable manometer to measure pressure differential when determining water flow. Regular gages are insensitive and do not provide accurate measurement of flow conditions.

Pressure Gage Location

NUMBER OF PASSES	GAGE LOCATION (Cooler or Condenser)
1 and 3	One gage in each water box
2 and 4	Two gages in water box with nozzles

Oil cooler water supply — City water or system chilled water may be used. If city water is used, it must be clean and noncorrosive. *Water-side erosion or corrosion of the oil cooler coil can lead to extensive machine damage not covered by the standard warranty.*

In addition to being clean and noncorrosive, oil cooler water must meet the following requirements:

Application data (cont)

Max inlet temperature .... 85 F (29 C)
Max inlet working pressure ...... 200 psi (1379 kPa)
Velocity in tube, fps (m/s) .... 10 max — 6 min (3.0 max — 1.8 min)
Flow, gpm (L/s) .... 7 max — 4 min (26.5 max — 15.1 min)
Pressure drop, psi (kPa) diff .... 5 max — 2 min (34.5 max — 13.8 min)

A factory-supplied solenoid valve and a 1/2-in FPT plug valve are provided at the oil cooler water inlet. The plug valve permits manual regulation of oil cooler water flow for close control of oil temperature. The solenoid valve permits the start and stop of oil cooler water flow.

If chilled water is used as the oil cooling medium, it enters oil cooler from the entering water of machine cooler, and drains from oil cooler into the leaving water of machine cooler. Place drain connection downstream from chilled water control element so that oil cooler water does not affect temperature readings.

If machine has a single-pass cooler, it is advisable to pipe oil cooler drain into suction side of the chilled water pump to ensure adequate pressure drop through the oil cooler.

Thermometers

The 19DK has thermowells provided for use in measuring refrigerant temperature. One well is located in the high temperature side (condenser), and one in the flash subcooler drain.

Thermometers (field supplied) should have a temperature range of 0°F to 200 F (-18 C to 93 C).

Thermometers for measuring chilled water and condensing water temperatures are field purchased, as required, for individual jobs. It is recommended that thermometer wells be provided in cooler and condenser water piping. Wells in the leaving water pipes should be 6 to 10 pipe diameters from the water boxes. This provides sufficient distance for complete mixing of water as it leaves the heat exchanger tubes. Extend thermometers into pipe at least 2 inches (51 mm).

Relief devices

19DK machines are furnished with a rupture disc assembly. In accordance with ASME requirements, the rupture disc is certified to burst within 5% of design bursting pressure. If local codes require other relief devices such as relief valves, they must be furnished in the field.

The total volume of the unishell (cooler and condenser together) has been taken into account in sizing the rupture disc assembly since the cooler is not isolated from the condenser.

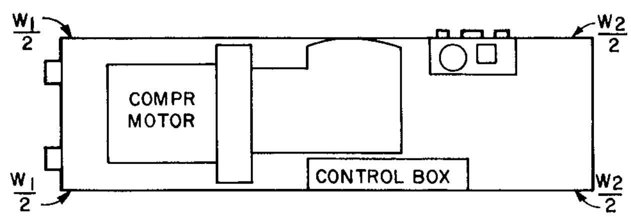
See table below for the maximum allowable equivalent length of discharge pipe from rupture disc to atmosphere. Do not use pipe sizes smaller than the rupture disc exit fitting.

Vent relief device to outdoors in accordance with the ANSI safety code and all other codes applicable to mechanical refrigeration. *Refrigerant discharged from a safety device can displace oxygen in closed spaces and cause asphyxiation.*

Refrigeration log

The Carrier log sheet provides a convenient check list for routine maintenance and forms a continuing record of machine performance. It is an aid in scheduling maintenance and in diagnosing machine problems. The log sheet for 19 Series machines is available from Carrier.

Operating Weight Distribution



UNISHELL SIZE	TOTAL OPER WEIGHT		WEIGHT DISTRIBUTION*			
			W1		W2	
	lb	kg	lb	kg	lb	kg
42	9,136	4 144	4,928	2 235	4,208	1 909
44	9,281	4 210	5,128	2 326	4,153	1 884
46	9,446	4 285	5,328	2 417	4,118	1 868
50	10,961	4 972	6,168	2 798	4,793	2 174
51	11,191	5 076	6,373	2 891	4,818	2 185
53	11,456	5 196	6,518	2 956	4,938	2 240
55	11,716	5 314	6,663	3 022	5,053	2 292
57	11,971	5 430	6,813	3 090	5,158	2 340
61	15,412	6 990	8,791	3 988	6,621	3 002
63	15,792	7 163	8,996	4 081	6,796	3 082
65	16,122	7 312	9,186	4 167	6,936	3 145
71	17,693	8 025	10,104	4 583	7,589	3 442
72	17,953	8 143	10,249	4 649	7,704	3 494
73	18,338	8 318	10,469	4 749	8,869	3 569
76	19,078	8 653	10,789	4 894	8,289	3 760
77	19,648	8 912	11,069	5 021	8,580	3 891
78	20,108	9 121	11,389	5 166	8,719	3 955

