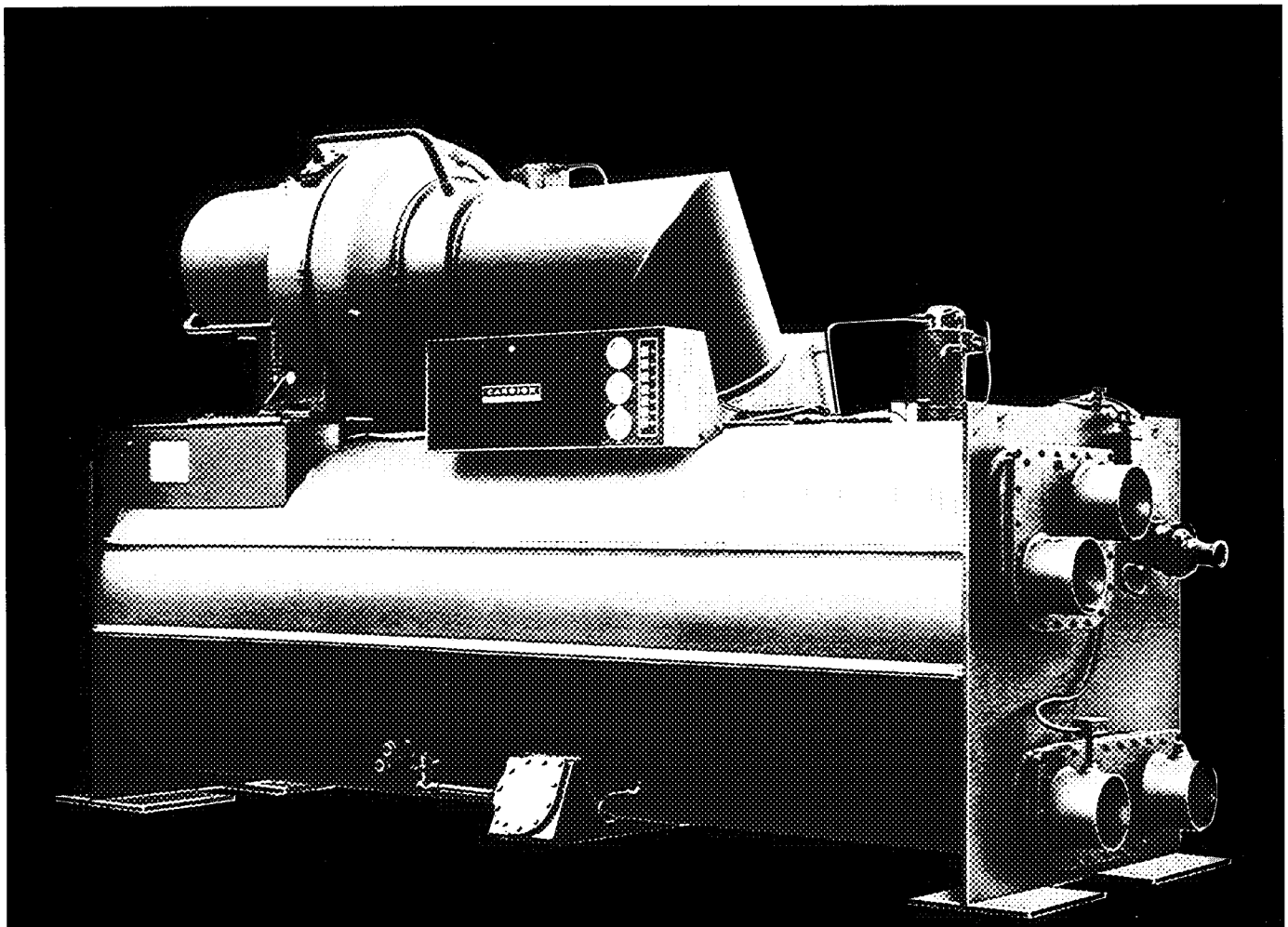
# Carrier
# Packaged Hermetic Centrifugal Liquid Chillers

**19DK**
150—450 Tons



- Proven reliability
- Efficient operation
- Low installation costs
- Reduced lead time

Carrier®

# Superior Design. . .Proven Reliability

Carrier's Design Philosophy is to improve upon existing designs.

The 19DK centrifugal liquid chiller is an excellent example of the superior machine resulting from this approach. Carrier designed the 19DK with the customer's needs in mind. The benefits are *reduced lead time, low installation costs* and *more efficient operation;* backed by Carrier's proven quality and dependability. These improvements save time at installation, minimize maintenance cost, and keep operating costs low — all part of Carrier's plan to provide economical, energy-saving, efficient cooling with minimum maintenance.

### Reduced lead time

- Assembly line production reduces manufacturing time for this high-volume machine (over 1000 units produced per year).
- Pre-scheduled production means an inventory of finished machines is maintained
- Standard lead time is 14 weeks; average lead time only 8 weeks.

### Low installation costs

- The 19DK is shipped as a completely assembled, single piece machine, ready for installation.
- Pre-testing of mechanical and electrical systems means no delays at installation.
- Start-up service — factory-trained representatives check the installation and start the machine — regardless of geographic location.

### Proven reliability

- The 19DK is the sixth generation in a family of products distinguished by the lowest warranty rate of any centrifugal chiller.
- Performance is assured — no delay in delivery pending factory capacity test.
- Spot tests of random chillers, ranging from complete mechanical teardowns to ARI-dictated capacity tests, ensure reliability and capacity.

### Economical operation

Standard components provide design IKW/ton of 0.65. By mix-matching components, IKW/ton of 0.60 can be achieved with no penalty to lead time and with little increase in cost — for the ultimate in performance.

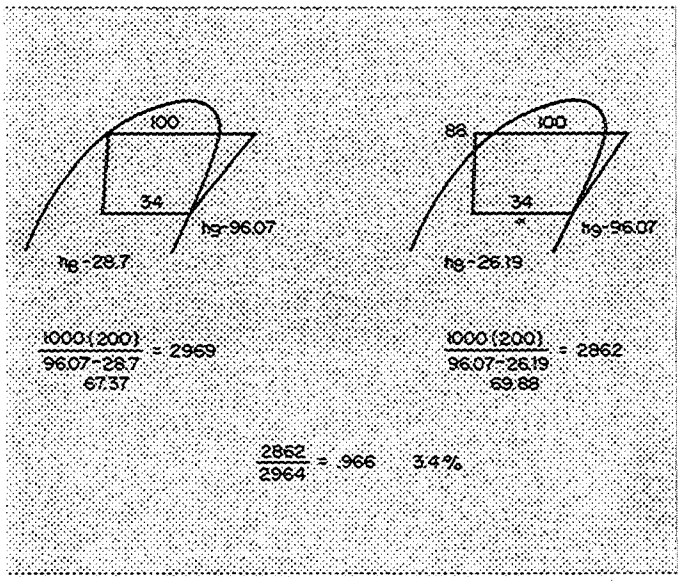
- Heat exchanger includes refrigerant thermal economizer and Carrier's own high performance tubes.
- Choose compressor to meet your requirements by selecting from various compressor sizes, impeller diameters and speed increasing transmissions.
- Single-stage compressor means no penalties related to multi-stage compressors (i.e. torrid changes in the flow of refrigerant gas from stage to stage).
- Efficient design allows operation at lower condensing water temperatures with no hot gas bypass — even when the load dips to 10% of design.
- Low chilled water recycle control circuit permits the machine to supercool the loop and then shut down till cooling is needed again — no wasted energy

# Refrigerant thermal economizer improves efficiency

One way to improve the efficiency of a refrigeration cycle is to get more refrigeration effect per pound of refrigerant. This is done by using a subcooler in the condenser of a centrifugal chiller. The entering (coldest) condensing circuit water is directed in a counter flow manner to subcool the condensed refrigerant. The effect is shown by plotting the standard and subcooled refrigerant cycle.

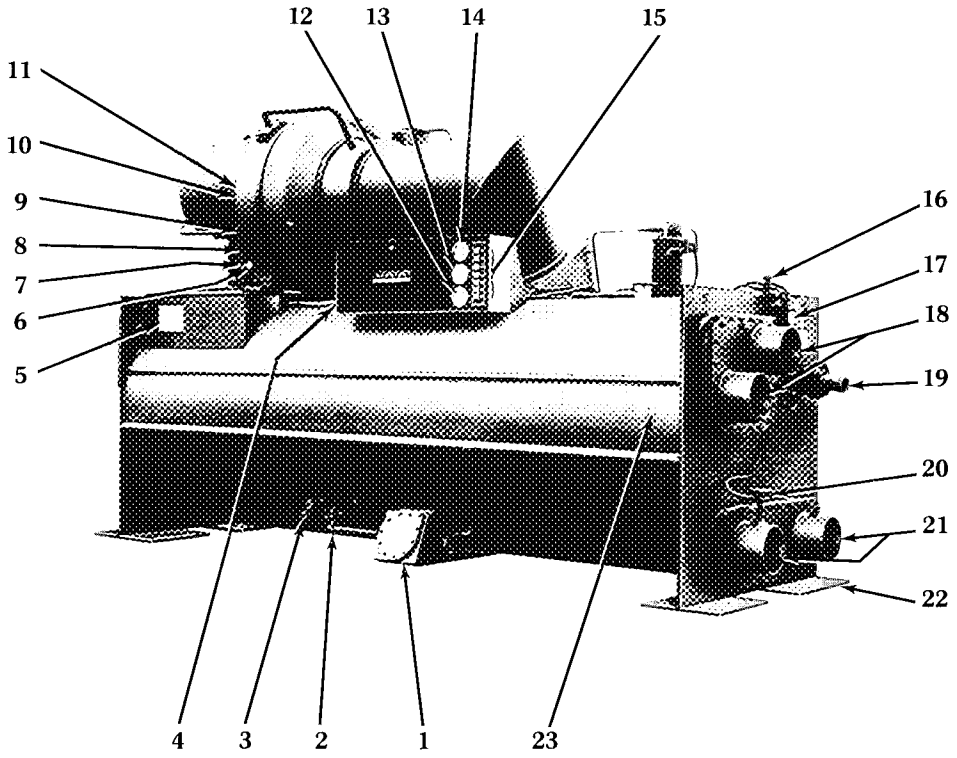
The difference in enthalpies of the refrigerant, the gas as it enters the refrigerant and the liquid as it leaves the condenser determines the refrigerant effect

The example shows how a significant improvement of 3.4% is achieved by simply adding the thermal refrigerant economizer.



