

2mm Finescale Chassis Kit for Farish Jubilee: Construction Notes

I. Introduction

This kit has been designed to fit a Farish Jubilee loco and tender body and includes all parts for the loco chassis and the parts necessary for the tender chassis plus sideframes. Farish bodies may be obtained (at the time of writing) from the Bachmann service department (either via the contact us section on the Bachmann website or by telephone on 01455 847097) although these lack the detail pack that comes with the complete loco (this includes valve crosshead guides, the 'glass' for two of the four cabside windows, and the vacuum pipes). Note that this chassis has the correct (1:148) scale wheelbase and so is not suitable for the Peco Jubilee.

Parts required to complete are: -

Bogie wheels	4 x 6.5mm
Driving wheels	6 x 13mm
Tender wheels	6 x 8mm
Crankpins	6
Crankpin cap washers	2
Motion pins/0.3mm wire	minimum 2 packs of pins
Frame bushes	minimum 18
Wheel muffs	minimum 9 including one gear muff
Gears	1 x 38:1 Ultrascale gear set
12BA washers	several for packing worm shaft (optional)
Axle steel	3" or so
PCB frame spacer	1" or so
Motor	Faulhaber 1219 or 1017, Maxon RE10 or other if preferred
Thin double-sided PCB (say 10 thou thick)	2 sq. inches should suffice
Brass/ nickel silver rod 10 thou and approx. 2.5mm	6" of each
Brass bar 1mm x 1mm	2"
Screws and nuts 12BA cheesehead	12
Screw and nut 14BA also optional washer	1 of each
Small spring (for bogie)	1 (ones from redundant N gauge couplings are suitable)
Flexible wire 0.3mm or similar	6" or so
Lead for boiler and tender weight	As much as possible
Shim/plasticard for packing	
Vacuum pipes	2 (e.g. BH Enterprises)
Couplings	own choice
LMS loco buffers	set of 4 (optional)
Black 5 loco castings	1 set
Stanier tender castings	1 set

Tools required include: -

Soldering iron and solder, flux
Needle files – flat, round
Modelling knife
Broaches
Wet and dry paper, glass fibre brush
Set of jewellers screwdrivers
Chassis frame assembly jig
Tweezers
Piercing saw/Razor saw
Flat nosed pliers
12 BA tap
Minidrill and burrs

There are a number of small and delicate parts on the etch. It's best to leave parts on the etch until actually required.

All folds are made with the half-etched line inside the fold unless otherwise stated. Traces of tabs holding parts in the etch should be removed with a needle file prior to assembly. It is recommended that work done is cleaned periodically to remove all traces of flux.

It is desirable, though not essential, to have a lathe to turn a bogie pivot bearing, a pair of universal joint housings, and dummy valve covers. These parts can be fabricated using other means. All apart from the bogie pivot bearing may be obtained from the Black 5 loco and tender castings supplied from the Association shop

The following instructions assume that left and right are as viewed by the driver when looking forward past the boiler. The instructions

should be read from start to finish before removing metal from the etch. Whilst the instructions broadly follow the order of construction they are grouped into discussions of sub-assemblies and reference will occasionally be needed to later sections of the instructions. There will of course be other ways to assemble the chassis rather than following the build order outlined below, but there are still points worth noting if only to avoid the mistakes made by the test builder! Simpson springing is catered for on the loco chassis if desired. To do this follow the instructions below except open out the bearings to 1.6mm once the frame has been assembled and solder thin phosphor bronze wires in the holes provided (Simpson springing is explained in the 2mm magazine Aug/Sept 2008).

Whenever a nut is to be soldered in place on one of the etched parts this may be done by covering all surfaces not to be soldered together in pencil lead (or chemically blackening) and retaining the nut in place with a suitable bolt (also covered in graphite/blackened). Be sparing with the solder otherwise the whole lot will be locked solid!

The section covering assembly of the valve gear assumes you rivet the parts together using the washers once supplied with the .3mm rivets or motion pins. The washers are no longer supplied with the rivets but an alternative is to use the washers included on the etch. Or, instead of riveting the parts together you can solder them together. The basic idea is insert a rivet through the hole in the first part, ease a small piece of grease proof paper over the protruding rivet, place the second part over the rivet, hold down the second part, but not too tight, add a little solder paint and solder in place. Then remove the paper and clean up the parts.

