

Virginia's Pipe Works

By Don Althouse

10-20-2016

Fitting the Water Pipes

I have not been looking forward to fitting the water pipes, not because of the slight complexity of the piping but because my "routing" experience with SolidWorks is very limited. SolidWorks uses an add-in called routing to do piping design work or you could use what they call a sweep and a 3D line sketch. It can be used for industrial scale or a smaller scale like what we are doing using small diameter tubing.

From what I recall, I am going to have to add connections points to all the fittings for the pipe work. SolidWorks uses the connection points as a start-point and then an end-point for the 3D path of a line you create and can modify that simulates the route of the pipe. You can add dimensions and bend radius as you see fit in the x, y or z plane, which adjusts your route accordingly. Before the route is complete, you can specify a tubing diameter, wall thickness, material and then SW creates a tube concentric to the line you created and your tubing route is complete. I have found that U-tube is a fantastic resource for SolidWorks; they have many videos on a wide variety of topics that SolidWorks uses.

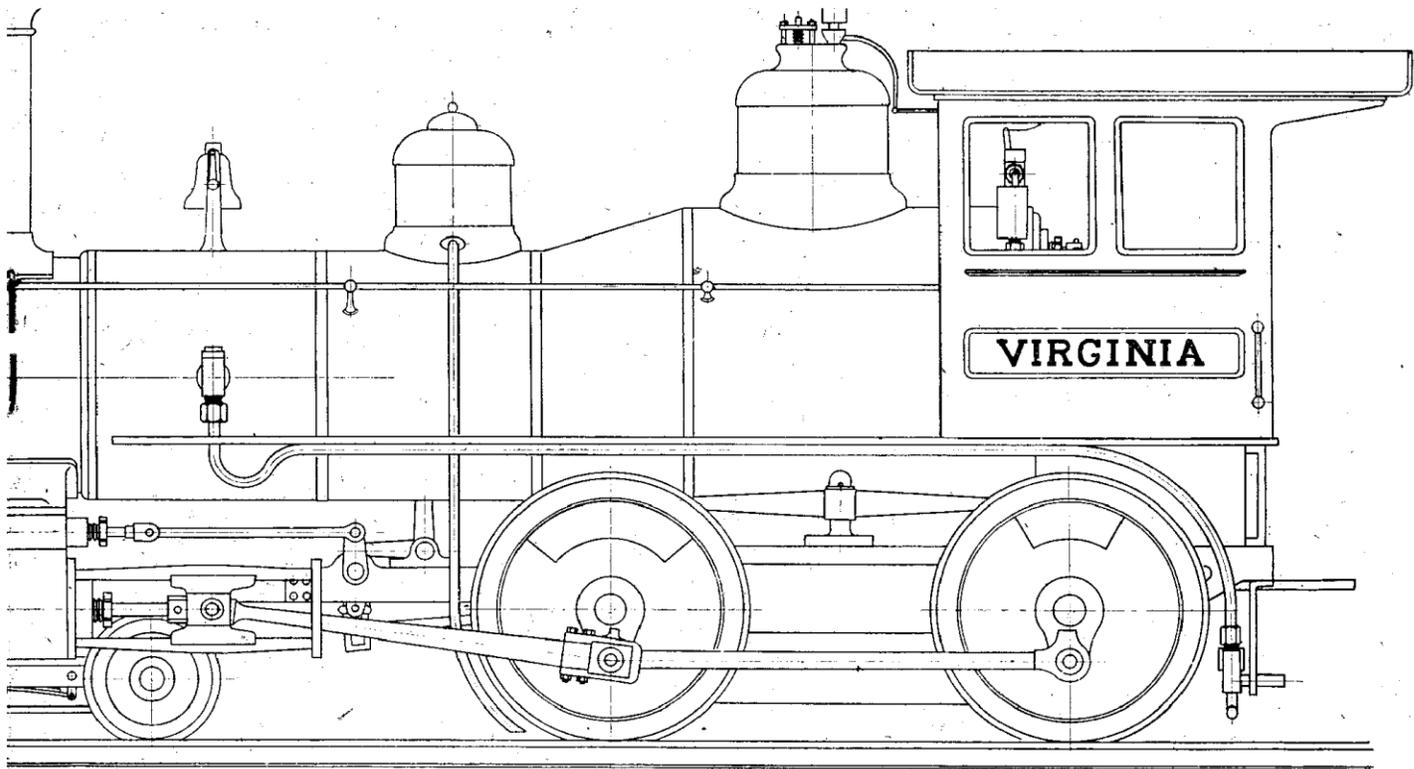
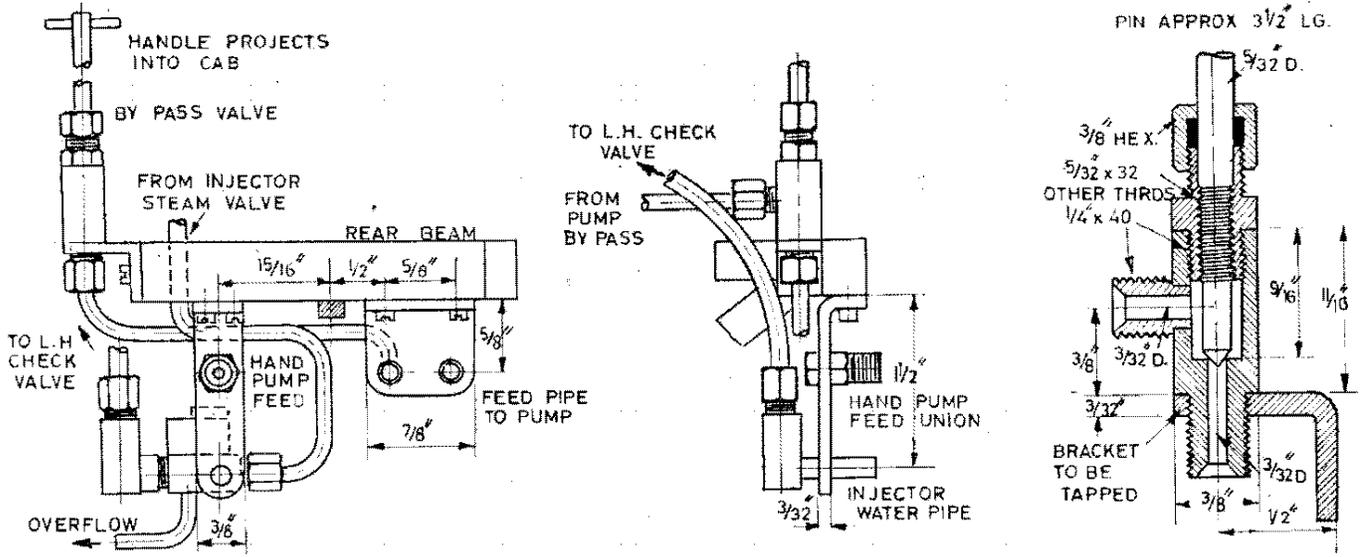