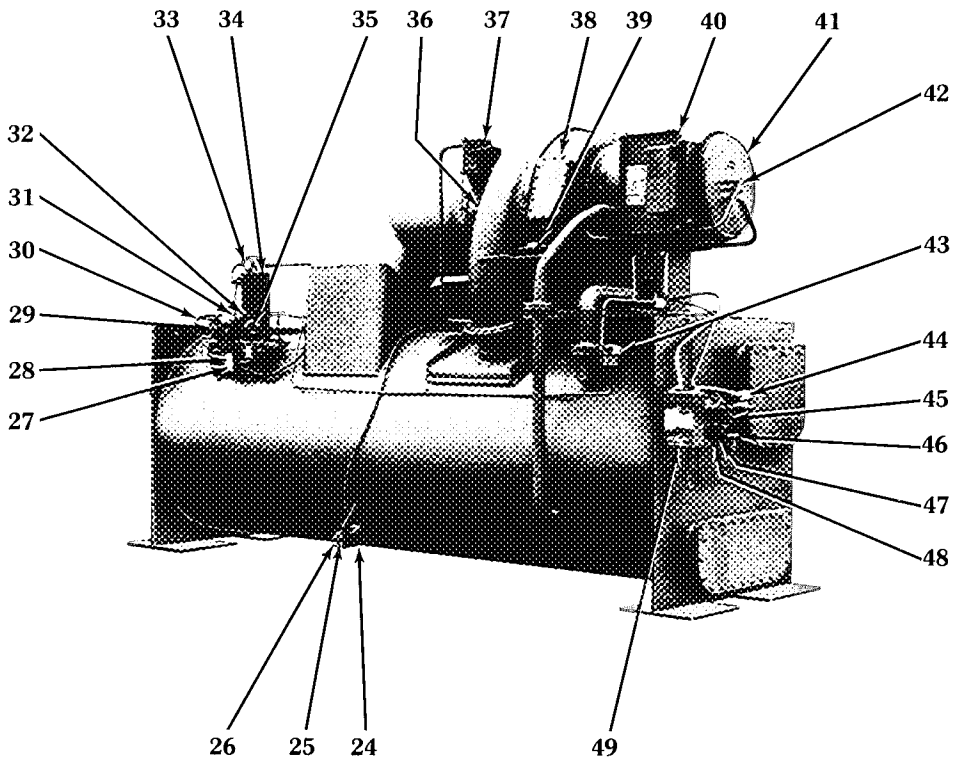
# 19DK machine components

## 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 — Oil Reservoir Pressure Gage (Hidden)
10 — Return-Oil Temperature Gage (Hidden)
11 — Compressor Nameplate (Hidden)
12 — Cooler Pressure Gage
13 — Condenser Pressure Gage
14 — Oil Pump Differential Pressure Gage
15 — Control Buttons and Indicating Lights
16 — Purge Valve No 3
17 — Chilled Water Low-Temperature Cutout and Recycle Switch
18 — Condenser Water Nozzles
19 — Safety Relief Device
20 — Chilled Water Control Sensor
21 — Cooler Water Nozzles
22 — Support Plates
23 — Condenser Temperature Thermowell (not shown)

## REAR VIEW




24 — Refrigerant Low-Temperature Cutout
25 — Low-Temperature Cutout Element
26 — Refrigerant Thermowell
27 — Purge Pump Switch
28 — Purge Solenoid Switch
29 — Purge Pump
30 — Purge Valve No 2
31 — Water Drain Valve
32 — Water Level Sight Glass
33 — Purge Pressure Gage
34 — Purge Condensing Chamber
35 — Refrigerant Sight Glass
36 — Vane Seal Oiler
37 — Guide Vane Actuator
38 — Compressor Access Plate
39 — Inlet Volute Drain Filter
40 — Compressor Terminal Box (less cover)
41 — Motor End Cover
42 — Motor Rotation Sight Glass
43 — Refrigerant Filter
44 — Oil Cooler Solenoid Valve and Plug Valve
45 — Oil Pump, Cooler and Filter Assembly
46 — Oil Cooler Drain Plug
47 — Oil Charging Valve
48 — Oil Pressure Regulating Valve (Factory Set)
49 — Oil Pump Starter, Factory Installed

# Quality options offer added efficiency

### Safety indicator panel

This accessory provides the operator with an instant trouble-shooting capability. Seven panel lights monitor high motor or bearing temperature, low refrigerant temperature, high condenser pressure, starter (overloads and protective devices), low water flow (chilled or condenser), low oil pressure, low chilled water temperature. When safety is tripped, the light goes on. Panel does not affect the integrity of the central control system, is easily connected to the machine without disturbing factory wiring. In addition, a remote sound or light alarm can be easily field installed to alert you, should a safety light be tripped on the indicator panel. Only a simple 2-wire hook-up is required.

### Selective insulation

The 19 Series machines are adequately insulated at the factory to meet most application demands. However, additional insulation packages are available for specific machine applications.

### Lead-lag control

Desirable when 2 or more machines are installed in series or parallel. Centralized control features the following capabilities:

- parallel operation
- series operation with split or common point control
- two or more chiller operations
- uneven sized chillers working together
- independent control of chillers both manually and automatically
- automatic lead-lag operation
- reassignment of lead-lag hierarchy
- automatic standby

Panel lights indicate system operating mode.

### Isolation assembly

A combination of soleplates, jacking screws, leveling pads and neoprene pads are available in isolation packages. Specify this option for installations requiring special mounting. Isolation pads are shipped at no charge.

### Unit-mounted starters

To consolidate job site responsibility the starter can be ordered mounted and wired to the machine. The only field wiring that is necessary is to bring in line power to the starter, connect the oil heater to a separate 115-v source and connect the chiller interlocks, chilled water pump, condenser water pump, cooling tower and chilled water and/or condenser water flow switches.

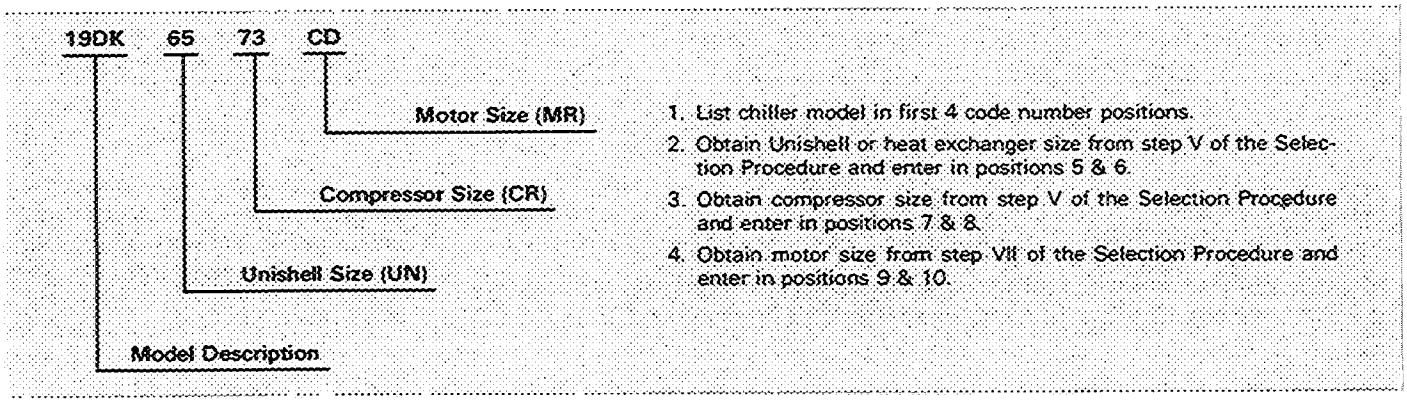
### Auto start

Remote control, time clock, outdoor air temperature, EMS control to start and stop the chillers and the chilled water and condenser water pumps. Provides pre-flow and part-flow of the pumps — interlocks the operation of the pumps as a function of the chiller.

### **UL or CSA label** is available

This means that the water boxes are in accordance with ASME (American Society of Mechanical Engineers) Standards

MODEL NUMBER DESCRIPTION



# Selection procedure

This example represents the machine selected to satisfy a 290 ton at 44 F leaving chilled water and 85 F 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 in accordance with ARI Standard 550-77 for centrifugal chillers.

For rapid selection of chillers operating at other than the listed tonnages, use the following procedure·

**I Establish design conditions.**

Example

Required Capacity ..... 290 tons
Leaving Chilled Water Temperature (LCWT) .. 44 F
Entering Condenser Water Temperature (ERWT) ..... 85 F
Chilled Water Temperature Rise or Gpm* .... 10 F
Condenser Water Temperature Rise or Gpm* ..... 840 gpm
Pressure Drop Limitations
Cooler ..... 22 ft
Condenser ..... 25 ft
Power Limitation ..... 200 IKW

*Flow/Rise calculation:
Cooler tons = (Gpm x Rise)/24
Cond· tons = (Gpm x Rise)/29

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

Using example, enter Selection Data table for 300 tons.

A unit producing 300 tons at 44 F cooler LCWT and 95 F condenser LRWT has a heat exchanger (Unishell) size of 65 and a compressor size of 73.

**III Determine number of passes** for selected heat exchangers:

Enter Pressure Drop curve

At 696 gpm, size 65, unishell the pressure drop in the cooler is 16.5 feet At 840 gpm, size 65, unishell the pressure drop in the condenser is 18 0 feet.

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

Enter Pass-Rise Temperature Adjustment table and find·

At 2 pass and 10 F rise (cooler) there is no adjustment required. At 2 pass and 10 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

**V Make final selection of heat exchanger and compressor.** Make preliminary determination of motor size CE and power input (kW) 200

In this example since no temperature adjustment is necessary, the final selection is the same as the preliminary heat exchanger (or unishell) size is 65 Compressor size is 73. Motor size is CE Power input (preliminary) is 201 kW.

**VI Adjust power input (kW)** 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 kW =

$$194\ \text{kW} = 201\ \text{kW} \times \frac{290\ \text{tons required}}{300\ \text{tons selected unit}}$$

**VII Make final motor selection** — From the Electrical Data table, determine if the maximum kW of the next smaller motor exceeds the required kW If so, use the smaller motor. If not, use the motor selected in Step V

Max kW of size CD motor = 199
Required kW (Step VI) = 194
Use size CD 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 full load amperage (FLA), locked rotor amperage (LRA) and overload trip amperage (OLTA) directly from the Electrical Data tables

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

Maximum tonnage for any of the listed component combinations, component selections at other than the listed conditions, or component selections requiring lower input kW per ton can be readily obtained from Carrier's Computer Selection Service thru your local Carrier office.

PASS RISE TEMPERATURE ADJUSTMENT

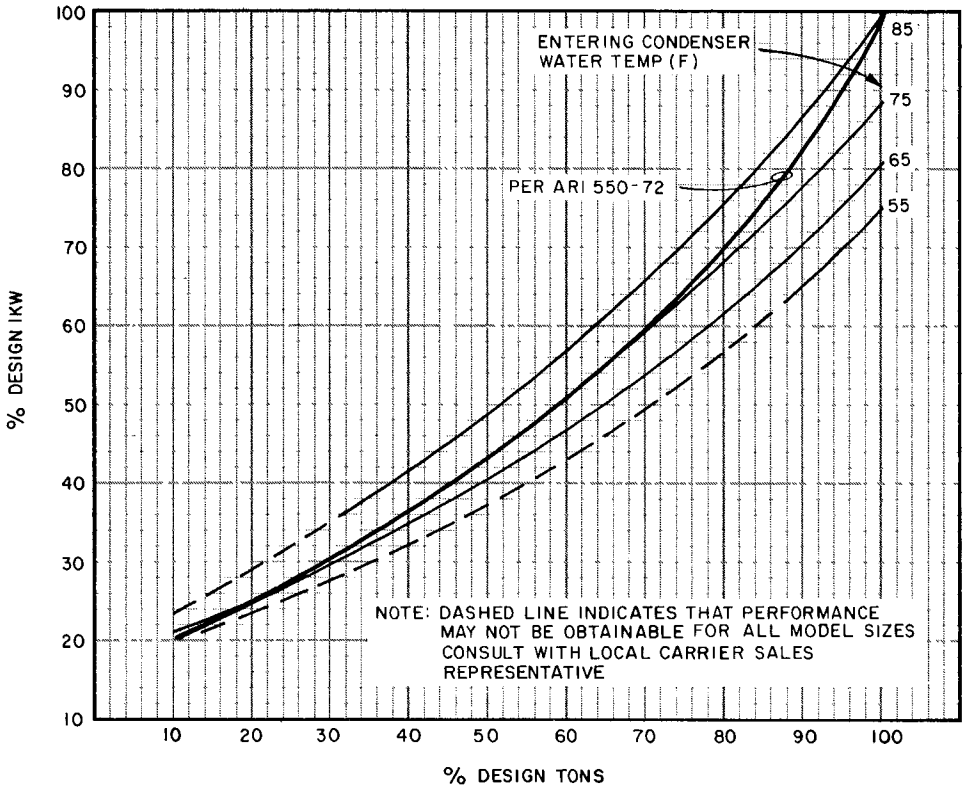
| WATER TEMP RISE (F) | COOLER PASSES | | | | CONDENSER PASSES | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 5 | -2 0 | +0 5 | +1 5 | +2 0 | +2 0 | 0 | -1 0 | -1 5 |
| 10 | -3 5 | 0 | +1 5 | +2 5 | +3 5 | 0 | -1 5 | -2 0 |
| 15 | -6 0 | -0 5 | +2 0 | +3 0 | +4 5 | 0 | -1 5 | -2 5 |
| 20 | — | -0 5 | +2 0 | +3 5 | +5 5 | 0 | -2 0 | -3 0 |

