1). INTRODUCTION :

Today's depot work day (27 March) was one of those with a more relaxed flow and comprised of a number of repetitive small jobs instead of one or two photogenic repair operations. The two operating locomotives, the Class 12AR No.1535 'Susan' and the Class 25NC No.3472 'Elize' are in good shape at the moment.

On the latest restoration project, all the major fitting and fabrication work has been completed on the as-yet un-named Class 15F No.3046. Sandstone Heritage Trust's GMAM Garratt needs some repairs to several cracked boiler tube beads but has otherwise passed her hydraulic boiler tests as mandated for a further three year boiler certificate. The hydraulic part of the boiler certificate will be signed once the repaired tube end beads are visually checked. Fortunately, GMAM No.4079 'Lyndie Lou' does not have to go through another hydraulic test just for those beads.

So, it was just small jobs today.

Peter 'Lappies' Labuscagne took Colin Hall under his wing. They did some work on the compressor plant and then continued doing small finishing up jobs on the No.3046 – which is practically at its final axle mass with all parts, fittings and the fluffy dice fitted. One surprise job required on the 15F No.3046, though, will be the re-drilling of the circumferential bolt holes for the smoke box front cover. There is a misalignment and although the cover bolts on firmly enough – it doesn't stand vertical. Not only does it look a bit ugly, but it can cause an accident if the skew smoke box door swings unexpectedly under its own hefty weight during repairs or maintenance.

The rest of the motley crew was preparing the GMAM Garratt No.4079 for visual inspection of the internals of the boiler and firebox. They worked in two teams. The work primarily involves removing covers, test blanks and literally dozens of washout plugs. That's where the repetition came in. A lot of this work involved the use of that high technology tool called a 'gwala' – basically a crowbar type affair – hence the title of this report.

There was no work performed on the recently stripped Class 12R No.1947 Rosie, apart from sourcing a spare petticoat during the week. 'Rusty Rosie' will not be worked on until the required thickness tests are done on the firebox, as requested by our trusted boiler inspector – Dawie Olivier. Mr. Olivier is strict, but fair and co-operative. You just don't take chances with old boilers.

The 2nd Sandstone Day Sitter has just had its interior re-sprayed and now awaits the reassembly of the trim and the toilet fixtures.

As said, these photos are a little disjointed as there weren't any jobs done with a prolonged sequence of individual steps. However, I trust that you will enjoy the read regardless.

Keep it near the red line!

Lee D. Gates.



'A study in front ends'
Class 25NC No.3472 (Left) and Class 12AR No.1535 (Right)
Home-bound servicing at the Bethlehem Diesel Depot – Sunday, 22 Nov 2009

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2). PROJECT - GMAM NO.4079 – BACKHEAD WASHOUT PLUG REMOVAL :



BH00 – It shouldn't be too long before the Big Green Hefelump is back in steamy action again. As expected, she gave us very little trouble during the boiler certification phase. There was just a little trouble with a leak at one of the clack valve seats.

The delay in getting Sandstone Estates' GMAM re-certified has been a matter of economics – we waited until the 15F No.3046 was also ready for testing. Thus, we got two sets of Hydraulic Tests done for only one call-out fee for the Boiler Inspector. (And we had 'Rusty Rosie' checked too.) We iz smart cookies!

Now the hydraulic belly-buster has been done, the various washout plugs, the dome cover and various blanking plates need to be removed to facilitate the visual inspection.

This photo of the GMAM Garratt was taken on a rather clammily misty morning on the 31 January 2009.



BH01 – Andrew King tackles a simple job for a change ☺, and in the comfort of the spacious cab too, while his teams are working in confined spaces underneath the locomotive or scrambling around the amply girthed boiler. Andrew is undoing the temporary blanking plates that are installed onto the four flanges of the water column glasses to eliminate possibilities of incidental external leaks for the hydraulic pressure testing.

Notice that the lower cover plate (just to the right of the spanner) is just a rough-cut square rubber sheet gasket.

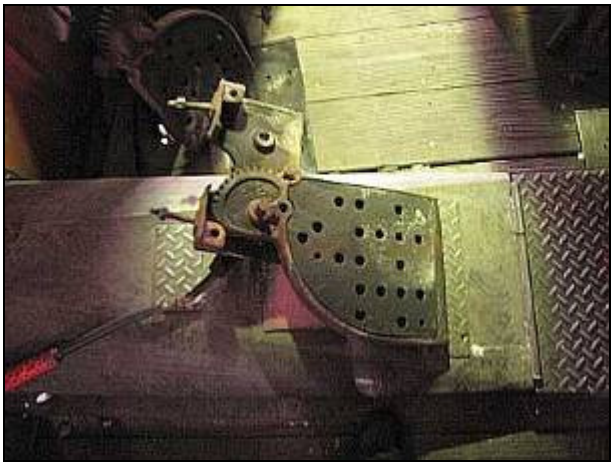
Here's a detail … that square headed 'bolt' in the recessed pocket, the one that has a white line on it, is the rightmost washout plug for the backhead's water space. The white chalk line is a marker that means that it leaked sometime during a preliminary boiler test and was marked to be tightened up at least once.



BH02 – It is quite easy to get a full back-head view on the GMAM Garratt, as one can sit in the fold-down shovel plate and aim the camera into the fully enclosed cab with the rear wall and roof braces out of view behind the photographer.

The backhead fittings are essentially the same as those of a Class 25NC, albeit the gauges are in slightly different locations. Two extra features that make 'Lyndie Lou's' cab the most complicated in our fleet are the two extra changeover valves visible – one to the right of Andrew's hips (Steam operated cylinder cocks) and the one down in the right corner. (Steam operated drain cocks for the steam transfer lines.)

This is also the warmest cab in the fleet as it is fully enclosed with doors and an enclosed rear end. The warmth of the GMAM cab is cursed in summer and much coveted in winter!



