SUPERSEDED BY 16JB-5XA 5/73

Hermetic Absorption Liquid Chillers

GENERAL

Application details in this publication cover various methods of applying the 16JB absorption machine to meet liquid chilling needs. Throughout this publication, the chilled liquid will be water.

Subjects covered are chilled water temperature control, condenser water temperature control, system design for steam and hot water machines, and general information.

CHILLED WATER TEMPERATURE CONTROL

The absorption machine is basically a water chiller that can be connected to any conventional open or closed system. However, circulation of chilled water must be continuous during operation of the machine and during the shutdown dilution cycle. Chilled water flow may be restricted at partial load.

For fine chilled water temperature control within narrow limits, such as required in precision control of industrial processes or maintenance of laboratory conditions, the chilled water system may require additional storage volume to allow the machine to adjust slowly to changes in load. Normal air-conditioning applications are not subject to such requirements.

Systems having large storage volumes of chilled water transmit load changes to the machine slowly, allowing accurate chilled water temperature control. Small storage systems transmit load changes rapidly, making temperature control more difficult. For fine temperature control, the chilled water system volume should be at least ten times the gpm flow through the cooler. If a tank is added to the system for extra storage volume, it should be located in the line from the load to the cooler.

Two-Pipe Cooling-Heating Systems — When machines are used in conjunction with a two-pipe cooling-heating system, certain precautionary steps should be taken during changeover from heating to cooling.

Maximum water temperature permitted thru the evaporator is 130 F because of the possibility of tube stress. If system water temperature is above 80 F but less than 130 F at changeover time, evaporator flow should be throttled to prevent machine overload.

It is recommended that hot water temperatures be reset, based on outside air temperature. If a reset-type control is used, the entering hot water temperature at changeover will normally be lower than 130 F.

STEAM MACHINES

Boilers — Generally, any boiler capable of modulating its input to maintain design operating steam pressure within 1 psi under varying loads, is suitable for application with the absorption machine. This generally includes all gas- and oil-fired boilers.

Some oil-fired boilers are conversions from coal-fired to oil-fired and may have control systems which are too sluggish to give proper response to machine load changes. Direct control of oil feed rate normally ensures proper response.

Coal-fired boilers, due to slow buildup and shutdown characteristics, should be used only when the absorption machine represents less than 15% of boiler operating load. This generally limits coal-fired boiler applications to large industrial jobs where process steam is generated in large quantities year-round.

BOILER CAPACITY — Minimum boiler capacity for use with the absorption machine is equal to full load steam consumption, plus sufficient capacity to offset piping radiation losses. In the absence of a detailed study of radiation and vent losses, a minimum 10% safety factor should be used.

Pressure Reducing Valves — Maximum unit ratings are based on 14 psig steam pressure at the generator inlet. Operation at higher inlet pressures or with more than 100 F superheat is not permissible. Higher inlet pressures may lead to overconcentration.

Where steam supply pressures are above 15 psig (14 psig + 1 psig for control) and below 20 psig, the steam control valve can be used to reduce the pressure. If steam supply is above 20 psig, a pressure reducing valve must be provided between the steam supply and the control valve inlet. A safety relief valve should be provided between the steam control valve and the generator inlet. This valve must be set in accordance with paragraph UG-133 (f) of the ASME code to relieve at a pressure not exceeding 17 to 18 psig or the setting determined by applicable local codes.

Further specific details relative to pressure reducing stations should follow accepted standards, such as the ASHRAE Guide and manufacturer's recommendation. For applications on high-pressure district heating, the steam utility should be consulted for local codes or standards.

Steam Piping should be sized to avoid excessive pressure drop or excessive velocities. Recommendations and pipe sizing tables are given in the Carrier System Design Manual. It is recommended that lines be sized on the basis of design system flow for the machine plus a 10 to 20% safety factor to allow for normal radiation losses.

Start-Up Demand — Steam demand by the absorption machine is greatest at start-up (see Table 1 for values).

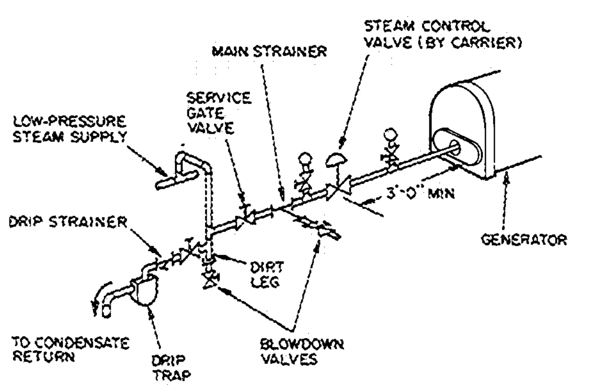
Table 1 — Maximum Condensate Flow (lb/hr)

VALVE SIZE (in.)	VALVE INLET STEAM PRESSURE			
	20 psig	14 psig	12 psig	10 psig
2	2450	2025	1880	1750
2½	4825	4000	3710	3430
3	8175	6760	6285	5810
4	14540	12025	11190	10350
5	21650	17900	16655	15400

When boiler capacity is unable to keep up with start-up demand, the steam pressure will fall off. On boilers serving only the absorption machine, this reduction in steam pressure will have no adverse effect on the absorption machine other than to lengthen start-up time. However, the increased steam demand may have an adverse effect on the boiler, causing it to run dry and fail. As steam pressure is reduced, the steam control valve pressure drop will eventually limit the demand on the boiler provided the steam control valve is properly sized.