2. Locomotive chassis

Frames

2.1 Start by removing the loco frames and open out axle holes with a round file until frame bushes just fit. Solder bearings in each hole on the inside of the frames. I don't know if other modellers do so but I file the part of the bearing protruding on the outside of the frames flush with the outside face of the frame. This gives a little more side play for the wheels. (Now may be a good time to make the alterations needed to the loco body – **see section 6**)

2.2 Open out each bearing until a driving wheel axle can be inserted and spun freely with minimum play, especially the middle axle which carries the worm wheel.

2.3 Remove loco frame spacers (4 in total) and bend up as per loco frame diagram (Fig 1).

2.4 Cut pieces of double-sided PCB for each spacer, slightly larger than the spacer in question, and solder all four to one of the frames, in the positions indicated in fig.1 (see also photos, although they need not be so intricately shaped!). Ensure position of the PCB is flush with (or at least not proud of) the top of the frames. Ensure that the PCB doesn't cover the holes for the brake hanger wires or the slots for the springs.

2.5 Solder spacers onto PCB in accordance with the positions shown in fig 1. The front (bogie) spacer should be placed so that the middle horizontal portion is well below the cylinder cutout in the frames to leave room for your pivot bearing and to ensure that there is clearance for at least a half nut stuck onto the body where the original body fixing was. The middle spacer may be set 1mm below the top of the frame to ensure it doesn't clash with the motion bracket which will be fitted later. The rear spacer should be set so that the rear of the spacer is flush with the rear of the frames and approximately half way up the narrow rear frame. This is to allow a (half) nut or bolt to be glued to the loco body directly above it and also allow room for a (half) nut to be soldered above the spacer to take the bolt that forms the drawbar pivot. The spacer may also be mounted lower on the frame if desired, but this would make securing the body in place harder to conceal. The position of the gearbox spacer should be worked out by taking one of the frames (with bearings fitted), placing the worm wheel over the middle driving axle bearing and offering up the completed gearbox assembly (see below) as if to bring the worm and worm wheel into partial mesh. The base of the gearbox can then be marked and the spacer positioned slightly lower than this mark (at least 2.5mm from top of frame) taking care not to solder the spacer too far forward so that it fouls the worm wheel once fitted (!) (see **photo 6**). Check that each spacer is square to the frame horizontally and vertically. Repeat 2.4 for the other frame.

2.6 Join frames together using a loco frame assembly jig or lengths of axle steel inserted through the outer axle holes. In either case check that frames are square to each other. This can be done using lengths of axle steel through the outer axle holes or temporarily fitting driving wheels and checking that the chassis doesn't wobble when set on true track or a sheet of glass.

2.7 Open out all frame spacer holes to required diameter using a suitable cutting broach or round needle file. Solder a 12 BA (half) nut over the rear hole in the rear frame spacer, ensuring accurate alignment and that the body does not sit proud when the drawbar is introduced above this nut. There should be room for this and a bit more to allow a small amount of up and down movement in use.

2.8 The springs can now be soldered to the bottom of the frames, thinning the vertical 'prongs' as required to get them to fit neatly in the half-etched recesses in the frames, and taking care not to cause the bearings or spacers to shift. If fitted at this stage then there is more danger of them being damaged e.g. during quartering, but you won't accidentally solder something where they should fit e.g. ends of your brake hanger wires.

2.9 Solder together pairs of coupling rods (a single layer will bend too easily).

2.10 Insert flanged crankpins in driving wheels, and then the driving wheels can be fitted into the frames, with the worm wheel on the middle axle. Quarter the drivers one pair at a time (Jubilees had right hand lead – see references 1 and 2), ensuring the chassis can run smoothly down a gentle slope with the coupling rods fitted and held in place with rings of wire insulation material. When satisfied, glue the axles in the muffs. It is vital that the chassis runs smoothly now – when you fit the valve gear you want to be sure any uneven running is not due to poor quartering so eliminate this possibility now. You can also test the gear meshing at this stage by fitting the gear assembly including packing, and connecting the U/J to a motor. Run the motor and check that the meshing is satisfactory, and the wheels rotate smoothly.

2.11 You can attach the driving wheel balance weights now. The larger ones go on the middle driving wheels. Refer to drawings or photographs for positions. Ensure they don't sit proud of the wheel rims or this may be a source of intermittent binding once the valve gear is fitted. Epoxying in place seems to be the best method.

Gearbox

2.12 Prepare the worm shaft assembly by opening out bearing holes and solder frame bushes on the same side as half-etched fold lines. Solder 12 BA nuts over both the small holes in the central rectangular section of the assembly, again on the inside, check alignment, and remove any solder that may have run onto the threads using a 12 BA tap.