BH03 – Half a firebox 'butterfly' door that has just been removed from the firebox. The quadrant gear that usually connects the two leaves together is obvious. The doors aren't necessary to remove for inspection or testing work – but they make access for both men and tools a lot easier in the firebox. It also means those of, er, wider gauge around the middle, have a better chance of getting in.

Although the boiler has passed the Hydraulic Test – standing for 30 minutes pumped creakingly full of water at 150% operating pressure without leaks, the test will not be signed off until some cracked tube beads are repaired. So we will be seeing some repair work done in the firebox anyway, not to mention the rebuilding of the fire arch.

To orientate those not familiar with a GMAM cab – the front of the cab is to the right. That door and the quadrant carrier is resting on the cover of the descending stoker worm tunnel.

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BH04 – I'm sitting quite comfortably on the driver's seat while Robbie and Aidan scramble for handholds and footholds while tackling the seemingly hundreds of washout plugs out there. That's Robbie Davies-Hannibal looking in on me, cheerful enough, but puzzled, as I call his name out from the cab.

Maybe he was hoping I was calling him for tea or something…

Visible driver's controls include the train brake lever (Bottom), the brake vacuum ejector's isolating cock (Ribbed lever in the middle) and the square handle of the drifter valve's pull rod.

The big black crank that muscles its way in the center left of the picture is the main crank for the regulator's rodding. Unlike most of the other locomotives, the GMAM's regulator linkage is on the right side and there is no massive cross-shaft right across the boiler back head to operate the rodding on the left.

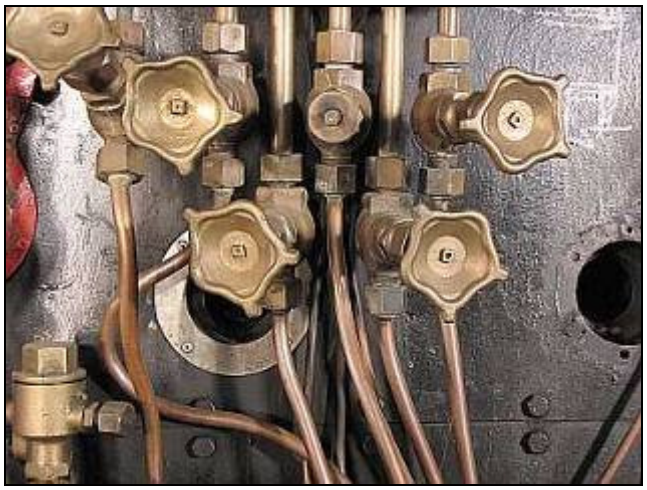


BH05 – Lucas Dreyer is one of our newer members and although still somewhat inexperienced, he is always enthusiastic and willing to learn. Unfortunately, he often has to do salary earning work on Saturdays.

Here, Lucas tackles one of the washout plugs that open up into the water space between the firebox's inner rear wall and the boiler backhead. This particular washout plug also covers the upper end of one of the five arch tubes.

The long socket is necessary to gain clearance between the rod and the backhead fittings. Unfortunately, the long sockets tend to tip on the square heads as they aren't a perfect fit, and you easily go out of line holding the extra length – so it's easy to slip off, and skin your knuckles.

This is often a two man job – one to hold the socket down and another to apply force to the lever. To the left is Michael Thiel who had just arrived after lunch and is still socializing before he gets given a practical job to do and is safely out of what's left of Andrew King's hair. ☺



BH07 – Brilliant coordination in engineering and design. As happens on most mechanically stoked engines, the stoker jet valves or their pipes get in the way of the left-most arch-tube plug. Actually, this looks worse than it is because I centered the camera on the 'fine coal' valve. (Center).

The long plug sockets have narrow shafts so that obscured washout plug was actually removed without too much difficulty.



BH08 - To give you an idea of the quantities involved – these are the washout plugs that had been removed from the Class 15F No.3046 for her boiler's visual inspection. There are about 34 plugs in this picture.

The barrow o' plugs is waiting safely within the old grease store, which is now Peter 'Lappies' Labuscagne's stores and workshop area.

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3). PROJECT - GMAM NO.4079 – BOILER WASHOUT PLUG REMOVAL :



BW01 – Thanks a lot! Not. These two kind gentlemen popped that washout plug (next to Robbie's outstretched hand) just as I came walking by from the left – my clip-board pad of carefully written notes spasmed and wrinkled up in hydro shock. The boiler was still nearly full of test water.

Normally a locomotive boiler is drained via the blow down cocks – but the Green Machine's blow downs had been sealed for testing, and there were people working down in that area anyway. Not to mention the electrical wiring for the work lamps. So these guys tried to drain the highest part of the water into an unused area – and caught me buzzing around!

I decided to let them live…



BW02 – Regular maintenance of complex machinery often brings about a paradox. While doing the original job, you observe something else that is wrong and needs to be fixed. Oh great. The snags list just gets a few more lines. But at least you fixed it under your own terms and not when handling a failure condition while in service.

Here's one of those instances now…

A selection of four typically tapered washout plugs shows a failure condition developing on the right most plug. The shiny un-oxidised area where the threads were engaged within the boiler shell is rather thin. It is likely that this washout plug, which come in five sizes, is oversized for the hole from which it came. Regardless, it is bad fitting work.



BW03 – The boiler was eventually drained via the RHS blow down cock over venison stew m' rice time. So this twosome could get on with twisting out 'Lyndie Lou's' 'corks.' They sure had to apply some grunt and wellie on this job!

In this case, Robbie applies the grunt and Aidan applies the wellie. And even with the cheater pipe on I could see the iron socket driver bar bending. I actually stood back some steps in case something sprung loose and took off.

This plug is one of the easy ones. The tight ones on top of the boiler are tricky as there is little upon which to brace yourself against to grit, grunt and growl. (And gripe when you can't get the plug loose.).



BW04 - The sobering thing about our steam locomotive hobby is that an accident can happen so quickly and without any negligence on the part of the hurt person.