On boilers serving other loads simultaneously, the start-up demand can reduce boiler pressure sufficiently to cause adverse effects on other steam-driven equipment. When a reduction in boiler pressure cannot be tolerated without upsetting other equipment, the boiler capacity available for absorption machine operation (with other loads deducted) must equal or exceed the start-up demands. If it does not, the start-up demand can be reduced by using demand limit controls, or installing a back-pressure regulator in the steam line(s) between the boiler and the control valve(s).

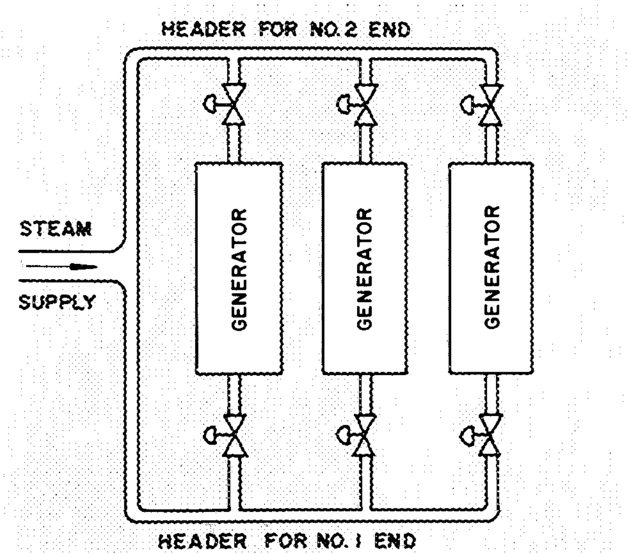
VALVE LOCATION AND PIPING — The steam control valve should be located a minimum of 3 ft away from the generator inlet. This is dictated by good piping practice, to allow equal distribution of steam in the generator tube bundle. Unequal distribution of steam in the tube bundle may cause a loss of capacity. Recommended steam supply piping for low-pressure steam applications is illustrated in Fig. 1.



NOTE: Separate supply piping for each end of machine sizes 16JB077 thru 124.

Fig. 1 — Low-Pressure Steam (2 to 15 psig) Supply Piping

Machine sizes 16JB077 thru 16JB124 have steam supply inlets on each end. *These are to be considered as two generators* and should be piped from a common steam header as in multiple machine installations (see Fig. 2). Each inlet should then be piped in accordance with Fig. 1.



NOTES:
1. Piping applies to multiple machines connected in parallel (3 shown).
2. Each end must be considered as a separate generator.
3. The feed to each end of each generator should be piped as shown in Fig. 1.

Fig. 2 — Steam Piping For 16JB077 thru 124

Steam piping to the absorption machine should be designed and supported to allow for thermal expansion without imposing undue stresses on the generator inlet. The machine is not designed for, nor expected to act as, a piping support or anchor for withstanding thermal stresses.

Condensate Systems — Satisfactory operation of the absorption machine requires a condensate handling system designed with the specific characteristics of the absorption machine in mind. The following is intended to supplement available reference data on condensate systems such as Carrier System Design Manual, ASHRAE Guide and individual manufacturer's recommendations.

ATMOSPHERIC CONDENSATE RETURN SYSTEMS (VENTED) — These systems usually consist of steam traps, vented receiver, condensate pump, and condensate cooler. Fig. 3 illustrates typical atmospheric condensate return systems. On larger machines, with dual steam generators, the condensate outlet from each generator must be piped thru separate steam traps.

Trap Selection — Steam traps should be located as far below the generator outlet as possible. Actual pressure drop available for trap selection will depend on exact trap location below the generator