2.13 Fold up worm shaft assembly and run a fillet of solder down each corner join. Check nuts and bearings have not moved.

2.14 Open out bearings until a length of axle steel will just slide freely through both holes.

2.15 Mount a worm on one end of some axle steel shaft (ream out to 1.5mm if required), insert in worm shaft assembly and attach universal joint coupling on other end. For the u/j housing you can turn your own, use one from the Black 5 castings, or form one from axle muffs and tube or use tube alone. It may be necessary to pack out the shaft with washers between the worm and the axle bearing, and the u/j and the other axle bearing so that backwards and forwards movement is no more than a half millimetre. Then check that when screwed in place over the gear spacer the worm ends up centrally over the middle axle.

2.16 Check mesh of worm and worm wheel and use thin shim (brass/plasticard) to move worm up until correctly meshed.

Bogie

2.17 If using a cast bearing, open out the hole in the top of the bearing until a 14 BA nut just fits inside the hole, and solder the nut in place there. Check that the nut will take a 14BA screw. Open out the hole in bogie pivot spacer and solder the casting in place as shown by figure 1. Alternatively turn a bogie pivot bearing, and solder on to the top of the spacer as per fig 1. The inside bore through the centre of the bearing should be sufficiently wide to take a 12BA screw, and the outside bore narrow enough to allow a spring to be attached along it and under the spacer. The spring can be soldered to the underside of the spacer if desired. The spring itself needs to be long enough to press gently down on the bogie, but not too much. A third alternative is to fabricate a bearing from approx. 1.5mm (outside diameter) tube and a 14BA washer soldered together taking care to limit the solder on the outside of the joint. In contrast to the turned pivot the tube should be long enough to protrude beneath the bogie when the chassis is on the track. This can then be soldered in place and a 14BA nut soldered to the top etc as per the turned spacer. This avoids the use of a lathe, but will be weaker in service than the turned alternative.

2.18 The bogie itself is assembled using the same procedures as the loco frames (paras 2.1 – 2.6). If using the fabricated bogie pivot then it may be necessary to open out the slot in the spacer to allow smooth side-to-side movement, but minimal fore and aft play.

2.19 Bend the cosmetic guard irons outwards, the lower section being roughly in line with the wheel treads, and check that the front wheels still rotate freely.

Cylinders and Valve gear

2.20 Remove both cylinder side covers from the etch and gently tap a sewing machine needle into the half-etched holes using a firm surface to work on. These represent rivets on the outside of the cover.

2.21 If you are not using Black 5 castings for the valve ends now is the time to turn them up from suitable diameter rod (the real ones are 15 inch diameter) using published drawings (see references 1 and 2 below) for dimensions. If you are using the Black 5 castings you can now cut up the one piece valve cover assembly to remove the redundant centre section. A piercing saw is handy for this.

2.22 Using the cylinder end pieces as guides, form the bends in the cylinder side covers. Open out the holes in the cylinder ends as required to allow you to fit turned valve covers if you are not using the Black 5 parts. Also check that the piston of the Black 5 piston/crosshead assembly will slide in its hole. It is a good idea to open out the hole in the front of the cylinder as well at this point to avoid having to shorten the piston until you know exactly what length it needs to be. Tin the cylinder ends (ready for attaching the dummy ends later) and solder the ends inside the covers with the face of each end flush with the cylinder cover. Check the fit in the aperture over the bogie. It is important that everything is square at this point.

2.23 You will need to electrically isolate the two sides of the cylinder assembly at some point but if you do this now it will help stop the cylinder assembly collapsing as you solder cylinder and valve end covers to the assembly, as described later. This step can be accomplished by soldering a square of PCB frame spacer inside the middle of the front and rear cross pieces (see **photo 8** for one way

of doing this). An alternative is to build up layers of rectangles of PCB frame spacer until they are thick enough to just fit between the front and rear cylinder cross pieces. I formed a sort of 'club sandwich' of PCB, a layer of 10 thou nickel silver, PCB, another layer of nickel silver and a layer of PCB, with one side of the rectangle about the same as the depth of the cross pieces. The sandwich is then soldered in place between the crosspieces but left ungapped until the work on the cylinder and motion assemblies is complete. The nickel silver rectangles need to be a bit bigger than the PCB so that they stick out and allow you to get your iron on them to solder to the PCB. Once soldered in place you can file the nickel silver filling flush with the PCB.

