

Brassmasters

Scale Models

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EasiChas

Chassis and Detailing Kit for Hornby A3 Locomotive and Tender

For EM and P4 Gauges only

Instructions

PO Box 1137 Sutton Coldfield B76 1FU

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1 Introduction

1.1 The Easichas frames for the Hornby A3 locomotive, based on the original concept devised by John Brighton, have been specifically designed to allow easy conversion to EM or P4 gauge, which results in a fully sprung locomotive and tender. Furthermore, the basic conversion can be completed without the need to solder any of the main components together, although a way has not been found to attach the valve gear return crank without soldering.

1.2 There are various levels of conversion with the builder choosing which, of any, additional detail required beyond the basic conversion.

1.3 Basic level of conversion makes use of:

- fold up mainframes and keep plate with sprung bearings
- fold up replacement bogie (3 different types are provided for)
- fold up trailing truck with springing
- fold up replacement tender frame with sprung bearings.

1.4 Further components are provided to add to the detail of the conversion. These are, working from the front:

- replacement front footsteps
- overlays for the main frames in front of the cylinders with bogie wheel splashers, etc.
- replacement bogie
- German type smoke deflectors
- replacement coupling rods
- replacement return crank
- return crank bearing cover
- replacement reach rod and brackets
- replacement brake hangers and blocks
- brake hanger brackets
- footplate support brackets
- replacement damper operating linkage
- replacement tender brake gear
- replacement tender guard irons

1.6 Unfortunately, it is not possible to re-use the loco pickups on the basic conversion. However, as the Hornby loco is fitted with tender pickups which can be adapted, this does not pose a problem. For more advanced modellers it is recommended that pickups are fitted to the loco as well. A possible solution is shown in section 7.15

2 General Notes

2.1 There are three etches, two for the loco and one for the tender. Numbers shown in square brackets [] in the instructions refer to the etch (L for the loco etch and T for the tender etch) and part numbers, e.g., [L2] is part 2 on the loco etch. The part number appears on the separate etch diagrams. Certain parts, e.g. bolts, wire, springs, are not numbered.

2.2 Some of the parts are small and easily damaged, so do please take care. Parts should be removed from the sheets as and when needed by use of a small scalpel etc., and the tabs and etch cusp removed with a small fine-cut file.

2.3 All folds and bends are made with the half-etched line on the inside unless otherwise stated.

2.4 On some parts it is necessary to emboss rivet / bolt heads from the reverse sides by use of a punch.

2.5 There are half etched test rivet holes on the back of the etch edging strip. Use these to get used to forming uniform rivets.

2.6 You should look at instruction 5.1 regarding pre-preparing the wheels before commencing building.

2.7 Notes on CD

We have included a CD-rom version of these Instructions. We have taken advantage of the medium to provide more detail than we can include in traditional paper-based Instructions. In particular it has selected prototype photographs which are quick and easy to view. We hope you will find this new way of presenting our instructions helpful when building your model, and welcome your comments on it. It is an excellent way to familiarise yourself with the kit, particularly since the constructional photographs can be reproduced to a much larger size than those included below.

To start

The CD is viewed using a standard Internet Explorer browser. Depending on which version of Windows you are running, when you insert the CD into the drive it will open up to show a file titled "A3". Double click this to reveal two files – double click the one titled "Start" to run the CD.

If the disc does not automatically start and take you to the "A3" file, then open up Windows Explorer and locate the "A3" file that way. Proceed as above.

Navigation – you can use the "BACK" button on your Internet browser and the menu on the left hand side of each page to move around the guide. Click on any of the diagrams, photographs or etches to display it full size on the page. When you have selected the picture or diagram you will see a small square in the bottom right hand corner – this is an expansion button and

allows you to “zoom in”. (If you can’t see the button at first move your mouse around this corner and the top left corner of the picture until the button appears).

Installation

The Guide will operate directly from the CD, but if you will be able to access the pages and images more quickly if you copy the material onto your hard disk. To do these simply copy the whole folder “A3” onto the C: drive of your PC and then open the Start file from there instead of the CD.

We recommend you read the notes in the “Help” section before using the CD. If you have any difficulties please email us for assistance – sales@brassmasters.co.uk

3 Dismantling the locomotive

3.1 Tools Required

- A selection of cross head and normal miniature screwdrivers
- Small pliers
- Small plastic bags and labels to identify parts & screws when dismantling
- Small files
- A set of small reamers (useful but not essential)
- Soldering iron (for electrical connections and return crank)
- A steel rule
- Back to Back wheel gauge
- Plastic solvent, superglue and epoxy resin (24 hour & 5 minute)

3.2 The valve spindle guides fitted to the front and rear of the Hornby cylinders are very delicate and susceptible to being damaged. It is advised that the cylinders are removed and put in a safe place whilst work is being carried out. Take care when handling and working on the body.

3.3 Bag and label all small parts and source of screws **as soon as removed** (they are all different) - trust us on this one!

3.4 The chassis has a ‘tongue’ at the rear end and a screw at the front. To remove the body from the chassis undo the large screw above the bogie. Push the chassis forward in the body to disengage the tongue and then withdraw the chassis leading end first. Put the body to one side. Keep the screw for future use.

3.5 Remove the bogie and its bracket by undoing the screw at the back end of the bracket. Ease the bracket over the lug on the back of the cylinder moulding. Keep the screw and plastic washer for future use.

3.6 Remove the DCC blanking plate and unscrew the lower plate thus allowing the removal of the chassis block upward extension piece. Unscrew the 2 screws from the cylinder saddle and motion bracket saddle. Keep the screws for future use.

3.7 Remove both crank pin screws from the centre axle and slide off the return cranks and connecting rods. The coupling rods will now hang loose!

3.8 Remove the 3 screws on the keeper plates and gently remove the lower brake linkage keeper plate. Remove the phosphor bronze pickup strips. Remove the upper keeper plate. Once free cut the wire where it joins the motor for the basic conversion. If you are fitting new pickups to the loco, cut the wire where it joins the keeper plate and tuck out of the way in the chassis for now. Keep the screws for future use.



3.9 Remove the wheel sets from the chassis, unscrew the machine screws from the remaining wheels and remove the coupling rods. Put the screws back into the wheels for safekeeping. The chassis should now look like the photo. De-grease the chassis and remove any insulation tape residue.

3.10 Hold the centre wheels and with a twisting pulling motion pull off the wheels from the axle (you will need to hold the axle with small pliers to get the second wheel off). Also slide off the brass bush.

3.11 Using a pair of pliers on one side of the gear wheel, gently slide the plastic gear down and off the axle by holding the axle vertical and pressing down. It is very important not to damage this gear.

3.12 Using a normal screwdriver on the bottom and a spanner on the top, unscrew the bogie retaining nut from the bolt. Note this is very tight. Push the bolt out of the bogie casting. Note that this is also a very tight fit. Once free put the bogie to one side and re-assemble the screw and nut for use later.

3.13 Using a cross head screwdriver, unscrew the trailing wheel screw and remove the keep plate and wheelset. Keep the screw and keep plate for future use.

3.14 You will now have a box of bits and an invalid Hornby guarantee!

4 Dismantling the tender

- 4.1 Remove the rear coupling from the housing by gently prising it off with a small screwdriver.
- 4.2 Remove the two screws on the bottom of the tender and remove the keeper plate. Keep the screws and keeper plate for future use.
- 4.3 Remove all the wheelsets.
- 4.4 Remove the tender body fixing screw from the deep hole at the rear of the tender. Put the tender body and screw to one side for safety.
- 4.5 Undo the two screws and remove the weight. Keep the weight and screws for future use.
- 4.6 Unsolder or cut the wires off the phosphor bronze pickup strips. Carefully pull the pickup strips out of the body. Put to one side for future use.
- 4.7 Your loco and tender are now ready for conversion.
- 4.8 Wash your hands as you will have grease on them from stripping the chassis and the etches should be kept as clean as possible.

5 Basic loco conversion



5.1 If you are using Alan Gibson wheels the following will prevent problems with loose crankpins. Countersink the rear of the crankpin screw holes using a 3mm drill and half screw the M1 (14BA) screws home. Using 24 hour epoxy smear the remaining thread and screw the 14BA screws home. Smear a little epoxy over the head for additional security but there should not be a big blob that will catch on wheel rotation. Leave in a warm place for 24 hours to set. This will retain the screws and stop them from rotating. See photo (before the epoxy was applied).

Prototype Frames - There were major problems with frames cracking almost from new. This resulted in a series of evolving solutions as described below:

First 62 (pre 1930 build) started with 4 oval holes per side.

In May 1929 No 4471 had strengthening patches between middle and rear coupled axles obscuring the holes, 2545 4470/4/5/7/81 also fitted in next 3 years.

