

Understanding the Boiler Gas Train

SHARING

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Categories: Commercial Heating (/systems-help-center/category/commercial-heating)



One of the most misunderstood portions of the commercial heating system is the gas train. The gas train is a series of components that safely feed the natural or propane gas into the burner.

The first component of the gas train is the sediment trap or more commonly referred to as the "dirt leg" This is used to catch any dirt or moisture that may be entrained in the natural gas feed to the building. It is typically a nipple and cap that is located on the run of the tee. The gas feed is on a right angle coming from the bull of the tee.

ASME CSD1* recommends a strainer before the other horizontal components in the gas train. Although not commonly installed, it is a good idea as it will also protect the gas train components from dirt.

Just past the strainer is the upstream manual gas valve. This manual gas valve usually has a 1/4" or 3/8" plug that should be on the upstream side of the gas valve. That pipe tapping is where you should attach the pipe or tubing to the burner pilot assembly. The pilot connection should be on the upstream side of the valve to allow you to test the safety controls. The valve handle should be oriented so that the handle is parallel to the gas flow when open and perpendicular to the gas flow when closed. This allows you to know quickly whether the gas valve is open or closed.

The gas pressure regulator should be the next component. It will be upstream of all electric valves. The orientation of the regulator is important and is usually right side up with the adjustment access at a 90 degree angle to the gas train. Inside the top of the regulator is an adjustment screw and a spring. On many regulators, the spring can be changed to allow different gas pressures to the burner. The gas pressure regulator usually has a fitting on top that is to be vented to the outside. This vent pipe can sometimes plug and fill with spiders or bees. If plugged, it will not allow the gas to flow. A bug screen should be installed on the outdoor termination of the vent pipe. Some new regulators use vent limiters which do not require venting to the outside.

"Be careful as the flames roll out the side of the boiler when it starts." the new client warned us when we were going to perform a pre season check of the boiler. We saw what he was warning us about immediately as the

boiler started. Flames did indeed roll out of the boiler and licked the boiler jacket. The cause of this anomaly was because the gas pressure regulator was improperly installed downstream of the first electric gas valve. When the electric gas valve was powered off, the gas pressure regulator would open wide. After the gas valve was energized and open, the regulator would be wide open and over feed the gas to the burner. The gas pressure would regulate itself to the proper setting but not until the flame shot out of the side of the boiler. To repair the problem, the regulator had to be relocated upstream of the electric valves.

In some areas, a relief valve is required. I have never seen one on any of the projects that we have worked on but ASME CSD1 states that it is required in some areas.

The next item downstream in the gas train progression is the low gas pressure switch. As you can guess, it will shut off power to the burner if the gas pressure is below the setpoint. The high gas pressure switch will be located between last manual gas valve and the burner. Many are located atop the burner housing. This will shut off power to the burner if the gas pressure is too high. These controls usually have a manual reset that will require resetting if they trip. Gas pressure switches are not installed on every boiler and are typically used when the gas rating of the burner is greater than 2,500,000 Btuh.

Safety-shutoff valves are the next components the gas train. It is most likely two redundant valves that are to limit the chance of gas leaking through into the boiler. If the state or municipality adheres to ASME CSD1, there will be a tapping with a valve and cap immediately after each valve. This is to allow the leak testing of the gas valves. Many facilities will leak test the gas valves using a bubble test. The orientation may be important when installing the gas valves and the installation manual should be consulted to see whether the valves can be installed horizontally or vertically.

Some older gas trains used what was called Block, Block and Bleed gas train. In between the two Normally Closed safety shutoff valves was a tee and the pipe from the bull of the tee was attached to a solenoid valve that was Normally Open. It was installed to vent any gas that may leak past the first electric safety shutoff valve to the outside. If the system had this type of gas train, the outlet pipe from the solenoid valve was to be vented by itself to the outside. The other gas train components could be combined into a single vent but separate of the Bleed valve piping. The solenoid valves should be checked on a regular basis to assure that gas is not leaking through the solenoid valve.

"Our gas costs are suddenly very high. Do you have any suggestions?" The customer asked. I asked what had changed and was assured that nothing had changed. There was something wrong with my boiler that was over 10 years old I was informed. When we got there, we saw that something did change. Someone had replaced the Normally Open Bleed valve with a Normally Closed solenoid valve. No one knew who changed the valve. It must have been the Boiler Fairy that anonymously changes components and control settings. The solenoid valve would open when the Safety Shutoff valves opened, allowing a 1 1/4" pipe filled with gas to vent to the outside anytime the boiler was firing. Once the valve was changed back, the client liked my boiler again.

Another manual gas valve or the downstream manual gas valve is installed right past the last electric valve and before the modulating or firing rate valve.

Firing rate valve. This valve is operated by a modulating motor and will change according to input from the modulating control. It may also be called a "Butterfly Valve." These are not installed on an on off burner.

Teflon Be careful when using Teflon tape or pipe dope on the gas train threads as many manufacturers will not allow it and could actually void the warranty.

*ASME CSD1 - American Society of Mechanical Engineers Controls and Safety Devices for Automatically Fired Boilers

Want to learn more? Check out my books, **Lessons Learned in a Boiler Room** (<http://astore.amazon.com/heatinghelp-20/detail/0984043616>), **Lessons Learned: Connecting New Boilers to Old Pipes** (<http://astore.amazon.com/heatinghelp-20/detail/0984043624>), **Lessons Learned: Servicing Boilers** (<http://astore.amazon.com/heatinghelp-20/detail/0984043640>), and **Lessons Learned: Brewing with Steam** (<http://astore.amazon.com/heatinghelp-20/detail/1530806194>).

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RayWohlfarth (/profile/RayWohlfarth)
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Ryan, I believe you are referring to the vent pipe from the gas train components. They are used to vent the natural gas if the rubber diaphragm inside the gas pressure regulator or gas valve splits or cracks. They are to be vented outside. If they are not vented, a 1/4" fitting leaking could fill a boiler room with a combustible mixture in a relatively short time making it very dangerous. Hope this helps.

Ray

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Ryan (/profile/Ryan) Member Posts: 1

October 13 (/discussion/comment/1442997/#Comment_1442997)

What is the purpose of the main gas vent valve and the pilot vent valve? I understand that they vent the gas to the atmosphere when the main gas valves and the pilot valves close, but why do you need to vent the gas?

Thanks,

Ryan

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