This hand rail suddenly snapped clean through at this point, the second right stanchion, at the rear of the smokebox. Robbie was standing on the handrail at the time and took a tumble – only saving himself by catching hold of the regulator housing and a split second later, the front handrail.

It turned out to be a very poorly penetrated weld. The stanchion to the left is actually missing – so there is a long section of hand rail that is only joined by a female threaded nipple. You can, in fact, see the nipple's barrel just over the stainless steel boiler band in the left picture.

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BW05 – Dawie looks depressed and reclusive in this view, retreating from the world and its hurts. He's actually looking for the many washout plugs that festoon the front tube plate of a locomotive. It is inconveniently dark in there (My flash makes it look light) and the lead light casts its own dark shadows.

Dawie is sitting on the table plate where the baffle plates would normally go.

As you can see, the petticoat peeking in from overhead is suffering from a bit of char cutting. A typical petticoat is 7-11mm thick and so you see the remarkably abrasive effect of constant rubbing with high speed grits and char entrained and pulled through by the blast of the exhaust steam. T

he spark arrestors only stop the bigger and presumably hotter chunks, letting the little grits and glowing cinders through to die of fright as they get blasted up out of the chimney. But the little grits are still abrasive enough to do damage over time, even if they don't start line side fires.



BW06 – Scrunched in under the super heater elements, Dawie takes stock and starts counting the plugs and planning what exotic combination of rods, sockets and cheater bars he would need.

There are five washout plugs visible in this picture – can you find them all?

The lime scale and salts in the boiler feed water tend to settle out more towards the front end of the boiler, hence the provision of many washout plugs. The reason for the asymmetric settling is because of the slower water circulation – allowing the solids to precipitate out of the water.

The idea of these plugs is to provide access for a hose or a steam lance to be able to wash the scale and deposits loose, swilling them back towards the firebox. They will then come out of the boiler via the belly plugs (if fitted) or will be flushed out via the firebox's washout plugs.

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4). PROJECT - GMAM NO.4079 – BOILER DRAIN :



BD01 – The old fashioned fibreglass shrouds adopted by the SAR for their fire extinguishers make great drain channels for draining of locomotive boilers. The water is draining neatly into the wheel drop pit – which is equipped with a sump pump.

The GMAM has a completely separate hex-operated stop-valve so the blow down can be removed without having to drain or depressurize the boiler. Regardless, it is not a job I would like to do on a live, pressurized steam locomotive. The actual cab-operated blow down valve is 11 o'clock to the stream of water.



BD02 – Lucas Dreyer is using two wrenches at arms' length to get the blanking plug off. Above his head is the left side water main, and under his hand is the train brake vacuum line. The separate stop valve for the blow down is obvious here.

One of the blow down valve assemblies has been discovered to have a fractured flange.



BD03 – The test plug that has just been removed. The blow down valves are potentially the leakiest boiler fittings that can cause problems during a hydraulic boiler test and they definitely have to be sealed. This test plug would fit any late era SAR locomotive once the blow-down scuttles (drums) have been removed.

However, on a conventional locomotive, it is far easier just to split the 2-bolt flange and collar joint of the outlet pipe from the easily accessible side-mounted blow downs and then insert a rubber sheet backed up with a steel strip to seal the valve off.

The under-slung blow downs on the Garratt are harder to reach, with potentially very rusty and corroded bolts because of their location. Removal and subsequent blanking also requires making up a three-hole blanking plate as well as gaskets to suit. It is far easier just to remove the blow down drums and bung up the pipe work.



BD04 – Here is one of the two blow down drums, sometimes called 'a scuttle', with the inlet on the left This one looks pretty scuzzy on the outside but the metal work is actually quite thick gauge and is still in good shape. Some of these drums end up paper-thin from rust at the outlet.

The primary purpose is to control and deflect the discharge of blow-down steam sideways. The drum also imparts a very mild deceleration effect on the steam although the blow-down exhausts are still pretty fierce even with a good pair of drums on the locomotive.

With a bit of wire wound once or twice around the drum to form a grid across the outlet chute, these were often used to boil, or more correctly, steam, breakfast eggs. It is possible to just gently 'crack' the blow-down linkages for a gentle flow of steam. Sometimes, there would be enough rust holes on the bottom of a worn flat-bottom drum to safely hold one or two of the crackle-berries without the use of wire.

Now, how far would a chicken ovary fly if the 'loaded' blow down is opened fully – I gotta try that experiment that the next time I do loco minding work. ☺

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5). PROJECT - GMAM NO.4079 – WRAPPER PLATE STAY CAULKING :



TP01 – This is Dawie 'Swak Hart' Viljoen at work on the wrapper plate and he doesn't even have knee pads!

In spite of his nickname, this boertjie is tough!

We are facing back towards the locomotive cab – that sheet metal in the background is the ash pan. The GMAM is unusual in that the three levers that operate the rocking grates enter the firebox area through the ash pan's sheeting rather than through or above the ash pan's collar. The cross shaft really got in the way and you can see that the right-most grate shaker pull rod (left in the picture) has been disconnected for access.



TP02 – Here's Dawie 'caulking' stay heads, working with arms over his head and in that confined space. The term 'Caulking' is a bit misleading as no caulking is actually applied – it currently refers to the process of peening the edges of the rivet-like heads of the stays back to the plate-work to establish a pressure tight seal.

You can see by the rust and lime scale marks that this wrapper plate has been seeping for a while. As awkward as this position looks on the GMAM, a conventional locomotive has frames at that point which makes access very difficult indeed.



TP03 – The uppercut shot. The reason why these stays are leaking in this area is because the position of the washout plug interrupts the regular pattern of braced support. The location of the plug means that there is an unavoidable one-rivet-wide area that isn't braced – with a potential steam pressure of over 14 tons per square centimetre. The inevitable expansion and micro flexing loosens the stay heads over time.

