Shay Plumbing IX - Feed Water Pipes

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Feed Water Pipe Orientation: Photos of a couple of the Cass shays were reviewed before deciding how to orientate the feed water pipes. This photo shows the right side of Cass No 5. The feed water pipe runs from the boiler port horizontally for a short distance and then angles up and then horizontal again and on into the cab beside the window.

This photo shows the feed water pipe on the left side of Cass No 5. It's very similar to the right side.

This is a close-up on the left side fittings next to the boiler port: elbow - valve - check valve - union.

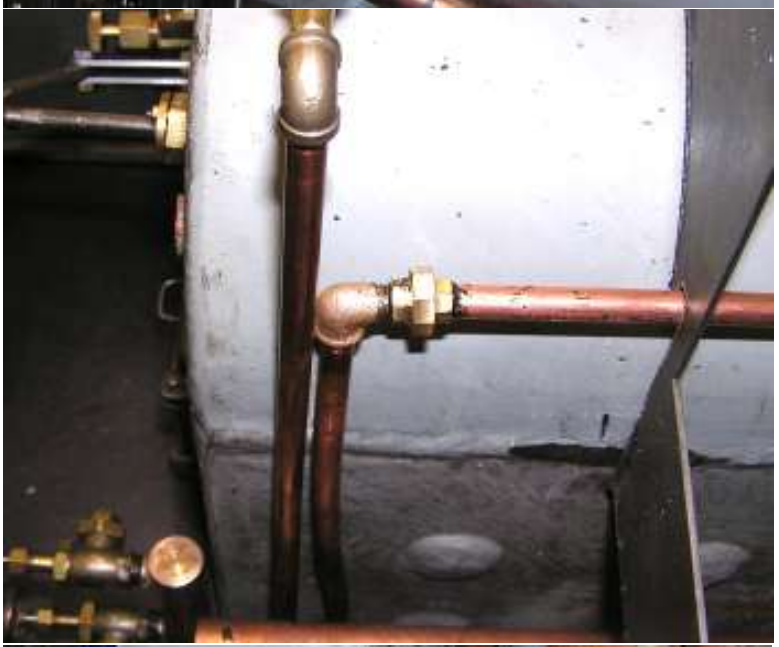
This shows the left side of Cass No 11. Note that the shape of the feed water pipe is like Cass No 5 except the injector is just in front of the cab. The feed water pipe curves up match with the injector.

This shows the left inside of the Cass No 5 cab. Cass 5 has the injectors (one for each side) inside the cab (the Cass 5 cab is longer than the Cass 11 cab).

Hand Pump Feed Water Pipe: This photo shows the fabricated right side feed water pipe ---- the pipe that connects the hand pump in the tender. The initial plan was to run the feed water pipes straight back rather than curving them up and then back. However, there is an advantage in having the pipes enter the cab over the curved part of the boiler---- there can be a slot for the pipe in the cab front rather than a hole. The cab can be removed by merely lifting it up and the feed water pipes don't need to be removed. The black marks on the boiler show the planned path of the pipe.

There is a union and elbow in the pipe in the cab.

Care was taken to keep the feed water pipe and fittings at least 1/4" out from the boiler to allow for lagging and jacket. The lagging and jack will end at the cab front.



The pipe follows the side of the boiler down to the top of the frame and then bends to the rear, angles around the corner of the boiler and runs parallel to the top right side of the frame.

The hard temper pipe (1/4" tube) is very stiff but bends easily after heated red hot and then quenched in cold water. As the tube is worked it hardens again but can be softened by heating again..

