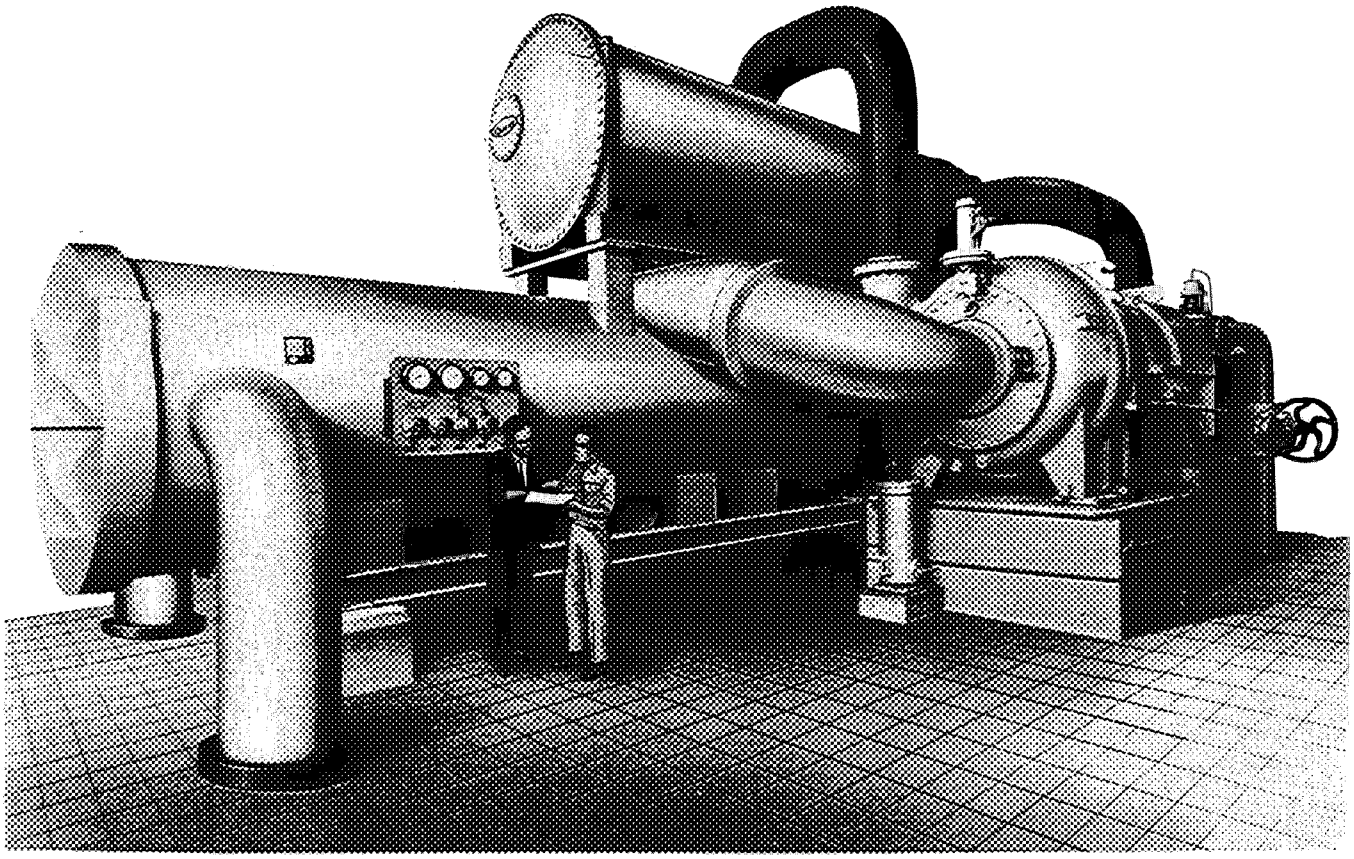
Carrier®

Liquid Chillers

Centrifugal
Open Drive
2000 to 5000 Tons

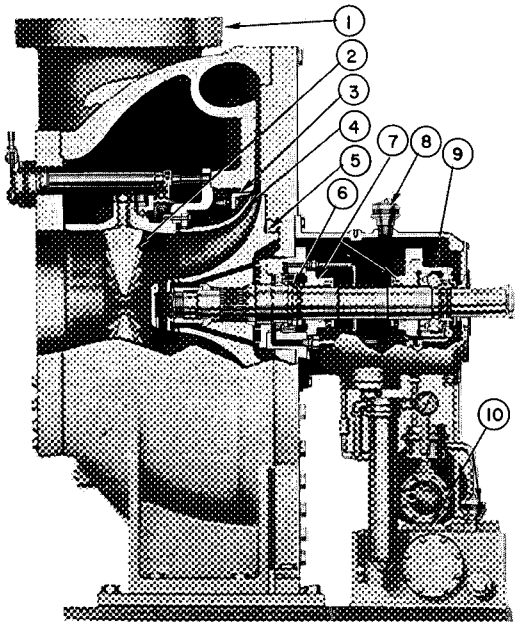
17DA



DESCRIPTION

The Carrier 17DA Open Type Centrifugal Liquid Chilling Machines are designed for large capacity water chilling plants. They may be driven by steam turbines, electric motors or other prime movers. Many combinations of standard components provide flexibility in matching job requirements in the 2000 to 5000 ton range. Central chilling plants for educational complexes, urban redevelopment projects, large recreational facilities, industrial air conditioning, and large office buildings represent the major markets for these machines.

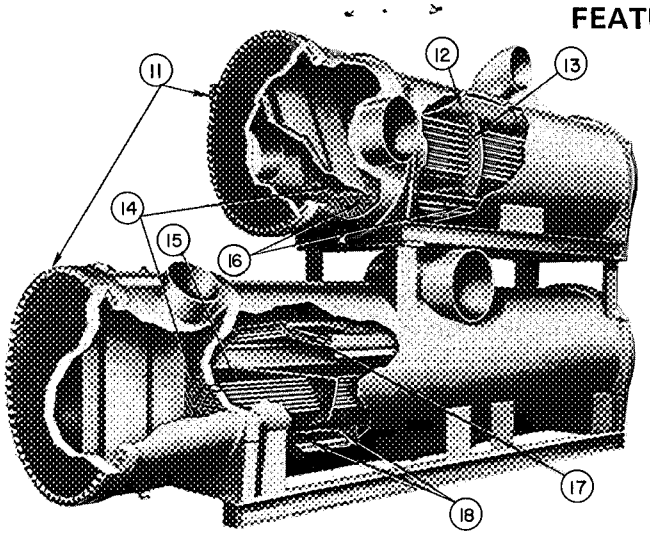
FEATURES