# Selection data

## Physical data

| UNISHELL SIZE | RIGGING WEIGHT (lb) | OPERATING WEIGHT (lb) | REFRIG (R-11) CHARGE (lb) | AREA TO INSULATE (sq ft) |
|---|---|---|---|---|
| **42** | 8,280 | 9,140 | 500 | 130 |
| **44** | 8,380 | 9,285 | 525 | 130 |
| **46** | 8,480 | 9,450 | 550 | 130 |
| **50** | 9,860 | 10,965 | 575 | 130 |
| **51** | 10,060 | 11,195 | 575 | 130 |
| **53** | 10,260 | 11,460 | 600 | 130 |
| **55** | 10,460 | 11,720 | 625 | 130 |
| **57** | 10,660 | 11,975 | 625 | 130 |
| **61** | 13,650 | 15,410 | 775 | 213 |
| **63** | 13,950 | 15,790 | 810 | 213 |
| **65** | 14,150 | 16,120 | 850 | 213 |
| **71** | 15,580 | 17,695 | 975 | 218 |
| **72** | 15,780 | 17,955 | 985 | 218 |
| **73** | 16,080 | 18,340 | 1010 | 218 |
| **76** | 16,580 | 19,080 | 1100 | 218 |
| **77** | 16,980 | 19,650 | 1150 | 218 |
| **78** | 17,280 | 20,110 | 1200 | 218 |

**19DK PART-LOAD PERFORMANCE CURVE**



## 150 TON SELECTION

| ADJ LVG COND WATER TEMP (F) | | ADJ LVG CHILLED WATER TEMP (F) 40 | 42 | 44 | 46 |
|---|---|---|---|---|---|
| 90 | IKW | 99 | 95 | 93 | 85 |
| | UN | 55 | 55 | 53 | 53 |
| | CR | 26 | 19 | 19 | 18 |
| | MTR | AB | AB | AB | AA |
| 95 | IKW | 110 | 101 | 100 | 97 |
| | UN | 57 | 57 | 53 | 53 |
| | CR | 20 | 19 | 19 | 19 |
| | MTR | AC | AB | AB | AB |
| 100 | IKW | 117 | 113 | 111 | 110 |
| | UN | 57 | 57 | 55 | 53 |
| | CR | 27 | 20 | 20 | 13 |
| | MTR | AD | AD | AC | AC |
| 105 | IKW | 129 | 124 | 117 | 116 |
| | UN | 61 | 57 | 57 | 53 |
| | CR | 29 | 28 | 20 | 20 |
| | MTR | AE | AD | AD | AD |

## 200 TON SELECTION

| ADJ LVG COND WATER TEMP (F) | | ADJ LVG CHILLED WATER TEMP (F) 40 | 42 | 44 | 46 |
|---|---|---|---|---|---|
| 90 | IKW | 136 | 126 | 121 | 118 |
| | UN | 57 | 57 | 57 | 57 |
| | CR | 43 | 42 | 49 | 42 |
| | MTR | AE | AE | AE | AD |
| 95 | IKW | 143 | 139 | 138 | 127 |
| | UN | 57 | 57 | 57 | 57 |
| | CR | 50 | 50 | 43 | 42 |
| | MTR | CB | CB | AE | AE |
| 100 | IKW | 155 | 151 | 145 | 141 |
| | UN | 61 | 57 | 57 | 57 |
| | CR | 51 | 43 | 43 | 43 |
| | MTR | CC | CC | CB | CB |
| 105 | IKW | 169 | 166 | 159 | 154 |
| | UN | 61 | 61 | 57 | 57 |
| | CR | 52 | 45 | 44 | 44 |
| | MTR | CD | CD | CC | CC |

## 250 TON SELECTION

| ADJ LVG COND WATER TEMP (F) | | ADJ LVG CHILLED WATER TEMP (F) 40 | 42 | 44 | 46 |
|---|---|---|---|---|---|
| 90 | IKW | 169 | 158 | 153 | 147 |
| | UN | 63 | 61 | 61 | 61 |
| | CR | 57 | 56 | 49 | 49 |
| | MTR | CD | CC | CC | CB |
| 95 | IKW | 180 | 174 | 172 | 158 |
| | UN | 63 | 63 | 61 | 61 |
| | CR | 64 | 57 | 50 | 49 |
| | MTR | CD | CD | CD | CC |
| 100 | IKW | 196 | 184 | 183 | 178 |
| | UN | 65 | 65 | 61 | 61 |
| | CR | 65 | 57 | 57 | 50 |
| | MTR | CE | CD | CD | CD |
| 105 | IKW | 210 | 205 | 198 | 192 |
| | UN | 73 | 72 | 63 | 63 |
| | CR | 66 | 59 | 58 | 51 |
| | MTR | CE | CE | CE | CD |

## 300 TON SELECTION

| ADJ LVG COND WATER TEMP (F) | | ADJ LVG CHILLED WATER TEMP (F) 40 | 42 | 44 | 46 |
|---|---|---|---|---|---|
| 90 | IKW | 200 | 183 | 182 | 180 |
| | UN | 65 | 65 | 63 | 63 |
| | CR | 73 | 72 | 72 | 63 |
| | MTR | CE | CD | CD | CD |
| 95 | IKW | 213 | 207 | 201 | 200 |
| | UN | 65 | 65 | 65 | 65 |
| | CR | 73 | 73 | 73 | 64 |
| | MTR | CE | CE | CE | CE |
| 100 | IKW | 230 | 226 | 218 | 212 |
| | UN | 72 | 65 | 65 | 65 |
| | CR | 74 | 74 | 81 | 64 |
| | MTR | CL | CL | CL | CE |
| 105 | IKW | 254 | 244 | 240 | 230 |
| | UN | 73 | 72 | 65 | 72 |
| | CR | 83 | 75 | 75 | 65 |
| | MTR | CM | CM | CM | CL |

## 350 TON SELECTION

| ADJ LVG COND WATER TEMP (F) | | ADJ LVG CHILLED WATER TEMP (F) 40 | 42 | 44 | 46 |
|---|---|---|---|---|---|
| 90 | IKW | 230 | 215 | 214 | 204 |
| | UN | 73 | 71 | 65 | 65 |
| | CR | 80 | 79 | 72 | 79 |
| | MTR | CL | CL | CL | CE |
| 95 | IKW | 246 | 244 | 236 | 232 |
| | UN | 73 | 65 | 65 | 65 |
| | CR | 80 | 87 | 80 | 73 |
| | MTR | CM | CM | CL | CL |
| 100 | IKW | 275 | 266 | 257 | 244 |
| | UN | 73 | 71 | 71 | 65 |
| | CR | 82 | 81 | 81 | 80 |
| | MTR | CN | CN | CM | CM |
| 105 | IKW | 299 | 285 | 278 | 267 |
| | UN | 76 | 73 | 72 | 72 |
| | CR | 83 | 82 | 82 | 74 |
| | MTR | CP | CN | CN | CN |

## 400 TON SELECTION

| ADJ LVG COND WATER TEMP (F) | | ADJ LVG CHILLED WATER TEMP (F) 40 | 42 | 44 | 46 |
|---|---|---|---|---|---|
| 90 | IKW | 263 | 242 | 242 | 234 |
| | UN | 76 | 76 | 72 | 72 |
| | CR | 87 | 86 | 86 | 79 |
| | MTR | CN | CM | CM | CL |
| 95 | IKW | 277 | 271 | 269 | 263 |
| | UN | 77 | 76 | 73 | 72 |
| | CR | 94 | 87 | 80 | 80 |
| | MTR | CN | CN | CN | CN |
| 100 | IKW | 313 | 299 | 294 | 281 |
| | UN | 77 | 76 | 73 | 72 |
| | CR | 96 | 95 | 88 | 87 |
| | MTR | CP | CP | CP | CN |
| 105 | IKW | 341 | 322 | 316 | 303 |
| | UN | 78 | 77 | 76 | 73 |
| | CR | 96 | 96 | 89 | 88 |
| | MTR | CQ | CQ | CQ | CP |

## *450 TON SELECTION

| ADJ LVG COND WATER TEMP (F) | | ADJ LVG CHILLED WATER TEMP (F) 40 | 42 | 44 | 46 |
|---|---|---|---|---|---|
| 90 | TONS | 450 | 450 | 450 | 450 |
| | IKW | 321 | 289 | 269 | 264 |
| | UN | 78 | 78 | 76 | 73 |
| | CR | 96 | 94 | 93 | 93 |
| | MTR | CQ | CP | CN | CN |
| 95 | TONS | 445 | 450 | 450 | 450 |
| | IKW | 333 | 331 | 298 | 272 |
| | UN | 78 | 78 | 77 | 77 |
| | CR | 96 | 96 | 94 | 93 |
| | MTR | CQ | CQ | CP | CN |
| 100 | TONS | 428 | 450 | 450 | 450 |
| | IKW | 348 | 345 | 328 | 314 |
| | UN | 78 | 78 | 77 | 76 |
| | CR | 96 | 96 | 95 | 94 |
| | MTR | CQ | CQ | CQ | CQ |
| 105 | TONS | 403 | 421 | 444 | 450 |
| | IKW | 344 | 349 | 348 | 339 |
| | UN | 78 | 78 | 78 | 77 |
| | CR | 96 | 97 | 96 | 95 |
| | MTR | CQ | CQ | CQ | CQ |

*Check Tons for Maximum Capacity

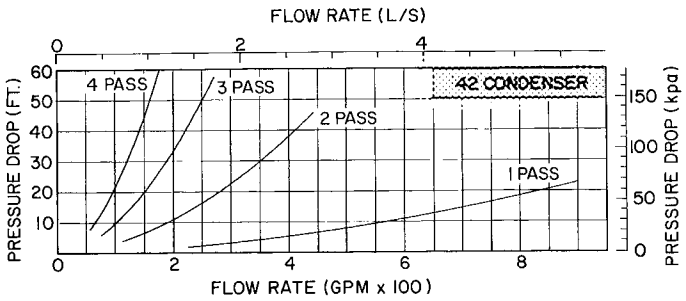
LEGEND

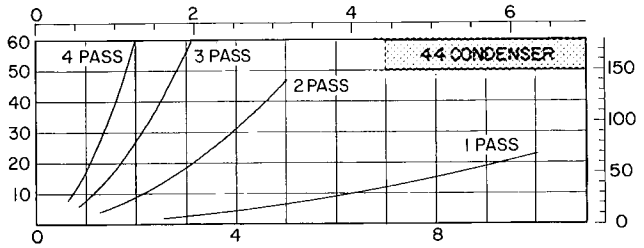
**CR** — Compressor Size
**IKW** — Power Input
**MTR** — Motor Size
**UN** — Unishell Size

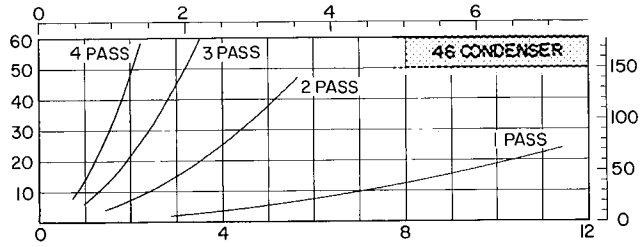
NOTE: Selections based on using Carrier High Performance tubing in unishell

