



George R. Carey Jr.

One-pipe steam systems

One-pipe steam systems were one of the first central heating systems installed in this area, going back as far as the early 1860s. In operation, they are basically simple and would appear to have been easy to install. But after looking at many problem jobs, reading a lot of the old books on the subject and listening to Dan Holohan, I have come to appreciate just how involved the design and installation of these “simple” systems really were.

The service technicians of today are not installing these systems from scratch—only replacing old boilers or moving one or more radiators to satisfy a customer’s addition or renovation. And because of this, I think they can become handicapped in appreciating how involved the “inner-workings” are of these systems. So based on what I have read and what I have seen in many basements, the following is a list of some common “do’s and don’t’s” when wrestling with an old One-Pipe steam system...

- **DON’T** size the replacement boiler by using the heat loss calculation method, the old boiler’s label method, the “looks a lot like” method or any other rule of thumb method.

- **DO** size the replacement boiler by counting **ALL** the radiation in the house. The total becomes the Net EDR (equivalent direct radiation) rating of your replacement boiler. Steam doesn’t care about heat loss or anything else except the amount of **COLD** metal attached to the boiler. If the boiler is too small, parts of the building will **NEVER** heat! If it is too big, the new boiler will short cycle like mad, consume bodacious amounts of fuel and create numerous service calls!

- **DON’T** assume that you can pipe the new boiler exactly the same way as the old boiler.

- **DO** pipe the new boiler according to the boiler manufacturer’s installation instructions. (It’s that packet of white papers found inside the brown envelope shipped with every boiler!) New boilers are **VERY** different from the old boilers. The sections are narrower, the exit hole(s) is usually smaller, there are fewer of them, and the steam chest is almost nonexistent. All these changes affect the boiler’s ability to manufacture **DRY** steam. So pipe them according to the directions and you will save yourself many headaches!

- **DON’T** just throw in a couple of bottles of cleaning chemicals when you are done with piping the new boiler.

- **DO** skim the boiler according to the boiler manufacturer’s instructions. Oil and dirt from the foundry as well as cutting oils used during the installation will create surface tension on the top of the water in the boiler. This sets up a foaming/

priming condition that creates very wet steam. The results are water hammer, lack of heat and unhappy customers!

- **DON’T** use adjustable vents on radiators based upon the radiator’s location.

- **DO** use adjustable vents based upon the size of the radiator. Somewhere along the way, we started thinking that adjustable vents were designed to balance a one-pipe steam system by adjusting the venting capacity of each radiator according to its location in the house. When you look back in those “old” books, you realize they were developed to balance larger radiators against smaller radiators. When coal fired systems were converted to oil, they found that the system operated differently. To adjust to this new “on & off” type of system, they had to balance the air venting of the larger radiators versus the smaller radiators. It had **NOTHING** to do with the location of each radiator. That problem was taken care of by installing at least one large-capacity main vent at the end of each main. Then the adjustable vents would simply control the venting rate of the smaller radiators compared to the larger radiators.

- **DON’T** use small radiator vents as end of main vents! Or worse, **DON’T** plug the end of main vent tapping with a pipe plug!

- **DO** use the largest main vents that you can put your hands on! By venting the air from the main separately and quickly, you will significantly improve the balance of the system. Steam is a gas, and it will always look for a way to get out of the system. By using a large vent, the steam will head towards the end of the main before it starts filling the risers. This provides balance to a one-pipe system.

- **DON’T** size the horizontal run-out which feeds the one-pipe riser based on the inventory method of pipe sizing.

- **DO** use a steam pipe-sizing chart that tells you the exact pipe size needed to support the amount of radiation connected to the riser. The pipe that connects the steam main to an up-feed riser is called a horizontal run-out. Its job is to supply steam to the riser while allowing condensate, which is coming back from the radiators, to gravity drain back into the steam main. If the steam is moving too fast (velocity), the condensate won’t be able to drain back into the main. Instead, the steam will drive it towards the radiator vents.

- **DON’T** remove the insulation from the steam carrying pipes!

- **DO** insulate any/all steam carrying pipes. If the asbestos insulation has been removed, make sure you re-insulate the mains. When a steam main is uninsulated, it becomes a large radiator, causing the steam to condense in the distribution

pipings instead of in the place where it is needed; the radiators! An uninsulated pipe has five times the heat loss of an insulated pipe. By keeping the mains insulated, you are giving the steam a chance to get where it needs to go.

- DON'T raise the setting of the pressuretrol control, thinking it will solve a heating problem!

- DO keep the pressuretrol or vaporstat set as low as possible. There are many benefits to running a one-pipe steam system on low pressure. First, low pressure steam moves faster than high-pressure steam. If you want the steam to reach the end of the main quickly, lower the pressure. (Of course, make sure you install a large capacity main air vent!) Also, all radiator vents have a rating known as the drop-away pressure. This is the maximum pressure that the float inside the vent can fall down against, allowing the vent to re-open. If the pressuretrol setting is too high, once the vent closes it won't re-open to vent any remaining air in the radiator. Lastly, EVERY one-pipe steam radiator in the Northeast was sized to heat the house on the coldest day of the year with less than 1 psi of steam. We know this because of the definition of a square foot of steam. For every square foot of EDR, the

radiator will emit 240 BTU/H when the room temperature is 70°F and the steam temperature is 215°F. So when you have to set your customer's pressuretrol, set the cut-in at ½ psi (to overcome the pressure drop of the piping) and set the differential at 1psi. This will give you all the pressure the system will need!

- DON'T forget about the "A" dimension when installing a replacement boiler!

- DO measure the distance between the water line of the new boiler and the lowest steam-carrying pipe. The minimum distance for a one-pipe system should be 28". This dimension allows the returning condensate to stack up above the water line of the boiler and, combined with the leftover steam pressure, return into the boiler. When this dimension is ignored, the condensate can back up into the steam main causing incredible banging noises and create water level problems back at the boiler.

The next time you encounter a one-pipe steam system, pay attention to the details and I'm sure you will be successful. If you have any questions or comments, please e-mail me at gcarey@fiainc.com or call at 1-800-423-7187. □

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