New Build from 1930 all had round holes 12" diameter (2595/6/7, 2795/6/7/8/9)

From 1931 onwards stiffening plates were added for several locos around leading hornguide obscuring front holes completely and partially obscuring leading axle rear holes.

From Oct 1931 6 new frames were produced and fitted as replacements, it is assumed following the new build rules of round holes.

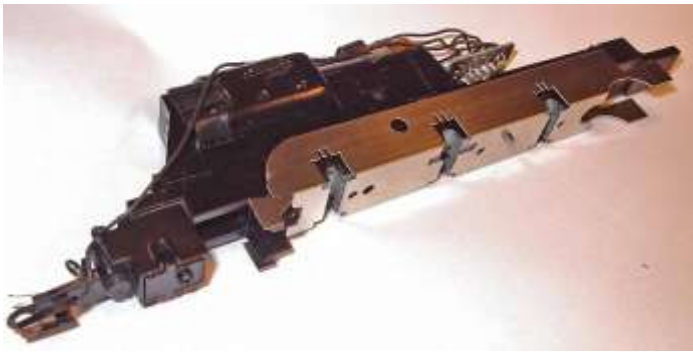
From April 1932 frames were cut in front of rear coupled axles and new 3/4 front portion butt-welded on with a cover plate behind. From thereon spares were produced and frames were swapped. These repaired frames had 1ft round holes, the front hole in the cover plate matched the hole in the 3/4 frame, which we believe was built to the round hole rule above, the other hole lining up with the larger hole in the rear end. Here again it is assumed that this hole in the cover plate would simply match the new build.

From October 1933, when half the Pacifics had had new or 3/4 new frames fitted it was decided to do away with the lightening holes completely (except those in front of the cylinders). The last nine built (2500-8) were built without lightening holes.

By 1938 all the original GNR locos (class A1) and most of the 1928-30 built A3s frames been corrected in some way. However replacement frames continued to be fitted and swapped right up to 1962 so the situation regarding exact locos is confusing or unknown unless you have a clear photo with the frames well lit.

The nickel silver kit frames have half etched lines on the rear for early oval lightening holes and later circular holes. These should be drilled out and opened up with a piercing saw to suit your prototype. Photos showing the patching during post war overhaul show these patches and repairs to be quite crude and 'heavy engineering' - and of course covered in lots of oil and crud!

- 5.2 Remove the section from the front of the loco mainframes [L1] and put the bogie top plate [L8] in a safe place for later use. Clean up the residual tabs with a small file



5.4 Check tight, using a edges of the very important side play

around the edge indents in the shaft bearing wants to put in



obtained by having the thin side of the bearings on the outside or rubbing off the circular beading round the axle hole. For EM gauge, it will also be necessary to file off the raised section on the Hornby chassis around the front axle slot and the similar raised rim on the inside face of the bearings to ensure the bearings move up and down freely.



5.9 sawing next hold the room! See lower



Place the frames flat on the bench and with a thin metal rule fold to produce a 'U' section. Either again using a ruler or using a strong pair of pliers, fold up the small sections along the edge of the main frames at 90 degrees. See Photo (A late version with no lightening holes).

5.3 Ensure the mainframes fit over the original Hornby chassis. Note that they will need to be eased over the locating dowel (open the hole out slightly with a round file but ensure it remains a good fit but the mainframes sit down fully), on the bottom of the Hornby chassis. See Photo below. Remove the mainframes.

the fit of the brass bearings into the slots in the mainframes. If smooth sharp file, lightly file away the cusp equally on both of the slots until the bearing slides up and down with no binding. It is that too much metal is not removed resulting in a sloppy fit – no whatsoever is the aim, just a smooth sliding fit.

5.5 Emboss the rivets on the locomotive keep plate [L2], 3 of the front dummy bearing in front of the leading axle. (The centre of the front dummy bearing and in the centre of the cross (just in front of the dummy bearing) are centre marks if the builder the cross shafts).

5.6 Fold up both sides at 90 degrees and fold up the 'cups' that will hold the Hornby plastic brake hangers so that they form a flat bottom gentle 'V' shape (rather than a parallel-sided 'U' shape). See Photo.

IMPORTANT - Carefully examine the bearings as they are not symmetrical. It can be seen that the flange on one side of the slot is wider than the other side. For EM gauge the bearings need to be mounted in the frames with the thicker flange towards the centre of the frames. For P4 gauge the bearings need to be mounted with the thinner flange towards the centre of the frames. Increased side-play on the drivers can be

5.7 Fit the mainframes to the Hornby chassis, place the bearings in the slots and check for easy movement. See Photo

5.8 Temporarily fit the keep plate, using the original Hornby screws and lower keeper plate. Ensure the bearings slide to the bottom of each slot in the keep plate.

Carefully cut the brake gear off the two Hornby keeper plates by to the main part of the centre solid section. Once the saw cut is started brake block (not the bigger keeper plate) or they will ping off across the photo. Keep safely for later use. Then remove the springs from the keeper plate again cutting with a saw.

5.10 Take the new 3mm axles and test fit them, firstly in the axleboxes (if tight ream them out to 3mm using a reamer or, if you do not have one, a small round file, a precision drill or a broach), then place each through the axleboxes and through the "slots" in the Hornby chassis block. If tight gently file the slots in the Hornby chassis to allow the axle to move freely. The most likely problem will be the front edge of the leading axle and the trailing axle. If any filing is to take place on the rear chassis axle, then cover the holes in the side of the motor with sellotape to stop mazak filings getting into the motor. Do not make the slots deeper (just wider as required) as the system is designed to 'bottom out' on the Hornby chassis block. See Photo.

5.11 Mount the Hornby worm wheel onto the new axle by gentle pushing the gearwheel into the worm wheel, carefully ensuring that the worm wheel is offset on the axle. If it is a loose fit, a simple pop mark on the axle will grab the worm wheel. See photo.

5.12 Mount the bearings on all axles the correct way round, then any spacing washers required (there will be about 0.7mm lateral movement of an axle with no washers in 18.83 gauge –so not many washers are required, There is not much clearance behind the sidebar/connecting rod for the front axle. For 18.83mm gauge we suggest one full washer each side of the leading axle (none for EM), none on the centre axle and none on the trailing axle) and finally mount the wheels on the axles. Quarter the wheels with the right hand wheel leading the left hand wheel by 90 degrees (a three cylinder loco should be 120 but can cause problems on a model).



5.13 Place the bearing springs over the tongues on the frames, fit the wheelsets into the main frames and attach the keep plate. See Photo. Check that the motor turns the centre wheelset with no sign of any binding.



5.14 Re-assemble the Hornby coupling rods onto the crankpins using the 8 special bushes provided. These have to be soldered or glued with epoxy centrally in place (sometimes they are slightly loose in the rods and if so need careful 'central' positioning to maintain the correct wheelbase) and if needed reamed out to take the Gibson crankpin bushes (as

fitted on the right hand boss below) (See photo).

A finer scale solution is to solder up a new set of coupling rods, but this of course takes longer (see section 7.8).



Fit the rods and temporarily secure with a piece of electrical wire sleeve (does not come unscrewed unlike a proper 14BA nut!). The rod with the simulated joint (as Photo) is the trailing rod on both sides. The trailing rod sits (un-prototypically) on top of the leading rod on the middle crankpin. Check that all the wheels now turn without binding when power is applied to the motor. See photo.

5.15 Now comes the scariest job on the conversion! The Hornby splashers have insufficient clearance between their inner faces for EM or P4 18.83 wheels. However all is not lost as the splashers are actually made from quite thick plastic and their vertical faces can be thinned to allow sufficient clearance. Details of available space are as follows;

Hornby A3 as supplied – distance between the splashers leading 21.54mm, centre 21.97, trailing 21.93mm.

Splasher thickness (each side) - leading 0.8mm, centre & trailing 0.71mm.

Gibson P4 wheels need 21.95mm plus any sideplay as desired. Therefore by reducing the thickness of the plastic splashers, clearance of around 22.7mm (or .75mm between each wheel and the splashers) should be achievable.

Although this sounds difficult, I have had no trouble thinning the splashers on all the models I have converted. The process I use is to hold the body firmly and with a burr cutter in a mini drill, gently remove a little plastic and regularly do a 'candle test' by holding it up to a strong light – if the plastic is getting too thin you will be able to see light through and therefore STOP! If this is done a little at a time there should be no problems. If you are more cautious then the same job can be done with scrapers and files –just keep doing the candle test!

Alternatively, etched replacement splashers are provided. See section 7.14



The completed models have been run at speed through B6 turnouts with side play in the centre and rear driving axles without and problems nor replacements of the splashers.

Bogie

5.16 The bogie is intended to be built as compensated with a spring between bogie and chassis.

Prototype Bogie - Prior to WW2 the bogies were fitted with twin dust guards on the front of the bogie [L4]. When BR AWS was fitted to the locos in the mid to late 50s, the front of the bogie was rebuilt with a different cross member and no dust guards [L5]. However, check a prototype photo of your particular loco.

