Great Central Railway 4-4-0 Class 11B

Modelling the Great Central Railway

Robinson GCR Class 11B

Version 2.2 March 2019

Assembly Instructions for personal collection

This kit is optimised for P4 standards. Earlier kits were designed by “Great Central Models Ltd” as part of a range of Great Central Railway locomotives. However, this kit has been designed purely as a private enterprise for my personal collection and will not be for sale to other modellers.

Great Central Models Ltd was registered as a Private Limited Company - 7355519 - but ceased trading in 2015 and the company has been dissolved.

Details of the original kits from Great Central Models have been preserved at https://traders.scalefour.org/greatcentralmodels/ by kind permission of the Scalefour Society
# Numbering

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### Additional Notes

**Important Note**

This kit has been designed for P4 standards. There are plenty of spare parts for the smaller items. Considerable additional work will be needed to build this kit to ‘EM’ or ‘00’ standards. Remember that ‘EM’ and ‘00’ wheels will cut into the boiler space. For EM modellers care must be taken not to increase the upward movement of the wheels if sprung or compensated by filing out the axle slots in the frames.

This kit can be built to represent the original GCR Class 11B which became the LNER D9 on Grouping, although most had been superheated by that time.
Notes on the kits and constituent parts

The etched parts in this kit have been designed using a CAD program (TurboCAD 2017 DL) to ensure accuracy when fitting the parts together. Included in these notes are:-

- A list of etched and cast parts
- A list of additional and optional parts
- Drawings of the etch fret
- Detailed step-by-step instructions with the drawings extracted from the CAD originals

The original CAD drawings were prepared from GA drawings obtained from NRM and scaled at 12" to 1’. During the design process a number of compromises had to be made (such as the frame widths) because of the materials and parts available to the modeller and the P4 standards. These compromises were used to draw a full size CAD drawing which was then used to provide the instructions and construction drawings and the final etch parts. The etch parts of the drawing were scaled down very accurately to produce etches for the 4 mm modeller.

The kit prototypes were built by the designer. The first trial etch was used as a feasibility project and to write outline instructions. The second test etch was used to test the assembly, write instructions and produce the assembly diagrams as well as a viable model. A modeller familiar with etch brass kit construction should be able to build an accurate model if these instructions are followed, generally as written. However, fine-scale modellers being who we are, other ways of building the kit will be tried!

The Instructions

More years ago than I care to remember I was involved in validating and writing Master Work Sheets for the Royal Air Force. These were sets of instructions that had to be followed to the letter by technicians world-wide even though they may never have met that particular piece of equipment before. Deviations were never permitted to the technicians – given that the machines being tested were vital to safe flying – and any permission to be deviant had to be granted by senior authority was subject to a very close monitoring process.

However, senility and pending obsolescence have taken their toll – nobody is perfect – so if you find anything in these instructions you feel to be wrong it will be examined closely and amended where appropriate. Likewise, with the measurements of the parts, if there is something which you feel may be wrong then, please let me know. It would be nice if this was supported by drawings, or copies of drawings with time stamps if possible. Photographs are useful as well. But be warned, the available drawings are neither consistent nor accurate if my research means anything at all and there were so many cosmetic changes made to these locomotives over nearly 50 years that photographs without a date stamp must be treated with some caution.

Things to note

In a few areas there are alternative ways of doing things. For this kit the springs have been printed using 3D CAD technology as an option, they are fitted to the frames in the same way as the traditional metal springs. Note that these are heat sensitive and will melt as quickly as white metal castings. Using these means that the wheels can also be removed for ‘servicing’.

Continuous Springy Beams (CSBs) may be fitted - they seem to be all the vogue these days. I am a little uncomfortable with the idea and prefer to stick with the prototype idea where each axle is sprung by itself. Short handrail knobs are used for the spring mounts.

Inside connecting rods and frames and the Stephenson’s Valve Gear would have been visible only by looking very carefully. Extra parts are provided so you can experiment with the way it fits together. If you are tempted to try this then please do remember not to solder the parts in situ ‘after’ you have fitted your plastic centred wheels. The valve gear may be fitted in working order or as a very loose fit on the front axle. In the second case this means they will be visible but will not move except around the axis of the axle.

The Stephenson’s Valve Gear is tricky to get working well and may be left out. The rest of the engine will still look good.

Rear and centre frame spacers - those supplied on the etch are to scale and may be fitted if desired - you can create frame spacers which are a good representation of the originals but these are difficult to see when the model is completed. In practice the rear spacer construction was used to steady the front of the fire box but this may be omitted without weakening the whole chassis. P4 versions of these spacers are supplied. These are not standard widths though. Spacers may be added if needed for extra electrical pickups.

There is substantial current collection capability in the tender. I was tempted not to have pick-ups in the locomotive since they would detract from the scale frame spacers and the valve gear and since there is plenty of space in the tender with or without
the optional DCC chip this may be a good option. The two wires for the motor may then represent the vacuum and heating pipes.

The part numbers and descriptions (where space permits) are half etched on the frets as near to the parts as sensible and match the description that appears in the Parts List. These annotations will appear in the form “212”, or “223,224” or 213-217” or 218-225+3”. Where the “+” appears in the part number it shows that additional parts have been included and the number following shows that 3 additional parts are on the fret. This allows for two possibilities

a) losing very small parts in the carpet after cutting them from the fret

b) practising the assembly in cases where some difficulty may be expected

Refer to photographs to check if parts were actually riveted early in life, Robinson abominated ‘proud’ rivets and there is some photographic evidence to show that they may not have been used in the early days

The instructions also use the Part Number and Full Description. This may seem a little pedantic but can help where there may be some uncertainty. I also list all parts separately and do not group sets of parts together (i.e. Springs Qty 7) so that you will find the parts list will show each layer in a built up assembly as an individual item.

Assembly Instructions

The frets are made from 12’ (0.3 mm) brass and 15’ (0.38 mm) N/S. They are fragile and the edges are sharp. Take care when assembling and especially when drilling out holes. Rotating brass or N/S will cause a lot of skin and tissue damage if the drill sticks and tears. For preference use a hand drill or pin chuck.

