

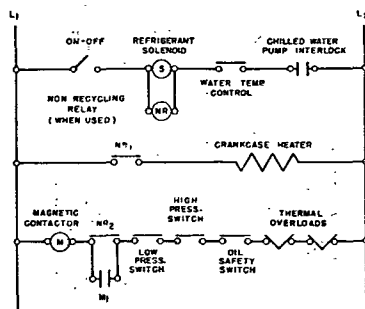


Fig. 6... Typical Control Schematic Packaged Water Chiller

High-pressure cutout switch. This switch functions to stop the operation of the system when excessive pressures are reached on the high side. Many units are supplied with high-side switches, with lock-outs that require manual reset after determination of the cause of the interruption.

Freeze control. This type of control is normally furnished to stop the system when the conditions are such that freezing of the fluid to be cooled is imminent. In some systems this is a direct-acting temperature control set at the cutout temperature. On others a low-side pressure switch used is preset to stop the machine after operating for an interval of time at this preset pressure.

Oil safety switches. Most larger systems include an oil pressure differential switch to assure a positive oil pressure above the back pressure of the system. The oil safety switch will interrupt the operation of the system on low oil pressure and normally will require manual resetting of the device after determination of the cause.

Crankcase heaters. Many systems utilize the crankcase heater as a means to boil off entrained liquid refrigerant in the crankcase and maintain a temperature within the oil supply during the off-cycle to assure a refrigerant-free oil source.

Relief valve. The high side of the system is always protected by a pressure relief device set to start functioning at a pressure not to exceed the design working pressure of the pressure vessel. The discharge capacity of the relief device is determined in accordance with the American Standard ASA B9.1-1964, *Safety Code for Mechanical Refrigeration*.

The control systems of unitary water chillers vary somewhat but the following sequence is usually followed (Fig. 6):

A manual switch is provided for starting and stopping the machine regardless of the settings of the various control switches.

When the switch is in the off position, the unit is inoperative, but the crankcase heater is energized.

When the switch is in the on position, a circuit should exist through various components to allow the unit to start. In cases where a pump-down cycle exists, closing of the on-off switch will complete a circuit through the temperature controller and the refrigerant feed solenoid. When the temperature control is closed, indicating that cooling is required, the liquid-feed solenoid opens and refrigerant is admitted into the low side of the system. This action allows the pressure to build up within the low side of the system so that the low-pressure cutout switch may close to start the machine. The low-pressure cutout switch is a part of a circuit including the high pressure cutout switch, the oil safety switch, the

thermal overload relay on the magnetic contactor, the thermal overload relays of auxiliary equipment such as pump motor and tower fan motor, and electrical interlocks of the chilled water pump magnetic contactor and holding coil of the compressor magnetic contactor. On those units where a single pump-out of the compressor is desired, a non-recycling relay is employed to eliminate nuisance cycling when the system is satisfied.

Testing and Rating.

Unitary water chillers should be tested in accordance with ASHRAE Standard 30-60, *Methods of Testing for Rating Liquid Chilling Packages*, which outlines the test methods, instruments required, and the test procedure. Ratings should be obtained in accordance with ARI Standard 590-62, *Reciprocating Water-Chilling Packages*.

PART II: DRINKING WATER COOLERS*

A mechanically refrigerated drinking water cooler consists of a factory made assembly, in one structure, that employs a complete mechanical refrigeration system and which has the primary function of cooling potable water and provides for dispensing such water by either integral or remote means, or both.

Water coolers differ from water chillers in that water coolers are used to dispense potable water, whereas water chillers are used in air-conditioning systems for residential, commercial, and industrial applications, as well as cooling water for industrial processes.

The capacity of a water cooler is expressed in gallons per hour and is the quantity of water cooled, in one hour under the conditions shown in the paragraph entitled, Ratings. Normal standard capacities of water coolers range from 1 to 30 gph.

TYPES

The three basic types of water coolers are shown in Fig. 7.

1. **Bottle Type.** A bottle water cooler is one which employs a bottle or reservoir for storing the supply of water to be cooled and utilizes a faucet or similar means for filling glasses or cups or other containers and which includes a waste water receptacle.

2. **Pressure Type.** A pressure-type water cooler is supplied with potable water under pressure and includes a waste water receptacle or means for disposing of water to a plumbing drainage system (see Fig. 8). Pressure-type water coolers can utilize a faucet or similar means for filling glasses or cups, or may employ a valve to control the flow of water as a projected stream from a bubbler so that water may be consumed without utilizing glasses or cups.