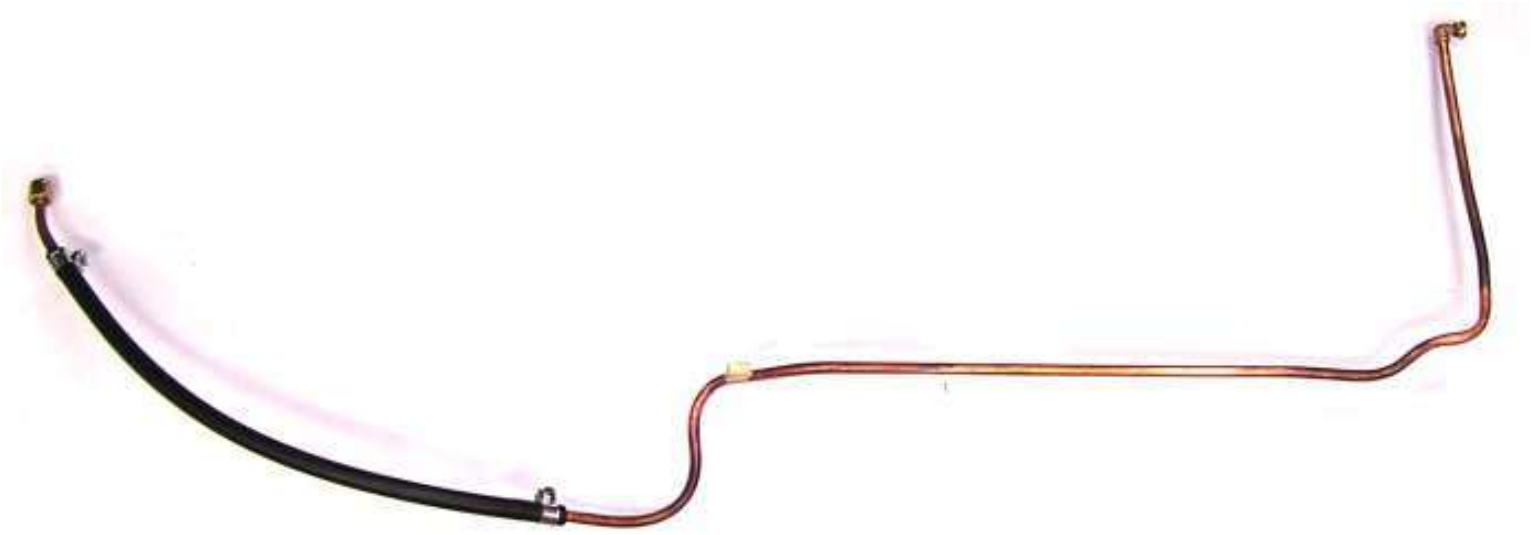
The view is from the left side and shows the pipe following the right frame side I beam over the bolster and then down near the center of the truck and back over the axel and under the truck top tie bar.

There is a brass tab silver soldered to the pipe above the bolster. The tab is secured to the bolster with a 4-40 flat head screw.

Note: This pipe was modified when the steam powered pump was installed. See Pump Part IV.

A 1/4" ID hose connects to the pipe under the tie bar and runs to a short length of pipe and compression fitting to the hand pump output under the tender. The ends of the pipe are flared slightly to keep the hose from slipping off. The hose is also secured with a hose clamp. The hose is SAE 30R3 1/4" ID rated for 400 psi (McMaster- Carr # 5645K22)

This shows how the pipe angles up and under the blower and atomizer manifold.



The photo above shows the back part of the pipe and the hose. With all the bends it sort of looks like a miniature exhaust pipe. This job whole job turned out to be much less difficult that anticipated. The bent pipe took very little effort. Starting at one rear end the pipe was heated and quenched in the area for the first bend, the bend made around a !' piece of steel rod, the area for the next bend was then heated it, etc.

