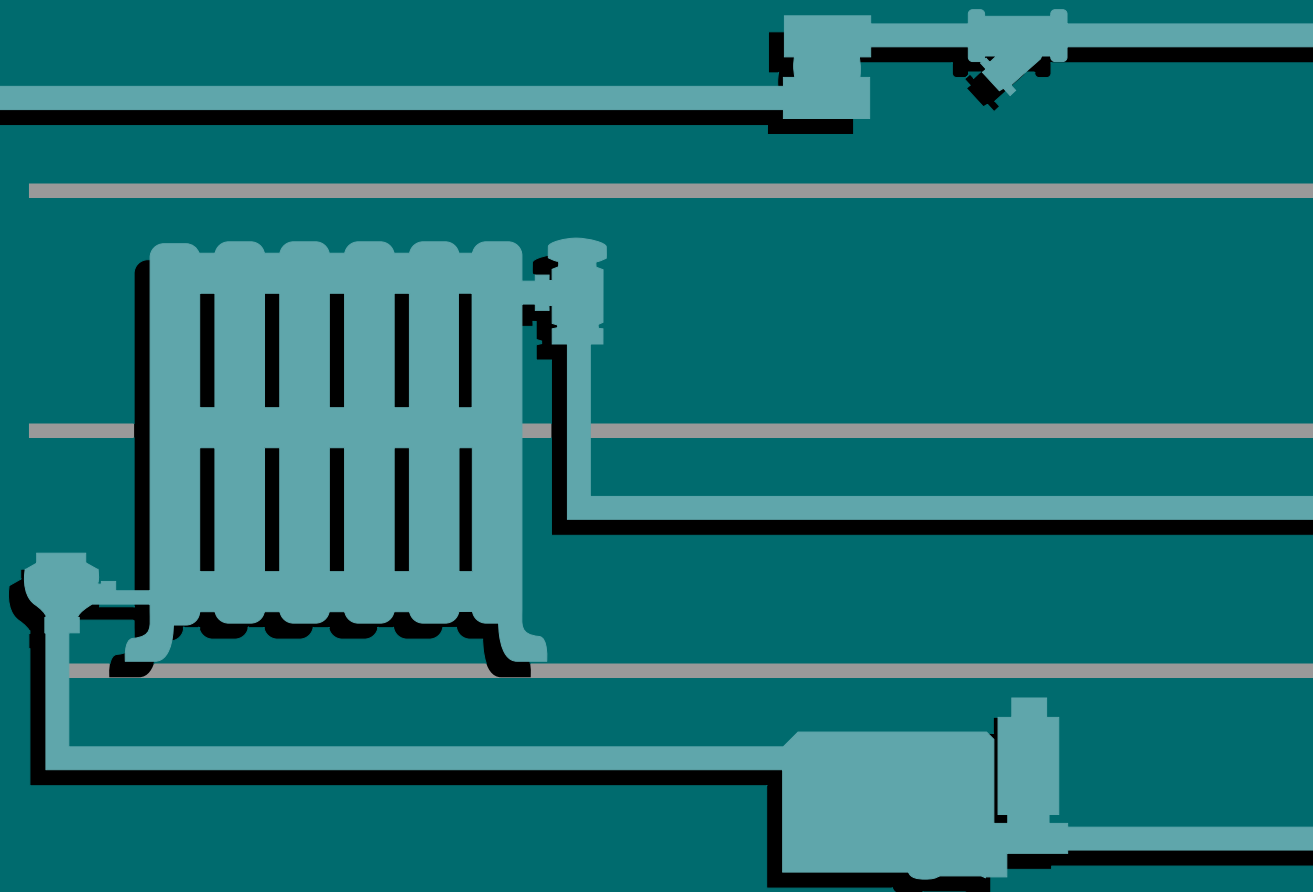


Hoffman SPECIALTY



BASIC STEAM HEATING SYSTEMS

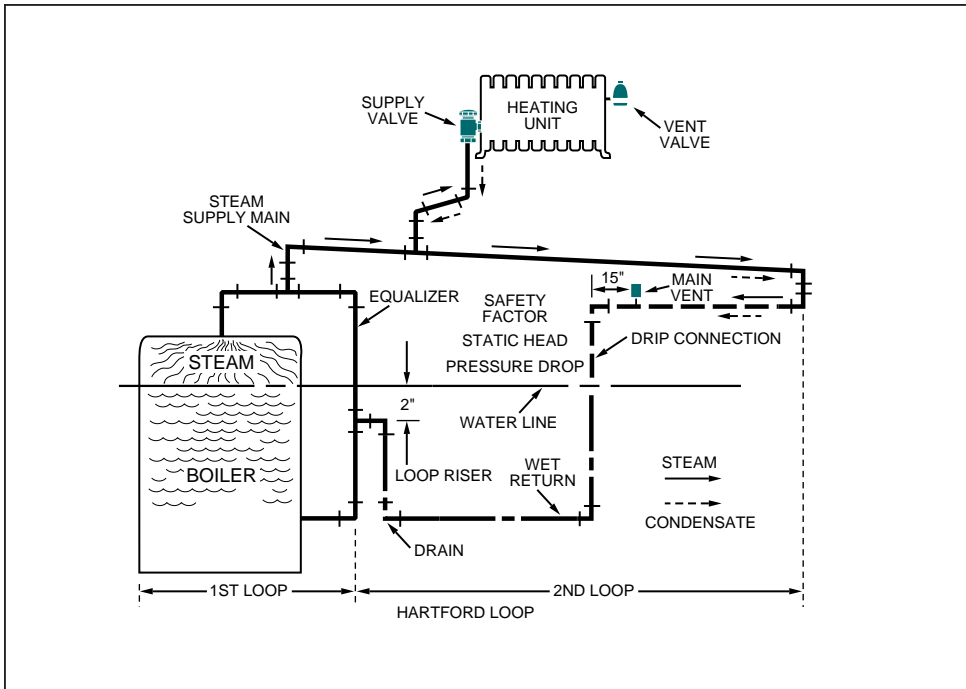
- One-Pipe
- Two-Pipe



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Basic Steam Heating Systems

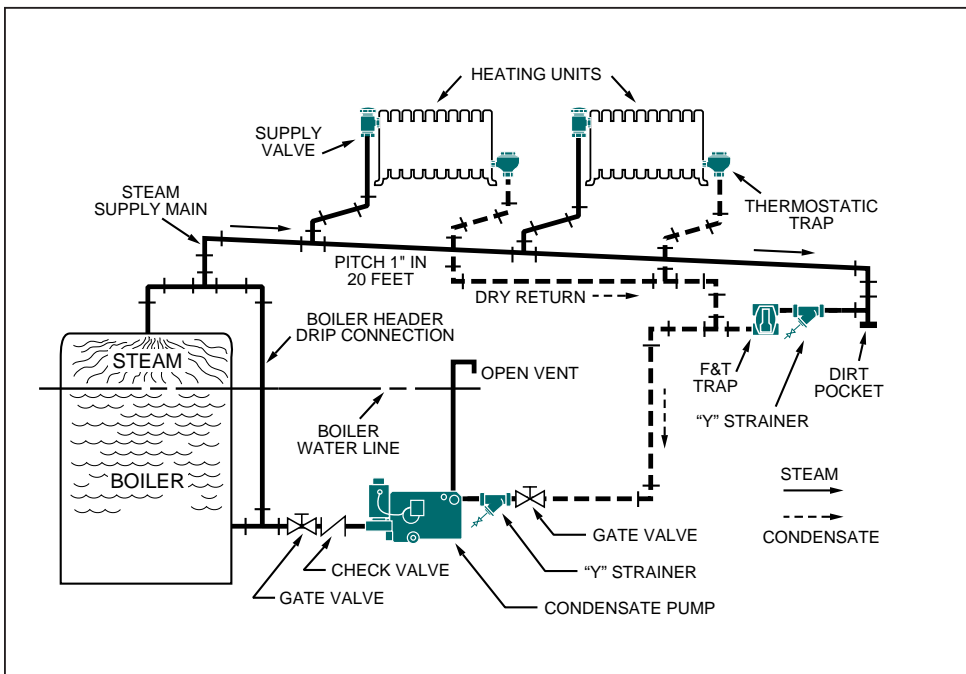
One-pipe steam heating system



In a one-pipe, gravity-flow system, each heating unit has a single pipe connection through which it receives steam and releases condensate at the same time.

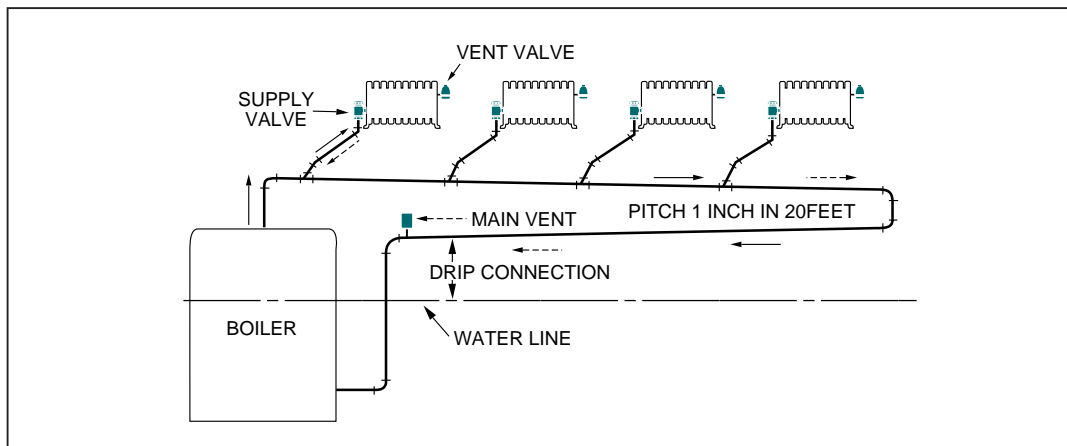
