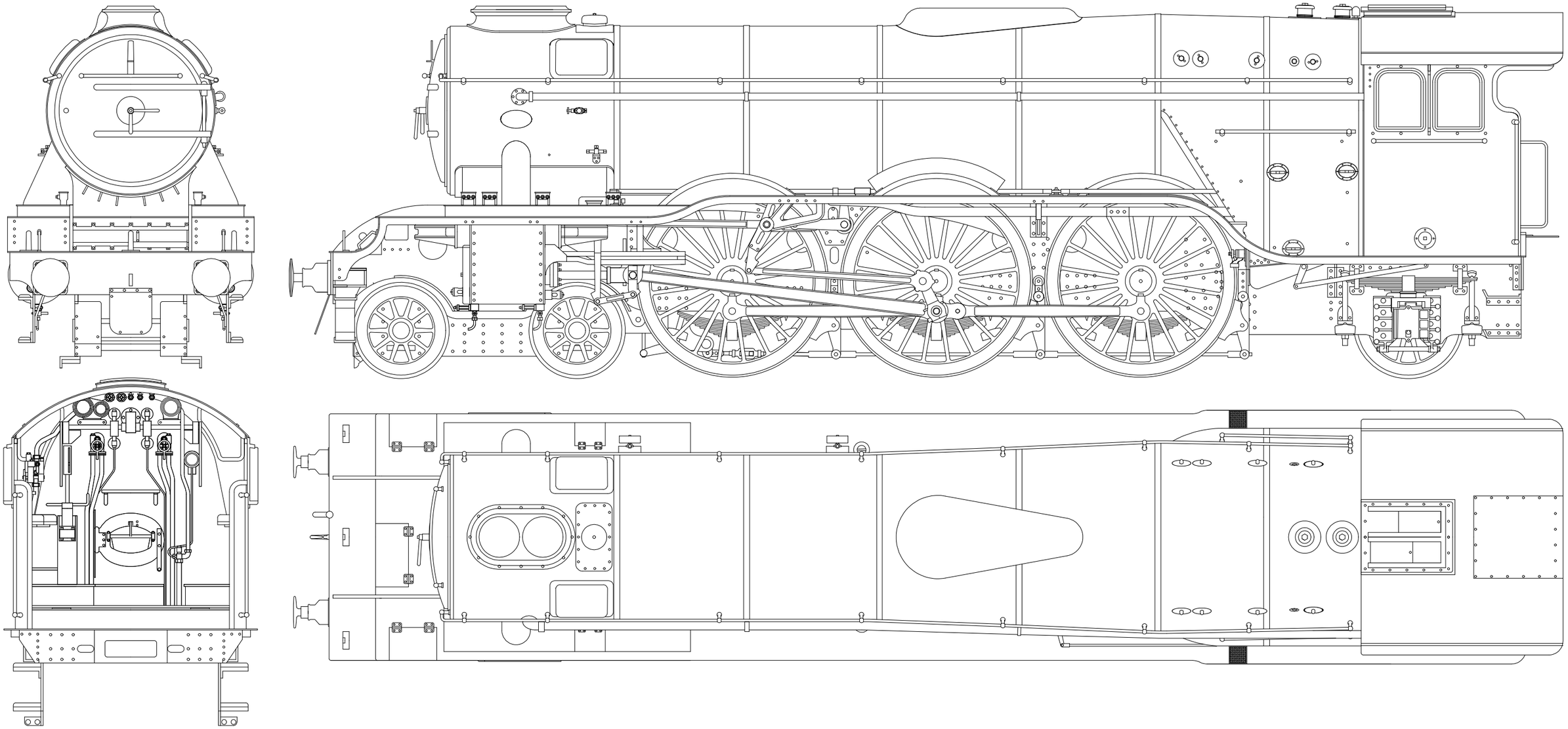


Fig 1. General Arrangement

COUPLING RODS & FRAME PREPARATION

COUPLING RODS.

The coupling rods are now made so that they can be used as a jig to align the hornguides accurately. First drill out all the crankpin holes to a convenient size which is undersize for the crankpins and the fork joint holes. Remove all burrs caused by the drilling. Now drill a hole, with the drill used for the crankpin holes, in a small block of wood or Tufnol and leave the drill in the wood with its shank projecting. This projecting shank is used as a mandrel to accurately align the laminations of each rod.

Place the laminates over the mandrel and, using plenty of solder and flux, solder the two laminates together. You will now have rods with the crankpin and fork joint holes aligned. Carefully file the edges so that the 'laminated' effect is lost and the rods appear to be made from one piece of metal.

The crankpin holes now need carefully opening out until they just fit, with no free play, the ends of the hornguide alignment jigs. The fork joints are now pinned using the 1.6 mm nickel silver wire. Retain the pins, which should be a tight fit, by lightly soldering on the inner face of the rods. The correctly assembled rods should now have a completely flush inner face.

FRAMES.

Construct the hornguides using the instructions in the separate kit.

Having decided which chassis to construct you can now start construction by preparing the frames (F1 & F2). First drill out the frame lightening holes (marked L in Fig. 3) as required and, using photographs as a guide, emboss the appropriate rivets.

Full Compensation. For a fully compensated or fully sprung chassis, open out all of the frame slots for the hornguidess by cutting around the half etched lines.

Drill out holes P1 for plunger pick-ups and C1 (1/8") for the compensation beams. Solder the rear hornguides to the inside of the frames aligning them with the half etched line and with the bottom of the frames.

Partial Compensation. For a partially compensated chassis open out the frame slots for the hornguides by cutting around the half etched lines on the front and centre axles only. Drill out holes P2 for plunger pick-ups and C2 (1/8”). Solder top hat bearings in place for the rear axle.

Drill the B holes 0.8mm for the brake hanger pivots. If you are not fitting the front guard irons drill out G holes to 0.8mm. Bend the lubricator linkage brackets along the fold lines at right angles and strengthen with a fillet of solder. The front bracket will need relieving slightly to clear the driving wheel.

Fold up the centre sandbox base and front marked in Fig 3 to the inside of the frames, or use the updated white metal sand box (WM22) after first drilling the base with a 0.8mm hole, see Fig 4 for position. If using the white metal sandbox then remove the tabs from the frames and make good the edges. Note, the middle sandbox casting will conflict with the partial compensation beam if fitted; other holes may need opening as required in the casting once fitted.

Drill a 0.8mm hole in the middle of the front white metal sand box (WM10) at the base, solder to the outside of each frame as shown in Fig.5.

No.	Description	Sheet			
F1	Frame, left	A2	M2	Coupling rod, front outer lamination (2)	A3
F2	Frame, right	A2	M3	Coupling rod, rear inner lamination (2)	A3
M1	Coupling rod, front inner lamination (2)	A3	M4	Coupling rod, rear outer lamination (2)	A3

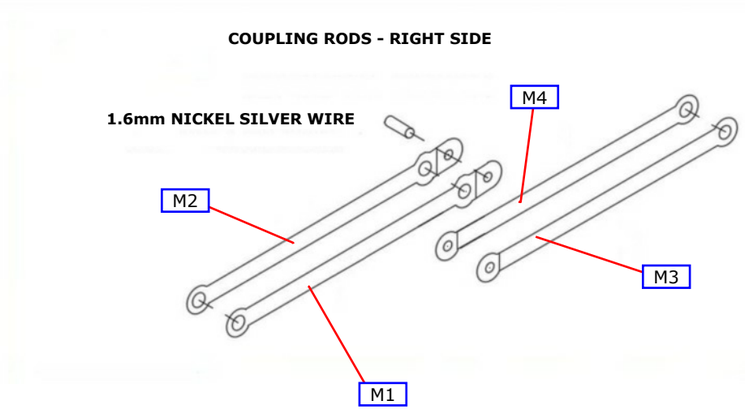


Fig 2. Coupling Rods

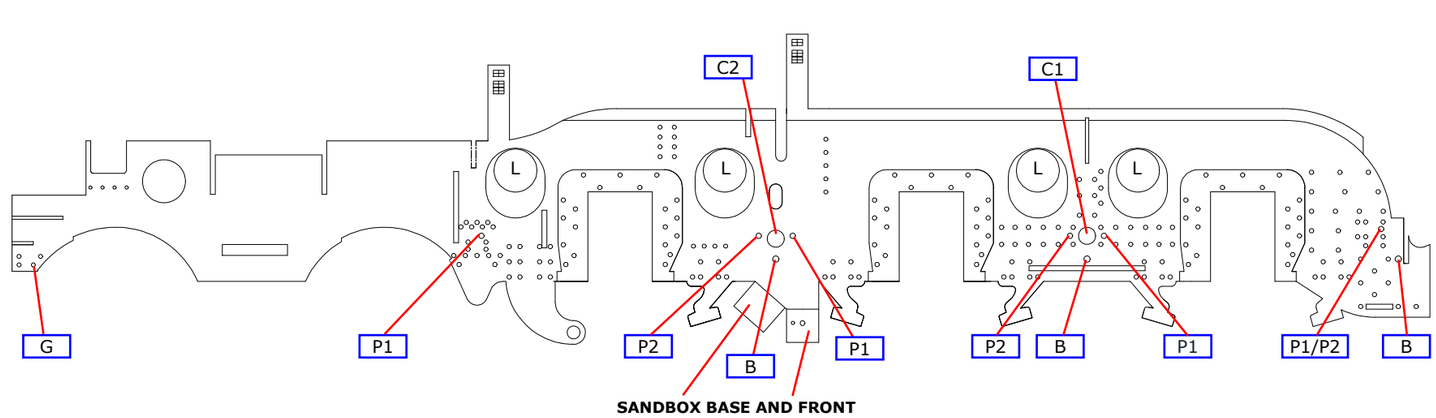


Fig 3. Frame Preparation

ASSEMBLING THE FRAMES

Select the following frame stays for your chosen gauge - the firebox bracket (F3), the horizontal (F4), the compensation rod (F5), the cylinder mounting (F6), and the reversing rod bracket (F7). Open out the holes for the 1/16" steel wire in the front compensation beam. Fold up the brackets making sure the 1/2 etched fold line is on the **inside** and that each bend is a right angle.

Check that all tabs on the stays fit properly in their corresponding chassis slots so that the rest of the stay is hard up against the inside of the frames. Tap the 6BA cylinder fixing holes in the front cylinder mounting F6. Solder one of the longer 6 BA bolts through the hole in the cylinder mounting, for the bogie pivot.

Now assemble the frames and stays. Note the shorter side of the middle reversing rod bracket is on the left. Start by tack soldering the front compensation beam mounting bracket to both sides. Check that everything is square and that the stays are hard against the frames. Put an axle (or better a longer piece of 3/16" rod) through the rear bearings and place the chassis on a piece of graph paper to check that the axle is square to the frames. If all is well solder the remaining stays to the frames checking constantly that the chassis is square and the frames are straight and checking that the rear of the rear firebox bracket is vertical.

Solder in place the brake hanger pivots from 0.8 mm wire. The middle wire will need to cut flush with the inside of the frames to allow the compensation beams to go in place.

FITTING THE COMPENSATION BEAMS.

Full Compensation. Solder a piece of 1/16" wire through the holes in the front compensation rod mounting. For the rear beams cut a piece of 1/8" brass rod so that it fits through the holes C1 and is flush with the outside face of the chassis frames. Cut two equal pieces 5/32" tube which together fit between the frames and solder each compensation beam (F9) to the tubes close to one end. Temporarily fit the beams.

Partial Compensation. For the simpler system fix both beams (F9) centrally to a piece of 5/32" tube as shown in Fig 5.

Temporarily fit all the wheels and axles and confirm that the compensation works properly and check that the chassis is sitting level. The height of the top of the frames above the rails, between the coupled wheels should be 44.0 mm. Solder in 0.8 mm wire for the brake pivots and then attach the brake hanger pivot overlays (F17) to the front and centre axle hangers as shown in Fig 5. The compensation beam pivot is retained by the centre brake hanger pivot overlay.

No.	Description	Sheet			
F3	Frame stay (firebox bracket)	A1	F7	Frame stay (reversing rod bracket)	B1, B3
F4	Frame stay (horizontal)	A1	F9	Compensation beam (2)	A3
F5	Frame stay (compensation rod)	A1	F17	Brake hanger pivot overlay (4)	B1, B3
F6	Frame stay (cylinder mounting)	A1			

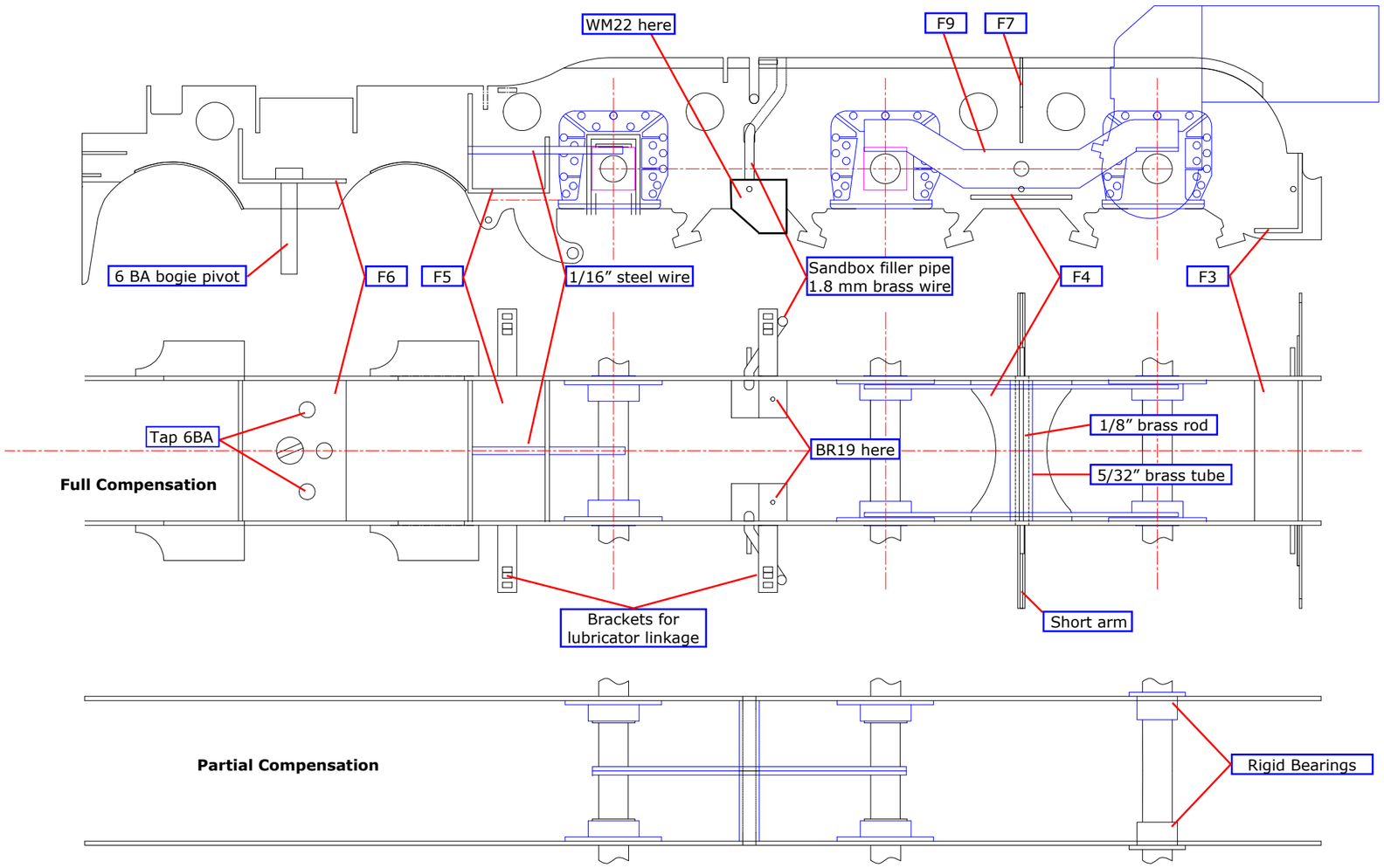


Fig 4. Frame Erection and Compensation

DETAILING THE FRAMES AND THE REAR FRAMES

Detailing. Solder the reversing lever bracket overlays (F10) in place. Add the reversing lever bracket ribs (F11) to the lower edge of the middle reversing rod bracket and trim to length. Solder the radius link bracket frame overlay (F12) in place. Then attach the slide bar bracket frame overlay (F13).

