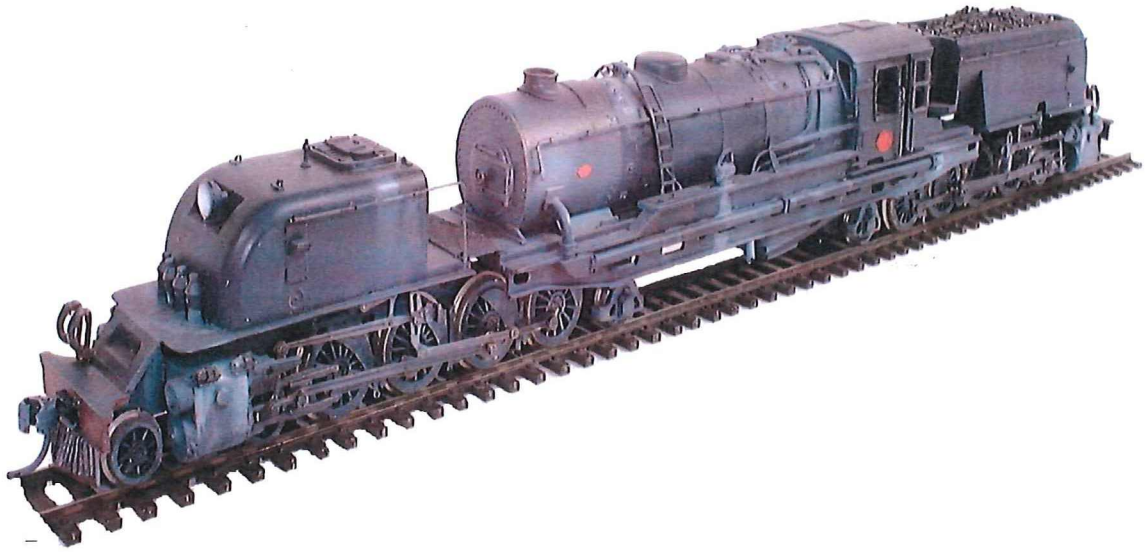
DJH MODEL LOCO

S.A.R. GMA/M GARRATT
4-8-2+2-8-4



Kit Reference
E222
(HOm Scale)

DJH Engineering Ltd
Project House, Consett Business Park, Villa Real, Consett
Co.Durham DH8 6BP England
Tel: +44 (0) 1207 500050 Fax: +44 (0) 1207 599757
Email: sales@djhmodelloco.co.uk Web: www.djhmodelloco.co.uk

HELPFUL HINTS FOR INEXPERIENCED MODELLERS
By TONY WRIGHT (Professional Model-maker)

DJH Engineering Ltd – Model Loco kits are among the best on the market with regard to accuracy of components and ease of construction. By choosing a suitable kit from their range with regard to your own experience, no great problems should be encountered with its construction if a few simple rules are followed.

First check all components against the list provided in the instructions. It is wise to leave any smaller castings and pieces in the polythene wrapping until they are required. In the event of any bits being missing or damaged, complete and return the parts form in the kit, stating parts and numbers.

Tools

A few simple tools are a pre-requisite for making any metal loco kits. Our suggested list contains:-
Fine files – flat, round (mousetail), half round, square etc. These are usually described as Swiss files and a set will stand you in good stead. However, they clog easily and for heavier work warding files are more suitable, again in a range of different types.
Small pliers – flat, snipe-nosed and round if possible, a good set of tinsnips, small craft knife and fibreglass propelling pencil brush are also useful. A range of small drills, mini-drill (if possible), pin chuck and a set of small taper broaches are also most useful, along with fine tweezers and a range of fine emery papers. A small engineers square will aid getting components together straight and parallel.
Larger tools might include a small vice, piercing saw, razor saw, and junior hacksaw.
As with all tools, buy the best you can afford, adding to the set as experience and finance permits. The model press should provide you with a list of suitable suppliers.
Before beginning, identify the actual locomotive of the class you plan to model. To this end, collect a number of good photographs and, if possible, an accurate 4mm drawing. Railway pictorial volumes usually can supply a selection of different prototype pictures. Remember, throughout a loco's life there were often substantial alterations to its appearance. Most of the kits in the Grandspot range provide a selection of different bits and pieces for many of the components. By reference to a photograph, choosing the appropriate piece is made easier. Good drawings can usually be sourced via the model press.