Chose the front bogie spacer for the bogie type required and remove the cusp in the holes for the bogie wheel axles on the bogie side frame [L3], front bogie spacer [L4] or [L5] and rear bogie spacer [L6]. The axle holes should allow the axle to slide or rotate freely without any slop. Check the holes in [L3], [L4], [L5], [L6], [L7] and [L8] for clearance for 16BA bolts.

5.17 The prototype bogie sideframes were assembled to the stretcher by countersunk rivets. These sometimes were not flush. If required, push through lightly the half etched rivets on the bogie sideframes [L3].

5.18 Fold up the bogie sideframes [L3] See photo

5.19 Select the bogie front spacer for your period. For the locos from build up to the fitting of BR AWS use [L4]. For the later period with BR AWS fitted use [L5]

5.20 It is necessary to lightly score the half-etch section of the front bogie spacer [L4] to ensure that the fold lines are in the correct place on the two dust guards. Where the etch needs to be scored is indicated by a nib on the outside edge of the etch. The score line should be made with a scriber or tip of a scalpel or craft knife across the back of the dust guards. Once the etch is scored, file off the nibs flush with the edge.



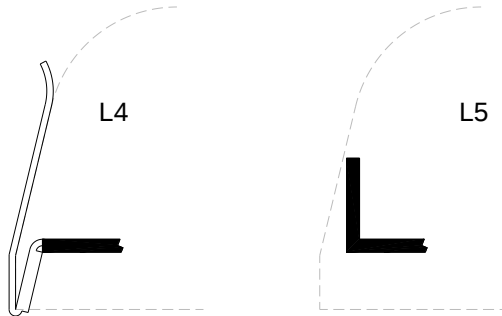
5.21 For both versions [L4 or L5] fold the two main bends on the front spacer, fold up the front axle bearings and the guard irons. **Ensure that every angle is 90 degrees.**



For [L4] fold down the dust guards along the half etch line until the dust guard touches the front edge of the lifeguard. Fold the dust guards up along the edge of the half etched section. The spacer should now look like the Photo.

Place the spacer in the bogie side frames [L3] and bend the dust guards back along the scored line so that it rests against the front edge of the sideframe (see Diagram 1).

Diagram 1 – Bends for dust guards



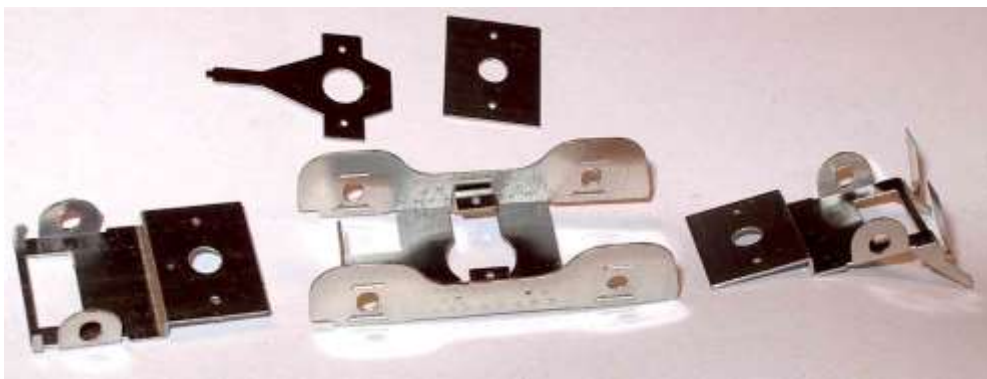
For [L5] bend up the front section along the half etched line by the lifeguards. Ensure that it is at 90 degrees. (see Diagram 1 and Photo).



5.22 Fold the rear spacer [L6]. Ensure that every angle is 90 degrees. See Photo.

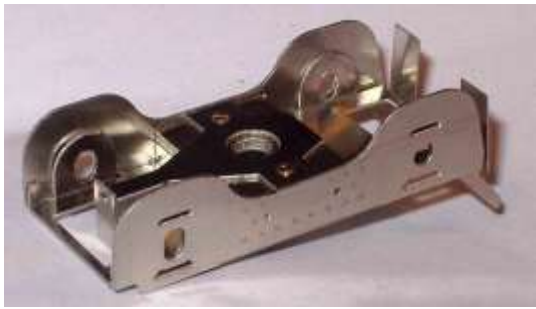
5.23 Remove and clean up the half etch retaining tabs from the rectangular bogie spacer [L7], followed by the top plate [L8].

All the bogie components are shown in the Photo below.



5.24 Fit the rear spacer and then the front spacer into the sideframes. These should be a fairly tight fit, but shouldn't force the sides of the sideframes outwards. Ensure that the axle holes in both etches line up. Any slight discrepancy can be corrected by tweaking one or more of the bends.

Complete the assembly of the bogie by adding the rectangular bogie spacer [L7], followed by the top plate [L8]. Ensure the countersunk holes for the 16BA bolts are to the top and that the tail of the top plate engages into the small slot in the rear plate of the main spacer. Pass the screws through the mounting holes from the top. An etched spanner [L9] is provided which needs bending at 90 degrees along the etch line, to hold the nut whilst the screw is tightened with a screwdriver. For clarity the order of the etches from the bottom of the bogie is; 1. bogie side frame, 2. rear bogie spacer, 3. front bogie spacer, 4. rectangular bogie spacer, 5. bogie top plate. Check that the holes/slots align perfectly by placing an axle through the holes, it should rotate easily. Adjust 90 degree folds (or enlarge inner holes/slots) as necessary.



See Photos of the completed bogie. Note the dust guards have not been bent to finished shape.



5.25 Fit the wheels to the bogie using sufficient spacing washers to ensure there is no sideplay.

5.26 Bend the guard irons to shape if necessary shortening them slightly. See photo (note the dust guards are removed from this bogie).

5.27 Bend the closely as central tab back the bracket).

5.28 Re-using the original one thin washers bottom of the etched washer underside of the [L13] between the



bogie mounting bracket [L10], matching as possible the Hornby original bending the on itself. See Photo (the central tab is under

assemble the bogie to the mounting bracket screw and nut, placing the two thick [L11] and [L12] on the screw first before inserting in the bogie. Use the new spring provided with an [L13] between the top of the spring and the bogie mounting bracket and another washer top of the bracket and the nut. See Photo.



5.30 Fold up the trailing wheelset each side of frames at 90 degrees.

5.31 Cut two pieces of the thicker over the last 3mm at 90 degrees. Insert bracket so that the bend is away from wheelset retaining plate in half (as piece without a hole).



5.29 Re-fit the Hornby cylinders by unscrewing the new chassis/keeper-plate allowing the front of the frames to be lowered so the cylinders slide back in place. Secure cylinders with the original screw and re-fasten the new chassis/keeper plate in place. Fit the new bogie to the chassis using the original Hornby screw (if you did not label it this has a plastic washer attached), note that there is a tongue on the rear of the cylinder support that goes through the new bogie mounting bracket. See Photo.

bracket [L14] and bend out the four small ears on

(10 thou) spring wire to a length of 23mm and bend into the holes in the ears in the trailing wheelset the axle. See photo. Cut the Hornby trailing shown in Photo) to form a spacer (discard the



5.32 Remove the 3 plastic ribs from inside each side of the Hornby Cartazzi truck with a craft knife – the plastic is quite brittle. Fit the new trailing wheelset into the Hornby chassis block by placing the axle in the trailing wheelset bracket between the plate and the springs, putting the spacer in the recess in the Hornby chassis, and then putting the bracket and wheelset on top of the spacer with the axle in the chassis slot. Use the original Hornby screw to retain in place. See Photo.

5.33 Re-fit the Hornby chassis extension block above the cylinders using the original countersunk screw. As it is not possible to re-use the loco pickups, test run the chassis at this stage using jumper wires. You may prefer to convert the tender at this stage to provide electrical power.