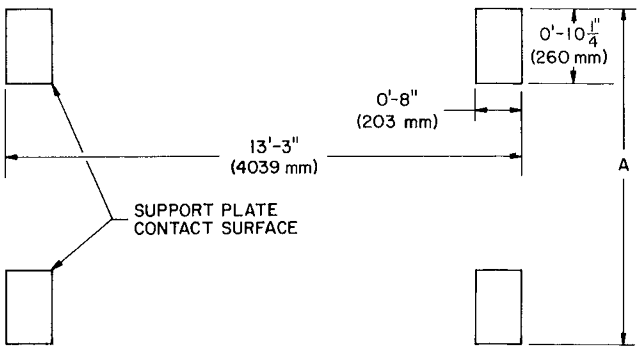
*W1 is the weight resting on the compressor motor end support plates W2 is the weight resting on the support plates at the end opposite the compressor motor

Maximum Allowable Equivalent Length of Discharge Pipe

UNISHELL SIZE	RUPTURE DISC NOMINAL SIZE	REQUIRED AIR DISCHARGE CAPACITY		SCHEDULE 40 PIPE SIZE (in.)					
				2		3		4	
				Maximum Allowable Equivalent Pipe Length					
		lb/min	kg/min	ft	m	ft	m	ft	m
42 — 57	2	38.6	17.5	12	3.66	100	30.5	390	118.9
61 — 65	3	50.5	22.9	8	2.44	59	18.0	238	72.5
71 — 78	3	58.5	26.5	6	1.83	44	13.4	170	51.8

Application data (cont)

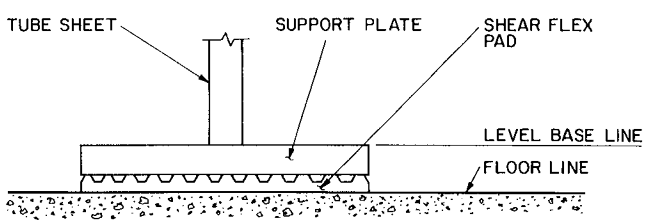
Standard Contact Surfaces



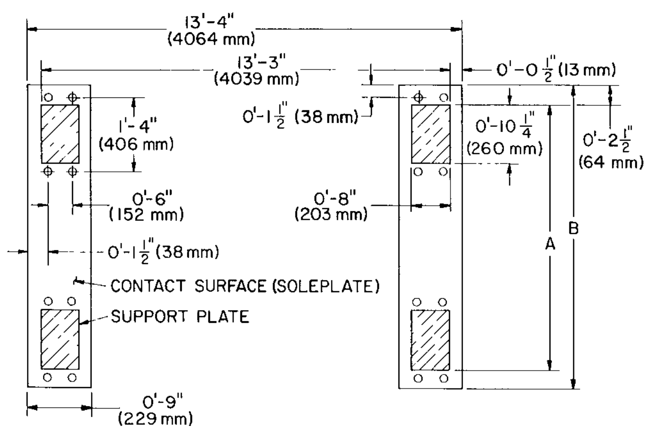
UNISHELL SIZE*	DIMENSION A	
	ft-in.	mm
42 — 57	3-0	914
61 — 65	3-10	1168
66 — 78	4-6½	1384

*See machine informative plate

Standard Isolation



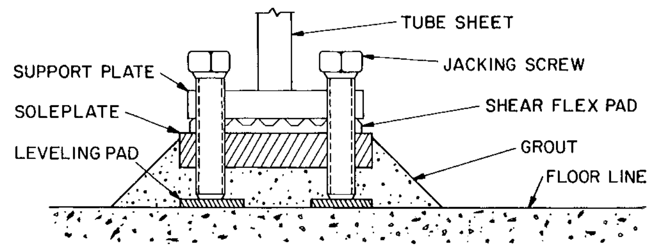
Contact Surfaces With Soleplates



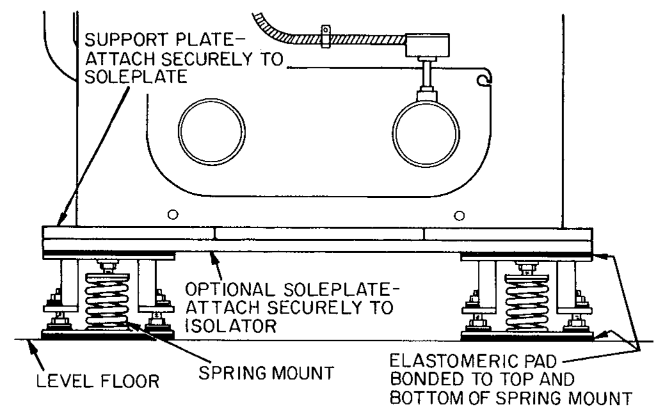
UNISHELL SIZE*	DIMENSIONS			
	A		B	
	ft-in.	mm	ft-in	mm
42 — 57	3-0	914	3-5	1041
61 — 65	3-10	1168	4-3	1295
66 — 78	4-6½	1384	4-11½	1511

*See machine informative plate

Machine Isolation With Soleplate Package



Typical Spring Isolation



Standard isolation — All 19DK machines are supplied with 4 elastomeric pads of resilient cross-ribbed neoprene and 4 steel support plates that provide vibration isolation.

Optional isolation — When ordered, a soleplate package, containing 2 soleplates, 16 leveling pads and jacking screws, is shipped with the unit. The package is used in conjunction with the standard isolation.