Figure 1: Side view of pipe arrangement for the injector to the left hand check valve on the boiler.

I decided to start with the pipe work between the left hand check valve on the boiler and the injector. Figure 1 shows the basic arrangement of the plumbing needed between the two components. The first thing that struck me was that I was going to need some dimensions considering that the pipe work goes under the running board. LB does give a dimension for this at 1 5/8 inches above the top of the frame. However, he did not as far as I can tell give a dimension for the radius of the bend that is behind the back wheel going to the injector. In addition, from what I see in Figure 1 the pipe runs on the outside of the frame. Figure 2 shows the arrangement of the pipe work from the rear beam.

Arrangement of pipes at rear beam and sectionalised view of the bypass valve



31 JANUARY 1957

171

MODEL ENGINEER

Figure 2: Arrangement of pipe work from the rear.

I started off by making the bracket that the injector water pipe goes through, there was no mention of the screw size used to attach it to the rear beam so I will use 3-48's like the ones called out for the anti-lifting brackets shown in Figure 9 of my previous article. After modeling the bracket I attached it to the rear beam where indicated in Figure 2 and one thing I noticed right off the bat was that the fittings are not in line, there is approximately a 0.866-inch difference between the two centerlines of the fittings as Figure 3 shows. In other words, the L.H. check valve sticks out proud of where the injector valve is located by about 0.866 inches. I then proceeded to do the piping for the turret. I decided to hold off on the pipe for the whistle until I get the cab done.