You may also find it easier to drill out all the locating holes while the parts are still within the main etch, and even to assemble some of the parts together - simply because this helps to hold at least one of the parts firmly in place.

Do not use force at any time, you are likely to bend the parts beyond repair. The tabs and slots are designed to be a semi-tight fit and on occasion a little easing with a strip of wet & dry sandpaper may be needed, especially on the slots in the smaller parts. If needed, where parts fit into a slot, very lightly dress the mating edges with a fine file.

Unless otherwise stated, the folds are all done with the half etch on the inside.

TAGS, which are usually half-etched, are on the fret and hold the individual parts in place when the fret is etched. TABS are on the parts to fit into SLOTS in the corresponding parts. In many areas on the fret TAGS have been arranged so that they fit onto TABS solely to help minimize any possible damage to the component when the TAGS are removed since the TABS will all in the end be invisible.

Do not confuse TAGS and TABS and file off any TABS!

It may be easier to do a number of preparatory jobs before removing parts from the main etches. The smoke box wrapper was flush riveted when built but as the LNER super-heated the locomotives they would normally have been replaced by the usual, highly visible rivets. Front buffers sometimes had rivets added after superheating but not necessarily at the same time. The smoke box wrapper may also have had further rivets added as well as the smoke box front around the door, which seemed to have happened in the late ’30s and early 40s.

As always, if you are really keen on authenticity then the best thing to do is to examine a photograph of the engine you are modelling.

Decision time

The kit has been designed to use frame spacers that approximate to the frames on the original engines, which means that stiffeners are also added to the inside and outside of the frames.

Cosmetic spring mechanisms are provided. These are removable using screws for those of us who like to be able to remove the wheel sets easily.

Sufficient parts are included to make this kit to P4.

The kit as designed will go around a 1250 mm radius curve.

There are three wheel sets available, from Alan Gibson, Ultrascale and Exactoscale. For P4, the Alan Gibson wheels have a rear boss which is 0.5 mm deep. This will impact side play, especially for P4 modellers. This rear boss should be removed from Alan Gibson wheels. There are alternative horn blocks on the market which allow wheels to sit more closely to the frames, such as those from ‘High Level’.
Soldering

I use ‘Nealetin’, a liquid solder with its own flux. This allows very close control of the initial solder join. Most initial joints will be secure using this (or a similar liquid solder). Motion parts should be soldered with a higher temperature solder. Once you are convinced things are square then it is possible to run a small fillet of solder along critical joins by first priming with a little ‘Nealetin’.

I have never used lead free solder for making models.

Square Frames

There are a couple of mechanisms, neither of which I have used, which have been acclaimed for the ease with which they permit a square frame to be built. While these are expensive to start, many modellers have sung their praises.

Under Etched parts

On occasion some parts may be a little under etched. The individual frets have outer frames which are the same width as the vast majority of the slots - just use a short section of this to free up any dubious slots. In any event it is always wise to prepare parts before assembly, using a very fine file to remove any bits of ‘cusp’ left from the etching process.

Health & Safety

Experienced modellers will know all this already but -

- The frets are made from 12’ brass and 15’ nickel silver. They are fragile and the edges are sharp. Take care when assembling and especially when drilling out holes. Rotating brass (which tends to grab drill bits, especially near the end of their cut) or nickel silver will cause a lot of skin and tissue damage if the drill sticks and tears. For preference use a hand drill or pin chuck.

- Soldering entails the use of toxic materials such as lead and acid flux. Observe the warning notices that come with these products and especially use adequate ventilation. Wear suitable eye protection where needed.

- Solder also gets very hot when melted, as do the parts when heated to solder them together. Take care to hold parts carefully with insulating material where needed and to let them cool properly before handling. This is especially true if annealing parts so they can be bent into shape more easily. It is also true where several layers may have been used to build up an assembly such as the boiler and firebox assemblies.

- When painting, ensure proper ventilation, especially if using a two part etch solution. Some of these carry hazardous chemicals.

- On a few occasions there will be a wire across the frames or bogie soldered at both ends. Do not be tempted to cut this after assembly with the normal wire cutters, this will force the frames apart and cause some damage. Use something like a triangular file or a disc cutter to make the first cut!

Note on bending parts with half etched lines

Tighter bends may be achieved as follows if thought to be necessary (notes extracted from some thoughts by Will Litchfield).

1. Deepen the fold line with a triangular 4 cut needle file till a witness line shows though to the other side.

2. Hold the etch on a flat surface with a your trusty steel rule along the fold line.

3. Run a craft knife blade along under the etch to start the fold on it way.

4. When the edge stands well way from the flat surface, use another steel rule to complete the fold.

You get a sharper bend this way, because a of step 1 and it is accurately placed on the centre of the fold line. I use a sharpened scriber to achieve the same effect.

Notes on wheel choices

The frames on this kit are set to a design width of 16.15 mm for P4 so that with cusp removal on the spacers 16.05 mm is the approximate final frame width. This is slightly less than some kits, but more than others, especially those which were designed for the ‘00’ market and then had options added for the finer scale gauges of ‘P4’ and ‘EM’. To this width must be added the outer flange of the horn blocks, which will vary depending on horn block supplied - the ones supplied are from Markits.