Spring isolation — Certain critical machine locations may require a greater degree of vibration isolation than that provided by standard arrangements. Generally, spring isolation mounts are used in such situations. When required, mounts are field selected for the desired degree of isolation and are furnished and installed by others.

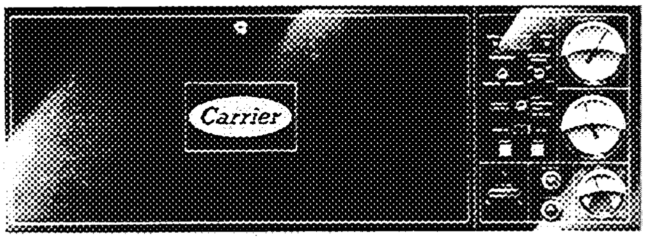
While spring isolators may be placed directly under the support plates, soleplates provide a broader support base, increase unit stability, and decrease the natural (bounding) frequency of the unit. For individual spring loadings, divide W1 and W2 by 2 (see Operating Weight Distribution table).

When applying isolators, securely fasten soleplates to the heat exchanger. If bolts are used for this purpose, drill or tap soleplates, as required, in the field.

Spring isolation requires that special consideration be given to the support and isolation of the system piping Refer to Carrier System Design Manual for general system piping information. Also, contact an experienced, responsible local organization for detailed information on a specific installation.

Basic microprocessor controls

Purpose: To provide the safety, interlock, capacity control and indications necessary to operate the chiller in a safe and efficient manner



Basic Microprocessor Control Panel

Control system — The microprocessor control on each Carrier centrifugal chiller is factory mounted, wired and tested to assure machine protection and efficient capacity control In addition, the program logic assures proper starting, stopping and recycling of the machine.

The capacity control system is fully automatic, using the microprocessor for precise control of machine capacity at optimized efficiency for all load conditions.

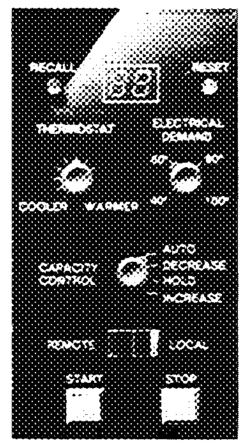
The operating capacity of each chiller is matched directly with the need for cooling As cooling needs change, guide vanes in the refrigerant vapor stream entering the compressor change position to maintain the selected chilled water (brine) temperature.

The changes in vane position are initiated by a thermistor located in the leaving chilled water nozzle This probe constantly relays any variations in water temperature to the microprocessor. The microprocessor causes the guide vane actuator to adjust the guide vane position as required.

If the chilled water temperature drops below the selected design temperature by more than the dead band (adjustable ± 0.5 to ± 1.0 degrees F, ± 0.27 to ± 0.54 degrees C), the guide vane actuator moves the guide vanes toward a closed position; the rate of refrigerant evaporation slows and chiller capacity decreases. A rise in chilled water temperature above the set point causes the actuator to move the vanes toward a more open position. Refrigerant begins to evaporate at a more rapid rate and chiller capacity increases.

Built-in overrides in the capacity control system prevent motor overload. When motor full load current is reached, the guide vanes stop opening immediately. If motor current continues to increase, the guide vanes begin to close until motor current is reduced.

To minimize start-up current demand, the soft loading feature is employed. This feature loads the machine/motor in a pre-programmed, gradual manner. This prevents any costly power demand spikes which might otherwise occur during initial loop pull down.



Close-Up View of Basic Microprocessor Control Panel

Equipment self-diagnostic check

It is recommended that, at initial start-up, the chiller self-diagnostic check be executed. The control panel must be placed in local mode. The moment power is applied to the control it is in an initialization mode for the first 2 minutes. Any time during this initial 2-minute period, or within 2 minutes after a power-on-reset (POR), the RESET button (located on the face of the panel) may be depressed. This action puts the equipment into the self-diagnostic check, which consists of 34 tests. (Details of this test are available in the product Application Data, available from your Carrier salesperson.)

After the tests have been completed, depress the POR button again and the machine is now ready to start.

19DK Hermetic Centrifugal Liquid Chiller

Features

Safety Cutouts:

Bearing High Temperature
Motor High Temperature*
Refrigerant (Condenser) High Pressure
Refrigerant (Cooler) Low Temperature*
Lube Oil Low Pressure
Compressor (Refrigerant) Discharge Temperature
Under Voltage
Over Voltage
Oil Pump Motor Overload
Cooler and Condenser Water Flow†
Motor Overload
Motor Acceleration Time
Intermittent Power Loss

Capacity Control:

Leaving Chilled Water Control*
Guide Vane Actuator Module
Manual — Power (Demand) Limiter
Manual — Chilled Water Reset

Interlocks:

Manual/Automatic Remote Start

Starting/Stopping Sequence

- Pre-Lube/Post-Lube
- Pre-Flow/Post-Flow
- Compressor Starter Interlock
- Soft Loading Interlock
- Oil Cooler Water Flow Solenoid

Current Limiter*
Pre-Start Check of Sensors Status
Low Chilled Water (Load) Recycle
Monitor-Number Compressor Starts
Manual Reset of Safeties
Purge Malfunction Override

Indication:

Chiller Operating Status
Power-on
Pre-Start Diagnostic Check
Compressor Motor Amps
Pre-Alarm*‡
Alarm
Contact for Remote Alarm
Safety Shutdown Code
Elapsed Time (Hours of Operation)

*Override protection: Causes compressor to first unload automatically and then, if necessary, shutdown.
†Required: Field or factory supplied (installed at jobsite).
‡By display code only.