All heating units and the end of the supply main are sufficiently above the boiler water line so that condensate flows back to the boiler by gravity.

Two-pipe steam heating system

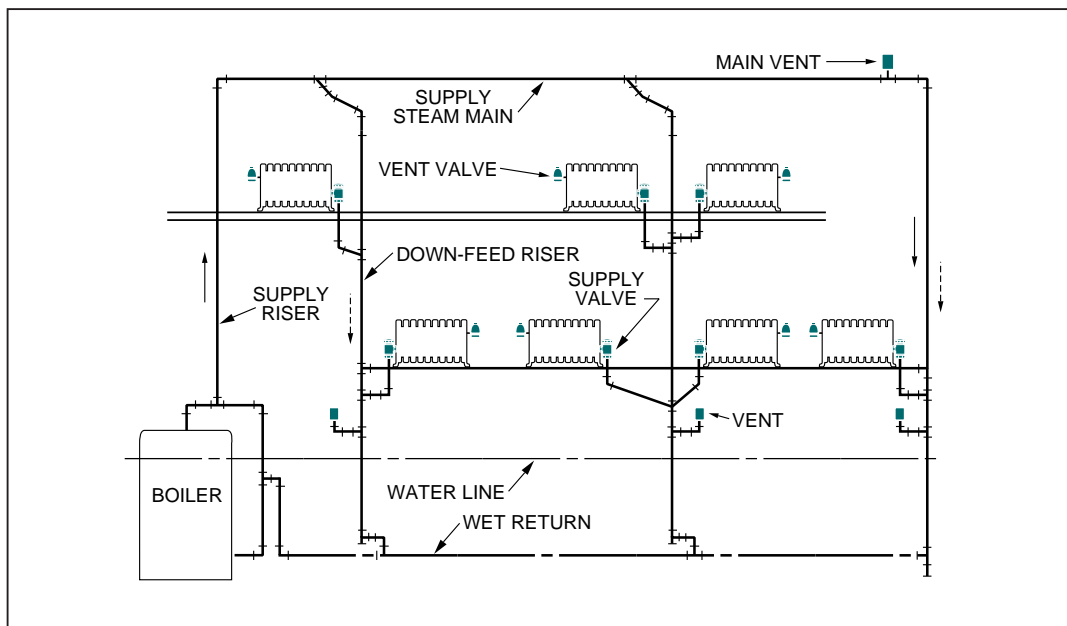


In a two-pipe system, steam supply to the heating units and condensate return from heating units are through separate pipes. Air accumulation in piping and heating units discharges from the system through the open vent on the condensate pump receiver. Piping and heating units must be installed with proper pitch to provide gravity flow of all condensate to the pump receiver.