2.24 The slidebars can now be assembled. These come in pairs set at the correct spacing. Two layers should be soldered together to form each slidebar pair. Do not remove the tabs between the slidebars at this stage; they will be filed out later. Depending on how brave you feel you can then either thread two dummy cylinder end layers onto a set of slidebars and insert them in the cylinder end and solder everything up in one go, or alternatively form a dummy ends plus slidebar sub-assembly which you then solder in place on the cylinders. Whichever method you choose be careful to avoid unsoldering the main cylinder assembly (it's easily done!). If you haven't filled the gap between the cylinder end cross pieces as described above, a wooden coffee stirrer or similar inserted between the front and rear cylinder ends can help avoid any disasters.

Ensure that the slidebars are square to the cylinder in all directions. Now you can carefully remove the tabs between the slidebars (I used a decent quality file for this). An alternative is to remove these tabs only when you have soldered the slide bars inside the slide bar support brackets as described below. Then repeat the whole procedure for the other set. Once the tabs have been removed check the inside faces of the slidebars are smooth and check that the piston/crosshead will slide easily between the two slidebars (note the crosshead shaped part on the etch is not required). If not file the surfaces opposite each other on the slidebars and check that the crosshead casting is smooth.

2.25 Now the front cylinder ends (2 layers) and the valve covers can be soldered in place. Extreme care needs to be taken here to ensure nothing shifts. Alternatively these parts can be glued in place later. Certainly if using the Black 5 castings, assemble the valve gear before fitting the valve cover with the valve crosshead guide attached to ensure that everything fits without clashing. If using this casting it will be necessary to remove the valve guide from the valve cover end, remove the rear of the valve guide (i.e. the portion nearest the frame), thin the front portion of the valve guide to give more clearance for the combination lever etc, if necessary remove more material to make room for the combination lever/radius rod joint, and finally reposition it slightly further out from the frames. This is due to the fact that the cylinders are placed at the correct separation, but with the slidebars set further out on the cylinders than is prototypical. The Black 5 parts are designed for prototypical placement of the slidebars on the cylinders and so problems may be experienced with the combination lever if this is not altered.

2.26 Solder pairs of connecting rods together. Ensure there is room for the connecting rod to swing in the slot in the crosshead.

2.27 Then solder a motion pin (or piece of 0.3mm wire) in the bottom hole in the crosshead from the rear. Now check the connecting rod fits easily in the aperture and if happy, insert a crankpin from the rear of the crosshead, through the connecting rod and front of the crosshead. Carefully solder the crankpin to front and rear of the crosshead, and check the connecting rod swings up and down by at least 2mm at its rear end. If the swing is much less than this in either direction it may be necessary to partly dismantle and increase the clearances slightly. I filled the inside of the crosshead with Jif before I did the soldering and this helped stop me soldering the connecting rod to the crosshead! You could use oil to do this instead. File the back of the crankpin so that it is only slightly proud of the crosshead rear. The front of the crankpin can also be trimmed back to be almost flush with the front of the crosshead.

2.28 Check the whole assembly slides easily between the slidebars with the piston entering the cylinders in a line parallel with the slidebars. Trim the piston to the correct length at this stage if you have not already done so.

2.29 Repeat steps 2.26 to 2.28 for the other crosshead.

2.30 Bend up motion bracket/slidebar support units, noting the slidebar support is left at a slight angle to the vertical rather than perpendicular (and in place must be clear of the front brake hanger), and add a fillet of solder inside the bends. Join the two brackets together by soldering a length of PCB frame spacer along the bottom of the inside of the flat, horizontal faces of brackets. Check the slidebar supports are level, and that the sides of the bracket are parallel to each other and lie just inside the (valance) edges either side of the loco footplate. Also check that this unit is central when placed between the frames. Then saw a gap along the top face of the PCB to electrically isolate the two brackets.

2.31 Solder a motion pin (or 0.3mm nickel silver wire) through the hole in the side of the motion bracket from the outside, ensuring it is square, and then solder the little circular cover over the top of the pin.

2.32 Fit the cylinder assembly into the aperture in the frames, then the motion bracket assembly in its cut outs in the loco frames, with the slidebars between the cut out in the slidebar support bracket. It will be necessary to remove some material from the top or bottom edges of the slidebar support aperture (a total of about 0.75mm until the support for the lower slidebar is approx. 0.35mm deep) until (1) the slidebars are parallel and (2) join the slidebar support bracket at right angles and (3) the motion bracket assembly is flat in the cut outs in the frames. When satisfied, carefully tack solder the rear ends of the slidebars to the slidebar support bracket to form a cylinder/motion bracket unit. To ensure the crosshead will pass the slidebar support bracket inner vertical edge, solder the slidebars right on the outer edge of the slidebar support bracket.