These washout plugs cover the entry ports for the lower end of the arch tubes. The area alongside Dawie's forearm is the outer plate alongside to the front, or 'The Toe' of the fire. The corresponding plate on the inside of the firebox is called 'the 'Throat Plate.'

That silvery band above Dawie's head is one of the stainless steel boiler bands that help retain the cladding and seal the gaps between the sheet metal cladding plates for the boiler's courses. The cladding strap has been loosened and shifted slightly to inspect the girdle rivets.



TP04 – Here's a view through one of the massive external bridge girders that form a GMAM's deep-chested boiler frame. The pneumatic hammer has to be constantly rotated to keep the chisel-like bit at a tangent to the domed head of the stay. It then has to be passed around the full circumference and rotated all the time.

Hence if you look back at photo TP01, you will see that the air hose quickly gets wound up and twisted.

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6). PROJECT - GMAM NO.4079 – WRAPPER PLATE WASHOUT PLUG REMOVAL:



TW01 – Michael Thiel came in after lunch and he was soon sent down to tickle the GMAM's rusty belly button. The fellows had a cursory twist at those five plugs but they were as stubborn as expected. No one was surprised when the heavy artillery (aka, the acetylene trolley) had to be called into action.

A cheerful looking Michael is applying the first flambé to heat up the plug, burn off some of the oxide and force the washout plug to expand. Unfortunately, the thick steel plating, with which that tapered plug is so lovingly embraced, 'sinks' the blow torch's heat away quite effectively.



TW02 – Once the washout plug has heated up nicely – a sudden chilling with fresh cold water will hopefully cause enough contraction to break the grip of the threads and the corrosion therein.

Michael is aiming a hose to squirt low pressure stream of water at the recalcitrant plug.



TW03 – It is a tedious job but the process is working – you can see the center plug is out already. Although Dawie Viljoen is no weakling himself, Michael Thiel is quite powerfully, but compactly built. This made him the perfect choice to apply torque in such a limited space.

The fact that the heads of all these plugs are square instead of hexagonal really does limit the number of positions that the tommy bar can be placed at. It leads to some interestingly awkward postures in tight spaces!



TW04 – Ja, dis net mos Dawie !

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7). PROJECT - GMAM NO.4079 – SOME LOCO DETAILS :



RG01 – Aidan McCarthy folds himself up comfortably into a surprisingly compact package with the aid of the deeply recessed regulator pocket on the GMAM's smokebox. The superheater header is physically located directly under Aidan's 'Big-End.'

The regulator valves always have to be opened up and specifically sealed for boiler testing – as any incidental leaks here may cause a false leak detection for the boiler. (Pressure loss.) All of these valves have been removed and re-ground. They are usually sealed with silicone for the test as well.



RG02 – An end view of the intact regulator ('Throttle') valve chest. The GMAM's regulator is a mirror image of that of most of the late SAR steam era locomotives as the crank handle and pull rods are on the right hand side of the boiler, instead of the left.

These valves were new member, Mike Murphy's first official job upon joining Reefsteamers. Sealing the valves for a boiler test also corrects the incidental leaks that form in operation.



RG03 – Here's a top view of the same regulator chest. A feature that I didn't notice until handling the photos is that the GMAM has FIVE main regulator valves whereas the other locomotives usually have four. The smaller square cover for the left is for the smaller diameter pilot valve, which applies steam to a pair of common steam plenums above and below the valve bodies of the five sequentially cam-operated double beat valves. The idea is that there is equal steam pressure on both sides of the double beat valves, which cancels itself out – sort of like a steam pressure counterweight.

This arrangement allows the driver to open the regulator against the steam pressure. If these were conventional single-ended valves, the driver wouldn't have the strength to open her up. The locomotive would either then need some servo operated arrangement, (dangerous if it fails) or some form of gearing. (Slow and cumbersome especially on pull off.)



RG04 – Details of the regulator crank. Nearly all 20th century SAR locomotives have cranks that are closed when facing forward, because of the use of a relay rod halfway along the pull rodding. (You give her some 'wortels' by moving the fore-rods back.)

The use of a relay rod halfway along the boiler means that at any one time, only half of the rodding is under compression for any regulator adjustment. This means less chance of motion being lost because of the steel rodding bending, or problems arising if a bending rod binds up against its guide wheels.

This crank is a frequent leak point for steam. Most glands on a steam locomotive only have to handle reciprocating motion. This gland has to handle rotating motion, which tends to open up the ends of the cut sections of graphite rope that make up the gland packing.

Notice that a bolt has gone missing - fallen out or left out by some naughty fitter along the way?

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RG05 – An ominous number 'two' scrawled on the smokebox front plate in Andrew's hand writing. That 'two' could mean anything, like two leaky tubes found, or perhaps two superheater elements. In this case though, it simply refers to two front tube plate washout plugs that started weeping right at the end of the hydraulic test.

The front end does look rather rough but it is just surface rust. The paint that was previously applied was a thin mixture of graphite and silver. The paint got partially burnt off on the last run and water got underneath in storage. All the loose paint has been ground off.

The rust will be sanded off and the front end repainted before entry into service. Most locomotives with a conventional self-cleaning smokebox tend to burn their exterior finish at the lower half between 5 to 7 o' clock, especially if the smokebox char isn't removed regularly. The GMAM has centrifugal char separators arranged radially around the door opening and thus the heat is spread more evenly around the sides and later, the top of the door.



RG06 – The GMAM's 'nads.

The space under the wheel-less boiler is used to good affect to house the brake system, including the unusual twin vacuum cylinder layout for the brakes. Because of the twin engine unit layout, there are 16 wheels that have to have brakes applied, as well as the need to overcome the frictional drag of the extra linkage between the central, suspended boiler and the two pivoting engine units.

At the top of the picture, are the four vacuum chambers.