Attach the bogie splashers, front and rear (F14 & F15) in the frame cut-outs and depending on the date modelled, add the frame guard irons (F16) to the outside of the frames.

Rear frames. Fold in the radial truck hornguides on the rear inner frame extension (F18). Now make all the bends on the inner frame extension, all 90° and with fold lines **inside,** then solder in place on the rear of the frame stay (rear firebox bracket) ensuring that the rear frame will be level. Fold the rear frame spacer (F19) and solder into place as shown, ensuring that the rear frames remain square and true. Emboss the rivets on the rear outer frame extension (F20) and form to fit. Check everything fits correctly before soldering the rear frames in place. Detail the rear frames by first adding the axle boxes (WM7 & WM8) and then the springs (NS9) followed by the rear steps, upper and lower (F21 & F22), the rear spring retaining bracket (F23), the rear frame footplate bracket overlay (F24) and the drag beam bracket overlay (F25) together with the Cartazzi axlebox ties from 1.25 mm wire.

Bend the firebox below footplate wrapper (F26) to shape and solder around the firebox below footplate former (F27) to make the lower firebox. Add the washout plugs at the corners from 1 mm square wire and the blowdown tap (BR7), before soldering in place on top of the rear inner frame extension.

No.	Description	Sheet	No.	Description	Sheet
F10	Reversing lever bracket overlay (2)	B1	F20	Rear outer frame extension (2)	B2
F11	Reversing lever bracket rib (2)	B1	F21	Rear steps upper (2)	B1
F12	Radius link bracket frame overlay (2)	B3	F22	Rear steps lower (2)	B1
F13	Slide bar bracket frame overlay (2)	B2	F23	Rear spring retaining bracket (4)	B2
F14	Bogie wheel splasher front (2)	B3	F24	Rear frame footplate bracket overlay (4)	B1
F15	Bogie wheel splasher rear (2)	B3	F25	Drag beam bracket overlay (2)	B2
F16	Frame guard iron (2)	B3	F26	Fire box below footplate wrapper	B1
F18	Rear inner frame extension	A1	F27	Fire box below footplate former	B1
F19	Rear frame spacer	A1			

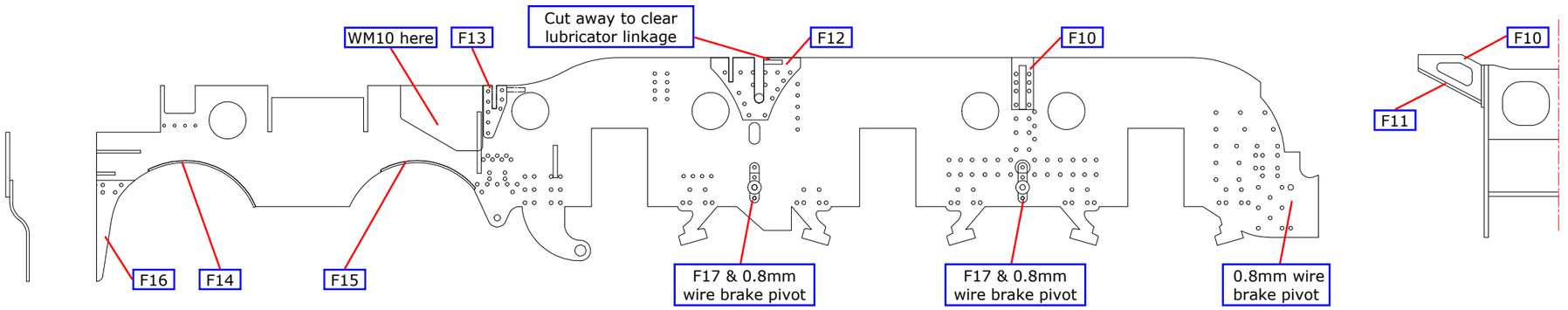


Fig 5. Frame Detailing

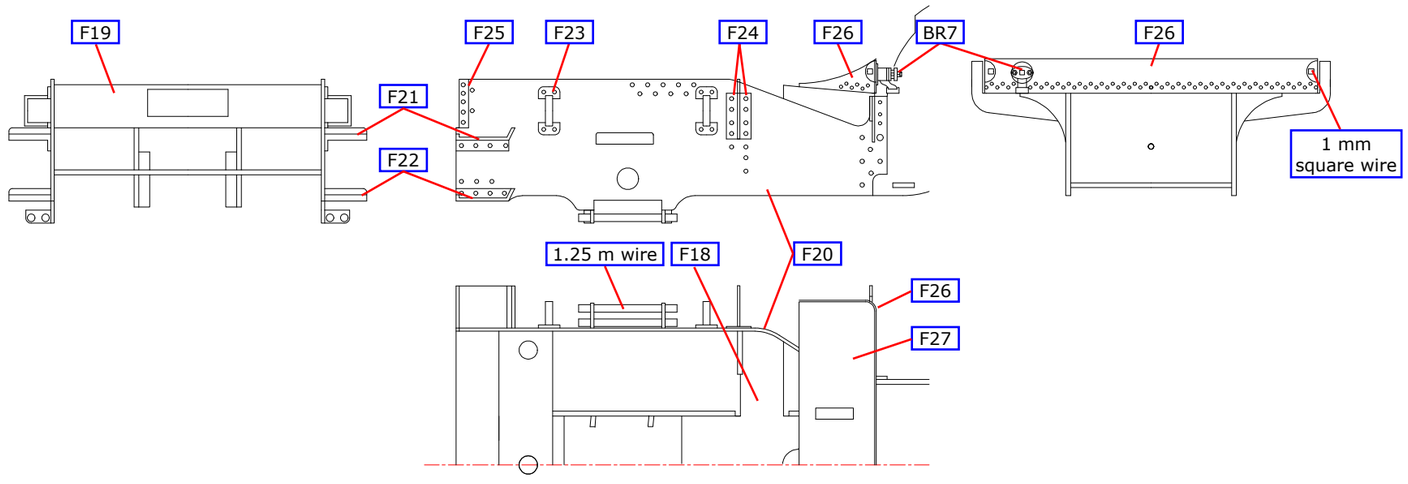


Fig 6. Rear Frames

RADIAL TRUCK & BOGIE

Radial truck. Fold up the spring wire brackets and side play stops on the radial truck top plate (F28). Fold up the radial truck bottom and ends (F29) and attach the top plate. Check for free, but not sloppy, movement in the horngUides. Solder the small top hat bearings in place and fit the radial truck wheels using the washers to eliminate any side play. Bend up the spring wire to give some downward pressure and solder in place through the bracket on the inner frame extension and the hole in the rear firebox Bracket. The radial truck is retained with lengths of 1 mm square wire.

Bogie. Emboss all the frame rivets on the bogie frames (BO1) as shown in Fig 8. There are two choices of bearing, plain top hat bearings or detailed white metal bearings (WM23), gently open out the holes in the side frames and fit the bearing of choice.

NOTE; top hat bearings are inserted from the outside, white metal bearings are on the inside. Once satisfied with the fit, solder the bearings in place. Use an appropriate reamer to ease the holes in both bearings to give a free rolling chassis once the bogie assembly has been completed.

Fold up the guard irons (BO2) and solder in place on the inside of the frames. Fold up the centre frame stay (BO3) and reinforce the spring wire retaining brackets with a fillet of solder. Solder the frames and frame stay together and add the front and rear frame stays (BO4 & BO5) using the width of your choice. Form the dust shields (BO6) to shape and solder in place.

Using appropriate washers (F43) fit the wheels so that there is a minimum of side play. Bend up the spring wire to give some downward pressure and solder in place through the holes in (F5). The bogie is retained with a 6 BA nut.

Completing the chassis mechanically. Assemble the wheel sets, bearings and motor/gearbox selecting 3/16" axle washers (F44) of appropriate thickness to control side play. Side play on the leading axle should be kept to a minimum to avoid clearance problems with the valve gear and connecting rod. The cranks on the right hand side should lead the left by 120°. Now connect the motor to your pick-ups and test run.

Fold the front buffer beam stay (FO40) so that it traps the buffer gaiters (BR25) on the inside and fix to the frames, fold down the backing plates and angled straps as shown in Fig 9, add the later style steps (FO41 & 42).

No.	Description	Sheet			
F28	Radial truck top plate	A1	BO1	Bogie frame (2)	A2
F29	Radial truck bottom & ends	A1	BO2	Bogie guard iron (2)	B3
F43	Washer 1/8”	A1	BO3	Bogie centre frame stay	B2
F44	Washer 3/16”	A1	BO4	Rear bogie frame stay	A1
FO40	Frame stay behind buffer beam	B1	BO5	Front bogie frame stay	A2
FO41	Later front step upper (2)	B3	BO6	Bogie dust shield (2)	B3
FO42	Later front step lower (2)	B3			

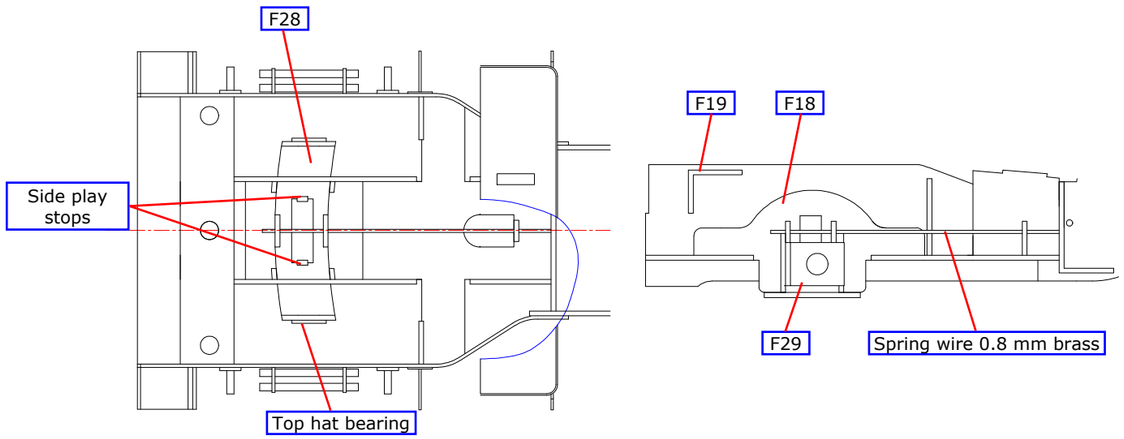


Fig 7. Rear Truck

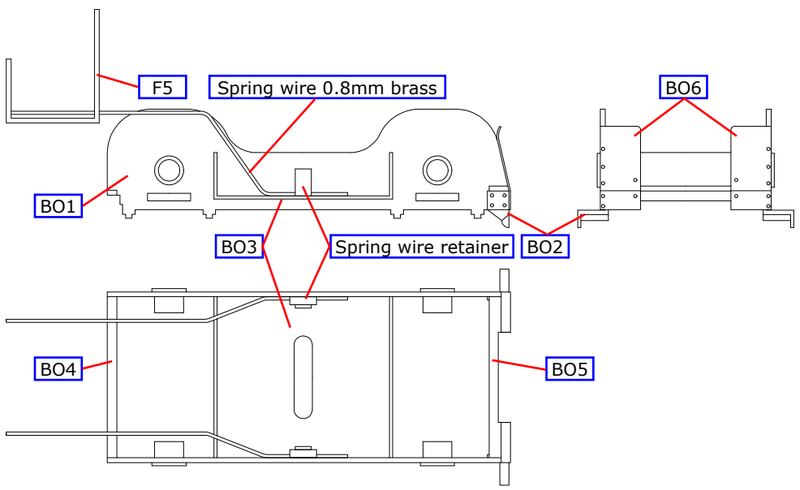
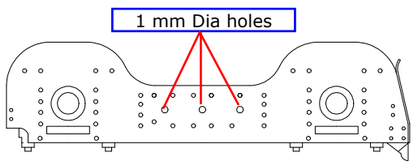
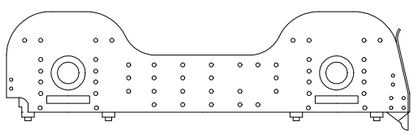


Fig 8. Bogie



Helical Spring Side Control EO 331



Swing Link Side Control EO 314 & 317

Fig 9. Front Frame Stay and Steps

CYLINDERS AND MOTION BRACKET

CYLINDER ASSEMBLY

Check all the holes in the cylinders (M5) against the appropriate components and open up the holes if necessary. Reduce the width of the inside cylinder faces to the etched lines provided as appropriate, so that the cylinders are a good fit in the slots in the frames. Fold up the cylinders making sure they are square and fold out the 2 to 1 arm bracket.

Construct the slidebars (M6) as shown in Fig 10. Build the stack of laminations with layer 6 on the bottom up to layer 1 on top. Use plenty of solder whilst applying pressure to keep the laminations together. Clean off the front and rear faces and remove the rear section. The crosshead slot will need cleaning out so that the crosshead (NS3) is a good fit. This can be done with a thin file or by using a piece of emery paper over a scrap piece of brass etch. The appearance of the slidebars is much improved by carefully filing the top smooth.

Insert the slidebars in the cylinders and tack solder in place. After checking all is square and parallel they are permanently attached. Attach the piston rod gland castings (NS4) and check that the crosshead slides properly. Solder the valve crosshead guides (BR17 & BR18) in place aligning them with a piece of 1.4 mm wire passed through the valve rod holes. Note BR17 is shorter and should be at the front.