2.33 With the unit in place in the loco frames, insert each crosshead assembly in turn and check the crosshead passes the slidebar support and runs smoothly inside the slidebars. It may be necessary to remove some of the slidebar support bracket aperture to ensure the crosshead can slide along the slidebars. When there is sufficient clearance, you will need to trim the front driving wheel crankpins back almost flush with the coupling rod. You can then attach the coupling rod to the driving wheels, then a washer on the middle driver

crankpin, then the connecting rods to the middle driver and check that the connecting rod doesn't need to be forced down towards the driving wheel. If this is the case, it may be necessary to ease the sidebar support end of the slidebars in towards the centre of the frames slightly, ensuring both slidebars on one side remain parallel and in line from above.

2.34 Once you are satisfied with the cylinder/ motion bracket unit, the cylinders can be isolated electrically. Do this by sawing a thin vertical groove through the cylinder end cross pieces and the first layer of PCB. A piercing saw is good for this. With the unit mounted on the frames check each side of the frames is isolated from the other. You may want to leave this step until all the bits of valve gear have been attached to the cylinder/ motion bracket assembly.

2.35 The rest of the valve gear can now be assembled (see **photos 1 and 9** for arrangement of the finished valve gear, but note that the loco shown (photo 10 excepted) uses an older version of the etch with closer set slidebars and a fabricated crosshead). If you have never assembled valve gear before, the chapter in Pete Wright's book on the subject ("Loco Bits and Pieces" available from Shop 1) is well worth reading. Firstly solder pairs of the various parts together. You can include the union link in this (the smallest part) but I don't think it's essential. Next solder motion pins (or 0.3mm nickel silver wires) into the various parts as indicated by the hatched holes in fig 4. Solder the pins from the back and remove any pins so that a flat surface is left.

2.36 The various parts can now be joined together. A clear bench and a big piece of white paper are useful to work on for this, as the washers are small and easily dropped. I recommend starting with the combination lever (shaped as per fig.3 or **photo 2**) and the union link. Join the first two parts together and place a washer on the motion pin. File the rivet away almost to the washer, and with everything resting on a steel block, gently tap the rivet with a light hammer. Now check the movement of the parts at the rivet. They may be a bit stiff at first but should soon loosen up. Also check the rivet has not bent to one side when you hit it with the hammer. If this has happened, you can try to straighten it but probably you will need to fit a new rivet and start again. Therefore it's best to have plenty of spare rivets and washers. (If the riveting approach doesn't work for you cover the bits you don't want soldering together with graphite, join the parts together, place a layer of lightly oiled greaseproof paper over the pin, add a pre-tinned washer and solder in place.)

2.37 Next join the return crank, eccentric rod and expansion link together. It is advisable to kink the return crank away from the frames at the eccentric rod end, and the expansion link also at the eccentric rod end to obtain the clearance required to pass the connecting rod as the various parts rotate. The precise amount is a matter of trial and error.

2.38 Now the combination lever/union link can be joined to the radius rod, and then this three-part assembly can be rivetted to the bottom of the crosshead.

2.39 The various bits of valve gear can now be mounted onto the motion bracket. First locate the free end of the expansion link on the pin in the motion bracket, then a piece of greaseproof paper is placed on the pin. Now thread the radius rod through the rectangular hole in the sidebar support bracket and mount this on the pin in the motion bracket, and insert the piston/ crosshead assembly between the slidebars. (This can be a fiddly operation). Arrange the radius rod so that its upper edge rests against the top of the sidebar support bracket aperture and solder radius rod in place behind the pin, ensuring the expansion link swings on its locating pin when the grease proof paper is removed. If you are satisfied that everything is in order so far, solder the radius rod to the sidebar support bracket to provide extra strength.

2.40 Repeat 2.36-2.39 for the other side.

2.41 A twelve thou washer, then the connecting rod and the return crank can now be mounted on the centre driving wheel crank pin, the hole in the return crank being opened until it is a tight fit on the crank pin. Check the chassis runs freely. If this is not the case, examine the valve gear closely to spot parts which may be catching on other parts. There isn't much clearance in places so it may be necessary to increase clearances by filing down the offending item. Possible problem areas include the front crank pin which, as mentioned, needs to be filed almost flush with the coupling rod, and the expansion link not being bent far enough away from the frames. Sometimes it's necessary to realign the slidebars away from or closer to the frames.

