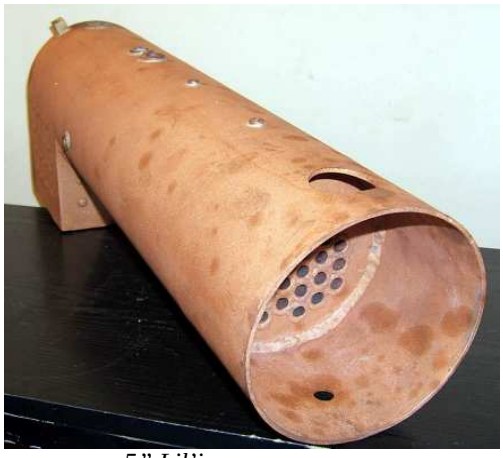
Welded boilers.

We in Maxitrak like to think that we keep up with technical advances in production for our models. Since we started thirty years ago we have seen the introduction of a number of new technologies such as CNC machining, CAD drawing, laser and water jet cutting. One item that has changed very little over this period is the manufacture of boilers. On pre war model locomotives the boilers were usually made from copper with the plates riveted together using copper rivets. To keep the joints steam tight they were then caulked with soft solder. As the rivets gave the strength and the solder only caulked the joints this was a very strong form of construction. The next development was to use silver solder on joint construction, this is a much harder solder capable of holding the plates together to the required strength and caulking the joint in one go. The temperatures required in construction are much higher but have the added advantage that even if the boiler is run dry it will not usually get hot enough to sustain any damage. This has been the standard form of construction for model boilers over the last fifty years.

5" Simplex



5" Lil'jo

We have recently started to use copper TIG welding in boiler construction, Tungsten Inert Gas (TIG) BS EN 288/287. This has several advantages both in construction and in use. We have been working with Marco Willis, a coded welder used to manufacturing pressure vessels in all sorts of materials. Marcos welding skills have been used in aerospace, naval, hospital, atomic and north sea oil industries working at pressures up to 8,050 bar (115,000 PSI). By comparison a boiler for a steam model working at 7 bar or 100 PSI is small fry indeed. As a fresh welders look at model boilers Marco started by saying why not use stainless steel? I related problems with cracking in this sort of boiler unless very careful water quality was maintained. "What about the new grades of stainless that avoid this problem" Marco asked. I had no reply to this one, except that it might be a step too far for our conservative boiler testers and insurance companies. It looks as though the usual pressures on manufacturers for modern efficiencies are not present in model engineering and anything that is not done the same way as it was a generation ago is not acceptable. "If you want to stick to copper why don't you weld it then" was the next question." Don't know, why not" was the reply.

TIG welding copper is not a new technique but I had only rarely heard of it in model boiler construction. Once the gauntlet had been thrown down there was nothing to do but try one. We started with one of the more simple boilers, the Chaloner vertical type. Due to long lead times from boiler manufactures we had made our own batch of gas fired Chaloner boilers, silver soldered, and were not really keen to do the same for the next batch of coal fired engines, the result was Marco producing a most satisfactory welded
boiler.

5" Chaloner

There is one pitfall with copper welding, all of the copper used in the construction must be C 106 grade. Other grades have arsenic in them which give rise to cracking on reheat even when the relatively low temperatures of ordinary service are encountered. For this reason we do not use any odd pieces of copper in boiler construction if we have no record of it's grade, nor do we use copper rivets as all stays are cut from bar of a known grade. This is much the same as steel boiler construction where a known grade of boiler plate must be used.

3" Aveling & Porter

The technique for boiler preparation is also more akin to welded steel boilers where the weld needs to penetrate the joint to it's full depth for maximum strength. This is usually done by leaving a gap of a couple of millimetres in the parts to be welded. This gap is filled with weld on the first run and then built up with a second or third run of weld to give extra strength. Plates that would be usually flanged in silver solder construction are left flat and slightly under sized, weld would not penetrate the depth of a normal flanged plate. The runs of weld round the joint replace the flange giving a superior strength to the job. Girder stays and strengthening plates have to have holes in them so they can be welded on to the plate beneath in a sort of filled spot weld, as well as being welded round the edges. Stays are all made from solid copper bar with the rivet head effect being obtained in weld. Marco did offer to grind off the stay heads to give a completely smooth side to the boiler, you can imagine the reaction of boiler inspectors when no stays appear to be present on the sides of the firebox! This technique is used on foundation rings though, making the water jacket look as though it is entirely solid copper. In a similar vein Marco leaves the weld on boiler tube ends, this is all very fine work done with a special flexible head set and left for the boiler inspector to see the skill involved. The only items not welded are the boiler bushes, as these are bronze and not copper they have to go in as a last job using silver solder.

5" Simplex

There is a strict regime laid down by the welding inspectorate with regard to materials, preparation, welding techniques, gas purging etc. All this is applied to the model boilers as it would be to other much larger and more demanding pressure vessels. We now have a number of these welded boilers in service of all the larger designs, we anticipate that their life will be longer than the normal silver soldered boilers. If you try to repair an old silver soldered boiler you are asking for trouble from joints and stays near the repair as the heat opens up previously good solder areas. If necessary a welded copper boiler can be given a "spot weld" repair at any time in it's life, though we have not had occasion to do this to date. We have started to extend this technique to boilers for designs other than the usual Maxitrak range and are happy to quote on any type of model boiler for locomotives or other uses.

Andy Probyn