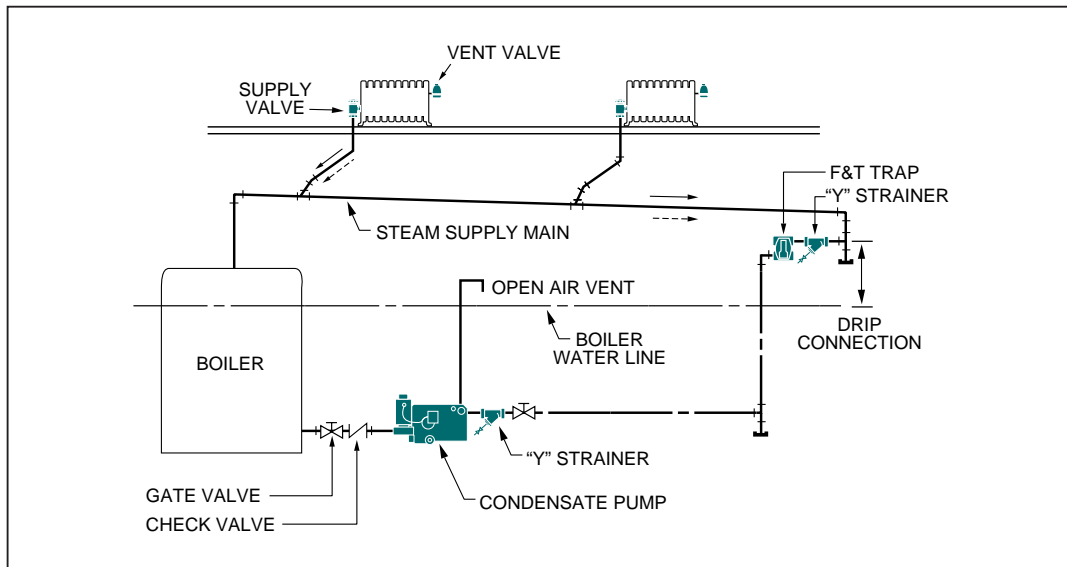
Dry Return



Down-Feed



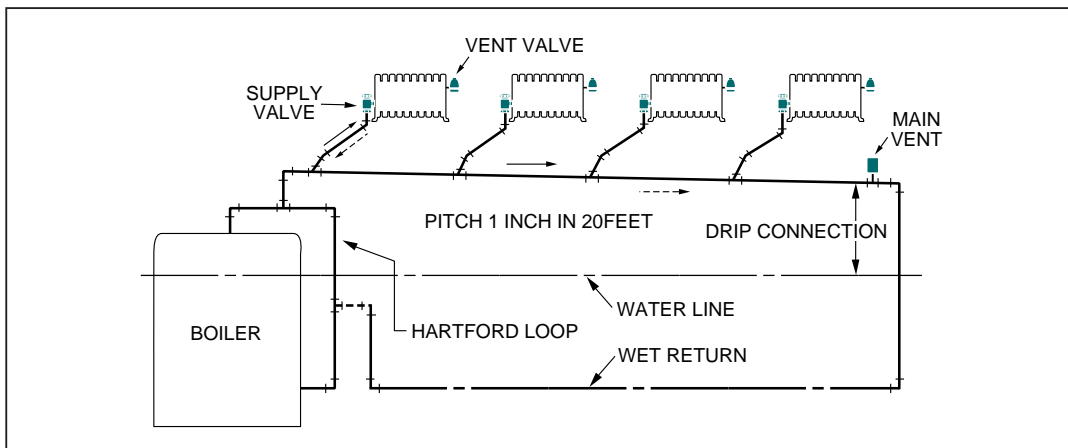
Mechanical Return



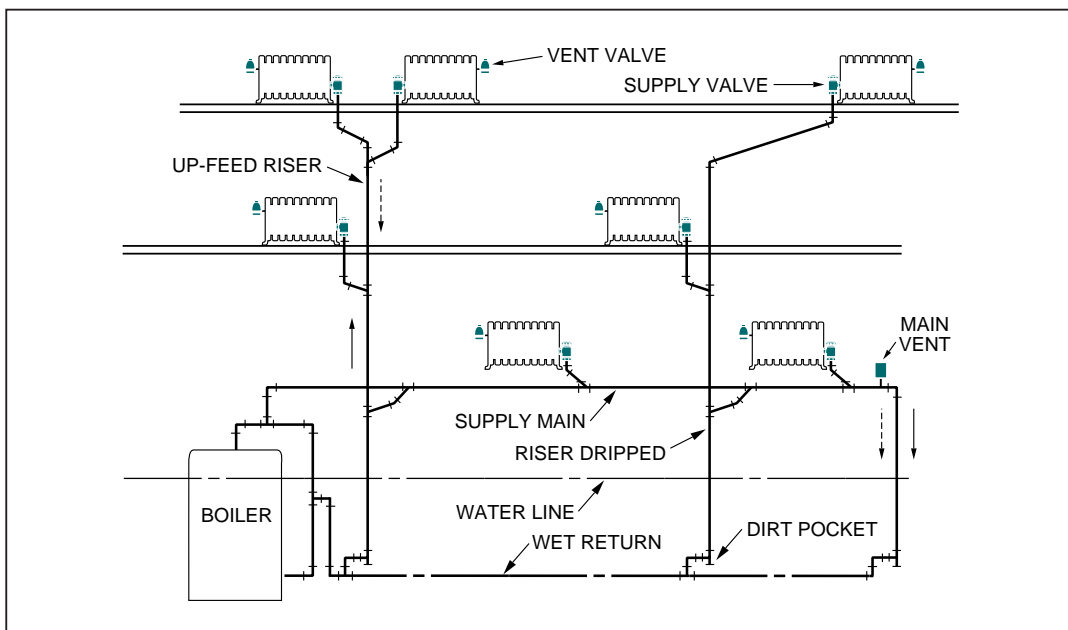
Parallel Flow

Applications— One-Pipe Systems

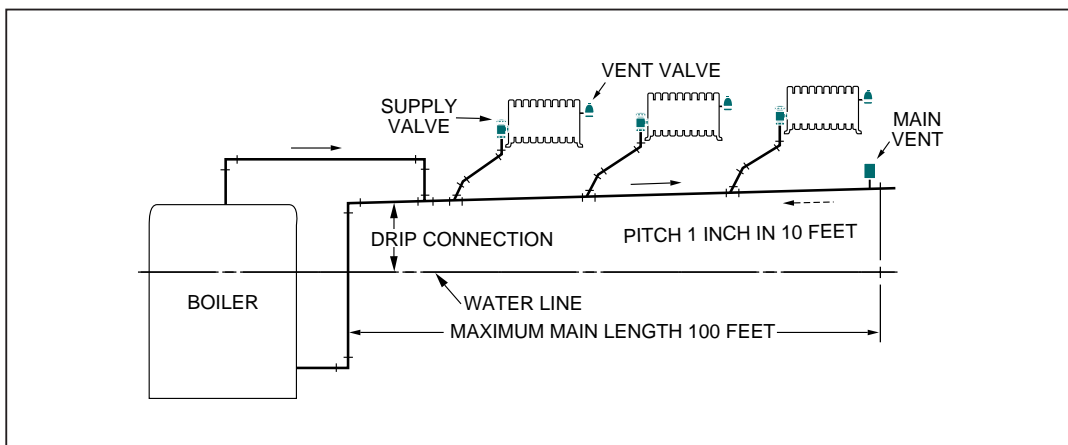