- **Flexible Drive Arrangements** for open drive, centrifugal compressor (1).
- **Broad Capacity Control** thru variable guide vanes (2) coupled with diffuser throttle ring (3). Capacity may be reduced to 10% full load without surge.
- **Smooth Operation** provided by finely balanced shrouded impellers (4).
- **Thrust Forces Balanced** by balancing piston (5).
- **Low Refrigerant Loss** ensured by Iso-Carbon seal and shutdown seal (6)*. Seals isolate oil from refrigerant.
- **Long Life Babbitt Journal Bearings** (7) in **atmospheric pressure vented housing** (8), are easily serviced.
- **Proven Thrust Bearing** of Kingsbury tilting shoe type (9).
- **Easily Serviced Lubrication System** (10) with vented oil reservoir.

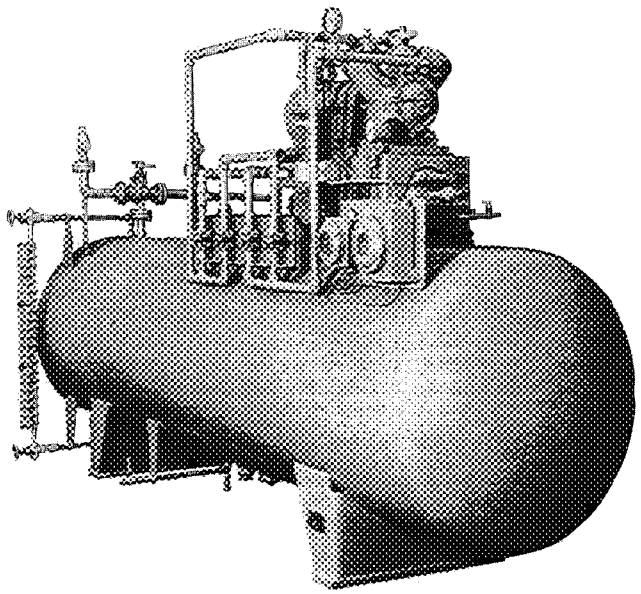
*See Product Sales Literature 17DA-28

FEATURES (cont)