For the fine scale gauges, side play can be an important issue especially where small radius curves of less than 1200 mm are to be tackled.
Potential purchasers in the fine scale gauges are urged to consider these points. There are, as always, strategies to ameliorate such issues. Further reading on these points are in :-

- **Side Play Supplementary Notes**
- **Design Notes**

Both of which are available on the web site at [https://traders.scalefour.org/greatcentralmodels/](https://traders.scalefour.org/greatcentralmodels/) on the ‘instructions’ page.
**Locomotive Chassis**

**0.015’ 0.375 mm Nickel Silver**

**Locomotive Frame**

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2. Frame Right - Sheet 3
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6. Front Buffer Beam Overlay - Sheet 3
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8. Rear Buffer Beam Overlay - Sheet 3
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13. Centre Frame Spacer Brace - Sheet 3
14. Centre Frame Spacer Stiffener Left - Sheet 3
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18. Valve Guide Support Spacer Stiffener Right - Sheet 3
19. Rear Frame Support - Sheet 3
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21. Buffer Support Right - Sheet 3
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23. Sandbox Support Right - Sheet 4
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25. Brake Cylinder Support Right - Sheet 3
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28. Guard Iron Left - Sheet 3
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30. Buffer Mount - Sheet 3
31. Buffer Mount - Sheet 3
32. Rear Buffer Housing Plate - Sheet 3
33. Rear Buffer Housing Plate - Sheet 3
34. Fixing Bracket - Sheet 3
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36. Front Buffer Beam Draw Bar Plate - Sheet 3
37. Rear Buffer Beam Draw Bar Plate - Sheet 3
38. Brake Frame Mount - Sheet 3
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40. Brake Frame Mount - Sheet 3
41. Brake Frame Mount - Sheet 3

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43. Brake Pull Rear Bracket - Sheet 3
44. Brake Pull Rear Bracket - Sheet 3
45. Brake Pull Front Bracket - Sheet 3
46. Brake Pull Front Bracket - Sheet 3
47. Vacuum Cylinder Link - Sheet 3
48. Brake - Sheet 3
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50. Brake - Sheet 3
51. Brake - Sheet 3
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71. Coupling Rod Right Overlay - Sheet 3
72. Coupling Rod Right Boss - Sheet 3
73. Coupling Rod Right Boss - Sheet 3

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75. Connecting Rod Left - Sheet 3
76. Connecting Rod Right - Sheet 3
77. Connecting Rod Right - Sheet 3

**Valve Gear**

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79. Valve Rod Left Inner - Sheet 3
80. Valve Rod Right Outer - Sheet 3
81. Valve Rod Right Inner - Sheet 3
82. Valve Rod End Strip - Sheet 3
83. Valve Rod End Strip - Sheet 3
84. Valve Rod End Strip - Sheet 3
85. Valve Rod End Strip - Sheet 3
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91. Valve Rod End Strip - Sheet 3
92. Valve Rod End Strip - Sheet 3
93. Valve Rod End Strip - Sheet 3
94. Eccentric - Sheet 3
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96. Eccentric - Sheet 3
97. Eccentric - Sheet 3
98. Eccentric Bracket - Sheet 3
99. Eccentric Bracket - Sheet 3
100. Eccentric Bracket - Sheet 3
101. Eccentric Bracket - Sheet 3
102. Eccentric Short Bracket - Sheet 3
103. Eccentric Short Bracket - Sheet 3
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105. Eccentric Short Bracket - Sheet 3
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**Common Parts**

1. Reversing Axle Tube 1/16”x1/32” (1.6 mm x 0.8 mm) Eileen’s BRT0201G - 50 mm
2. Reversing Axle Rod 1/32” (0.8 mm) Eileen’s BSW080A - 50 mm
3. Valve Rod Tube 1.5 mm x 1.0 mm Eileens BRT1510D (50 mm) - 50 mm
4. Valve Rod Tube 2.5 mm x 1.5 mm Eileens BRT2515D - 20 mm
5. Valve Rod 1.00 mm Eileen’s NSW100A 80 mm
6. Cross Head Guides Eileen’s NF01005D NiSi 1.0 x 0.5 - 100 mm
7. Brake Spacers 1 mm long 1/16”x1/32” (1.6 mm x 0.8 mm) Eileen’s BRT0201G (cut from tube - 6)
8. Brass Wire 0.3 mm Eileen’s BSW031A - 250 mm
9. Brass Wire 0.45 mm Eileen’s BSW045A - 250 mm
10. Brass Wire 0.7 mm Eileen’s BSW070A - 250 mm
11. Vacuum Pipe Markits RVACTB - 1
12. Steam Heating Pipe Markits RVACSHTB - 1
13. Brass Round Tube 0.8mm x 0.4 x 305mm (MT2) Eileen’s BRT0804D (used smoke box hinges) - 50 mm
14. 8 BA Nut
15. 10 BA Bolts 1/4” - 4
16. 14 BA C/S 1/4” - 4
17. Spring Wire Ernie Ball Gauge 12 - 2x200 mm
18. Drwg. 209 Centre Axle Spring - 2
19. Drwg. 216 Rear Buffer - 2
20. Drwg. 218 Vacuum Cylinder - 1
21. Drwg. 224 Spring Hanger Block - 2
22. Drwg. 225 Bogie Axle Box - 4
23. Drwg. 226 RMarkitsRAXFBsq601 axle boxes - 4
24. Drwg. 297 Class 11B Crosshead - 2
25. Drwg. 298 Front Axle - outline guide
26. Drwg. 299 Eccentric Plate 11B Set of 4
27. Drwg. 300 Reverser Axle - assembly guide
28. Drwg. 301 Bogie Pivot - 1
29. Drwg. 302 Counter Weight - 2
30. Drwg. 333 Rear Brake Pull - 1
31. Drwg. 334 Smokebox Step - 1
32. Drwg. 335 11B Brakes - 2 pairs - optional
Great Central Railway 4-4-0 Class 11B

**Locomotive Body**

0.012’ 0.3 mm Brass

**Boiler**
1. Boiler - Sheet 1
2. Boiler Support Rear - Sheet 1
3. Boiler Support Front - Sheet 1
4. Smoke Box Frame - Sheet 1
5. Smoke Box Main Wrapper - Sheet 1
6. Smoke Box Outer Wrapper - Sheet 1

