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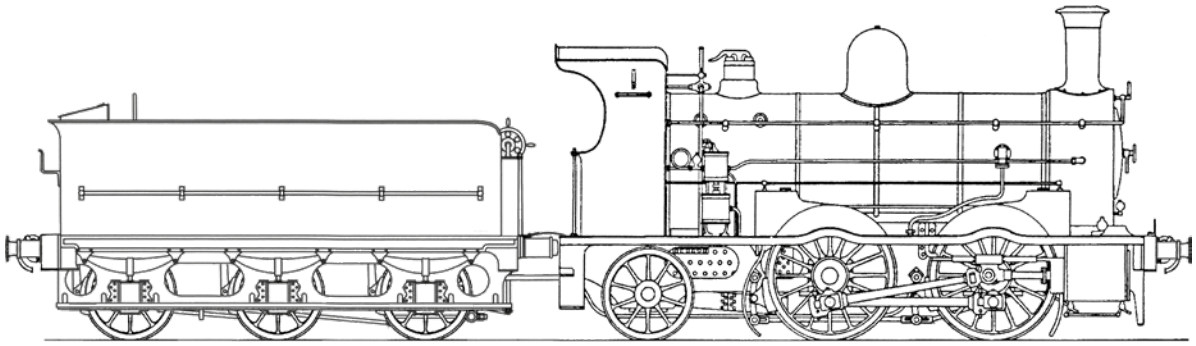


Building Instructions for kit CL03 Caledonian Railway Class 670 0-4-2

Original C.R. numbers 670-679; 700-719
L.M.S. numbers 17000-17020

Section 1 Prototype Notes *by David Hamilton*

(an extract from David's book 'Caledonian Railway Locomotives; The Formative Years'. Lightmoor Press/CRA 2019. ISBN 9781 911038 56 6. Used by permission)

Engine Nos	Builder	Delivered	Rebuilt	Withdrawn
670 – 679	Dübs	1878	1901 – 11	1922 – 30
700 – 719	Dübs	1881	1901 – 14	1922 – 32

The '670' Class continued the incremental enlargement of the standard 0-4-2 engine; the design of this class may even have been instigated by Conner. Compared with Nos 621- 630, the last 0-4-2s built by Conner, the new engines had a boiler with a barrel 5 inches longer, containing ten more tubes, which gave an increase of 70sq.ft in tube heating surface compared with the earlier engines. They retained the normal Conner working pressure of 130psi. A notable change on these engines, compared with Conner 0-4-2 mineral engines, was that the use of spring compensation was abandoned and a conventional arrangement of springs substituted.

Nos 670 - 679 weighed 30 tons 7 cwt empty and 33 ton cwt in working order. The later engines, Nos 700 - 719, weighed 31 tons 17 cwt 2 qrs empty and 35 tons 4 cwt 2 qrs in working order, with a weight of 5

tons 3 cwt 1 qrs on the trailing wheels and 30 tons 1 cwt 1 qr adhesive weight. The most obvious visual difference between the two groups of engines was that the on built in 1878 had sandboxes in which the top was flush with top of the driving wheel splasher. In the 1881 ones, the boxes curved up from the splasher, and gave a greater sand capacity.

The first lot had a four-wheeled tender with 3ft 8ins wheels on an 8ft 6ins wheelbase, which weighed 11 tons 15.cwt empty and 21 tons 13 cwt full. Nos 700 - 719 had a six-wheeled tender also with 3 ft 8ins wheels but on a 11ft 5 ½ ins wheelbase, which weighed 16 tons 6 cwt and 24 tons 9 cwt 2 qrs full, with a capacity of 210 cubic feet of coal and 1,840 gallons of water. Peculiarly, as well as giving the normal loaded weight of the tender in the general particulars of the engine, Dübs gave a second loaded weight with 'Tanks full & 4½ tons of coal' At 29 tons, this weight was more than 4½ tons heavier than the normal full weight. As the original tenders were worn out they were replaced by good used tenders from withdrawn classes. In LM&SR times most of the 700 - 719 group lost their high sided 6-wheeled tenders, these being replaced by earlier low sided 6-wheeled or 4-wheeled ones.

An unusual feature of this class is that it carried two whistles. One was an ordinary whistle but the other was described as a 'Gong' whistle, and was fitted on the fireman's side of the footplate[1]. The '700' series were renumbered in 1887, Nos 700 to 707 becoming 248 to 255, and Nos 708 to 719 becoming 275 to 287.

They were shedded in the same territories frequented by the earlier 0-4-2s, mineral branches and sidings in the Lanarkshire coal and iron workings and country branches up and down the CR system. Many of the first lot were sent to the Callander & Oban line to work freight services over that tortuous route and, when the '152' Class failed so disastrously, the class found itself working both goods and passenger traffic on the line. This continued for nearly 2 years, until the introduction of Britain's '179' Class 'Oban Bogies'.

All the class were rebuilt between 1901 and 1913, several of them having two rebuilds. The latter engines had received rebuilt Drummond boilers from 2-4-0 type engines, which were replaced by the McIntosh 'rebuild boiler' just before the Great War. In their final form, the locomotives were slightly heavier at 36 tons 1 cwt 1 qr, with 13 tons 15 cwt 3 qr on the leading wheels, 15 tons 9 cwt 2 qr on the driving wheels and 6 tons 10 cwt on the trailing wheels.

During their rebuilding they received the Westinghouse brake and by 1904 all the class was so fitted. In this form, they were considered to be passenger engines, and proved useful on rural branches, minor passenger turns in Lanarkshire and generally on all the odd little 'bits and pieces' jobs which kept a railway running. Alan Dunbar described No. 717, renumbered 487, on a typical turn at St. Rollox during the last few years before grouping. Both engine and footplate crew seemed to be in a state of semi-retirement:

'When I got to know "Dandy Jim Robertson" he was off the main line and had 0-4-2 487 on the Stores Pilot at St. Rollox - a canny day shift job with their own engine. His fireman was Jimmy Wilde another old driver off the Carlisle goods - both retired over 70. But 487 - she was painted blue and the smoke box was tallowed every day with tallow - it shone like a blackleaded grate. They cleaned every day, and the cab - the front was blackleaded and polished - every bit of brass and copper burnished till you could see your face in it, last the polished strip round the smokebox front which was on nearly every Caley engine. '

Of a class of thirty engines, twenty one were taken into LM&SR ownership and given the numbers 17000 to 17020. Only twelve carried the new company's livery and No.17003 seems to have been the only one to receive the later style. By the summer of 1929 just seven engines were still at work. Nos 17002 (CR676) and 17003 (CR705) were in use as station shunters at Hamilton, Nos 17007 (CR674) and 17018 (CR675) were at Dundee with 17018 (CR675), No. 17013 (CR711) was at Dalry Road where No. 17020 (CR487) was in use as a stationary boiler, and No. 17011 (CR714) was at Ardrossan North. Two