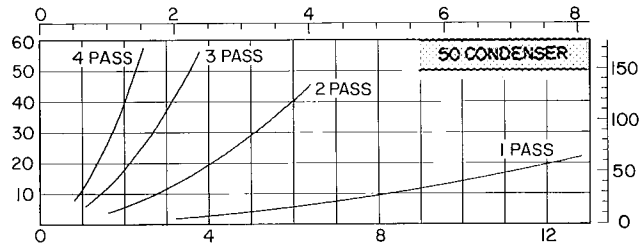
# Selection data (cont)

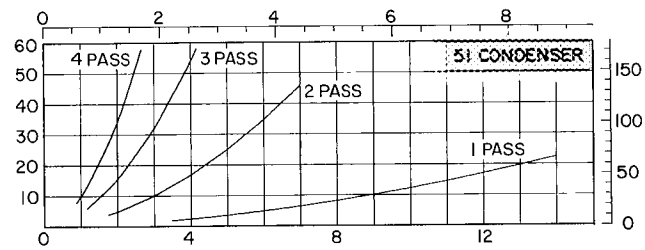
## UNISHELL CONDENSER

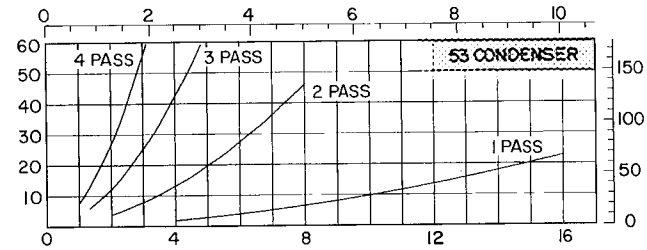


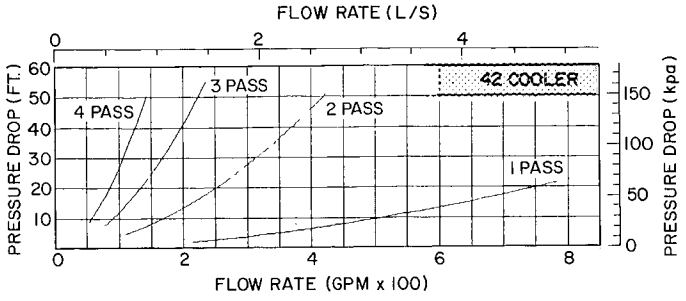



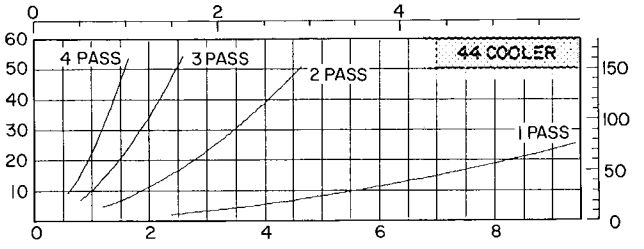



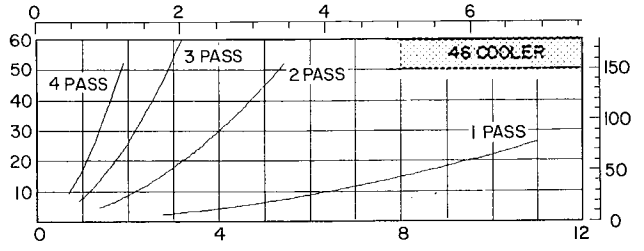



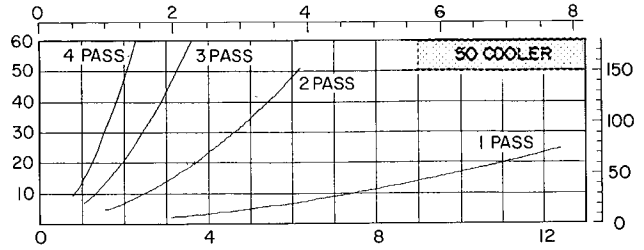



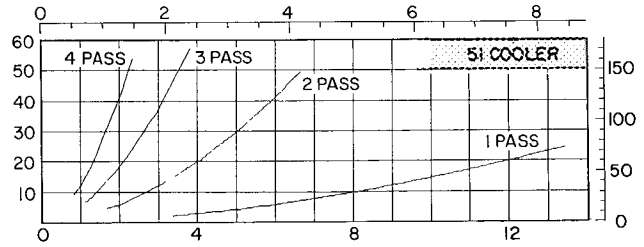

## UNISHELL COOLER

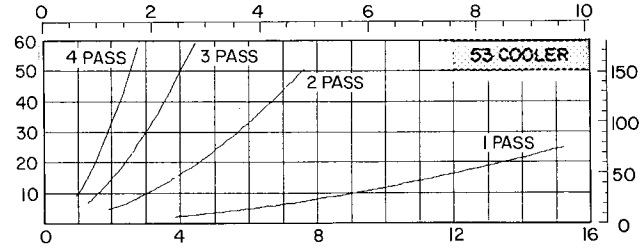


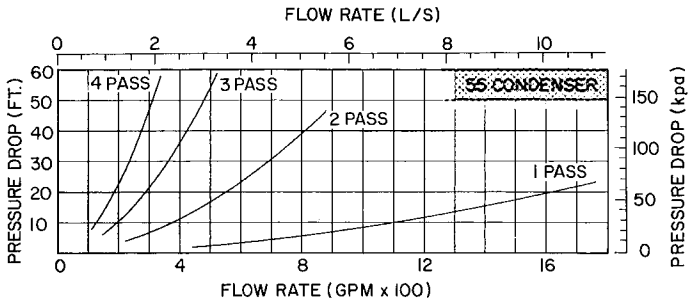



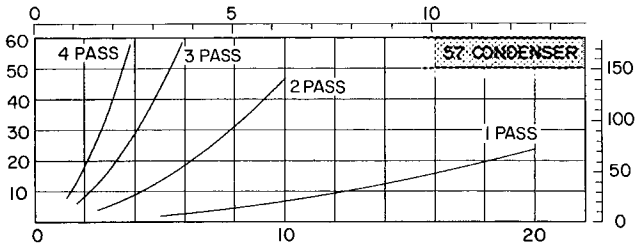



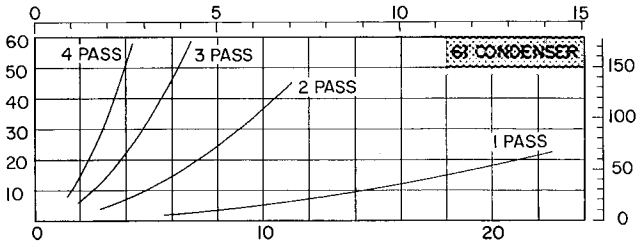



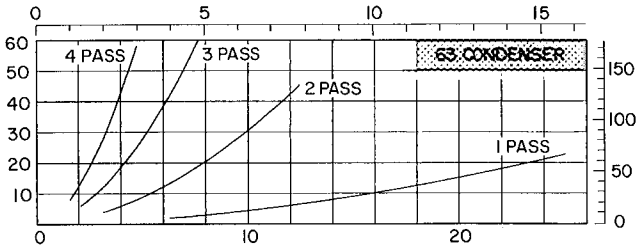



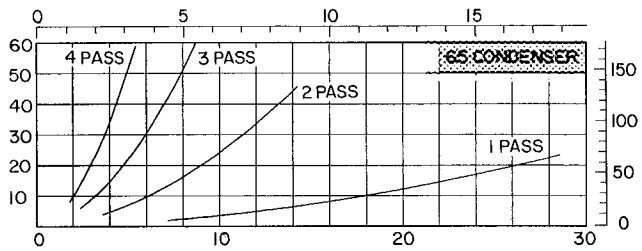
## UNISHELL CONDENSER

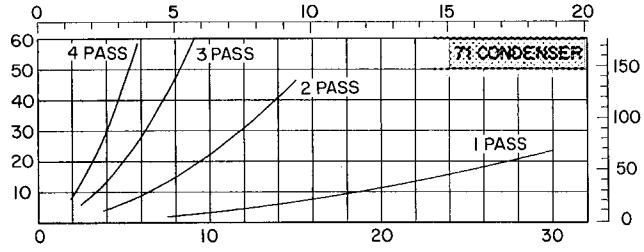


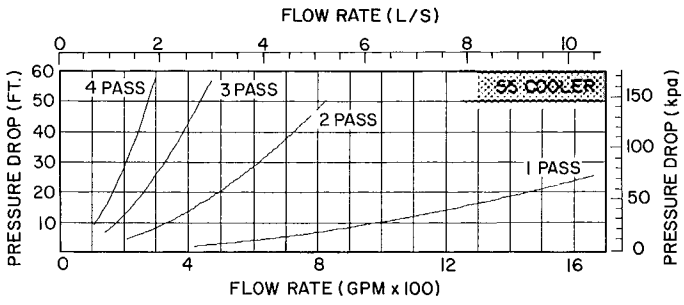



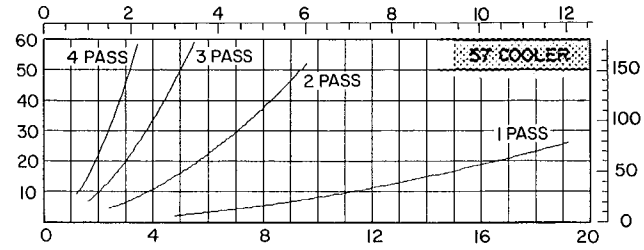



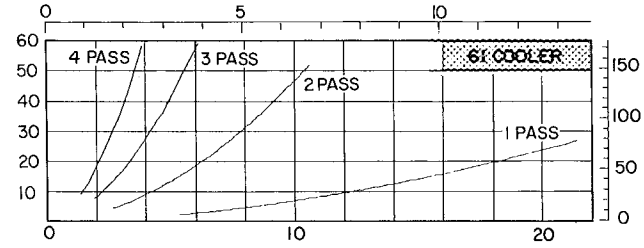



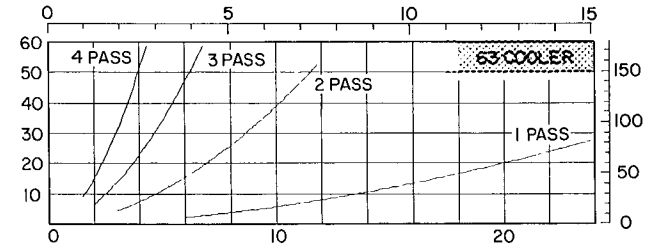



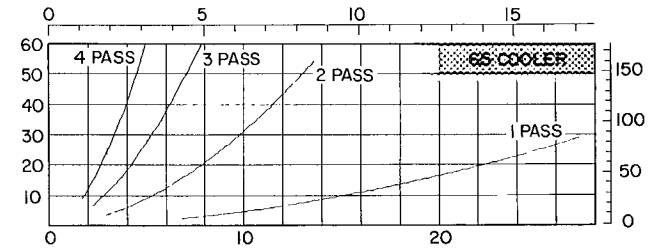

## UNISHELL COOLER

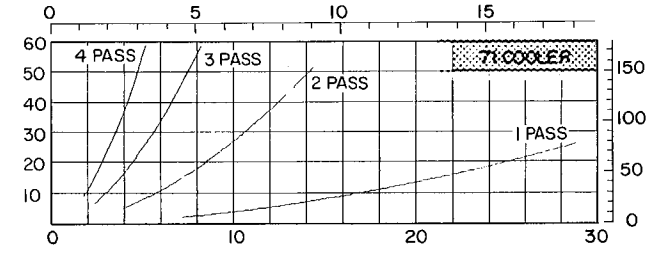


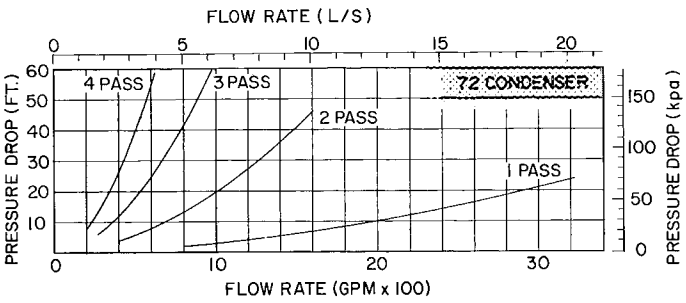



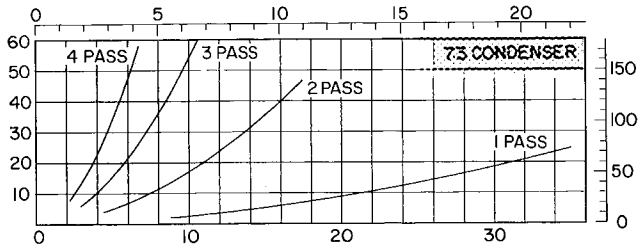



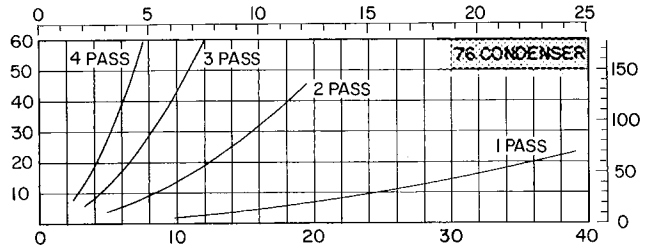



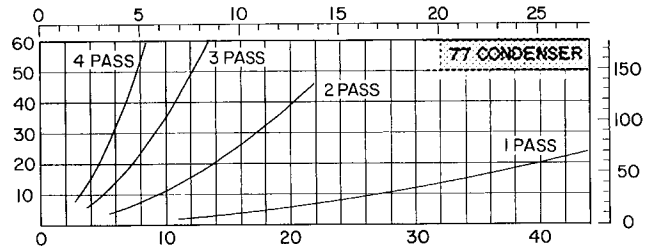
# Selection data (cont)

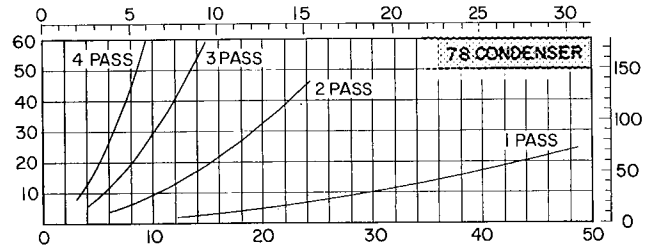
## UNISHELL CONDENSER



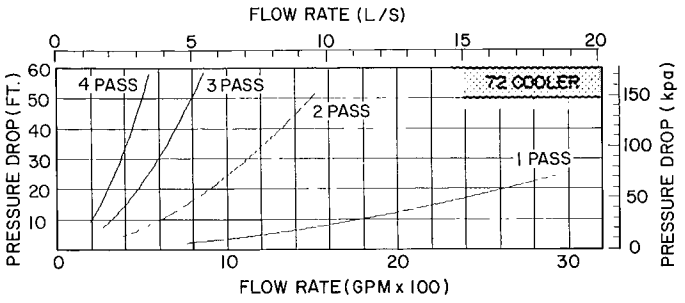



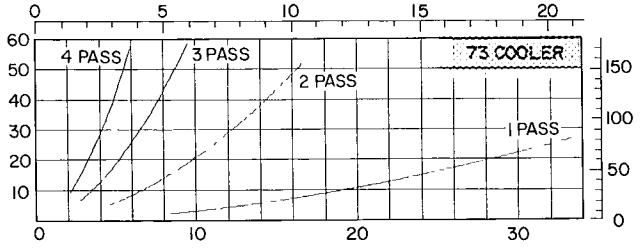



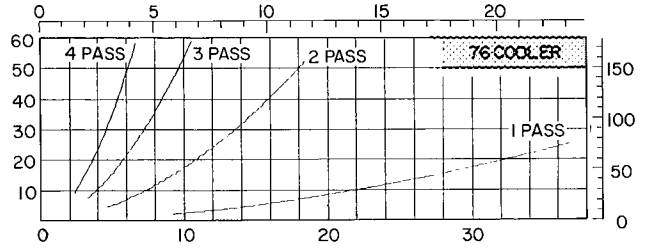



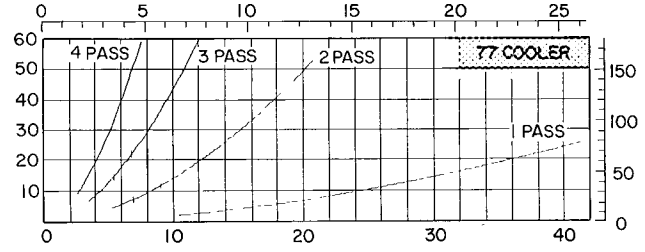



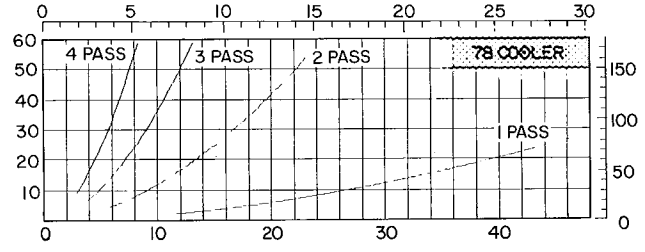

## UNISHELL COOLER



# Electrical data

| MOTOR | MAX kW | VOLTS | 208 | 230 | 460 | 575 | 2400 | 4160 |
|---|---|---|---|---|---|---|---|---|
| AA | 94 | FLA per kW | 3 19 | 2 89 | 1 44 | 1 15 | — | — |
| | | LRA Wye | 548 | 394 | 197 | 161 | — | — |
| | | LRA Delta | 1711 | 1230 | 615 | 502 | — | — |
| AB | 105 | FLA per kW | 3 19 | 2 89 | 1 44 | 1 15 | — | — |
| | | LRA Wye | 500 | 418 | 217 | 177 | — | — |
| | | LRA Delta | 1561 | 1305 | 678 | 552 | — | — |
| AC | 115 | FLA per kW | 3 19 | 2 89 | 1 44 | 1 15 | — | — |
| | | LRA Wye | 567 | 498 | 249 | 193 | — | — |
| | | LRA Delta | 1771 | 1556 | 778 | 602 | — | — |
| AD | 129 | FLA per kW | 3 19 | 2 89 | 1 44 | 1 15 | — | — |
| | | LRA Wye | 692 | 530 | 293 | 254 | — | — |
| | | LRA Delta | 2162 | 1657 | 916 | 793 | — | — |
| AE | 144 | FLA per kW | 3 19 | 2 89 | 1 44 | 1 15 | — | — |
| | | LRA Wye | 721 | 667 | 333 | 273 | — | — |
| | | LRA Delta | 2252 | 2083 | 1042 | 853 | — | — |
| CA | 144 | FLA per kW | — | — | — | — | 264 | 153 |
| | | LRA Wye | — | — | — | — | — | — |
| | | LRA Delta | — | — | — | — | 188 | 108 |
| CB | 155 | FLA per kW | 3 08 | 2 79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 884 | 763 | 374 | 318 | — | — |
| | | LRA Delta | 2762 | 2385 | 1167 | 994 | 204 | 118 |
| CC | 171 | FLA per kW | 3.08 | 2 79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1086 | 964 | 418 | 321 | — | — |
| | | LRA Delta | 3393 | 3012 | 1305 | 1004 | 226 | 130 |
| CD | 199 | FLA per kW | 3.08 | 2.79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1182 | 1012 | 486 | 405 | — | — |