- **Easy Access to Heat Exchanger Tubes** by removing water box covers (11) without removing major pipes.
- **Uniform Hot Gas Distribution** ensured by distribution baffle (12).
- **Low Vibration, Leakproof, Rigid Tube Bundle** provided by closely spaced tube support plates (13); copper tubes with extruded fins roll expanded into multiple grooved tube sheets (14); cooler tubes (15) mechanically expanded into tube support plates.
- **Improved Refrigeration Cycle Thermal Efficiency** by means of liquid subcooler (16).
- **Liquid Refrigerant Carryover** prevented by three-bend eliminators (17) and perforated equalizer plate.
- **Optimum Cooler Performance** ensured by good refrigerant distribution system (18).

ACCESSORIES



Pumpout Unit — A factory-assembled pumpout unit, with five horsepower compressor mounted on refrigerant storage tank, is available. This assembly is complete with refrigerant valves, piping, sight glass, and pressure relief valves. See illustration.

Auxiliary Oil Pump With Differential Pressure Control Switch — This safety equipment consists of an auxiliary oil pump identical to the machine oil pump and is piped in parallel with it A differential pressure control switch, mounted on safety panel, starts the auxiliary oil pump when differential pressure between supply and return oil lines falls below its set point

Control Console — A custom-built panel can be furnished to meet individual job requirements.

Special Tube Materials and Epoxy-Coated Water Boxes are available for jobs with poor water conditions

PHYSICAL DATA

HEAT EXCHANGER

CHARACTERISTIC	COOLER	CONDENSER
DESIGN PRESSURE (psig)		
Refrigerant Side	150	185
Water Side	150/300	75/150/300
MIN WTR TEMP (w/compr running)	–	60 F
FACTORY TEST PRESS. (psig)	1.5 x Design Pressure	
WATER VELOCITY (fps)	3–10	
MATERIAL SPECIFICATIONS		
Tubes	Finned Copper	
Diam x Thickness (in.)	¾ OD x .035 Wall	
Length (ft)	22, 18, 15	15
Shell and Water Box*	Steel, SA 285, Grade C	
Tube Sheet and Water Box Cover	Steel, SA 201, Grade A	

*Cooler water box alternate material steel, SA 201, Grade A.

NOTE: Cooler, condenser, and refrigerant storage tank are built in accordance with ASME code.

COMPRESSOR

COMPRESSOR	17DA7	17DA8
NO. OF STAGES	1	1
SPEEDS (Rpm)		
Nominal	5350	4510
Max Continuous	6350	5300
Overspeed Test	6990	5830
First Critical	9515	7925
SHAFT DIAM, Coupling End (in.)	3	3½
WEIGHT (lb)		
Including Oil System and Sole Plates	15,500	20,000
Max Servicing, Volute	6400	8000
ROTOR WR^2 (not including coupling) (ft^2–lb)	34.1	92.2
HYDROSTATIC TEST PRESS. (psig)	275	
BEARINGS		
Thrust	Kingsbury Type	
Journal	Pressure-lubricated sleeve	
Seal	Iso-Carbon ring	
MATERIAL SPECIFICATIONS		
Shell	Cast iron, ASTM A-48, CL 35	
Shaft	Forged steel, AISI-4130	
Impeller (shrouded)	Cast aluminum, 355-T6	
End Wall	Steel, ASTM A-201	

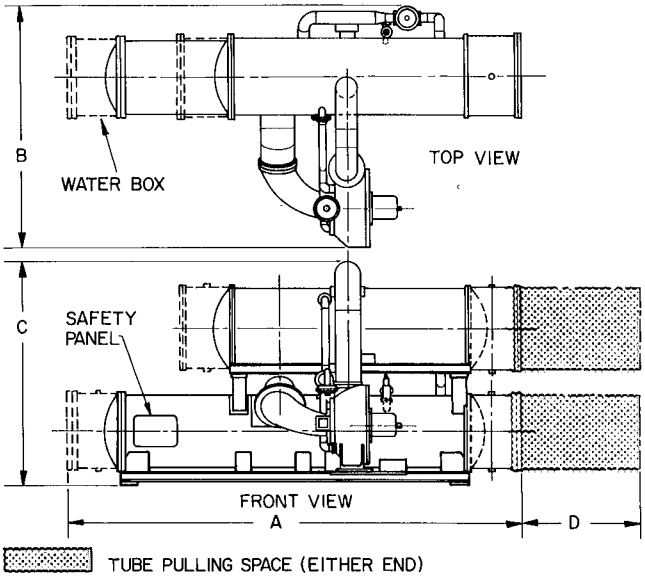
DIMENSIONS

Because of many combinations of water box and drive arrangements, the dimensions offered below are the minimum to maximum space requirements for this family of machines See your Carrier representative for machine outline drawings which include: dimensions, nozzle arrangements, weights, and contact surfaces.