1 I am unsure if this arrangement was perpetuated on the rebuilt engines. I see no evidence in photos. JS

Original CR Number	Date Built	2nd CR Number	Renumber-ing Date	3rd CR Number	Renumber-ing Date	4th CR Number	Renumber-ing Date	5th CR Number	Renumber-ing Date	6th CR Number	Renumber-ing Date	7th CR Number	Renumber-ing Date	8th CR Number	Renumber-ing Date	LMS Number	Rebuild date	Rebuild date	With-drawn
670	1878	1670	1919														1910		1922
671	1878	1671	1919														1911		1922
672	6/1878	1672	1919													17000	1908		5/1925
673	6/1878	1673	1919													17001	1908		5/1925
674	6/1878	1674	1919													17007	1908		5/1930
675	6/1878	1675	1919													17008	1901	1911	3/1929
676	6/1878	1676	1919													17002	1902		4/1930
677	7/1878	1677	1919													17009	1902		3/1927
678	1878	1678	1919														1911		1922
679	7/1878	1679	1919													17010	1902		3/1927
700	3/1881	248	1887	1248	1920											17015	1902	1911	3/1923
701	1881	249	1887	1249	1920												1901	1911	1922
702	3/1881	250	1887	1250	1920											17016	1902		8/1923
703	3/1881	251	1887	1251	1920											17017	1902		2/1928
704	1881	252	1887	1252	1920												1903		1922
705	3/1881	253	1887	1253	1920											17003	1902	1912	12/1932
706	1881	254	1887	1254	1920												1912		1920
707	4/1881	255	1887	1255	1920											17004	1909		10/1927
708	4/1881	275	1887	1275	1922											17018	1904		12/1930
709	1881	276	1887	1276	1921	1709	1922										1910		1922
710	4/1881	278	1887													17012	1912		2/1928
711	4/1881	279	1887													17013	1902	1914	11/1931
712	10/1881	280	1887	1280	1919											17019	1902		12/1926
713	1881	281	1887	1281	1919												1902		1922
714	10/1881	282	1887	653	1889	165	1908									17011	1911		2/1930
715	1881	283	1887	657	1889	482	1908	1482	1922								1910		1922
716	10/1881	284	1887	661	1889	488	1920	1716	1922							17006	1909		5/1926
717	11/1881	285	1887	1205	1889	1285	1900	159	1901	487	1915	1717	1922			17020	1910		12/1932
718	11/1881	286	1887	1207	1889	1286	1900	161	1901	486	1915	1718	1922			17005	1910		4/1926
719	11/1881	287	1887	1215	1889	1287	1901	164	1901	1164	1904	164	1912	1164	1922	17014	1913		4/1928

Wheels

Driving Wheels	5'2" 16 spoke In-line Crank Pin
Trailing Wheels	3'8" 10 spoke
Tender Wheels	3'8" 10 spoke

of them, Nos 17003 and 17020, lasted until 1932, although the latter was being used for tube cleaning.

Section 2 Parts list

Please check the contents of your kit and inform me of any shortages.

2 Cast fittings :-

CL3/1	Chimney	1
CL3/2	Dome	1
CL3/3	Ramsbottom safety valve	1
CL3/4	Smokebox door	1
CL3/5	Smokebox door dart	1
CL3/6	Cylinder lubricators	1
CL3/7	Injectors	4
CL3/8	Whistle	2
CL3/9	Backhead	1
CL3/10	Crossheads	2
CL3/11	Westinghouse pump	1
CL3/12	Tender axleboxes	6
CL3/13	Westinghouse pipe	2
CL3/14	Steam pipe	2

4 Turned brass fittings :-

Buffers	4
Short handrail knobs	19
Medium handrail knobs	6
1/8" bearings	4

6 Miscellaneous parts :-

0.45mm brass wire	2 lengths
0.7mm brass wire,	2 lengths
0.45mm N/S wire,	1/2 length
1" 10BA bolt	1
3/8" 10BA bolts	2
10BA nuts	5
3/8" 8BA bolts	2
8BA nuts	2
1/8" bore tube	1
1/16" bore tube	1
1mm bore tube	1
1mm square nickle silver	1
U channel	1
Insulated wire.	1
Copper clad strip	2
Phosper Bronze wire	1
1/8" bore Hornblocks and guides	2
2mm bore Hornblocks and guides	2

7 Printed matter :-

General building notes,
A4 Sheets (7 sizes)
CL03 building instructions (this document !)

Section 3 General

The model represents a key member of the Caledonian Railway locomotive fleet, but it has unfortunately taken a long time to bring it to the market. The etchings for this kit were designed quite a few years ago. They featured best practice of the time, together with motors and gearboxes of the time, but things have moved on. In the light of a re-appraisal, the following notes on construction will suggest some optional deviations and a correction. In particular, this will enable the daylight to be shown below the boiler. As to suspension, these notes assume use of a compensation beam, but advanced workers may wish to use one of the newer springing methods of suspension. While this kit is not suited to beginners, fun and satisfaction may be had, with the happy result of owning a characteristic old Caledonian locomotive.

The kit gives you a choice to build in one of three gauges, 00, EM and P4. These are indicated on the relevant parts.

The usual conventions with etched items apply:

- items to be folded should be bent so that the etched fold line is inside;
- rough tags from detaching parts should be filed off;
- tabs and slots should be tight fits, eased by emery paper if needed;
- if tabs and slots don't align then you are assembling the wrong bits or doing something the wrong way round;
- use a square to keep things at right angles;
- an L-shaped jig of wood with its two sides at right angles is useful;
- tack solder first and examine the alignment before making the final soldered joint;
- check, check, and check again.

These written instructions cover the main areas of the kit in some detail, leaving some details to be concluded from the diagrams, and assuming the builder has his or her own views on how to arrange electrical pick-up and livery. They do not assume use of a resistance soldering unit (RSU), but this could be an asset for some of the detail. Annealing is useful and is explained in the text at 2.1.9. These instructions should be read in conjunction with the exploded diagrams, but do on occasion modify them. Notably, the exploded diagram will suffice to build the kit as originally designed, but the arrangement will prevent daylight showing below the boiler and note that the Contorto motor is no longer available. The written instructions offer means of overcoming these drawbacks.

Suitable motor and gearbox combinations or their equivalents are a) Mashima 1220 and a Branchlines M8R compact gearbox, or b) Mashima 1220 and a High Level Roadrunner. The latter is a little tighter, but in both cases the shaft will need to be cut shorter where it would protrude beyond the boiler backhead.

Section 4 Detailed Instructions *by Jim Summers*

1 Chassis/frames for the engine

1.1 Coupling rods

1.1.1. Deal with the coupling rods first, as these will then assist as jigs in checking the accuracy of your later work on setting up the axles. The rods are designed as eight pieces. Each of the coupling and connecting rods is made of two layers. Before detaching them from the etch, clean them with a fibreglass brush or fine emery paper, as this will keep them rigid and safe during the cleaning. You will need a left-hand and right-hand set, each with fluted sides outwards, so be careful when arranging the layers; the etched faces should be outermost and the plain sides innermost. Check also that the spigots representing the oil cups are all pointing upwards, otherwise the oil will run out . . .

1.1.2. Parts 15 and 16 need to be soldered together, so that the double thickness represents these chunky rods. Tin the inner sides a little, align them very carefully together (a pointed cocktail stick in each of the end holes will help), hold them in position with a clothes peg, and solder them together. Drill the holes to 1.0mm, keeping your drill as vertical as possible, if you do not have a drill press. These holes should enable the rods to slip on the crankpins and can be opened out later to 1.6mm for the crankpin bushes (you'll just lose these little bushes if you get involved with them now). A quick twist with a larger drill will clear any proud edges of the hole.

1.1.3. Repeat with Parts 17 and 18, and that is the rods for one side of the engine dealt with. Those for the other side are the un-numbered parts opposite Parts 15/16 and 17/18, and are assembled in the same way, remembering they are a mirror image to fit on the other side. Put safely away in a wee plastic bag.

1.2. Main frames

1.2.1. The sides of the frames are next, Parts 1 and 2. You now have a decision to make. Will the locomotive be sprung, or compensated, or simply have the axles rigid in the frames? The last option might do for an 00 gauge model, but not for EM or P4, with their finer standards. The kit comes with all you need to build the model with the tried and proven method using a compensation beam (Part 7 but leave it alone for the moment).

1.2.2. If you have opted for rigid axles, insert brass axle bushes in all six axle holes and solder them in place. In doing so, remember the frame sides are 'handed'.

1.2.3. If you have decided on sprung suspension, you will need to use a piercing saw to remove carefully the half-etched sections at all six axle holes on Parts 1 and 2, and install your favoured hornguides and axle boxes. The axleboxes for the trailing axle will need to be suitable for a 2mm axle.

