



# Basic two-pipe system with condensate pump

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.

## Basic Equipment and Definitions

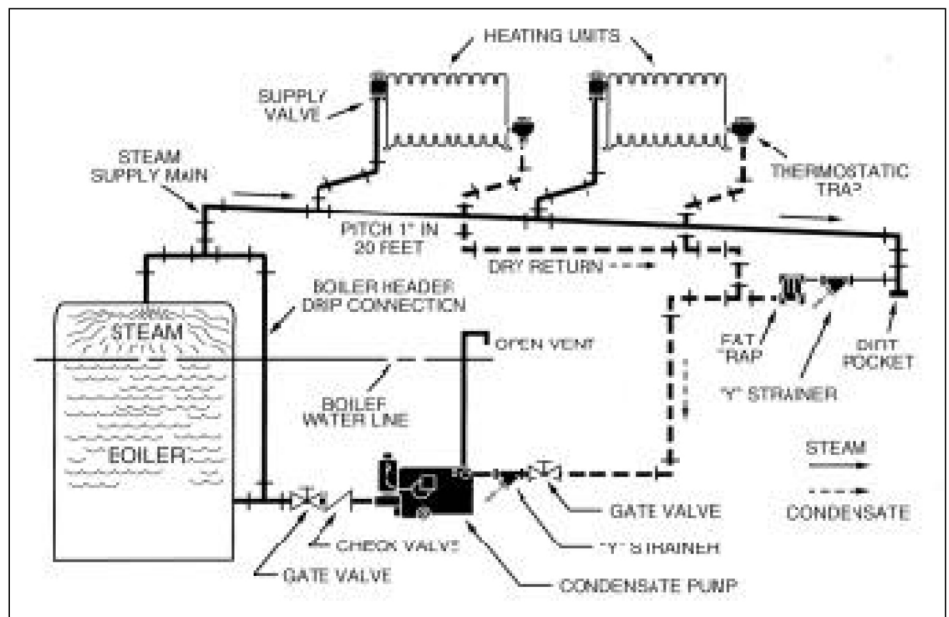
**Steam Boiler** – A closed vessel for conversion of water into steam which is usually automatically fired and equipped with suitable controls to maintain system pressure, required safety devices for proper burning of fuel, automatic water feeder, and low water cut-off.

**Supply Valve** – On a two pipe system, Hoffman modulating-type supply valves – either spring packed or packless – admit steam to heating unit through its top inlet connection; choice depends upon construction requirements and system pressures.

**Heating Unit** – Convectors, cast iron radiators, wall-fin radiation units, and similar devices which transmit heat from the heating system to the room and its occupants.

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

**Float and Thermostatic Trap** – A Hoffman F & T Trap stops steam flow and continuously discharges condensate and air accumulations into returns. Install the trap far enough from the condensate pump receiver so flash steam does not affect the pump operation.



**Condensate** – In steam heating, the water forms 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.

**Supply Main** – Primary piping that carries steam from boiler to heating units.

**Thermostatic Steam Traps** – Located at bottom outlet connection of the heating unit, Hoffman Thermostatic Traps stop flow of live steam, but open to drain condensate and air into the return.

**Strainer** – Install a Hoffman Strainer to protect valve pins, seats, and other parts from dirt and foreign matter.

**Square Foot of Heating Surface** – Equivalent Direct Radiation (EDR). By definition, that 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.)

**Condensate Pump** – A Hoffman/Domestic Condensate Pump returns condensate to the boiler where this cannot be done by gravity. Pump must be located so that condensate flows into receiver by gravity.