NOMINAL MACHINE CAPACITY (Tons)	DIMENSIONS (Ft–in.)			
	A Less Driver	B	C	D
2000	26–5*	15–10	13–7	15–0
5000	27–3†	17– 7	17–2	22–0

*Add 3'–0" when cooler water boxes are on compressor end.

†Add 3'–6" when cooler water boxes are on compressor end.



SELECTION PROCEDURE

The large number of combinations of 17DA components precludes publishing complete performance data. The Performance Data table included shows sample computer selections for the operating conditions shown. This data is for reference purposes only.

Contact your local Carrier office for machine selections to your exact job requirements Furnish them the following data:

Required Cooling Load (tons)
Leaving Chilled Water Temperature (F)
Entering Condenser Water Temperature (F)
Chilled Water Quantity (gpm)
Condenser Water Quantity (gpm)
Fouling Factor Allowance (cooler and condenser)
Compressor Drive (steam, electric, engine, etc)
Space Considerations

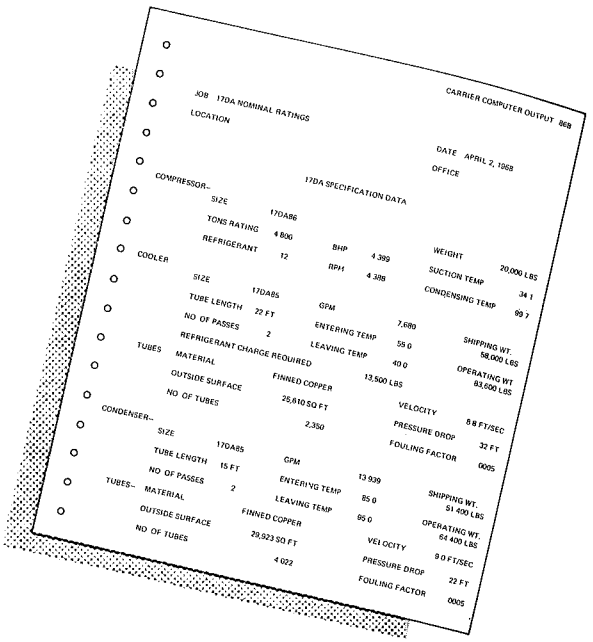
The following selection formulas will be helpful:

$$\text{Cooler Water (gpm)} = \frac{\text{Cooling Load (tons)} \times 24}{\text{Temp Drop (F)}}$$

$$\text{Condenser Water (gpm)} = \frac{\text{Cooling Load (tons)} \times 29}{\text{Temp Rise (F)}}$$

In return, you will receive computer selections of 17DA component combinations to meet your job conditions See Typical Computer Selection.

