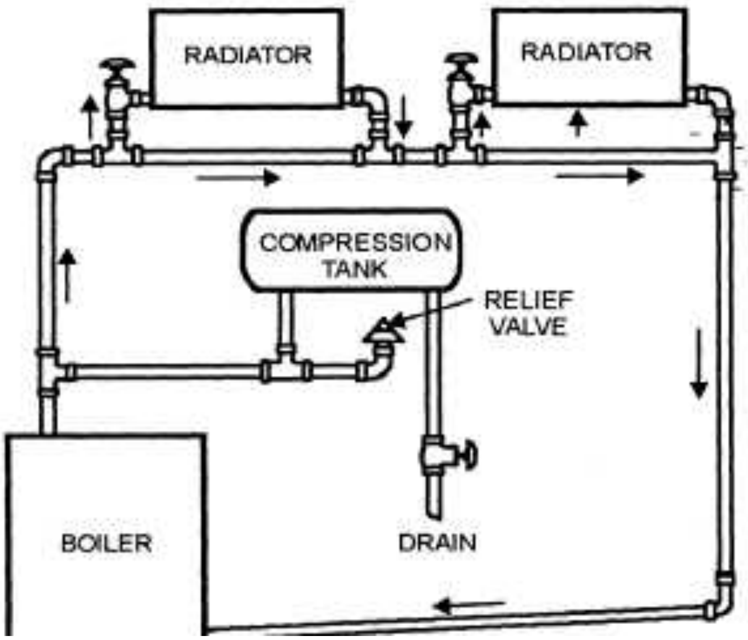

A tank with its vent open to the atmosphere is installed in the system above the highest radiator for water expansion. The water level in the expansion tank rises and falls, as the system is heated and cooled, and the system is full of water and free from air at all times. In the open-tank gravity hot-water heating system, the expansion tank is installed on a riser directly above the boiler, so the air liberated from the boiler water enters the tank and is not retained in the system.

One-Pipe, Closed-Tank System A one-pipe, closed-tank gravity hot-water distribution system, as shown in tigure 4-65, is similar to the one-pipe, open-tank gravity hot-water heating system, except the expansion tank is a pneumatic compression tank not open to the atmosphere. When the water in a closed-tank system is heated, it. expands into the pneumatic compression tank. This action permits system operation at a much higher water temperature, without boiling, than the temperature in the one-pipe, open-tank gravity system. This also results in higher heat emission from the radiators. A gravity open-tank system with an average boiler water temperature of 170°F has a radiator emission rate of 150 Btu psi, whereas a gravity closed-tank system with an average boiler water temperature of 190°F has a radiator emission of 180 Btu per square foot (psf). Higher boiler water temperatures permit higher temperature drops through the radiators; consequently, smaller pipe sizes can be used. The closed pneumatic compression system requires a relief valve, usually set for the relief of water pressure over 30 psi, depending upon the height of the building. A pressure-regulating valve automatically maintains the system full of water. Installation of the radiators and piping for an equivalent two-pipe, closed-tank gravity upfeed or overhead downfeed system is the same as that for the open system, except the sizes of both the pipe and the radiators are uniform and can be smaller. The open-tank system may have a reversed return main that does not go directly back to the boiler. It doubles back from the last radiator and parallels the supply main back to the boiler entrance. The reversed return system allows equal length of heating circuits for al I radiators. Friction and temperature losses for all radiators are nearly equal. In most cases, the reversed return system involves no more piping than other piping arrangements. With the correct size of piping and radiator supply tappings, the reversed return system provides even heat and circulation to all radiators, even those near the end of the circuit. Figure 4-65.— .A typical one-pipe, closed-tank distribution system. Expansion in a Gravity Hot-Water Distribution System In the gravity and forced-circulation systems, open and closed expansion tanks allow the water in the distribution system to expand as the temperature rises. An open tank must be mounted at the highest point in the system; a closed tank can be located at any point. If the air cushion leaks out of the closed expansion tank, it fills with water. At times, you must recharge the tank by draining part of the water out of the tank and allowing air to -fill the space. In the open system, an expansion tank open to the atmosphere allows the system to expand. The open system is normally designed to operate at the maximum boiler temperature of 180°F. This gives an average radiator temperature of 170°F or a radiator output of 150 Btu psf. The closed system, in which the expansion takes place against a cushion of air in the tank closed against the atmosphere, can be operated at temperatures above 212°F because the pressure built up in the system prevents the water from boiling. Radiator temperatures then become equal to those of low-pressure steam systems. When a hot-water system is first filled with water, it is normally necessary to bleed the air out of the system at the same time. You can remove the air by opening an air vent on a radiator or by breaking a union near the end of the line. The temperature of the water distributed is from 150°F to 250°F. The higher temperatures are used with the forced-circulation systems.