2.42 If the chassis is now running freely, you can solder a crankpin cap washer onto the rear driving wheel crankpin. Note that a twelve thou washer should be placed on each crankpin between the driving wheels and the coupling rod (if not using flanged crankpins) to help free running and prevent the coupling rod scratching the paint on the driving wheels. Use a piece of greaseproof paper on the crankpin between the coupling rod and the cap washer to provide a little clearance, and then solder in place. Remove the greaseproof paper and check the driving wheels still rotate.

2.43 The return crank can then be attached in similar fashion to the cap washer in the paragraph above, in this case a cap washer not being required. You may consider inserting a 16 BA washer between the coupling rod and connecting rod, rather than a 12 thou washer. This brings the connecting rod further out at its rear end and more in line with the piston rod.

2.44 Repeat 2.40 - 2.43 for the other side of the valve gear etc.

Brake gear

2.45 The brake gear can be attached if desired (if you haven't already done so attach the loco springs to the frames now otherwise the brakes will get in the way). Firstly solder lengths of 10 thou rod through the small holes in front of each driving wheel. It's easier to bend up 'L' shaped lengths of rod and solder one of the legs to the inside face of the frames, but take care to avoid the PCB spacer mounts. The rod should protrude from the frames on each side just less than the outer face of the driving wheels. Then solder the six brake blocks to the brake hangers and open the holes in the brake hangers to take the 10 thou rod. Place a brake assembly on the front piece

of rod and solder in place checking the whole assembly is inside the outer face of the driver. Repeat for the other two brakes, and then repeat for the other side.

2.46 Check the brake hanger lower holes line up with the brake pull rod holes, and thread a length of 10 thou wire through the lower hole on the front brake hanger, the two brake pull rods, and the brake hanger on the other side. Repeat for the rear brakes, and solder the hangers and pull rod to the wire. Add the wire for the middle brakes and solder in place. Check the driving wheels still rotate freely.

2.47 Finally remove the central sections of the 10 thou wire to maintain electrical isolation by carefully cutting just inside each brake hanger.

3. Tender Chassis

3.1 Repeat steps 2.1 to 2.6 for the tender frames and three tender spacers, positions as per Fig 4. Open out the holes in the front and rear spacers so that the bolts attaching the drawbar to the inner footplate (a.k.a. the bit you solder the cosmetic outer frames to) don't foul them when pivoting (see below). Then fit wheels.

3.2 Bend the tender pivot spacer at the half-etched line to form a right angle as shown in Fig 4. A hole should be drilled 1mm closer to the fold line than the hole furthest from the fold line so that the muff can be positioned as per Fig. 4 (rather than adopting the arrangement shown in **photo 4**) to enable the wheels still line up with the holes in the cosmetic sideframes (see 3.10)

3.3 Cut a rectangle of thin PCB of width equal to the space between the frames and solder to the vertical face of the tender pivot spacer. Check this just fits between the frames and epoxy an axle muff inside the angle of the spacer. It will be necessary to file a flat on the muff to reduce the effective diameter of the muff by about 0.5mm so that the frames end up at the correct height in relation to the wheels. The pivot is mounted inside the frames by a short length of axle steel glued into the muff from either side of the frame, but check before gluing in place that the frames are electrically isolated.

3.4 Solder the brake blocks to the brake hangers and fold up the hangers. Where there is a little fold over at the top of the brake hanger solder a length of brass bar (1mm square section or similar) into the angle and file to length so that the brake hanger is about 1.5mm away from the side of the frame. Then hold brake assembly in place with tweezers and a quick dab with a hot iron before the rod moves from the brake hanger. Only four are provided as the rear two are completely hidden by the rear frames/steps.

3.5 Fold up the tender body 'anchors' to form U-shapes (see **photo 3**). Open out the holes in these to take 12BA bolts and solder a 12BA nut over the top of each hole (i.e. within the 'U'). Also open out the holes in the inner footplate and the drawbar/motor mounting plate and solder a 12BA nut over the middle hole of the drawbar. Screw the latter to the tender pivot spacer and check it pivots freely. Then form the 'joggle' in the drawbar and add fillets of solder for strength.