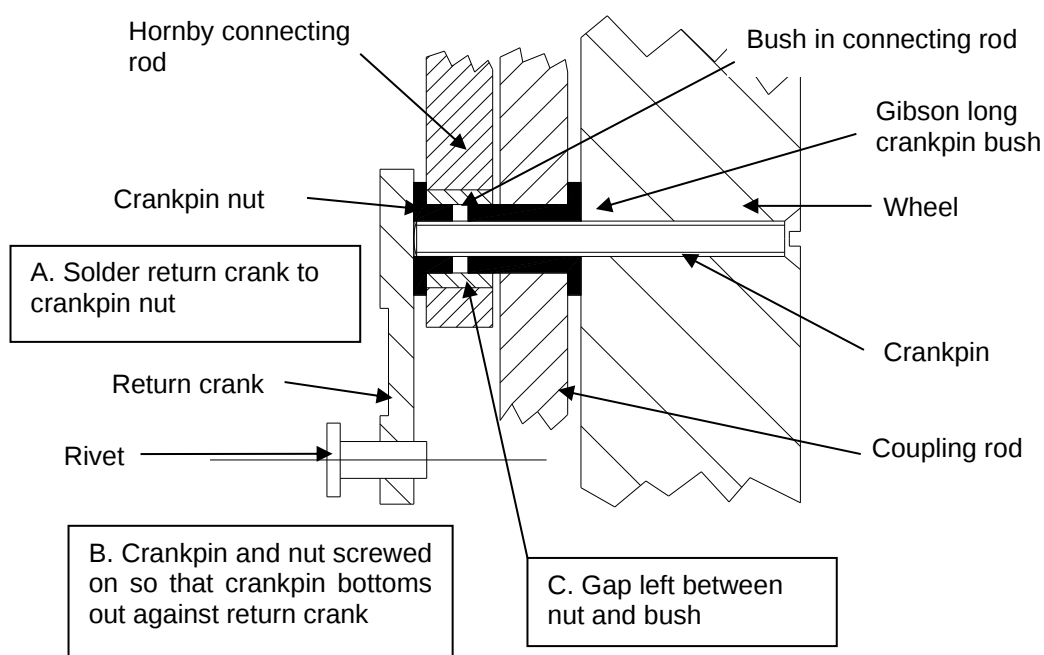
5.34 If it is intended to run the loco round tight curves on a loco where the chassis/frames are live, then it may be necessary to remove the front leg of the leading brake hanger attachment point on each side of the sideframes together with the front sanding pipes. This is easy to do once the model is completed so a decision does not need to be made at this stage.

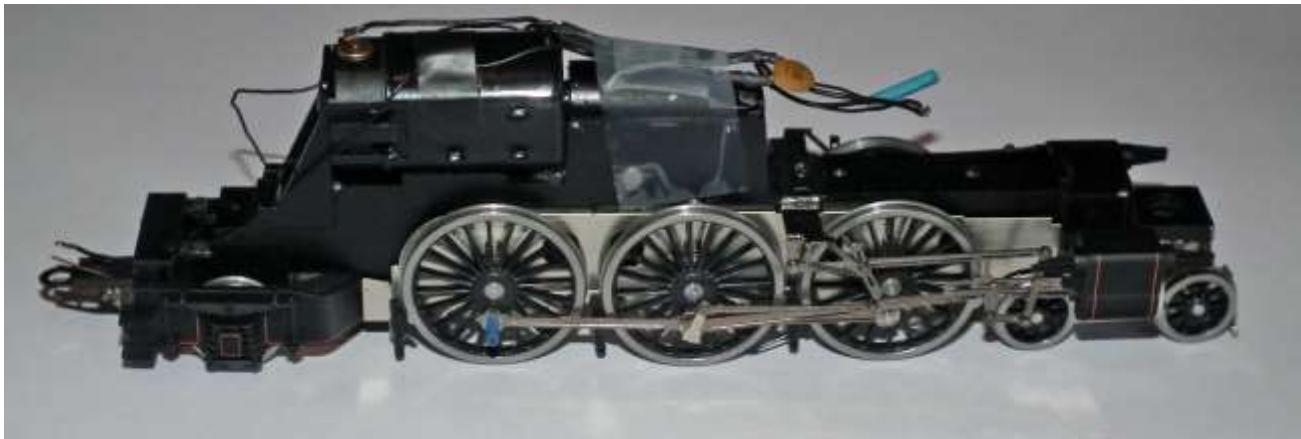
5.35 Clean up the cut line on the plastic brake hangers to ensure there are no raised edges and if necessary shorten the hanger back 'studs' (that fit in the 'cups') so they line up with the wheel treads. Remember the chassis is sprung and the wheels will move upwards under the loco weight. The brake with sanding gear pipe attached goes on the leading axle with the gear pointing towards the centre driver. It will be necessary to cut a slot in the leading cups to clear the sanding gear pipe. Attach the brake hangers to the brake hanger attachment points using cyanoacrylate glue or epoxy resin.

5.36 Take the brake pull rod etch [L15] and twist the front section through 90 degrees so the adjusters are visible from the side (refer to the Hornby plastic pull rods), clip it into the holes in the bottom of the brake hangers. See Photo.



Diagram 2 – Return Crank Assembly





5.37 Diagram 2 shows the new arrangement for the return crank and photo above the completed valve gear (with Hornby Rods). Remove return crank from the Hornby valve gear by drilling out the rivet attaching it from behind; **be careful not to damage the hole in the valve gear** as a new rivet will have to go through this.



5.38 Form the new return crank by soldering the return crank front [L16] to the return crank rear [L17]. Solder the return crank assembly to a crank pin nut. See rather cruel photo!

5.39 Screw the return crank onto the centre crankpin. Adjust the length of the crankpin so the return crank sits at the same angle as the original Hornby one or refer to the website www.rail-online.co.uk for a perfect side on photo of 60080 showing the positioning.

5.40 When satisfied with the angle when fully tightened, attach the other end of the return crank to the Hornby valve gear by a rivet inserted through the valve gear from the front. The rivet can be attached by squeezing with pliers firmly so the back expands. An alternative is to oil the moving link and carefully solder the rivet to the rear of the return crank working quickly with a very hot iron.

5.41 Replace the cylinders and valve gear onto the chassis. Unlike the similar Hornby A4 there is sufficient clearance for the front crankpin to be fitted in the normal way as long as the 'nut' is thinned down slightly to give adequate clearance for the connecting rod. Fit the remaining crankpin nuts. Check the valve gear runs freely under power.

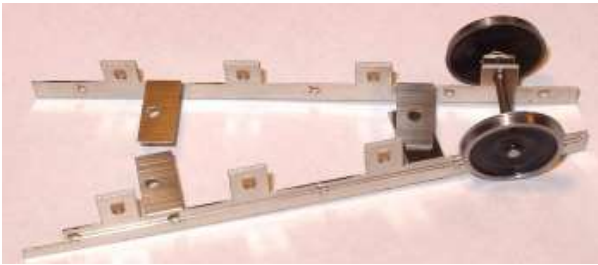


5.42 Attach the driving wheel balance weights [L18] and the coupled wheel balance weights [L19] to the wheels, using photographs to ensure the correct position (they are missing from the photo below!).

5.43 Cut a large piece of lead and attach inside front end of the loco body. This is necessary because the Hornby chassis is heavier towards the rear and does not sit level on the new sprung chassis.

5.44 Re-fit the loco body. The basic loco conversion is now complete.

6 Basic tender conversion



6.1 Taking the tender frames [T1] and [T2], fold the four cross pieces to 90 degrees. Fold the outer half of the slotted axle bearing sections through 180 degrees back on themselves. Note: the etched line is on the outside of the bend. To ensure a tight bend, squeeze the two halves together using a pair of pliers. (see Photo taken at a slightly later stage)

6.2 Open up the slots in the tender frames [T1] and [T2] so that the tender axles slide freely without any slop.

6.3 Bend out the five small ears on each side of frames at 90 degrees.

6.4 Cut off the 16 plastic wheel guides from the bottom of the Hornby tender.



6.5 Ensure that the new frames fit into the Hornby tender, fitting the right hand side frame first (looking from above – this is the frame that slides under the metal plate at the front of the tender). Secure in place using the original Hornby screw in the front hole. Drill a 1.5mm hole in the plastic tender underframe in line with the rear fixing hole and fit a new screw in the hole. Remove screws and tender frames.

6.6 Fold up the 8 axleboxes [T3]. This is best done by placing the etch with the half etched middle section perpendicular to the edge of a rule, or similar, to form a 'T' shape. Push down on each end of the etch so that it begins to wrap over each side of the rule. See photo.

Remove from the edge of the rule and push together between the fingers. Complete the bend by squeezing the two edges furthest from the bend with a pair of pliers. The holes in the two halves of the folded section should be in line. Open out the holes so that the axles rotate freely with a very slight amount of slop.

6.7 Assemble the rear tender wheelset through the tender frames by firstly fitting a bearing, then fitting the axle through the frame, then fitting the second bearing, and finally the second wheel. Sufficient washers also need to be fitted between the wheel and the bearing to ensure there is minimum sideplay. For guidance for P4 two full width washers per side is recommended on outer axles. For EM a single washer is sufficient. Put a 3mm right angle bend in the end and then slide the thin 8 thou steel spring wire through the hole in the axleboxes and then through the retaining ears (this is a bit of a fiddle!). See Photo.



6.8 Feed the other 6 axleboxes onto the steel wire at the appropriate positions. See Photo.

6.9 Assemble the leading wheelset with similar washers. Assemble the two inner wheelsets in the same way but without the spacing washers and fit all wheels checking for the correct back to back.