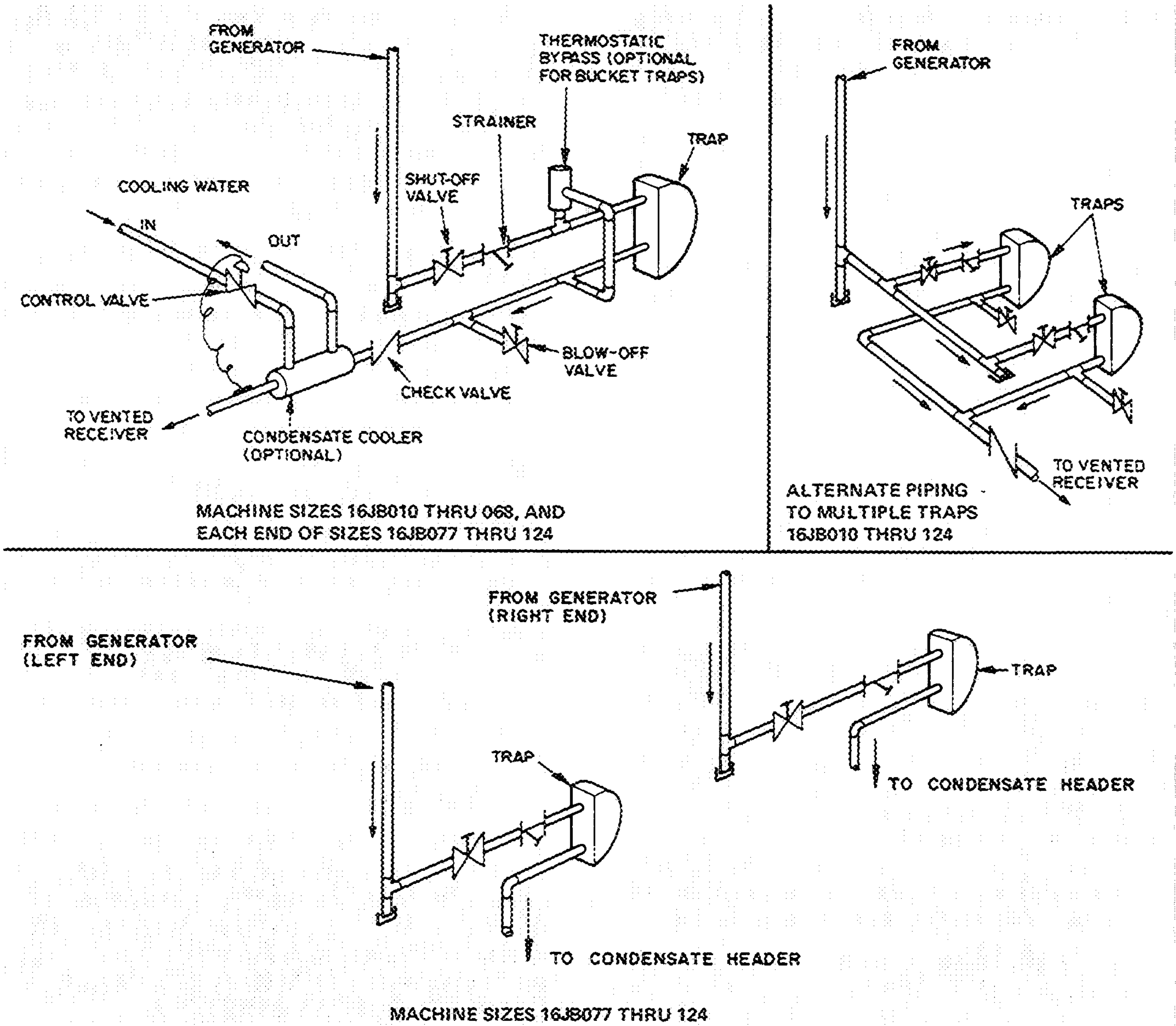


Fig. 3 — Typical Atmospheric (Vented) Condensate Return System

outlet, and trap outlet pressure. A vacuum breaker is factory installed to ensure that operating steam pressure in the generator does not fall below atmospheric pressure. Use the following formulas to determine available trap pressure drop:

Trap pressure drop = trap inlet – trap outlet psig.

Trap inlet pressure = 0 psig + hydrostatic head to trap inlet – condensate leg pressure drop.

Trap design outlet pressure = receiver pressure + line pressure drop from trap outlet to receiver.

In determining trap outlet pressure, discount any liquid head drop to the receiver. This line may not run full. If there is liquid lift from trap outlet to the receiver, it must be added to trap outlet pressure.

Either float-and-thermostat or inverted-bucket traps may be used, provided the trap is recommended by the manufacturer for rapid handling of noncondensables. For fast start-up with inverted-bucket traps, install an external thermostatic air vent around the trap.

Traps should be sized for capacity to handle more condensate than twice the design full-load steam rate. See steam trap manufacturer's recommendations. Maximum load on the trap will occur during start-up when generator pressure falls to atmospheric (0 psig) and steam condenses rapidly.

At this time, pressure drop across the steam control valve is maximum. If boiler capacity is large enough, the control valve inlet pressure will stay at design, then flow rate will be limited by control valve capacity.

Table 1 gives maximum condensate flow for different inlet steam pressures. Interpolate for intermediate pressures.

If steam demand on start-up can be held within a controlled limit, the trap(s) may be sized accordingly.

When traps are undersized, condensate will back up in the generator with loss in machine capacity and may cause dangerous water hammer. Depending on boiler size, the boiler water makeup system could operate and add water to the boiler. Sooner or later, excess water would return to the boiler room and either overflow the hot well to drain, or if it flows directly into the boiler, it may shut the boiler down on high boiler water level control.

Condensate Cooler is used on some atmospheric condensate systems to reduce or eliminate loss of flash steam from the open receiver vent. The condensate cooler must be sized for handling and condensing flash steam as well as cooling the condensate. Condensate is normally cooled to about 180 F. Pressure drop thru the condensate cooler should be very low, as it must be added to trap outlet pressure. If there is a liquid leg down to the condensate receiver, the condensate cooler and trap should be located at the bottom of this leg.

When a condensate cooler is used, it is desirable to use either cold boiler feed water or other cold water source which can benefit by heat rejected from hot condensate. Cooling tower bleed water can be used, but it may be heavy with dissolved solids and may rapidly foul the cooler. Tower makeup water can be used when large cooling towers are part of the system. Extra load to the tower would be insignificant.

Receiver and Condensate Pumps – When open receivers are used, the vent should be directed outside the equipment space to eliminate fogging.

Be careful in using small receivers and close-connected condensate pumps. Some commercially available systems may work well on standard heating systems but can present problems in handling condensate from absorption machines. The basic difference in absorption machine operation lies in higher condensate temperatures and greater amounts of flash vapor. Commercial heating systems normally deliver condensate to the receiver thru long return runs. This lowers condensate temperature to 200 F or lower with relatively little flash steam.

Absorption machines commonly located close to the condensate receiver have little or no condensate cooling. During full load, condensate may be delivered to the trap at close to 12 psig and 240 F. This creates large amounts of flash steam at the trap outlet and in the condensate receiver. Very hot condensate drawn into the condensate pump may cause cavitation.