Wet Return



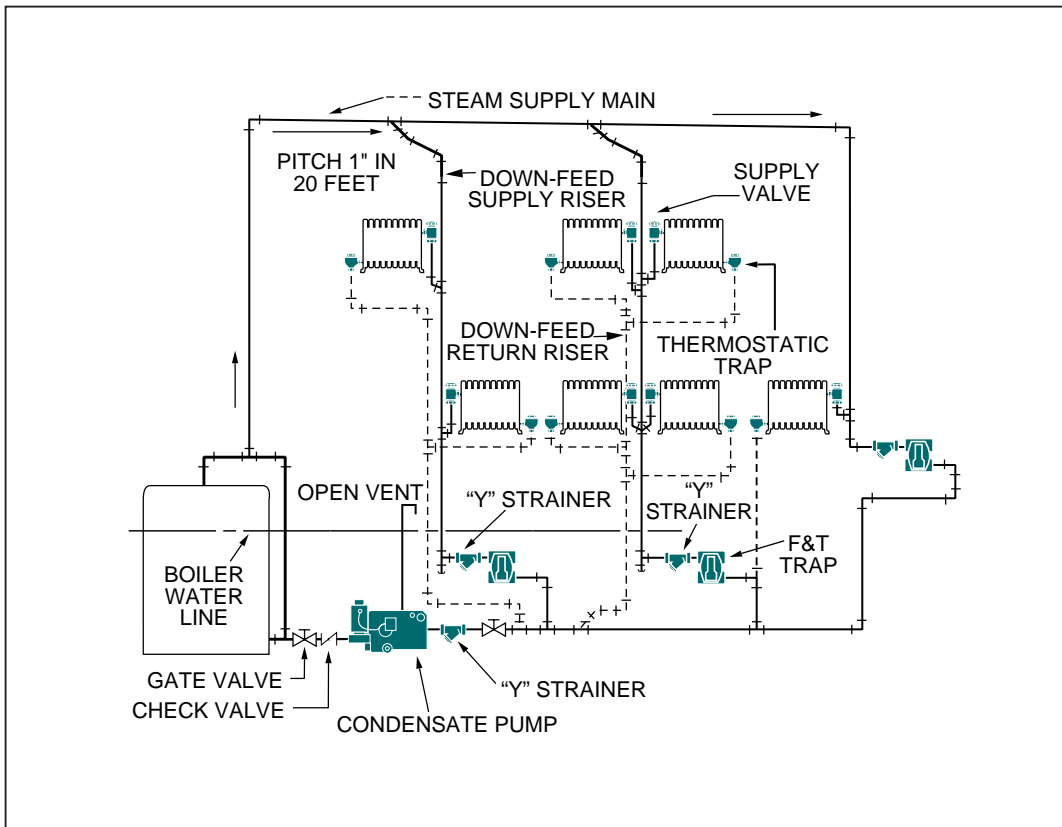
Up-Feed



Counter Flow

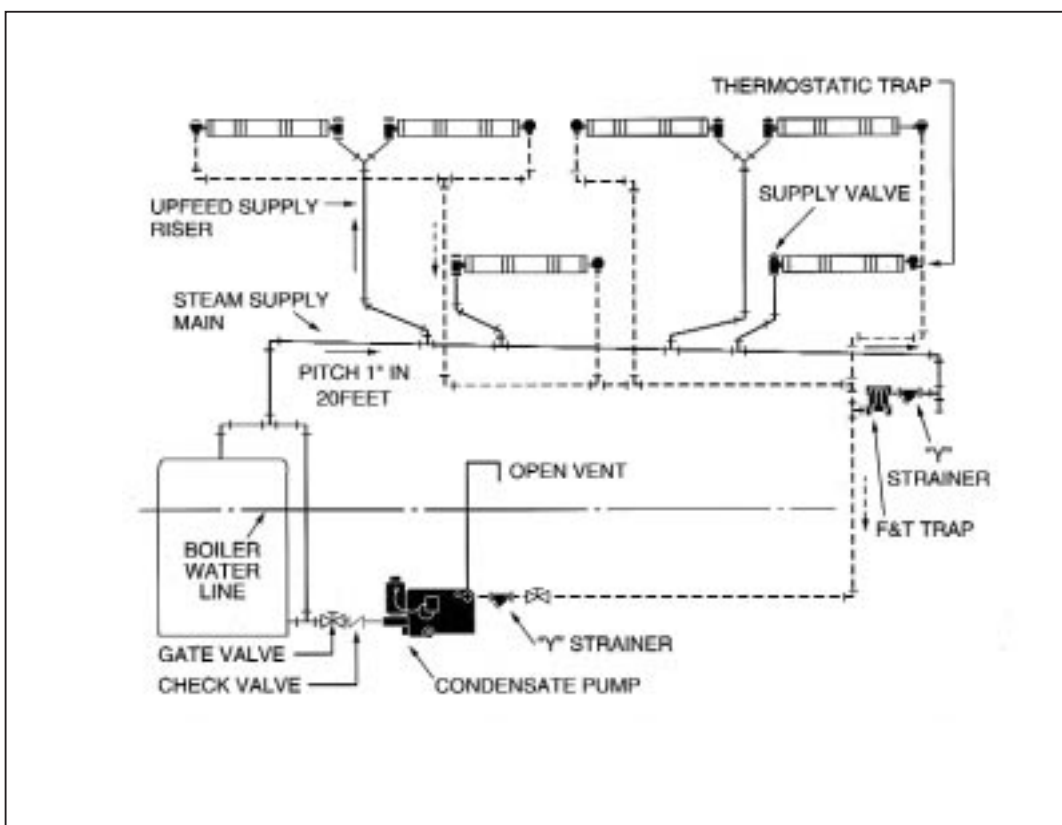


Down-Feed with Condensate Pump



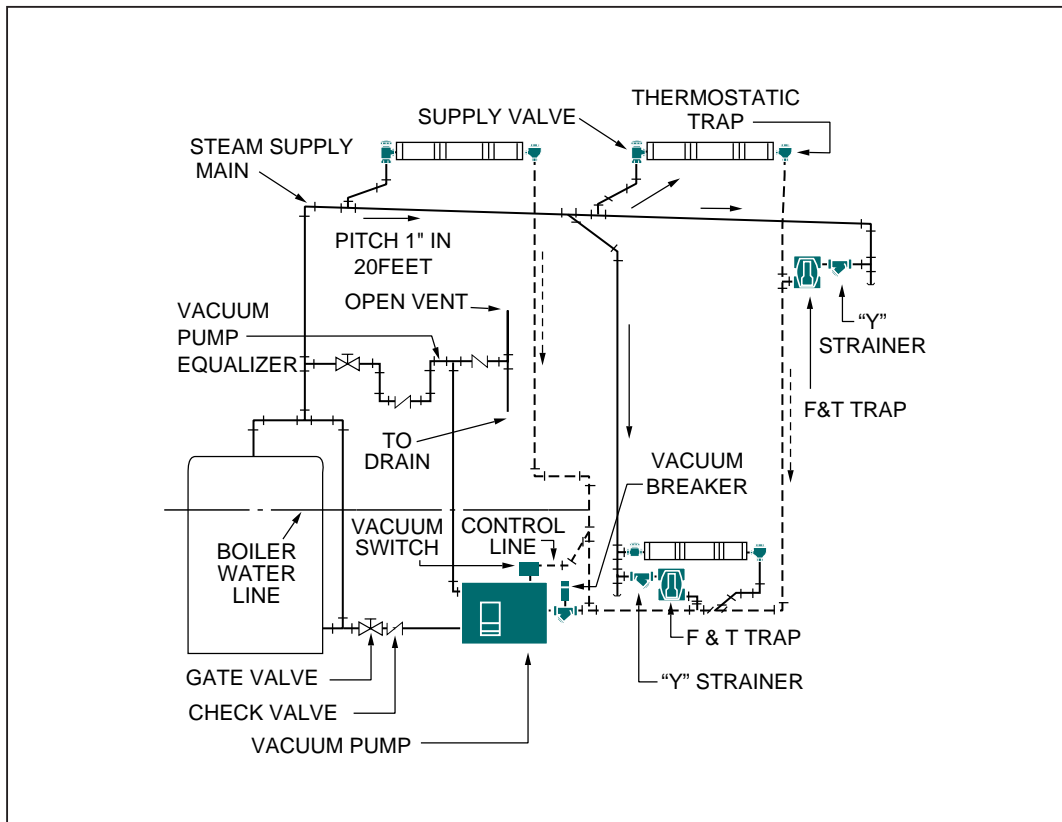
Applications—
Two-Pipe
Systems

Up-Feed with Condensate Pump