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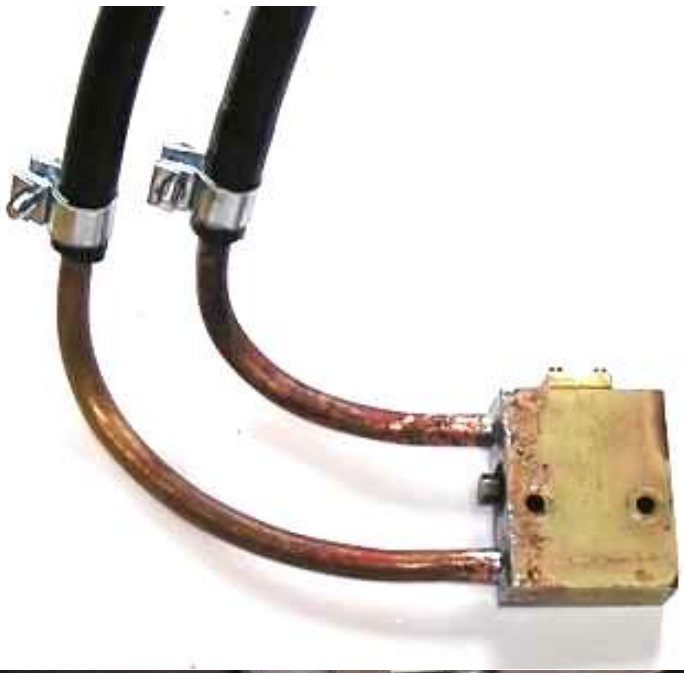


Axel Pump Feed Water Plumbing: The axel pump feed water plumbing is on the left side. Water from the tender is fed to the low pressure side of the pump and the high pressure side feeds the left side of the boiler.

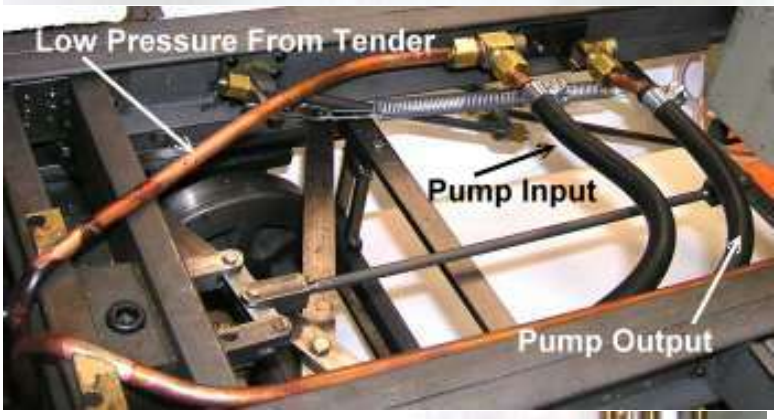
The first step was to make the short pipes from the axel pump input and output ports as shown in the photo. The pipes go between the two brake rods and then bend up and over the axel pointing to the front. The front clevis pin on the upper brake rod was removed to ease manipulation of the pump end and pipes. The pipes were threaded and then soft soldered at the pump end to keep them from rotating. The hoses were fastened to the pipes before reinstalling the end of the pump.

This shows the routing of the pipes and hoses. The hoses run over the truck top tie bar but are shown here tucked under the tie bar to give a clear view of the pipes.

