Number One Air Conditioning Maker
Carrier
Division of Carrier Corporation
Carrier Parkway • Syracuse N Y 13221
Application Data
Application Detail
19DK

Hermetic Centrifugal Liquid Chillers

CONTENTS

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 gal. (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

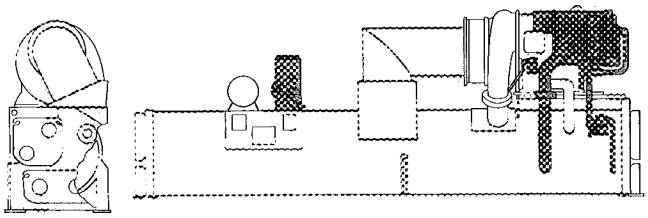
Design and test pressures for 19DK unishell heat exchangers are listed in Table 1.

Table 1 — 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	—	

Table 2 — 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

UNISHELL SIZE*	EXTRA INSULATION*	
	ft²	m²
42 — 57	130	12.08
61 — 65	213	19.79
71 — 78	218	20.25

*Water box insulation not included If added, allow for service access to the covers

Fig. 1 — Insulation Requirements

INSULATION

Standard Insulation — Compressor motor and motor cooling lines, motor vent-gas line 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 • ft² • 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 Table 3, 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 Fig. 1.

If the cooler and the suction elbow are to be field insulated, obtain the approximate areas from Fig. 1.

Insulation of water box covers is made only in the field and this area is not included in Fig. 1. When insulating the covers, allow for service access and removal of covers.

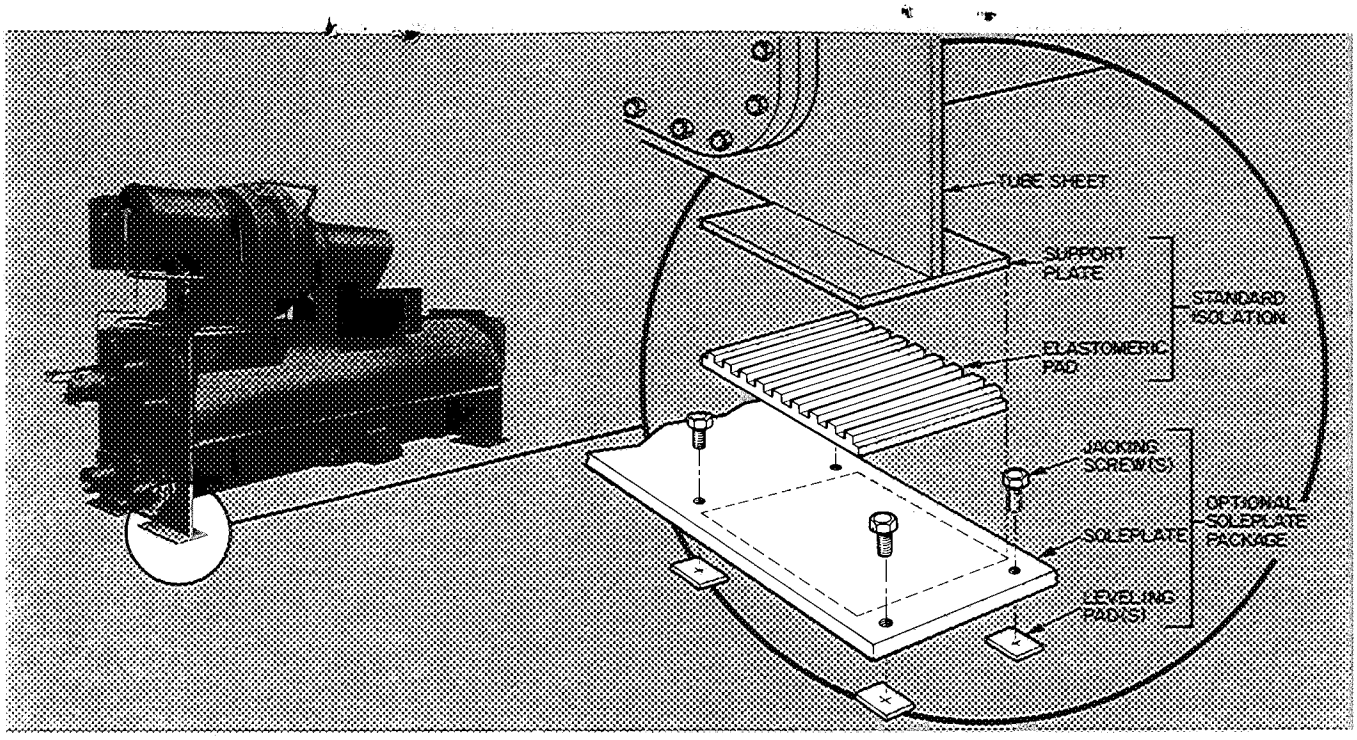


Fig. 2 — Typical Isolation Assemblies (without Spring Mounts)