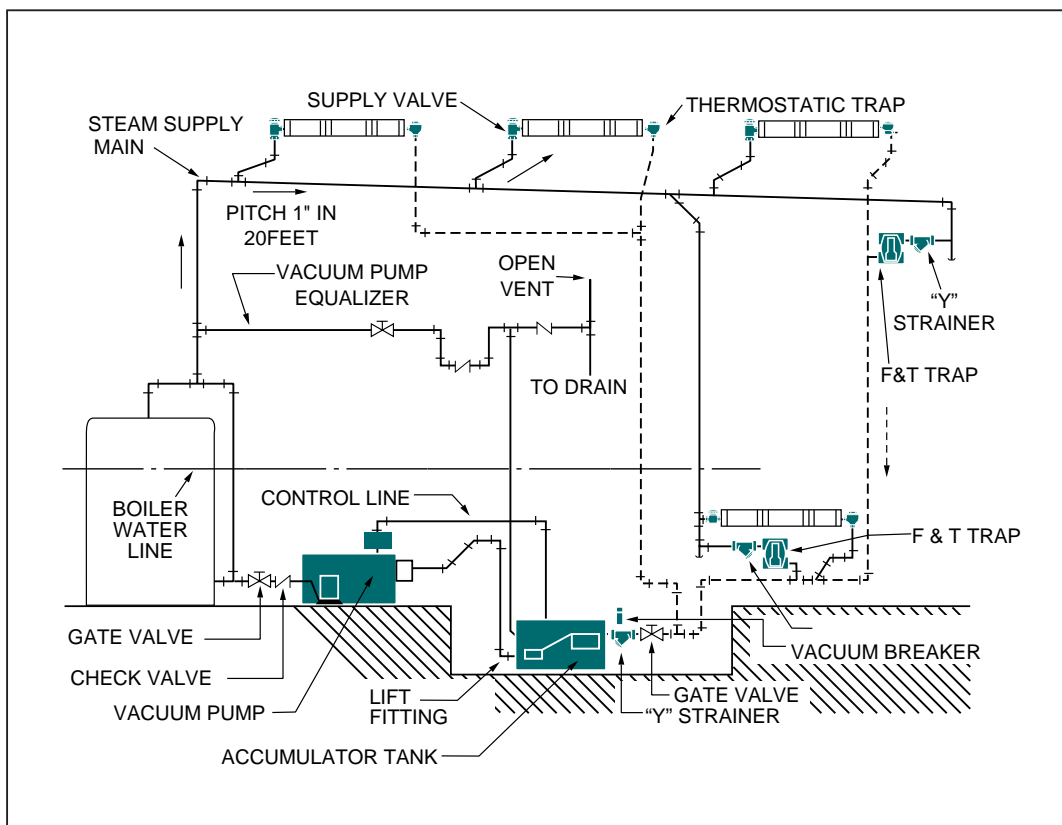


Applications—
Two-Pipe
Systems

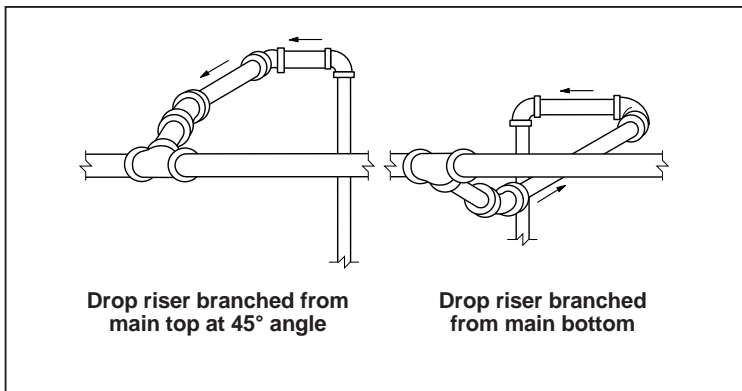
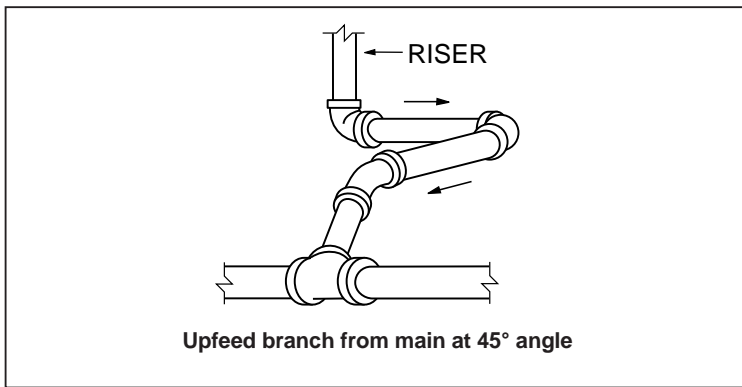
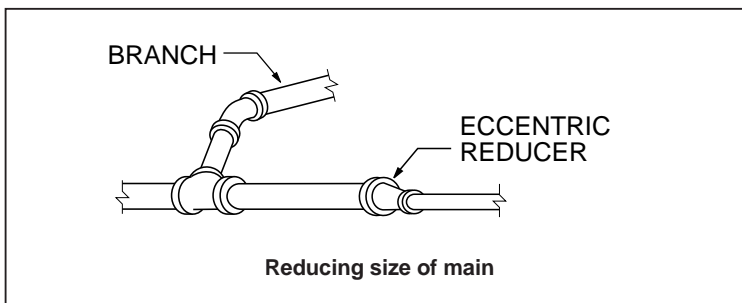
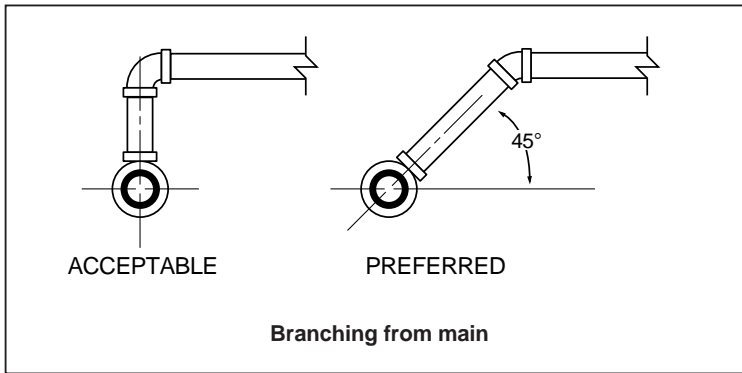
Vacuum