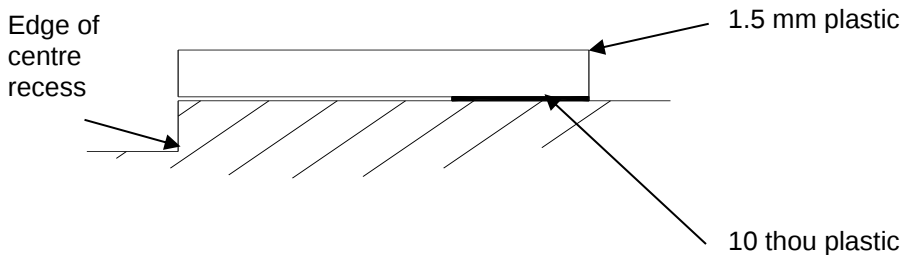
A tip to check the first wheel fitted is running true is to balance them on a steel rule holding the axle with a file and move to left and right spinning the wheels, and wobble can be corrected by 'twisting' the wheel with finger pressure and then re-checking. See Photo.



6.10 Fit the frames to the Hornby tender, and refit the cast weight and tender top. Ensure that the tender runs smoothly and that all the axleboxes are free to move up and down. See Photo,

6.11 Bend the Hornby phosphor bronze pickups flat.

Diagram 3 – Tender pickup retaining blocks



6.12 Remove the Hornby tender top and cast weight. Cut the bigger strip of plastic into 4 x 9 mm lengths. Cut the smaller strip of plastic into 4 x 3 mm lengths. Glue the smaller pieces of the plastic strip onto the larger pieces of plastic strip at one end (see Diagram 3). Fit the four assemblies as shown in Photo equidistant between the out wheel opening and the inner wheel opening ensuring the resultant slot is towards the centre line of the tender. (Photo shows a non-corridor tender with the assemblies butted up against plastic pips. On the corridor

tender plastic underframe there are no protruding pips)

6.13 Curve the two outer pickups of each pickup strip downwards and then slide the strip into the slot under plastic strip. The inner two pickups rest on the plastic frame. Adjust the curvature until the outer pickups just rests on the top of the wheels. Repeat for the other strip. See Photo.

6.14 Reconnect the pickup wires to the pickups, at this point it might be a good idea to check electrical conductivity through the rivet to the vertical draw-pin at the front of the tender – it has caused an intermittent fault on at least one loco!

6.15 Connect the tender to the loco and ensure that the loco moves under its own power. If there are any problems first check the pickups, but the most likely cause of the problem is the two phosphor bronze springs on the loco coupling that press on either side of the tender pin and the two phosphor bronze springs that stand up on the loco coupling. For the former ensure there is adequate pressure on each side of the pin. For the latter make sure that the springs are touching the plate on the underside of the tender and are not touching the plastic ring that surrounds the base of the pin.

6.16 Glue two smaller pieces of lead into the underside of the tender body, each side of the coal slope as far forwards as possible. This ensures that the tender springing works correctly and the tender sits at the correct height.

6.17 Re-assemble the tender

6.18 The tender brake gear can be replaced either utilising the original plastic brake hangers or fitting with new metal brake hangers. For metal brake hangers see section 8.1. Again remember the plastic ones will not cause electrical shorts!

6.19 Cut off the tube section at the back of the Hornby keeper plate flush with the plate.

6.20 Divide the Hornby keeper plate into sections by sawing across the plate immediately in front of the first brake hangers, immediately behind the second brake hangers and immediately in front of the third brake hangers. Discard the sections without brake hangers cut the remaining two pieces roughly along the centre line. Clean up the cut edges. See photo with the original brake keeper plate above the chopped up version.



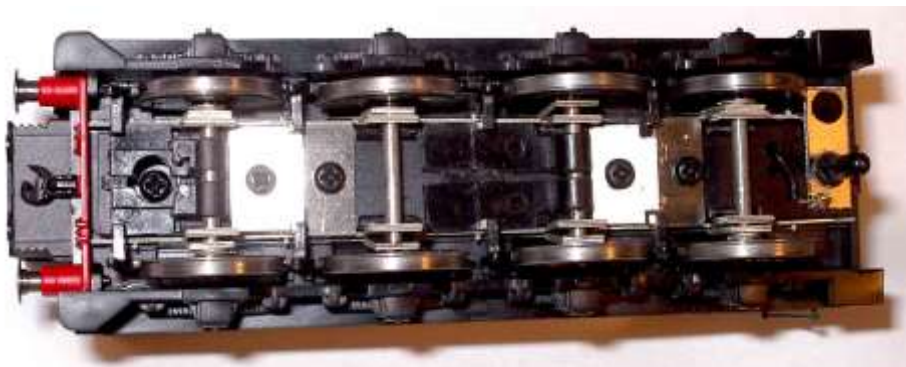
6.21 If the brake gear is glued to the chassis then it would not be possible to take the chassis apart so a removable version is suggested. Place one of the brake gear clamping plates [T4], with the larger cutouts towards the front, on the underside of the tender immediately behind and touching the leading frame spacer. Drill a 1.5mm hole in the plastic tender underframe through the hole in the plate.

6.22 Position the two halves of the forward section of the plastic brake hanger section in position on the tender underframe, place the tender clamping plate over the top and fit a new screw through the hole, clamping the brake hangers in position.

6.23 A second clamping plate [T4] can be fitted if required over the back end of the forward section of the plastic brake hanger by placing the clamping plate in position over the plastic brake hanger section, drilling through the hole into the plastic tender underframe and fitting a new screw.

6.24 Repeat 6.23 for the clamp plate [T5] for the rear section of the plastic brake hanger behind the rear frame spacer utilising the existing hole in the plastic tender underframe.

6.25 Clamp the rear plastic brake hanger in position using the clamping plate and a new screw. Ensure the wheels move freely in the plastic brake keeper plate by clearing the inside of the 'U' shaped axle covers. This can be done with a file or a burr in a mini drill. (The plastic is quite 'soapy' and not the easiest to work) See photo – the clamping plates are highlighted.



Because the plastic is quite soapy it easily distorts under the clamping down process, it may be necessary to superglue a 'wedge' of scrap plastic in the gap between the two cut halves at the opposite end from the clamping plate (avoid gluing permanently to the chassis or it will not be removable!).

6.26 Refit the plastic brake pull rods and secure with superglue. Alternatively the etched pull rods [T9] may be used fitted over a piece of 0.7mm wire attached through the holes at the bottom of the plastic brake hangers. Photo shows the completed chassis with brakes fitted.



The basic tender conversion is now complete.

7 Additional loco components

7.1 The following additional items are provided in the kit and may be used if the builder requires.

7.2 Front chassis overlays

7.2.1 Emboss the rivets in the two front chassis overlays [L20 and L21].

7.2.2 Curve two of the bogie wheel splashers [L22] to match the radius of curve above the bogie wheel. NOTE: the two should be of opposite hands. The angled corner should be to the outside and towards the front of the loco. IMPORTANT, the method of chassis removal for the Hornby chassis requires it to slide forward releasing the rear tongue. If the wheel splashers remain full length they restrict this forward motion (the cylinders hit the splashers), so it is necessary to file back the rear of the splashers level with the bracket that has the bolt pushed through on the front frames. In addition reduce the length of the locating 'tongue' on the Hornby chassis (above the Cartazzi truck) to 1mm with a file. Solder the splashers into position. This is not shown on the photo below. The alternative would be to introduce a new method of rear chassis fixing but this has not been investigated.

7.2.3 If required for your period, push through the rivet detail in the frame guard irons [L23 and L24] (they were removed in late BR days). Test fit to the front chassis overlays to the Hornby chassis and body and test fit the frame guard irons [L26 and L27] with the 'notch' over the rear of the slightly thick Hornby bufferbeam. Mark the position, remove and solder in place. Bend to shape (there is a good head on photo in Yeadon Vol1) See Photo of the completed right hand frame overlay with vertical frame guard irons fitted – see 7.2.7 below



7.2.4 Make sure the etch cusps are removed from each side of the thin arms of the buffer spring housings [L25 and L26].

7.2.5 Cut two pieces of 3/32" tube to a length of 3.7mm and chamfer both ends so that they locate in the recesses in the buffer spring housings [L25 and L26].

7.2.6 Score a line along the base of the triangle piece to aid bending later (see 7.2.8)

7.2.7 Fold up the two buffer spring housings [L25 and L26] by first bending the ends (with half etches to locate the tube). Solder the tube in place using a cocktail stick to aid holding and centering, then bend the small piece at the end over at 90 degrees. Fold the two side arms at 90 degrees and solder ends.



7.2.8 Cut two short lengths of 1.0 mm diameter wire. Insert the wire through the buffer washer [L27] and the smaller hole in the end of the buffer spring housings ensuring that the wire does not protrude into the tube. Trim the wire to length. Solder together (see photo of the finished assemblies).