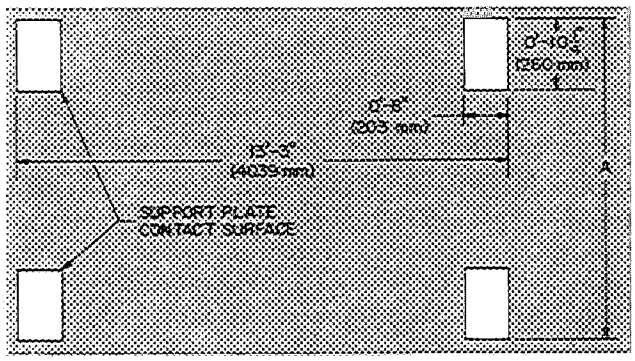
Table 3 — Condensation vs Relative Humidity*

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

MACHINE ISOLATION AND CONTACT SURFACES

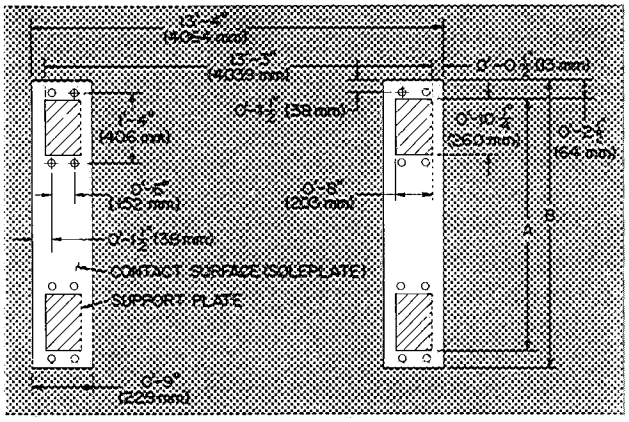
Standard Isolation — All 19DK machines are supplied with 4 elastomeric pads of resilient cross-ribbed neoprene and 4 steel support plates that provide vibration isolation, as shown in Fig. 2. Figure 3 shows standard machine contact surfaces.



UNISHELL SIZE*	DIMENSION A	
	ft-in.	mm
42 — 57	3- 0	914
61 — 65	3-10	1168
66 — 78	4-6-1/2	1384

*See machine informative plate

Fig. 3 — Standard Contact Surfaces



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	4-6-1/2	1384	4-11-1/2	1511

*See machine informative plate

Fig. 4 — Contact Surfaces with Optional Soleplates

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 as indicated in Fig. 2. Figure 4 shows machine contact surfaces with the optional soleplate package.

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

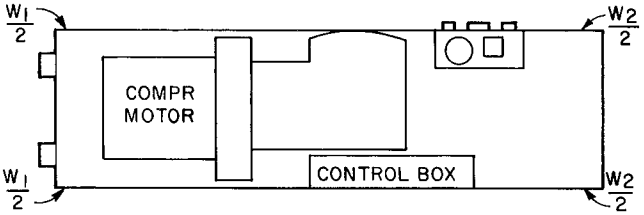
selected for the desired degree of isolation and are furnished and installed by others.

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 Table 4).

A typical spring isolation arrangement is illustrated in Fig. 5. 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.

Table 4 — Operating Weight Distribution



UNISHELL SIZE	TOTAL OPER WEIGHT		WEIGHT DISTRIBUTION*			
			W1		W2	
	lb	kg	lb	kg	lb	kg
42	9,136	4144	4,928	2235	4,208	1909
44	9,281	4210	5,128	2326	4,153	1884
46	9,446	4285	5,328	2417	4,118	1868
50	10,961	4972	6,168	2798	4,793	2174
51	11,191	5076	6,373	2891	4,818	2185
53	11,456	5196	6,518	2956	4,938	2240
55	11,716	5314	6,663	3022	5,053	2292
57	11,971	5430	6,813	3090	5,158	2340
61	15,412	6990	8,791	3988	6,621	3002
63	15,792	7163	8,996	4081	6,796	3082
65	16,122	7312	9,186	4167	6,936	3145
71	17,693	8025	10,104	4583	7,589	3442
72	17,953	8143	10,249	4649	7,704	3494
73	18,338	8318	10,469	4749	8,869	3569
76	19,078	8653	10,789	4894	8,289	3760
77	19,648	8912	11,069	5021	8,580	3891
78	20,108	9121	11,389	5166	8,719	3955

*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

PHYSICAL DATA

Compressor Weights (Table 5) — Net weights may vary from those listed by ±5% depending upon casting process. For total compressor weight, add applicable motor weight (Table 7).

