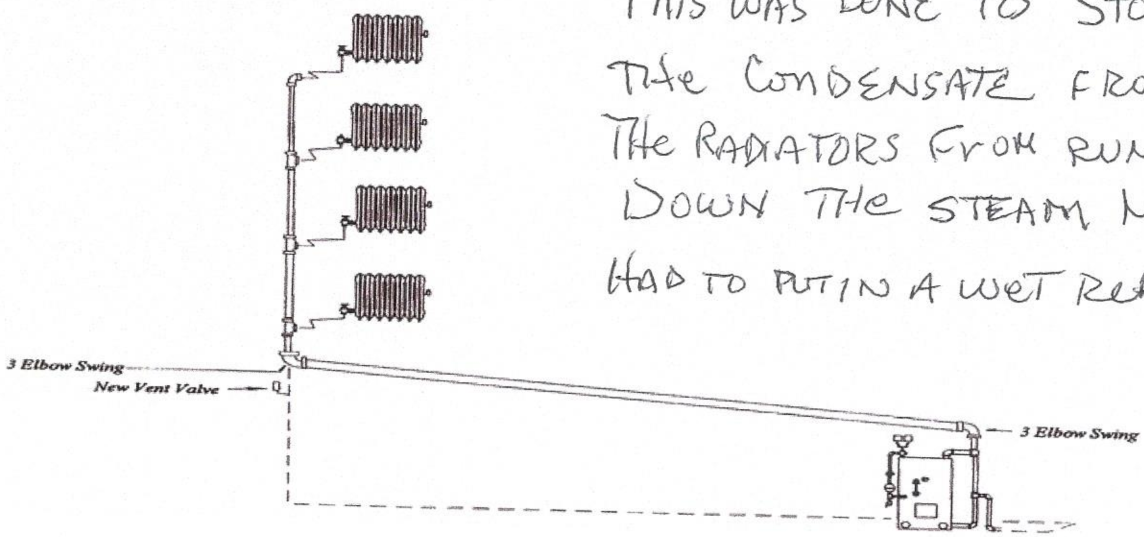
This building's usage changed and became a storage and distribution facility. Instead of being occupied for 24 hours, it was now used 12 hours a day. The office space supported a security guard, purchasing agent, and distribution clerk. Heat had to be supplied to keep people comfortable at a desk. Additionally, the room grew from 200 square feet to a 600-square-foot office with insulated walls.



THIS WAS DONE TO STOP THE CONDENSATE FROM THE RADIATORS FROM RUNNING DOWN THE STEAM MAIN. HAD TO PUT IN A WET RETURN

To upgrade the system and assure economical operation, a new cast-iron steam boiler with an oil burner should have been installed. The original coal boiler operated 24 hours a day and the original vacuum vent valves vented 1 cubic foot of air a minute, and when the boiler shut down, the system went into a vacuum. Four vent valves released 240 cubic feet of air an hour. After the boiler began to make steam, it took about 1.5 minutes to vent 5 cubic feet of air (the volume of the space in the boiler and steam main) and start to heat the offices. When I became involved with this building, I made these changes:

I installed one Competitors # 1 vent valve on the steam main in the basement. A Competitors # 1 vent valve can remove 4 cubic feet of air per minute at 1 psig. The boiler and steam main had about 5 cubic feet of internal air space. At an air-removal rate of 4 cubic feet of air per minute, steam could arrive at the base of the riser in about 1.25 minutes.

A Competitors C vent valve was installed on the radiator on the top floor and a Competitors # 5 vent valve on the remaining three radiators. A Competitors C vent releases 2.26 cubic feet of air per minute. Competitors # 5 vent valve release .560 cubic feet of air per minute. The total venting capacity of all vent valves is about 7.82 cubic feet of air per minute. To find out how long it would take steam to reach the radiator at the top floor, add the cubic feet of air space of the boiler, steam main, steam riser, and the radiators. Each radiator has about 5 cubic feet of internal air space; the 2-inch steam main has 2 cubic feet of air space and the boiler had 3 cubic feet of internal air space. The total internal air space of the heating system is about 25 cubic feet.

The combined venting capacity of the vent valves is nearly 8 cubic feet of air per minute. Divide the system's internal air space of 25 cubic feet by 8 cubic feet and steam could reach the top floor radiator in about 3 minutes. In actuality, the speed or time it takes for steam to reach the radiators is the time it takes for the boiler to produce steam plus 3 minutes.