ESP — expanded services panel

Purpose: To enhance the operation capabilities of the chiller and satisfy several requirements demanded by the industry.

The ESP can be mounted in the machine control panel, or remotely, as the owner sees fit.

It provides:

Remote indication:

- Chiller operating status
- Shutdown codes
- Key operating parameters
- Self-diagnostics

Keypad Programming capabilities of:

Leaving chilled water temperature

Reset of chilled water temperature from:

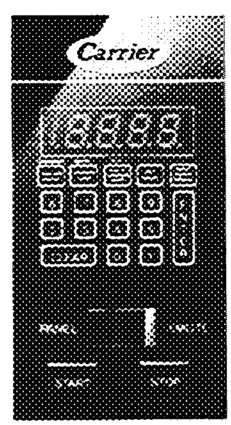
- Return chilled water temperature (maintains constant return chilled water temperature)
- EMS, building management system, (4-20 mA) or (1-5 Vdc)
- Remote temperature (i.e , outside air, supply air)
- Load on chiller

Power demand limit

Reset of power demand limit from:

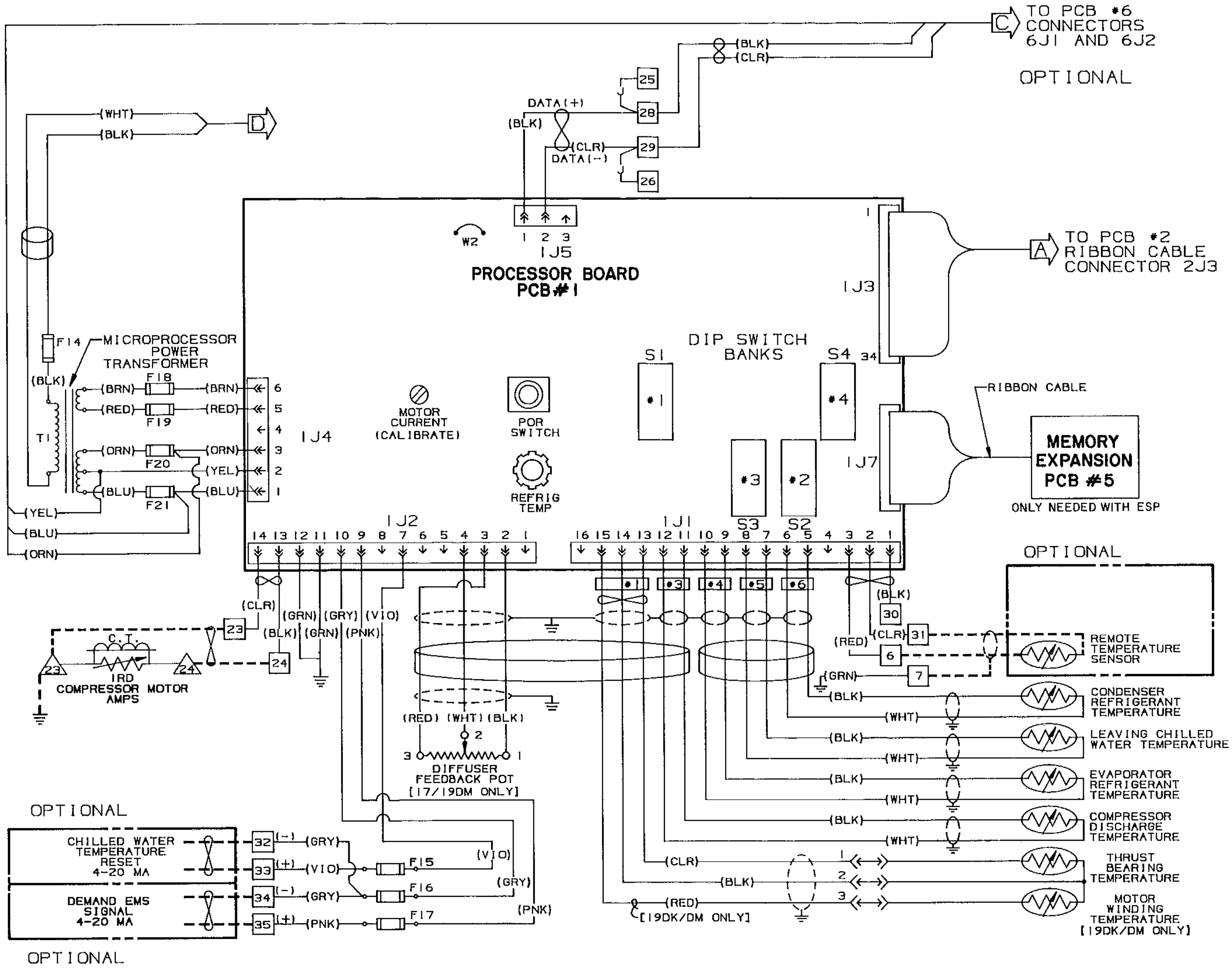
- Stepped-position contact closure (80/60/40% selectable)
- EMS, building management system; (4-20 mA) or (1-5 Vdc)