Drill out the holes for the relief valves on the front cylinder covers, left and right (NS5 & NS6), marked on the inside, so that the relief valves (BR3) fit. Attach the front covers and fit the relief valves. Add slide bar front flange (M7) as shown in Fig 11.

Solder the slide bar bracket laminations (M9) together back to back. Attach the cylinders to the chassis with two 6 BA bolts. Fit the slide bar bracket through the frame slots and solder to the slidebars.

MOTION BRACKET

Bend up, in a Hold and Fold or vice , the motion brackets (M10) centring the bends on the etched slot. Solder the motion bracket inner (M11) in the slot in the motion bracket ensuring that the holes for the radius link pivot align horizontally and vertically. Solder the motion brackets to the motion bracket stretcher (M12) as shown and check the assembly fits in the frame slots. Solder short pieces of 1.8 mm wire to the brackets for the expansion link pivots on the inside of M10 & M11.

No.	Description	Sheet	No.	Description	Sheet
M5	Cylinders	A2	M10	Motion bracket (2)	A3
M6	Slide bar lamination (12)	A3	M11	Motion bracket inner (2)	A3
M7	Slide bar front flange plate (4)	A3	M12	Motion bracket stretcher	A3
M9	Slide bar bracket lamination (2)	A3			

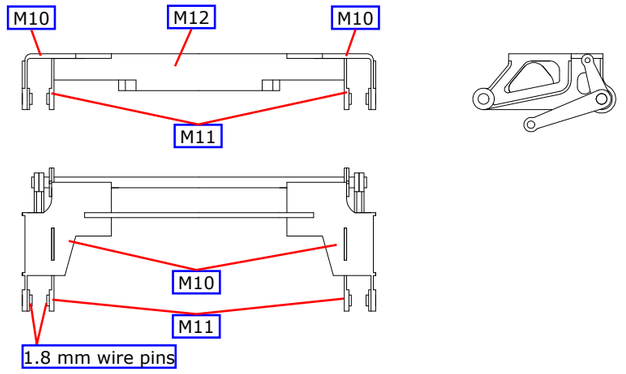


Fig 12. Motion Bracket

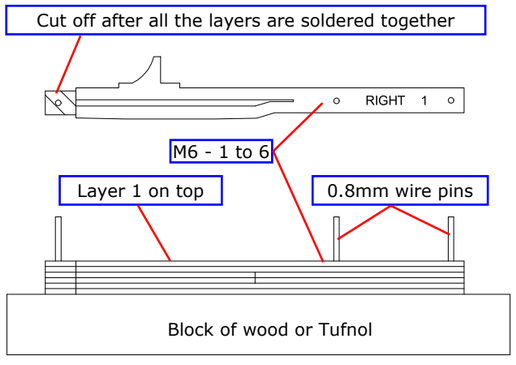


Fig 10. Slidebars

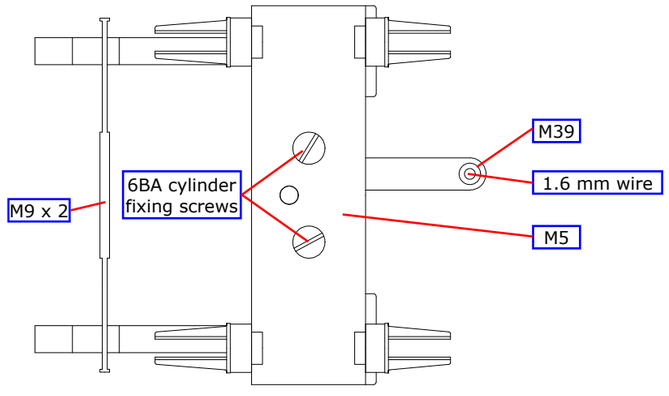


Fig 11. Cylinders

MOTION 1

VALVE GEAR JOINT ASSEMBLY

All the valve gear joints, with the exception of the eccentric arms/eccentric rods, are made with wire pins soldered on the inside (back). This clearly runs the risk of soldering the joint solid. To minimise this:

(i) ensure the pin is a tight fit in the hole.
(ii) use oil or a proprietary solder mask.
(iii) use plenty of flux, a small amount of solder, and be quick!

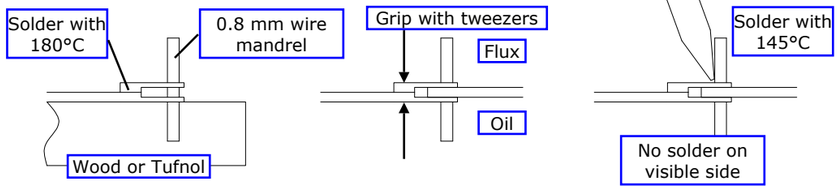


Fig 13. Valve Gear Joints

No.	Description	Sheet	No.	Description	Sheet
M13	Expansion link outer lamination (4)	A3	M21	Union link outer lamination (2)	A3
M15	Expansion link inner lamination - LTV (4)	A3	M22	Rear valve rod flanges (4)	A3
M16	Radius rod (2)	A3	M23	Motion bracket - washer - (2)	A3
M17	Radius rod rear lamination (2)	A3	M24	Connecting rod inner lamination (2)	A3
M18	Radius rod fork joint (2)	A3	M25	Connecting rod outer lamination (2)	A3
M19	Combination lever (2)	A3	M26	Connecting rod boss lamination (4)	A3
M20	Union link inner lamination (2)	A3	M28	Crosshead arm - LTV (2)	A3

Expansion Link. Drill out the holes in the expansion link laminations (M13 & M15) to take the 0.45 mm wire pins which align the laminations and represent the bolt heads. Solder the inner laminations (M13) together with 4 lengths of 0.45 mm wire as shown. Check that the slot in the inner laminations is a sliding fit with the 1.25 mm wire.

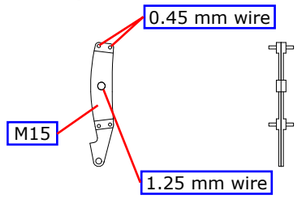


Fig 14. Expansion Link

Radius Rod. Place the radius rod (M16) and radius rod rear lamination (M17) over the expansion link, align with a piece of 1.25 mm wire, and solder the lamination to the rod. Solder the 1.25 mm wire pin in place and clean off flush. The radius rod should now move smoothly in the link. Add the fork joint (M18) to the front of the radius rod.

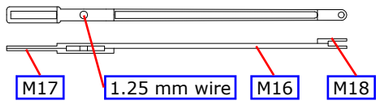


Fig 15 Radius Rod

Open out the holes in the expansion link outer lamination (M13) so that they are a good fit on the pivot wires on the motion bracket. Solder the outer laminations in place and cut off and dress the 0.45 mm wire to represent the bolt heads. Gently spring the links in place in the motion bracket, inserting washers (M23) as necessary to ensure that the links pivot freely and are vertical.

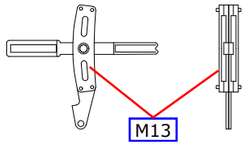


Fig 16. Expansion Link and Radius Rod

Combination Lever, Union Link and Valve Rod. Form the joggle in the combination levers (M19) with the fold lines inside reinforcing the bends with solder. Assemble the union link (M20 & M21) and rear valve rod flanges (M22). Make the valve rods as long as possible so that they just go in past the slide bar bracket. Pin together the combination lever, union link, valve rod and radius rod.

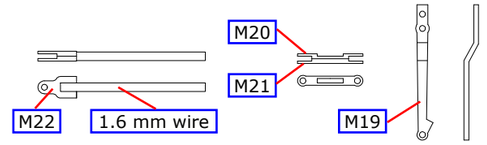


Fig 17. Combination Lever, Union Link and Valve Rod

Connecting Rods and Crossheads. Solder together the connecting rod inner and outer laminations (M24 & M25) and add the rod boss laminations (M26) to the big end back and front. Drill the big end to fit the crankpins and the small end to 1.6 mm. Solder the crosshead arm (M28) to a piece of 1.6 mm wire as a pin. Fit the connecting rod to the crosshead, ensuring the crosshead arm is vertical, carefully solder the pin from the rear and file flush. Fit the connecting rods with a thin washer between the coupling rods and connecting rods and check the clearance of the connecting rod and the leading axle crankpin nut. You will possibly have to reduce the thickness of the nut.

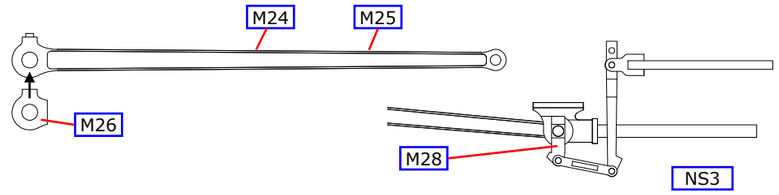


Fig 18. Connecting Rods and Crossheads

MOTION 2

Eccentric Rod and Arm. Add the eccentric rod fork joint (M30) to the eccentric rod (M29). Reduce the diameter and thickness of the rivet heads so that they will fit in the recess in the back of eccentric rod bearing overlay (M32). Tap the crankpin hole in the eccentric crank (M31) for the crankpin. Fit the arms on the crankpin and tighten so that the offset of the end of the arm is 4.4 mm ahead of the main crank pin, see motion drawing below. Rivet the radius rod to the arm and add the bearing overlay.

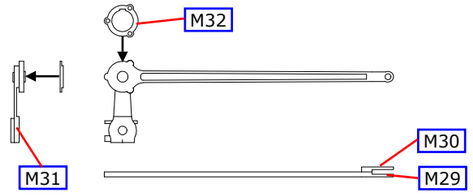


Fig 19. Eccentric Rod and Arm

Now pin the remaining two joints between the union link and crosshead arm and between the radius link and eccentric rod. Check that the motion works smoothly. Install the over length reversing cross shaft made from 1.8 mm wire through the frames and attach the reversing lever cranks (M33) (drivers side) and (M34) (fireman's side), ensure the horizontal arms are parallel with each other. Trim the 1.8 mm wire to leave a small stub to replicate the boss. Add the pins through the ends of the cranks and through the slots in the radius rods. By rotating the cross shaft you should now be able to reverse the motion!

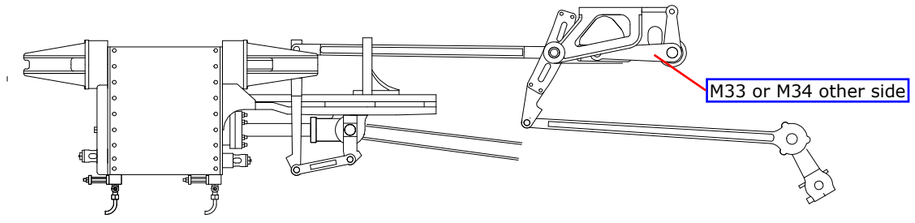


Fig 20. Valve Gear Assembly

2 to 1 Lever. Assemble the 2 to 1 lever (M35 & M36) and the front valve rod flanges (M37) as shown in Fig 21. Pin the valve rods, 2 to 1 lever and equal lever (M38) together. Solder a 1.6 mm wire pin in place in the bracket attached to the cylinders. Make the pin just long enough so that the 2 to 1 arm can be sprung in place over the washer (M39), see Fig 11. Adjust the valve rods to length so that they do not interfere with the rear valve rods and check for free movement. Now link the valve rods together with hoops of 0.8 mm wire (see Fig 11) checking that you have equal backward and forward movement on the conjugated valve gear arms. This now means that the valve gear is permanently fixed to the cylinders but the complete unit can be removed by unscrewing the eccentric arms and cylinder bolts. With the motion finally assembled add the slide bar packing pieces M8 to retain the crosshead assemblies, see Fig 11.

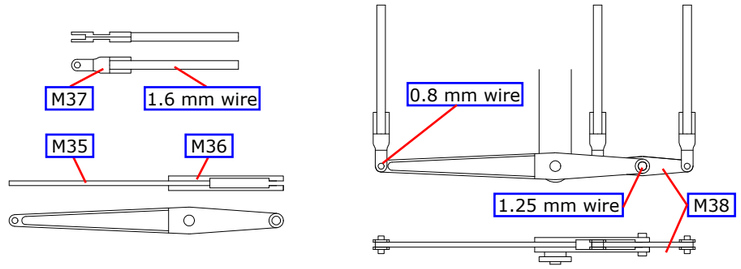


Fig 21. 2 To 1 Lever

Finishing. Form the cylinder wrappers (M40) to shape and solder in place making sure the drain cock holes are on the bottom centre line. Attach the drain cock castings (BR2). Emboss the rivets on the drain cock linkage (M41) and joggle the front lever, as shown BELOW, before soldering in place together with lengths of 0.8 mm wire to represent the operating rods.

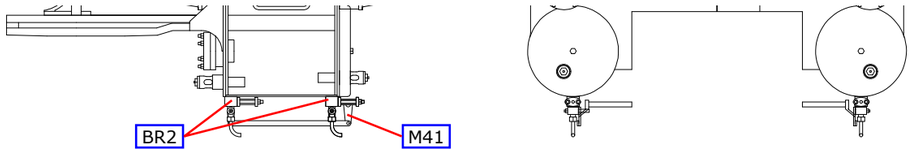


Fig 22. Cylinder Drain Valve

No.	Description	Sheet			
M8	Slide bar rear packing piece (2)	A3	M35	2 to 1 lever	A3
M29	Eccentric rod (2)	A3	M36	2 to 1 lever lamination (2)	A3
M30	Eccentric rod fork joint (2)	A3	M37	Front valve rod flange (6)	A3
M31	Eccentric crank (2)	A3	M38	Equal lever	A3
M32	Eccentric rod bearing overlay (2)	B2	M39	2 to 1 lever washer	A3
M33	Reversing crank lamination, reversing rod side	A3	M40	Cylinder wrapper (2)	B3
M34	Reversing crank lamination, non reversing rod side	A3	M41	Drain cock linkage (2)	B3

FINISHING THE CHASSIS

Brakes. Assemble the brake hangers (B1 & B2) first embossing the rivet on each lamination. Attach the hangers to the pivot wires.
Emboss the bolts in the brake pull rods & cross shafts (B3) and the brake cross shaft overlays (B4, B5 & B6) and solder the cross shaft overlays to the top of B3. Fix this assembly to the brake hangers.
Laminate together and then fit the front brake pull rod laminations (B7). The brake shaft is made from 2.0 mm wire and fits through the holes in the frames and is soldered to the pull rods. Mount and attach the brake cylinders (WM11) to the front compensation beam mounting frame stay.

Assemble the wheel sets, bearings and motor/gearbox, selecting 3/16" axle washers (F44) of appropriate thickness to control side play. Side play on the leading axle should be kept to a minimum to avoid clearance problems with the valve gear and connecting rod.