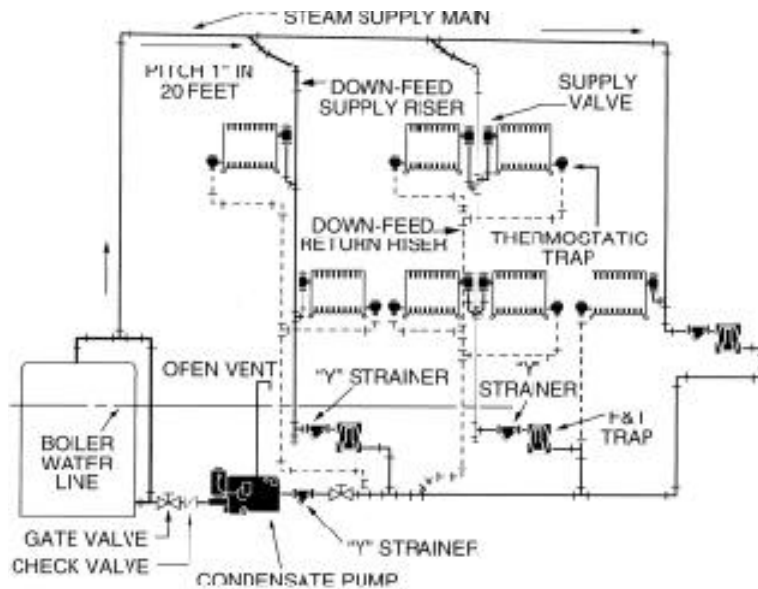
**Open Vent** – Piping arrangement extending up from pump receiver to above boiler water line. Open-end pipe vents air accumulations in system and maintains atmospheric pressure in pump receiver and return piping.

**Check Valve** – A valve that controls direction of water flow in piping.

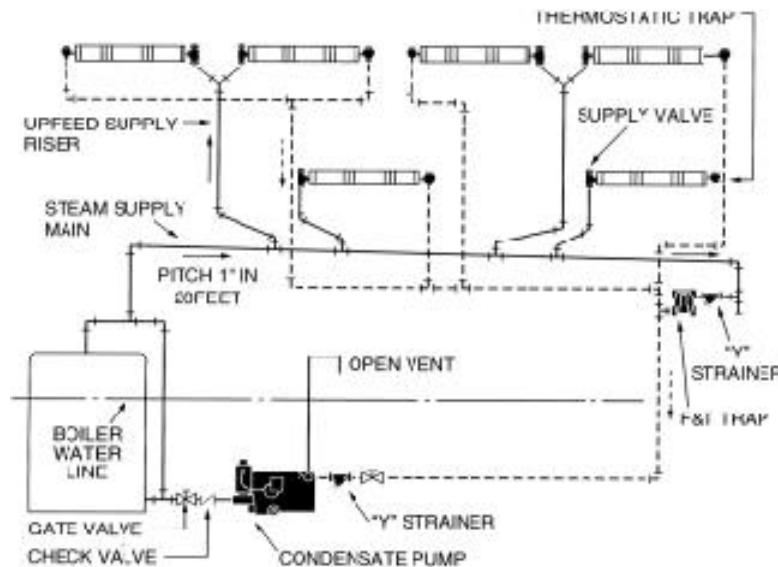
**Gate Valve** – A valve which permits full flow when open and tight shut off when in closed position. It facilitates repairing or servicing traps, pumps and other equipment.

# Two-Pipe Steam

## Two-Pipe, Down-Feed System with Condensate Pump



## Two-Pipe, Up-Feed System with Condensate Pump



## Equipment & Definitions in other two-pipe systems

**Down-Feed Steam System** – Heating system in which supply main is above level of heating units it serves.

**Down-Feed Supply Riser** – Vertical piping that carries steam from overhead supply main to heating units below. Supply riser must be dripped through trap to return piping.

**Up-Feed Steam System** – Heating system in which supply main is below level of the heating units it serves. Low points of supply main must be properly dripped through trap to return piping.

**Up-Feed Supply Riser** – Vertical piping that carries steam from the supply main up to the heating units.

**Pressure Drop** – Loss of pressure due to pipe friction and the condensing process of steam.

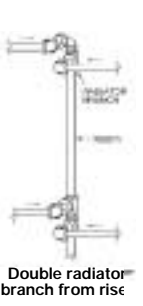
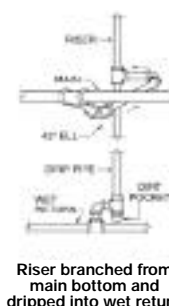
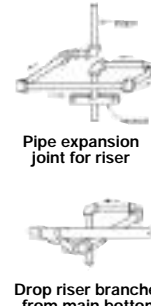
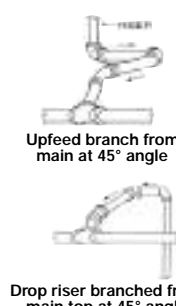
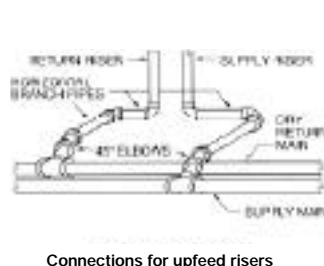
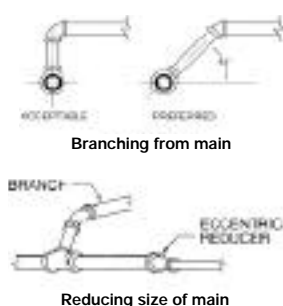
**Differential Pressure** – Difference in pressure measured between inlet and outlet of trap or similar equipment.