TYPICAL COMPUTER SELECTION



PERFORMANCE DATA*

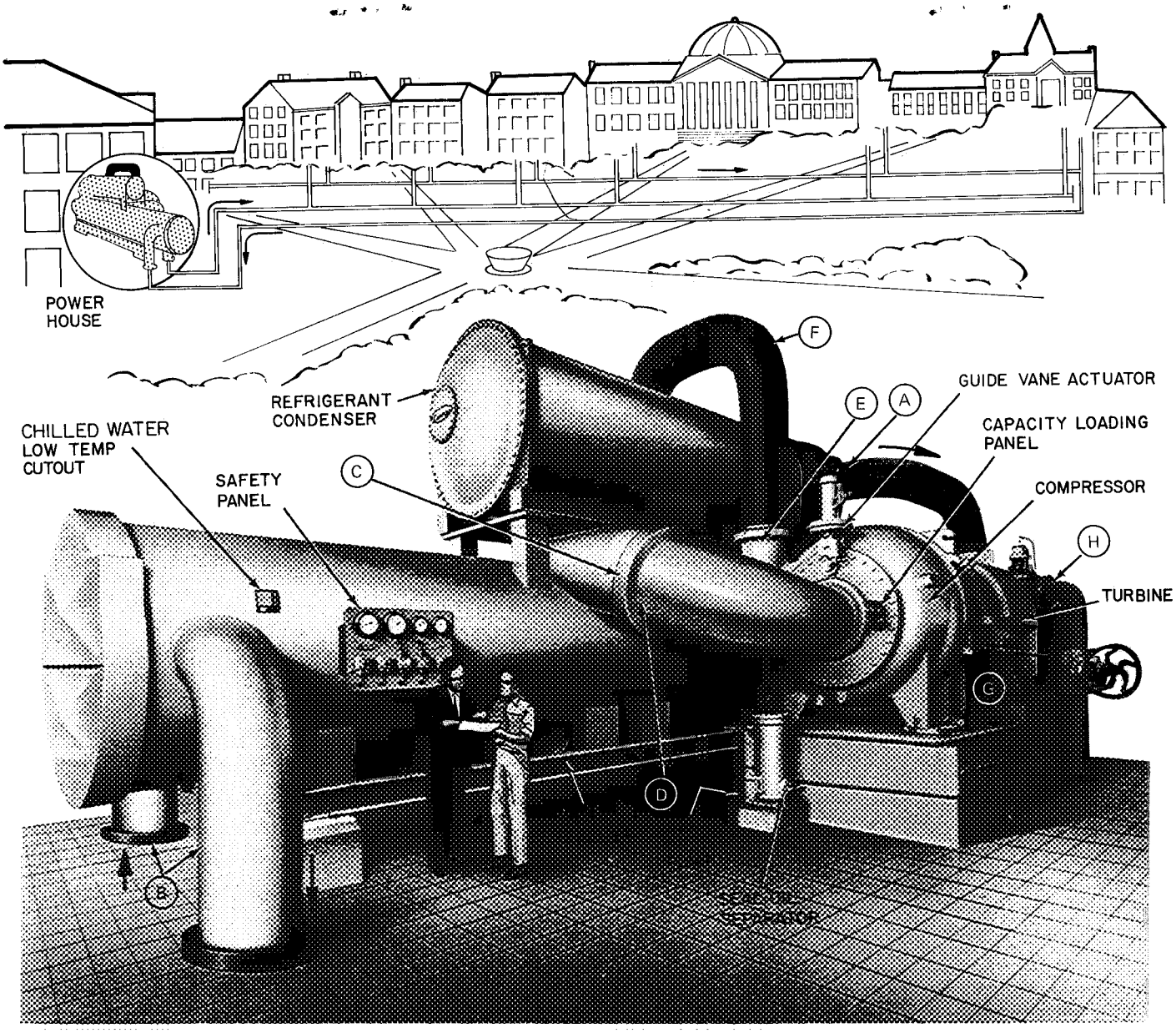
NOM TONS	17DA UNIT SIZE	COOLER Flow (gpm)	COOLER Vel (fps)	COOLER PD	CONDENSER Flow (gpm)	CONDENSER Vel (fps)	CONDENSER PD	COMPR Power (Bhp)	COMPR Speed (rpm)
Chilled Water – 54-44 F, 2-Pass Cooler†, 15-ft tubes									
2000	**71-73-63**	4800	9 2	25	5808	9.4	24	1866	5056
2250	**71-75-65**	5400	8.8	25	6534	9.4	23	2013	5082
2500	**72-75-67**	6000	9.8	30	7260	9 4	23	2207	5116
2750	**73-81-71**	6600	9.5	27	7986	9.4	24	2405	5128
3000	**75-83-73**	7200	9 2	26	8712	9.4	25	2595	5101
3500	**76-85-75**	8400	9.6	27	10164	9 5	24	3097	5157
4000	**84-87-81**	9600	10.0	30	11616	9.4	25	3461	4282
4500†	**85-87-83**	10800	5.6	8	13068	9.4	26	4363	4533
Chilled Water – 54-42 F, 2-Pass Cooler, 18-ft tubes									
2000	**71-67-63**	4000	9.2	29	5808	9.4	24	1923	5128
2250	**71-71-65**	4500	9.4	30	6534	9.4	23	2089	5166
2500	**72-73-67**	5000	9 6	31	7260	9.4	23	2271	5180