1.2.4. If you are going for mechanical compensation you will need to use a piercing saw to remove only one pair of half-etched sections. This will be the **rear** driving axle, if you are building the kit in its originally intended form, the one with a representation of coil springs below the hole. If you favour the alternative method to permit daylight under the boiler, you should remove the **front** half-etched section at the front drivers on each side. Also remove the section at the rear for the trailing axle below the cab. Solder a bush in the etched hole of what is to be the fixed axle.

1.2.5. Cut out Part 24, which is the brake rigging. If you attach it with masking tape to a piece of card, then this delicate part will be safe till you need it, much later.

1.2.6. Form the cylinder block by folding up Part 3, remembering to choose the one which is marked as appropriate to your model. One has two slots, marked for 00 or P4, and the other has only slots for EM. This will set the correct distance between the frames, as will Part 6 which should now be made up, following the exploded diagram. Again, choose the part which is marked for your intended gauge.

The cylinder block may be used at this point for trial fitting, but do read section 1.5 for the details of this component.

Alternative locations for motor and gearbox

If you have chosen to build the frames as originally designed, use the following instructions prefaced by **A**. If you are choosing to place the motor and gearbox less obtrusively, then follow the instructions prefaced by **B**.

A 1.3.1. Part 4 is an entertaining fold-up assembly which contains the pivot for the compensation beam, so study the diagram carefully. Note again that there is a choice between 00, EM and P4. Even if you have decided against installing a compensation system, still build and install this item.

A 1.3.2. When cutting Part 4 from the fret, be careful not to cut the narrow neck which holds the two "wings" to the main part. Bend the two wings inwards until they are parallel, then push them forward, using the groove in the neck, until they sit neatly against the main part of the whole assembly. Solder the joints, using a thinned down wooden lollipop stick in the groove to preserve the alignment - and your fingers. Then bend up the two little ears in the centre of the etch, pushing them up with a small screwdriver. Ensure the holes are aligned, so that a rod can eventually pass through, and solder the bend for security. Bend up the two steps and solder the seams.

A 1.3.3. You should now find on the etch the two compensation beams (Part 7, two off), assemble them as a sandwich and solder them together. The point of a cocktail stick through the holes will again help to set the alignment, and hair grips are useful for holding two pieces together while soldering.

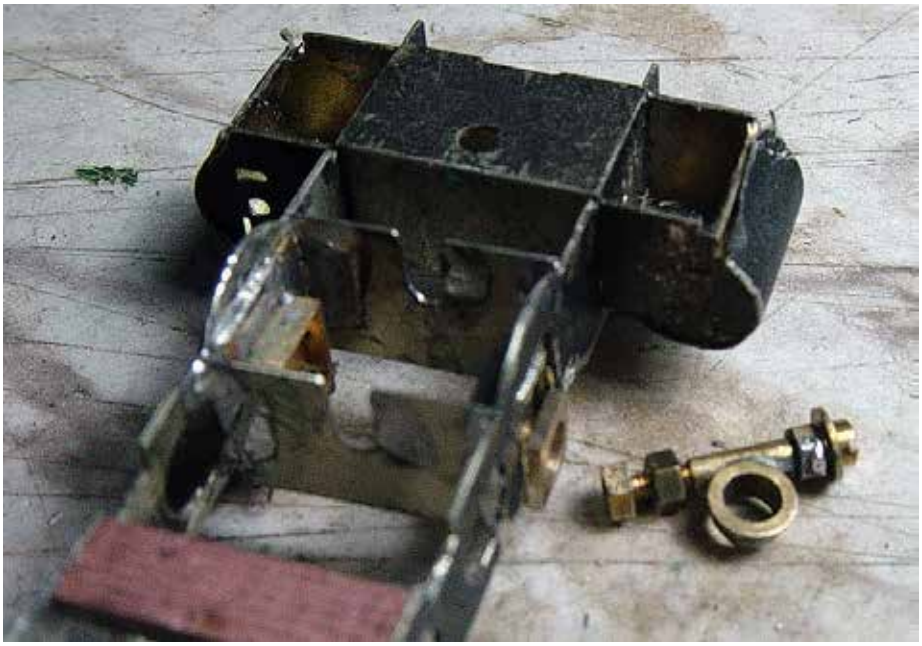
B 1.3.1. The following instructions now deviate from the original design. Parts 4 and 7 will not be needed and can be disposed of. We are going to power the rear driving wheels, not the front, and the motor will sit well back in the firebox. This will alter the suspension arrangements, and three choices exist:

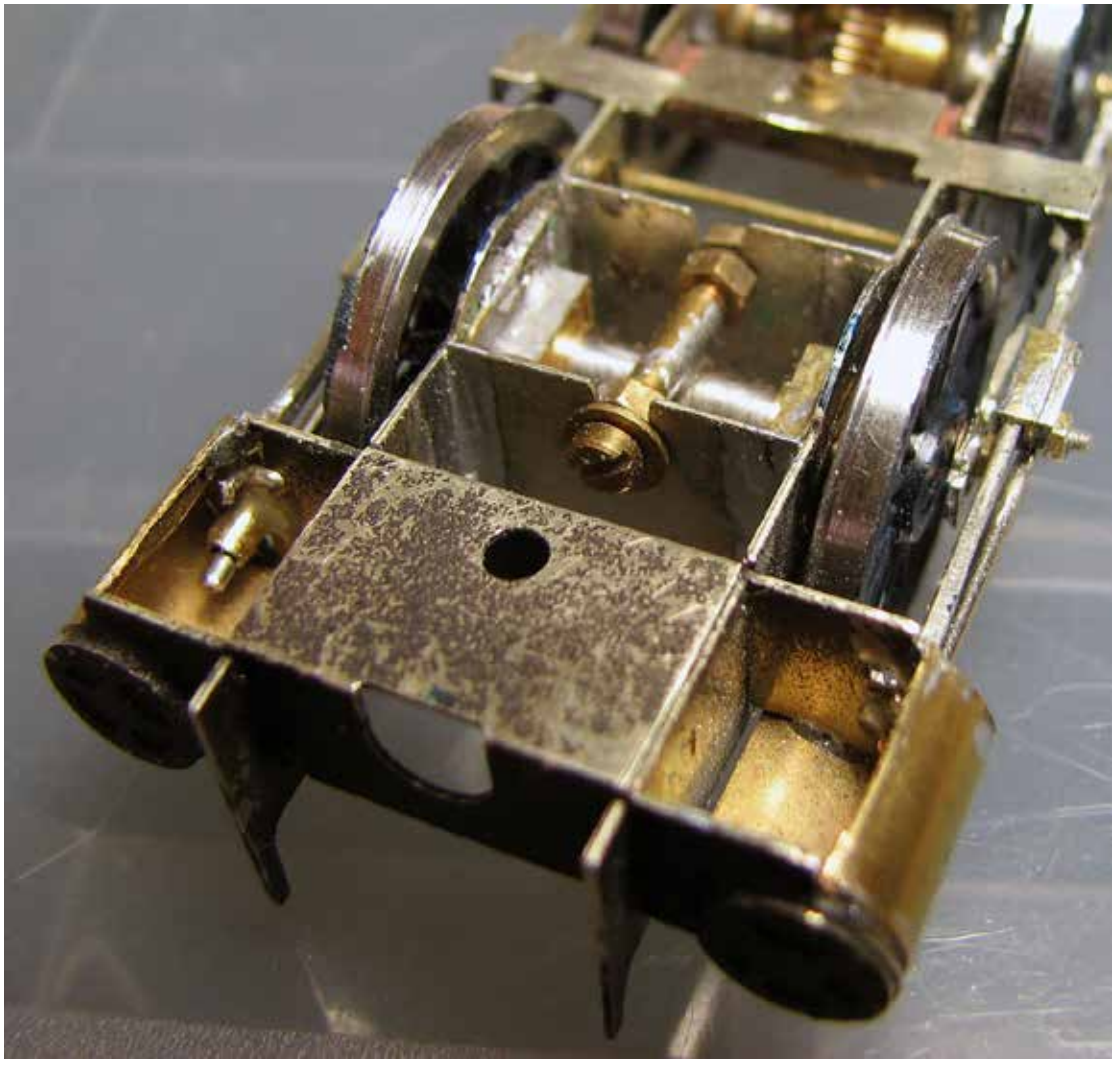
the simplest is to use sprung axleboxes, such as those from Alan Gibson (Workshop);

a sophisticated alternative is to use continuous springy beams (csb). The theory of the latter is described at http://www.clag.org.uk/beam-annex3.html

The third method adheres to the original concept of using a compensation beam, and this is what these notes will now describe. You will need, however, to be prepared to make yourself the swinging mechanism for the front axle, as advocated by the late Mike Sharman under his proven Flexichas system.