| | | LRA Delta | 3693 | 3163 | 1519 | 1265 | 265 | 153 |
| CE | 218 | FLA per kW | 3.08 | 2.79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1451 | 1044 | 462 | 373 | — | — |
| | | LRA Delta | 4533 | 3263 | 1443 | 1165 | 284 | 164 |
| CL | 242 | FLA per kW | 3.08 | 2.79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1326 | 1173 | 546 | 398 | — | — |
| | | LRA Delta | 4143 | 3665 | 1707 | 1245 | 320 | 185 |
| CM | 265 | FLA per kW | 3.08 | 2 79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1403 | 1422 | 562 | 498 | — | — |
| | | LRA Delta | 4383 | 4443 | 1757 | 1556 | 354 | 204 |
| CN | 292 | FLA per kW | 3.08 | 2.79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1710 | 1333 | 663 | 610 | — | — |
| | | LRA Delta | 5344 | 4167 | 2071 | 1908 | 392 | 226 |
| CP | 320 | FLA per kW | 3.08 | 2 79 | 1 39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1672 | 1430 | 719 | 601 | — | — |
| | | LRA Delta | 5224 | 4468 | 2247 | 1878 | 421 | 243 |
| CQ | 356 | FLA per kW | 3.08 | 2.79 | 1.39 | 1 12 | 264 | 153 |
| | | LRA Wye | 1989 | 1639 | 1000 | 672 | — | — |
| | | LRA Delta | 6215 | 5121 | 3125 | 2099 | 474 | 273 |

**FLA** — Full Load Amps
**kW** — Compressor Power Input (Kilowatts)
**LRA** — Locked Rotor Amps

NOTES:
1 FLA based on nominal power factor (P F ) values as follows:
Low V AA-AE P F = 87
Low V CB-CQ P F = 90
Hi V CA-CQ P.F = 91
2 All values relate to 60 Hz

| ITEM | HP | 19DK VOLTS | SUPPLY VOLTAGE | FULL LOAD AMPS | LOCKED ROTOR AMPS |
|---|---|---|---|---|---|
| OIL PUMP | | | 3-Phase 60-Hz | | |
| 19DK | ½ | 220 | 200-240 | 1 8 | 11 5 |
| | | 430 | 380-480 | 0 95 | 5 62 |
| | | 575 | 550-600 | 0 76 | 4 55 |

NOTES:
Listed motor voltages are design voltages Motors are suitable for use with supply voltages as noted, and will operate satisfactorily at 10% below the minimum and at 10% above the maximum supply voltage

200 v — for use on 200- to 208-v systems
230 v — for use on 220- to 240-v systems
380 v — for use on 360- to 400-v systems
460 v — for use on 440- to 480-v systems
575 v — for use on 550- to 600-v systems
2400 v — for use on 2300- to 2500-v systems
4160 v — for use on 4000- to 4300-v systems
6900 v — for use on 6600- to 7200-v systems

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

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

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

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

EXAMPLE Find the full load amperage for a motor listed at 1 12 amps per kW input and 550 volts

$$\text{FLA} = 1\ 12 \times \frac{575}{550} = 1\ 17$$

LEGEND: FLA — Full Load Amps per kW input
LRA — Locked Rotor Amps
OLTA — Overload Trip Amps (= FLA x 1 08)

## CONTROL TRANSFORMER REQUIREMENTS

| MODEL | 19DK |
|---|---|
| **Control Circuit** | |
| **Inrush va** | 1800 |
| **Sealed va** | 550 |
| **Purge System** | |
| **Inrush va** | 3014 |
| **Sealed va** | 528 |
| **Oil Heater** | |
| **Inrush va** | 1000 |
| **Sealed va** | — |