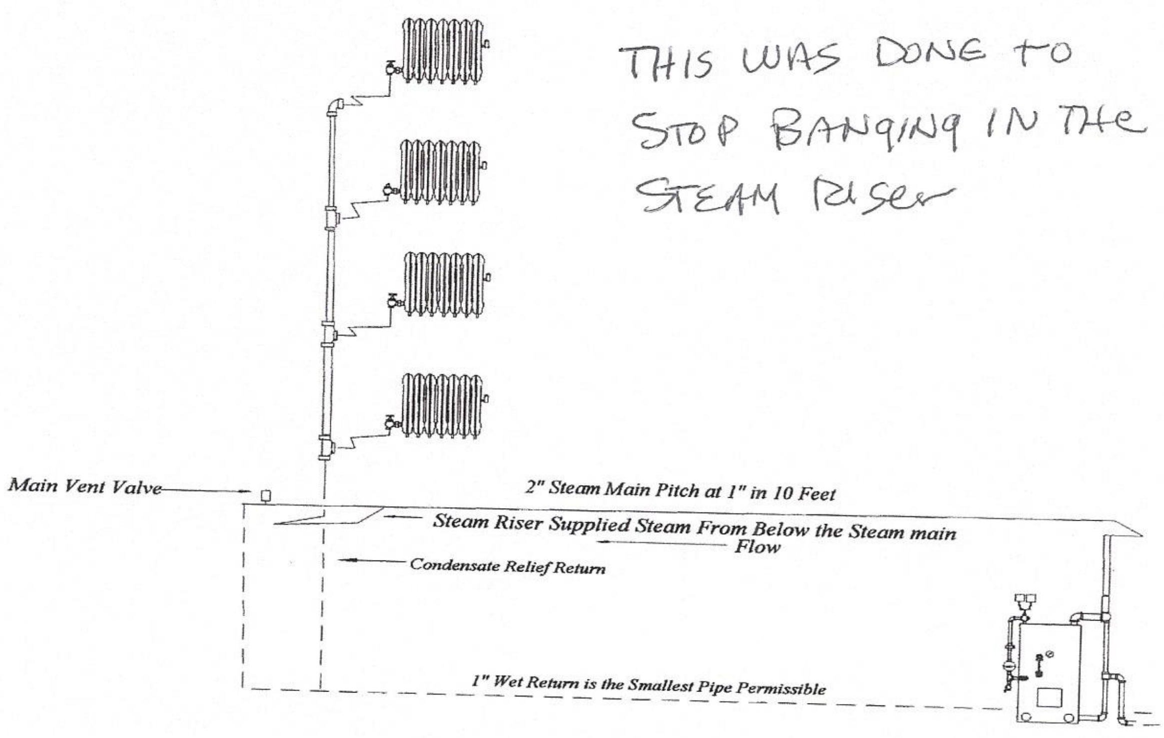
Banging occurs because all the water in the radiator did not flash into steam. The rapid formation of steam (flashing) can propel the remaining water into walls of the radiator. Additionally, steam is present at the inlet of the radiator. The steam tries to enter the radiator and when a moving slug of leaving water meets the entering steam head on, loud banging can occur.

When a steam system is designed and installed properly, steam's velocity is controlled. Reaming all pipes, installing the pipes with proper pitch, installing insulation, and removing system air quickly will prevent poor circulation, water retention, and banging.

Steam systems are piped, pitched, and vented several different ways. In this chapter, I listed basic steam systems installed without steam traps where water returns to the boiler by gravity. Additionally, steam systems are classified by how they were piped. Shown on the next pages are sketches of several variations of the most common steam systems I found in Connecticut, New Jersey, and New York.

The steam system I altered could have been better modified. If banging occurred or steam supply to any of the radiators was insufficient, the problem most probably would have been retained water. To assure that retained water would not cause a problem, these changes could be made. Alter the existing piping in the basement by pitching the steam main away from the boiler. Install a lateral riser supply pipe starting below the steam main and connect it to the steam riser with a drip connected to a wet return. This piping alteration changes the counterflow system to a parallel flow system; that would assure water retention would no longer cause a problem. Additionally, by relief dripping the riser, condensate water from the radiators is diverted away from the steam main directly to the wet return.