Vacuum with Accumulator Tank



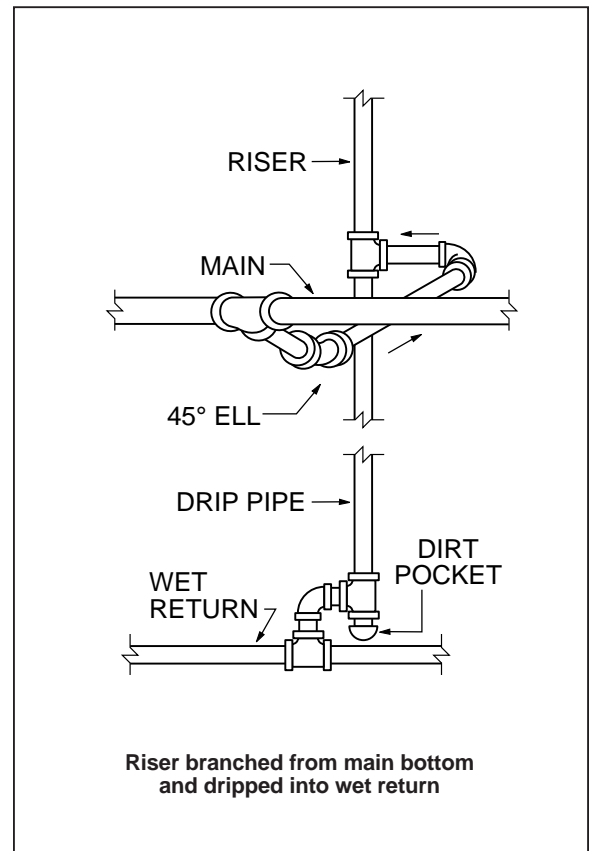
Steam Mains



Typical Installations

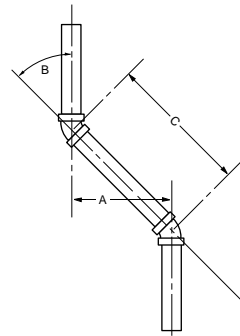
Correct pitch for horizontal supply mains and dry returns must be 1/4" min. in 10' in the direction of steam and condensate flow.

Arrows indicate direction of pipe pitch.



Typical Installations

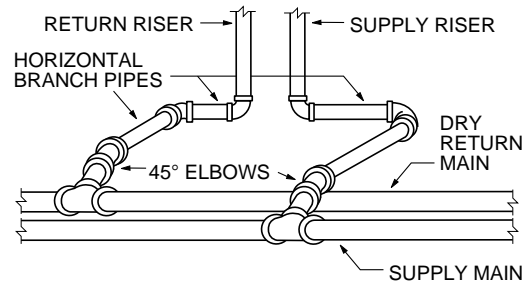
Steam Mains



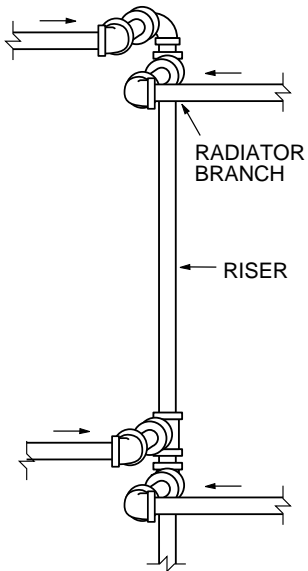
B	Constant
11 1/4°	5.126
22 1/2°	2.613
30°	2.000
45°	1.414
60°	1.155

To find C—
multiply A by
constant for angle B

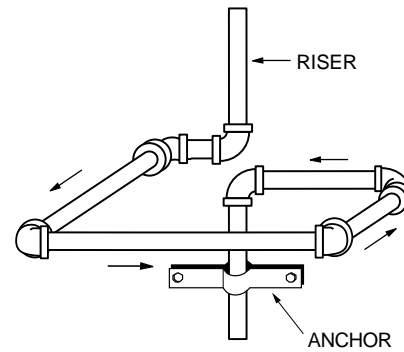
Offset pipe calculation table



Upfeed riser connections
(two-pipe system)