Lead-lag operation and control



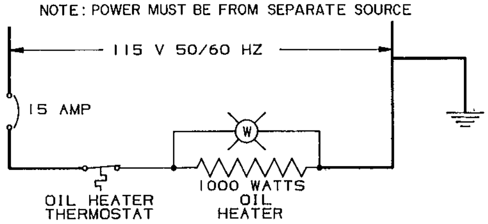
Expanded Services Panel

Typical schematic

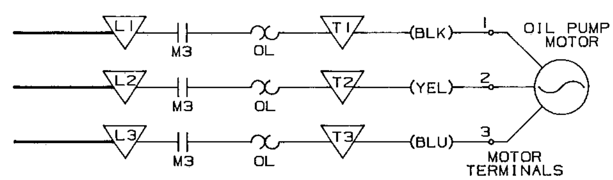


OIL HEATER

NOTE: POWER MUST BE FROM SEPARATE SOURCE



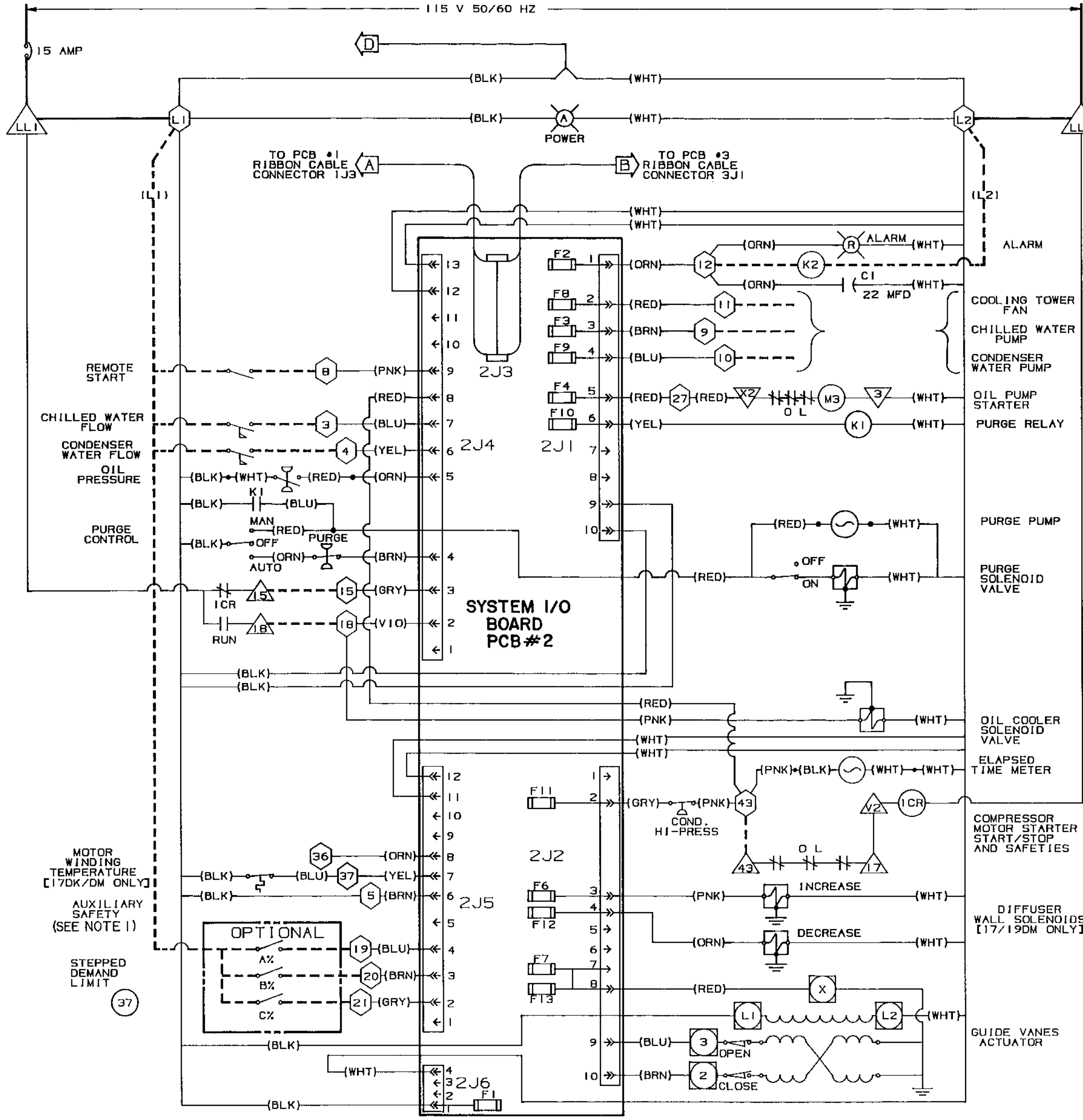
OIL PUMP STARTER CIRCUIT

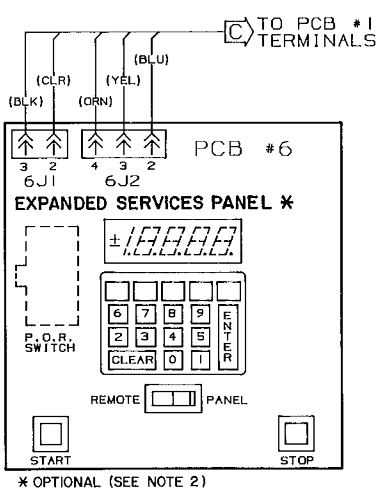


LEGEND

- POWER WIRING – FIELD
- STARTER WIRING – FACTORY
- CONTROL WIRING – FIELD
- CONTROL WIRING – FACTORY
- WIRE NUT
- TWISTED PAIR CABLE
- SHIELDED CABLE
- SWITCH OR DRY CONTACT
- CONTROL PANEL TERMINAL, 115 VOLTS
- CONTROL PANEL TERMINAL, 5 VOLTS
- COMPRESSOR MOTOR STARTER TERMINAL
- HGBP TEMPERATURE SWITCH TERMINAL
- GUIDE VANE ACTUATOR TERMINAL
- OIL PUMP STARTER TERMINAL

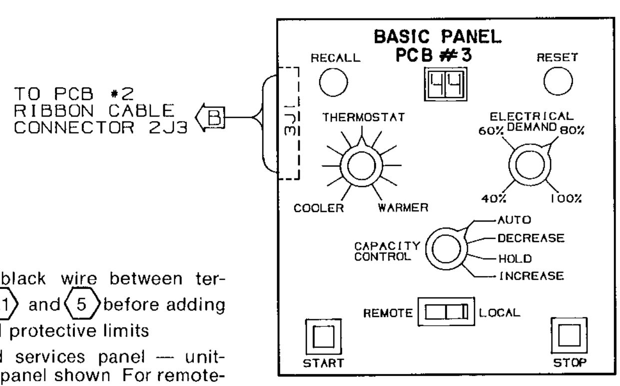
Typical schematic (cont)





* OPTIONAL (SEE NOTE 2)

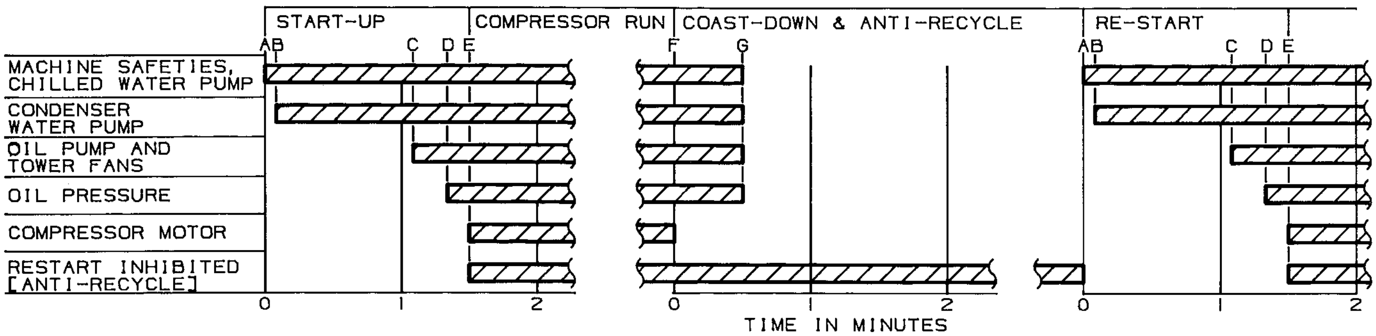
TO PCB #2 RIBBON CABLE CONNECTOR 2J3



NOTES:

1. Remove black wire between terminals L1 and 5 before adding additional protective limits