**Fire Box**
7. Fire Box - Sheet 1
8. Fire Box Cab - Sheet 1
9. Fire Box Front Cover - Sheet 1
10. Fire Box Rear Cover - Sheet 1
11. Fire Box Brace - Sheet 1
12. Fire Box Brace - Sheet 1
13. Fire Box Brace - Sheet 1
14. Fire Box Brace - Sheet 1
15. Fire Box Brace - Sheet 1
16. Fire Box Brace - Sheet 1
17. Inspection Cover - Sheet 1
18. Inspection Cover - Sheet 1
19. Inspection Cover - Sheet 1
20. Inspection Cover - Sheet 1

**Footplate**
21. Footplate - Sheet 2
22. Footplate Front Cover - Sheet 2
23. Footplate Hinge - Sheet 1
24. Footplate Hinge - Sheet 1
25. Lamp Bracket - Sheet 1
26. Lamp Bracket - Sheet 1
27. Lamp Bracket - Sheet 1
28. Lamp Bracket - Sheet 1
29. Valence Left - Sheet 2
30. Valence Right - Sheet 2

**Steps**
31. Centre Step Plate Left - Sheet 2
32. Centre Step Left Upper - Sheet 2
33. Centre Step Left Lower - Sheet 2
34. Centre Step Left Upper Chequered - Sheet 2
35. Centre Step Left Lower Chequered - Sheet 2
36. Centre Step Right Plate - Sheet 2
37. Centre Step Right Upper - Sheet 2
38. Centre Step Right Lower - Sheet 2
39. Centre Step Right Upper Chequered - Sheet 2
40. Centre Step Right Lower Chequered - Sheet 2
41. Rear Step Plate Left - Sheet 2
42. Rear Step Left Upper - Sheet 2
43. Rear Step Left Lower - Sheet 2
44. Rear Step Left Upper Chequered - Sheet 2
45. Rear Step Left Lower Chequered - Sheet 2
46. Rear Step Plate Right - Sheet 2
47. Rear Step Right Upper - Sheet 2
48. Rear Step Right Lower - Sheet 2
49. Rear Step Right Upper Chequered - Sheet 2
50. Rear Step Right Lower Chequered - Sheet 2
51. Rear Step Stabiliser - Sheet 2
52. Rear Step Stabiliser - Sheet 2

**Cab**
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54. Cab Side Right - Sheet 1
55. Cab Side Overlay - Sheet 2
56. Cab Side Overlay - Sheet 2
57. Cab Side Small Overlay - Sheet 2
58. Cab Side Small Overlay - Sheet 2
59. Cab Side Small Overlay - Sheet 2
60. Cab Side Small Overlay - Sheet 2
61. Cab Opening Edging Left Strip - Sheet 1
62. Cab Opening Edging Right Strip - Sheet 1
63. Cab Front - Sheet 2
64. Cab Window Overlay - Sheet 2
65. Cab Window Overlay - Sheet 2
66. Roof - Sheet 2
67. Roof Blanking Plate (optional) - Sheet 2

**Wheel Covers**
68. Cab Base - Sheet 2
69. Wheel Cover Left - Sheet 2
70. Wheel Cover Right - Sheet 2
71. Footboard - Sheet 2

**Springs**
72. Axle Box Spring Mount - Sheet 1
73. Axle Box Spring Mount - Sheet 1
74. Axle Box Spring Mount - Sheet 1
75. Axle Box Spring Mount - Sheet 1

**Wheels**
76. Wheel Weights Front Axle - Sheet 1
77. Wheel Weights Front Axle - Sheet 1
78. Wheel Weights Rear Axle - Sheet 1
79. Wheel Weights Rear Axle - Sheet 1

**Bits and Pieces**
80. Footplate Connection - Sheet 1
81. Ramsbottom Actuator - Sheet 1
82. Ramsbottom Actuator - Sheet 1
83. Regulator Lever - Sheet x
84. Regulator Plate - Sheet x
85. Regulator Plate - Sheet x
86. Spacers 3 mm - Sheets 1 & 2
87. Spacers 2 mm - Sheets 1 & 2
88. Cab Wheel - Sheet 1
89. Cab Wheels with Handles - Sheet 1
90. Cab Side Numbers - Sheet 2
91. Spare

**Assembly Aids**
92. Cab Assembly Aid - Sheet 2
93. Beltpaire Filing Aid - Sheet 1

**Safety Valve**
94. Ramsbottom Side Cover - Sheet 2
Great Central Railway 4-4-0 Class 11B

Templates

95. Chimney Outline - Sheet 1
96. Dome Outline - Sheet 1

GCR Class 11B

1. Cab Roof Front Brace ('L') Eileen's L0080 x 250 mm
2. Boiler and Splasher Supports ('L') Eileen's L0080 x 250 mm
3. NiSi Wire 0.45 mm Eileen's NSW045A (250 mm)
4. 10 BA Nuts - 4
5. 10 BA Bolts 1/4" - 4
   alternative Drwg. 335
6. Washout Plugs Eileen's LF4WP01 - 7
7. Hand Rail Knobs Markits M4HRKM 2.0 mm - 8
8. Hand Rail Knobs Markits M4HRKS 1.6 mm - 3
9. Drwg. 293 Smoke Box Door - 1
10. Drwg. 229 Whistle Markits M4WhistGW2 (2)
11. Drwg. 294 Backhead - 1
12. Drwg. 334 Smoke Box Step - 1
13. Drwg. 295 Dome Original - 1
14. Drwg. 296 Chimney Original - 1
15. 4M778 Alan Gibson GCR 4 column Rambottom Safety Valve - 1
16. GC Smokebox Door Handle Markits M4SBDH4 - 1

Additional Parts Required - not part of the kit

Wheels, motors and gears are a personal choice - these were the ones used by the designer

17. Cab Roof Centre Brace ("T") Eileen's Brass T Section 1/32" x 1/32" x 12" (TBK ST1) - optional
18. Wheels Alan Gibson 4880B 6' 8" Dia.
19. Crank Pins 4M42B Alan Gibson
20. Bogie Wheels G4842 3' 6" Dia. Alan Gibson
21. High Level Gear Box SlimLiner+ 40:1 1.5mm shaft
22. Mashima Motor 1220 1.5mm shaft
23. Buffers AG 4M4901 or 4M4909 or Markits LNER Stepped
24. Markits Screw Couplings MCOUP/S

Recommended Tool

If 14 BA bolts are used to fix the cosmetic springs
CSTB141 Carbon Steel Taper Tap 14BA Eileen’s
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Main Frame Preparation

Note

You may wish to leave the main frames in the fret while preparing them. I have found this a lot easier and only remove the frames from the fret when I am ready to join the frames together.