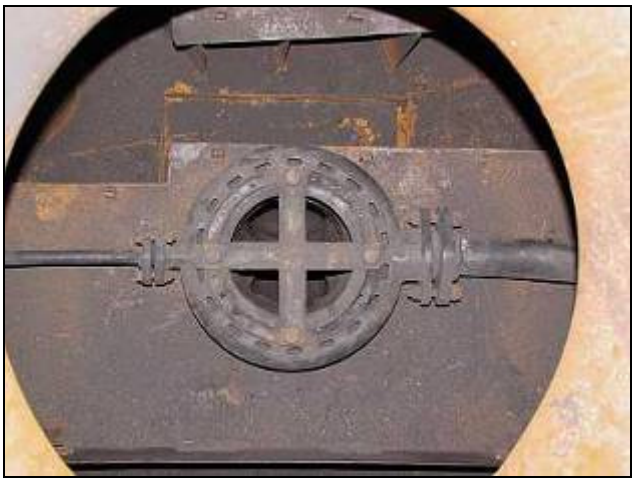
In the background is the Bissel truck of the leading engine unit.

The locomotive isn't standing hock-hipped – I didn't have the cross hairs turned on in my camera's display and I was firing nearly blind in the darkness under the belly of the beats.



RG07 – A view right down the GMAM's chimney right onto the blower ring. The chimney is actually still wearing its petticoat, but because I have rocked backwards to centralize the camera flash, the shadow of the petticoat does not show.

As we recently discovered on our Class 25NC No.3472 'Elize', the alignment of the simple looking chimney pot has a profound affect on the blast and hence the performance of the locomotive. In fact, steam locomotives are very affected by the design of their steam intake and exhaust tracts, as well as the tuning of the drafting system.



RG08 – This device that looks like a gas burner ring is the blower ring. It is basically a hollow doughnut with a ring of rectangular holes discharging steam upwards to create a fire-drawing vacuum in the smokebox. The thin pipe from the left is the high pressure line from the fireman's blower. The wider gauge pipe from the right is the lower pressure steam exhaust from the brake vacuum ejector.

Under the cross-like blast restrictor, the exhaust ports can be seen. Their fore-and aft arrangement is typical of Garratt locomotives, whereas a conventional; locomotive has the holes oriented from side to side. The difference is because the cylinders of the GMAM (or any Garratt) are not directly under the smokebox – so their exhaust is piped from the front and the rear engine units.

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RG09 – Dawie Viljoen undoes the 36 dome cover nuts by hand after he's gone around with the air-wrench. In the foreground, the very low profile clack box and then the auxiliary, or vent valve, with the spoked wheel. This valve is used for venting air out the boiler when it is filled up in the shops. In the railways days, it was also used to pre-fill the boiler, usually with hot water cooked up in stationary boilers. This was done to save time in raising steam for service after the locomotive has been cold and under repairs or maintenance.

Naturally, this valve can be used to fill a boiler with cold water as well – and if the valve is provided, it must be used in preference to filling the boiler via a removed washout plug.

Like most of the later and larger SAR locomotives, the GMAM's 'dome' is actually more of a manhole cover. However, the GMAM's dry-pipe does pick up steam from the dome in the old fashioned way. (See pic RG12) The cover was removed to facilitate visual inspection of the boiler interior.



RG10 – Looking like a low-profile flying saucer, the dome cover has been removed and is hanging via the angled chain of the hoist, which is hanging from a roof beam and not a crawler.

In the foreground is the clack box.

Work like this is the reason for hardhats in the work shops. It's always possible to have a crowbar, a socket or a washout plug go tumbling from the top of the boiler to the frantic cry of 'Heads Up.' It is remarkable that we have very few incidents of dropped tools and parts. In most cases though, they would slide down the boiler barrel and jam in the handrail, or the small parts bounce off the walkways which tends to break their fall.

Experienced loco fitters make sure they don't balance their tools and parts on edges of the boiler cladding. When people are walking or sitting on the boiler, the sheet metal tends to distort and then pop back upwards when the weight is lifted. The movement might nudge something overboard.



RG11 – The GMAM has an extra access cover just in front of the firebox – for access to the turret pickups and for viewing of the crown stays above the firebox.

The 'horns' that supply steam through separate lagged pipes to the twin turrets each have their own spanner-operated valve. The turrets, like those of the 15F, the 23 class and 25NC, are split and mounted radially displaced down the boiler's circumference to reduce the height requirement.

The safety valves are still missing here, normally sitting where the three rear blanking plates are. The rear blanking plate also has a test venting and drain valve, the hose for which can be seen lying loose on the boiler. This small bore valve allows for a very gentle, controlled draining on a boiler that has been hydraulically pumped to above its rated operating pressure and as the boiler slowly relaxes – it initially displaces the drain water UPWARDS through that vent valve.



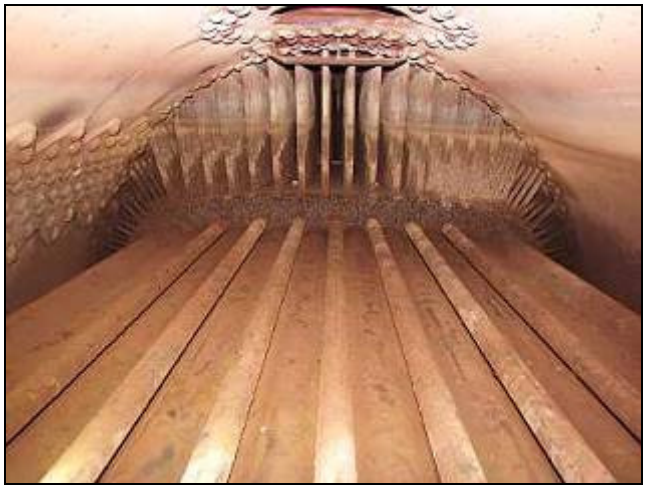
RG12 – Here's a view down the hatch – the front of the locomotive is to the left. The raised end of the 'dry pipe' is obvious. Ironically, the so called 'dry pipe' is full of standing water in this photo. This is the pipe that feeds steam to the regulator chest.