B 1.3.2. Solder the supports (Parts S4 according to gauge) for the vertically swinging front axle between the frames. See photo below:





B 1.3.3. To create the swinging axle, cut a piece of $^{1}/_{8}$" internal diameter tube approx. 4mm long. This will eventually hold the axle. File a slight concave curve in the middle, as this will assist the seating of

trunnion arrangement. This consists of a long 10BA screw with a sleeve of 1/16" internal diameter tube, which should be around 6mm long in order to fit nicely between the two new spacers you recently made. File down the circumference of the screw if necessary to ensure the sleeve moves round easily. Study the photo above to get the hang of all this.

B 1.3.4. Place a driving axle through one axle box, thread on the piece of 1/8" internal diameter tube and push the axle through the other axle box. Place the trunnion arrangement in the U-slots and solder the two tubes together at right angles.

B 1.3.5. Take the head off the 10 BA screw, then use two nuts at each end to adjust and tighten the trunnion in the U-slot. Adjustment will be necessary when you are getting the ride height correct once the locomotive has taken shape.

We can now bring these parts together to assemble the mainframes for the engine.

1.4. Assembling the frames

1.4.1. Before bending up Part 6, solder a 10BA nut to the centre hole on the side which has the etched bending lines. Thin this nut down with a file but leave enough for the bolt to engage. Bend up Part 6. It acts both as a spacer for the frames and as a fixing for the drawbar (Part 25] between engine and tender, as shown on the drawing alongside the main one, so a 10 BA bolt will require to pass up though the lower part and engage with the nut.

1.4.2. Ensure all is square and aligned. With a needle file, enlarge the slot for Part 25, as it is important to have some leeway when the tender is coupled. You may choose an alternative method of coupling engine and tender, involving a 0.7mm dia. wire loop on the rear of the locomotive drag beam and a hook on the tender. This saves a lot of fiddling when coupling the two.

1.4.3. The frames may now be set up and soldered. Various tools and jigs are on the market to assist with this, as accuracy is important. Parts 3 and 6 should be tack-soldered in place. The whole should be checked to ensure that the frames have not inadvertently taken up a banana shape.

1.4.4. If you are building a rigid chassis, use a set of stainless steel assembly axles, which are available as aids to alignment. (Try London Road Models, https://traders.scalefour.org/LondonRoadModels/various/components/) Their pointed ends enable you to use the coupling rods for precise alignment. Adjust the tack soldering until all is square, then solder securely. (See photo above.)

1.4.5. If you are not building a rigid chassis, you can now install the hornguides in the cut-outs, and

a bush at what will be the fixed axle. Use the coupling rods (see 1.1) to set precise alignment of the axleboxes in their hornguides by means of a set of pointed aluminium jig axles, as mentioned in 1.4.4., or one of the advanced chassis assembly tools, such as Master Chassis from Hobby Holidays (http://www.hobbyholidays.co.uk/masterchassis1.php).

1.4.6. That leaves the trailing set of wheels to be dealt with and a simple spring suffices if you have been going for method B. This can be fashioned from 0.45mm nickel silver wire, bent in a vee shape, each leg being roughly 10mm long. It is mounted horizontally. One end should be soldered centrally below the rear spacer with the point of the vee towards motor. The other end of the vee is intended to bear down centrally on the axle, so that it can rock.

1.4.7.With the chassis and wheels assembled and standing on a level surface, the ride height can be adjusted by the 10BA nuts up and down the slots at the leading driving wheels. The spring which bears on the trailing axle can then be tweaked so that it bears lightly on the axle without distorting weight distribution on the driving axles.

1.5. Cylinders and valve gear

1.5.1. The cylinders are on one etched part covering both sides and acting as a frame spacer. It is therefore important to choose which Part 3 is for your track gauge. One etch has slots for P4 and for 00 standards and the other has slots for EM only. Before folding up the chosen one, use a piercing saw to extend the holes for the slidebars 1.0mm outwards. Also move the hole for the piston rod outwards similarly. This is to give more clearance for the moving parts in the case of the wider track gauges.

1.5.2. The hole for the piston rod should also be enlarged to take a tube of 1mm internal diameter or slightly more. Install this tube to act as a guide and bush for the moving piston rod as it enters the cylinder. Complete the folding of part 3, trial fit it, and solder the bent angles, but delay finally installing it till after dealing with the slidebars (item 1.5.6.).

1.5.3. The cylinder wrappers (Part 48, two off) must now be bent, which will be helped by first annealing them. Form the top and bottom lip of each, then bend the centre part round a bar of slightly smaller diameter than the cylinder, keeping all edges as square as possible. The formed parts should be sprung on to each side of Part 3, aligned, and soldered in place.

1.5.4. Deal with the cylinder covers next. Part 19 has small rivets to emboss in a delicate (and perhaps optional) operation. Attach by solder or glue the outer (Part 19) and inner (Part 20) cylinder covers to the front of each cylinder. Simulate the drain cocks with a short handrail knob in each of the holes provided: these should be joined by wire simulating the operating rods.

1.5.5. Solder the slidebar outer support (Part 5) in place, noting its orientation, and install 0.7mm wire across the frames from which the brake hangers (Parts 13) will be suspended.

1.5.6. While the cylinders are still not permanently mounted in the frames, ensure that the hole for the slide bar is large enough and also for the piston rod. The slide bars for each side are folded from Part 8 (two off), but have little spare for inserting one end in the rear of the cylinders. It is suggested that you might care to ease this problem by filing some 1.0mm square nickel silver to shape. This should be 22mm long with a further 2mm filed down as a tongue to insert in the end of the cylinder. The other end may need to be mounted below, rather than on top of the step in the slidebar outer support, in order to align the slide bar strictly horizontally between cylinder and slidebar outer support. You may now solder the cylinder block in place, but do not secure the slidebars yet, as this would inhibit the mounting of the wheels into the chassis.

1.5.7. This is the moment to clean up and paint the frames and wheels. Once this is dry, install the motor, gearbox and wheels, coupling rods, and electrical collection arrangements. You have already cut out

Part 24, which is the brake rigging, and kept it safe (see 1.2.5). When this is all to rights, turn back to the slide bars.

1.5.8. The kit provides cast crossheads (CL3/10) with integral piston rods. Parts S3 form the top cover to retain them on the slidebar – glue or carefully solder in place (see photos). Workers in P4 and EM will find the clearances tight, and it is recommended that they fashion their own crossheads. This can be done by using some U-tube with a 1.0mm channel and ensuring it moves smoothly on the slidebar. It will lie on top of the slidebar in a ∩ configuration. To the channel must be soldered a representation of the crosshead itself from nickel silver. This should be 5.5mm long, with a pivot for the connecting rod 3.0mm from the top. It should be shaped with piercing saw and files on the basis of photographs. A projection is necessary to which a nickel silver piston rod must be soldered. Naturally the two crossheads, one for each side, should be cut as an identical pair from two pieces of nickel silver soldered together and parted when done. It cannot be denied that this is the trickiest part of the kit, with some tight clearances and fitting required, but it can be done and is worthwhile. Parts S8 can be used as a basis for this work.

2 The engine body

2.1 The footplate

2.1.1. The essential point to note is that Part 42 is dealt with as if the engine is upside down. It is a cradle which is also used as a jig for the entertainingly curved footplate. A number of jobs can be more easily done while this part is still attached to the main etch and is thereby flat. Do not cut it free from the etch yet.