To minimize these effects, the following guides are offered:

1. If equipped with a vented receiver, the inlet line to the receiver should enter above the receiver water level. Flash steam can go directly out the vent without creating turbulence or frothing.
2. Locate the condensate pump as far below receiver water level as possible to give maximum Net Positive Suction Head (NPSH) to the pump.
3. If pump suction pipe is located at bottom of the receiver, use a vortex breaker at the receiver outlet.
4. Locate pump suction at opposite end of receiver from the condensate inlet. This will minimize agitation and frothing at pump inlet.
5. A properly selected condensate cooler, as previously described, will eliminate problems with flashing.

VACUUM PUMP CONDENSATE RETURN SYSTEMS are sometimes used to return condensate from space heating installations. The vacuum pump maintains the condensate return system at a subatmospheric pressure and permits the heating system to operate with subatmospheric pressure when the heating load is small.

It is generally impractical to use an existing vacuum pump condensate return system. Condensate from the absorption machine is far higher in temperature than condensate from the original heating system for which the vacuum return pump was selected. Hot condensate forms excessive quantities of flash vapor when released into the vacuum return system and will usually cause vapor lock in either the return piping or the vacuum return pump, or both. When the existing condensate return system is a vacuum pump type, the recommended method of returning condensate from the machine is a separate wet-return system, if possible.

As an alternate choice, condensate can be discharged thru a steam trap to an atmospheric vent receiver. The receiver discharges flash-cooled condensate thru a second trap into the vacuum-return system.

If a condensate cooler is used, condensate may be cooled to an acceptable level and discharged into the vacuum pump condensate return system. If this method is used, it is desirable to use either cold boiler feed water or any other cold water source which will benefit by heat rejected from hot condensate.

CLOSED CONDENSATE RETURN SYSTEM (PRESSURIZED)

16JB010-068 – Many manufacturers have high-temperature condensate units, generally suited for use with most of the Carrier absorption machine line. Because the condensate units are usually quite high, some of the smaller machines may not be high enough to provide liquid head for gravity flow. In these cases, the closed system should not be used. A typical unit consists of a closed ASME Code receiver and centrifugal pump for returning hot condensate to the boiler. This system has the advantage of complete condensate recovery without flash losses often experienced in atmospheric return systems.

These systems require very careful application to the absorption machine. There are two common types of closed condensate systems:

The first type will operate under pressurized conditions. The pressure between the generator and receiver is equalized and condensate flows by gravity to the closed receiver located below the generator outlet. It is essential that under these conditions the vacuum breaker on the 16JB generator should be blocked. This is to prevent air from building up in the closed receiver. Also, the closed receiver should be equipped with a device that is capable of releasing the air that is in the system after a shutdown period. A thermostatic vent is usually supplied for this purpose. In this type of system, the pumps on the receiver can pump under vacuum.

The second type of closed system consists of a closed receiver with atmospheric condensate pumps. Therefore, the receiver is usually equalized with the steam chest. In this type of system, the vacuum breaker and the generator must be left open so that the receiver cannot go into the vacuum range. A steam trap is usually recommended.

16JB077-124 – Because the 16JB077-124 units have two steam inlets, these machines must be considered as having two generators when applying a closed condensate system. Each end of the machine operates at a different steam pressure. This could cause the condensate to back up into the generator and cause dangerous water hammer if the condensate system were not properly designed.

Each end of the machine should be considered similar to the system on 16JB010-068 units (see Fig. 4).

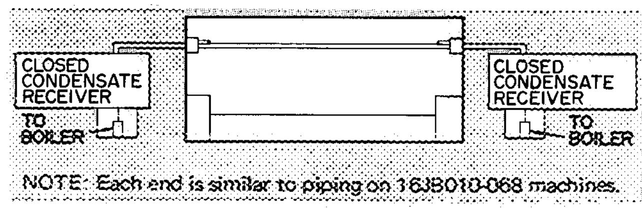
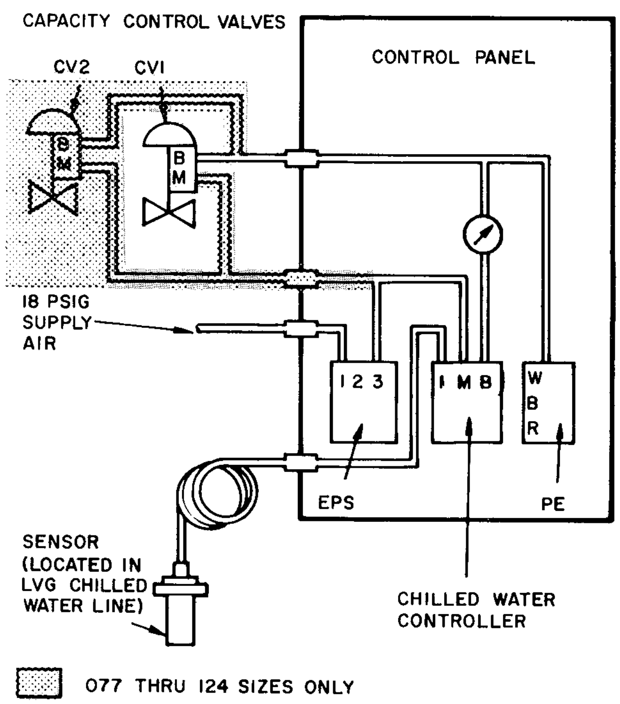


Fig. 4 — Closed Condensate Return System (16JB077-124)

HOT WATER MACHINES

The 16JB hot water absorption machines are furnished with pneumatic controls only. Fig. 5 schematically illustrates the capacity control valves, controls and control panel. There are two commonly used piping systems, depending on the temperature of the supply hot water.