NOTE: Oil heater must be on separate circuit providing continuous service

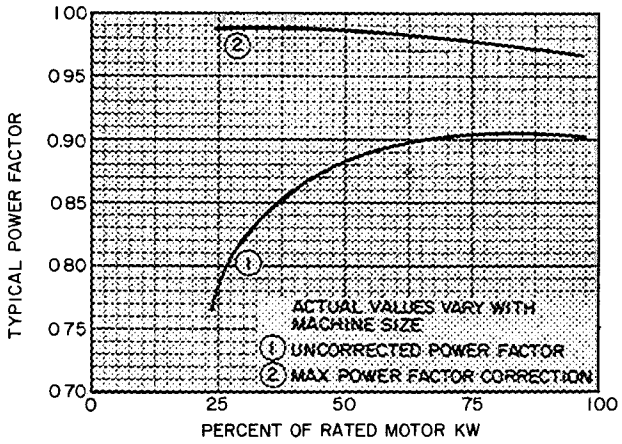
## Compressor motor controllers

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

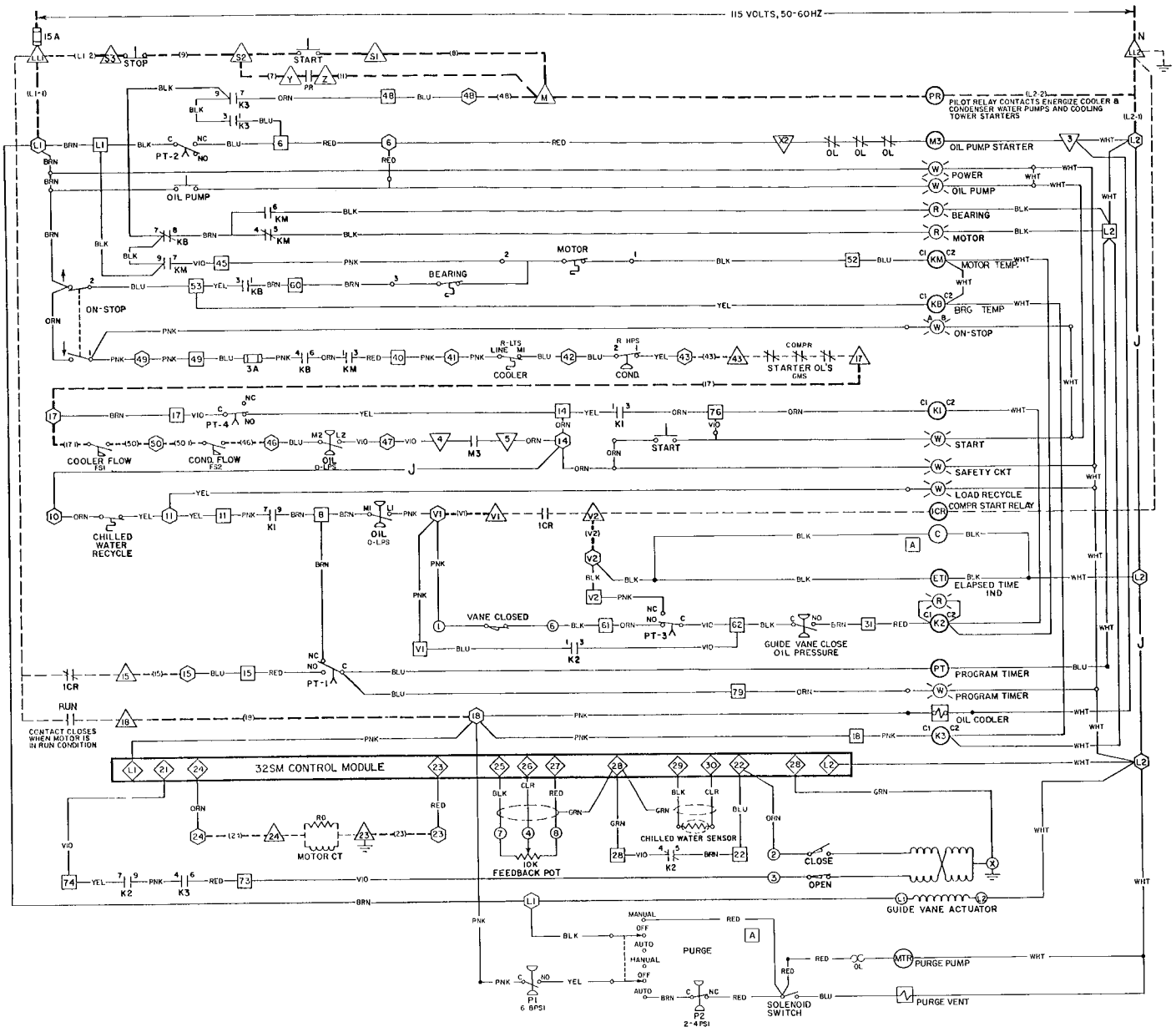
## Capacitors

Power factor considerations may indicate use of capacitors. Properly sized capacitors improve power factors are illustrated in the Typical Power Factors curve

### TYPICAL POWER FACTORS

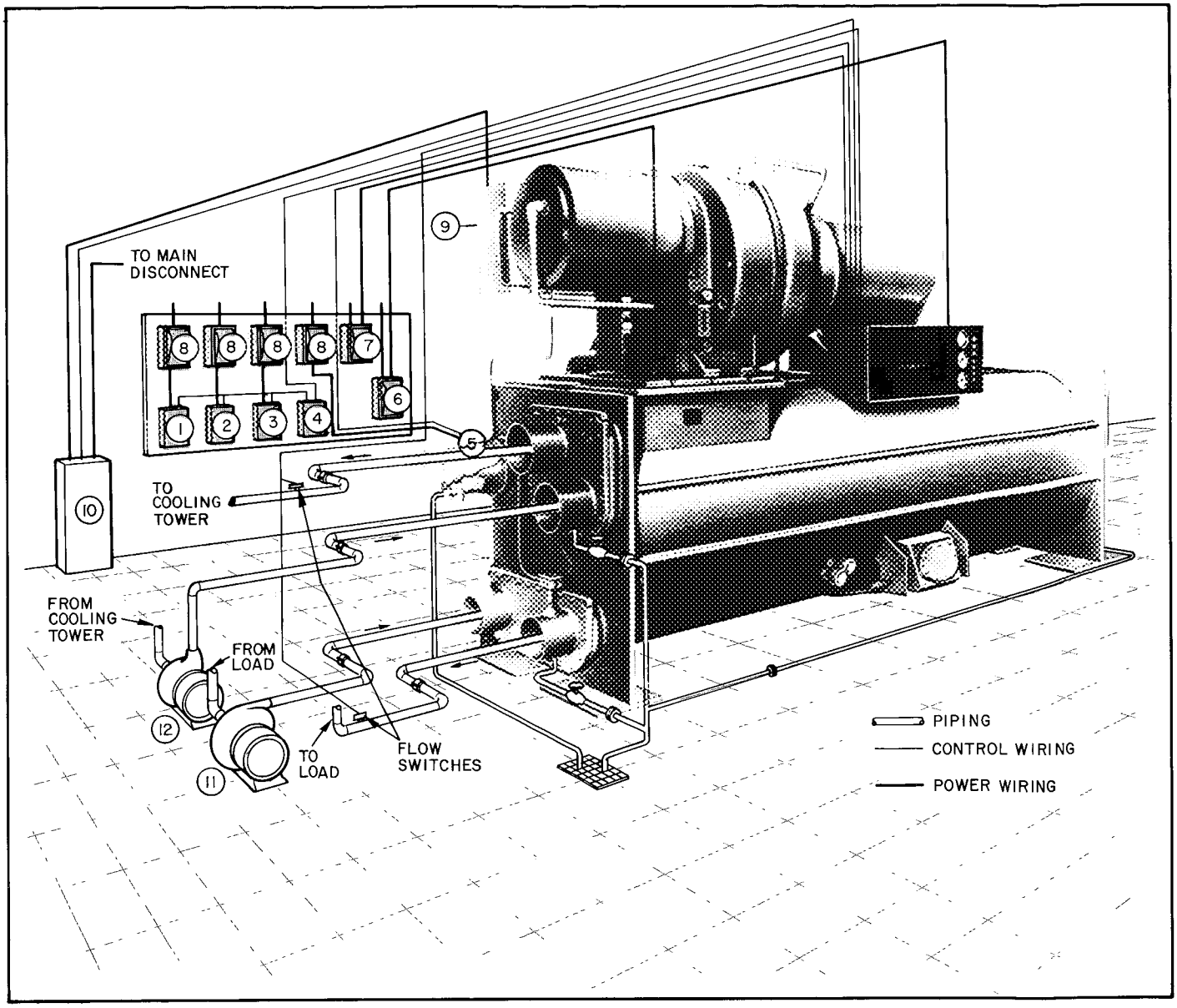


# Typical control wiring schematic




Field Wiring
Starter Wiring
Factory Wiring
Field Wiring Terminal
Relay Module Terminal
Main Starter Terminal
Guide Vane Actuator Terminal
Capacity Control Module Terminal
Bearing and Motor (Temp Sensor) Module Terminal
Oil Pump Starter Terminal

# Typical piping and wiring



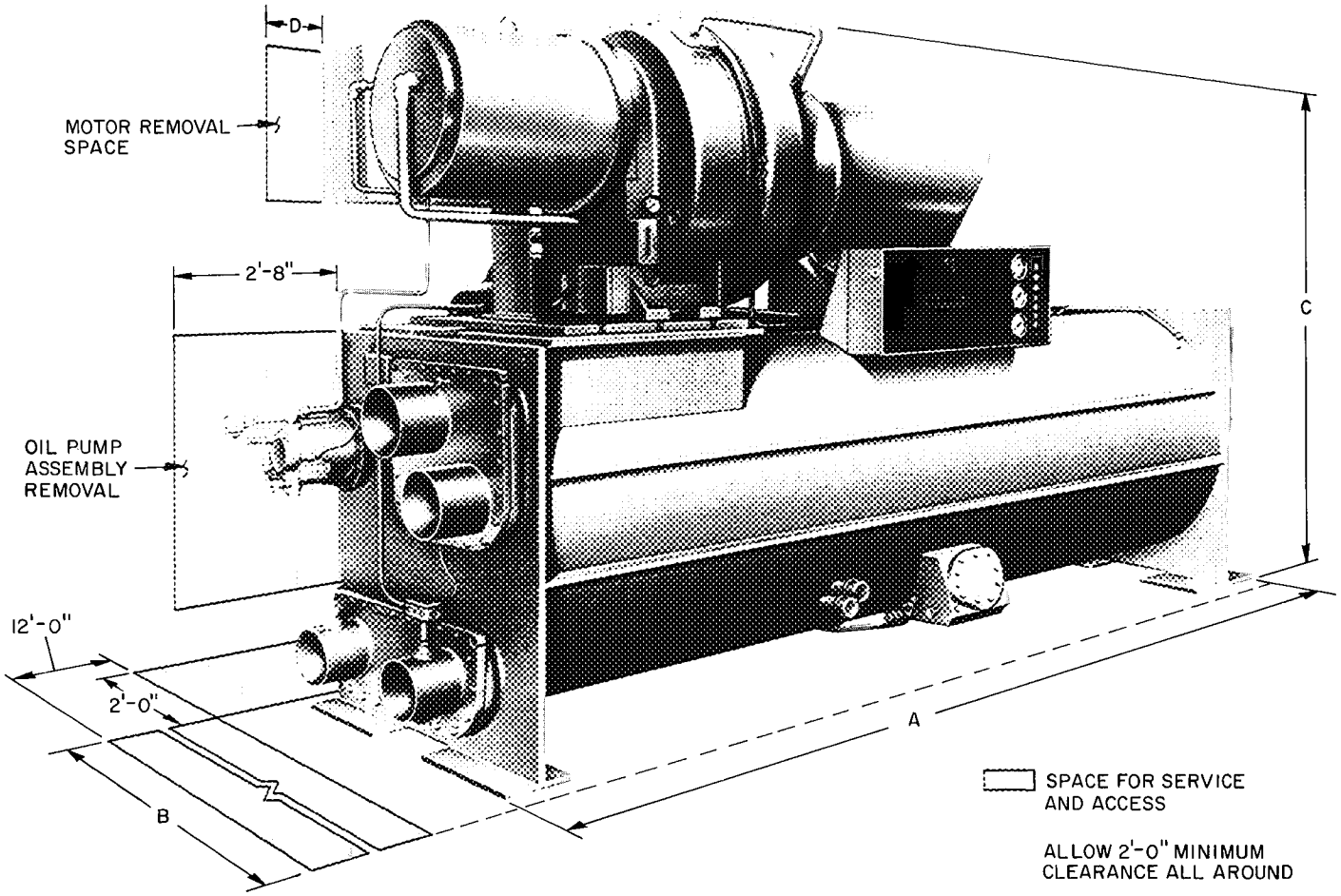

LEGEND

1 — Cooling Tower Fan Starter
2 — Condenser Water Pump Starter
3 — Cooler Water Pump Starter
4 — Pilot Relay
5 — Oil Pump Starter
6 — Fused Disconnect for Oil Heater and Thermostat
7 — Fused Disconnect for Purge System
8 — Fused Disconnect
9 — Compressor Motor Terminal Box
10 — Compressor Motor Starter
11 — Cooler Water Pump
12 — Condenser Water Pump