2750	**73-75-71**	5500	9 0	29	7986	9 4	24	2474	5191
3000	**75-75-73**	6000	9 8	34	8712	9 4	25	2700	5189
3500	**76-81-75**	7000	10 0	35	10164	9.5	24	3224	5247
4000	**83-85-81**	8000	9.2	29	11616	9.4	25	3572	4361
4500	**85-87-83**	9000	9 4	31	13068	9 4	26	3999	4366
5000	**86-87-85**	10000	10.4	38	14520	9.4	24	4574	4401
Chilled Water – 55-40 F, 2-Pass Cooler, 22-ft tubes									
2000	**71-63-63**	3200	9 2	36	5808	9 4	24	1979	5197
2250	**71-65-65**	3600	9.2	34	6534	9.4	23	2147	5228
2500	**72-67-67**	4000	9 2	35	7260	9.4	23	2332	5240
2750	**74-71-71**	4400	9.2	34	7986	9.4	24	2545	5227
3000	**75-73-73**	4800	9.2	35	8712	9 4	25	2764	5242
3500	**76-75-75**	5600	9.2	36	10164	9.5	24	3300	5300
4000	**84-81-81**	6400	9.2	35	11616	9.4	25	3648	4381
4500	**85-83-83**	7200	9.2	36	13068	9.4	26	4126	4425
5000	**86-85-85**	8000	9.2	35	14520	9.4	24	4658	4436
5500	**86-87-87**	8800	9.2	35	15972	9.4	24	5386	4581

