Boiler Making Hints

By Mike Pavie

I have been asked to write a short technical article for the "news", as I am currently rebuilding and reboilering a pre war Bassett-Lowke Midland 4-4-0 it would seem sensible to write a few notes on boiler making. Even in our relatively small size a steam boiler at 90 psi contains considerable energy and must be treated with the utmost respect both in operation and manufacture.

Do not attempt to brass braze any part of a small boiler, I always use Easy Flow no. 2 silver solder for the entire boiler including stays. Due to the remelt temperature being slightly higher than the initial melting point, things are not as lightly to come apart at subsequent reheatings as you might imagine. Also well fitted joints attract and retain the molten material by capillary attraction.

I firmly believe that the accuracy of the individual components, and the general accuracy of assembly, has a major bearing on the ease of the silver soldering operations and the quality of the finished job. It is possible to fill excessive gaps with silver solder but it will probably run out again at a subsequent reheat. Aim to get all the joints fitted with a maximum 0.005inch gap. Always turn a locating spigot on the end of the flue tubes to give them a positive depth location in the firebox tubeplate. If you don't bother you can bet your life one will slip down when it's all red hot !

Flanged plates;

It is unnecessary to use steel for the former blocks, 1/4 inch thick Tuffnol is very easy to cut and shape and will last for several similar boilers. Use the flanging plate to mark out the copper sheet. A piece of ½ inch brass bar drilled to push over a pencil will mark a line ¼ inch larger than the former.

Expect to anneal each plate 4 or more times, It is better and less messy to allow the copper to cool naturally after each heating, Also the oxide film tends to protect the surface of the copper from marks.

Wrapper plates;

To shape the inner and outer firebox wrapper plates it is best to make a wooden former block, draw around the flanged plate several times on a piece of MDF and glue the slices together. Narrow fireboxes with their reverse bends can be very hard to shape properly without a former. Clamp the flanged plates to the wrapper plates and drill a few 1/16 inch holes for rivets, Trim everything exactly to size as you go , it is much harder to try and trim bits off later. Fit the rivets with the heads inside and don't bash the tails right down. This leaves a space around each rivet for a dash of silver solder.

Making the joints;

Try to make all the joints from one side only, That is to say feed the silver solder to the outside of the job and fill the joint until a fillet appears, because the joints are closely fitted the molten silver solder will not run out the other side but form a fillet on the inside as well. I

only attempt one joint per heat up, this ensures a free flowing sound joint. Allow the job to cool, wash in cold water to dissolve the flux, then pickle in 5% sulphuric acid, then rinse well.

Inspect each joint and be sure it is perfect before moving on. If small areas have not filleted on the inside then reflux and reheat from the inside, this will draw the molten material through the joint. Avoid the temptation to just add more silver solder to the inside, the design strength of flanged boiler joints relies on full penetration, this is important.

Stays;

I avoid threaded stays, I have found the best method of staying is to use 1/8th inch snap head rivets about 1inch long fitted with the heads inside the firebox. Leaving the full length protruding on the outside helps to pick up the heat better and ensure sound joints. Silver soldering the stay heads inside a narrow firebox can be awkward, to make things easier I do not fit the firebox back plate until the staying is complete, the fire hole ring and rear stays being previously dealt with before fitting the back plate.

Longitudinal stays are plain rods, If a blower tube is required then silver solder in a length of copper tube, the blower steam supply pipe can be pushed through the centre. This avoids any potential leaks from "running threads "

Inspection;

When the boiler is complete give it a thorough pickle and wash , then visually inspect every joint, If any part looks anything other than a shiny smooth fillet then it is not right, reflux and reheat as required. Finally trim off all the extra stay material and file back to just proud of the silver solder fillet, it should now look less like a porcupine and more like a boiler!

Hydraulic test;

To avoid making blanking plugs I generally make and fit the boiler fittings before hydraulically testing a boiler. The added bonus is you are testing your fittings at the same time, The disadvantage occurs if you do find a leak, as you will have to take them all off again! Do not be tempted to affect any repairs using soft solder. Repeat: Never use any soft solder.

There is no reason for a properly made boiler to have even the slightest seepage; I do not allow any leakage whatsoever. Do not be too alarmed if the areas between the stays move a tiny amount as the pressure is first applied, Remember the copper is very soft.

Slowly pump the boiler up to twice working pressure using the tender hand pump and a reliable gauge. Leave it at pressure for about 20 minutes to be sure then give yourself a pat on the back!

Mike Pavie

PS I have just tested the boiler mentioned in the text and it held 160 PSI for 20 minutes with not so much as a bead of water from anywhere and no distortion. That's good enough for me!