2. Expanded services panel — unit-mounted panel shown For remote-mounted panel, see certified prints

Control sequence



A = START INITIATED, SAFETIES CHECKED CHILLED WATER PUMP STARTED
B = CONDENSER WATER PUMP STARTED [5 SEC. AFTER A]
C = CONTROLLER VERIFIES WATER FLOW. TOWER FANS AND OIL PUMP STARTED. [MINIMUM 1 MINUTE-MAXIMUM 5 MINUTES AFTER B]
D = OIL PRESSURE VERIFIED [WITHIN 15 SEC. AFTER C]
E = COMPRESSOR STARTS [10 SEC. AFTER D]
F = SHUT-DOWN INITIATED, COMPRESSOR STOPS.
G = OIL PUMP, EVAPORATOR & CONDENSER PUMPS AND TOWER FAN DE-ENERGIZED, EXCEPT WHEN STARTER CONTACTS WELDED [30 SEC. AFTER F]
E TO A [START TO START]= 15 MINUTES MINIMUM
F TO A [STOP TO START] = 3 MINUTES MINIMUM

To start: Push Start Button — Start initiated; all safeties are checked to see that they are satisfied (if one is not, an indication of the fault will be displayed and the start aborted). The signal is sent to start chilled water pump.

After 5 seconds, the signal is sent to start the condenser water pump and the tower fans.