2.1.2. The superstructure is built on a cradle, which serves as a jig for assembling the curves of the footplate and valances. The cradle is Part 42. Do not cut it free from the etch yet.

2.1.3. Part 42 contains the narrow wavy strips which are the valances, for eventual attachment to the footplate. On each valance is a small row of indentations. These have to be punched to give the effect of rivets on the other side, the side which will be seen (so remember that, when it comes to installing the valances). While supporting the etch on a piece of flat lead or wood, administer a gentle tap with a pointed punch or panel pins (a Gravity Powered Rivet Embossing Tool with a drop weight is available from London Road Models, and is ideal for adjusting pressure and achieving consistency.)

2.1.4. That done, Part 42 can now be removed from the surrounding mother etch - take care not to cut the wrong tags and inadvertently separate the valances from the cradle; the sections which will be the valances along the footplate must stay attached to Part 42 when filing off the remnants of the tags which held each piece to the mother etch, not to file off the similar-looking lugs on the curved parts - these are locating tabs for use when you attach the delicate valances to the footplate.

2.1.5. In the centre of Part 42 are some small parts including footsteps (Parts 44 and 43). It is handy to attach the smaller step to the support at this stage of construction. Use tweezers to position and hold the small step in the slot: it is easy to get this squint. Use high temperature solder for this task. If you then use lower temperature solder (e.g.145 degree) at later stages, you can avoid these small steps becoming inadvertently unsoldered through excessive heat. The lower step, which is part of the etch, can now be

bent upwards, and reinforced with a fillet of low-temperature solder.

2.1.6. The steps and other items which are etched in the middle of Part 42 can now be detached and put safely to one side, preferably in a little plastic bag. Note that one item is not numbered. It is actually Part 47 and is one of the four splashers. You will see a small word 'front' etched alongside, so mark that with a pen or paint. Do the same with its mate, which is one of the items etched inside Part 41, which we come to in 2.1.8 below.

2.1.7. Bend up the sides of Part 42, using a proprietary Hold-and-Fold gadget, or a couple of steel rulers held in the vice with the part to be bent placed between them.

2.1.8. Part 41 is the footplate. Note that there is an etching groove which must be on the underside, as that is where the valance is to be soldered in. While Part 41 is flat, you should cut out any space in the cab area which will be needed to accommodate the motor if you have chosen the method outlined in **B** above. Cut out the area between the three slots at the cab end, being careful not to go too close to the slots at each side, which are needed to secure the cab sides in due course. Then extend the cut-out further towards the rear, to allow a bit of room for the motor shaft when you are attaching the chassis to the main body. This extra cut-out should be 11mm long by 7mm wide, i.e. 3.5mm each side of the centre line.

2.1.9. Then comes bending Part 41 into smooth curves at the driving wheels. This is not so terrifying, if you first anneal the part to soften it to ease the bending. (To anneal the part, hook it to a piece of wire dangling from a vice or other point clear of anything inflammable. Play the flame from a mini gas blow torch - carefully - on to it until it is reddening, especially in the areas which are going to be bent. You can also lay it on the ring of a household cooker, but this is less accurate.) Bending should be done by squeezing the cooled metal with your fingers round a suitable piece of tube. The centre point of the bend is identified by the little slots on each side which engage with the top of the curves on Part 42.

2.1.10. Sort out one curve as follows, before proceeding to the next: don't bend anything before ensuring that the slots each side of the front of the footplate will engage neatly with the tabs on Part 42. If not, give a touch with file to the tab. Check the slots will engage with the tabs on the wheel arches of Part 42, and the same with the slots at the cab end. Now, bend the top of the curve downwards for the leading arch. When it seems about right and fits the slots, move the tube to the other side and bend up the curves each side of the top of the arch. Don't try to get them right first time - do it progressively and gently to prevent any kinking. Do not secure anything yet.

2.1.11. Make the trial bends for the rear curves, ensuring you leave enough metal to cover the flat section of the footplate between the arches. When things are looking promising, place the slots at the front over the tabs on Part 42, and solder them in position. Press the footplate to its final form up and over the first arch and secure the slot and tab with solder. Press the rest of the footplate into position and over the second arch and solder the tab and slot with solder. Continue to the end of the footplate, then solder the final tab. Check you are happy with the results. If not, unsolder and try again. The footplate should end neatly at each end of Part 42. If all is well, wangle your soldering iron in through the gaps underneath Part 42, and solder the footplate to Part 42, from behind. You may need to cut away some of the base of Part 42 to get access, but it has nearly finished its purpose as a jig to aid construction.

2.1.12. Attach an 8BA nut to the top of the frames, at the hole in the front. There is a second one, at the rear, but open the hole out a bit with a round needle file, to give some fore and aft play, as this will avoid stresses when the chassis is bolted to the footplate. Only solder the nut to the top of the footplate when you are happy with the fit of chassis and footplate. The rear nut will intrude into the footplate but can be disguised in course.

2.1.13. Parts 22 are the projections of the loco frames above the footplate and enclose the smokebox. The tabs may need filing to allow a smooth fit in the slots.

2.1.14. Before bending and installation of the front buffer beam (Part 56), drill out the holes to 1.9mm while it is still in the flat and, and test that the buffers will fit. If they don't, enlarge the holes gently with a small round needle file or cutting broach. Thereafter bend and tin the corners as shown in the diagram. Do the soldering with the piece upside down on a flat surface as the top edge must be level to line up nicely with the end of the main footplate, from which a lip extends to carry the beam.

2.1.15. The rear drag beam is Part 57. Fold the two protrusions so that they point to the rear. Don't install this assembly until the body is rigid enough to be removed from the building jig.

2.1.16. The four Parts 59 are to be found in two places on the etch – one on the top edge near item 55, and the other three midway down the edge on the right hand side. The four parts have to be fabricated into brackets for each side of the footplate. While they are still on the etch, press out the rivets shown on two of them, then bend the other two. Aluminium hairclips are useful here, as they often are. Bear in mind that these brackets need to be 'handed', so that when attached to the footplate, the rivet on each will be on the forward side, as shown in the diagram.

2.1.17. It is wise to put these carefully aside. Only install them on the footplate once the chassis is united with the footplate, so that they align exactly with the motion support bar Part 5.

2.2. The Cab

2.2.1 The front is on the brass etch (Part 49), and the two sides are on the nickel silver one (Parts 11 and 12). Resist the temptation to fit the rims (Part 58) to the holes for the spectacle glass until the whole cab is assembled, as these delicate items might be dislodged by the greater heat needed for soldering the cab sides.

2.2.2. The fingers at the top of the front (Part 49) have to be gently bent backwards to meet the roof, which in turn has to be given a gentle curve across the locomotive. Anneal the area of the fingers on Part 49 and the roof (Part 50) to assist the gentle bending.

2.2.3. The first adjustment of the fingers can be made by bending each one in succession around the handle of a needle file. While doing this, be careful to hold firmly flat or better, clamp flat, the area around the circular holes for the spectacle plates, as it will tend to want to join in the curve around the fingers.

2.2.4. Using the L-shaped jig (mentioned in the general notes above) to keep things square, attach one of the cab sides. The sides go outside the cab front, so use masking tape to hold one side to the vertical face of the jig, with the bottom hard against the horizontal wood, and butt the front up to it. Ensure the bottom corners are aligned, and tack-solder. When satisfied that the assembly sits neatly on the footplate without rocking, make permanent the tack-soldered joint by running more solder up the joint, (but not as far as the fingers – the kit's, not yours – as they will need further adjustment). Repeat with the other side, ensuring the whole resultant assembly is a neat fit into the slots on the footplate.

