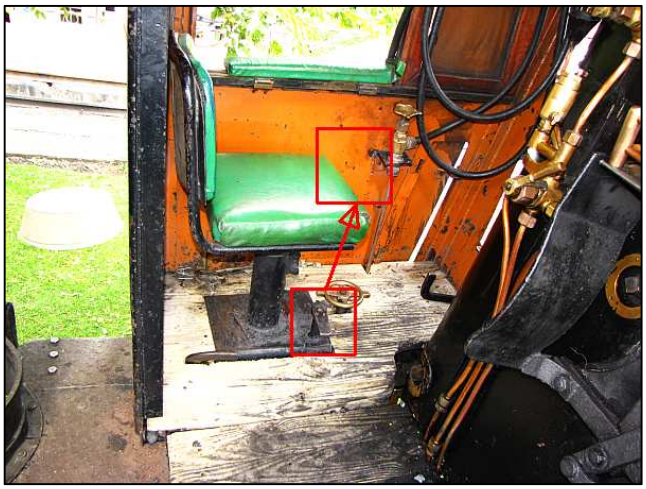
1). 12AR 1535 - INJECTOR KICK VALVE EXTENSIONS:

P01 - While the Class 12AR is off the high irons for repairs to the leading axle of the front bogie, the opportunity afforded by the enforced downtime was taken to upgrade the persistently troublesome water valves for the injectors.

P02 - The poor old 12-Bucket is still suspended in the air as she waits for her bogie axle bearings to be bored and machined for refitting. Painted in red are the early plate frames that are characteristic of earlier steam locomotives.

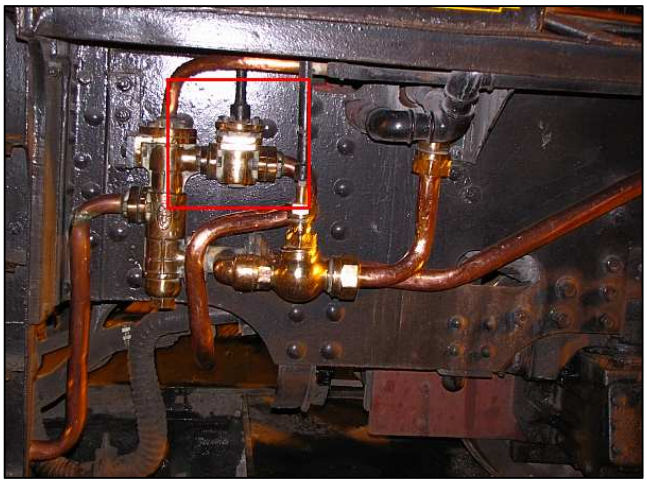


P03 - The 12AR's injector kick levers (for the injector water supplies) are being relocated to the cab walls for easier hand operation. If the 12AR's modifications prove to be successful, the 15F 3046 and 15CA 2056 will undergo the same treatment in their turn.

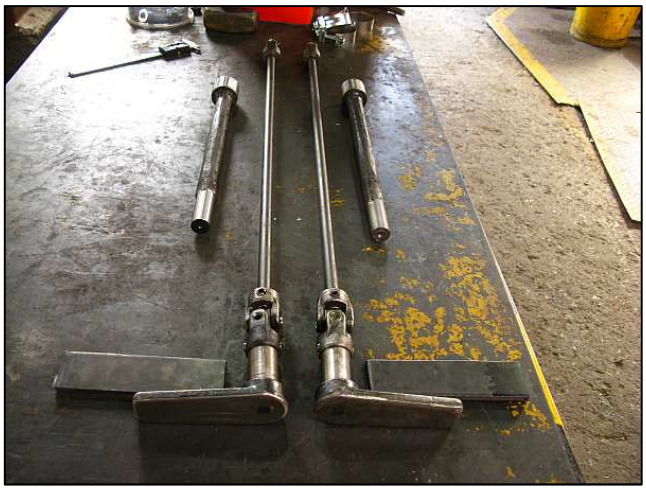
P04 - The vintage bronze water valves are being replaced with PFTE-seated stainless steel ball valves. The leaky originals waste the tender's water, but also dangerously distract the fireman as he has to look down and kick the loose-linked lever back-n-forth to find the elusive 'off' spot.

P05 - The bore in the new ball valve is 6mm wider in diameter than the original valve bore.

P06 - New shank blocks were machined to help eliminate excess play from the system. Unlike with the originals, the valve kick lever will only be allowed to operate through a 90 degree arc, so the system must not have any free play.



P07 - Pictured on the 12AR locomotive is the injector water valve to be replaced. You can see how the socketed black shaft fits over a square shank. If you pull the kick lever upwards away from the floor inside the cab, the socket slides off and uncouples.



P08 - To move the kick lever from the floor to the wall required an extra shaft to be made with a universal joint at each end. The short shafts shown are similar to the originals which pass loosely through the cab floor to couple onto the valve stem via a noggin and socket arrangement.

P09 - Detail of the kick levers mounted onto new stubby shafts, each running within a machined sleeve. The sleeves will be welded to the two bars which will protrude from the cab wall and will also support the quadrant stops. The tubular sleeves will also have grease nipples fitted.

P10 - A close up of a universal joint being overhauled. These joints are being repurposed from old turret valve spindles, which usually only have one universal joint each. The yokes and die blocks are being drilled-out and pinned together with spring steel pins to eliminate all free play.