PD – Pressure Drop (ft water)

*All units – condensing water 85-95 F; 2-pass condenser, 15-ft tubes; 0005 fouling factor for all coolers and condensers.

†1-pass cooler on 4500-ton unit.

TYPICAL PIPING



(A) Condenser Water Nozzles
(B) Cooler Water Nozzles
(C) Cooler Suction Connection
(D) Compressor Suction Connection
(E) Compressor Discharge Line Connection
(F) Discharge Line Compressor to Condenser
(G) Turbine Exhaust
(H) Turbine Steam Inlet

Plus safety, control, water feed, and water drain piping.

CONTROLS

OPERATING CONTROLS

The standard 17DA safety panel contains condenser pressure gage, cooler pressure gage, duplex gage for seal oil supply and back of seal pressures, bearing oil supply pressure gage, condenser high-pressure cutout, cooler low-pressure cutout, auxiliary oil pump control when used, seal oil low-pressure cutout, and bearing oil low-pressure cutout. See top line of Operating Control Diagram.

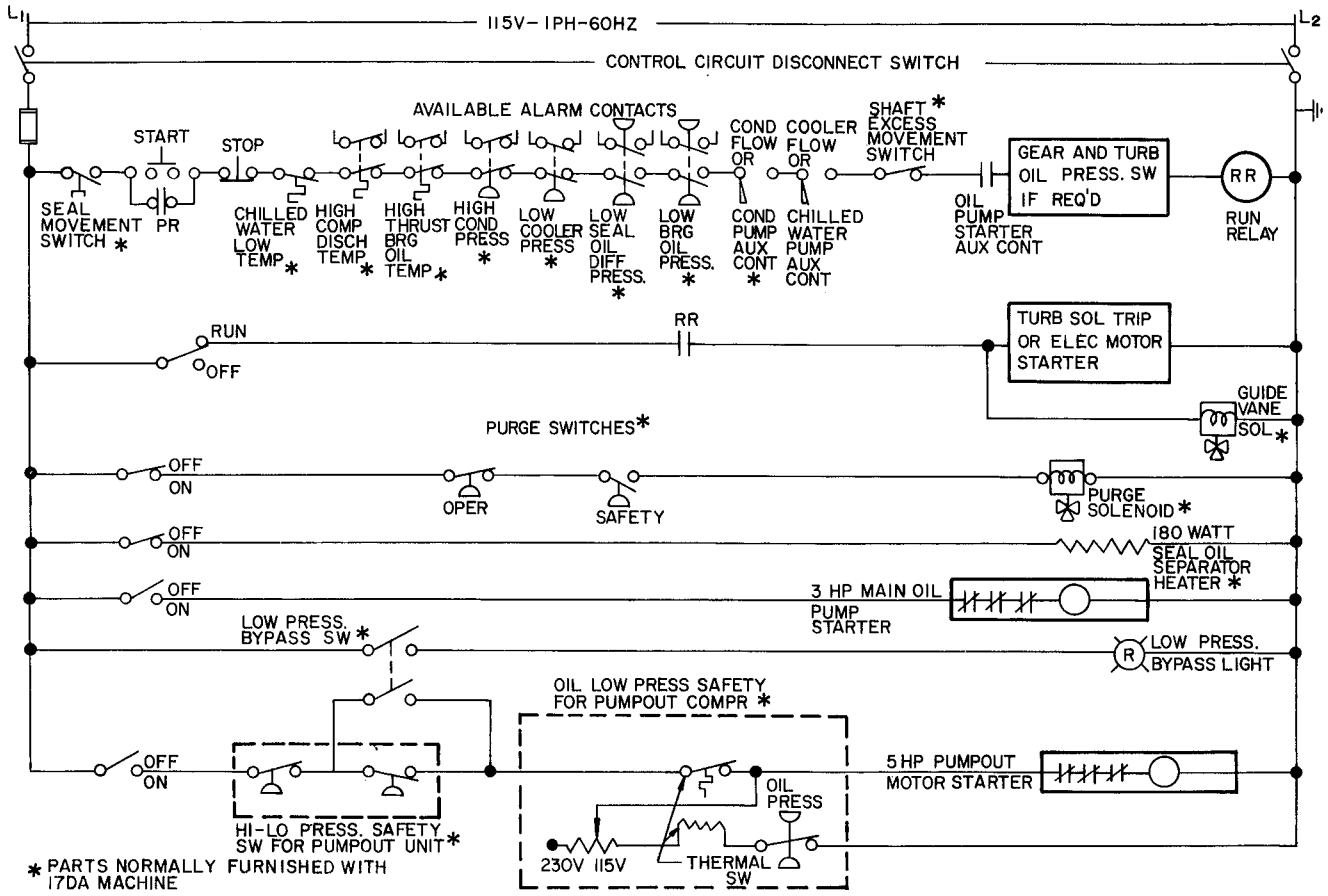
This circuit assumes that all auxiliary equipment is manually started from individual "Start-Stop" stations. These functions may all be automated to start in proper sequence by pushing the 17DA "Start" button.

To start machine, all switches, except pumpout circuit, should be in the "On" position. Oil pressure will then close seal oil pressure switch, bearing oil pressure switch, and shutdown seal switch. Either flow switches or auxiliary contacts close to indicate that water pumps are running.