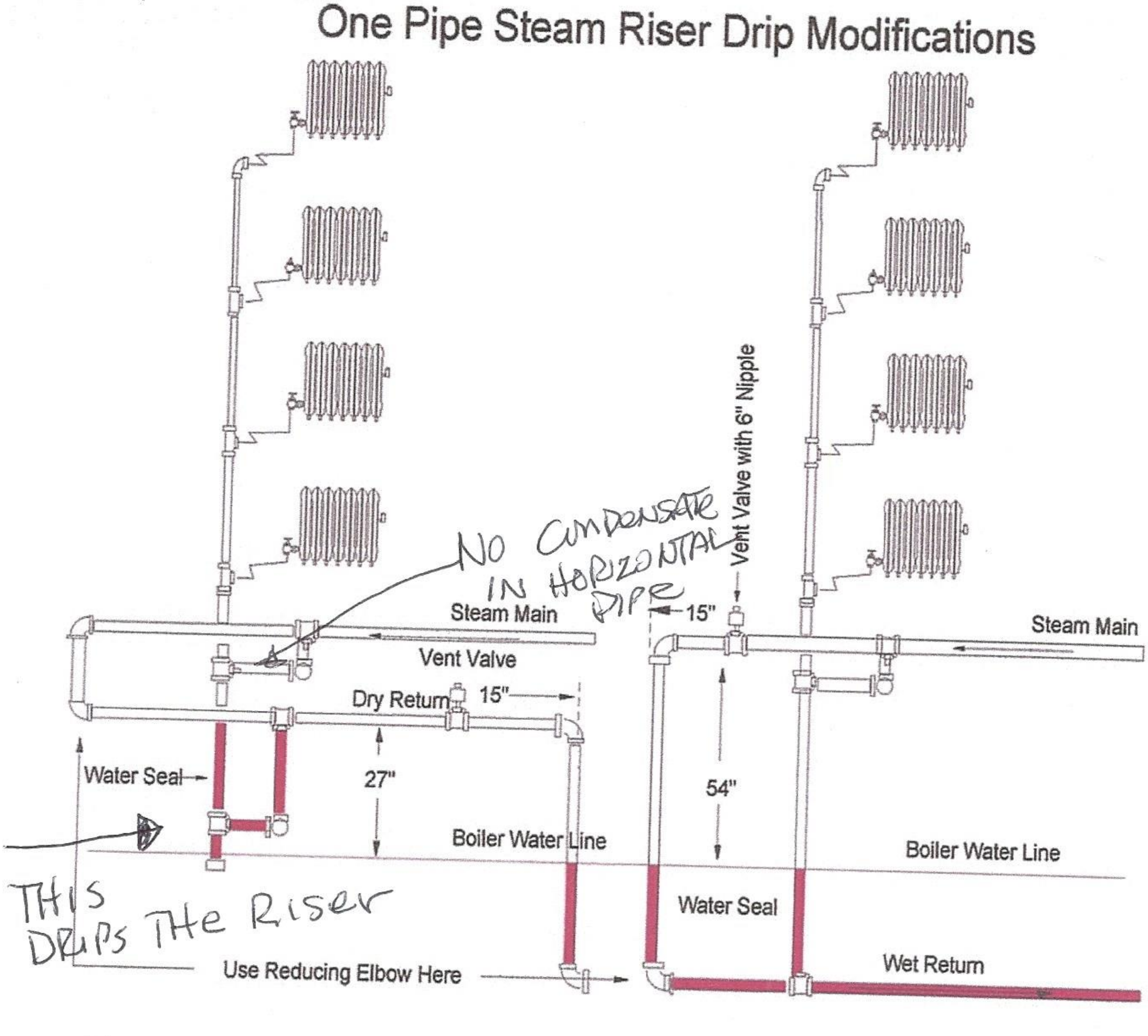
ONE PIPE STEAM PARALELL FLOW



This drawing shows the best way to modify the piping system. The drawing shows a parallel flow steam system with a relief drip at the base of the riser. The difference between both steam systems is how condensate water is handled. Originally, the steam system was a counterflow steam system, where

1½-inch pipe is nearly double the capacity of the 1¼-inch pipe, so we can safely extend the distance to 12 feet. When using the proper tables, correcting problems associated with horizontal run-out extensions to radiators or moving radiators are less problematic.

All piping layouts, solutions and correction of problems that occur due to a dropped steam riser, adding new radiators to a building extension, or installing a new boiler require a proper dimension "A."



Two radiator risers are shown in the drawing above. Each riser is equipped with relief drip piping. One riser is connected to a dry return and the other a wet return. At the left riser, the riser's relief drip connects to the dry return via a water seal. The water seal separates the riser from the dry return and allows the condensate from the radiators to drain and bypass the steam main. Condensate drains directly into the dry return, and the water seal prevents steam in the dry return from entering the return riser and interfering with condensate drainage. The other riser drip is connected to a wet return.