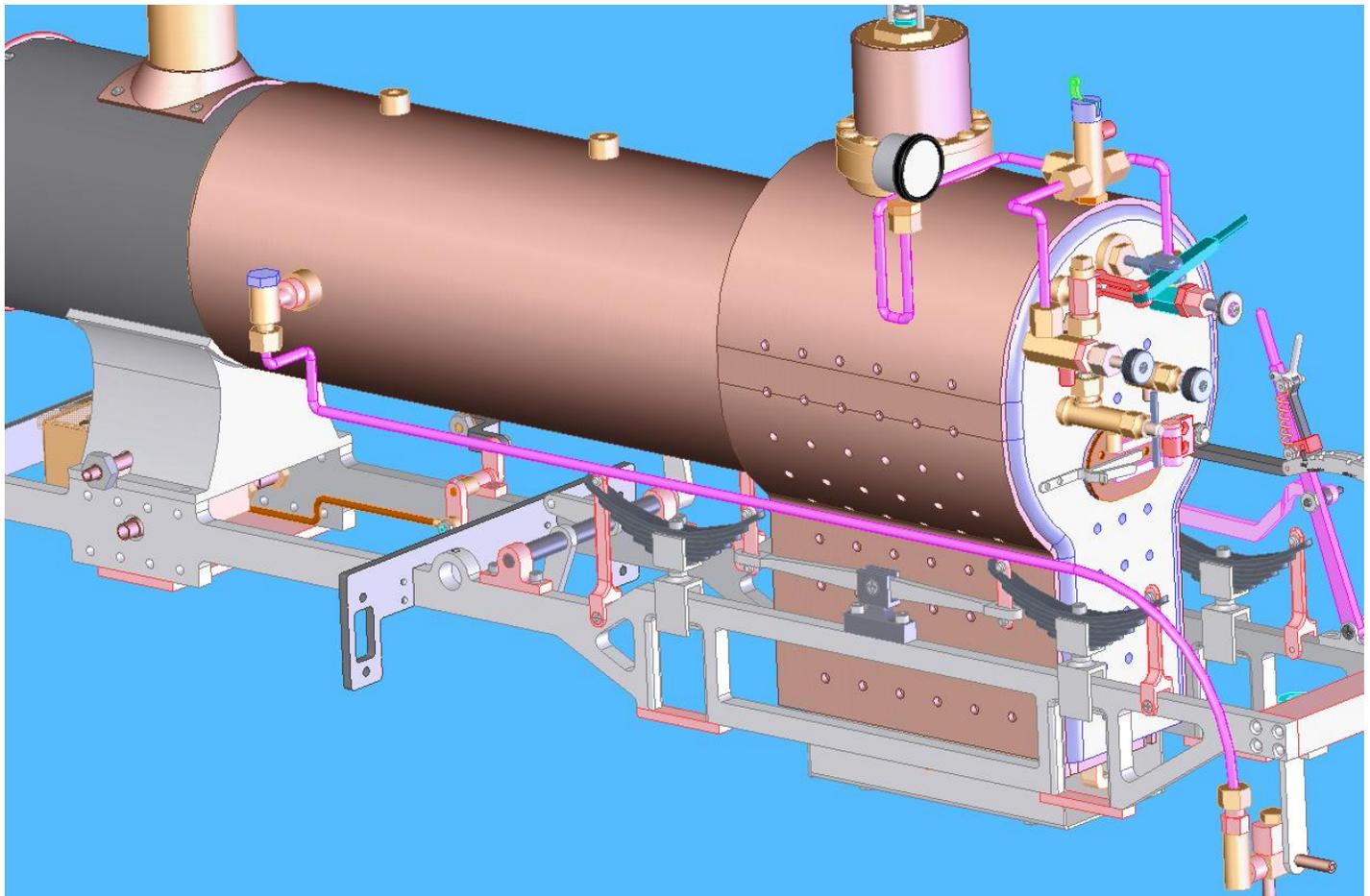


Figure 1: L.H. Check Valve to Injector pipe work shown with pink tubing.