The cranks on the right hand side should lead by 120°, attach the coupling rods and test for free running, fettle where appropriate.

Once running smoothly add the balance weights (F34 & F35) as shown in Fig 24.

The axles are now retained by the springs, formed from a triple lamination of F31, F32 and F33.

Complete the chassis detailing by fitting the front sandboxes (WM10), sandpipes (0.8 mm wire), steam sanding pipes (BR19) and sand box filler pipes (1.8 mm wire) as shown in Figs 4 -5 & the GA.

Drawbar. Attach a washer (F37) to the head of a 6BA screw (see Fig 25), remove the cusp from the insides of the pivot holes so that the drawbar (F36) fits over the head of the screw. Pass the drawbar through the rear drag beam and use the screw to retain.

No.	Description	Sheet			
B1	Brake hanger lamination (rear)	B3	F31	Spring centre lamination (6)	A3
B2	Brake hanger lamination middle & front (8)	B1, B3	F32	Spring outer lamination (6)	A3
B3	Brake pull rods & cross shafts	B1	F33	Spring inner lamination (6)	A3
B4	Front brake cross shaft overlay	B1	F34	Balance weight, leading & trailing axle (4)	B3
B5	Middle brake cross shaft overlay	B1	F35	Balance weight, centre axle (2)	B1
B6	Rear brake cross shaft overlay	B3	F36	Drawbar	B3
B7	Front brake pull rod laminations	B1	F37	Drawbar washer	B3
			F44	Wheel washers (16) Driver	A1,A2

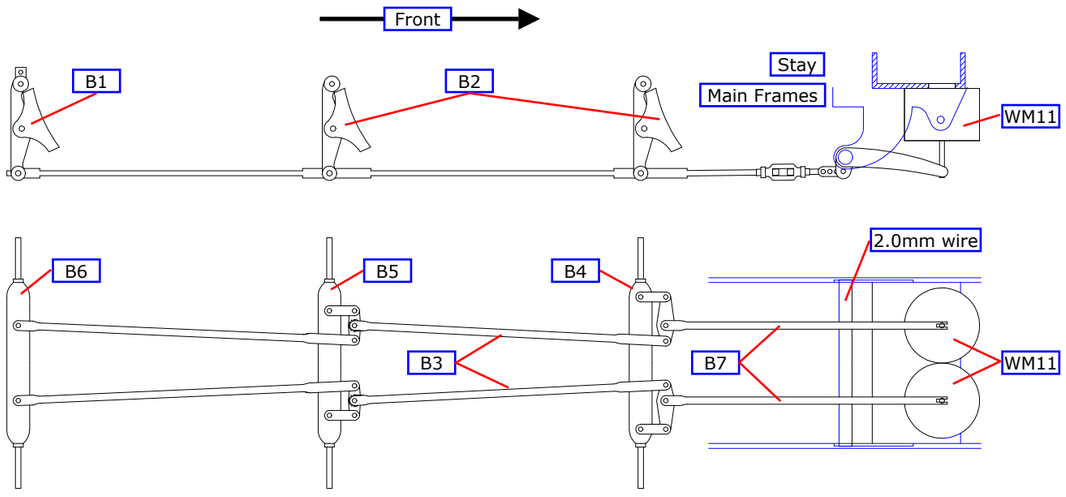


Fig 23. Brake Rigging

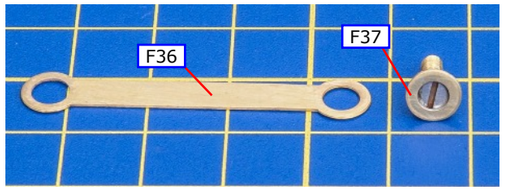


Fig 25. Drawbar

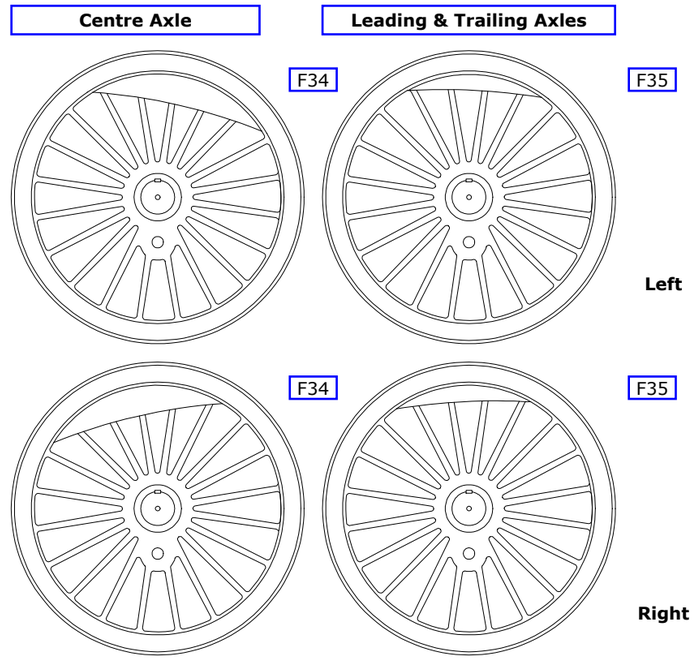


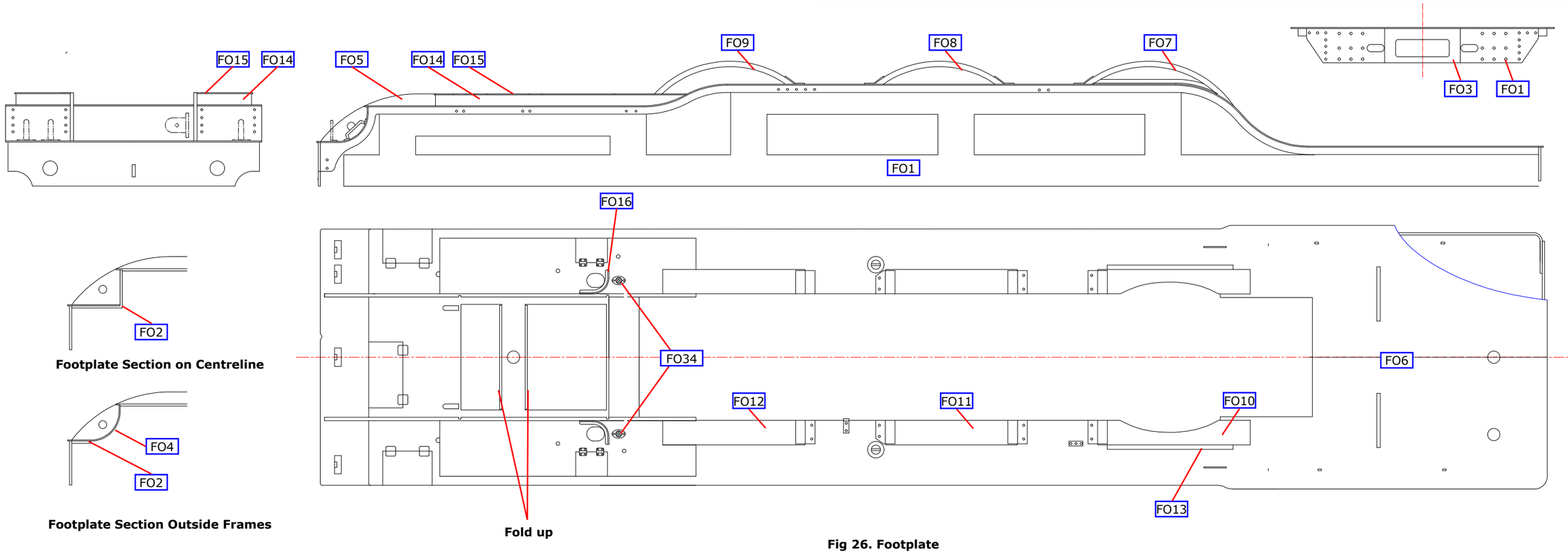
Fig 24. Balance Weights

FOOTPLATE 1

Emboss the rivets on the valances (FO1) and fold up. Now emboss the rivets on the drag beam and buffer beam to match your chosen engine and fold up. There are two fold lines below the drag beam and the fold should be made on the lower one.. Curve the valance behind the drag beam as shown below. Fold up the front drop plate (FO2) and then fold the lamp irons so that they face upward, solder the assembly in place behind the buffer beam and between the valances so that it is flush with their upper edges. Carefully form the bends in the footplate by bending over a rod of suitable diameter. Fold up the strengthening ribs either side of the body fixing nut. Now solder the footplate in place with the valances in the half etched recess along each side and the front drop plate in the recess under the front edge. Add the drag beam overlay (FO3) to the rear drag beam and a 6BA nut over the middle hole at the rear. This now gives a sturdy platform upon which to construct the upper works, The excess metal is not broken away until the boiler is fixed to the footplate.

Curve the outer edges of the front drop plate footplate overlay (FO4) and locate in place over the lamp irons. Locate the front frame extensions (FO5) and then solder up all the joints at the front end. Locate the half etched groove in the splasher fronts, rear, middle and leading (FO7,FO8 & FO9) on the footplate (FO6) edge and solder in place in the centre of each opening. Curve the splasher tops, rear, middle and leading (FO10,FO11 & FO12) to shape by rolling underneath a suitable rod or dowel on a resilient surface (a piece of rubber sheet). Emboss the rivets, and fold up the end brackets before soldering in place. Add the rear splasher footplate overlay (FO13) as shown below. Fold up the valve cover boxes (FO14) and solder in place in the half etched recesses in the footplate. Form the valve cover box sand filler rim (FO16) and solder in place on the valve cover box top (FO15) then attach the two Sandbox spindle bearing overlays (FO34) before soldering the valve cover box top in place on the valve cover box.

No.	Description	Sheet			
FO1	Valence, bufferbeam & dragbeam assembly	B3	FO10	Splasher top, rear axle (2)	B2
FO2	Front drop plate	B3	FO11	Splasher top, middle axle (2)	B2
FO3	Dragbeam overlay	B1	FO12	Splasher top, leading axle (2)	B2
FO4	Front drop plate footplate overlay	B3	FO13	Rear footplate splasher overlay (2)	B1
FO5	Front frame extension (2)	A1	FO14	Valve cover box (2)	B3
FO6	Footplate	B3	FO15	Valve cover box top (2)	B3
FO7	Splasher front, rear axle (2)	B1	FO16	Valve cover box sand filler rim (2)	B2
FO8	Splasher front, middle axle (2)	B2, B3	FO34	Sandbox spindle bearing (2)	B2
FO9	Splasher front, leading axle (2)	B3			



Footplate Section on Centreline

Footplate Section Outside Frames

Fig 26. Footplate

FOOTPLATE 2

Fit the smokebox saddle casting (WM18) between the frames aligning it with the half etched lines on the inside of the frames. The front end detail can now be completed by adding the footplate access door hinges (FO17), the pot lubricators (BR5), the front sandbox lids (BR20), extra footplate lamp irons (FO18)-if required, the front end cover plate, either original (FO19) or later type with overlay (FO20 & 21) as appropriate.

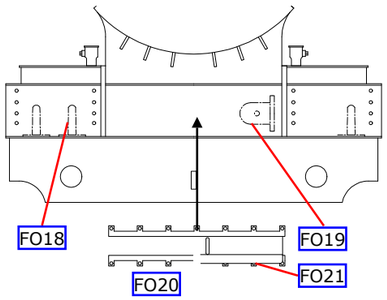
Sanding levers. Twist the sanding rod (FO28) through 90° in the places marked **X** and add the crank overlay (FO29) on top, above this, add the crank bracket overlay (FO30) and pass a short length of 0.45 mm wire through the pivot point and pin this assembly to the footplate. Fit the transverse rod overlays (FO33) to the top at each end of the transverse rod (FO32) and front crank overlay (FO31) as shown in Fig 27. Add 0.45 mm wire pins at each end and the inner offset pivot.

Attach the transverse sanding rod so that the outer pins align with the spindle bearings on the valve travel covers. The inner offset pivot should now align with the free front end of the main sanding rod (FO32). Note the height difference between the two rod assemblies and join the two.

Lubricators. Attach the front and rear lubricator arms (FO24 & FO25) to the lubricators (BR4), then add the hand wheels (FO26) over the arms; pass the arms through the footplate and valve cover box and secure the lubricators. Fix the lubricator foot (FO27) to the front left side lubricator only to complete their installation. The mechanical linkage (FO23) is best fitted once the footplate support structure has been removed. Detail the lubricators with 0.3mm brass wire, use prototype photos to ascertain pipe runs.

Buffers, hooks & hoses. Assemble the buffers as shown in Fig 28 and attach to the front buffer beam, Add the two grab irons to the dropped footplate from 0.45 mm wire as shown in Fig 27 and finally add the front vacuum pipe and stand (NS8) to the buffer beam, its location is defined by the small notch in the footplate (FO6). An etched hook is supplied in the kit (FO37) if you wish to use it.