Ensure that the larger hole in the end of the buffer spring housing and tube pass over the inner end of the Hornby buffer – open up if necessary with an appropriate size drill. Do not attach to the chassis overlays at this stage.

7.2.9 Bend the triangular extended edge through 45 degrees then curve the end to follow the curve in the buffer beam (see second photo above)

7.2.10 Place the frame overlays into position each side of the plastic front frames. With the frame overlays now in place carefully align the buffer spring housings with the back of the Hornby buffer shank and check that the buffers are free to move. Do not fix them in place at this stage. See photo.



7.3 Replacement front footsteps

7.3.1 The Hornby model has the front footsteps glued below the front footplate. These are very delicate and are liable to be broken off and lost. They are also not how the footsteps were fitted on the prototype as they were attached to the frames just below the buffer spring housings.

7.3.2 To fit the steps, the buffer spring housings must have been fabricated as above.

7.3.3 Emboss the two rivets on each footprint [L28 and L29]. Solder the upper steps [L30] into the slot in the buffer and with a good pair of pliers bend up the edges along the edge to form the upturns. Repeat for the lower steps [L31]. Once assembled the edge of the steps may be thinned on the outside edge if required.

7.3.4 Bend the top over along the half etched line to 90 degrees.



7.3.5 Bend the step supports as shown in photo left, making the bends at the end of the half etched section and at the small hole in the half etched section. Solder to the base of the footsteps. See photo right.



7.3.6 Solder the footsteps to the underside of the buffer spring housings and fix the complete assembly in place on the front frames with epoxy glue. If front steps are fitted additional handrails 0.33 hard wire may need to be fitted to the front footplate of the Hornby body from as not all models have these.

7.4 Footplate support brackets

7.4.1 There are two footplate support brackets each side of the loco, one behind the driving wheels and one on the Cartazzi truck frame.



7.4.2 Fold up the larger bracket [L32 and L33] by first folding the small outer section back on itself with the fold line towards the outside of the bend, and then bending at 90 degrees at the second bend line with the bend line to the inside of the bend. See Photo left.

7.4.3 Attach the brackets in the slot at the rear of the mainframe sides so that the half-etch is to the front and the right angled piece is also towards the front. See photo right.



7.4.4 Fold the smaller bracket [L34 and L35] to 90 degrees along the slots with the bolt detail on the inside of the bend and fit to the Cartazzi truck frame immediately in front of the moulded spring hanger in-line with the rivets and with the riveted flange towards the front of the loco (see photo above). Fix using cyanoacrylate or preferably epoxy resin (the plastic is difficult to fix to and fixing is helped by scoring the plastic).

7.5 Replacement brake hangers

The plastic brakes are rather nicely moulded however metal replacement brake hangers [L36, L37 and L38] can be fitted if the Hornby brake hangers are lost or a metal replacement is preferred. Remember plastic does not produce an electrical short and the wheels are sprung so move vertically!

7.5.1 Take the brake hangers [L36] and solder the brake block overlays [L37] to the front of the brake hangers, making sure that you have 3 of each hand. Solder the brake hanger washers [L38] to the bottom of each hanger.

7.5.2 If required attach the brake hanger brackets – see 7.6

7.5.3 Open up the holes in the middle and bottom of the brake hangers, the middle to clear 0.7 mm wire and the bottom to clear the ends of the brake pull rods [L15]

7.5.4 Attach 3 pieces of 0.7 mm wire across the keeper plate through the holes in the brake hanger attachment guides and protruding beyond the wheels on both sides.

7.5.5 Attach the brake hangers to the wire, making sure that the brake blocks do not touch the wheels, which would cause a short circuit.

7.5.6 Trim the wire back to the face of the brake hanger.

7.5.7 Fit the brake pull rods [L15]

7.6 Brake hanger brackets

7.6.1 If there is sufficient clearance, attach the brake hanger brackets [L39] to the top of the brake hangers on the leading and middle wheels only. The 'point' faces downwards. This can be done to enhance either the etched or plastic brakes.

7.7 Replacement reach rod

7.7.1 Remove the original reach rod from the Hornby body.

7.7.2 Select the appropriate reach rod for the locomotive you are modelling ([L40] for Doncaster built locos, [L41] for Darlington built locos)

7.7.3 Attach the reach rod joint [L46] to the front of the reach rod [L42] or [L43] taking into account whether the loco is left hand or right hand drive. The joint plate is arranged with the end with two prongs towards the rear and the other end just covering the half etched spot on the reach rod. Note that early locos had no joint plate. Trial fit and then attach the reach rod to the underside of the footplate using cyanoacrylate into the slots provided in the Hornby body, (minor filing may be required).



reach rod with no joint plate fitted to the Hornby body.

7.7.4 Fold up the reach rod safety loop [L44] using a piece of scrap etch to push the loop into the guide [L45]. Bend over the two legs and trim to length and attach mid way between the centre and rear driving wheels (there is a depression in the Hornby body indicating the position). The photo shows an early

7.8 Replacement coupling rods

7.8.1 Each side is manufactured from 4 etches and hinged behind the center crank pin. There are also overlays for the bosses. In all cases cut the half etch supporting the bosses near the bosses and away from the rods in order to not distort the rods.

7.8.2 Cut rods from fret [L45 & L46]. Remove the bosses from the centre but do not separate the two sides of the rods. See photo right.





7.8.3 Bend the half etch tabs between each pair of rods to allow the rods to touch back to back - this holds them accurately ready for soldering. It is critical to align the two halves exactly in order to make one rod so take some time tweaking. Do not clean off the tabs from the rods at this stage in order to minimise risk of distortion. See photo.

7.8.4 Place a little flux along the top surface of the rod and apply heat; the solder on the soldering iron will run down between the rods and join them. The secret is to apply only a little solder at a time. Solder will fill the "cusp" and give the impression of a solid rod. See photo left. Repeat for the whole length of the rod.

7.8.5 There are four bosses – the front boss [L47] and the centre boss [L48] are fitted to the leading coupling rod, and the rear boss [L49] and the forked joint boss [L50] are fitted to the trailing coupling rod. The front boss [L49] cannot be fitted if building the loco in P4 due to the reduced clearances. (Spare bosses are provided on the etch) Apply each boss holding in place with a cocktail stick and solder in place using the same technique as for joining the rods. Clean up each rod with files. Carefully blend the bosses into the front face of the rods.

7.8.6 The rear length of each rod has a knuckle joint to manufacture. The front and rear rods are joined with a rivet which is pushed through from the front and then cropped back on the rear leaving about 0.5 mm proud. The rivet head can be filed to a hexagon shape to represent the knuckle nut. See photo.



To stop solder flooding the joint apply a little oil to the surfaces not to be soldered - this will prevent the solder running into the joint. Keep the rear of the rod clean. Solder can then

be quickly applied with a very hot iron to the back of the rod to fix the rivet in place. Clean off excess solder leaving enough to keep a strong joint. See photo above of completed rods.

And comparing the Hornby rods and the replacements (actually an A4 but they are identical) see photo right



7.8.7 The front boss is designed to be recessed



thereby allowing the crankpin 'nut' to be screwed flush. See photo left

Open up the crankpin holes in order that the crankpin bushes will rotate in the rod. This can be done with a reamer, broach or a fine Swiss file.

7.8.8 Fit the rods to the wheels and test run.

Note: on the A4 the axle protrudes beyond the wheel face, therefore ensure the rods do not catch on the axles. If necessary, fit washers behind the rods.



7.9 Speedo drive

7.9.1 Late in their career some locos were fitted with BR speedo equipment. See photo. A casting for the speedo drive is available separately from Brassmasters if required for the period modelled. The support bracket and drive crank are provided as part of the Easichas kit.

7.9.2 Bend the speedo crank [L51] into a shallow 'S' shape (see photo right showing rib and angle)

7.9.3 Insert rib [L52] through front of crank and solder in position. Solder a crankpin nut to the return crank (wide part of threaded top hat away from crank). Once secure file the rear of the crank flush. (If you try putting the nut on last it all falls apart – we speak from experience!)



7.9.4 Screw the return crank onto the rear crankpin. Adjust the length of the crankpin so the speedo crank sits with the free end exactly over the centre of the wheel see Photo above.

7.9.5 Bend up the speedo bracket [L53]. Attach to the loco body behind the reach rod using cyanoacrylate or epoxy resin referring to prototype photos

7.9.6 Attach the speedo casting (available separately) to the speedo bracket and, if necessary, bend the outer end of the speedo so that it is directly over the centre of the rear driving wheel.