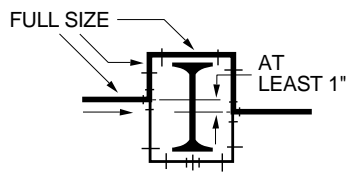


Double radiator branch from riser

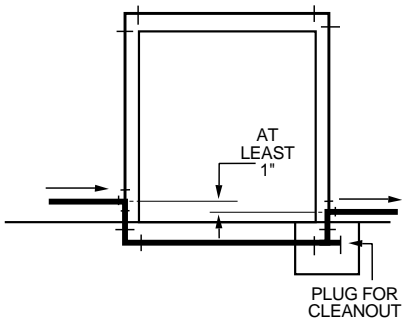


Pipe expansion joint for riser

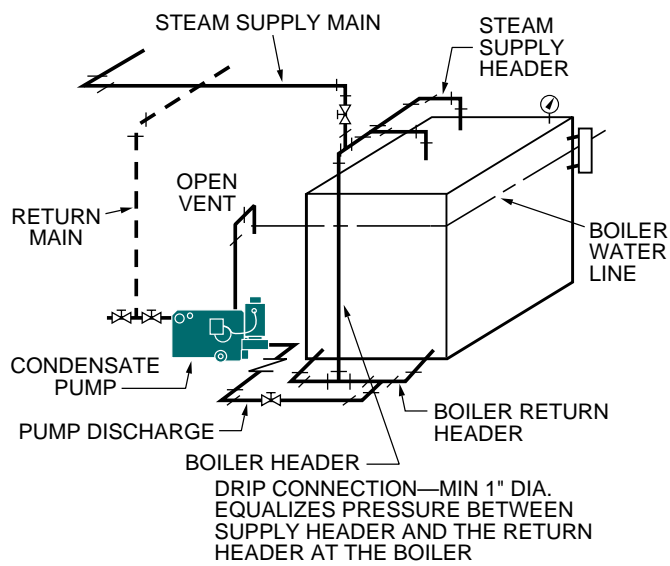
Typical Installations



Looping steam main around an obstruction

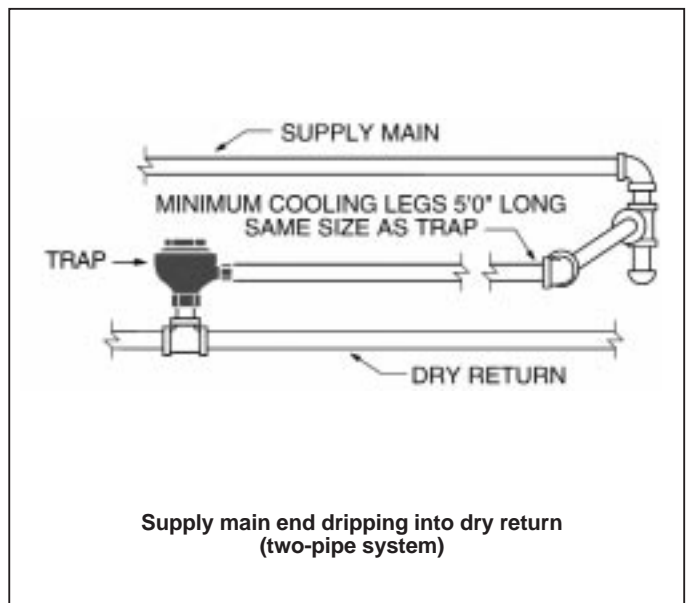
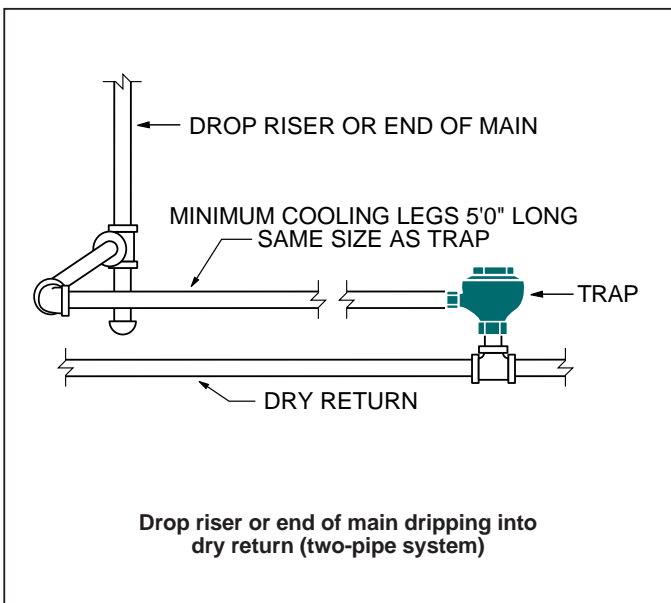
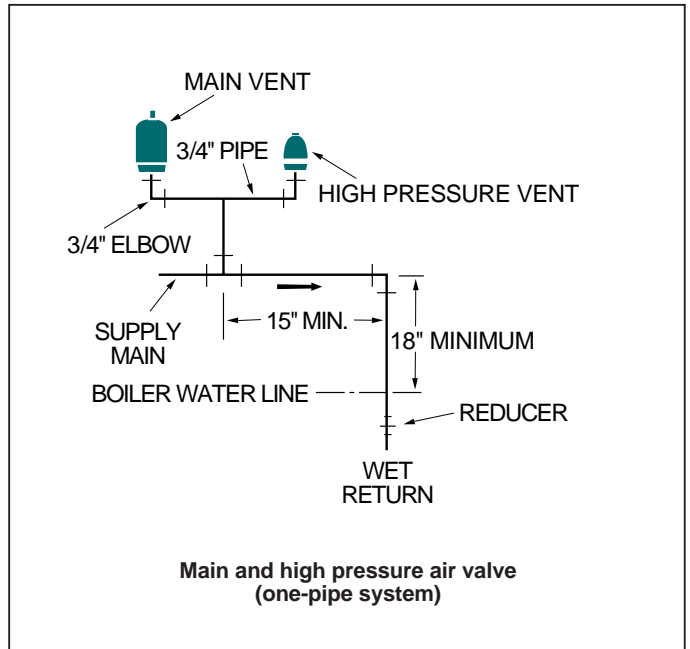
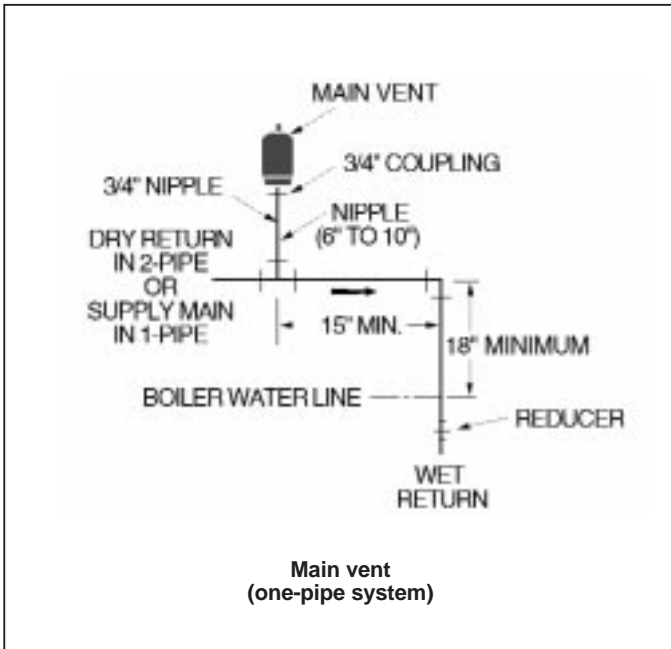


Looping dry return around door
(two-pipe systems)



Boiler piping to main

Typical Installations



Accumulator Tank—Where returns in a vacuum pump heating system are below inlet connection of vacuum pump receiver, an accumulator tank needs to be installed. Its location should be such that condensate flows by gravity to accumulator, and is lifted to vacuum pump receiver.

Boiler-Header Drip Connection—Piping arrangement that drips steam header to return header and equalizes pressure between the two.

Check Valve—Valve that controls water flow between pump and boiler inlet, so that water cannot flow back from boiler to pump.