No.	Description	Sheet			
FO17	Footplate access door hinges (6)	B3	FO29	Sanding rod crank overlay	B2
FO18	Extra footplate lamp iron	B2	FO30	Sanding rod crank bracket overlay	B3
FO19	Front end cover plate, original type	B2	F031	Sanding rod front crank overlay	B3
FO20	Front end cover plate, later type	B2	FO32	Sanding rod transverse	B1
FO21	Front end cover plate overlay, later type	B2	FO33	Sanding rod transverse overlay (2)	B3
FO23	Mechanical lubricator linkage, late type	A1	FO35	Damper operating rod (2)	A2
FO24	Mechanical lubricator arm, front	A2	FO37	Etched hook (2)	A2
FO25	Mechanical lubricator arm, rear	A2			
FO26	Mechanical lubricator handwheel (2)	A2, A3			
FO27	Mechanical lubricator foot	B2			
FO28	Sanding rod	B3			



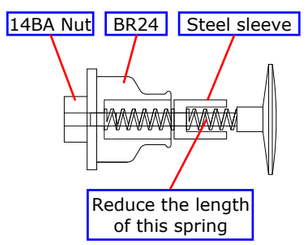


Fig 28. Buffer Assembly

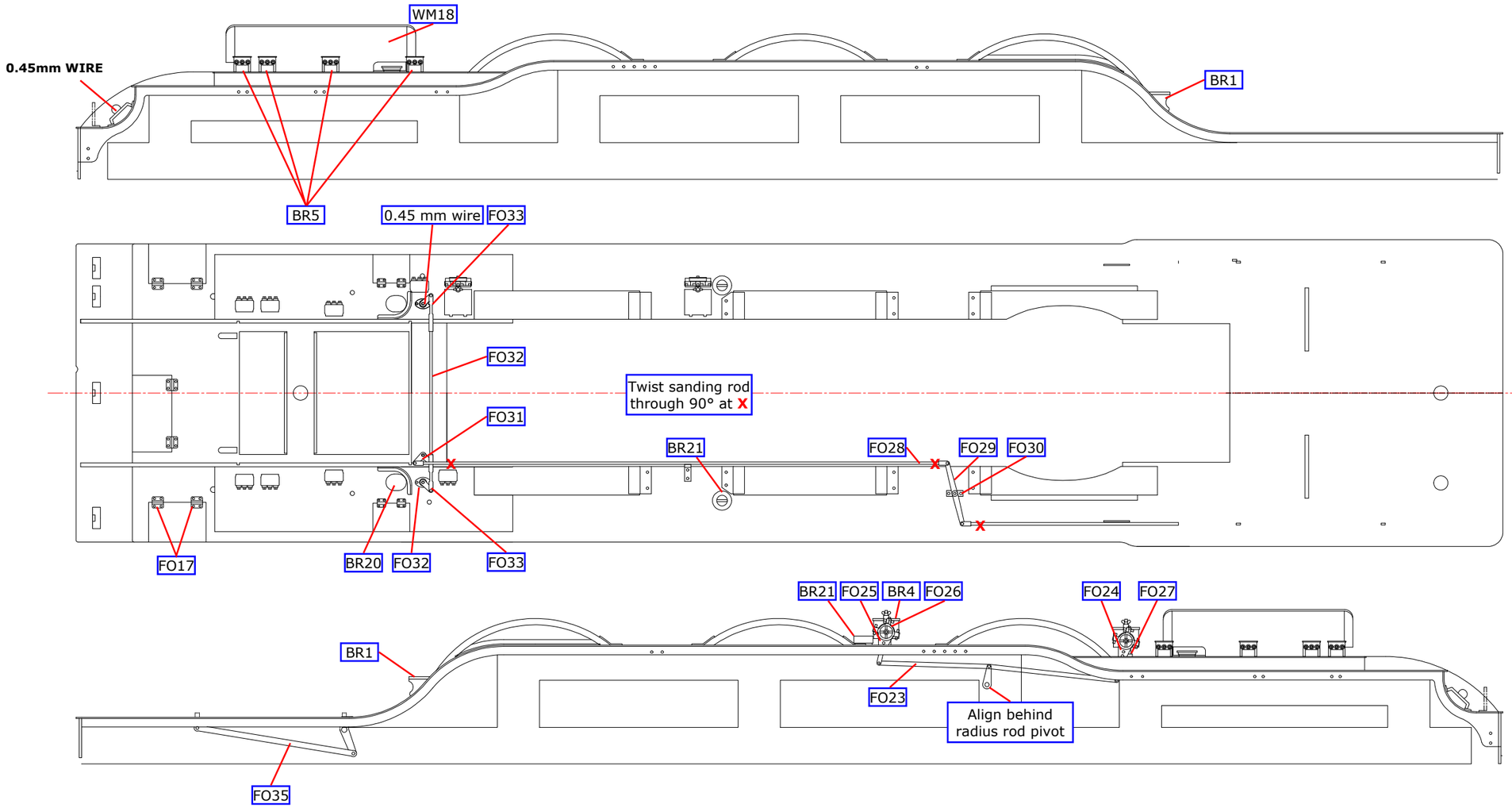


Fig 27. Footplate

FIREBOX, BOILER & SMOKEBOX CONSTRUCTION

Firebox. Do not remove the cusp around the edges of the firebox and boiler formers and the firebox former spacer or they will be too small. Pin together, using 0.8mm wire pins, the firebox front spacer (SB2), the front former lower extension (SB3), and the front former packing piece (SB4) as shown below with the packing piece with the cut outs for the sanding and reversing rods on the left side. Fold this assembly along the fold lines and solder together with the firebox rear former (SB1) and the firebox former spacer (SB5) to make the firebox cage. Open up the slots for the sanding and reversing rods and round the sloping front edge.

Solder the upper mudhole doors (SB6) and the lower mudhole doors (SB7) in place on the firebox wrapper (SB8) before forming the wrapper to shape. Centre the wrapper on the formers by using the small notches in the top of the formers (accuracy here is essential) before soldering the wrapper in place. Solder two short pieces of 1.25 mm wire into the holes in the rear former to act as dowels to locate the firebox and cab. Alternatively 10 BA screws could be used. Fix the mudhole doors clamps (BR23) in place and the upper washout plugs/doors (SB20). Add the safety valve plates (SB19) to the firebox top and then fit the safety valves (BR6). Solder the handrail knobs in place and add the lower handrail from 0.8mm wire.

Coned Boiler. Form the coned boiler wrapper (SB9) by rolling and check for fit around the formers, rear and front (SB10 & SB11). Bend the boiler band joining brackets on the coned boiler joining strip (SB12) and fit through the small slots from inside the boiler. If the fit is good and the formers fit then solder the wrapper ends together with the joining strip. Solder the formers in place so that they are almost flush with the ends with the etched notch at the top of the rear former aligned accurately with the notch in the wrapper. Solder two short pieces of 1.25 mm wire into the holes in the rear former to act as dowels to locate the boiler and firebox. Alternatively 10 BA screws could be used. Check the boiler/firebox fit. Represent the bolts in the joining brackets using 0.45 mm wire and solder the handrail knobs in place..

Smokebox/Parallel Boiler. If you are fitting the smoke deflectors then drill the appropriate holes as shown in Fig 29 using the supplied measurements. In addition the front hand rail knob hole will need filling.

Emboss the rivets around the ejector exhaust pipe flange on the smokebox/parallel boiler wrapper (SB13). Roll the wrapper and check-fit it on the formers, rear (SB14) and smokebox front (SB15). Solder the wrapper ends together using the smokebox/parallel boiler joining strip (SB16) after first folding down the boiler band joint brackets. Position the formers flush with the back and front with the two handrail knob holes on the front spacer equally spaced from the adjacent holes on the wrapper and solder in place. Drill out (**NOTE, DO NOT** drill these holes if deflectors are fitted) the handrail knob holes in the smokebox front overlay (SB17) and attach to the front of the smokebox aligning the handrail holes. Add the remaining handrail knobs, **NOTE, DO NOT** add the first smoke box hand rail knob if deflectors are fitted, the boiler handrail stops short adjacent to the superheater cover casting.

Tap the hole in the parallel boiler rear former 6BA so that the smokebox and boiler can be screwed together. Now check-fit the boiler/smokebox to the firebox and saddle and once satisfied, solder the two halves of the boiler together. Fit the required dome to suit your engine, round (WM5) or streamlined (WM6).

Attach the firebox to the boiler and form the ejector exhaust pipe from 1.8 mm wire and attach using the exhaust ejector pipe bracket (SB18) through the slots in the boiler. Add the boiler handrail from 0.8mm wire, on deflector fitted engines this stops by the superheater cover behind the deflector, on all other engines it wraps around the front to end on the smoke box front.

No.	Description	Sheet			
SB1	Firebox rear former	A1	SB12	Coned boiler joining strip	B1
SB2	Firebox front former	A1	SB13	Smokebox & parallel boiler wrapper	B1
SB3	Firebox front former lower extension	A1	SB14	Parallel boiler rear former	A1
SB4	Firebox front former packing piece	A1	SB15	Smokebox front former	A1
SB5	Firebox former spacer	A1	SB16	Smokebox & parallel boiler joining strip	B1
SB6	Firebox upper mudhole doors (2)	A1	SB17	Smokebox front overlay	A1
SB7	Firebox lower mudhole doors (2)	A1	SB18	Exhaust ejector pipe bracket (5)	B3
SB8	Firebox wrapper	B1	SB19	Safety valve plate (2)	B2
SB9	Coned boiler wrapper	B1	SB20	Firebox washout door cover (12)	B3
SB10	Coned boiler rear former	A1			
SB11	Coned boiler front former	A1			

Fig 29. Smoke Deflectors Drilling Pattern

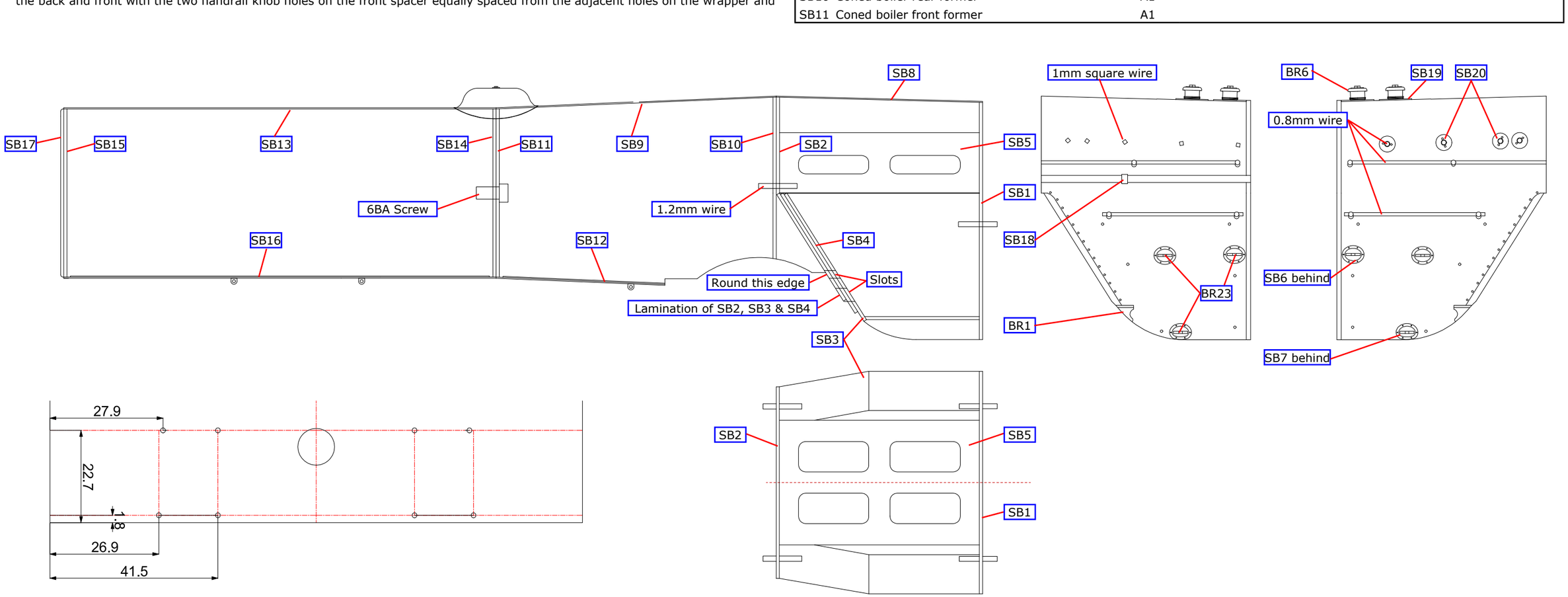


Fig 30. Boiler

SMOKEBOX DETAILS

Detailing. If fitting deflectors then fit the smoke box door (WM2) afterward. Drill a 0.5 mm hole for the top lamp iron (SB24), note there are two locations. Fold the top part and fit to the door, fold the lower part (SB25) and glue below (see Lamp Iron drawing below) Add the hand rail knobs (note late BR period engines have a split hand rail Fig 32) and 0.8mm wire, the smoke box door knob (NS1) and the smoke box door handles (NS7).

Attach the chimney of choice (WM3 or 4) and the two Superheater covers (WM9) as shown in Fig 30, select the correct snifting valve cover plate (SB22 or 23) followed by the valve (BR22).

The two works plates (SB26) are fitted one on each side as shown in Fig 30, finally, fit the anti carboniser (BR8) left and right hand sides and valve (BR9) right hand side only, use prototype photos to ascertain the pipes runs and fit accordingly.

Smoke Deflectors. Fold the deflector brackets (SB28) and deflector plates (SB27) as shown in Fig 32, form the two handrails from 0.8mm wire and fit to the deflector plates.

Attach the brackets to the deflectors then pass the ends through the base plates (SB29) and into the holes drilled in the smoke box wrapper (Fig 29) and fix from the inside. To complete the late BR version add the AWS cover plate (FO35) to the buffer beam.

No.	Description	Sheet			
SB22	Anti-vacuum valve plate, early	B1	SB27	Smoke deflector plates (2)	B1
SB23	Anti-vacuum valve plate, late	B1	SB28	Smoke deflector bracket (2)	B1
SB24	Lamp iron top	B3	SB29	Smoke deflector bracket base plate (8)	B3
SB25	Lamp iron lower	B3	FO35	AWS cover plate	B2
SB26	Works plate	B2			

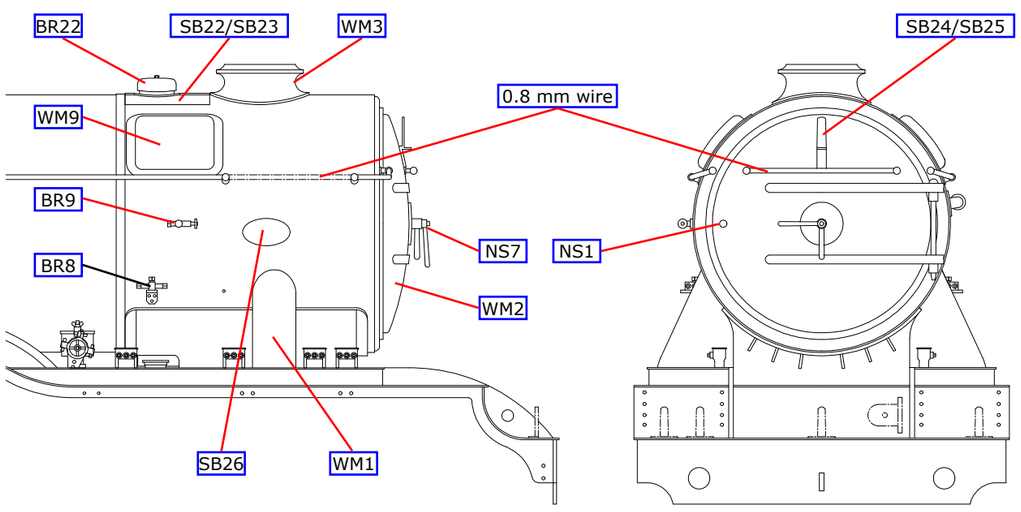


Fig 31. Smokebox detail

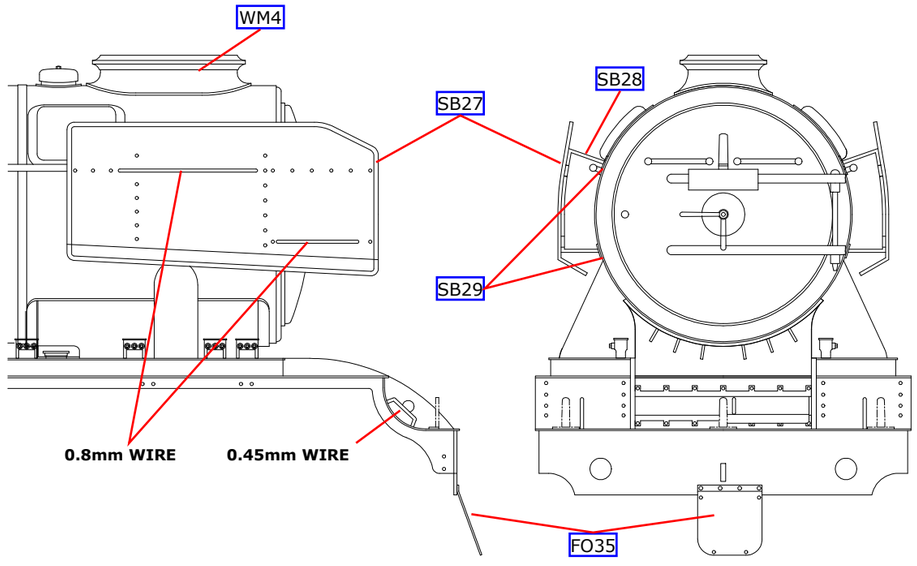
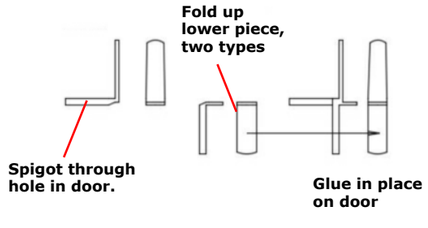


Fig 32. Smoke Deflectors



Lamp Irons

CAB

Fold up the cab floor support (C1) and solder the cab floor (C2) in place. Add the washout plugs from 1 mm square wire. Curve the rear edges of the cab sides, low or high cut-out (C3 or C4) and solder the rear inner beading, low cut-out or high cut-out (C9 or C10) inside the rear edge. Solder the cab doors (C5) to the hinges that form part of the inner beading. Solder the cab handrails in place.