Note

Note that the frames on this locomotive have a distinct bend inwards under the smoke box and this is modelled in P4 only. Since the frames need to be closer together for EM gauge, they must remain straight and therefore a short piece of 0.45 mm wire should be soldered into the bend slot to strengthen the frame at this point.

Note - small radius running

On the inside of the frames above the position of the bogie are half etched lines. These indicate the cutting needed to allow the bogie to move much more than would be prototype practice. If your curves are less than 1200 mm radius then these must be cut out. It is better to do this when the frames are assembled and have some rigidity.

Measure the short (WD style) handrail tails which will be used for the springs (they will be about 0.7 mm diameter) and then drill out the 6 spring mount positions shown (and marked as 0.65 mm in the picture on the right) if you require active springing. Push the handrails supplied into place on the inside of the frames, using a length of 0.3 mm steel wire through the holes to align them and solder them into place. Carefully file off the protruding tails on the outside of the frames.

Drill out the holes for the cosmetic, removable springs, 2 each side, which are located either side of the rear horn block spacing for the rear axles only, to 0.80 mm to clear 16 BA c/s bolts (not supplied) or 1.05 mm to clear 14 BA c/s bolts (supplied). Carefully countersink the outer face very slightly for the fixing bolts.

Drill out the brake shaft holes, 2 each side, to 0.7 mm.

Fire Box

Note

The firebox is located into the inside of the frame using two locating holes, the front one for 1.0 mm NiSi wire and the rear for 0.7 mm brass wire, noting that the rear one also doubles up as the brake axle. If this is soldered in place with the frame still fixed to the main etch it will make cleaning easier.

Locate Fire Box Side Left (9), Fire Box Side Right (10) on the fret, drill the holes in the fixing tabs to 1.0 mm and the brake axle holes to 0.7 mm. Remove from the fret and fold with the etch on the outside so the holes align. Bend to shape supporting both sides of the etch and and solder into place inside the main frames using 1.0 mm NiSi wire and 0.7 mm brass wire to locate them.

Brake Frame Mounts

Remove parts Brake Frame Mounts (38,39) from the fret and solder to the inside of the frames for the front driver only, using 0.7 mm brass wire to locate. A firmer mount for the brake axle may be made using a pair of these frame mounts on each side. If a single wire is used across both frames, when trimming these wires do not use a pair of cutters.
between the frames since this will seriously distort the frames. Use a disc cutter or a triangular file to grind away a cut in the centre and then trim to size. Leave a small spigot on the inside to represent the bolt.

Now add the brake axle spacers if required - these are used to ensure the brake shoes are at the correct distance from the frames. They are made from brass tubing which is 1/16” x 1/32” (1.6 mm x 0.8 mm) and are 1 mm in length. Solder into place. Later, the brake shoe assembly will simply clip over this.

**Scale frame cross members**

Locate parts Centre Frame Spacer Stiffener (14 & 15), Centre Frame Spacer (12) and Centre Frame Brace (13) and remove them from the fret.

Drill the two small holes in Centre Frame Spacer (12) to 0.3 mm, these are for the spring wire on the leading driver and replace the usual WD style handrail. Thread Centre Frame Spacer Stiffeners (14 & 15), onto Centre Frame Spacer (12) making sure the nib points forwards. Solder Centre Frame Brace (13) forwards of this assembly.

Locate parts Valve Guide Support Spacer Stiffeners (17 & 18) and Valve Guide Support Spacer (16) and remove these parts from the fret. Ensure that the large holes in Valve Guide Support Spacer (16) are clear so that 2.4 mm tubing can fit in them.

Remove Rear Frame Support (19) and Cylinder Block (11) from the fret. Check the tabs are clean.

On Rear Frame Support (19) drill out the two holes to 0.45 mm, these are for the rear buffer fixing bolts if needed. Now bend Rear Frame Support (19) carefully into shape.

Bend Cylinder Block (11) to shape. Ease out the hole in the bottom for the Bogie Pivot, which should be 2 mm. This is the slot in the bogie main frame. Ease out the lower (widely spaced) holes to 1.5 mm for the piston rod tubes and the upper (closely spaced) holes to 1.0 mm if needed. Note that the top of Cylinder Block (11) will fit as shown in 07 Front Assembly

**Note - small radius running**

*If there is a need to cut along the half etch wheel arcs to allow the bogie to move ‘through’ the frames then it may be necessary to remove a corner of the cylinder block as well.*

Now remove the part of the Cylinder Block (11) that protrudes to the front, this was added to allow a solid block to be formed, but must be removed or the body will not locate correctly. If the body is to be fitted to the chassis through the chimney then solder an 8BA nut to the top section of so that it is on the inside of the box. A small bolt may be made such that it fits as a key to the Cylinder Block (11) if you have access to a lathe and die tool. This makes a much better connection than just soldering one on the metal.
Note

The etching process is not always accurate so it may be wise to lightly file the cusp from the spacers where they meet the frames before fitting, it is usually the tiniest bit that is needed. In an ideal world the width over the frames should be 16.15 mm for P4. Use +/- 0.1 mm as a general guide although it won’t hurt too much if a little more under sized.

One by one do a test fit into between the two frames for the Cylinder block (11), Rear Frame Support (19), Centre frame Spacer assembly and Valve Guide Support Spacer assembly. Check the width of the frames at several points, the design width is 16.15 over the frames, if it is slightly lower, down to 16.00 mm it will be all right, over 16.15 mm may begin to impinge on side play for the drivers.

Connecting the frames together

Note

Solder each of these parts into place very lightly. Ensure each is fitted the correct way. Check the measurements again. There are two P4 Frame Templates (190,191) which will help alignment if needed.