NOTES

1 Wiring and piping shown are for general point-of-connection only and are not intended to show details for a specific installation Certified field wiring and dimensional diagrams for specific 19 Series machines are available on request
2 All wiring must comply with applicable codes
3 Refer to Carrier System Design Manual for details regarding piping techniques
4 A separate 115-volt fused power source for controls is required unless compressor motor control is furnished with a transformer
5 Provide a separate fused 115-volt power source for oil heater and thermostat

# Dimensions




Certified dimension drawings available on request

## SERVICE CLEARANCE FOR MOTORS (ft-in.)

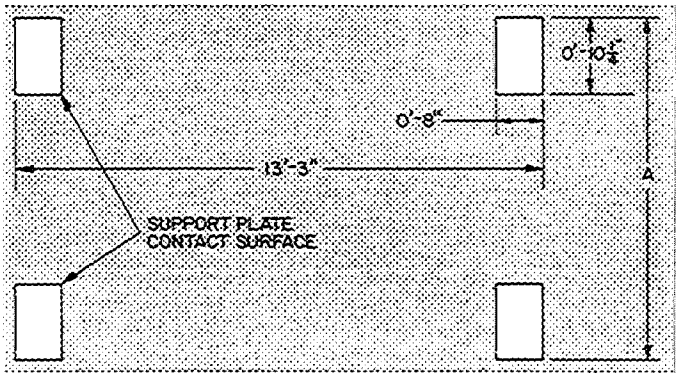
| DESIGN CENTER VOLTAGES | SIZE | | | CLEARANCE D (ft-in.) |
|---|---|---|---|---|
| | Unishell | Compr | Motor | |
| 208,230, 460, 575 | 42 thru 65 | 12 thru 38 | AA thru AE | 1-11 |
| | 50 thru 78 | 43 thru 68 | AE | |
| | | | CB thru CL | 2- 1 |
| | 61 thru 78 | 72 thru 98 | CD thru CQ | |
| 2400 & 4160 | 50 thru 78 | 43 thru 68 | CA thru CL | 2- 1 |
| | 61 thru 78 | 72 thru 98 | CD thru 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 19DH | DIMENSIONS (ft-in.) | | | NOZZLE SIZE (in.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length* A | Width B | Height C | Cooler Passes | | | | Condenser Passes | | | |
| | | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 42, 44, 46 | 14-4 | 3-8 | 6- 5 | 6 | 4 | — | — | 8 | 6 | — | — |
| 50, 51, 53, 55, 57 | 14-4 | 3-8 | 6-11 | 8 | 6 | 6 | — | 8 | 6 | 4 | — |
| 61, 63, 65 | 14-4 | 4-6 | 8- 1 | 8 | 6 | 6 | 6 | 10 | 8 | 6 | 6 |
| 71, 72, 73 | 14-4 | 5-0 | 8-10 | 10 | 8 | 8 | 6 | 10 | 8 | 6 | 6 |
| 76, 77, 78 | 14-6 | 5-0 | 8-10 | 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 inches

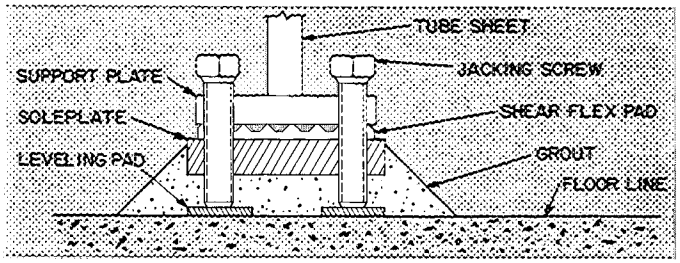
## STANDARD CONTACT SURFACES



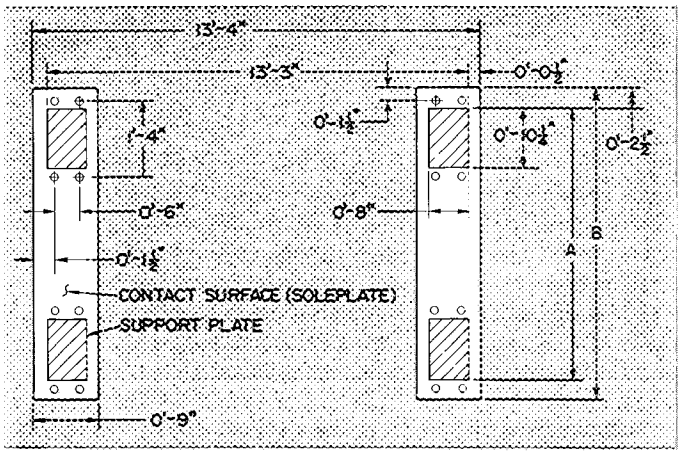

| UNISHELL SIZE* | DIMENSION A (ft-in.) |
|---|---|
| 42-57 | 3- 0 |
| 61-65 | 3-10 |
| 66-78 | 4-6½ |

*See machine informative plate

## MACHINE ISOLATION WITH SOLEPLATE PACKAGE



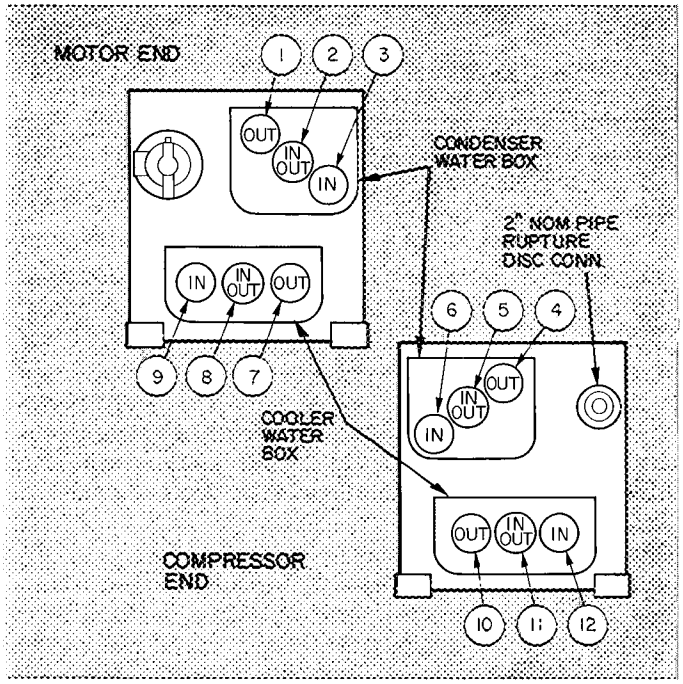

## CONTACT SURFACES WITH SOLEPLATES




| UNISHELL SIZE* | DIMENSIONS (ft-in.) | |
|---|---|---|
| | A | B |
| 42-57 | 3- 0 | 3-5 |
| 61-65 | 3-10 | 4-3 |
| 66-78 | 4-6½ | 4-11½ |

*See machine informative plate

## 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 |

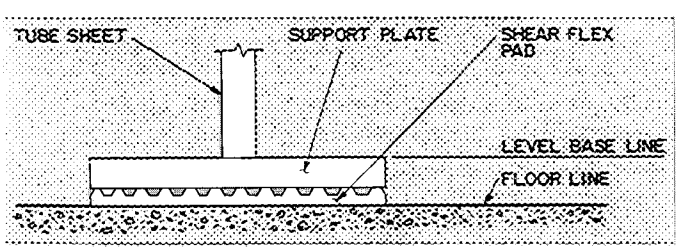
| CONDENSER NOZZLE NO. | | | ARR |
|---|---|---|---|
| Pass | In | Out | |
| 1 | 2 | 5 | W |
| | 5 | 2 | X |
| 2 | 6 | 4 | A |
| | 3 | 1 | B |
| 3* | 3 | 4 | C |
| | 6 | 1 | D |
| 4† | 6 | 4 | E |
| | 3 | 1 | F |

*3-pass available on 50 thru 78 Size Unishells only
†4-pass available on 61 thru 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 |

## STANDARD ISOLATION



# Controls

SAFETY AND CONTROL COMPONENT FEATURES

| FEATURE | |
|---|---|
| **SAFETY CUTOUTS:** | |
| Bearing High Temperature | * |
| Motor High Temperature | * |
| Refrigerant High Pressure (Condenser) | * |
| Refrigerant Low Temperature (Cooler) | * |
| Oil Pump Motor Overload | * |
| Lube Low Oil Pressure | * |
| Cooler and Condenser Water Flow Switches | √ |
| **INTERLOCKS:** | |
| Unloaded (Vanes Closed) Start | * |
| Pre-Lube and Post-Lube (via Program Timer) | * |
| Starting Sequence (via Program Timer) | * |
| Low Chilled Water Temp/Recycle Sequence (via Program Timer) | * |
| Oil Cooler Water Flow (Solenoid) | * |
| Machine Manual Reset after Safety Cutout | * |
| **CAPACITY CONTROL:** | |
| Guide Vane Actuator | * |
| Solid-State Leaving Chilled Water Control | * |
| Motor Current (demand) Limit — Adjustable 40-100% | * |
| Manual Leaving Chilled Water Reset | * |
| **OTHERS:** | |
| Elapsed Time Indicator | * |
| Start Counter | * |
| Manual (Local) Start | * |
| Auto (Remote) Start | # |
| Pneumatic LCW Control Transducer | # |
| Safety Indicator Panel | # |
| Lead-Lag Panel | # |
| Mounted Oil Pump Starter | * |

*Factory supplied and installed

√Required — Field- and/or Factory-Option Supplied

#Optional

## Control system

The safety controls of each Carrier centrifugal chiller are factory wired and mounted to ensure machine protection against condenser high pressure, cooler low temperature, bearing or motor overtemperature, motor overload and oil low pressure Other safety controls ensure no-load starting of compressor and prevent compressor restart until a safe, preset interval has elapsed

The capacity control system is a fully automatic, modular, solid-state system for precise control of machine capacity at all loads. When it is desirable to use pneumatic controls to interface with a complete pneumatic system, control interface devices are available

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 solid-state thermistor in the chilled water line. This probe constantly relays any variations in water temperature to a solid-state capacity control module in the chiller control center. The control module, in turn, amplifies and modulates the probe signals. The amplified signals cause a guide vane actuator motor to adjust the guide vane position as required.