Condensate—The water formed when steam cools, as in a radiator or other heating unit. The capacity of traps, pumps, etc., is sometimes expressed in lbs. of condensate they will handle per hour. To convert lbs. of condensate or steam per hour, to sq. ft., EDR, multiply by 4.

Condensate Pump—Used to return condensate to the boiler where it cannot be done by gravity. Pump must be located so that condensate flows into receiver by gravity.

Cooling Leg—A length of uninsulated pipe with sufficient cooling surface to dissipate enough heat so that steam condenses and the trap can open to discharge condensate from unit.

Counter-Flow System—Steam and condensate flow in the opposite direction within the same piping. Piping should be one size larger than in a parallel-flow system to allow sufficient space for free flow of steam and condensate.

Differential Pressure—Difference in pressure measured between inlet and outlet of trap or similar equipment.

Down Feed Riser—Piping that carries steam from supply main above to heating units below. This piping also carries condensate from heating units to the return.

Down-Feed System—Steam system for more than one floor in which steam supply main is near top of structure and down-feed risers carry steam to heating units, as well as condensate to wet return. Condensate flows to boiler via the Hartford Loop.

Drip Connection—This section of piping, at least 18" long, is the minimum distance the end of the supply main must be above boiler water line for gravity flow of condensate back to the boiler.

Dry Return—Return piping above the boiler water line that carries condensate back to the boiler.

Equalizer—Piping from top of boiler to maintain pressure balance on water in boiler return connection.

Flash Steam—Re-evaporation of condensate back into steam. It occurs when condensate flows into a reduced pressure area where the condensate's temperature is above boiling point for reduced pressure. For example: if hot condensate is discharged by a trap into a low pressure return or into atmosphere, a certain percentage of water will be immediately transformed into steam. Flash steam usually has a white, puffy appearance.

Float and Thermostatic Trap—Stops steam flow and continuously discharges condensate and air accumulations into returns. Install trap far enough from condensate pump receiver so flash steam does not affect the pump operation.

Gate Valve—Valve that completely closes off the flow of water out of boiler inlet valve, usually open, can be closed tightly if pump needs repair or servicing.

Hartford Loop—Actually two loops, this system of piping acts as a safety device to prevent the water from draining out of the boiler if a leak develops in return piping. First loop surrounds boiler; second is the balance of the system.

Heating Unit—Convectors, cast iron radiators, wall-fin radiation units, and similar heating devices.

Loop Riser—Vertical portion of the wet return that brings water into the equalizer 2" below water line.

Main Vent Valve—Lets air escape from supply main quickly so steam can circulate and reach heating units for fast warmup. Main Vent should be located at least 15" from the last fitting of the supply main.

Mechanical Return—Steam heating systems in which the height between the end of the main and the boiler water line (drip connection) is insufficient for gravity return of condensate back to the boiler. A condensate pump provides the mechanical means for condensation return.

No Pressure Return—Actually a dry return below the boiler water line. Condensate flows by gravity through this return and enters the condensate pump above the high water line of the pump's receiver. Air in this return is at atmospheric pressure because the receiver has an open air vent that extends above the boiler water line.

Open Air Vent—Open length of piping extending up from the pump receiver to above the boiler water line. The vent keeps air pressure in both the pump receiver tank and the no pressure return equal to atmospheric pressure outside the system.

Parallel-Flow System—Piping arrangement of steam system in which both steam and condensate flow together in the same direction in the supply main and return.

Glossary

Pitch of Mains—Pitch is the amount of slope given to a pipe. Correct pitch for horizontal supply mains and dry returns must be 1/4" min. in 10' in the direction of steam and condensate flow.

Pressure Drop—Difference between steam pressure at top of boiler and pressure at the end of the steam supply main. It is caused from friction within piping and the condensing process in mains and heating units.

Safety Factor—Additional static head needed to compensate for higher pressures and greater steam consumption during warm-up periods.

Static Head—Amount of water needed in returns to build up necessary pressure to force water back into the boiler in a gravity feed system.

Steam Boiler—A closed vessel for conversion of water into steam. It should be equipped with automatic controls to maintain water level and sufficient safety devices for proper burning of fuel.

Square Foot of Heating Surface—Equivalent Direct Radiation (EDR) the amount of heating surface which will give off 240 Btu per hour when filled with steam at 215°F and surrounded by air at 70°F. (Equivalent square foot of heating surface may have no direct relation to the actual surface area.)

Strainer—Used to protect valve pins, seats, and other parts from dirt and foreign matter.

Supply Main—Primary piping that carries steam from boiler to heating units, and, in a one-pipe system, condensate from heating units to return main.

Supply Riser—Vertical piping that carries steam under pressure from boiler up to supply main. A riser carries steam up from supply main to heating unit.

Supply Valve—
One-Pipe System—Located at the bottom of heating unit's inlet connection. Supply Valve controls admission of steam, and flow out of condensate. In a one-pipe system, the supply valve should be fully open or closed tightly, since a partially open valve obstructs free flow of steam in and condensate out.

Two-Pipe System—Modulating-type supply valves—either spring packed or packless—admit steam to the heating unit through its top inlet connection. Selection depends upon construction requirements and system pressures.

Thermostatic Steam Trap—Located at the bottom outlet connection of the heating unit, thermostatic trap stops flow-out of live steam, but opens to drain condensate and air into the return.

Two-Pipe Vacuum System—An ordinary two-pipe vacuum system uses a vacuum pump to create a subatmospheric pressure, usually 3" to 8" Hg (Mercury), in the return piping. Vacuum removes air from system piping and heating units to provide quick heating and efficient steam distribution. Condensate flows to the pump receiver by gravity.

Up-Feed System—Steam system for more than one floor in which the steam supply main is in the basement above the boiler. Risers carry steam to heating units. Condensate from each up-feed riser is dripped by gravity into wet return and then flows via Hartford Loop to boiler. Supply main is kept free of condensate accumulation for free flow of steam.

Vacuum System—A closed heating system in which a partial vacuum is induced when the heating units and the main cool below the boiling point of water at atmospheric pressure. Pressures in a vacuum system range from below atmospheric pressure to a higher pre-determined pressure. Space heating is more even, and boiler water temperatures are usually lower; heating is more economical. Vacuum vent valves and vacuum main vents must be used.

Vacuum Pump Equalizer—Piping arrangement that equalizes induced vacuum between the supply header and vacuum pump receiver.

Vent Valve—Installed on a tapping at the opposite end of the supply valve, float and thermostatic vent valves let air escape from the heating unit under pressure, but closes against the passage of steam and condensate.

Water Hammer—A wave transmitted through a pipe filled, or partially filled, with water. It may originate as waves set up by steam passing at a high velocity over condensate collected in piping. It is one of the main causes of noise in steam heating systems and is the cause of much damage to thermostats and floats in traps.

Wet Return—Portion of the return which is below the boiler water line and filled with water (does not carry air or steam).

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