Note also that the front buffer beams should be fitted only after the piston tubes have been correctly fitted and are running loose and smooth. It is impossible to ream these out if the front buffer beams are fitted.

Note P4 Only

The frames have a half etch bend close to the front. Now is the time to very carefully bend this inwards (it is only 2 degrees). Once you are sure the bend is accurate (probably after fitting front buffer beam) add a piece of 0.45 mm NiSi to the half etch at the bend to strengthen it. Use a pair of flat nosed pliers to hold the frames so that the elongated hole for the cylinder spacers is covered and will be held flat. The smoke box base is etched to allow for this bend.

Note

Solder the parts solidly into place after they have all been test fitted and checked. Even with very light tacking the frames will be solid enough work on. To ensure that there is enough space, when fitting parts, it will be necessary to solder one side only of the previous part.

Check the chassis is still square after soldering each part lightly into place. Once these are fitted and you are certain the frame is within the specified width then take a well-deserved break!

Piston rod and Valve Rod fitting

The piston rod guides (tube 1.5 mm x 1.0 mm) fit in the cylinder block with a 1 mm protrusion front and rear, inside these will fit the 3.25” (1.0 mm) piston rods, the piston rods being part of the cross head.

The valve rods are also 1.0 mm but there is no tubular guide in the cylinder block. They are ‘guided’ in the Valve Guide Support Spacer (16) by two short pieces of tube, the outer is 2.5 mm x 1.5 mm and the inner is 1.5 mm x 1.0 mm but within the cylinder block they should have a slight looseness. Use a length of 1 mm rod to align the two short tubes in the Valve Guide Support Spacer (16) then solder these in place.
Cross Head Guides

Insert Qty 8 NiSi bars (1.0 mm x 0.5 mm) into the rear of the Cylinder Block (11) and solder into the rectangular holes in Valve Guide Support Spacer (16). File any extra bar so that about 1 mm is left.

Fitting the front buffer beam

Note

Do this only after you are satisfied the piston rods and valve rods have no tight spots.

On the Front Buffer Beam Overlay (6), Front Buffer Beam (5) and Buffer Mounts (30,31), drill out the holes to a ‘loose’ 0.45 mm, then remove them from the etch.

If you wish to add dummy bolts to the brass buffers then solder one each Buffer Mounts (30,31) to the buffer of choice and drill through from the back.

Note

Originally there were no buffer mounts on the prototypes until somebody discovered the buffers were perhaps a little too short for the footplate. It is possible to have none, one or two fitted. The Buffer Mounts (30,31) come with either a large hole in the centre or a small hole. The Gibson Buffers (4M4901) have a circular rear fitting which will fit inside these larger holes and there is also a notch on the Buffer Supports (20,21) to accommodate this.

Fit the Front Buffer Beam (5) to the two TABS on the front of the frames and at the same time fit Fixing Bracket (34) and Buffer Supports (20,21). Lightly solder these in place for now. File off any spare metal from the TABS.

Remove the Front Buffer Beam Drawbar Plates (35,36) from the fret and solder in place on the Front Buffer Beam Overlay (6).

Use short lengths of 0.45 mm NiSi to locate the buffers through the Buffer Mounts (30,31), the Front Buffer Beam Overlay (6) and the Front Buffer Beam (5). If you have drilled through the Gibson Buffers as described earlier these short lengths of NiSi will also become the dummy fixing bolts. Solder in place.

Fitting the Rear Buffer Beam

Drill Rear Buffer Beam (7) holes for the Rear Buffer Housing Plates (32,33) to 0.45 mm, remove from the fret and fit over the tabs on the rear of the frames. Remove any spare metal from the TABS.

Drill Rear Buffer Beam Overlay (8), Rear Buffer Beam Housing Plates (32,33) to 0.45 mm and remove from the fret. Now thread 0.45 mm brass wire through the parts (it may be necessary to ease the holes out slightly to 0.5 mm), and solder Rear Buffer Beam Overlay (8) and Rear Buffer Housing Plates (32,33) in place. Use the 0.445 mm brass wire to guide the overlay in position and solder in place. Now solder in place the two Rear Buffers (Drwg. 216). These should fit inside the buffer beams at the rear.
**Sand Boxes**

Remove parts Sand Box Surrounds (22, 23) from the fret and fold to shape - locate the tabs just to the rear of the smoke box and solder lightly to the main frames. These will add support to the footplate - in the prototype they were riveted to the footplate but as modellers we of course wish to have the chassis and body able to separate.

**Adjustment Plates Plates & Body Fitting**

If the body fit is slightly high then use the Adjustment Plate(s) (189) to fill the gap if required. Ensure the hole is aligned with the Cylinder Block (11) hole.

**Rear Brake and Vacuum Cylinder**

Remove Brake Cylinder Support Washers (26,27) and Brake Cylinder Supports (24,25) from the fret then fit to the underside of the rear chassis. Remove Brake Cylinder Actuators (64,65) from the fret, solder together at the 1.5 mm hole end only and thread (very carefully) a short length of 1.5 x 1.0 mm tube through these and the Brake Cylinder Supports (24,25). Finally a 1 mm NiSi rod through the centre will represent the fastening bolts. Adjust the Brake Cylinder Actuator assembly so that it is centralised and the arm that will eventually hold the Vacuum Cylinder Link (47) is horizontal.

**Brakes**

Solder Brake Pull Front Brackets (45,46) to top and underside of the Main Brake Pull (42) and Brake Pull Rear Brackets (43,44) likewise. Use the holes to locate them accurately using 0.45 NiSi rod and snip this off to represent the fixing bolts. Ensure the Rear Bake Pull (Drwg. 333) will fit into the rear of this assembly, but do not solder into place yet.

If using the NiSi parts to make up the brake and shoe assembly then remove from the fret four sets of parts for the brakes, two left and two right. These are Brake (48), Brake Top (52), Brake Shoe Base (56) and Brake Shoe Top (60).