P11 - These new flanges were custom-made by Jeandre's dad. They are very close-coupled to the valve body flange, to keep the length of the new valve assembly to be kept to a minimum. The whole new assembly was able to fit in a length only 25mm longer than the original cast-body valve.

P12 - The gaskets made in advance for the new flanges. This is Klingerite. As the new valves use stem seals, they do not need a bolted-upper cover as the originals do. Those old top gaskets are frequent sources of failure if not fitted 100% correctly or the injector allowed to blow steam.

2). 12AR 1535 - FITTING NEW INJECTOR WATER VALVES:

P13 - Here is a view of the assembled ball valve about to be installed for a trial fit. It was already known that the valve would be about 25mm longer than the existing and the pipework would need to be modified slightly. But our young steam-nutz were just about to get a nasty surprise!

P14 - Oops! The flange measurements were taken from the flange of the copper riser pipe and one would naturally assume that the holes are the same. (They DO match on the fireman's side) The bore of the injector's water inlet is significantly smaller even though the flange bolts match up.

P15 - We could just assembled the set, but the RHS inlet would have been prone to gasket failure due to insufficient mating surface for the gaskets – even under the passive pressure from the head of water in the tender. James machined a groove to fit a repurposed collar washer.

P16 - The flange on the right had a rebate carefully cut into the bore to accept the collar washer. The left flange (for the copper pipe of the water riser) did not need any modification. The flanges are quite chunky but will be less prone to distortion as the originals can be.

P17 - The same flange after welding. The mismatch on the RHS means that we mainly lose the advantage of the wider-bore water valve, but we will still utilize the positive action and better sealing. But even if we didn't match up the gasket face, the mismatch still would have been there.

P18 - Dawie initially did some VERY judicious grinding of the new welds with a small angle grinder. Then James cut down the new gasket surface on the TBS lathe.

P19 - As the flanges are very close to the valve body, the clamping bolts all needed to be cut down and their threads manicured. This photo shows the new square-shanked noggin and the existing valve stop plate. The old SAR valves could rotate through 360 degrees but would only seal properly in one orientation. To add to the confusion, the original kick lever shafts can be pulled upwards to disengage them and refitted in any one of four orientations.

P20 - The bolts were being incrementally ground-down with a mini grinder rather than being sawed off. If you look closely at the photo, the pairs of bolts to the left and right had already been chamfered and cleaned. The remaining two bolts had to be cut down quite precisely as their axis conflicted with that on the main flange bolts. (Unavoidable because of the valve/flange orientation.) Enough thread had to be left to allow the nuts to tighten up properly.

P21 - This was a fiddly job with SIXTEEN bolts all needing to be precisely cut down and their threads cleaned up.

P22 - James gives our Junior bolt-buster some company and a helping spanner!

P23 - Test fitting the valve. They knew the adapted flange would match, but the bolt being pressed inwards was still unknown. It turned out too long and had to be trimmed even move. Which pair of hands belong to which grunt?

P24 - Now THIS stage of the job was the most awkward and swearword-inducing. Not only did the pipe flange need to fit, but also the intake elbow at the bottom, with the pipe making a longer swan neck around the drench valve.

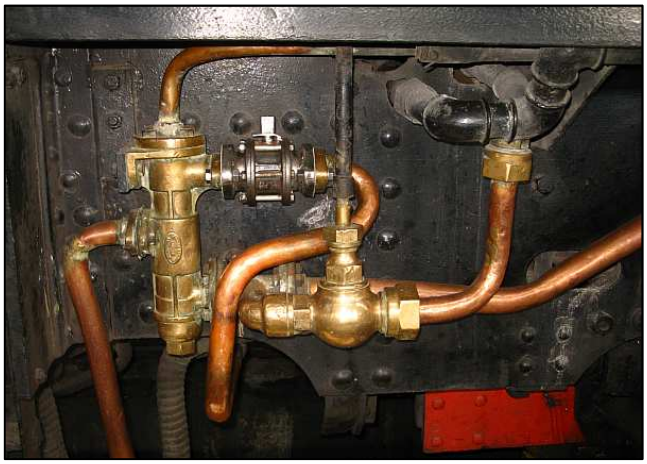
P25 - Here is the other end that needed to match up with two bolt holes to be engaged. This is where the flexible water hose from the tender is attached to the locomotive. The ribbed rubber pipe is the train brake vacuum pipe.

P26 - The need to keep the flanges and bolt holes parallel and to extend the swan neck meant many trips to the 'annealing shop' in the Millsite Store. The lovely Jeandrette demonstrates the fashionable copper pipe boa.

P27 - Another view of the riser pipe being set up for annealing. Big bore copper pipe bending and fitting an inevitable task in steam locomotive restoration, even when transferring parts and pipes between supposedly identical locomotives or from stock.

P28 - Dawie heats up the copper to dull cherry red before they dunk the hot pipe in a wheel barrow full of cold water parked right outside the door. This process is 'annealing' and it softens the copper pipe prior to bending – rendering it more malleable ('bendable') and less likely to fracture.

P29 - 'Swak Hart' Viljoen applies a bit of leverage to apply more grunt with an optimistic Jeandre trying to hold onto the other end without extension of leverage. This 3D bending process usually has to be repeated several times to get a good fit.



P30 - The tweaked pipework fitted to the new valve. The steel valve doesn't look pretty amongst the antique copper and bronze – but utility and reliability overrides aesthetic considerations. Best of it is that we can easily revert to the old valves if this doesn't work out as planned.