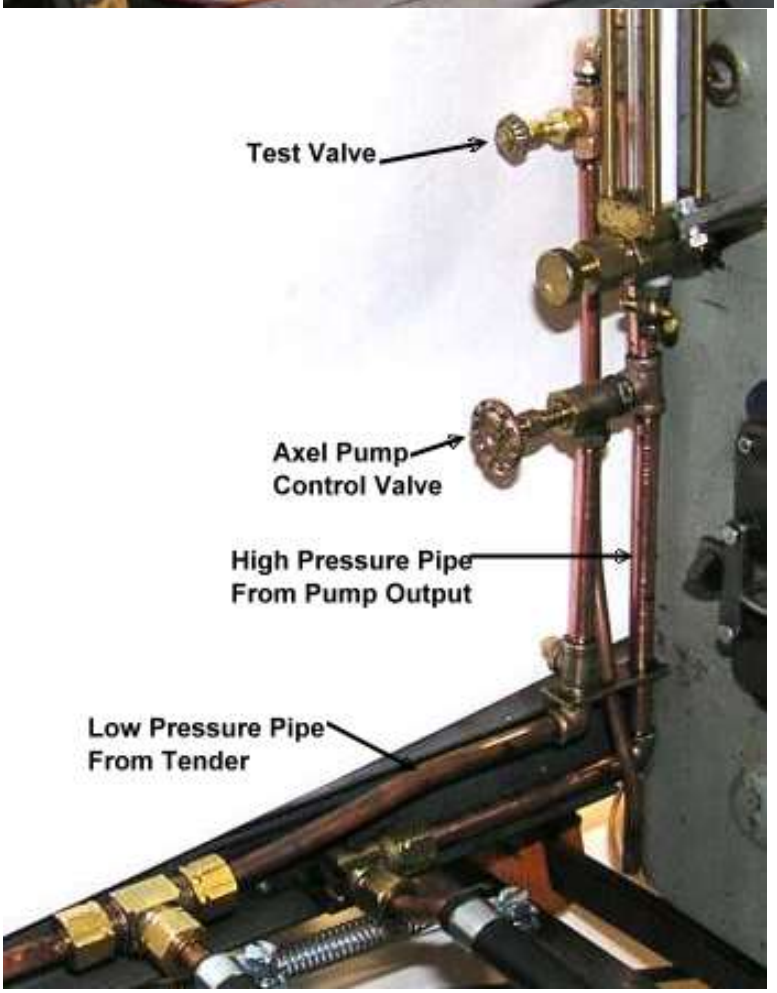
The pipes and hoses are secured to the inside of the left frame I beam. The brackets show on the right were fabricated from 1/8" X 3/4" angle iron. The compression fittings were silver soldered to the brackets.

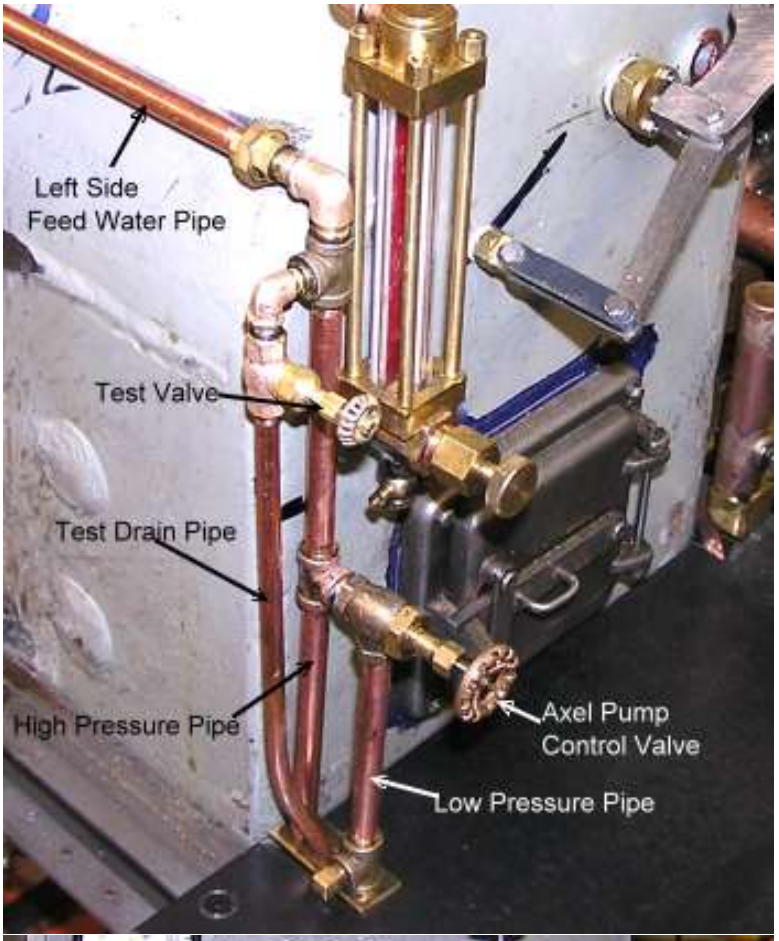
This photo shows the brackets installed on the left frame I beam. The captions on the photo identify the pipes and hoses. The pipe to the tender is similar to the pipe for the hand pump described previously.