It is always wiser to make the chassis before the body and for actually fixing the kits together there are two possibilities – glue or solder, the latter usually favoured by the more experienced for it is by far the better way.

Before each method is contemplated, mating components must be cleaned of any flash (odd bits left on castings after removal from the moulds) by using files and fibreglass brush. By employing a 'dry run', the true fitting of parts can be checked, it being occasionally necessary to file an edge to fit a slot etc.

The best glue for general construction is 5 minute epoxy – several manufacturers produce this twin tube system. Any parts must be held together whilst being fixed but the bond is durable and strong when cured. Smaller parts can be fixed with superglue, any excess adhesive being cleaned off later.

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As mentioned, soldering is the better option, though both methods can be used happily together. Any holes must be cleared with the appropriate bit, broach or reamer – the diameters are given in the instructions.

For fixing parts to the chassis 145-degree melting point solder is best, using phosphoric acid flux and a minimum 25-watt iron. It is wise to paint the assembled mainframes before fitting the axles and wheels.

Check constantly for free running as you proceed with the chassis. Any tight spots are best eradicated at source before moving onto the next stage, particularly when erecting any valve gear. Etched body and tender components may be soldered together in the same manner as the chassis. Where a cast metal component is to be soldered to an etched one, the latter part must be tinned first – that is a thin layer of 145-degree solder applied to the etching. Cast parts can then be soldered using 70-degree low melt solder, phosphoric acid flux and, for preference, a temperature controlled iron. Many die-hards solder white metal with a full mains iron but this can easily lead to a melted, destroyed casting. By employing a temperature controlled iron, the bit never reaches a temperature high enough to melt the parent metal, though the wattage (its power of recovery) remains the same. For those afraid or unhappy about the notion of soldering, practise on any spare scraps of white metal or spare parts not required provided in the kit. Competence will soon be attained. Any tiny details can be secured with adhesives if preferred, particularly if they are not load bearing.

When your model is completed and tested, attention must be turned to painting. This is a subject big enough to take a whole book, not just a short piece such as this. Basically, the model should be thoroughly cleaned – warm water, an old toothbrush and household Ajax are most suitable, everything being washed completely afterwards.

After being allowed to dry, ordinary car acrylic grey or red primer, sprayed straight from the can, can give a satisfactory base. Work in a warm, dust-free atmosphere and wear a mask. Top coats can be applied by car spray, air brush or sable. Some car colours are quite close to railway colours, though they are usually too glossy. A good airbrush will result in an excellent finish using the proprietary paints available. Hand painting with a decent sable is useful, particularly where secondary and tertiary colours are involved. The use of Maskol or low tack masking tape makes painting up to adjacent colours easier.

Experts can line and letter by hand. For ordinary mortals, transfers, available through the model railway trade are most useful. Most railways and regions are represented from a range of different manufacturers.

This little guide is far too small to offer anything but the most rudimentary advice. We recommend acquiring a range of suitable modelling books – most techniques and processes are described from one publisher or another. The model press too is a source of handy information – often an article describes the construction of exactly the kit you had in mind. Joining a model railway club can be beneficial too, there usually being someone there who can give practical first hand advice.

Tony Wright

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KEY CODE

W ----------PEWTER/WHITEMETAL EG. W1.

L ----------LOSTWAX BRASS OR NICKELSILVER.

E ----------ETCHED PARTS.

P/N ----------PART NUMBERS.

 ----------REMOVE BY CUTTING.

 ----------REMOVE HATCHED AREA BY CUTTING.

* ----------OPTIONAL PARTS.

IS ---------- INSULATED SIDE.

LS ----------LIVE SIDE

SUGGESTED LIST OF TOOLS REQUIRED

1. Soldering irons (15 - 100 watt).
2. Liquid flux.
3. 75 degree low melt solder (for cast parts) (160 degree solder for brass parts).
4. 2 part epoxy resin and 10 sec glue.
5. Smooth file.
6. Needle file.
7. Pin chuck or small electric drill such as Dremel or Minicraft.
8. Drill bits - metric diameter required 0.8/1.0/1.1/1.2/2.0 ect.
9. Pair of side cutters.
10. Small Phillips screw driver.
11. Pair of tweezers.
12. Fibre glass pen and refills.
13. Craft knife.