In normal operation, this dome and the 'dry pipe' is filled with steam, or merely air if the locomotive is cold. Water can get into the dry pipe via over filling or foaming. Mild water carry - over weakens the lubrication film in the steam chests, but also shocks the super heaters. A major water carry-over (a prime) locks up the pistons and motion as the water ingested in the cylinders is incompressible.

The copper sealing ring is still in place and this will need to be removed and re-annealed (softened) before it can be put back into service again.

This locomotive is going to need lots of cylinder-cock open time when she's returned to service.

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RG13 – A view inside the GMAM's boiler, looking back towards the firebox, the upper front corner of which appears in speckled grey. The splice plates are prominent to the left, where the edges of the rolled boiler plate were riveted together to form this 'course' of the boiler's barrel.

The rivets above are the flange rivets for the inspection hatch, beyond which is seen the fall-plate for the two independent turret inlets and the safety valves.

You can actually see the average boiler water level on the right side and on the crown sheet stays themselves.

If you look carefully down the center two rows of stays, you can see daylight. That light is coming in through the cab, from the holes left by the three removed backhead washout plugs and the five removed arch-tube plugs.

The two shiny objects towards the front center of the firebox, spaced four vertical stays apart, are the still new and reflective cast lead domes of the fusible plugs.



RG14 – Here is the beast in her 28 wheeled self and looking a bit embarrassed with a later of dust on her forehead. That is Aidan McCarthy working in the background.

That lubricator has been dripping oil. But the mechanically lubricated engines usually do mess their beds if stored after being operated.

What I always find amusing when considering the massive GMAM is that the original design platform, the GMA version, was only designed to be a secondary line engine.

The GMAM is a GMA with 2.4 more tons of coal and 450 more gallons of water on board. The GMA platform is designed to run 191 tons onto 60 pound rails with an axle load of 15 tons. The little 95t ton Class 12R 'Rosie' puts 17 tons on the rail per driver axle and the 108 ton Class 15F 3046 puts on 18.5 tons per driver axle. This is the biggest engine of the three, but has the lightest axle load of them all.

Maybe we should unilaterally rename 'Lyndie Lou' to 'Twinkle Toes.'

The maturity of the GMAM design, with the extra weight and range, allows it to be useful on the mainline as well. (Hence the second 'M' for 'main' in the name.)

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8). FINISHING WORK ON 15F NO.3046 :



FW00 – Class 15F No.3046 in repose. Some simple finishing work was done today, but the locomotive is primarily waiting for a visual boiler inspection. Peter Labuscagne has claimed this track as his workshop, with all the scaffold trolleys and steps in this area. He has put the old grease store into use too.

'Lappies' was just 'scroting around' today, so I was free to take lots of pictures without dodging sparks, steam, water and dust.

Notice that the baffle plates have been reinserted into the smokebox and one of the handles has been re-fabricated and freshly welded on, hence the shiny ends. 'Lappies' is checking them for ease of fitting, as he did later the spark arrestors, although they will need to be removed again for access by the Boiler Inspector for the visual boiler inspection.



FW01 – The almost complete backhead for the 15F's boiler. The light from within is coming from a fluorescent work lamp unit wired to the cab's backplate cross member.

With the exception of the firebox door, the weighted latch and the flame plate and shelf assembly, the backhead is complete.

The door and the shelf are currently stored on the tender – the shelf being a neat hand-built stainless steel affair with traditional copper posts and rails.

The five blank holes are where the washout plugs for the arch tubes have been removed to facilitate their cleaning and the visual inspection, which is the next step in the certification process. The blanking plates have been removed from the water column flanges too, but the rubber gaskets are still in place.



FW02 – Here's the wide Class 15F firebox, with the five arch tubes completely innocent of any fire arch. The fire grates are all in, although you can't see them here.

On this assembly, the fire arch is modular and goes on OVER the tubes so there is quite a lot of space underneath and the characteristically deep firebox of the Class 15F is obvious here.

This firebox grate area is 5.85m^2 (63 Sq ft.) The complicated tapered side profile allows the firebox grate area to be made nearly the full width of the locomotive whereas earlier fireboxes are often vertical at the sides. The generously curved corners at the top are more pressure resistant. See pic FW04 for more details.



FW03 – By comparison, this is the firebox of Sandstone's GMAM Garratt No.4079. Notice the increased number of boiler tubes as well as the five rows of superheater flues opposed to the 15F's four. There are also boiler tubes staggered at the end of their rows and alongside the flues, to fit the maximum number of tubes within the boiler's circumference.

This boiler transfers more heat than the 15F's, even though the firebox is practically the same size. The extra diameter of a Garratt's boiler is made possible by the fact that there are no cape gauge driving wheels or narrowly spaced frames under the suspended boiler on a Garratt type locomotive. The benefit is proportionally increased when the overall SAR+H loading gauge is larger than Britain's, but the boiler-limiting track gauge is 'only' 3ft 6in. This is one of the reasons for the prevalence of the Garratt locomotive on colonial cape gauge systems.

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FW03 – And here, by comparison, is the much older firebox of the Class 12R No.1947 'Rosie.' This firebox is 37sq. ft – just over half the size of the 25NC. The old fashioned straight inner walls are obvious. In spite of the long period of disuse, the lighter band marks left by the sides of the long-ago fire arch are still visible. The mounting studs for the arch side rails are still there as well.

The grates would lie one row of stay heads below the frame of the picture. If you look where the bottom of the fire arch would be (Third row of rivets from the bottom) – even though the shape of the firebox looks rather tall, 'Rosie' actually has quite a shallow fire.



FW04 – A 15F locomotive as dead as ol' Granddad's hat band.

As sad as it always is to see steam locomotives cut up, even bombed-out wrecks with no chance of ever running again – the real life cross-sectional views are often quite instructive. There is even a piece of boiler cladding remaining in this view.