Both the high and low pressure lines run up the left side of the boiler where the axel pump control valve connects between the two pipes. The valve is opened to bleed some of the water from the high pressure to control the flow rate into the boiler.

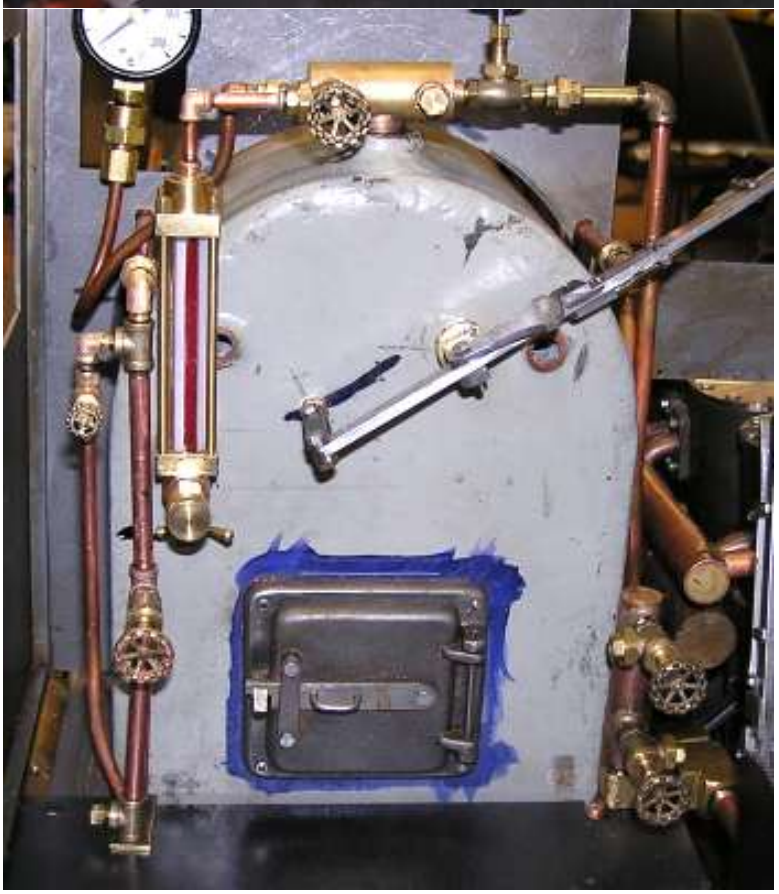


This shows the vertical pipes that run beside the boiler with the axel pump control valve and the test valve. The test valve connects to the highest point in the run to bleed off any air that may be blocking pump operation. The valve can also be opened to verify that the pump is actually delivering water. The discharge pipe goes through the floor. .