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HISTORY

CLASSES GMA/M 4-8-2 + 2-8-4: Makers: Beyer Peacock, North British and Henschel.

Purchase price GMA/M £95,673-0-0 (R191 346,00).

Entered service 1954.

The class GMAM were ordered in part to prevent main line traffic on certain sections from grinding almost to a halt through a chronic shortage of motive power – such a section was the Witbank – Germiston line when this line was being wired for electric traction. Steam came to the rescue and the GMAM's, supplied in record time by the builders helped existing motive power to keep traffic rolling. They also performed good work on the Waterval Boven – Komatipoort and East London – Queenstown main line sections.

The last M in the classification denotes for use on main lines. Many GMAM's were subsequently converted to Class GMA's for use over sections laid with 61 lb (30kg/m) rails merely by reducing their coal and water capacities.

PROTOTYPE STATISTICS

Working Pressure 200 p.s.i. (1 380 kPa)
Driving Wheel Diameter 4ft 6" (1 371,6mm)
Cylinders GMA, GMAM (four) 20½" x 26" (520,7mm x 660,4mm)
Tractive Effort at 75% of Working Pressure 60,700 lb (270 kN)
Valvegear – Walschaerts
Coal Capacity GMAM 4 tons (14,2 t)
Coal Capacity GMA 11 tons 12 cwt (11,8 t)
Water Capacity GMAM – Leading Tank 2,100 gallons (9 550 1)
Water Capacity GMA – Leading Tank 1,650 gallons (7 501 1)
Length over Couplers 93 ft 10" (28 600mm) (excluding tank-car)
Mass GMAM 191 tons 8 cwt (194,47 t)
Mass GMA 187 tons 1 cwt (190,05 t)

Note: The E222 kit is an updated version of the E177 in HOm gauge and some E117 etchings have been replaced with E222 etchings.
Use all E222 etched parts from the E222-1 fret and discard the E117 etched parts that they replace, as these parts are for the wider HO version.

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ASSEMBLY INSTRUCTIONS

BODY DRAWING 1

Clean up footplate 6 and check for levelness, adjust where necessary. Fit parts 7 and 8 to the footplate. Fix screw 2 in place through plastic bush 1 and plastic washer 19 with nut 3, also fix screw 4 in place with nut 5. Now the boiler can be fitted to the footplate using screw 11 and nut 12 as shown in the drawing (Note: All screws require cutting to the correct length as indicated in the drawing). Secure the firebox in place before the assembly of the cab 13, 15 and 16, check that the roof 20 fits squarely on to the cab, but do not secure the roof in place at this stage. This should be done after painting and the fitting of the glazing 14 has been completed. A piece of insulated wire 28 should now be soldered to the head of screw 2, being careful not to melt the plastic insulator 1. Make sure the length of insulated wire is long enough to reach the motor which is located in the coal tender. Thread the insulated wire through the boiler and out under the footplate ready for connecting to the motor (See drawing 7). Now the smokebox door 26 can be fitted as can the cab detail 17 and cab seats 18. Fit all remaining parts as shown in the drawing.

Pre drill all the fixing holes (See drawing 10 for assistance) and clean up the body ready for the next assembly stage.

WATER TANK CHASSIS DRAWINGS 2,3,4

Trim chassis frames 33 and 34 as shown in the drawing, and fit axle bushes 32 to the frames. Now fit parts 35 through to 42, check the chassis for squareness and adjust where necessary. Assemble the insulated wheels 43 onto the axles 44 with axle nuts 45, fit these assemblies in to the chassis. Please follow the drawings carefully and make sure that the insulated wheels are fitted to the correct IS (Insulated Side) of the chassis. Now fit the live wheels 48 onto the axles with axle nuts 45 on the LS (Live Side) of the chassis. Check that all the wheel sets run true, when satisfied fit parts 49, 50 and 51. Now fit parts 52 through to 56, check for free running and oil all moving parts. Assemble the cylinder parts 57 through to 63 and fix on to the chassis, also fit the motion bracket 64 and 65. Now the valve gear 66 can be fitted in place, first fit the connecting rod 67 to the crosshead 47 and valvegear with screw 72 and nut 73. Use a piece of 1mm wire to fix the valvegear to the motion bracket as shown in the drawing, check for free running and oil all moving parts and then fit detail parts 46 and 68. Now fit the brake gear using parts 69 to 71, and parts 74 and 75, making sure that the brake shoes do not foul the wheels. Assemble the pony truck and the bogie using parts 76 to 79, and parts 82 to 86, checking that the wheels run freely. These are best fitted to the chassis once the bodies have been fitted (with parts 80) using parts 81 and 87.