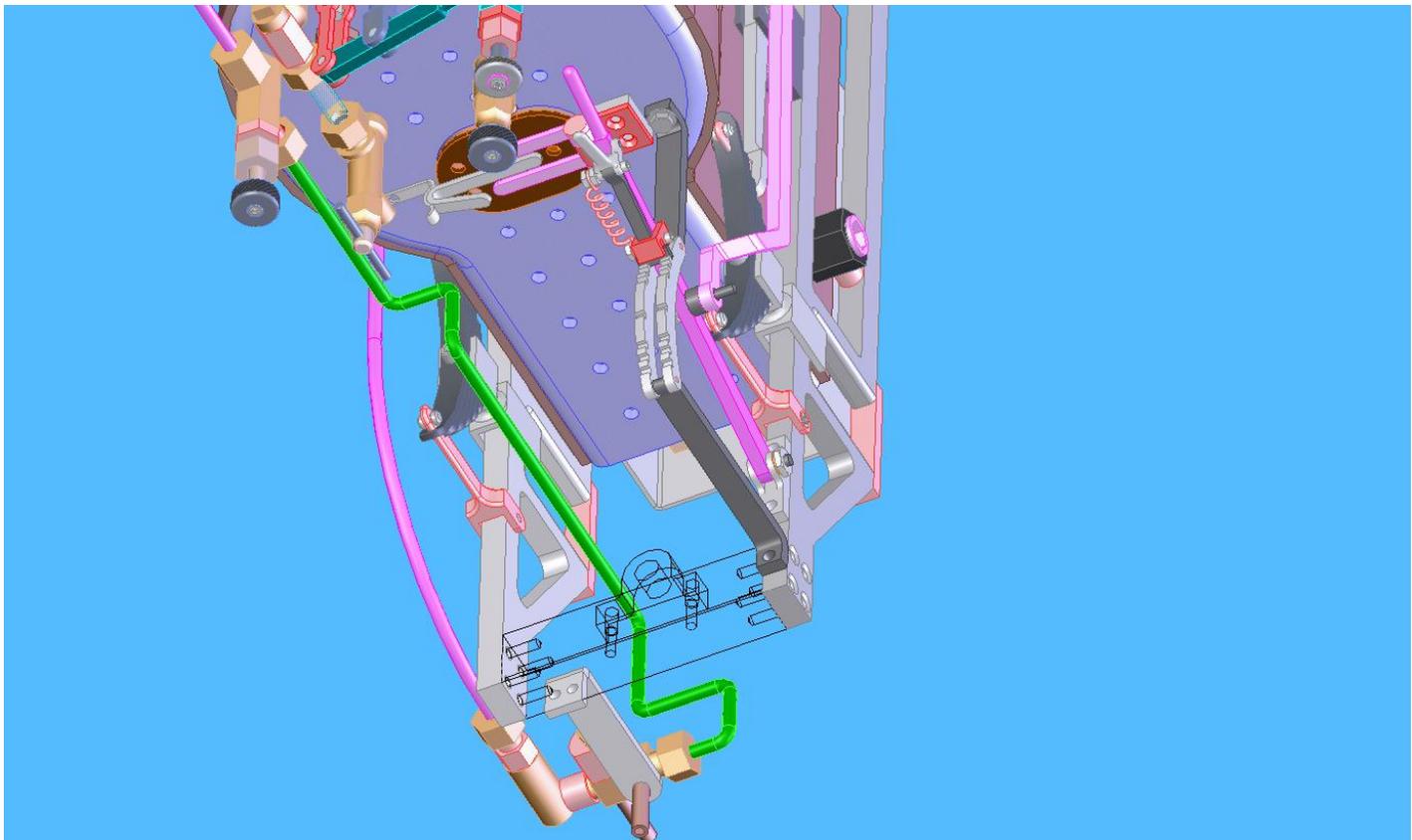
On a side note, the biggest radius SolidWorks would let me put in for the large radius of the pipe to the Injector was 2.5 inches, which should be enough to clear the wheel considering the wheel diameter is 4.125 inches. If I went bigger than 2.5, SW gave me an error because the pipe was coming out of the fitting at the injector. The height of the pipe at the centerline I put at the suggested 1.625 inches, I can easily change this dimension if need be later when I install the running boards and will update if I do.