Standard combinations of motor size and compressor size are given in Table 6.

Machine and Heat Exchanger Weights — See Table 8.

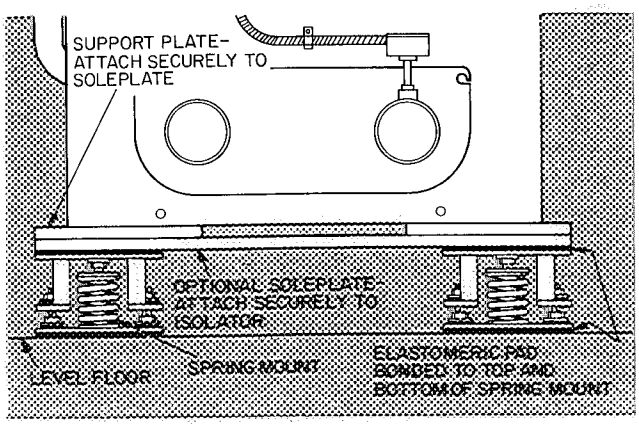


Fig. 5 — Typical Spring Isolation

Table 5 — Compressor Weights*

COMPRESSOR SIZE	ASSEMBLY (Less Motor)	
	lb	kg
12 — 38	1460	662
42 — 68	2060	934
72 — 98	2910	1320

*Net weight may vary; see text

Table 6 — Motor Compressor Combinations

MOTOR SIZE	USED WITH COMPR
AA thru AD	12 thru 38
AE	12 thru 68
CA thru CL	42 thru 68
CD thru CQ	72 thru 98

Motor Weights — Refer to Table 7. Listed weights are for low-voltage (200 thru 600 v) motors. To calculate the weight of high-voltage motors, add 200 lb (91 kg) to size CA thru CD total weight, and add 150 lb (68 kg) to size CE thru CQ total weight.

Table 7 — Motor Weights*

MOTOR SIZE	TOTAL WEIGHT		ROTOR WEIGHT		MOTOR END BELL	
	lb	kg	lb	kg	lb	kg
AA	520	236	110	50	70	32
AB	530	240	115	52		
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	90	41
CC	980	445	180	82		
CD	1020	463	190	86		
CE	1060	481	200	91	90	41
CL	1100	499	210	95		
CM	1130	513	220	100		
CN	1190	540	230	104	90	41
CP	1210	549	230	104		
CQ	1240	562	240	109		

*Low-voltage motor weights listed; see text for high-voltage weight correction

Table 8 — Machine and Heat Exchanger Weights

UNISHELL SIZE	MACHINE TOTAL WEIGHT				MACHINE CHARGE				HEAT EXCHANGER WEIGHT		WATER BOX COVER			
	Operating		Rigging		Refrigerant		Water				Cooler		Condenser	
	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
42	9,136	4144	8,276	3754	500	227	360	163	6,126	2779				
44	9,281	4210	8,376	3799	525	238	380	172	6,206	2815	53	24	76	34
46	9,446	4285	8,476	3845	550	249	420	191	6,326	2869				
50	10,961	4972	9,856	4471	575	261	530	240	6,556	2974				
51	11,191	5076	10,056	4561	575	261	560	254	6,756	3064				
53	11,456	5196	10,256	4652	600	272	600	272	6,956	3155	73	33	76	34
55	11,716	5314	10,456	4743	625	283	635	288	7,156	3246				
57	11,971	5430	10,656	4833	625	283	690	313	7,356	3337				
61	15,412	6990	13,652	6192	775	352	985	447	9,352	4242				
63	15,792	7163	13,952	6328	810	367	1,030	467	9,602	4355	123	56	137	62
65	16,122	7312	14,152	6419	850	386	1,120	508	9,852	4468				
71	17,693	8025	15,578	7066	975	442	1,140	517	11,278	5115	138	63	137	62
72	17,953	8143	15,778	7157	985	447	1,190	540	11,478	5206	138	63	137	62
73	18,338	8318	16,078	7293	1,010	458	1,250	567	11,678	5297	138	63	137	62
76	19,078	8653	16,578	7519	1,100	499	1,400	635	12,348	5601	208	94	268	122
77	19,648	8912	17,978	7701	1,150	522	1,520	689	12,698	5760	208	94	268	122
78	20,108	9121	17,278	7837	1,200	544	1,630	739	13,058	5923	208	94	268	122

Nozzle Arrangements — Refer to Fig. 6.