The cab seats can be modelled in their early and late form. The early ones come as driver's (C11 & WM13) and fireman's (C12 & WM14). The later bucket seats (C13 & WM15) fit both sides. Assemble the cab seats and fix in place.
Emboss the rivets on the cab front (C6) and solder the window frames (C7) in place on the inside. Solder the cab sides and cab front to the cab floor. Fold down the tabs on the fallplate (C8) which fit in the slots in the cab floor to give a hinge effect.
Fit the cab footplate platforms, left and right (WM16 & WM17).

Windows. Solder the cab window inner layer (C14) in place (first file away the red shaded pieces shown in the drawing) aligning the small holes for the cab side windscreens (C18). Solder the cab window middle layer (C15) over the cab window inner layer (C14) before breaking off the rear piece along the half etched line. The cab window outer layer (C16) which retains the cab window sliding frame (C17) should not be fixed until painting and glazing are complete.

Cab roof. Fold up the back and front of the cab roof former (C19) which gives the solid base upon which to build the removable cab roof. Roll the cab roof (C20) to shape and solder in place with the cut-out for the ventilator as far forward as possible. Complete by adding the ventilator from the ventilator sides and back (C21), the ventilator top (C22) and the ventilator shutters (C23) which comes in two positions.

Add the rain strips (C24). Now using a Carborundum disc in a mini-drill cut through the unwanted part of the former and snap off the redundant parts along the half etched lines. The edges of the formers will now need cleaning up.
Once complete, add the whistle (BR10) to the cab front.

No.	Description	Sheet	No.	Description	Sheet
C1	Cab floor support	B2	C13	Cab seat support dual late (2)	B2
C2	Cab floor	B1	C14	Cab window inner layer (2)	B3
C3	Cab side low cut out	B2	C15	Cab window middle layer (2)	B2
C4	Cab side high cut out	B2	C16	Cab window outer layer (2)	B3
C5	Cab doors (2)	B1,B3	C17	Cab window sliding frame (2)	B1
C6	Cab front	B2	C18	Cab side screens (2)	B2
C7	Cab front window frames (2)	B2	C19	Cab roof former	B2
C8	Cab fall plate	B1	C20	Cab roof	B2
C9	Cab Inner beading low cut out	B3	C21	Cab ventilator sides	B1
C10	Cab Inner beading high cut out	B3	C22	Cab ventilator top	B1
C11	Cab seat support driver early	B2	C23	Cab ventilator shutters (2)	B3
C12	Cab seat support fireman early	B2	C24	Cab roof rain strips (2)	B2

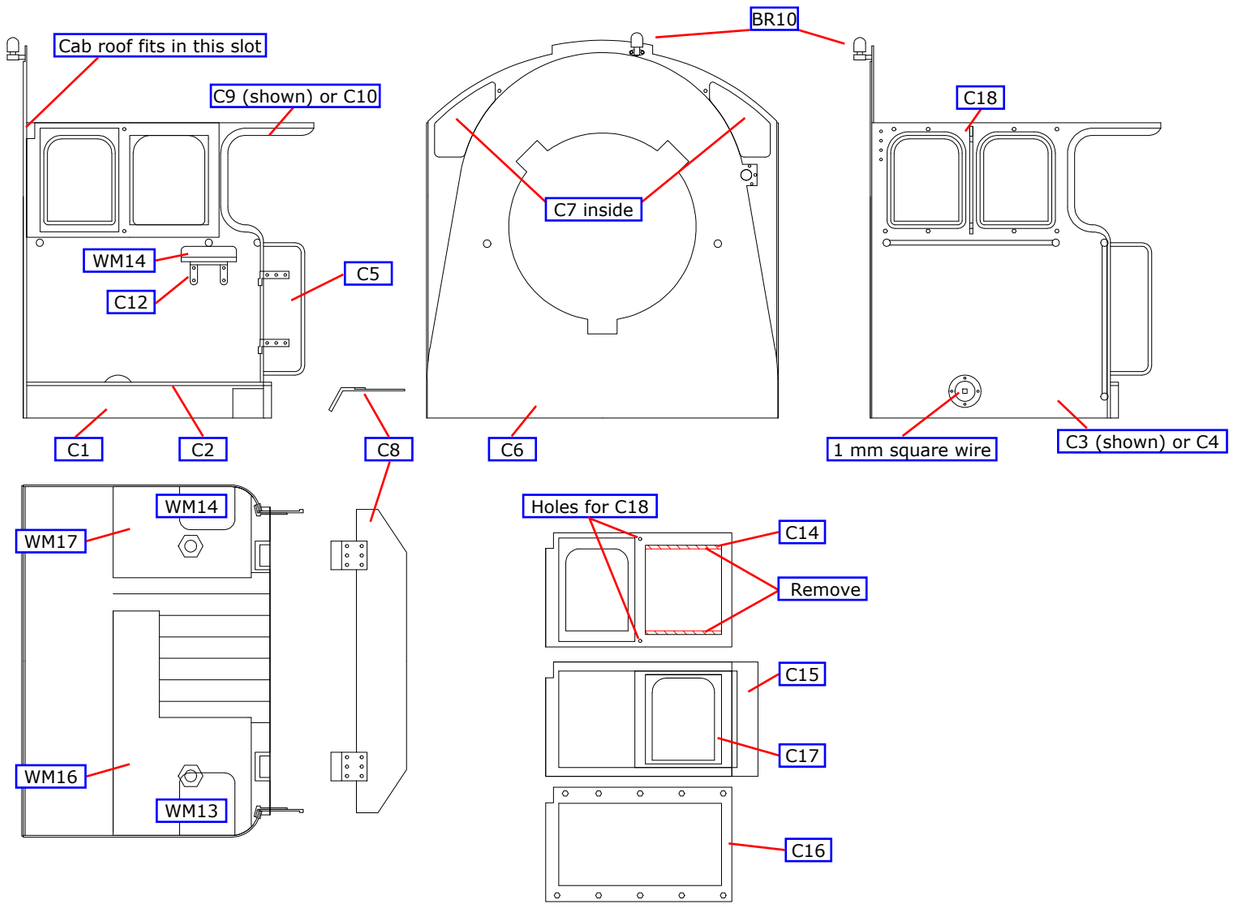


Fig 33. Cab Constructions

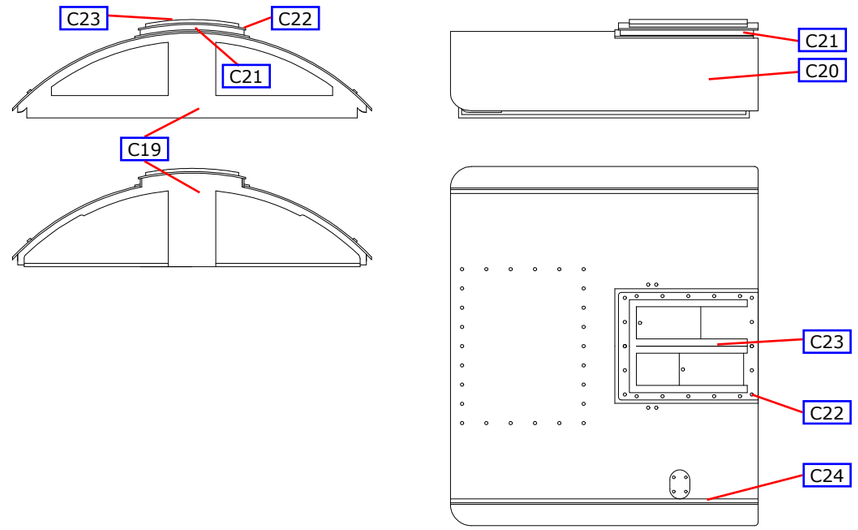


Fig 34. Cab Roof

FINAL ASSEMBLY AND DETAILING

Permanently attach the cab/firebox/boiler/smokebox to the footplate by soldering the smokebox to the saddle and bolting the footplate to the cab. It may be possible to arrange a non permanent fixing to the saddle to make painting the model easier but care will be needed in handling the footplate once the redundant material is removed. Remove this unwanted material in the same way as for the cab roof.

Reversing/damper rods. Select the RH damper operating rod (FO35) and fit to the underside of the cab on the RH side (Fig 27).
Select the required reversing rod (M42 or M43), laminate the two halves and attach the joint overlay (M44), note the support bracket should align with the chassis part F7 when fixing in place (see Fig 4). Slide the firebox end into the gap in the clothing and secure the reversing rod to the footplate. It is best to fit the reversing rod after the firebox and boiler assembly has been fitted.

Fit the eight nameplate brackets (FO36) to the middle splasher (four on each side), the two footplate steps (BR1) see Fig 27 and two steam pipes (WM1) see Fig 31.

Backhead. Drill out the holes in the backhead casting (WM12) to accept the steam distribution box (BR15) and the two injector valves (BR13 & 14) and the water gauges (BR16). Carefully drill the backhead regulator brackets to accept the regulator rods made from 1.0 mm wire and fit the rods in place. It is easier to make these as two rods rather than trying to drill the centre casting to take a single rod across the backhead. Make sure there is enough rod protruding from the left and right brackets to attach the regulator levers (C26) on each side. Attach the water gauges over the regulator rods and fit the steam distribution box and injector valve castings.

Punch the rivets on firehole door (C25) and fold the heat shield out through 90° and attach to the backhead. Fit the appropriate gauge to the heater gauge bracket (C35) and fit the bracket to the backhead, use the drawing as a reference. Fit the cut off indicator (C29) and backplate shelf (C28) onto the backhead, again using the drawing as a reference.

Attach the vacuum ejector valve (BR12) to the left side of the backhead, a small grove in the casting marks the fitting location; attach the handle (C36) and fit a short piece of 0.45 mm wire at the end to complete the handle assembly. Attach a length of 0.6 mm copper wire to the top of the valve and route up the left hand side of the backhead and terminate behind the distribution box.

Attach lengths of 0.3 mm copper wire to the base of the water gauges for the drain pipe work and run down the backhead past the tray and fire hole door guards to the floor. Four lengths of 1.2 mm copper wire are used for the drains from the two injector valves, route the same way as the water gauge drains to the cab floor. Fix a short length of 1.2 mm copper wire to the base of the firebox / floor for the Mason reducing valve feed and fit the casting (BR11) on top, the height is not critical as pipe work in service varied, use the drawing as a general reference. Fit a length of 0.6 mm copper wire to the relevant gland (see drawing) on the Mason valve and route up the backhead, over the right hand side regulator rod and up behind the distribution box. Finally a length of 0.3 mm copper wire runs from the Mason valve to the gauge mounted on the backhead mid height right side, see drawing.

Fit the two large (C31) and three small (C32) hand wheels to the Steam manifold (BR15) and attach to the top of the backhead, now fit the two Injector handwheels (C27).

Attach the two cab roof gauge brackets (C34 & C35) to the backhead and then attach the relevant sized gauges (C30).

Complete the cab fittings by attaching the Screw reverser column (WM21) to the raised cab floor (WM16) and attaching the handle (NS2) on top.