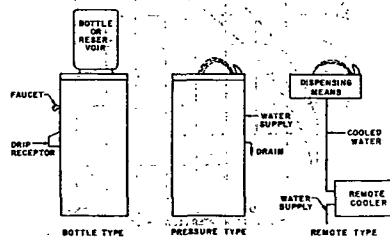


Fig. 7... Basic Types of Drinking Water Coolers

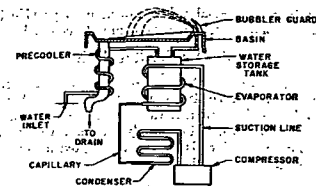


Fig. 8... Pressure-Type Water Cooler

3. **Self-Contained Remote Type.** A self-contained remote type cooler is a factory assembly in one structure which employs a complete mechanical refrigeration system and which has the primary function of cooling potable water for delivery to a separately installed dispensing means.

Coolers, in addition to the basic type descriptions, are also described as air-cooled or water-cooled, and by any specialized use or additional functions they perform.

1. Specialized Uses:

a. **Explosion Proof.** An explosion-proof type water cooler is one which is constructed for safe operation in hazardous locations as classified in Article 500 of the *National Electrical Code*.

b. **Cafeteria Coolers.** A cafeteria type cooler is one which is supplied with water under pressure from a piped system and is intended primarily for use in cafeterias and restaurants for dispensing water rapidly and conveniently into glasses or pitchers. It includes a means for disposing of waste water to a plumbing drain system.

2. Additional Functions:

a. **Refrigerated Compartment.** A water cooler may also have a refrigerated compartment with or without provisions for making ice.

b. **Hot Water.** A water cooler may also include a means for heating and dispensing potable water for making instant hot beverages, soups, etc.

3. Type of Installation (see Fig. 9).

- a. Free standing.
- b. Flush to wall.
- c. Wall hung.

REFRIGERATION SYSTEMS

Compressors

Hermetically sealed compressors are commonly used for a-c applications, both 50 and 60 cycle. Belt-driven compressors are generally used only for d-c and 25-cycle supply. Compressors are similar to those used in refrigerators and range from $1/12$ to $1/4$ hp.

Condensers

Fan-cooled condensers are most commonly used. In coolers rated less than 10 gph, natural-convection-cooled (static)

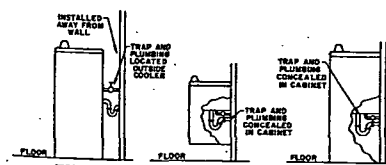


Fig. 9... Types of Installation for Drinking Water Coolers

condensers are sometimes included. Water-cooled condensers of tube-on-tube construction are used on models intended for high ambient temperatures or where lint and dust in the air make air-cooled types impractical.

Refrigerant Control

Capillary tubes are used almost exclusively for refrigerant flow control in hermetically sealed systems. In belt-driven systems and some hermetically sealed systems expansion valves are used.

Evaporators

Most water coolers manufactured today have the evaporator formed by refrigerant tubing bonded to the outside of a water circuit. The water circuit is usually a tank or a coil of large tubing. Materials used in the water circuit are usually non-ferrous or stainless steel. Since the coolers dispense water for human consumption sanitary requirements must be kept in mind.

Precoolers

Pressure-type coolers are often equipped with precoolers to exchange heat from the supply water to the waste water. When drinking from a bubbler stream the user wastes approximately 60 percent of the cold water down the drain. A pre-cooler is an arrangement for putting the incoming water in heat exchange relationship with the waste water. Sometimes the cold waste water is also used to subcool liquid refrigerant. Coolers intended only to dispense water into cups are not equipped with precoolers since there is no appreciable quantity of waste water.

Multiple Temperature Systems

Water coolers that also provide a refrigerated storage space, commonly referred to as *Compartment Coolers*, have the same control compromises common to all refrigeration devices that attempt two-temperature refrigeration using a single compressor.

Most bottle-type compartment coolers are provided with the simplest series system in which the refrigerant feeds first to a water-cooling coil and then through a restrictor device to

Table 1... Standard Rating Conditions*

Type of Cooler	Temperature, F				Spill, percent
	Ambient	Inlet Water	Cooled Water	Heated Potable Water*	
Bottle Types	90	90	50	165	None
Pressure Types Utilizing Precooler (Bubbler Service)	90	80	50	165	60
Not Utilizing Precooler	90	80	50	165	None
Compartment-Type Coolers	During the Standard Capacity Test, there shall be no melting of ice in the refrigerated compartment, nor shall the average temperature exceed 46 F.				

NOTE: For water-cooled condenser water coolers the established flow of water through the condenser shall not exceed $2\frac{1}{2}$ times the Base Rate Capacity and the outlet condenser water temperature shall not exceed 130 F. Base Rate Capacity of a pressure water cooler having a pre-cooler is the quantity of water cooled in one hour, expressed in gallons per hour, at the Standard Rating Conditions, with 100 percent diversion of spill from the pre-cooler.

* This temperature shall be referred to as the Standard Rating Temperature (Heating).

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