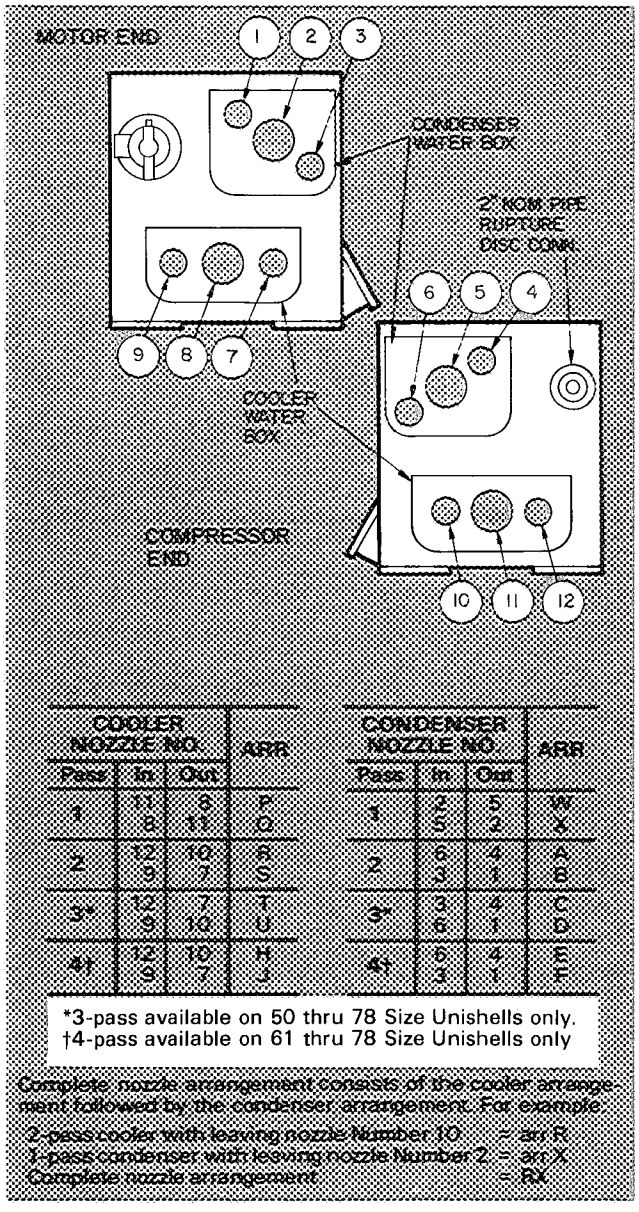
Vent and Drain Connections — With the exception of the cooler vent connection, located in the water box shell, all vent and drain connections are found in the water box covers. Connection size is 3/4-in. FPT.

The typical vent and drain piping arrangement shown in Fig. 7 is not the only method of piping to these connections, but illustrates one approach.

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 thru the heat exchanger. Gages may be installed as shown in Fig. 8 and 9 and Table 9. 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.



COOLER NOZZLE NO.		ARR
Pass In	Out	
1 11	6	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