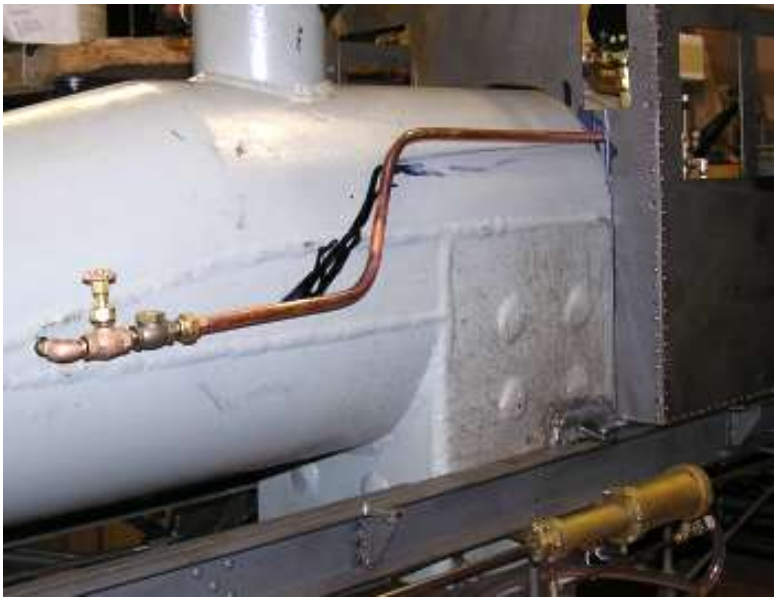


This photo shown a left side view of the pipes and valves. Note the finishing plate at the bottom of the vertical pipes. This plate has three holes to give a finished appearance. The floor has a slot so that it can be withdrawn to the rear without disturbing the pipes



The view from the rear with the cab in position.

The left side feed water pipe.



Drain Valve: The hole hadn't been made for the blowdown valve so before filling the boiler, a bushing and 1/4" tube with valve was installed in one of the drain holes as shown on the right. It would have been nice to use 1/8" pipe but the brake rod was in the way so this was about the only alternative.

Note: The four boiler drain holes would be much more useful if they were located in the front and back rather than the sides.

Hydrostatic Test: With the feed water plumbing in place it was possible to do a hydrostatic test of the boiler and associated plumbing. Normally one would fill the boiler via the blowdown valve. However, an adaptor to connect to the drain valve hadn't been made so both the hand and axel pumps were used. Compressed air was connected to drive the engine. The water level was checked from time-to-time however, apparently not often enough as water made it to the engine. The engine sort of choked up and stopped.

The hand pump was then used to build the pressure. Once all the air was expunged, the pressure builds from zero to 100

pounds with only a few pump strokes. Again, wasn't too attentive and safety valves operated and squirted water about 10 feet across workshop. What a shock! (Later showed the system to the daughter --- also an engineer. Explained everything and then pumped it up. She really jumped when the safety valves let go and squirted the water. Should have positioned her so that she would have been sprayed.)

Next, the pressure was pumped up to just less than 100 psi and the system checked for leaks. There were several leaks, mostly valves and a couple compression nuts. After everything was tightened there was one very small leak in a fitting next to the axel pump control valve. Will probably just soft solder it since most of the assembly would have to be taken apart to get at it. (This joint is not subjected to steam but will use the 550 degree solder anyway.)

The safety valves wept a little but don't think it's a concern. The test cock at the bottom of the water gauge continued to leak but not as much as with air. The cock will probably have to be replaced with a regular 3/16" globe valve.

The steam chamber cover leaked under air pressure but didn't leak with water. This was as predicted by Murray Curtis.

The safety valves were held off and the pressure pumped up to 200 psi. Other than the leaks mentioned earlier, no problems. The valves on all the boiler ports were then closed and it was verified that the boiler verified would hold pressure.

Water Gauge Test: Recall that I was advised that the top of the water gauge shouldn't be connected to the turret because the water lever would vary when steam was drawn from the turret. To test this, the water level was set half way up the gauge and the system charged to about 100 psi with compressed air and the valve in the air input pipe closed off. The 1/4" blower valve was fully opened to the atmosphere (the pipe to the blower had not yet been connected to the valve). This is probably a worse case test. The water lever in the gauge increase some --- maybe a half inch. This is probably tolerable but it's clearly a bad practice. So ..... I'll go back and move the input to a dedicated port on the top of the boiler.

After all the testing some of the water was drained from the tank and compressed air was fed to the boiler so that the engine could be run to clear out any remaining water. Well, the water got cleaned out ---- it ended up all over the ceiling above the smokestack. Another lesson learned ---- the hard way.

On to making the fire.....

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