7.10 Replacement damper linkage

7.10.1 Remove the Hornby damper linkage from below the cab

7.10.2 For a simple replacement attach the replacement damper linkage, [L54] for right hand drive locos or [L55] for left hand drive locos, using cyanoacrylate or epoxy resin

7.10.3 For a more detailed replacement, solder together the two parts of the damper bracket [L56].

7.10.4 Depending on whether the loco is right hand drive or left hand drive, attach the damper bracket to the appropriate damper linkage using a piece of 0.45mm wire through the hole in the two parts, with the longer leg of the bracket towards the front of the loco. Attach the assembly to the Hornby body using cyanoacrylate or epoxy resin.



7.10.5 Parts are supplied to form the opposite side damper brackets. However, as no representation of the firebox is provided by Hornby on which to mount the brackets, the modeller will need to make suitable sides from plastikard etc.

7.10.6 Solder together the two parts of the opposite side damper bracket ([L56] and [L57] for right hand drive locos, [L56] and [L58] for left hand drive locos) with a piece of 0.45mm wire through the hole. Trim to length.

7.10.7 Attach the bracket to the opposite firebox side in the same position as the damper linkage bracket, again with the longer leg of the bracket towards the front of the loco, using cyanoacrylate or epoxy resin. Note that extreme care will be required from now onwards when replacing the chassis as the rear footplate support brackets foul the damper linkage and so have to be 'fed' through during assembly.

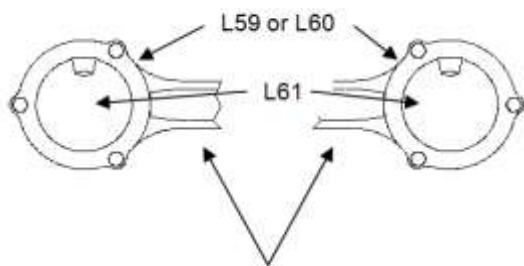
7.11 Return crank bearing cover

7.11.1 There are two types of return crank bearing back depending on whether it is covering the Hornby rivet or a replacement valve gear rivet. For Hornby use the one with the larger hole [L59] and for the replacement valve gear rivet use the one with the smaller hole [L60].

7.11.2 Emboss the bolt heads on the return crank bearing backs. Solder the return crank bearing fronts [L61] onto the appropriate return crank bearing backs. They are assembled with the raised section on the bearing front towards the top and the rivet pattern, on the first bearing back, with a single bolt on the left hand side and, on the second, with a single bolt being on the right hand side (see Diagram 4).

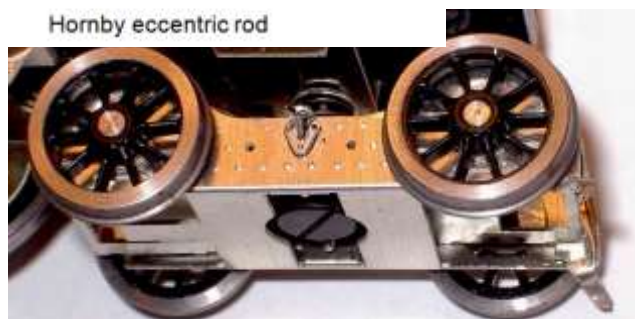


Diagram 4 – Return crank bearings



7.11.3 Reduce the thickness of the rivets connecting the eccentric rods to the return cranks.

7.11.4 Attach the bearings to the front of the eccentric rod over the top of the rivet connecting it to the return crank. Ensure that the rivet is still free to rotate.

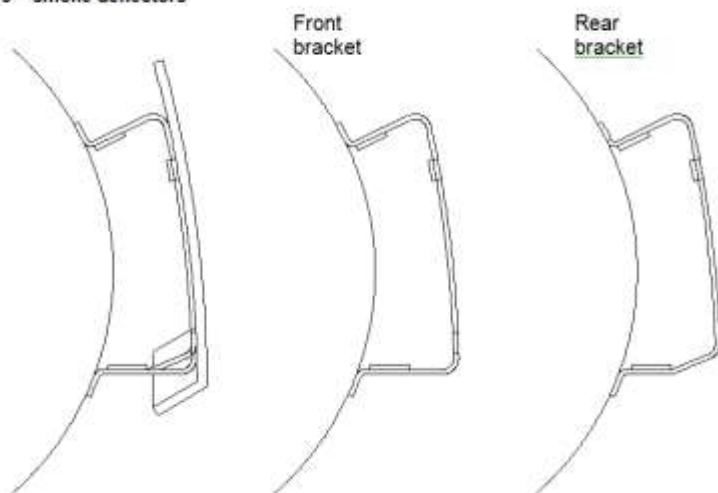


[L62],
of the front

7.12 Bogie Brackets

7.12.1 Form rivets and fold up the two bogie brackets attach the tiny triangular web [L63] and fit to central top bogie See photo.

Diagram 5 – smoke deflectors



7.13 German type smoke deflectors

7.13.1 Form 2 rivets in each of the smoke deflector frames [L64 and L65].

7.13.2 Open up the 4 holes in each of the smoke deflector frames [L64 and L65], and the smoke deflectors [L66 and L67] to clear 0.x mm wire

7.13.3 Fold up the smoke deflector frames as shown in diagram 5. The top bend should be about 1mm above the horizontal bar of the bracket.



Solder the left hand smoke deflector frame [L64] to the left hand smoke deflector [L66] using the 0.3 mm holes for alignment. Repeat for the right hand frame [L65] and the right hand smoke deflector [67].

7.13.4 Bend up four pieces 0.3 mm wire to form the hand rails and fit to the smoke deflectors.

7.13.5 Attach the smoke deflectors to the



Hornby smoke box as shown in epoxy resin, so are in line with



diagram 5 using cyanoacrylate or that the handrails on the deflector those on the locomotive.

7.14 Replacement splashers fronts

7.14.1 Should you wish to replace the splashers fronts to obtain the necessary clearance for the driving wheels detailed in 5.15, or have damaged a plastic front, then utilise parts [L69] to [L73]

7.14.2 Cut away the front face of the splashers leaving the splashers top untouched. Cut back the inner edge of the footplate where the splashers front has been removed. Use the appropriate replacement splashers front [L69] to [L73], with the raised edge inwards, and attach using cyanoacrylate or epoxy resin.

7.15 AWS protection plate

7.15.1 Locos fitted with BR AWS equipment had a plate mounted under the front buffer beam to protect the AWS receiver mounted on the front bogie frame.

7.15.2 If required, push through the rivets on AWS protection plate [L74]

7.15.3 Fold over the top section at 90 degrees and run solder in the bend lines. Then curve in the opposite direction as shown in Diagram 6. The actual angle of the plate varied according to how much damage it had taken!

Diagram 6 - AWS protection plate



7.15.4 Fit centrally to the extreme bottom of the front buffer beam using cyanoacrylate referring to photos.



7.16 Loco pick-ups

7.16.1 The model benefits from additional pickups on the loco. Using a copperclad sleeper (cut to fit between the keeper plate) and 30 swg phosphor bronze wire (not supplied but available from Eileens Emporium), wind a 'spring' shape with extended end and solder to the copperclad (gapping it first!) as the photo below.

7.15.2 Adjust so the springs lightly touch the flanges of the wheels and glue to the replacement keeper plate. Connect with wires to the motor (not illustrated) ensuring the correct polarity is maintained. The loco will now have loco and tender pickups.



8 Additional tender components

8.1 Replacement brake gear

8.1.1 The prototype had double pull rods, one each side of every wheel (i.e. 4 rods).

8.1.2 Drill out the holes in the tender frames to clear 0.7 mm wire. Also drill out the top and bottom holes in each brake hanger to clear 0.7 mm wire.

8.1.3 Place a 24 mm long piece of 0.7 mm brass wire through each of the holes in the tender frames but do not solder. Hold centrally by using a piece of masking tape.

8.1.4 Solder a leading brake hanger [T6 and T7] to each end of the leading piece of wire so that the brake block touches the wheel in the correct position on the tread. Repeat with brake hangers [T8 and T9] on the remaining pieces of wire.

8.1.5 Solder a piece of wire between the bottom holes of each pair of brake hangers, using the rear hole in the leading hanger, leaving a sufficient amount protruding each side to allow the outside pull rods to clear the front face of the wheels. Remember to allow for side play.

8.1.6 Place a brake pull rod [T9] over the ends of the protruding brass wire on both sides of the tender. See photo of a completed model (actually an A1 but the arrangement is near identical except for the plastic front pull rod).



8.1.7 Rotate the brake hangers backwards so that the brake blocks clear the wheels adequately and solder the top cross wire in the frames. Once the first one is done the pull rods will hold all the others in the correct position.

8.1.8 Solder the outside brake pull rods [T10] to the brass wire, allowing sufficient clearance for side play.

8.1.9 Cut a small section from the middle of the lower cross wires. Place the remaining pull rods [T10] over the wire on the inside of the brake blocks and solder in position allowing sufficient clearance for side play.