No.	Description	Sheet			
C25	Firehole door and screen	B2	FO36	Name plate bracket (8)	B3
C26	Regulator lever (2)	B2	M42	Reversing Rod - Doncaster (2)	A1
C27	Injector handwheel (2)	B3	M43	Reversing Rod - Darlington (2)	A1
C28	Backplate shelf	B1	M44	Reversing Rod joint overlay	A1
C29	Cutoff indicator	B1			
C30	Cab gauges (5)	B2			
C31	Steam distribution box handwheel, large (2)	B3			
C32	Steam distribution box handwheel, small (2-3?)	B3			
C33	Bracket for vacuum & steam chest pressure gauges	B2			
C34	Bracket boiler pressure gauge	B2			
C35	Bracket heating gauge	B2			
C36	Vacuum ejector valve handle	B3			

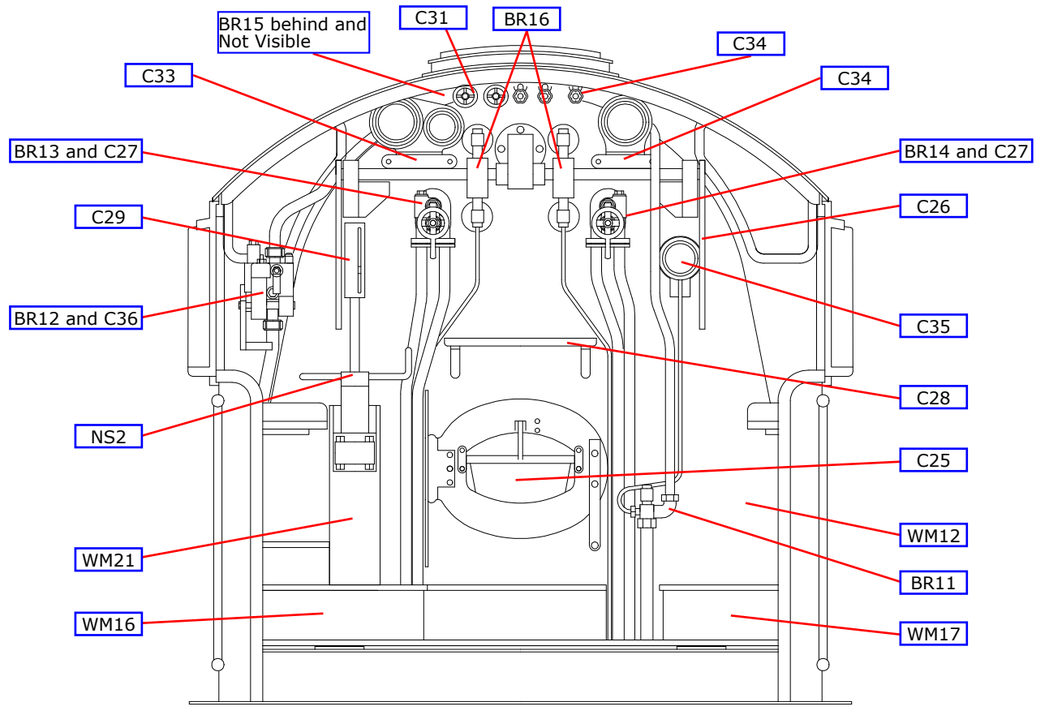
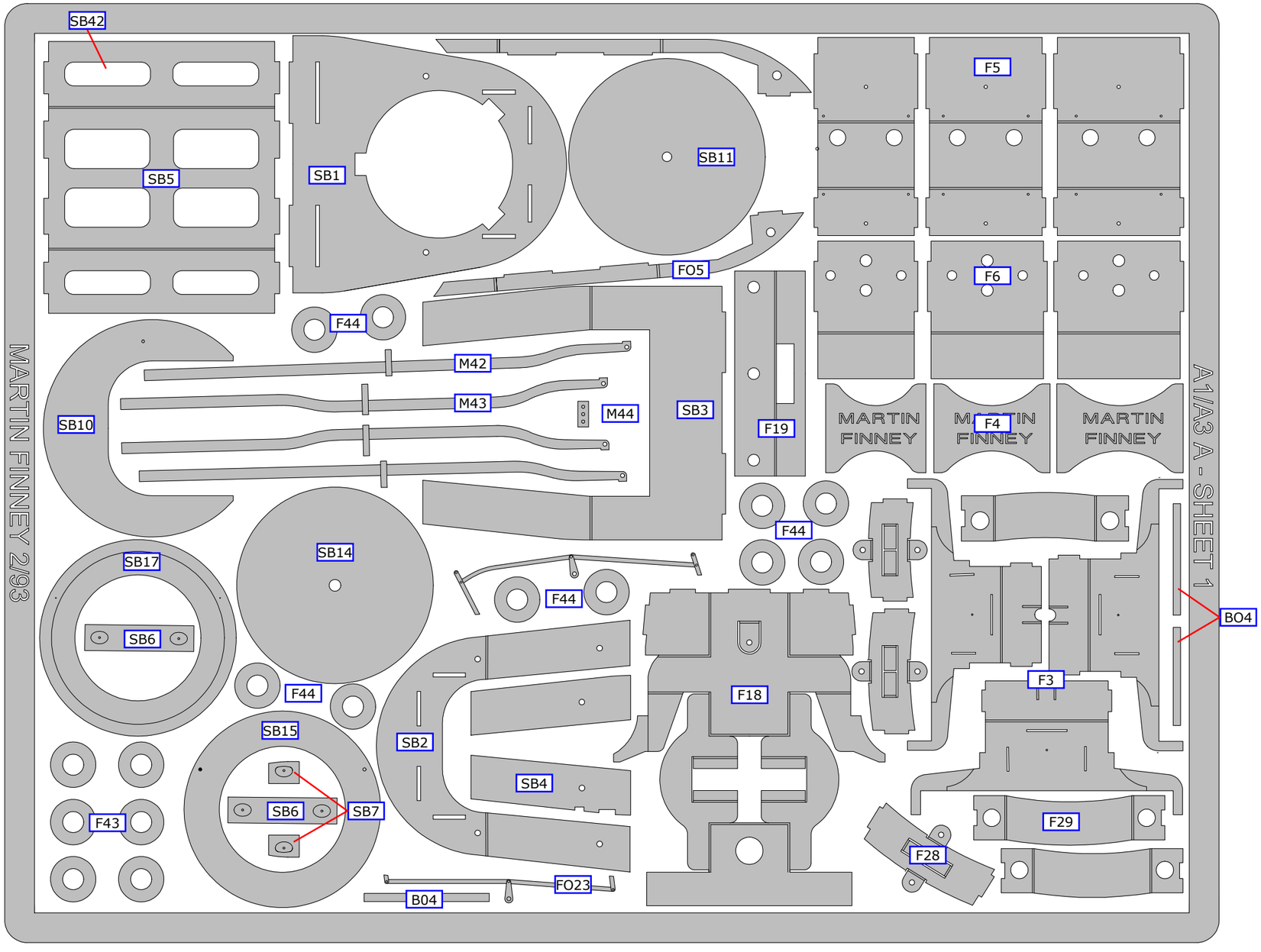
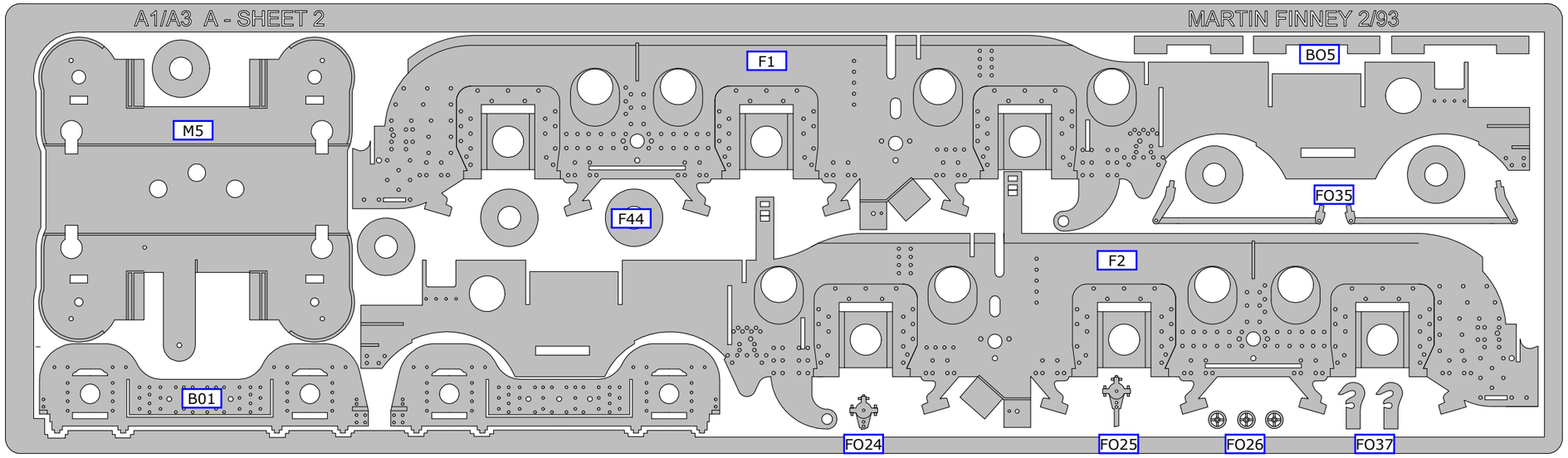


Fig 35. Backhead

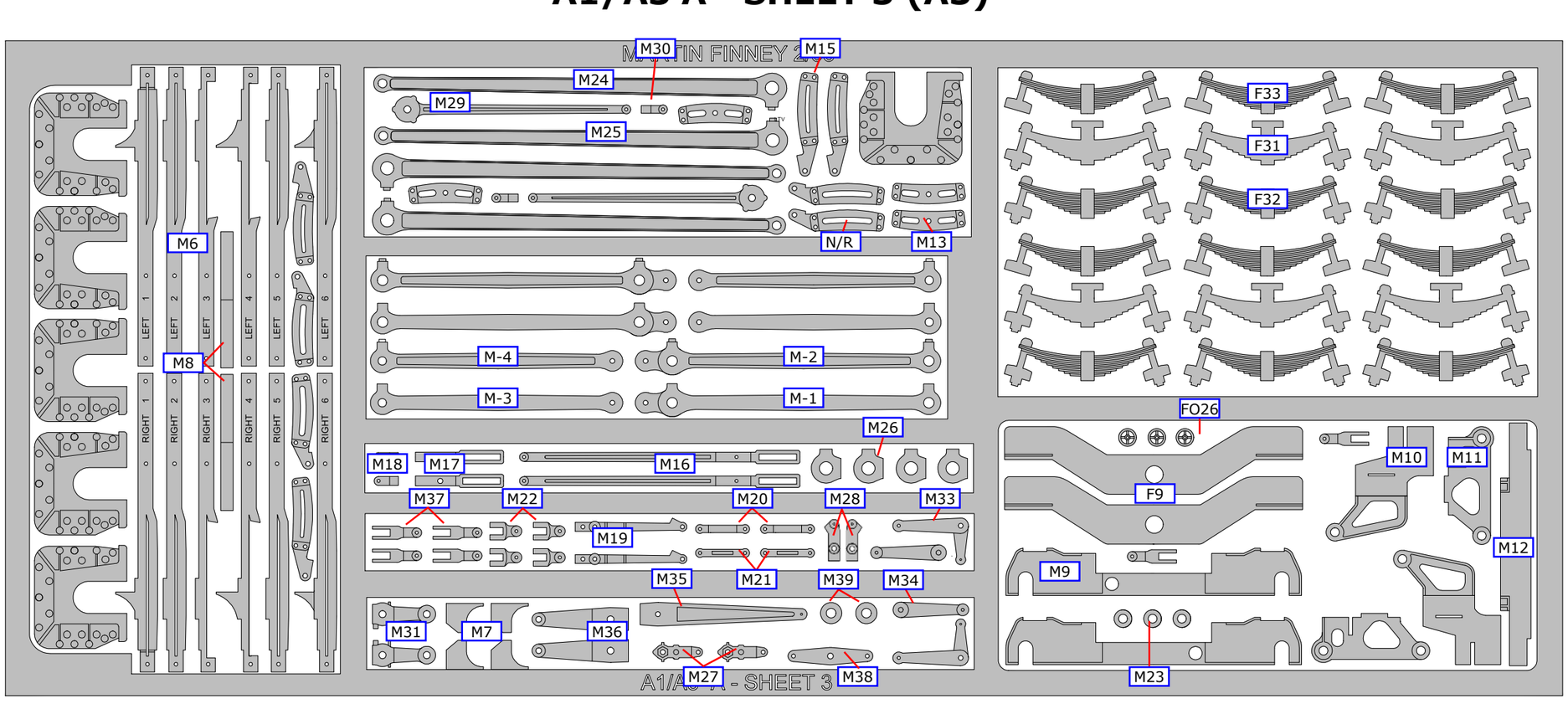
A1/A3 A - SHEET 1 (A1)



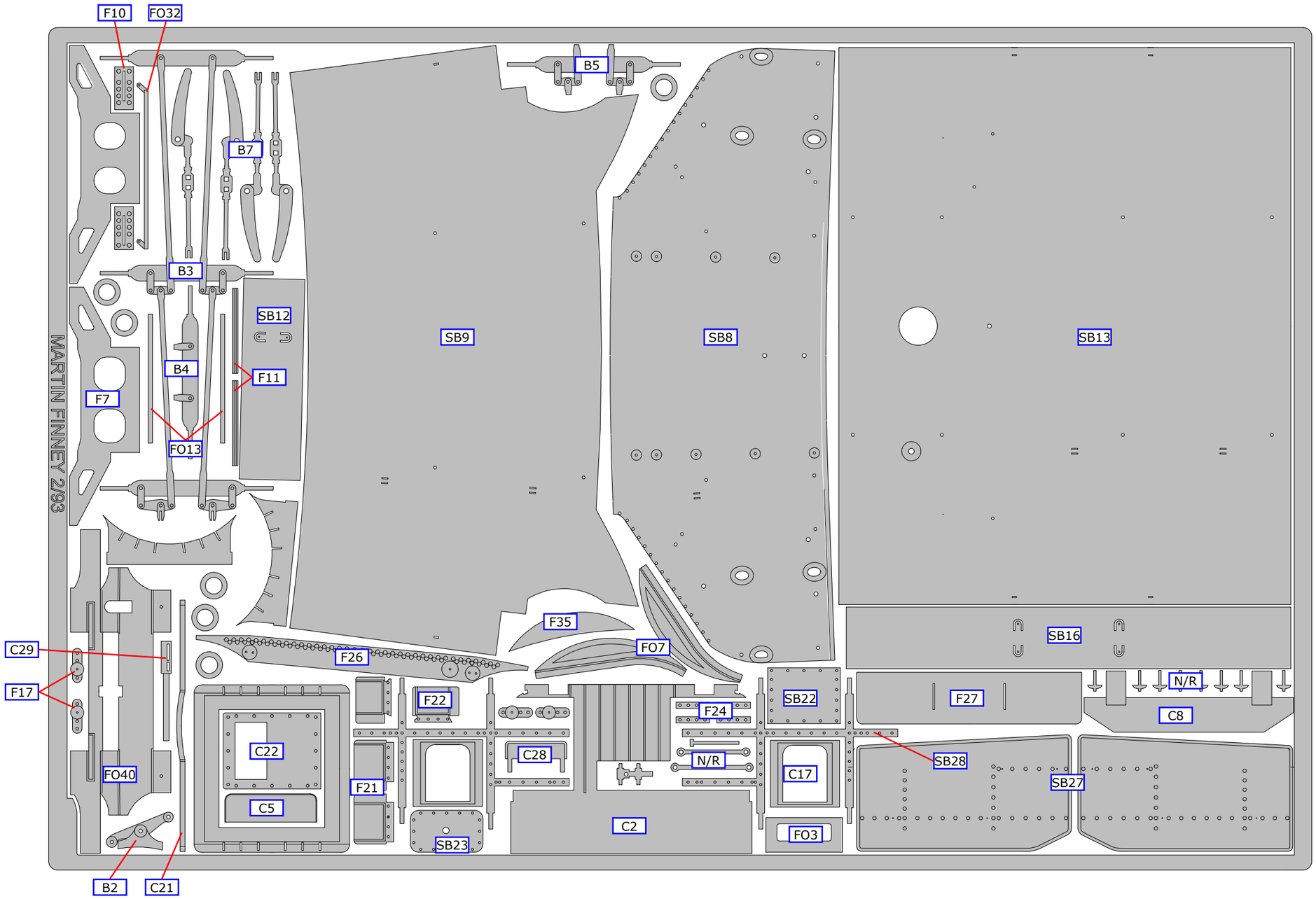
A1/A3 A - SHEET 2 (A2)