If using the 3D printed brake assembly, then remove Brake (48), two pairs, from the fret and superglue the 3D prints to them, being careful with which side you glue!

Carefully ease out the top holes to 0.7 mm so that they will fit over the brake axles, a slightly larger hole may make it easier to remove these during building and testing.

The lower holes should be drilled out to 0.7 mm (plus a little bit) so that they will fit over the ends of the Main Brake Pull (42).
**Bogie**

**Note**

The central frame for the bogie is in two mirrored parts, held together by the main frame. In the prototype this centre part was separated from the sides with springs to try to centralise the centre part when on curves. This is difficult to do in 4 mm scale and side control is exercised by the slot in the frames and steel wire springs.

Drill the small holes in Bogie Side Frames (114,115), Bogie Frames (116,117), Equalising Bar Spring Face Plates (126-129), Equalising Bar Spring Backing Plates (130-135), Bogie Springs (130 - 135) and Bogie Equalising Bars (122-125) to 0.45 mm and remove them from the fret along with Bogie Frame Braces (118,121), and Bogie Spring Hangers (136-139). There is a larger hole at the bottom of the Bogie Side Frames (114,115) is the point around which the whole bogie rotates, this will take a 1 mm NiSi rod.

On the Bogie Side Frames (114,115), drill out the end holes to 1.0 mm and fit 1.0 mm NiSi rod across the ends with 1.00 mm protruding, check the width is the same as the width at the centre.

**Note**

Use Bogie Frame Template (188) to check central slot of the Bogie Frames (116,117).

Bogie Frames (116,117) will need some care in bending up to shape and it may be necessary to slightly file the centres (or use a sharp scriber), so that the fold up is exactly vertical. Thread 0.45 mm NiSi wire through the locating holes in Bogie Side Frame (114,115), Bogie Frames (116,117) and lightly solder in place. Add Bogie Frame Braces (118,121).

The bogie prings are made up in layers from Bogie Spring (130 - 135) and Bogie Spring Face Plate (126 - 129), they sit between the equalising bars and are held in place by the Bogie Spring Hangers (136-139). Generally use 3 layers and one face plate.

They have a locating hole which will assist the fitting. One front and rear face plate showing the spring layers and two full width in
the middle will be correct. Solder these together. Fold and solder **Bogie Equalising Bars (122-125)**, thread short lengths of 0.45 mm NiSi rod through these with **Bogie Spring Hangers (136-139)** in the middle and then fit the springs between the front and back of the assembly.

Fit axle boxes if required, over the 1.0 mm end braces. The 3D printed parts have 1 mm holes that should be gently eased to 1.1 mm to avoid breakage. These fit slightly behind the equalising bars at the inside edge.

**Coupling Rods (if required)**

Remove **Coupling Rods (66,70)** and **Coupling Rod Overlays (67,71)** from the fret and solder them back to back. A **Coupling Rod Boss (66 etc)** may be needed on the rear and the front of the coupling rods to make sure they do not short on the wheels. There are half etched variants included.

**Connecting Rods (if required)**

Remove **Connecting Rods (74-77)** from the fret and solder back to back. Ensure large hole is cleared to 2 mm since (if fitted) it will revolve loosely around the crankshaft. Connect these to the two crossheads (Drwg. 297. Crosshead) using a short length of 0.7 mm brass rod or a steel pin, solder at one end only, ensuring free movement.

**Wheels**

If using Gibson wheels, remember to remove the boss from the rear or there will be little or no side-play in the axle.

Now is a good time to check the motor fit, note the SlimLiner+, if used, should be fitted as shown, to the rear axle. An alternative fitting, if the valve gear is ignored, is to drive the engine from the centre axle and a larger motor than the 1220 may then be fitted.

**Valve Gear (if required)**

*Note*

*These are a matched pair, mirrored around the centre of the locomotive.*

Before removing from the fret, all the small holes in **Valve Rods (78-81)**, **Valve Rod End Strip (82-85,88-91)**, **Valve Rod End Spacer (86,87,92,93)** should be drilled to 0.45 mm. Then remove these parts and assemble using 0.45 mm NiSi rod as shown in the diagrams. The two arms are fitted to the eccentrics using a short length of NiSi wire or a steel pin.

**Eccentrics (if required)**

Before removing from the fret, drill out the small holes to 0.45 mm in the **Eccentrics (94-97)**, the **Eccentric Brackets (98-101)** and the **Eccentric Short Brackets (102-105)**. Remove these parts from the frets and assemble firmly using 0.45 mm NiSi rod as shown in the diagram using a good dollop of solder. The rectangle on the rear of the assembly should now be filed to shape and a general gentle file and clean on the rest. In Fig. 22 the lifting arms are shown, at the top these fit around the reversing axle. Fit the valve gear to the top and bottom holes in the eccentrics, ensuring that there is free movement. File the rear of the eccentric to shape, it is just a half circle.
Valve Rods (if required) 23

Note

This connects the eccentrics to the rod that drives the valves in the cylinder block. It is the most difficult part to do and at this point it is recommended that function should be sacrificed in favour of sanity.

Remove Valve Rod Ends (112,113) from the fret and solder to NiSi 1 mm rod 30 mm long as shown in the drawings opposite. Check that the valve rods fit over the eccentric, slimming down the centre of the eccentric slightly if needed.

Balance Weights

Drill a 1 mm hole in Drwg. 302 Counter Weights and solder into these Rotation Arms (110,111). This will be soldered onto the reversing axle.

Reversing Axle 24

Note

The reversing axle fits across the frames and operates the lifting arms that control the regulation of the engine as well as the forward or rearwards motion. See Fig.24.

Coupling Hooks

Clear the holes in (Coupling Hooks (150) to 0.45 mm, then remove from the fret. Solder back to back. These may be fitted solid or a spring located behind the buffer beam may allow some movement.

Reversing Arm 25

Remove Reversing Arm (152-155) from the fret and assemble as shown in the diagram. At the rear this connects over the 3D printed ‘reverse’ in the cab and at the front connects to Reversing Arm Actuator (156), which is part of the reversing axle assembly. See Fig. 25.