Routing with SolidWorks is very cool; all I had to do was to make connections points in the fitting for the caps of the injector and the check valve, then pick one of the connection points and select start route. After that was done I selected the size of the pipe and wall thickness, then the other cap and selected add to route, this gave me two pipe stubs coming out of the caps. After that was done I selected Auto route, picked the two end points of the separate stubs and it automatically gave me a default route in a certain x-y-z coordinate system, which I could then easily drag the lines in, and change radius's in, pretty darn slick. There is a host of other parameters which you change as well, like the size of the pipe, the wall thickness, stub length, Etc., presuming of course that you have your design tables set up correctly for the different pipe or tubing configurations. Too much to go over here, but it is very customizable and when you get everything set up works very well, so far that is.

My next task was from the injector steam valve to the injector, I got kind of a funky bend, but I guess it will work for now. My main concerns were that the pipe did not interfere with the rear axle and that there was ample room for the water gauge handle to turn. In addition to this, I also made sure that the firebox door would be able to open and close unimpeded. Figure 4 shows the route highlighted in green.

Figure 5 shows the pipe work for the right hand check valve to the pump.

After getting the pipe work done for the R.H. check valve to the pump I realized I had not put the "swan neck" in the pipe for the L.H. check valve to the injector, figure 6 shows the corrected pipe.