The microprocessor then puts the start on hold It checks that water flows are established. If satisfied, it will send the signal to start the oil pump If not satisfied, it will continue to monitor water flows for a maximum of 5 minutes. If water flows are established within the 5 minutes, the microprocessor will send the signal to start the oil pump; if not, it will abort the start and give an indication of the reason.

Ten seconds after oil pressure is satisfied, the microprocessor sends a signal to the starter to start the compressor motor. If oil pressure is not satisfied, it will again abort the start and give an indication of the reason.

Once started the microprocessor initializes the primary restart protection (15 minutes — start to start). It monitors the motor acceleration time and if it is excessive, aborts the start. If the starter fails to transition again, the start is aborted. Once the starter transitions, it goes into its capacity control mode.

To stop: Push Stop Button — Signal sent to de-energize compressor motor.

The microprocessor ensures that the power to the compressor motor is off, and after 30 seconds sends signals to de-energize the oil pump, the chilled water and condenser water pumps and the tower fan. (If for some reason the power to the compressor motor remained on, the auxiliaries would be kept running.)

The microprocessor then initializes the secondary restart protection (3 minutes — stop to start), logs the reason for the stop into memory (if it was a safety shutdown) and recycles itself to be ready for the next start.

Guide specifications

Performance — Chillers shall be selected to meet performance requirements as indicated in the equipment schedule.

Chiller performance shall be rated in accordance with the latest edition of ARI Standard 550.

Full load operation of the motor shall not exceed nameplate ratings. Electrical power shall be supplied to the machine at the voltage, phase and hertz listed in the equipment schedule.

Chiller shall consist of motor, compressor, lube system, cooler, condenser, factory-assembled purge unit, isolation and microprocessor control. An initial charge of refrigerant and oil shall be furnished.

The chillers shall be shipped factory assembled with all refrigerant piping and control wiring factory installed.

If chillers using higher pressure refrigerant than R-11 are submitted, a refrigerant pumpout system shall be installed including refrigerant storage vessel (external to unit shells) sufficient to hold entire charge; pumpdown compressor and drive; piping; wiring; and starter. For multiple units, a single pumpout system of sufficient capacity for the largest unit may be used.

Machines operating on R-11 shall be charged at jobsite.

Refrigerant flow control shall be by means of a positive metering device either float or pressure operated.

Guide specifications (cont)

Chillers shall bear permanently attached metal plates that state name of manufacturer, chiller unit model number, compressor type, and refrigerant used

Compressor shall be of high performance single-stage hermetic design. Motor, transmission, and compressor shall be hermetically sealed into a common assembly, and arranged for easy servicing. Babbit-lined journal bearings shall be pressure lubricated.

Compressor transmission gears shall be of the double-helical type and must be arranged for visual inspection without disassembly or removal of compressor casing or impeller. Motor stator shall be arranged for service with only minor compressor disassembly and without requiring the breaking of main refrigerant piping connections. Impellers shall be over-speed tested by manufacturer to a minimum of 20% above operating conditions.

Compressor shall be provided with a factory-installed lubrication system to deliver oil under pressure to bearings and gears. System shall be complete with hermetic motor-driven oil pump, oil cooler, pressure regulator, oil filter, oil pump starter, automatic water control valve, thermostatically controlled oil heater, and reservoir oil temperature gage. Oil pump shall be energized prior to chiller motor energization. Oil pump starter shall be factory supplied and mounted on the chiller and factory wired with only field power leads required. Oil pump controls to have delayed action so that oil pressure is provided during machine coastdown. Oil pump is to be provided with a separate 460-, 220- or 575-volt, 3-phase, 60-Hz power source (230- or 410-volts, 3-phase, 50-Hz power source). When oil pump starters are not factory mounted, all required extra field mounting and wiring is to be done at no cost to the owner.

Oil pump shall have momentary switches to permit manual operation of the pump when the compressor is not operating.

Compressor motor shall be of the single-speed, non-reversing squirrel cage induction type and shall be suitable for voltage as shown on the equipment schedule The design speed shall be 3550 rpm at 60 Hz (or 2950 rpm at 50 Hz). The motor shall be suitable for operating in a refrigerant atmosphere. Compressor motor to be cooled by atomized subcooled refrigerant in contact with the motor windings. Motor stator shall be arranged for service or removal without complete compressor disassembly or breaking of main refrigerant piping connections Full load operation of the motor shall not exceed nameplate rating. Low-voltage motors shall be built for connection to Star-Delta type reduced inrush starter.

Cooler and condenser shall be of unishell (single vessel) construction, fabricated with high performance finned copper tubing rolled into tube sheets and individually replaceable, provided with water boxes having drains and vents with covers to permit tube cleaning within the space shown on the drawings.

Water box and nozzle connections shall be designed for 150 psig (1034 kpag) maximum working pressure, unless otherwise noted.

When the water side will contain water of 120 gallons (454 L) or more (including tubes and both water boxes), the vessel shall display an ASME nameplate which shows pressure and temperature data and the "U" stamp for Section VIII, Division 1.

Suitable tapping shall be provided in water boxes and nozzles for control sensor, gages and thermometers.

High efficiency, externally finned and internally enhanced tubing shall be .028 in. (22 gage) (0.71 mm) wall thickness measured at the root of the fins.