3.6 Check the fit of the anchors in the tender body. A small amount of material may need to be removed from the tops of these to allow them to sit low enough in the body to allow the inner footplate (when fitted) to sit flush with the bottom of the outer one. Also some material may have to be removed from the outer faces of the front anchor depending on whether or not you alter the tender body or remove the wire handrails (see section 6).

3.7 Solder the sideframes to the inner footplate ensuring using the half-etched lines to locate the sideframes. Ensure there is no overhang at either end.

3.8 Fold up and solder the tender guard irons to the rear of the inner footplate.

3.9 Epoxy the motor to the drawbar/motor mounting plate (if using a 12mm diameter motor). If using a 10mm diameter motor solder the folded up motor mount in place first and then glue the motor to this. A half-etched line indicates the approximate rear end of the motor. Then fix universal joint housing onto the shaft of the motor.

3.10 Screw the tender chassis unit to the drawbar/motor mounting plate and then solder thin, flexible wire from the motor tags to the tags on the sides of the chassis (these tags should be bent out as required to clear the motor). Screw the tender assembly to chassis unit and check that the holes in the cosmetic sideframes line up with the wheel centres.

3.11 Solder or glue axle boxes in place on the sideframes.

4. Finishing Off

4.1 Once the loco and tender chassis work is complete, the tender chassis and loco chassis can be attached with a screw through the hole in the rear loco frame spacer. Some adjustment may be necessary to get the tender to sit level. This can be achieved by adding washers above the rear frame spacer as required. The two u/j housings are connected using a suitable length of 10 thou spring steel wire bent up with a loop at either end (or steel wire with 7mm handrail knobs on the ends with 0.7mm wire crosspieces if using the Black 5 u/j housings). If current is now applied to the motor, the loco should run. Possible uneven running may be due to: -

1. Lack of weight on the drivers – blue tack a lump of lead over the gearbox.
2. Poor gear meshing – inspect and adjust as necessary.
3. Dirty wheels/ track – its important these are spotless.

4. Lack of oil – a spot of oil on all axles, gearbox bearings and moving parts of valve gear is advisable.
5. Poor pick up – this can be improved by joining the loco and tender frames together by soldering a length of thin, flexible copper wire between them. Then you will pick up current via the tender and the driving wheels.

4.2 It is almost inevitable that you will need to make some adjustments before reasonably smooth running is achieved, and it is a matter of trial and error until you succeed. It is important therefore that you ensured the chassis ran freely after you quartered the driving wheels, and that the valve gear does not catch on anything.

5. Painting etc

5.1 The stage at which you paint the chassis is up to you. If you've followed the instructions above, you can paint everything after assembly is complete. Alternatively the chassis and driving wheels can be painted before the driving wheels are permanently fitted. This approach is easier in some ways, but remember you may want to solder the brake gear in place as the last stage of assembly, and this may spoil the paintwork.

5.2 Painting can be completed using a suitable 1 or 2 part etching primer for the undercoat and then spray everything with a suitable black and weathering according to personal preference. Alternatively the chassis can be chemically blackened.

6. Fitting Body

6.1 The way the loco body is attached to the chassis is up to you (the method mentioned above being just how I chose to do it). However to fit the body you will need to remove the cosmetic frames below the smokebox, and some of the moulding at the rear of the underside of the body including in the dragbox area (see **photo 9**). Before removing any material from the body it is advisable to glue the cab to the valance moulding. If you do not then the rear valance becomes very weak when the hole for the universal joint is made. Also take care when removing the frames immediately below the smoke box saddle. Removal of the cosmetic frames weakens the front of the body; so when removing material from the original screw mount here avoid applying too much pressure on the bufferbeam as the body will bend just above the middle cylinder cover resulting in deformed plastic here.

If you choose to glue a nut/screw to the remainder of the screw mount ensure that it doesn't prevent the body sitting properly on the chassis (I used a half nut). Material also needs to be removed from the firebox door area of the loco body (see **photo 5**) and the coal hole area of the tender body (see **photo 7**) to allow room for the universal joint shaft. Material also needs removing from the tender front below footplate level to make room for the drawbar.

6.2 As already indicated the loco body can be attached to the chassis via the slot in the front of the bogie spacer and the hole in the rear spacer (see **photo 9**), but the hole in the spacer just ahead of the worm wheel may also be used, although this requires a nut to be fitted into the weight added in this area. I epoxied a front half nut and a rear bolt in place on the body (the photos show two half nuts as initially fitted, but later changed).