Here we see how the extra curved top corners of a 15F's firebox actually contribute to easier convection current flow to the arched steam raising space right above the crown sheet.

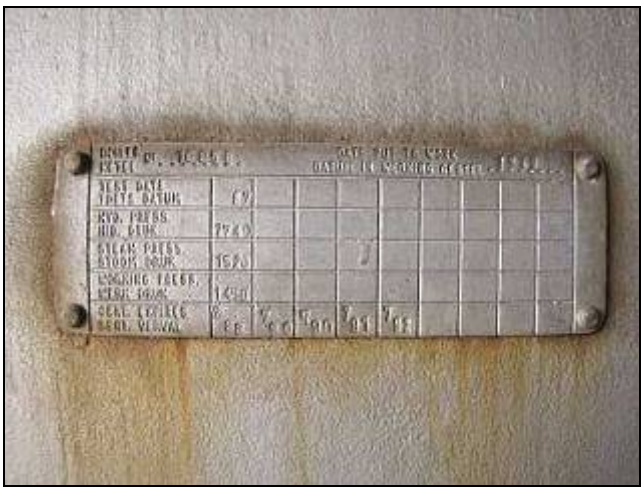
These are the remains of Class 15F No.3033 which was cut up by REKLAM next to the 15M workshop yard in August 2008.



FW05 – Reefsteamers' practice is to backdate our locomotives to as-delivered state with single barrel headlamps. This rugged looking lamp was made by 'The Pyle National Company' of Chicago! So that's why this headlamp looks like it belongs on a piny backwoods Shay somewhere!

These are heavy fixtures but the locomotive forehead brackets on the 15F's were originally designed to take heavy lamp fixtures anyway. The disadvantage of these antique lamps is the potential exposure of the separate parabolic reflector to oxidation and rust, or mechanical damage through misguided attempt to clean them. The reflectors of the prosaic standardized double-bulb box lamps are protected from dirt and interference as the lamps themselves are sealed beams.

The silvery coloured smokebox and chimney is to be painted semi gloss black. There is to be no graphite paint to be used on this locomotive. The graphite paint doesn't last very long. It is slippery when dry and positively lethal when it is wet or has the slightest trace of oil on it. In fact, traces of oil on your boots are enough to put you at risk.



FW06 – Here is the boiler information plate for Class 15F No.3046. The boiler entered into service in 1948 and this is boiler 10056. Hydraulic test pressure is 1740kPA. Steam test pressure is 1520kPA and the working pressure is 1450kPA.

The numbers are interesting – notice how much higher the test pressures are than the rated operating pressure – there is much margin for safety originally designed into these boilers.

This particular boiler was certified in July of every year from 1988 until 1992. This is probably why the No.3046 locomotive never continued soldiering on in preservation or excursion service – as the boiler certificate expired the same year that the Germiston Shed closed.

No.3046 was a popular and reliable locomotive when she was in service – Oom Attie remembers her performance well.

Note that the boiler service entry date should not be considered to be the date of service for the locomotive, for, like motor car engines (and hence the engine numbers) boilers can be replaced and frequently were.



FW07 – Geneticist Colin Hall works on a very different horse from the twitchy four legged beasties with which he is used to. He is sanding down the curved flanges of the regulator cover before remounting it and bolting it down.

The inverted regulator covers of these locomotives, placed across the chimney, act as VERY useful and stable tool and hardware trays for people working at the upper front end.

The clevis link in the foreground is the front end of the pull rod for the regulator. It has been deliberately disconnected by Peter so if anyone fiddles with the regulator handle back in the cab – the tightly sealed regulator valves are not disturbed or left dry and open. In fact, if anyone opens the regulator fully, the clevis link will move back and drop – jamming the linkages against the crank.

The red colour paint on the rods is not just for decoration – the contrasting colours were originally meant to indicate a moving part amongst all the boiler fittings.



FW08 – Most post WWII locomotive chimneys have the compatible model numbers stamped into their flared fittings and here we see some of the compatible models for this chimney casting. The shape of the chimney has more to do with the pitch of the boiler (center line height), combined with the diameter, and then the fitting of the blast petticoat to the underside of the chimney.

Note there aren't many layers of paint on the chimney as you can still see the grade stampings on the bolt heads. Many of the other locomotives just have vaguely hexagon-ish looking blobs where the bolts were, from years of paint and graphite being added over existing layers.

The 16E was a high-speed pacific locomotive, rather different from the maid-of-all work Class 15F. But the 15E type is the 'bongol' and is the type from which the 'F' originated. The A.G. Watson designed 15E 'Bongols', were identical to the subsequent 15F's but ran with rotary cam poppet valve gear whereas the later 15F's have Walshearts valve gear..



FW09 – The newly assembled fireman's seat and the platform. If the background looks a bit empty it's because the spray pipe hose hasn't been fitted yet, although the valve is there right in front of the seat. On the dusty, but neat looking seat cushion, is a stack of just-removed steel blanking disks that were used to seal off the water gauge column flanges for the testing.

Note there are two 'putting tee' handles protruding through the red painted reinforcing plate. The one at the rear is usually a spoked wheel and operates the ash pan coolers – but the kick levers are easier to use. The front lever is the fireman's injector water valve. Normally these are left unpainted but it looks as though Peter 'Lappies' Labuscagne has other plans…

The pull tab next to the seat is the lever for the ash chute door.



FW10 – A closer look at the upper end of an arch-tube through the washout plug pocket. There are three layers of the firebox visible here. The outer layer is the sheet metal cladding to improve the aesthetics of the boiler, but also to retain and protect the thermal insulation. The thickness of the insulating layer on the backhead can be seen by the depth of the stainless steel 'top hat' section trim.

The powdery dark grey plate with the thread in it is the outer rear wall of the firebox. The rust coloured plate is the firebox's inner wall. The space between the two walls is full of water. The arch-tube end is visible and is very neatly beaded.