2.2.5. You can now concern yourself with the roof. As you have annealed it, you should be able easily to shape it round a circular object, such as a bottle, to a smooth curve to the shape of Part 60. Part 60 is the curved lip at the rear of the roof, and is best attached while it is still on the fret: tape the fret to a board with masking tape, tin, offer up the roof in a vertical manner, and when that is aligned to your satisfaction, solder the two together. Try for fit against the cab front, bending the fingers down further, if necessary, to get the roof to lie horizontal to the footplate: it must not slope. Tack a corner and check and fiddle until everything is square and sits steadily on your work surface. Solder finally. Fill any gaps in the fingers area with solder, Milliput or similar and file and smooth the joint to give a uniform and jointless surface.

2.2.6. The beading round the cut-outs on the cab sides is Part 61, to be found on the etch the boiler etch Part 51. It is easiest to secure the beading when on the flat, so rest the outer side on a piece of wood

with a card spacer and apply solder from inside the cab. Bear in mind that the hole at one end of each piece should be positioned to permit the vertical cab handrail, in the form of .45mm wire to be dropped through it.

2.2.7. Parts 62 are the lamp irons for the cab sides, but if you are intending doing any lining of the cab sides, keep them safely for attachment after the cab has been painted and lined.

2.2.8. Add the rims (Part 58, two off) for the front cab spectacle plate. A sharpened pencil will hold these in alignment for soldering or gluing. The glass can be simulated by a single piece of clear Plastikard, which should be cut to fit the whole inside of the cab, trimming it fit the curvature of the roof. Do not fix this in position until after the locomotive has been painted, but you can glue the cast brass backhead in position on it at this stage. The backhead should be drilled through the brass and Plastikard where the holes have been started, and the various fittings can be added, before painting. The Plastikard can be painted at the same time, leaving a generous area around the windows.

2.3 Splashers

2.3.1 Much of the character of the locomotive derives from these, but study the parts carefully before assembly. The splashers each consist of two parts, which need to be assembled 'handed' to suit each side of the engine. They must also be arranged so that on each side of the locomotive the sandboxes face forward and backwards. Parts 45 and 46 refer each to two 'handed' parts, the sides of the splashers. The tops of the splashers are adjacent to these on the etch or were in the middle of Part 41 (see item 2.1.6). Remember that at item 2.1.6 you marked the front ends.

Consult a photograph to see how the sandboxes were filled and the way the operating rods ran (usually decidedly bent in practice) and drill holes in the tops of the splashers for the filler caps and the vertical shaft of the operating linkage. A filed down handrail knob can represent this.

2.3.2. Assembly is a tricky job, but you have four to do, so it is worth devising a method which works for you. One method is to bend the splasher tops (Parts 47 - four off) at the fold lines, run in a (little) solder, and then gently bend the curves of the remainder of the splasher top to the shape of the splasher sides (Parts 46 - four off). You might find it easier to achieve the bending by separating the tops into two pieces - the rectangular bit and the bit with the reverse curves. When satisfied, which may take some time to occur, identify carefully all four tops and ends - very carefully, because there are two subtly different tops. Two will have small recesses in the etch: watch these, they are for the front splashers. After studying the exploded drawing and remembering each side of the locomotive will be a mirror image, unite splasher tops and sides. Take care to ensure that the tops are going to be secured to what will be the inner side of the splasher sides, and not the outer side (the one with the half-etched circles). They should be attached inside the sides and not lie on top of them.

2.3.3. With high temperature solder, tack the straight edges of the tops to the straight top edges of the sides, using that right-angled wooden jig. When satisfied, make the final joint. This leaves the curvy bit to adjust if necessary, which can be done by bending to the general shape, tacking the bottom end to the bottom of the side. With a cocktail stick, round ends of needle files, and the like, form the bends moving up the curves and soldering as you go. Trim and file as necessary when you meet the straight section at the top, so all is neat and square.

2.3.4. This is all a bit of a palaver, but entertaining, and after you have done four you will be quite deft at it. The key thing is to be sure that you have made them left and right "handed" and front and rear. Remember that the two destined for the front should have slight recesses in the flat tops, to enable them to fit neatly round the smokebox. Also, they might need a nick filed out the front two to ensure that they sit neatly in relation to Parts 22 (see 2.1.13).

2.3.5. Attaching the splashers to the footplate involves small tabs on the footplate and the small slot in each splasher side. Begin by folding up that part of the footplate between the cut-outs for the splashers. Fiddle each splasher into the resultant space and on to the tab on the footplate. This is a useful method of locating the parts, but do take time to get the assembly vertical at front, back and sides, and to ensure that equal amounts are exposed symmetrically of the half-etched semi-circles on the sides. It may be necessary to trim the size of the tabs in order to permit a little fore and aft movement of the assemblies to ensure the fronts of the forward one on each side des are at the same distance back from the front of the footplate; and the rear ones the same distance from the rear edge of the footplate. Use a square to check this across the footplate. Do not solder everything irrevocably until completing the following stage 2.3.6.

2.3.6. With the wheels in the chassis, offer it up to the footplate and ensure that the wheels will revolve without touching the footplate or splashers. Adjust relationships, if this does occur.

2.4 Boiler

2.4.1 Detach from the etch the boiler Part 51, and the adjacent Parts 54 and smokebox wrapper 52. Anneal these, if you wish, in order to help the rolling to shape, but beware of kinks forming in the bending. If you don't anneal, the rolling can be done gently with a wooden vee-block or by squeezing around decreasing sizes of round bar. That done, solder together the edges of the smokebox end (the end without a hole for the chimney)

2.4.2 Study the drawing to see how the circular parts 51, 52 and 54 are assembled. The drawing shows the smokebox front (Part 53) being outside the wrapper Part 52, so roll the centre of Part 52 gently to a round shape, and place it on top of Part 53 which should be on a flat surface. The ends of the wrapper, which you have left straight, need to follow the shape of the smokebox front Part 53. It is important that the smokebox wrapper is not attached back to front. Tabs locate it into the frame, and these should be nearer the front than the rear. A dry run or two is essential before soldering the smokebox front and wrapper together, and Part 54, the spacer between smokebox and boiler, should also be tried out.

2.4.3 If you are pursuing the option of avoiding the motor protruding into the daylight below the boiler, you should use Part S1 to fill in the missing part of the boiler from the smokebox towards the firebox end. The piece needs to be bent to take the curve of the boiler. Lay this inside the boiler and solder it in position. Fill and smooth the solder joint so that the joint of the patch is not noticeable.

2.4.4 It is now possible to bring all the sub-assemblies of boiler, smokebox, cab and splashers together and solder them in place. As ever a dry run is important and items should at first only be tacked in place, and checked with a square at all stages.

2.4.5 The supporting cradle can now be cut away from the footplate.

<u>3 The Tender</u>

3.1 Tender frames

3.1.1. As there is no need for an alternative to the original design of the tender frames, these notes can be briefer than for the engine. The exploded diagram is comprehensive and the processes similar to the foregoing.

3.1.2. Sweat Parts 89 together with high temperature solder, Assemble the rear buffer beam Parts 74 and 95, working on a flat surface to ensure they are square when soldered. Note that the drawing implies that these two parts are the same length, but this is not the case. Align them centrally, using the holes for the buffers and coupling hook as reference, and noting that these in Part 95 are not central

vertically. Use high temperature solder, so that the beam can be attached to the footplate Part 70 with lower temperature solder. This can be most neatly done while Part 70 can be flat on the work surface. Study the diagram to see how the sweated Part 89 relates to the buffer beam, but do not attach it until the process of installing the tender sides and end is complete.

3.1.3. Be very careful to place the spacers (Parts 26, 29 and 30) the correct way round between the two inner frame sides (Parts 27) and to match the axle holes of which two sets are oval one and one set circular.

3.1.4. Having soldered the frames, offer them to the footplate Part 70. Ensure both parts are facing the same way; the drawing shows the details which help in this. The location holes do not line up perfectly, so carefully mark and drill new holes in Part 70 and solder nuts to the top side.

3.1.5. Deal with the compensation beam (Part 31), the brake rigging (Part 35) and the brake hangers (Parts 33) in accordance with the diagram.