EPS – Electric-Pneumatic Switch
PE – Pressure-Electric Switch

Fig. 5 — Pneumatic Control Schematic

Piping For Water Temperature of 300 F Or Below – Fig. 6 gives suggested hot water piping when supply hot water is 300 F or below. The capacity of the machine is controlled by regulating the flow of hot water through the generator. Either a two-way or three-way capacity control valve (CV) can be used. Machine sizes 16JB077-124 require two capacity control valves if partial load efficiency of double generators is to be utilized.

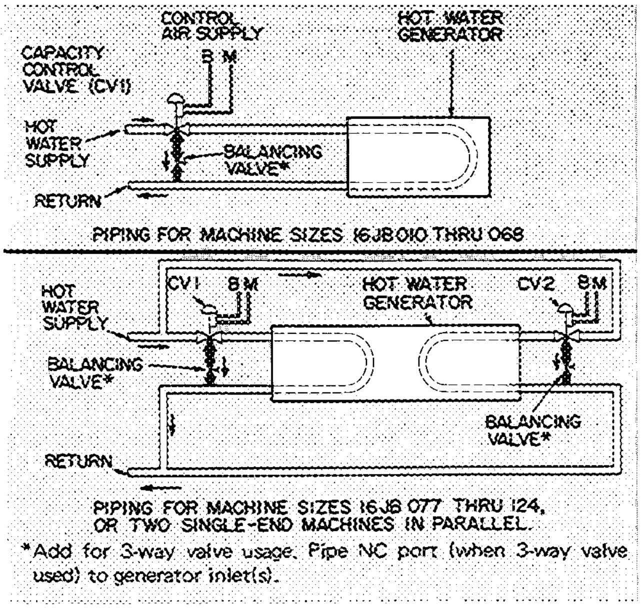


Fig. 6 — Suggested Piping For Hot Water Machines Using Supply Hot Water 300 F or Below

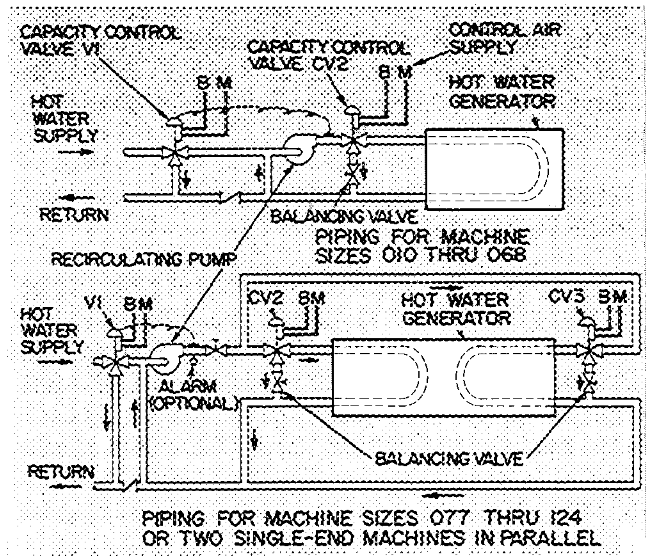


Fig. 7 — Suggested Piping For Hot Water Machines Using Supply Hot Water Above 300 F

A three-way valve is recommended to ensure a constant system flow of hot water supply regardless of load. A two-way valve is suitable when throttling of supply hot water at partial load does not adversely affect the boiler or primary circulating pump.

Piping For Water Temperature Above 300 F — Fig. 7 gives suggested hot water piping when supply High-Temperature Hot Water (HTHW) is above 300 F. The three-way valve — CV1, diverts HTHW and allows cooler recirculated hot water to maintain design hot water temperature (300 F max).

Machine capacity is controlled by regulating the flow of hot water thru the generator. As machine load decreases, the chilled water controller senses the lower chilled water temperature and acts upon the three-way diverting valve(s) CV2 (CV2 + CV3) to reduce the supply of hot water to the generator. The recirculating pump, however, is actually pumping a constant gpm.

The sensor for CV1 should be located, if possible, on the discharge side of the recirculating pump. The recirculating pump should be sized for design hot water at a head equal to the pressure drop through the generator and recirculating loop piping.

An alarm should be used to warn of excessive entering hot water temperatures. Excessive temperatures could develop if control valve calibration were lost.

RECIRCULATING WATER CALCULATIONS — Assume for example purposes:

Available supply hot water temp	= 400 F
Design quantity of hot water needed	= 243 gpm
Design entering hot water temp	= 300 F
Design leaving hot water temp	= 229 F

1. Determine the design hot water temperature drop (ΔT_1) thru the machine.

   ΔT_1 = ent hot water (F) – lvg hot water (F)
   = 300 F – 229 F
   = 71 F

2. Determine the temperature drop of 400 F water (ΔT_2) thru the machine.

   ΔT_2 = supply hot water (F) – lvg hot water (F)
   = 400 F – 229 F
   = 171 F

3. Determine the amount (gpm) of 400 F water required.

   Gpm of 400 F water = gpm of 300 F water $\times \frac{\Delta T_1}{\Delta T_2}$
   $= 243 \times \frac{71}{171}$
   = 101 gpm

4. Determine the amount (gpm) of recirculated 229 F water required to meet design quantity of water needed:

   Gpm of 229 F water = gpm of 300 F water – gpm of 400 F water
   = 243 – 101
   = 142 gpm

VALVE SIZING – The hot water capacity control valve CV2, should be sized to handle full design flow on machine sizes 010-068. Valves CV2 and CV3 on machine sizes 077-124 are each sized at one-half design flow. The pressure drop and sizing formula used in sizing the valve(s) should be consistent with valve manufacturer's recommendations. The three-way diverting valve should be sized to handle the design supply of high-temperature hot water (HTHW) and must be suitable for high temperature duty.