Odd to think that most of the boiler backhead is double-walled and contains water behind all those controls and copper pipes.

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FW11 – A rather old fashioned way of mounting the curtain plate's windows. This makes for easy unit replacement of the glass if it breaks. But the loco crews aren't going to appreciate those protruding bolts if they settle down with their heads back during a break! SAR locomotives use square shanked carriage bolts which only have round heads protruding from the inside.

Traditionally, an SAR loco cab interior is painted a sienna-orange colour – a mid-browny, orange shade. Many cabs, including most of ours, have been painted a brighter orange over the years, being the closest approximation to the original shade available from the standard paint colours available in the SAR+H stores. But many cabs have had more garish custom colours applied over the years such as signal red and bright azure blue. Some have even had racy two-tone colour schemes applied in an effort to get some more horse-power out of the engine!

I rather like this practical battleship grey colour. Whoever did the painting either ran out of time, paint or patience as you can see there are still some touch ups required.



FW12 – A view into the rather dusty but perfectly empty tender of the Class 15F No.3046. This tender is in as new condition. I had just removed the three 'stoker slides' to be able to view the full length of the stoker worm worm.

All three of the service hatches are open. The one nearest to the viewer is for access to the stoker worm's gearbox. There are two service hatches to the left – each of which provides access to a universal joint.

This is an EW type tender originally from a Class 23. These tenders were often fitted to Class 15F's as long range tenders when the Class 23's were retired in bulk. The capacity of this massive oxide red coal hopper is 18 tons while the water tank, above which I am standing and extends around the stoker's trough in a U-shape, has a water capacity of 26 390 liters (5800 gallons)



FW13 – Here is a totally different interpretation to the common photographic phrase, 'a worm's eye view.' The camera is right at the back of the trough. Although this is usually called the stoker 'worm' it is more correctly called an 'Archimedean Screw.' The grooves for the sliding cover plates are prominent above the trough and you can see the notch where the plates can be removed towards the top left corner.

That 'pipe' protruding from the cab is actually an end view of the grate shaker lever.

There is an extra gap between the vertical side plates for the stoker trough and the grooved rail for the stoker slides. It is to be filled up with steel bar stock welded in place.



FW04 – Here is the front universal joint in practically new condition. The yokes are of split design and have been bolted with new cadmium plated nylock nuts. The split design means that a universal joint can be repaired in-situ and no presses are needed to disengage the spider.

Notice that the drive shaft is of square cross section. This means it is keyed by its shape and thus no drive flanges are needed. Unfortunately, these joints usually receive very little lubrication in service. But as they use plain spiders without the needle bearings as used in automotive Hardy Spicer type UJ's, they are robust enough for this gritty service!

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9). MISCELLANEOUS PICS :



M01 – If this fellow slips, the results could be enuch-ifying! Hurtin' for Cert'n

Michael Thiel stands with his feet spread on a soaking wet old door which is spanning the inspection pit, while putting the 'purple-nurple' on some stubborn washout plugs.



M02 – The pressure testing coupling screwed into the GMAM's firebox box corner plug. The two plug valves are currently open. The drain valve (An in-line domestic globe valve in this case) is used to drain the boiler slowly from its high stressed state during hydraulic testing. During pumping, the valve can also be left open to create a flow to drain and thus a control enabling pressure drop across the pump-side valve. (Left)



M03 – The almost new WIKA™-made damped pressure gauge which was used for boiler testing. Quite often, any old brass gauge is plumbed-in for initial tests but accuracy can be a problem on the older units. Generally the high pressure required for official testing is out of range of most of the locomotive backhead originated gauges anyway.

The pump isn't running here. The pressure seen here is the residual pressure from the weight of the water still in the boiler.



M04 – This was a 'sacrificial' file of printouts of some recent Reefsteamers photo essays and I wouldn't have minded a black fingerprint mark or two. But it sure was funny watching these gritty fellows delicately trying not to dirty the pages – but at least they were considerate enough to take the effort. From left to right, Lucas Dreyer, Peter Labuscagne and Colin Hall.



M05 – Silhouetted by the brooding grey day while catching up on everyday life between the locomotives. Dawie Viljoen (left) and Michael Thiel have a chat about the big wide world outside the Depot's gates.



M06 – A pic from up on high, the 36 ton Booth Crane waits patiently for attention. We are extremely short staffed in terms of skilled machinists n' fitters at the moment and it is taking all of our efforts to keep the locomotives running. This crane is likely to stand and wait (in safety) for quite a while longer yet.

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M07 – Dreaming of a big bowl of dog biscuits, this furry mud flap snuggles up to the dog bowl. The Reefsteamers gravel-hounds don't lead a luxurious life. However, with regular controlled diet and lots of exercise in our spacious depot, these dogs are seriously fit with substantial muscle. They've gone a bit soft though and haven't eaten any trespassers for a while.



M08 – Sleeper Coaches at rest in the old running shed. That odd coloured coach at the end is a wooden-bodied ex 2nd Class 'Nie Blankes' coach in derelict condition. It is coach No. 14194 and was once assigned to the Breakdown Train for the Springs Depot. In this case – we need under-cover shelter for our revenue earning sleeper coach stock but at least that coach won't be scrapped.



M09 – Some outstanding depot maintenance work becomes apparent during a mid afternoon rain storm. The drain pipe in the valley between the two gabled roofs of the 15M workshop has been attacked by the oxide moth. The rain water cascades incontinently next to the 15CA. It is a relatively easy repair though, requiring a wrapper patch and some hefty jubilee clips – but is a scaffold job because of the height.



M10 – Viewed after the afternoon rain, the crowded 15M workshop yard has just been washed clean. The parts in the foreground, the cab, smokebox front plate, dome cover and dome fairing from No.1947 'Rosie' add to the clutter. That walkway trolley should have been wheeled inside though but no one was active in that particular aisle (15CA) for the day.

This Depot Report was compiled by Lee D. Gates on behalf of Reefsteamers
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