Springs 26

The front drivers have a 3D printed spring (Drwg. 209) attached to the underside of the hornblock using superglue or similar.

The rear drivers may use the etch components or the 3D version (Drwg. 224). In both cases use a 14 BA tap to make the fixing holes and counter sink the chassis holes to cover the head of the fixing bolt. For the etch versions, Main Spring (162, 163) and Spring Supports should be used, taking care to keep the width in check - nominally 5.5” maximum. There are face plates that should just fit under the edge of the chassis, these are the part half etched components.
**Body Preparation**

Remove **Footplate (22)** from fret, carefully file off all etch tags where it is safe to do so. Solder 4 10 BA nuts to the upper side, (marked on the part), these will form a means of foxing the chassis to the body. Bend up connection to **Cab Base (71)** but do not solder yet until final fitting.

Remove **Cab Sides (53,54)** from the fret, file off carefully all etch tags.

Remove **Cab Side Overlays (55,56)** from the fret as well as the **Cab Side Small Overlays (57-60)** and very carefully trim off all the etch tags.

If the locomotive is to have a GCR cast number plate, remove two of them from the fret and trim off the etch tags at top and bottom. There is a half etch circle on the inside of the **Cab Sides (53,54)**, drill this through with a 0.5 mm drill, the using fine wet and dry remove any protruding surface brass from the surface of the cab sides.

Use a fine pencil to make horizontal an vertical line across this hole on the outside so they can be used to align the number plates. Use liquid solder and ensure the number plates remain aligned with the pencil marks.

Preferably using liquid solder, place the overlays into the slots on the cab sides and solder into place. There is a spare set of these overlays.

Remove **Cab Front (63)** from the etch and the **Cab Window Overlays (64,65)**. Again, very carefully remove any etch tags, especially from the overlays and again using liquid solder, place these on the cab front and solder into place. There is a spare set of windows. Clean this area as though it would be ready for painting, the space will be very near the fire box. Bend the splasher cover part of Cab Front to shape using one of the cab sides as a guideline. Annealing may help here since this is a complex curve.

If you are fitting Ramsbottom safety Valves the drill though from the inside of the cab, using the half etch rectangles as a guide, two holes to take the operating levers. These are Ramsbottom Actuators (86,87), but do a test fit only for now.

Remove **Roof (66)** from the fret, decide whether to use 1 whistle (later) or two whistles (early) and drill 0.75 mm as required.

Remove **Boiler (1)** from the fret, removing any etch tags, and remove the cusp from the long edges, this will assist the fit for soldering. Roll the boiler taking care the marker tabs are on the outside at the rear of the boiler. These will line up with the firebox.

Remove **Boiler Supports Front and Rear (2,3)** from the frets, these fit inside the boiler and are easier to fit if fairly tight to begin with, so do not file off the outer cusp.

Remove **Smoke Box Frame (4)** from the fret, bend to shape and fit into front of boiler.

Remove **Smoke Box Main Wrapper (5)** from the fret, and bend to shape so that it fits around the smoke box wrapper and is flush with the front face. It may be easier to anneal this before bending since it involves two contrary curves. Use the hole on top to help align it to the boiler, there are also alignment marks on the Smoke Box Frame and the Smoke Box Outer Wrapper which should help. In accuracy here may cause pain later.

Remove **Smoke Box Outer Wrapper (6)** from etch. This is a half etch piece so carefully remove any etch tags. Once rolled into shape, clean both the inside and also the outside of the main wrapper, use the chimney holed to align it, with the small hole at the front (for the lamp) and solder into position. There is no need to solder either wrappers to the main boiler, movement here will assist later fitting.

Remove **Cab Base (71)**, **Wheel Covers (72,73)**, **Fire Box Cab (9)**, **Fire Box Rear Cover (11)**, **Fire Box Braces (12,13)** and **Footboard (74)** from the fret and fold to shape. Remove any etch tags.

Do a test fit, all these parts should hold together by themselves as follows :-

Footboard into Cab Base

**Fire Box Rear Cover (11)** into **Footboard (74)** and **Cab Base (71)**

**Wheel Covers (72,73)** on either side

**Fire Box Cab (9)** onto **Fire Box Rear Cover (11)**

Once this is accomplished, remove the **Fire Box Rear Cover (11)** and **Fire Box Braces (12,13)**. Drill holes 0.45 mm through all the alignment holes, fit 0.45 wire, clamp up tight and solder everything in place.

Now solder together the parts as in the trial assembly, adding **Fire Box Cab (9)** at the end. Once this is soldered up tight, the ears can be filed off.

Remove **Fire Box Front Cover (10)** and **Fire Box Braces (14-17)** from the etch, drill out the alignment holes to 0.45 mm, insert 0.45 mm wire and solder up. The remove any overflow - this must fit between the front edges of the **Fire Box (8)**. Do not solder this in place yet.

Drill out wash-out plugs on both sides of the Fire Box (8) to 1.3 and the hand rail knobs to 0.8 mm. Again remove any etch tags. Bend the firebox to shape using a 3 mm rod, do this slowly. Temporarily fit the **Fire Box Front Cover (10)** to help and stop any unfortunate bends and ensure that the Fire Box will slot into the 6 slots on the Cab Front. Once happiness prevails then solder the back of the Cab Front to hold this assembly in place.

Add wash-out plugs and solder in from the inside of the Fire Box. Use a 0.45 mm drill to locate a 2 mm hand rail in each side with the hole in the front of the cab.
Now solder in the Fire Box Front Cover (10) remembering that the braces are on the inside! File off the ears so you have a nice sharp corner.

Remove Belpaire Filing Aid from the etch and use it to create the curve each side of the fire box. Do not be over-enthusiastic. It is easier to do this now than when the boiler is fitted.

Remove Cab Assembly Aid (94) from the fret, bend to shape and solder the bend. This used to hold the cab spacing correct when placing the roof.