Methods Other Than Recirculation to lower supply hot water temperature to acceptable levels (300 F max) are:

1. A water-to-water heat exchanger
2. A hot water-to-steam converter

Rupture Disc – All 16JB hot water machines are provided with a rupture disc on the generator shell for safety reasons. A generator tube failure could subject the shell to hot water supply working pressure.

RELIEF PIPING – Some applications have relief piping installed from the rupture disc discharge to a location where high-temperature steam and lithium bromide will not cause damage or injury.

Relief piping must include access to the rupture disc, allowing replacement in case of failure. Piping must be supported independent of the machine.

Hot Water Inlet Pressure – It is necessary to ensure that generator hot water pressure is higher than saturation pressure corresponding to the inlet hot water temperature.

Minimum pressures are approximately equal to 10 psi plus the saturation pressure corresponding to inlet water temperature. Using a recommended minimum pressure will ensure that hot water inlet pressure drops will not cause the pressure in the lines to drop below saturation pressure. This could cause flashing and water hammer.

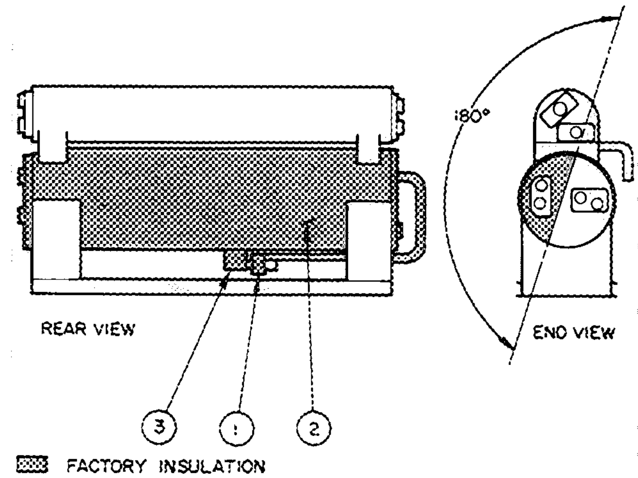
CONDENSING WATER TEMP CONTROL

If the absorption machine is to be applied under conditions where the condensing water temperature can fall below 55 F, condensing water temperature control is required. This can be accomplished by:

1. **Fan Cycling** – On a single-cell cooling tower, the tower fan can be shut off when the temperature of the water reaches 55 F. This allows the temperature of the tower water to warm up using the heat rejected from the machine. In order to ensure against rapid fan cycling, which can cause fan motor problems, it is recommended that the cooling tower water temperature be allowed to rise to design temperature before fan operation is resumed.
2. **Multiple-Cell Tower** – The temperature of a multiple-cell tower can be controlled by shutting off the number of operating cells. This creates an effect similar to shutting the fan off in a single-cell tower. The controls should be adjusted to shut off in stages to 55 F and come on again in predetermined stages.
3. **Winter Operation** – If the absorption machine is to be applied under winter operating conditions, an indoor cooling tower sump should be provided to protect the cooling tower water from freezing.

GENERAL INFORMATION

Insulation – Machine cold surfaces, subject to sweating and corrosion, are factory insulated. Refer to Fig. 8 and Table 2 for details.



LEGEND

1 – Refrigerant Pump Housing
2 – Evaporator Shell
3 – Refrigerant Suction Piping

Fig. 8 – Machine Cold Surfaces

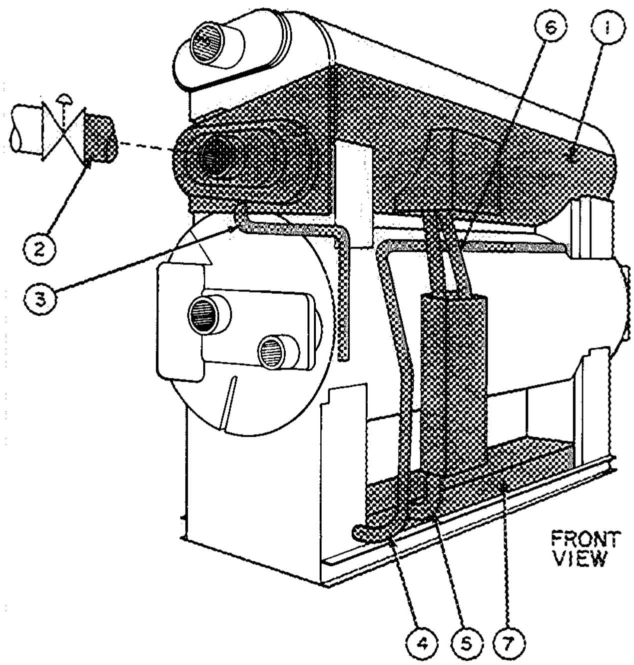
Table 2 – Insulation For Cold Surfaces

UNIT 16JB	EVAP SHELL (ft²)	REFRIG PUMP(S) (ft²)	REFRIG LINES		COOLER WATER BOXES AND COVERS* (ft²)
			Suction (ft²)	2 in. Disch	
010 012 014	75	3	6	10 ft	9
018 021	96	3	6	11 ft	12
024 028	114	3	6	12 ft	15
032 036	147	3	6	12 ft	17
041 047	177	4	6	12 ft	20
054 057	188	4	9	15 ft	21
061 068	216	4	10	13 ft	24
077 084	275	8	16	48 ft	21
097 107	328	8	17	60 ft	24
115 124	360	8	19	60 ft	27

*Quantity of insulation specified is adequate to cover cooler water boxes and covers on both ends of machine

The generator shell and some of the machine piping will become hot during operation. If insulation is to be used as a safety precaution, or to reduce ambient temperature in the machine room, we recommend insulating the surfaces shown in Fig. 9. Hot-surface dimensions are given in Table 3.