3.2 Tender Body

3.2.1. Assemble the inner frame Parts 75 and associated items, such as Parts 84 and 93, leaving Part 81 removable for the moment. The diagram illustrates how the corners are angled and will form support for the external sides of the tender, Part 76.

3.2.2. Note Part 70 on the diagram and ensure it is the correct way up – the clue is the shape of the gap where you removed the toolbox part. Three items have to be tabbed into the rows of slots in Part 70. The orientation is to be watched. Part 71 is outermost, Part 75 is in the middle one, and Part 72 innermost, then. As you add each, file any protruding tabs down so the footplate is flat and fill any holes apparent around the tabs. This is so that the edges of the footplate projecting beyond the tender sides will be flat like a sheet of metal, as in the real thing. It is useful to begin with Part 75, which you have just formed and is the centre one.

3.2.3. Part 76 is etched as one piece, intended as a wraparound the whole tender, with two bends to be made. It is undersize, which is easy to remedy and makes the bending easier. Cut what is the rear part of the etch vertically at a point near the slot which will eventually hold the tail lamp bracket (Part 91), giving two separate sides/end. On what will be the inner side, you should see two rows of dots to indicate where the bend is to be made. Clamp a rod of $^1/_8$". diameter to the workbench, with a side under it, aligning it so that the dots are equally on each side of the rod. Gently bend up the side so that a curved right angle is produced. Repeat with the other side. Stand them on a flat surface and, they rock, gently correct the angle.

3.2.4. The two Parts 76 now work as an overlay to the carcase of Parts 75, which are already attached to the base, Part 70. Working from the front of the tender, and only tack soldering at first, attach Part 76, one side after the other. A gap of nearly two mms. will result at the back of the tender. The carcase, Part 75, provides a support for Milliput or similar to fill the gap. When it is dry, work at it with files and emery paper until a smooth finish is obtained. A hole may then be drilled for the tail lamp bracket, Part 91.

3.2.5. Attach the rear bufferbeam assembly which you dealt with at 3.1.2. Study the top left of the diagram to see how the sweated Part 89 relates to the buffer beam.

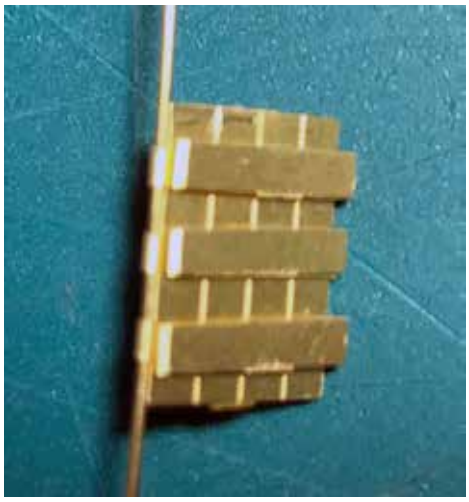
3.2.6. The tender flares are a feature and need careful attention. Anneal the top half of Parts 77 and 78. Taking each in turn, clamp the bottom 2mm lengthwise tightly in a vice and bend the top part around a $^1/_8$" bar to produce a flare. Remove from the vice and tin the lower half and the recessed part of the tender side. Clamp the two tinned parts with aluminium clips or hair grips and sweat them together. The corner flares are undeniably finicky, but do allow adjustment as necessary. Clean these delicate Parts 80 while still on the etch; they can be found near the tender overlay Part 76. Bend them around a screwdriver shaft to match the curve of the tender sides. Tin and solder them in place at the corners, and bend the

fingers to suit the curve. There will be gaps between these fingers and between the part and the end of the side raves, which should be filled with Milliput or similar and filed to a smooth shape when dry.

3.2.7. Part 72 (two off) is the cosmetic frames. One of these omits three holes. Sandwich the two frames together using masking tape and using the one with holes as a guide, drill through the other with a 0.5mm drill. These holes represent the centre of the axles and assist you in gluing the cast axleboxes accurately. Attach the cast axleboxes before fitting the footboards (Part 73).

3.2.8. The tank top Part 81 can now be fixed, unless you have ideas of tender drive, sound decoders, weight, and so on, for which you will need access to the inside of the tender body. The toolbox is situated on Part 81, with a Part 85 each side. The two Parts 85 can be found in the centre of the footplate Part 70. Study the detail drawing at the top of the large tender drawing to see the relationship of Parts 82 and 90 which are mounted on top of Part 81 adjacent to the toolbox.

3.2.9 Fold up the tender doors (Part S5) as shown trapping a length of 0.45mm wire in the fold between the two sides of the door as a hinge. Fit in place.



4 Couplings

4.1 The etch contains parts to assemble a screw coupling. Before detaching the elements, polish them on the flat etch with a fibreglass brush.

4.2 The coupling links are formed from the two long thin etched bars with a hole at each end. Run a 0.5mm drill through these four holes and cut them carefully from the etch. Place a 0.5mm drill through one hole and then bend the bar so as to thread the other hole on to the drill. Using fine pliers, even up the two legs to a satisfactory U-shape. Repeat for the second bar and place the completed U-shape through the flat hole in the etch of the coupling hook.

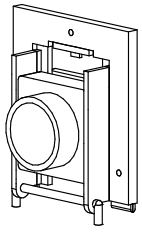
4.3 Cut the dumbbell-shaped etch from the fret, being careful to preserve the little spigots on each side of the circular ends. Grip the centre and, with a second pair of pliers, twist each end through 90 degrees. Each end has two spigots which must now be inserted in the holes which were used on the drill to form the U. Squeeze the U at that end with pliers to contain the centre piece but leave it able to swing. Repeat with the bar which you have already passed through the coupling hook etch.

4.4 The shackle with its ball on the end can now be cut out and the end bent so as to hang through the eye in the centre part of the assembly. Then squeeze the top end in, so as to retain the tommy bar in place. Add a little blob of Araldite or similar to the circular end of the shackle to represent the real-life ball.

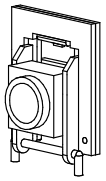
HIGH LEVEL

www.highlevelkits.co.uk

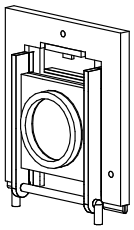
These instructions cover three types of High Level Hornblocks:



STANDARD

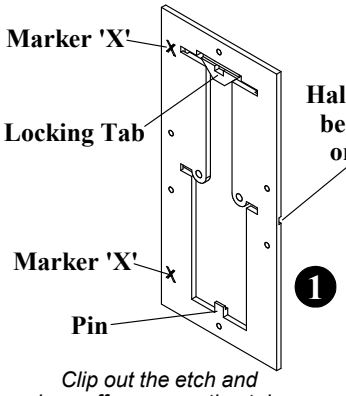


MINIBLOX



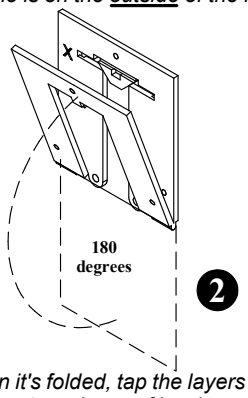
SPACESAVER

Although their size may differ, the procedure for folding the hornblock etch is the same for each type.



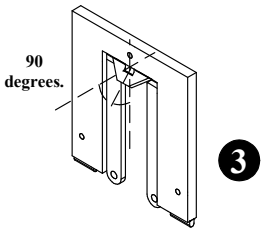
Clip out the etch and clean off any mounting tabs.

Fold the etch through 180 degrees, so the markers 'X' face each other. The half-etched line is on the outside of the fold.