Evaporator shall be of such design to prevent liquid refrigerant from entering the compressor Devices that introduce pressure losses (such as eliminators) are not acceptable; these devices are subject to structural failures resulting in compressor damage requiring extensive repair.

Tubes shall be removable from either end of the heat exchanger without affecting strength and durability of the tube sheet and without causing leakage at adjacent tubes

An economizer shall be provided as part of the assembly to increase cycle efficiency.

Purge systems shall be furnished for chillers operating under vacuum where ambient temperature is 75 F (24 C).

System shall be self-contained thermal type and provided with necessary devices for evacuating air and water vapor from the system and for condensing, separating and returning refrigerant to the system.

Controls shall be electronic microprocessor and fully automatic.

Control system shall provide shutdown for motor overcurrent, over voltage, under voltage, bearing high temperature, low refrigerant temperature, high condenser pressure, high motor temperature, high compressor discharge temperature, and low oil pressure. Each of these controls shall have manual reset feature and cause an alarm indication.

Controls shall provide override condition to automatically reduce load on chiller in the event of high motor temperature and low refrigerant temperature and cause a pre-alarm indication. If condition persists, then the control will shut down the machine.

Controls shall provide low chilled water temperature shutdown with automatic recycling to provide freeze protection at low load.

Capacity control shall be by means of variable inlet guide vanes located in compressor section Load modulation shall be from 100% to 10% full load under normal ARI conditions.

Guide specifications (cont)

Factory-furnished controls shall be pre-wired and pre-piped with connections to a terminal strip for convenience where interlocks to other equipment will be field connected.

Microprocessor system shall include a programmed sequence to meet pre-lube and post-lube, pre-flow and post-flow needs prior to start and during coastdown after machine stop, and to prevent restart until after a safe preset time. When started, the programmed soft load feature is employed to assure smooth pull down of loop temperature to prevent any power demand spikes.

Indication of elapsed time, compressor motor amps, pre-alarm and alarm, power on, failure mode and record of 5 past failure modes, plus a self-diagnostic routine shall be available

Common controls (options available when specifying the Expanded Services Panel [ESP]).

Remote set point shall permit selection and alteration of chilled water temperature from a central EMS, or as a function of return chilled water temperature, remote temperature, or chiller load.

Indicator panel shall provide the chiller operator with instant self-diagnostic capability. Panel shall be located at machine or remote.

Power demand limit shall permit selection of power limit from central EMS or from stepped contact closure of 80/60/40%.

Lead-lag control shall be provided when 2 machines are installed in series or parallel Centralized control panel with the following capabilities shall be provided·

- Parallel operation
- Series operation with common control point
- Two chiller operations
- Uneven sized chillers working together
- Independent control of chillers either manually or automatically
- Reassignment of lead-lag hierarchy
- Automatic standby

Structural supports

(Note to Specifier: select appropriate paragraph)

Chiller manufacturer shall furnish soleplate and isolation pad assembly for mounting and leveling chiller on a concrete base.

or

Contractor shall furnish and install isolation mounts for the chiller as indicated on the drawings.

Insulation

The compressor motor, purge chamber and miscellaneous piping shall be factory insulated by the chiller manufacturer. Optional cooler and suction elbow insulation shall be factory applied or cooler and suction elbow shall be field insulated by contactor.

Insulation shall be 3/4 in. (19 mm) thick, fireproof, and have thermal conductivity not exceeding 0.28 Btu • in./hr • ft^2 • °F (0.0404 W/m • °C).

Cooler water box covers shall be field insulated.

Compressor motor starter

The chiller machine manufacturer shall furnish unit mounted or free-standing Star-Delta closed transition type starter NEMA 1 enclosure. (For voltages above 660 volts, across-the-line type starter shall be furnished free-standing.)

Flow switches

Contractor or manufacturer shall furnish flow switches, to be installed by the contractor in chilled water and condenser water piping of each machine, which make contact when flow is established. Flow switches shall be mounted in horizontal run at least 5 diameters downstream from bend or tee.

Thermometers and gages

Contractor or manufacturer shall furnish a set of four 9-in. adjustable, indicating-type mercury filled thermometers, with separable socket, in glass faced metal cases to be installed by the contractor They shall be placed in the piping adjacent to the machine in the following locations:

1. Condenser water line entering condenser
2. Condenser water line leaving condenser
3. Chilled water line entering cooler.
4. Chilled water line leaving cooler

Thermometer bulb shall project sufficiently into pipe to accurately measure water temperature. Cases shall clear insulation.

Contractor shall provide and install gage valves and gages so that cooler and condenser water pressure difference across these vessels is indicated Gages shall be 4-1/2 dial, indicating at approximate mid-scale point.

Thermometers and gages shall be mounted in a readily accessible location and easily read in a standing position from the equipment room floor

Start-up service for chillers installed in the U.S. and Canada shall be provided by a factory-trained technician employed by the chiller manufacturer who shall leak test, refrigerant pressure test, evacuate, dehydrate, charge, calibrate the controls and start the chiller. For chillers installed elsewhere, manufacturer shall have service representative available for start-up assistance.

Manufacturer's operating and maintenance instruction manual and parts list (minimum of 2 sets for owner) shall be provided.