Generator insulation can be either blanket-type or low-pressure boiler insulation. Insulation used for piping is generally standard low-pressure steam pipe insulation.



HOT SURFACES THAT CAN BE INSULATED

LEGEND

1 — Generator Shell (refer to Table 4 for sq ft surface area)
2 — Steam Supply Line
3 — Condensate Line
4 — Weak Solution Line (to generator)
5 — Strong Solution Line (from generator)
6 — Generator Overflow Tube (only hot during abnormal conditions)
7 — Heat Exchanger

Fig. 9 — Machine Hot Surfaces

Isolation — 16JB machines are not in themselves a major source of vibration; and isolation equipment is not supplied with the machine unless requested on the order. It is possible, however, for a machine to receive and transmit vibrations from *other* sources that are imperfectly isolated such as condensing water pumps, chilled water pumps, or other piping. Isolation packages are available from a number of manufacturers. Specifications for Carrier machines are given in Table 4.

Table 3 — Insulation For Hot Surfaces*

UNIT 16JB	GEN† SHELL (ft^2)	HT EXCH (ft^2)	STRONG SOL LINE		WEAK SOL LINE		GEN OVERFLOW (GO) TUBE	
			Lgth (ft)	Size (in.)	Lgth (ft)	Size (in.)	Lgth (ft)	Size (in.)
010 012 014	62	40	7	3	20	1½	11	3
018 021	67	45	7	3	21	2	12	4
024 028	72	50	8	4	22	2	13	4
032 036	77	55	9	4	23	2½	15	4
041 047	82	60	10	4	24	3	16	4
054 057	98	55	8	4	22	3	10	4
061 068	98	60	10	4	24	3	12	4
077 084	152	102	16	4	44	2	3	4
097 107	184	110	18	4	47	3	4	4
115 124	184	118	20	4	49	3	4	4

*Refer to Fig. 10 for location of hot surfaces.
†Includes outlet box and ends
GEN — Generator
HT EXCH — Heat Exchanger

Table 4 — Isolation Pad and Soleplate Specifications

UNIT 16JB	NO. (EACH) OF PADS AND SOLEPLATES	PAD DIMENSIONS (in.)	SOLEPLATE DIMENSIONS (in.)
010 012 014	4	9 × 6 × ⅜	10 × 7 × ½
018 021	4	9 × 10 × ⅜	10 × 11 × ½
024 028	4	9 × 12 × ⅜	10 × 13 × ½
032 036	4	9 × 14 × ⅜	10 × 15 × ½
041 047	4	9 × 18 × ⅜	10 × 19 × ½
054 057	4	12 × 18 × ⅜	13 × 19 × ½
061 068	4	14 × 18 × ⅜	15 × 19 × ½
077 084	6	12 × 18 × ⅜	13 × 19 × ½
097 107	6	15 × 18 × ⅜	16 × 19 × ½
115 124	6	16 × 18 × ⅜	17 × 19 × ½

NOTE:
Higher isolation efficiencies may be obtained with double-layer pads. Double-layer pads, factory-fused together, are available from various manufacturers. If two single-layer pads are used, a metal divider equal to pad dimensions should be inserted between layers.

The integral shipping skids, or base rails, are normally left on the machine. However, the base rails may be removed, if desired, *but not until the machine is in final position.* When isolation pads are used, they should be located under the corners of the machine, atop soleplates with 1/2-in. minimum thickness (see Fig. 10). The soleplate ensures machine contact on the floor only at the corners when base rails are left on. Shims may be inserted under the soleplates for leveling the machine. Grouting is optional.

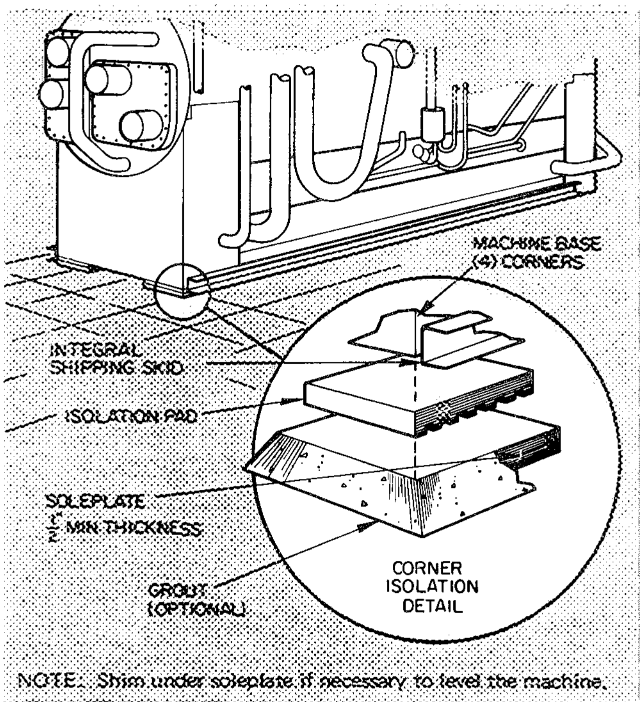


Fig. 10 — Typical Isolation Assembly

Explosionproof Machines — 16JB standard absorption machines can be factory equipped with explosionproof electric motors and controls suitable for Class 1, Group D hazardous locations specified by the National Electrical Code. Modifications to the standard control system are described in the controls application publications.