A variation on this approach is to grind the front fixing hole provided in the locomotive body flush with the underside of the footplate and use the screw that comes with the body in this hole via the slot in the front spacer. For the rear, use the forward hole in the rear spacer as a guide and drill a 1mm diameter hole through the underside of the cab floor into the cab. Then tap this to take a 1/2 BA screw.

6.3 Fix as much weight as you can into the body (some may also be added between the frames on the chassis), but be careful to avoid adding too much weight to the front end and unbalancing the loco.

6.4 The tender anchors can now be epoxied into place in the tender body ensuring that when in place the inner footplate remains flush with the outer. To ensure that the anchors are glued in the right place inside the tender body, screw the internal footplate and the motor mounting plate to the anchors, then insert this assembly into the tender body. Now epoxy the anchors to the body and leave to set. Add weight to the tender as required to ensure adequate electrical continuity.

6.5 Add vacuum pipes of your choice to the buffer beams. You can buy cast ones from BH Enterprises, make your own as per Pete Wright's article in 'Loco Bits and Pieces' or use the one supplied with the complete locomotive (these appear not to be supplied if you buy a body only from Bachmann). You can also add sandboxes and suitably modified valve crosshead guides (if not fitted earlier) at this stage.

Acknowledgement

Thanks to Simon Grand for the considerable help he has provided with the design of the etch and the production of the instructions.

References

1. Model Railways, June 1974. Includes detailed plans.
2. Historical Locomotive Monographs - 2: LMS Jubilees, Essery & Toms (Includes the same detailed plans as above)
3. The Book of the Jubilee 4-6-0s, Hawkins (Ed.)
4. The Jubilee 4-6-0s, Townsin
5. Power of the Jubilees, Morrison & Whiteley
6. Loco Bits and Pieces, Pete Wright
7. Stanier 4-6-0s at Work, A.J. Powell
8. Locomotives Illustrated No.36
9. Stanier Locomotive Classes, A.J. Powell
10. What Happened to Steam, vol.3: the London Midland 'Jubilees', P.B. Hands
11. video: Power of LMS Jubilees
12. Website: www.jubilees.co.uk (maintained by a chap called Simon Robinson; has a lot of info, including a good bibliography)

Farish Jubilee Replacement Chassis Photographs



Fig 1.

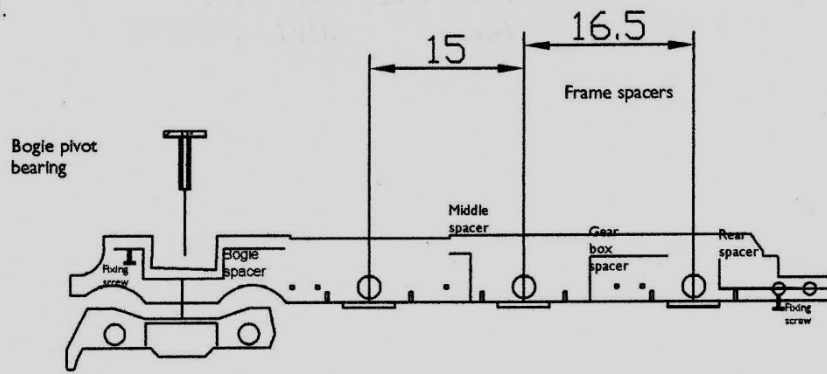


Fig 2. Bend guard from outward

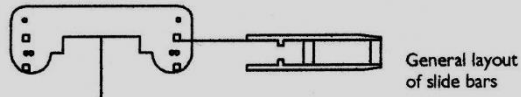


Fig 3.

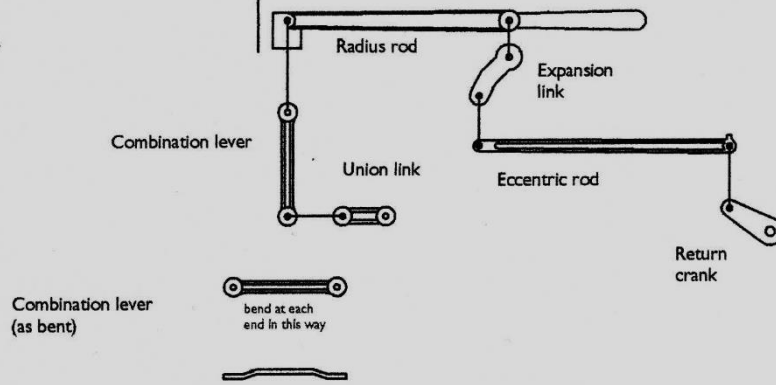


Fig 4.