8.1.10 Trim the lower wire to the inside and outside of each brake hanger.

8.1.11 File through (do not snip - it will distort the chassis) each of the top wires between the frames and then trim each back flush with the inside of the frames.

8.2 Tender guard irons

8.2.1 Emboss the rivets on the tender guard irons [T11 and T12]

8.2.2 Attach guard irons to the inside face of the Hornby side frames using cyanoacrylate or epoxy resin. These are almost impossible to see but photo shows the shape of the prototype (covered in grease & fluff!)



Etched Component List

L1	Loco mainframes	L45	Leading coupling rods (2)
L2	Loco keep plate	L46	Trailing coupling rods (2)
L3	Bogie side frame	L47	Front coupling rod boss (2)
L4	Front bogie spacer (twin dust shields)	L48	Centre coupling rod boss (2)
L5	Front bogie spacer (BR AWS)	L49	Rear Coupling rod boss (2)
L6	Rear bogie spacer	L50	Forked joint boss (2)
L7	Rectangular bogie spacer	L51	Speedo crank
L8	Bogie top plate	L52	Speedo crank rib
L9	Spanner	L53	Speedo bracket
L10	Bogie mounting bracket	L54	Damper linkage (right hand drive)
L11	Bogie screw spacing washer (thick) (2)	L55	Damper bracket (left hand drive)
L12	Bogie screw spacing washer (thin)	L56	Damper bracket (3)
L13	Bogie spring washer (2)	L57	Damper bracket (right hand drive) (1)
L14	Trailing wheelset bracket	L58	Damper bracket (left hand drive) (1)
L15	Brake pull rods	L59	Return crank bearing back large hole (2)
L16	Return crank front (2)	L60	Return crank bearing back small hole (2)
L17	Return crank rear (2)	L61	Return crank bearing front (2)
L18	Driving wheel balance weights (2)	L62	Bogie bracket (2)
L19	Coupled wheel balance weights (4)	L63	Bogie gusset (2)
L20	Front chassis overlay left	L64	Smoke deflector frame left
L21	Front chassis overlay right	L65	Smoke deflector frame right
L22	Bogie wheel splasher (2)	L66	Smoke deflector folding spacer
L23	Frame guard iron left	L67	Smoke deflector left
L24	Frame guard iron right	L68	Smoke deflector right
L25	Buffer spring housing left	L69	Splasher front leading left
L26	Buffer spring housing right	L70	Splasher front leading right
L27	Buffer washer (2)	L71	Splasher front middle (2)
L28	Footstep left	L72	Splasher front trailing left
L29	Footstep right	L73	Splasher front trailing right
L30	Upper steps (2)	L74	AWS protection plate
L31	Lower steps (2)	L75	Spacer washers for 3 mm axles
L32	Large footplate support bracket left	L76	Spacer washers for 2 mm axles
L33	Large footplate support bracket right	T1	Tender frames (lhs)
L34	Small footplate support bracket left	T2	Tender frames (rhs)
L35	Small footplate support bracket right	T3	Tender axleboxes (8)
L36	Brake hangers(6)	T4	Brake gear clamping plates (2)
L37	Brake block overlay (6)	T5	Brake gear clamping plate (1)
L38	Brake hanger washer overlay (6)	T6	Leading brake hanger (outline) left
L39	Brake hanger bracket (4)	T7	Leading brake hanger (outline) right
L40	Reach rod (Doncaster type)	T8	Brake hanger (outline) left (3)
L41	Reach rod (Darlington type)	T9	Brake hanger (outline) right (3)
L42	Reach rod safety loop	T10	Brake pull rod (4)
L43	Reach rod safety loop jig	T11	Tender guard iron left
L44	Reach rod joint	T12	Tender guard iron right
		T13	Spacer washers for 2 mm axles

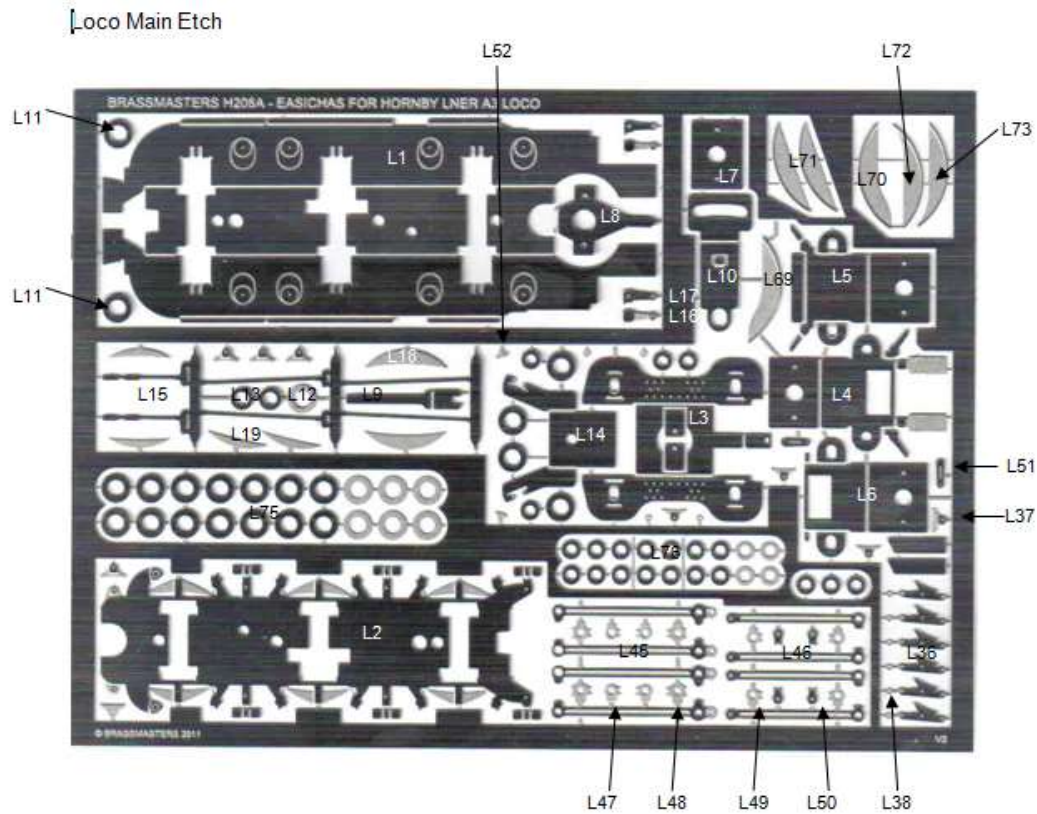
Other Components List

Brass axleboxes (6)	0.7 mm brass wire
Axlebox springs (6)	0.8 mm brass wire
16 BA screw (2)	1.0 mm brass wire
16 BA nut (2)	3/32" brass tube
Self tapping screw (2)	Bushes for Hornby rods (8)
Bogie spring	Valve gear rivets (5)
0.008" spring wire	
0.010" spring wire	
0.30 mm brass wire	Plastic strip (thin)
0.45 mm brass wire	Plastic strip (thick)

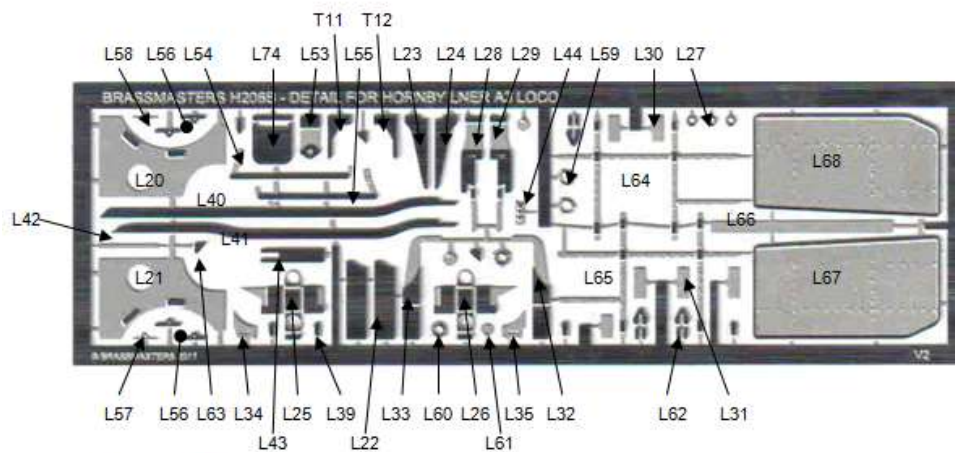
Additional items required

Lead weight for loco	50 mm x 22 mm	Code 4 (1.8 mm thick)	22.5 g approx..
Lead weight for tender (2)	42 mm x 12 mm	Code 4 (1.8 mm thick)	10.3 g approx.

Etched Components



Loco Detail Etch



Tender Etch