**Figure4: Pipe route from injector steam valve to injector.**

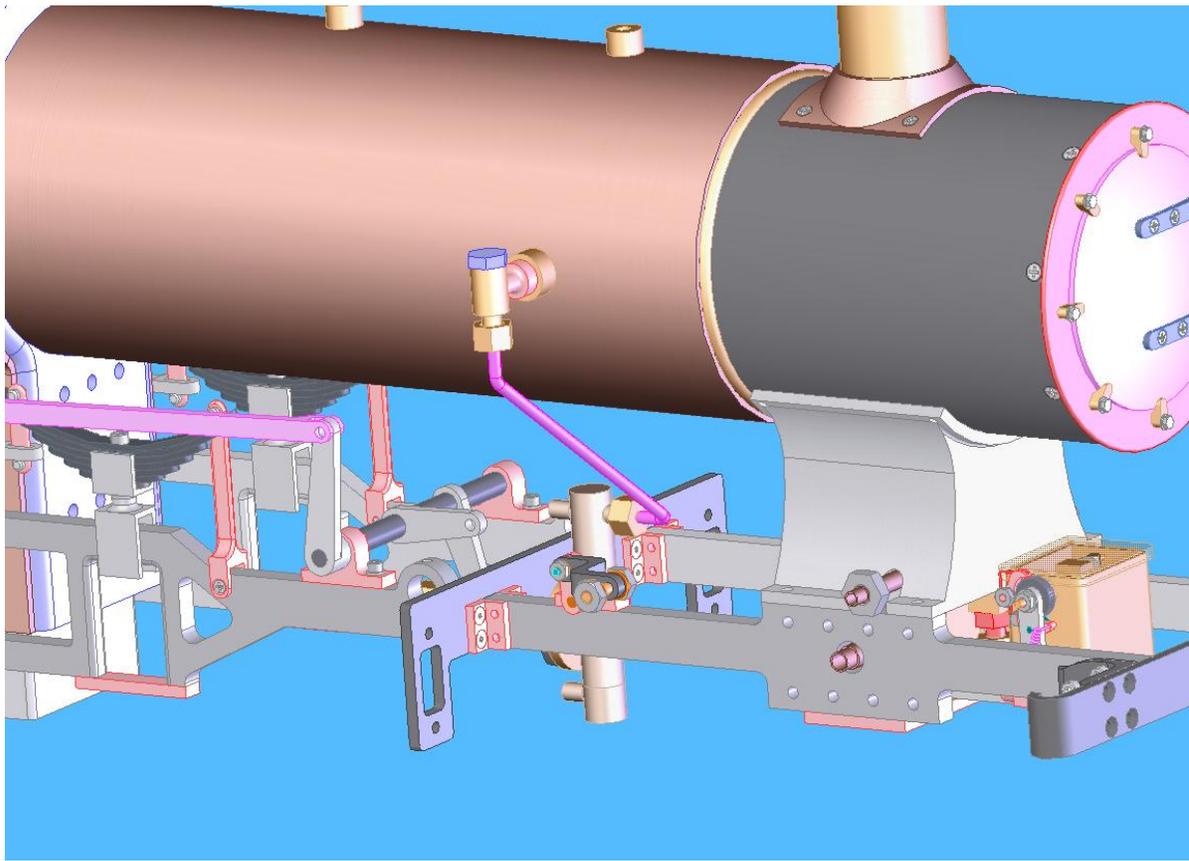
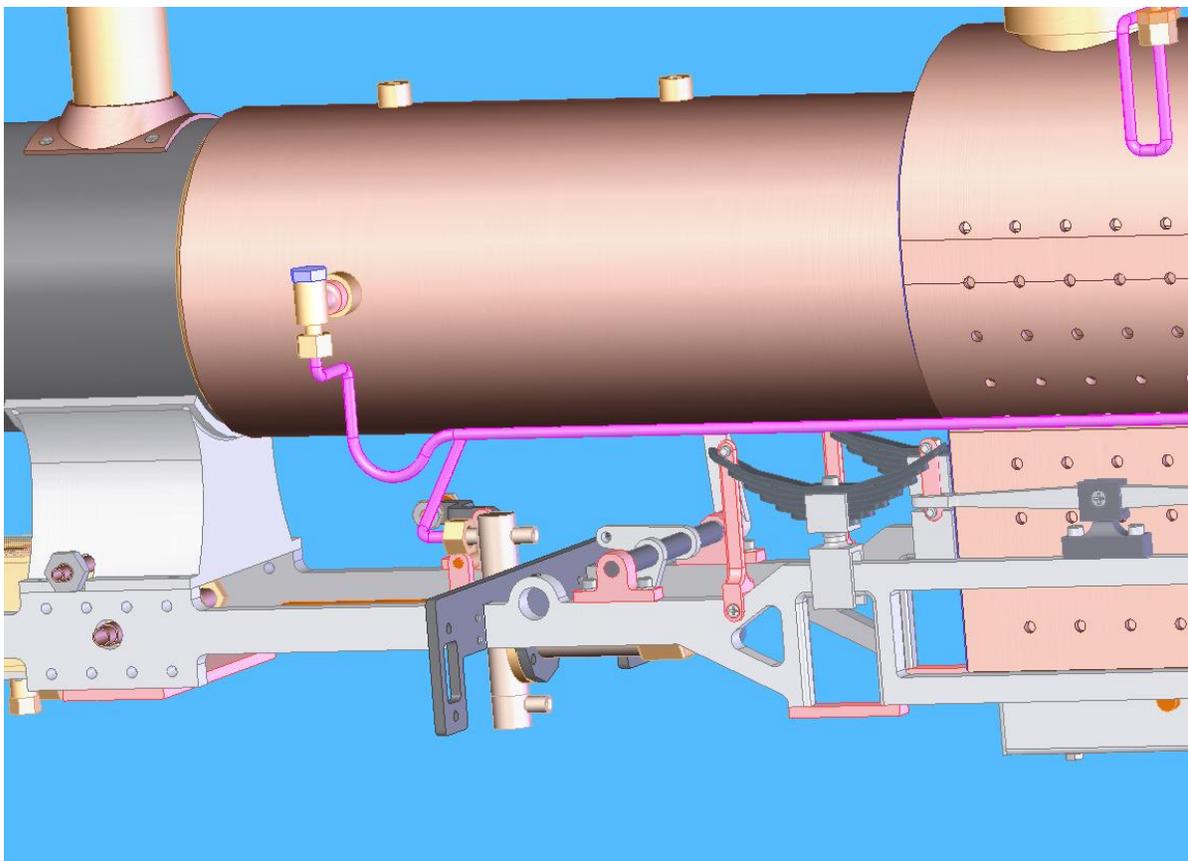
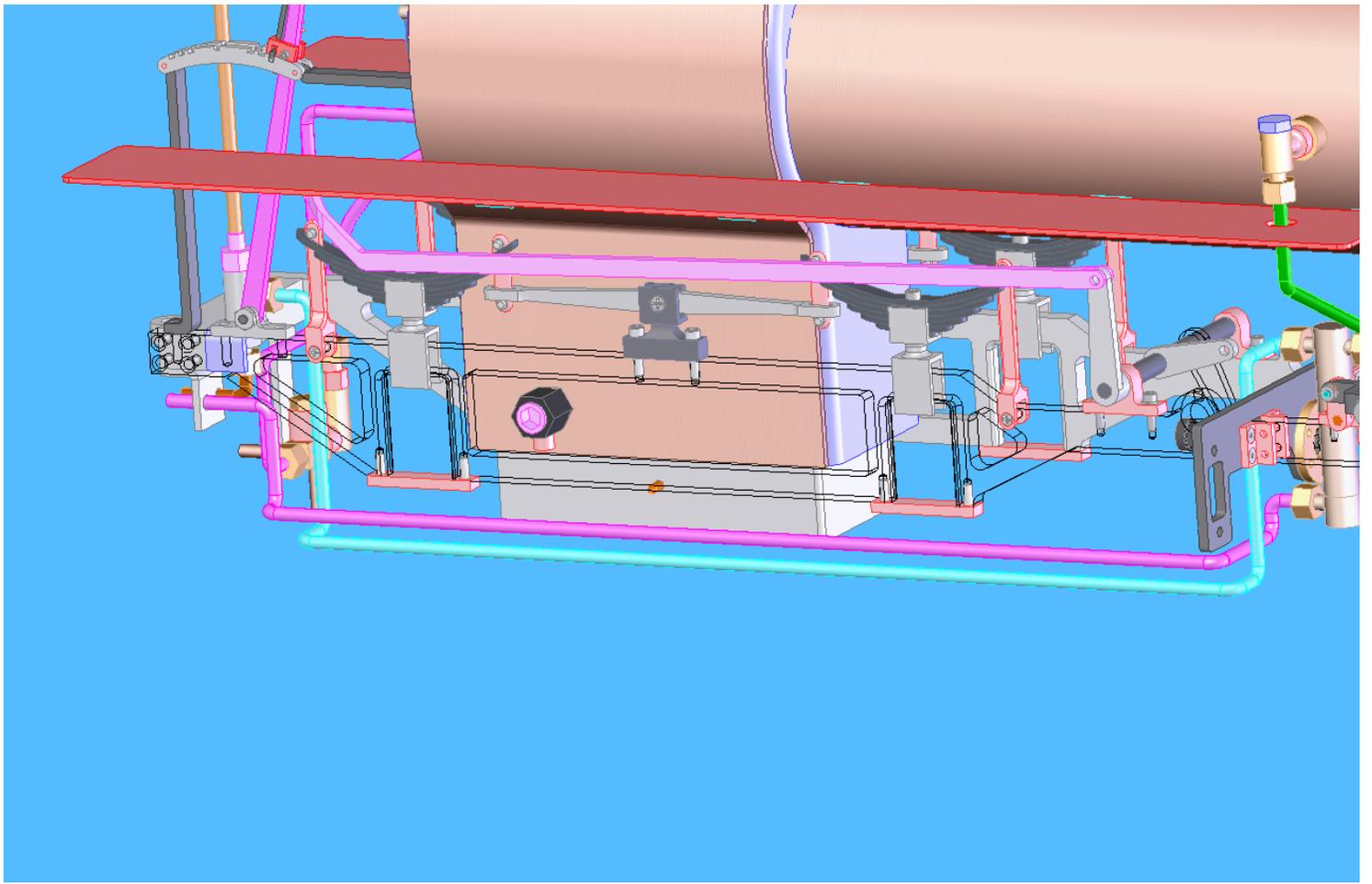


Figure 5: Piping route for the R.H. Check Valve to Pump.



**Figure 6: Pipe work for L.H. Check Valve to Injector, swan neck shown.**

My next order of business was to get the piping done for the pump. I made the bypass valve and the bracket for the pump feed, labeled PF, and the bypass labeled BP. I ran the lines as LB suggested under the bottom right hand part of the frame, the pump feed line is shown in pink and the bypass line is shown in light blue as Figure 7 shows.



**Figure 7: Pump lines, pump feed in pink, bypass in light blue.**

I may have to change a few routes once I get started on the cab, well and apron, but I would much rather change them in SolidWorks now rather than have to try and re-bend or scrap a pipe or two later.

I had to suppress and or delete quite a few things in my sub assemblies to get the routing to work; the main reason for this was due to memory issues. Old system 32 bit Pentium 4, old program 2007 -32 bit, graphics card-low end gamer card, but I do have 3.25GB memory, to say the least it has been a challenge to get things to work, but I think I am squeaking by so far.

Next will be the cab, well, apron and the whistle.