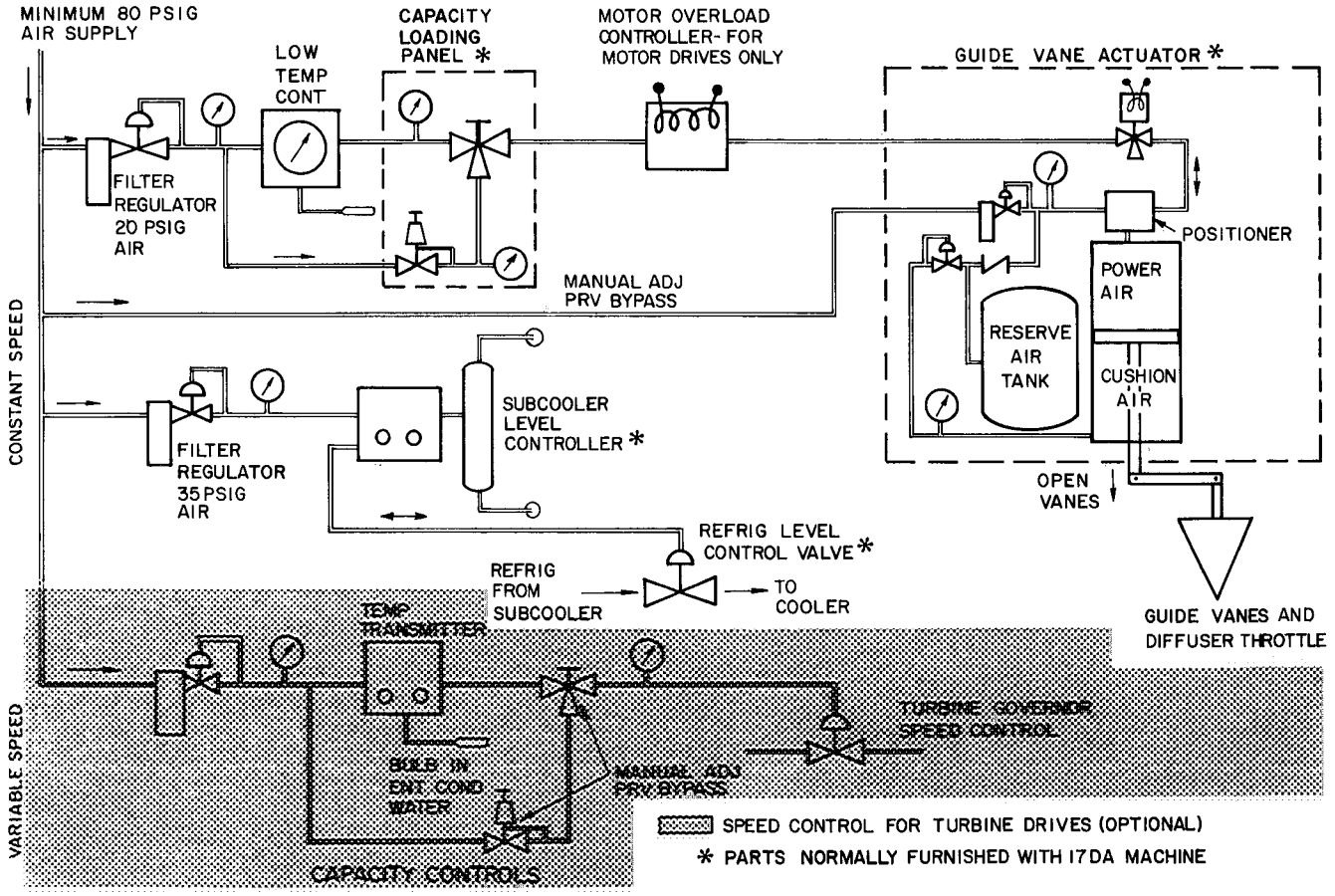
With all switches in safety circuit closed, the "Start" button switch may now be closed to energize run relay RR. Normally open RR contacts close to energize guide vane solenoid and either a turbine solenoid trip or a main electric motor starter. Motor-driven machines start immediately. On turbine-driven machines, the solenoid trip may now be manually set and steam valves opened to warm and start turbine.

Either the "Stop" switch or one of the safety cutout switches will de-energize RR and stop the machine. De-energizing the guide vane solenoid, vents control air pressure, quickly closing inlet guide vanes. This prevents compressor reverse rotation due to pressure difference between condenser and cooler.

CONTROLS (cont)



Operating Control Diagram



Capacity Control Diagram

CAPACITY CONTROLS

Leaving chilled water temperature is controlled by position of compressor inlet guide vanes and diffuser throttle at constant compressor speed. Machines selected for a required cooling job at highest condensing water temperature conditions, have excess capacity when condensing water temperature lowers. This extra capacity forces inlet guide vanes and diffuser throttle ring toward closed position Working together they throttle compressor capacity to hold outgoing chilled water at desired temperature. A heavily throttled compressor suction will increase horsepower required per ton of refrigeration.

The shaded portion of the Capacity Control Diagram shows a method of varying turbine speed. Turbine speed may be reset automatically by entering condensing water temperature. Manual speed reset may be used to trim compressor speed to open guide vane position.

Capacity Loading Panel permits either automatic or manual control of chilled water temperature. On turbine-driven machines, this may be used to keep guide vanes partly closed during turbine warm-up period.

Motor Overload Controller is required on motor-driven machines. Whenever electric motor current exceeds the selected maximum load condition, this control will override the leaving chilled water temperature controller to close the guide vanes thus reducing compressor horsepower.

Piston Type Actuator powers the guide vane, diffuser throttle mechanism. An air cushion is maintained on the underside The valve positioner applies air pressure to top of piston in proportion to control air pressure and thus controls guide vane position.

If air pressure fails, the reserve air tank has sufficient volume to ensure that vanes close quickly.

Guide Vanes and Diffuser Throttle are mechanically linked to provide simultaneous control for optimum performance. The pneumatic actuator, thru linkage, rotates coordinating ring which is linked to guide vanes.

Three program cams on coordinating ring move the diffuser throttle Below 50% load, the diffuser throttle and guide vanes move simultaneously to provide optimum part load performance down to 10% load

The diffuser throttle prevents reverse flow into compressor during light load operation. As load decreases, the throttle ring closes to maintain sufficient gas velocity to prevent backflow into the impeller. See sketch.

DIFFUSER THROTTLE