Fig. 6 — Nozzle Arrangements

Table 9 — Pressure Gage Location

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

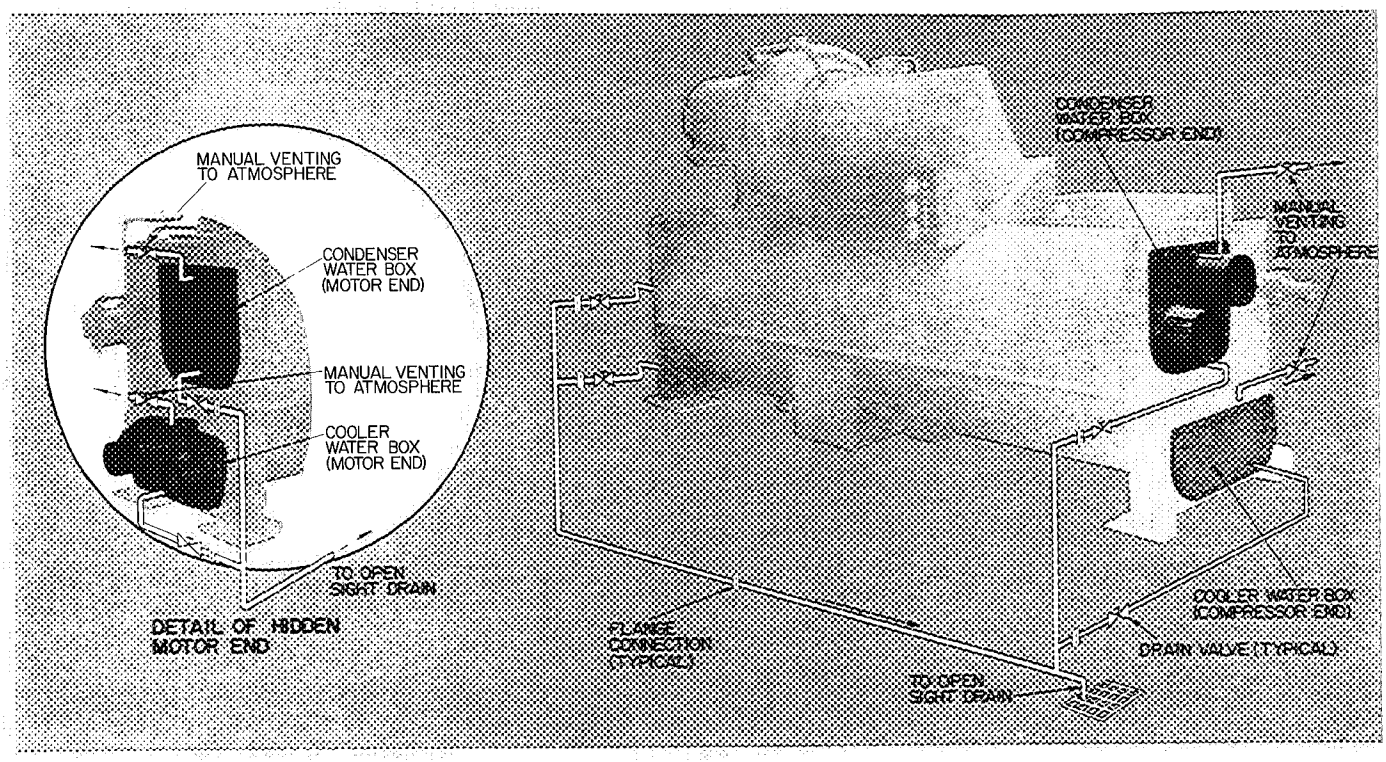


Fig. 7 — Typical Vent and Drain Piping

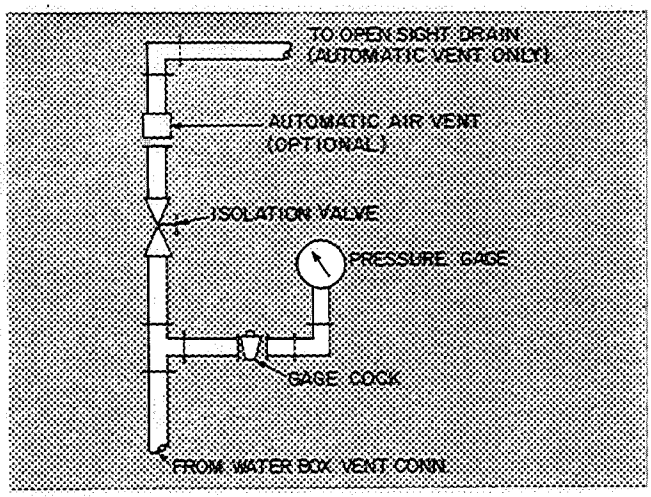


Fig. 8 — Vent Piping with Pressure Gage

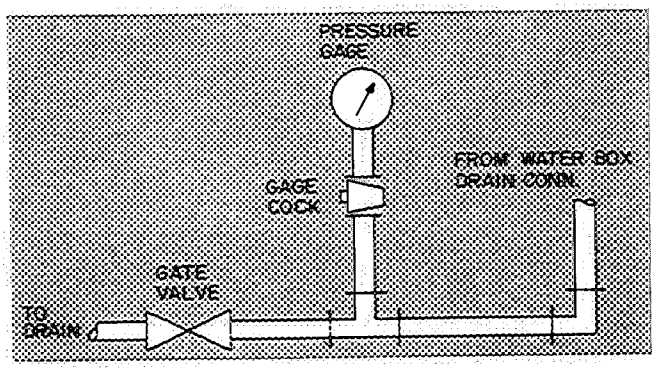


Fig. 9 — Drain Piping with Pressure Gage

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:

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 thru the oil cooler.

Refrigerant Charge — The refrigerant weight listed in Table 8 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.

THERMOMETERS

The 19DK has 3 thermowells provided for use in measuring refrigerant temperature. One well is located in the low temperature side of the machine (cooler), one 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 10 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 19D Series machines is available from Carrier in pads of 50 each. When ordering, list the form number, E-56A, found in the lower left-hand corner of the log sheet.

Table 10 — 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