If chilled water temperature drops below the selected design temperature, the actuator moves the guide vanes towards 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 towards a more open position. Refrigerant begins to evaporate at a more rapid rate and chiller capacity increases.

Built-in safeguards 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, capacity control interlocks keep the guide vanes in a closed (minimum capacity) position until the compressor motor reaches run condition

## Control sequence

Before the chiller can start, the condenser and chilled water pumps must be operating. Field-supplied pilot relays for pumps and fan are normally applied as shown in the Typical Control Wiring Schematic

Closing the chiller ON-STOP switch energizes the temperature control circuits in the compressor safety system. Once these temperature sensing circuits have been energized, the circuits containing pressure sensing devices can be energized. If condenser pressure and cooler refrigerant pressure/temperature are satisfactory, the machine control circuit can then be energized by pressing chiller START button A program timer now begins a series of 4 timed steps (PT-1 thru -4) to ensure the proper sequencing of the oil pump and compressor start.

When the compressor motor reaches RUN condition, a normally open contact closes to energize holding relay K3. This locks in control circuit power to oil pump and water pump motors whenever the chiller compressor is operating. Energizing the K2 and K3 relays also permits the capacity control circuit to position the compressor guide vanes as required to maintain the selected chilled water temperature.

To guard against stress or damage to the compressor motor, the program timer keeps the chiller control circuit de-energized for approximately 15 minutes after a compressor stop.

The chiller is stopped by pressing the ON-STOP switch. The auxiliary water pumps and fan motor are stopped by pressing the field-supplied STOP button.

## Typical control components

**Condenser high-pressure cutout** (manual reset) — Shuts down compressor if condenser pressure rises above cutout set point.

**Bearing high-temperature cutout** — Prevents damage to motor and compressor bearings from excessive temperature. Keeps compressor from starting or shuts compressor off if bearing temperature reaches set point. Chiller ON-STOP button must be opened and reclosed to reset this safety circuit.

**Motor winding high-temperature cutout** — Prevents compressor start or shuts compressor off if motor winding temperature reaches set point. Requires opening and reclosing chiller ON-STOP button to reset.

**Cooler low-refrigerant cutout** — Switch trips when refrigerant charge is low, shutting off compressor. Switch protects the cooler tubes from freeze-up if water flow drops off or chilled water thermostat is set too low. Switch requires manual reset.

**Oil low-pressure cutout** — Prevents compressor start until oil pressure is adequate for good bearing lubrication. Automatically stops compressor if oil pressure falls to set point Coastdown lubrication is provided in the compressor.

**Chilled water low-temperature recycle switch** — Stops compressor when chilled water temperature drops to a point indicating minimum refrigeration load Allows chiller to recycle automatically when water temperature rises to a point that indictes need for further cooling. Also provides protection against tube freeze-up

**Vane closed switch** — Prevents compressor start unless compressor inlet guide vanes are in closed position. Ensures no-load starting.

**Capacity control module (solid state)** — Transmits signals from temperature sensing element in the chilled water line to compressor guide vane actuator. Provides precise control of vane position, and hence, machine capacity at all loads. Module contains a motor load control that overrides the chilled water temperature control and closes the guide vanes to prevent motor overload.

**Guide vane actuator** — Motor opens and closes compressor guide vanes in response to signals from capacity control module.

**Program timer** — Sequences the start of oil pump and compressor motor to ensure adequate lubrication before compressor starts during operation and as the compressor coasts down at shutdown. The program timer also provides a 15-minute delay between any compressor stop and subsequent start-up.

# Guide specifications

**Furnish and install** — Hermetic centrifugal liquid chilling package(s) suitable for chilling water as shown when supplied with condenser water and electric power as shown on the plans

**Selection** — Each unit shall allow for water side fouling factor of .0005 in the cooler tubes and .0005 in the condenser tubes Cooler and condenser water pressure drops shall not exceed those shown on plans The kW power draw shall not exceed that shown on plans. Machine shall be rated in conformance with the most recent ARI Standard 550. Each unit shall conform to ANSI/ASHRAE 15-1978 Safety Codes.

**Water chiller** shall be complete with compressor and motor, evaporator, condenser, lubrication system, capacity control and controller, motor starter, instrument and control panel mounted and factory wired on the machine, purge system and other items as herein specified

The machine shall be shipped completely factory assembled with all refrigerant piping and control wiring factory installed. The entire refrigerant charge of R-11 shall be supplied. In addition, the necessary labor for pressure testing, checking and setting all controls, charging the unit, placing it into operation and reviewing the operating instructions with the owner's representative by a factory trained employee shall be included

**Compressor** shall be of high-performance single-stage hermetic design. A thrust bearing of the Kingsbury type with forced-feed lubrication shall axially position the shaft under unidirectional thrust loading. To prevent potential machine hazards, the impeller shall be designed so that the thrust loading is positive and unidirectional under all operating conditions.

Friction losses shall be maintained at a minimum by an impeller design utilizing precision shaft placement Impeller shall be an in-line design for even unloading and ease of maintenance. Impellers shall be overspeed tested a minimum of 20% above operating conditions.

Babbitt-lined journal bearings to be self-aligning type, pressure lubricated Compressor transmission gears must be arranged for visual inspection without disassembly or removal of compressor casing or impeller. The gears are to be of the double-helical design, symmetrical and center supported by a spherically seated, self-aligning bearing. All bearings must be serviceable without necessitating complete compressor disassembly or breaking of main refrigerant piping connections

Compressor shall be capable of operation without surge, cavitation or undue vibration from full load to 10% load without hot gas bypass when supplied with design entering water quantity

**Forced-fed lubrication system** with a hermetic motor driven oil pump shall be furnished as part of the water chiller System shall be complete with oil pump, oil cooler, pressure regulator, oil filters, thermostatically controlled oil heater and necessary motor controls. Oil pumps 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 are to have delayed action so that oil pressure is provided during machine coastdown. Oil pump is to be provided with a separate 460-volt, 3-phase, 60-Hertz power source. Oil pump shall have momentary switches to permit only manual operation of pump when compressor is not operating. When compressor is not operating, automatic operation modes are unacceptable since they are conducive to refrigerant absorption.

**Motors** shall be of the single-speed, non-reversing squirrel-cage induction type, and shall be suitable for voltage as shown on plans. The design speed shall be 3550 rpm The motor shall be suitable for operation in a refrigerant atmosphere. Compressor motor to be cooled by atomized subcooled refrigerant in contact with the motor windings. Water jacket designs are not acceptable, as they produce substantial temperature gradients throughout 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. Motor shall be built for connection to Star Delta type reduced voltage starter

**Evaporator and condenser** shall be fabricated with high-performance, integrally-finned copper tubing rolled into the tube sheets in both the evaporator and condenser as well as expanded into the tube support sheets in the evaporator Tubing shall be finned except in the area adjacent to and in contact with the tube and tube support sheets Tube support sheets shall be spaced at approximately 2-1/2 ft intervals to maintain proper tube spacing and to minimize tube vibration and wear.

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.

Water boxes are to be machine welded to the heat exchanger tube sheet and to be equipped with tapped drain and vent connections

Construction and materials for the heat exchangers shall conform to ANSI/ASHRAE 15-1978 Safety Code for Mechanical Refrigeration (which in turn requires conformance to the ASME Code for Unfired Pressure Vessels where applicable).

**Controls** shall be solid-state, fully automatic and "fail-safe." Safety shutdown shall be provided for low refrigerant temperature or pressure, bearing high temperature, high refrigerant pressure, motor temperature and motor overload. Each of the above controls shall have manual reset flags. Recycle shutdown shall be provided for low oil pressure and low chilled water temperature. These controls shall be automatic reset Motor shall be protected against drawing more than rated full load amperes Motor-driven elapsed running time meter shall be factory installed on each machine. Solid-state chilled water controller shall be located within control panel and capable of throttling range setting of 1.5 F

Each safety switch shall be wired across its own set of terminals for easy isolation.

**Demand limiter** — Demand Limiter Device shall be provided within the standard control panel so that maximum current may be manually set to any fraction between 40% and 100% of full load amperes. Limiters with 4-point settings in the control panel are not acceptacle

**Chiller** shall be equipped with instrument gage and control panel indicating condenser pressure, evaporator pressure and oil pressure. Panel shall contain switches permitting manual or automatic operation of oil pump and purge pump. In addition to gages, pilot lights and switches, the panel shall contain evaporator low-temperature or pressure cutout, condenser high-pressure cutout, and differential oil pressure controller interlocked so that compressor will only operate if adequate oil pressure is maintained to bearings. High-pressure cutout and evaporator low temperature cutout shall be arranged in a lockout circuit provided with reset buttons. Panel shall also operate the capacity control mechanism to limit the load on compressor motor to a safe maximum.

**Purge system** shall be furnished factory-installed, wired and piped; system shall be self-contained and provided with any necessary devices for evacuating air and water vapor from the system and for condensing, separating and returning refrigerant to the system. Compression type purges are not acceptable as they are susceptible to leaks. If city or other water piping is required for purge operation, chiller manufacturer shall include same in his bid.

**Refrigerant flow control** shall be by means of a positive metering device. The chiller shall be capable of operating with entering condensing water temperatures per ARI part-load conditions without a tower water bypass valve. If this cannot be done the chiller manufacturer shall include the price of a tower bypass valve in his bid.

**Chiller manufacturer** shall furnish magnetic motor starters, Star-Delta closed transition type, with suitable 3-leg overloads. Starters shall be furnished with NEMA 1 enclosures either unit mounted or for installation by the electrical contractor. The disconnect, protection devices and control voltage shall be provided by others.

**Electrical** — Electrical contractor shall furnish and install all electrical lines, disconnect switches, circuit breakers, auxiliary starters, and shall install the main starter and the control wiring according to the diagram furnished by the centrifugal refrigerating machine manufacturer.

**Piping** — Piping contractor shall make water connections to the oil cooler, and such other water supply, drain and vent connections as are required by the drawings and local codes.

**Initial refrigerant and oil charge** shall be provided.

**Water chiller unit performance data** shall be submitted for approval.

**Nameplates** — Chiller shall bear firmly attached metal plates which state name of manufacturer, chiller unit model number, compressor type and refrigerant used.

**Operating and maintenance instructions** prepared by chiller manufacturer shall be included in Operating and Maintenance Instructions herein before specified.

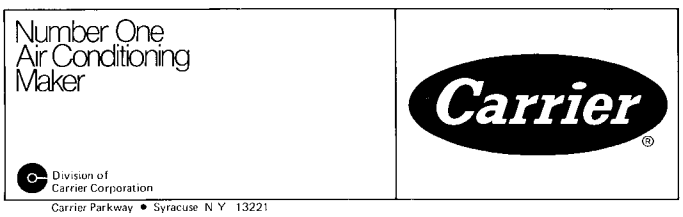
**Start-up** — Chillers shall be leak tested, refrigerant pressure tested, evacuated, dehydrated, charged, started, controls calibrated, and operating instructions given to owner's personnel by a factory trained service mechanic employed by the chiller manufacturer. Start-up supervision will not be acceptable.

**The drawings** are based on a Carrier machine. If another manufacturer is substituted, that manufacturer shall be responsible for all electrical, mechanical, structural or architectural changes.

**Equivalent material** which qualifies to meet the above specification will be acceptable. Manufacturers other than Carrier shall submit a 1/2-in. scale plan and section drawing showing proper fit and clearance for tube pull, motor or compressor removal, other maintenance clearances required and rigging clearance needed within the mechanical room.

**Guarantee** — All equipment furnished under this section of the specifications shall be guaranteed against defective workmanship and material for a period of one (1) year from date of beneficial use to the owner or 18 months from time of delivery whichever occurs first.

Number One
Air Conditioning
Maker

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