Outdoor Installation — Outdoor installation of the 16JB absorption machine creates a number of special problems which must be resolved. Such applications should be considered only when the customer has qualified operating personnel, familiar with the maintenance of mechanical equipment located outdoors. Standard machines require protection from weather. A simple, heated structure is preferred. If this is not possible, protection from the weather must be provided by machine modifications.

WEATHERPROOFING — Pneumatic control systems are recommended for outdoor installations. Controls can be factory furnished to meet NEMA No. 4 Waterproofing Specifications.

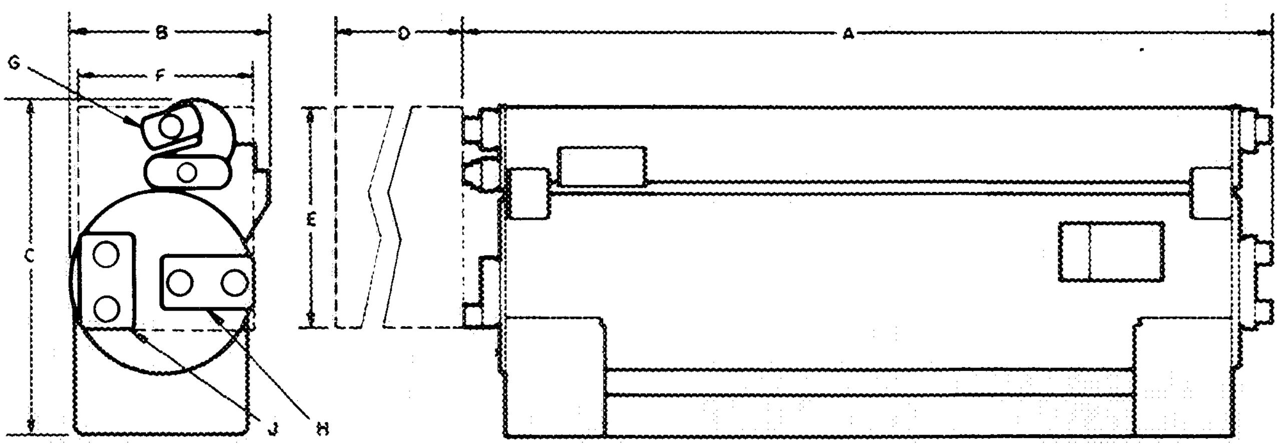
FREEZE PROTECTION — When the machine area may be subjected to temperatures below 40 F and if the machine is to be shut down for an extended time during these low-temperature periods, all water circuits and tube bundles should be drained, then filled with ethylene glycol. Table 5 lists storage volumes of 16JB header and tube bundles. This data can be used when calculating the quantity of ethylene glycol needed to provide adequate freeze protection.

Table 5 — Header and Tube Bundle Storage Volumes (gal.)

UNIT 16JB	EVAPORATOR	ABSORBER	CONDENSER	HOT WATER GEN
010	25	27	14	14
012	28	30	16	16
014	30	35	17	17
018	43	46	24	23
021	48	51	26	25
024	57	62	32	30
028	64	69	36	34
032	76	83	42	39
036	83	90	46	43
041	96	104	52	49
047	106	117	59	56
054 057	108	150	57	74
061 068	129	179	68	87
077 084	158	215	129	106
097 107	198	271	163	138
115 124	228	310	186	150

GEN — Generator

Tube Removal – Clearance for tube removal should be considered when planning a piping system. The 16JB machines are designed so all tubes are accessible for cleaning or servicing should the need arise. Refer to Fig. 11 for tube pulling clearance dimensions and data. Evaporator, absorber and condenser tubes may be pulled from either end.



UNIT	CLEARANCE DIMENSIONS (ft–in.)						COVER PLATE WEIGHTS* (lb)		
16JB	A	B	C	D	E	F	Condenser(G)	Absorber(H)	Evaporator(J)
010,012,014	16–10⅞	3– 7½	7– 3½	14–2	4– 8	2– 8	45	100	100
018,021	16–11¾	4– 4¼	7– 9⅞	14–2	5– 1	3– 6	50	177	177
024,028	17– 0⅛	5– 0¼	8– 9½	14–2	5–10	4– 0	88	275	275
032,036	16–11⅞	6– 3	10– 1¼	14–2	6–10	5– 0	87	325	325
041,047	17– 2¼	6– 9⅝	11– 6⅛	14–2	8– 6	5– 3	107	460	460
054,057	21–11¼	6– 3¼	11–10	19–3	8– 7	5– 0	169	318	384
061,068	21– 8⅛	7– 3¼	13– 2¼	19–3	9– 3	5–11	169	389	471
077,084	32– 2	6– 3¼	11– 4	29–1	8– 5	5– 0	153	310	384
097,107	32– 2	7–11⅛	12–10½	29–1	9– 5	6– 6	193	386	471
115,124	32– 2	7–10¼	13– 9⅝	29–1	9– 9	6– 0	193	438	566

*Weights given are for each cover.

NOTE: Minimum space for tube removal (Dimension D) may be located on either end.

Certified dimension drawings are available on request.

Fig. 11 – Tube Pulling Clearance Data

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