**Mechanical Return System** – System that uses mechanical means (condensate pump) to return condensed steam (water) to the boiler. Pump must be located so that condensate flows into receiver by gravity.

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

**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 pickup and efficient steam distribution. Condensate should flow to pump receiver by gravity.

## Piping Tips



# Heating Systems

**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 the accumulator, and is lifted to vacuum pump receiver.

**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 the 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.

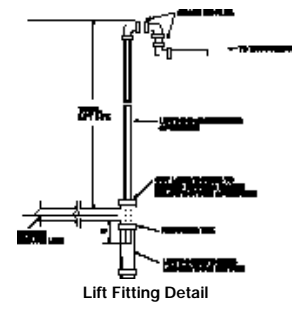
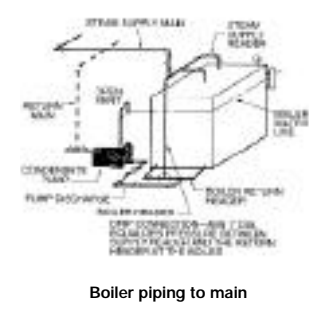
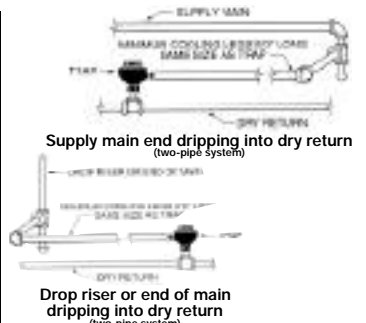
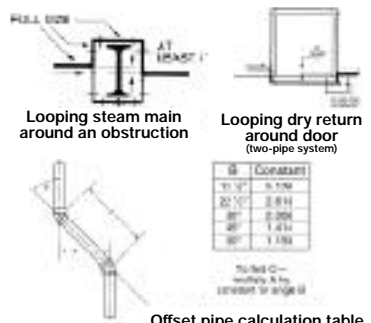
**Cooling Leg** – A length of uninsulated pipe with sufficient cooling surface to dissipate enough heat so that steam condenses and trap can open to discharge condensate from unit. Needed only with thermostatic traps.

**Water Hammer** – Water hammer is one of the chief causes of noise in steam heating systems and also the major cause of damage to thermostats and floats in traps. It is 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.