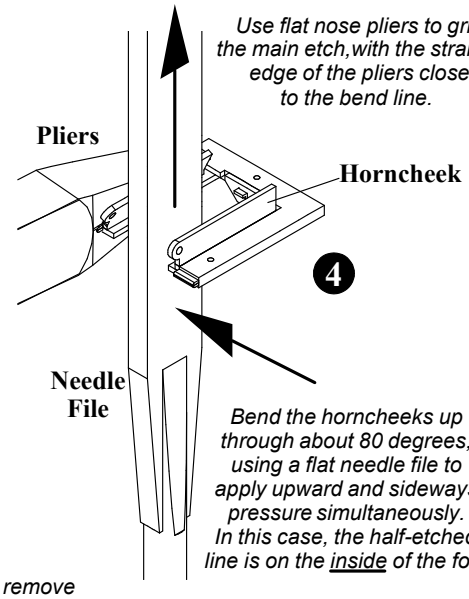
When it's folded, tap the layers between two pieces of hardwood, so they sit absolutely flat.

Hold the layers tightly together and fold the locking tab through 90 degrees, so it locates on the small pin.

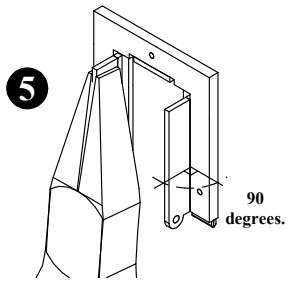


The end of a flat, pointed needle file is a good tool for this job. The tab locks the layers together, eliminating the need for solder.

Use flat nose pliers to grip the main etch,with the straight edge of the pliers close to the bend line.



Bend the horncheeks up through about 80 degrees, using a flat needle file to apply upward and sideways pressure simultaneously. In this case, the half-etched line is on the inside of the fold



Finish off the horncheek bends so they are at 90 degrees. Check this through a magnifying glass and adjust as necessary.

For SpaceSaver 'CSB' units, follow the instructions (overleaf) at this point...

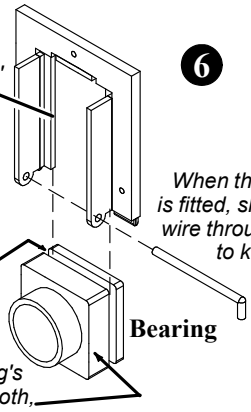
Use fine emery to clean up the bearing, remove any burrs and then try it in place - the groove on the block locates on the front layer of the etches.

If the bearing's tight in the etch, check that these edges aren't 'bottoming out' in the groove...

...If they are, use a file to remove the sharp 'cusp' from the edge of the etch...

... so there is clearance in this groove...

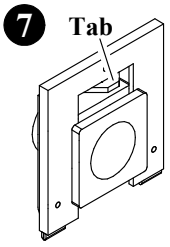
...then polish the bearing's side faces until it's a smooth, sliding fit in the etch.



When the bearing (and tag) is fitted, slot a length of 0.4mm wire through the bottom holes to keep it in place.

To fit Standard or MiniBlox 'CSB' Tags, turn to the instructions (overleaf) at this point...

The completed assembly can now be soldered to the inside face of the chassis, using axle jigs. If you fit it with the bearing in place, make sure the sliding surfaces are lightly oiled, to prevent the bearing being soldered to the etch.

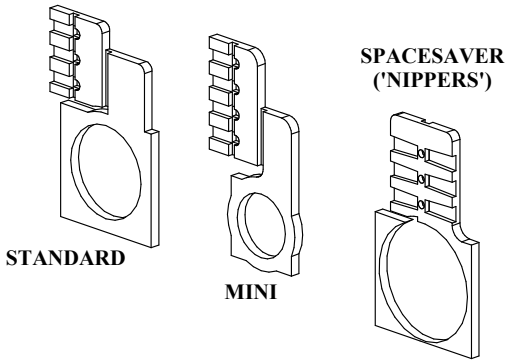


The top edge of the cut-outs on most loco chassis is 4mm above the axle centre. For 'Standard' and 'SpaceSaver' hornblocks, butt the tab up to the top of the cut-out, to set the unit at the correct height.

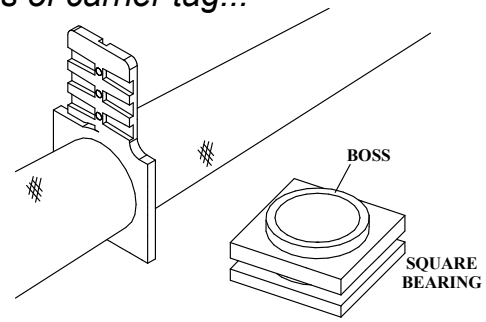
For MiniBlox, the top edge of the tab is 3mm above the axle centreline.

HIGH LEVEL, 14 TUDOR ROAD, CHESTER-LE-STREET, CO. DURHAM, DH3 3RY.
TEL. 0191 3882112.

Three types of 'CSB' Carrier Tags are available to fit our hornblocks.



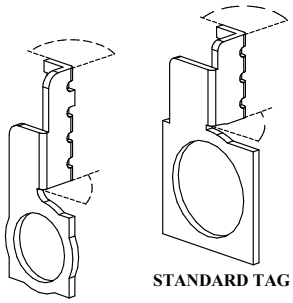
For all types of carrier tag...



...open out the large hole in the tag, so it's a snug fit on the circular boss at the rear of the bearing.

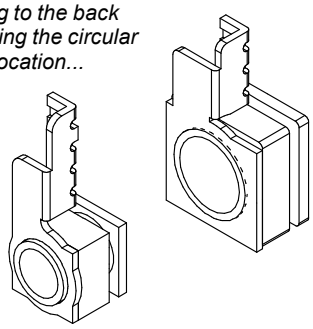
STANDARD AND MINIBLOX TAGS

Carefully fold the top tab to make a three-sided box shape.



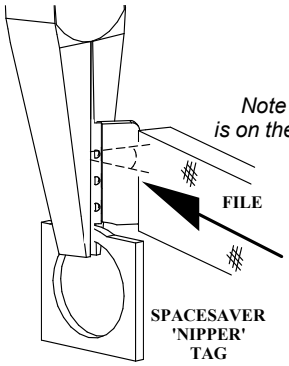
To prevent them from distorting when bending, use small, flat-nosed pliers to grip the etches near the bend lines.

Solder the tag to the back of the block, using the circular boss for location...



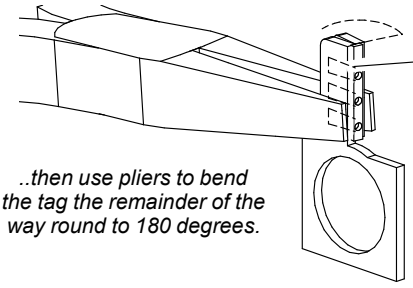
... then resume the assembly sequence at stage 7, overleaf...

SPACESAVER TAGS



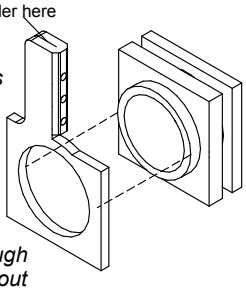
Note that the bend line is on the <u>outside</u> of the etch.

Grip the main etch near the bend line and use a file to push the top tag through about 90 degrees...



..then use pliers to bend the tag the remainder of the way round to 180 degrees.

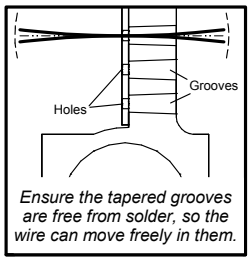
The three tapered clearance grooves should now be between the layers (on the inside).



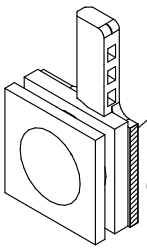
You can strengthen the tags by adding a small amount of solder between the layers, but be carefull not to flood the holes or clearance grooves.

Run a drill or broach through the holes and open them out to suit your spring wire...

...then solder the tag over the circular boss on the block, making sure it is absolutely square.



Ensure the tapered grooves are free from solder, so the wire can move freely in them.



When the tag is in place, carefully trim off the overhanging sides of the etches, until they are perfectly flush with the brass bearing...

... so they become part of the bearing surface...

... then resume the assembly sequence at stage 6 ,overleaf...