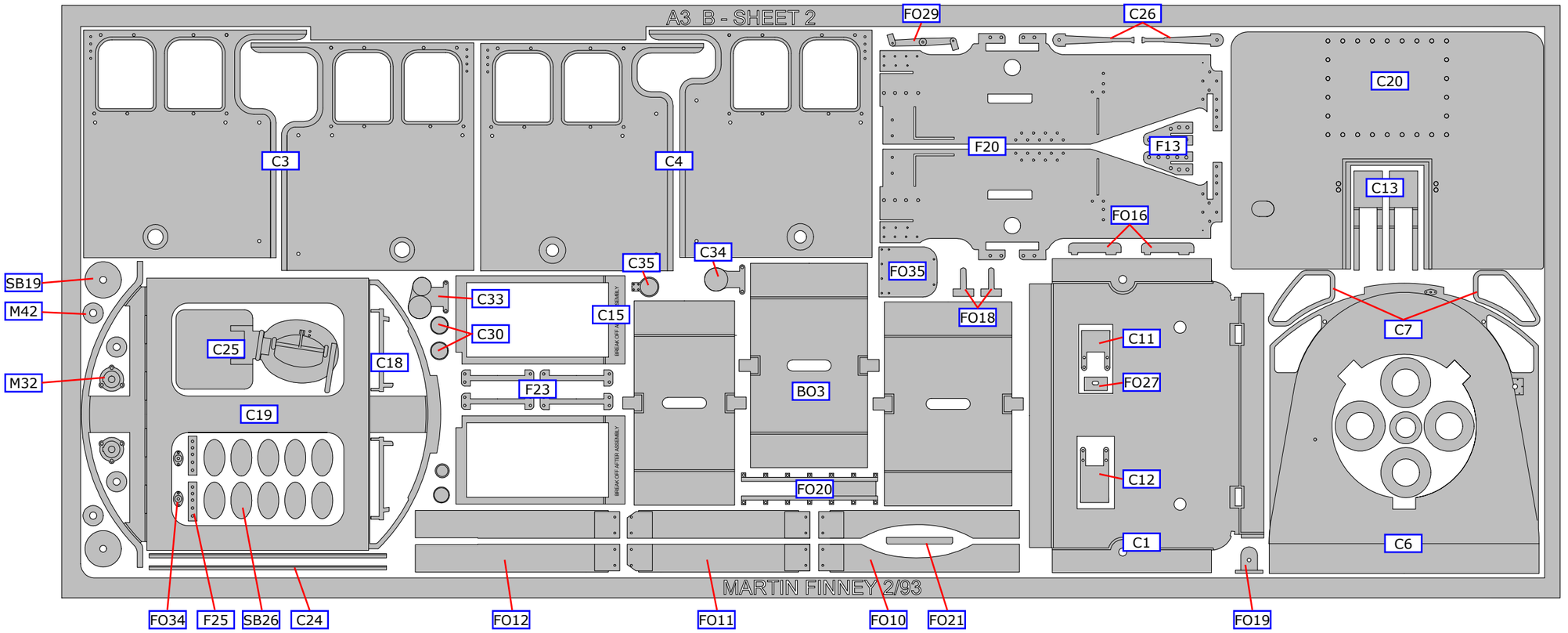
A1/A3 A - SHEET 3 (A3)



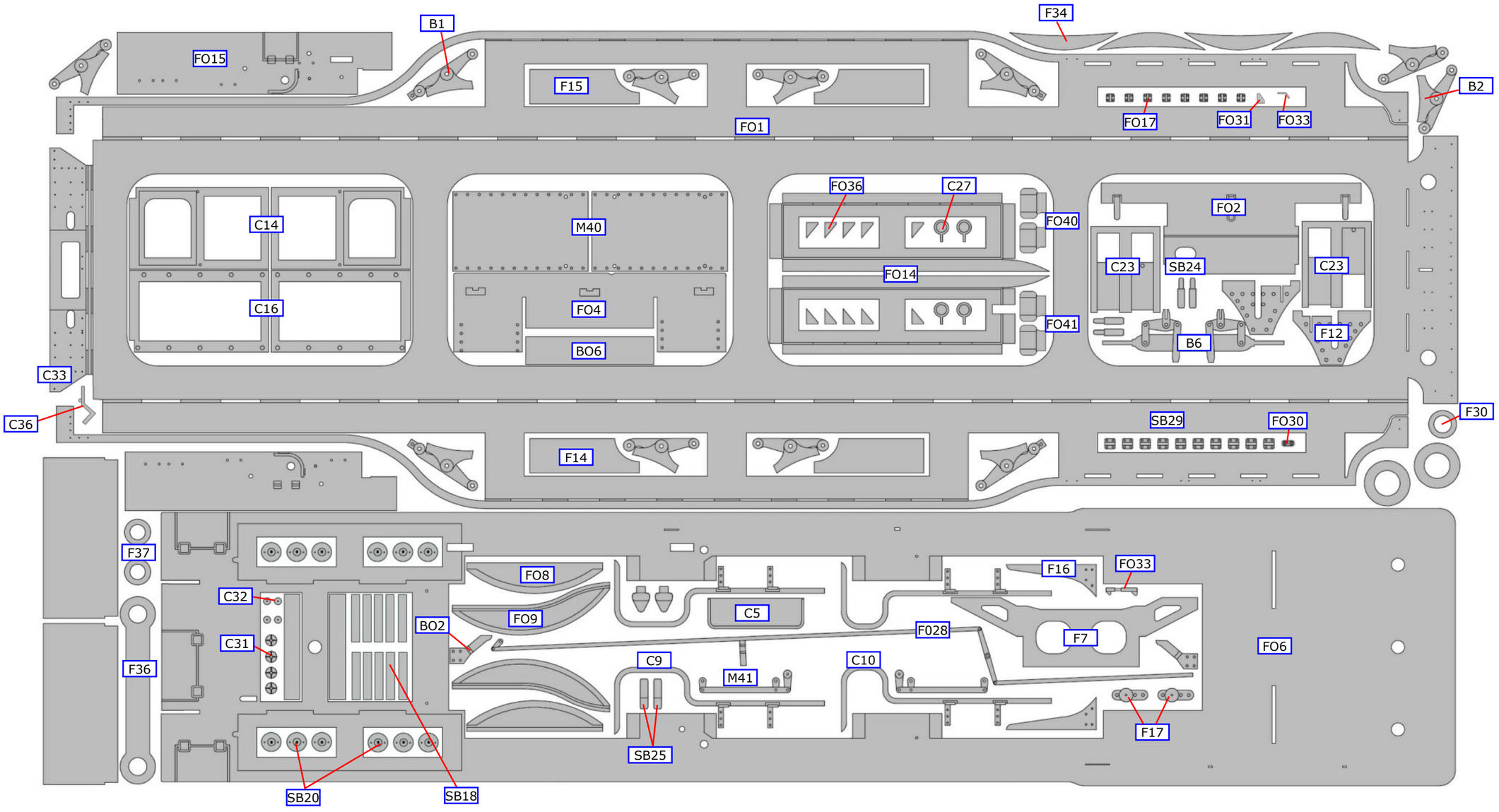
A3B - SHEET 1 (B1)



A3 B - SHEET 2 (B2)



A3 B - SHEET 3 (B3)



CAST PARTS

BRASS CASTINGS

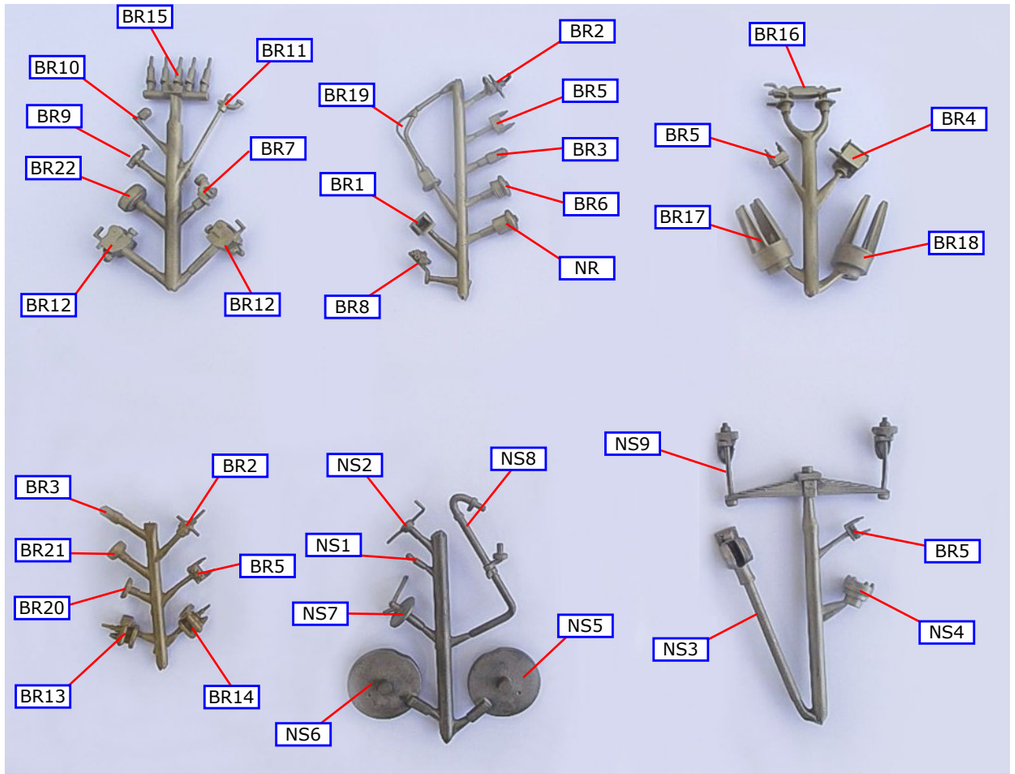
BR1	Footplate step (2)
BR2	Drain cock (4)
BR3	Cylinder relief valve (4)
BR4	Mechanical lubricator (2)
BR5	Pot lubricator (8)
BR6	Safety valve (2)
BR7	Blowdown tap
BR8	Anti carboniser (2)
BR9	Anti carboniser valve
BR10	Whistle
BR11	Mason reducing valve
BR12	Vacuum ejector LH & RH
BR13	Injector valve, left
BR14	Injector valve, right
BR15	Steam manifold
BR16	Water gauge (2)
BR17	Valve crosshead guide, front (2)
BR18	Valve crosshead guide, rear (2)
BR19	Steam sanding pipes (2)
BR20	Front sandbox lid (2)
BR21	Rear sandbox lid (2)
BR22	Anti Vacuum valve
BR23	Mudhole door clamp (6)
BR24	Buffer housing (2)
BR25	Buffer spring gaiter (2)

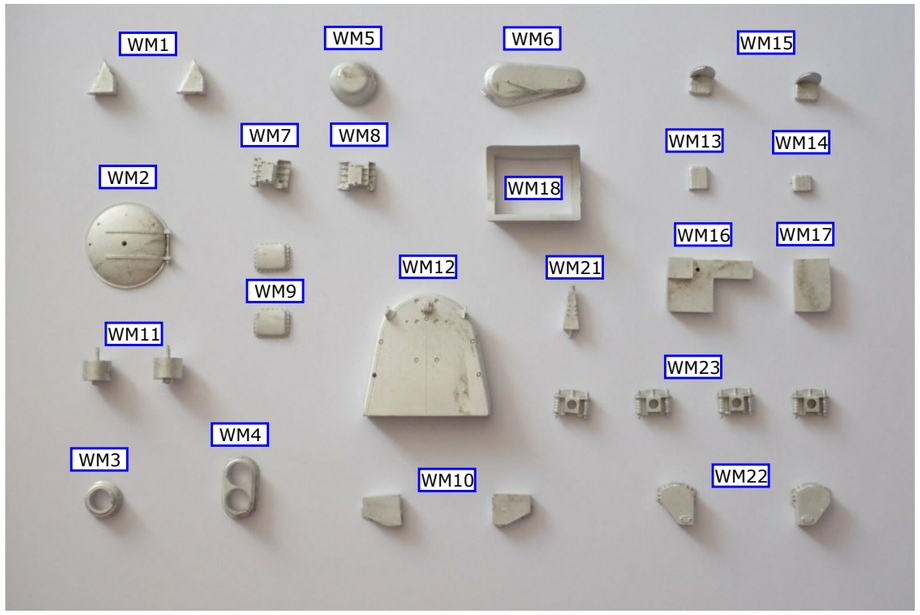
NICKEL SILVER CASTINGS

NS1	Smokebox door knob
NS2	Screw reverser handle
NS3	Crosshead & piston rod (2)
NS4	Piston rod gland (2)
NS5	Cylinder front cover, left
NS6	Cylinder front cover, right
NS7	Smokebox door handles
NS8	Vacuum pipe stand
NS9	Cartazzi axlebox spring

WHITE METAL CASTINGS

WM1	Steam pipe (2)
WM2	Smokebox door
WM3	Single chimney
WM4	Double Chimney
WM5	Round Dome
WM6	Streamlined dome
WM7	Cartazzi axlebox, left
WM8	Cartazzi axlebox, right
WM9	Smokebox superheater cover (2)
WM10	Front sandbox (2)
WM11	Brake cylinder (2)
WM12	Backhead
WM13	Seat early driver's side
WM14	Seat early fireman's side
WM15	Seat later (2)
WM16	Cab footplate platform, left
WM17	Cab footplate platform, right
WM18	Smokebox saddle
WM21	Screw reverser column
WM22	Middle sandbox (2)
WM23	Bogie axle boxes (4)





OTHER COMPONENTS FOR BODY

Nickel silver wire - 0.8mm - for handrails
Brass wire - 1.8mm - for vacuum ejector exhaust pipe
Brass wire - 0.45mm - for sand rod pivots and front & smoke deflector handrails
Brass wire - 1mm square - for washout plugs
Brass wire - 0.3mm for lubricator pipes
Brass wire - 1mm - for cab regulator shaft
Handrail knob (32)

OTHER COMPONENTS FOR CHASSIS

3/16" bearing (6)
5/32" top hat bearing (6)
6BA Cheese head screw (8)
6BA nut (5)
Nickel silver wire - 1.6mm - for coupling rod pins, crosshead pins, radius link pivots & 2 to 1 lever pivot
Nickel silver wire - 1.25mm - for Cartazzi axlebox ties & radius rods
Nickel silver wire - 0.8mm - for valve gear pins
Brass wire - 1/8" - for compensation beam pivots & exhaust steam injector pipe
Brass tube - 5/32" outside diameter - for compensation beams
Steel wire - 1/16" - front compensation beam
Brass wire - 0.45mm - for radius link bolts
Brass wire - 0.8mm - for brake hanger pivots, sandpipes & spring wire
Brass wire - 1.4mm - for valve rods
Brass wire - 1.8mm for sandbox pipes & reversing cross shaft
Brass wire - 2mm - for brake cross shaft
Valve gear rivet (2)