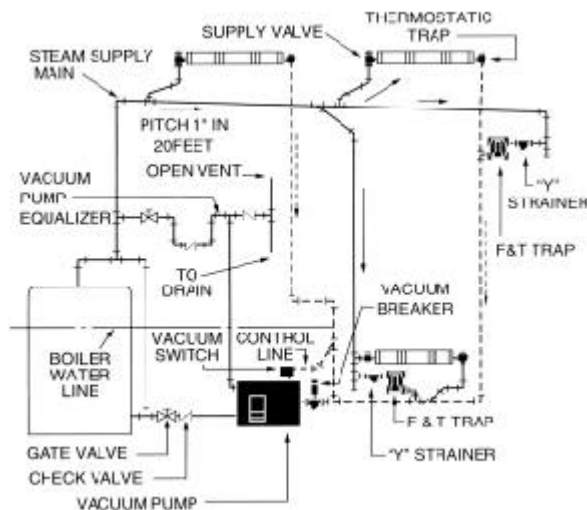


Fig. 3-19

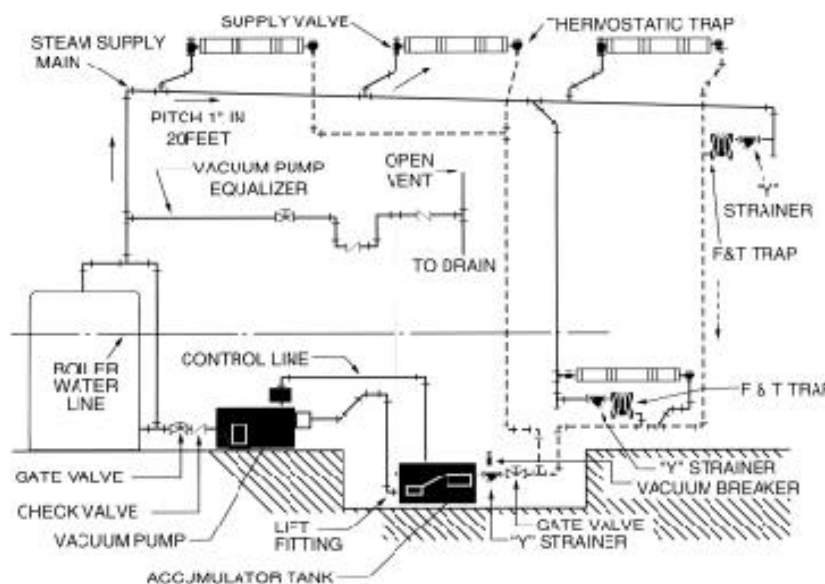
Fig. 3-19 illustrates how such a wave may be formed. The rapid passage of steam over the surface of the water causes a wave to form as at "B". The rapid condensation of the steam in pockets "A" brings the two slugs of water together with a considerable force, which may be telegraphed through the piping.



## Typical Two-Pipe Vacuum System



## Two-Pipe Vacuum System with Accumulator Tank



There's one pre-eminent name among two-pipe steam-heating-specialty manufacturers :

## Thermostatic Steam Traps

**Low-Pressure** – Maximum operating pressure: 25 PSIG

**Medium-Pressure** – Maximum operating pressure: 50 PSIG

**High-Pressure** – Maximum pressure: 125 PSIG



No. 17C Angle 1/2"



No. 17C Swivel 1/2"



No. 17C Vertical 1/2"



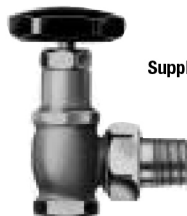
No. 8C  
Straightaway 3/4"



No. 8C  
Angle 1/2", 3/4"



No. 9C  
Angle 1"



Supply Valves



Strainers



### Series HC™ / CC™ Condensate Return Units

In Simplex or Duplex design, this condensate return unit is designed for feedwater temperature to 200°F (93°C) and systems up to 150,000 sq. ft. EDR. (At specified application points, can handle 210°F) Series HC units include:

- Low inlet, cast iron receivers with a 20 year warranty against failure due to corrosion.
- Receiver sizes from 6 to 250 gallon
- Capacities to 150 GPM (568 LPM)
- Discharge pressures to 90 psi (6.1 bar)

## Hoffman Specialty

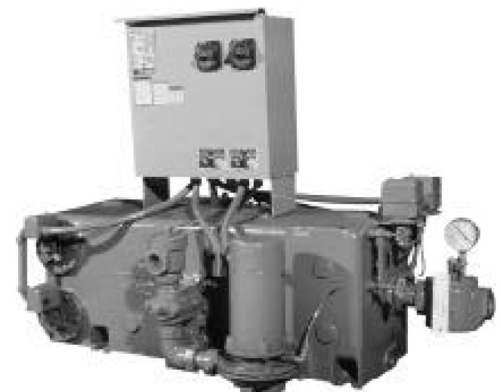


Series I



Hoffman Specialty Float and Thermostatic Steam Traps provide continuous condensate removal under modulating loads. They quickly vent air and other non-condensable gases during startup and steady state operation. All stainless steel internal components resist corrosion.

The Series I Float and Thermostatic Steam Traps eliminate unnecessary lifts in return systems making them ideal for air makeups coils and unit heaters.



### Series HV™/VL™/VLR™ Vacuum Heating Units

This unit produces a vacuum for fast, even distribution of steam throughout the system. It also collects and returns the condensate back to the boiler feed system. The HV is available in Simplex or Duplex design for systems from 1,000 to 65,000 sq. ft. EDR. Each unit is complete, factory assembled and tested with integral wiring of control equipment.

The HV features include:

- Two-compartment, cast iron receivers with a 20 year warranty against failure due to corrosion.
- Multi-jet Vacuum Producers are efficient for low or high vacuum systems
- Air capacities to 22 CFM (0.013 M³/s)
- Discharge pressures to 40 psi (2.7 bar)

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