COAL BUNKER CHASSIS DRAWINGS 5, 6, 7

Assemble the second chassis using the same method as that used for the first, with the exception of the following parts:-

i Fit the geared axle 99 to the second axle position from the front as shown in Drawing 5.

ii Assemble up the gearbox 125 as indicated by the separate gearbox instruction sheet, but leave out the two input shaft bearings. Now glue the motor 89 to the machined end of the gearbox being careful to keep the joint square.

iii Note: When fitting the brake gear there is a difference, i.e. parts 130/131 due to the gearbox fitting inside the frames.

iv Fit the assembled gearbox/motor, when the chassis is complete and secure in place as shown in Drawing 7 with the modified keeper plate 134, using screws 103. Check for free running and then secure the motor to the chassis using 132.

WATER TANK DRAWING 8 AND COAL BUNKER DRAWING 9

Being careful to keep the footplates straight assemble up these units as shown making sure that all the fixings are secure. Pre drill all the fixing holes (See Drawing 10 for assistance) and clean up both the water tank and the coal bunker bodies ready for the next assembly stage.

WATER TANK FINAL ASSEMBLY DRAWING 11

Fit all remaining parts as indicated, but note the optional parts. Add the handrails using the wire supplied in the kit. The plasticard 184 is best fitted after painting, and is used to provide insulation between the water tank assembly and the body.

COAL BUNKER FINAL ASSEMBLY DRAWING 12

Fit all remaining parts as indicated, but note the optional parts. Add the handrails using wire provided.

BODY FINAL ASSEMBLY DRAWING 13 & 14

Fit all remaining parts as indicated, before fitting the steps 221 & 222 put a fillet of solder in the corners of the folds for strength. Fit all pipes and handrails as indicated (See Drawing 15 for assistance). You may find it easier to finish the plates 226 separately and then fit them to the painted body.

Finally assemble all the completed sub-assemblies and thoroughly test your model around the curves of your track work before painting.

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PARTS LIST

1.	Insulated Bush (P/N 109235)	P
2.	M2 C/H Screw (Front Chassis Fixing) (P/N 108085)	T
3.	M2 Nut (P/N 108105)	T
4.	M2 C/H Screw (Rear Chassis Fixing) (P/N 108085)	T
5.	M2 Nut (P/N 108105)	T
6.	Footplate	W/M
7.	Footplate Side L/H	W/M
8.	Footplate Side R/H	W/M
9.	Smokebox Steam Elbow Pipe	W/M
10.	Boiler	W/M
11.	M2 C/H Screw (Boiler Mounting) (P/N 108085)	T
12.	M2 Nut (P/N 108105)	T
13.	Spectacle Plate	W/M
14.	Glazing	P
15.	Cab Sides x 1 Pair	W/M
16.	Spectacle Plate Rear	W/M
17.	Backhead Detail	W/M
18.	Cab Seats x 2	W/M
19.	Insulated Washer (P/N 109230)	P
20.	Cab Roof	W/M
21.	Spectacle Plate Support Rear	W/M
22.	Rear Footplate End	W/M
23.	Front Footplate End	W/M
24.	Dome	W/M
25.	Chimney	W/M
26.	Smoke Box Door	W/M
27.	Ash Pan Side Frames x 1 Pair	W/M
28.	Insulated Wire (P/N 109065)	-
29.	Ash Pan Back	W/M
30.	Ash Pan	W/M
31.	Smokebox Beam	W/M
32.	Bushes x 8 (P/N 108646)	T
33.	Chassis Frames R/H	E
34.	Chassis Frames L/H	E
35.	Spacers x 2 (P/N 108395/7.4mm long)	T
36.	Chassis Spacer Plate with Round Hole	E
37.	Chassis Spacer Plate with Oval Hole	E
38.	Pony Truck Fixing Plate	E
39.	Spacer Screws x 4 (P/N 108386)	T
40.	M2 C/H Screw (P/N 108085)	T
41.	M2 Nut (P/N 108105)	T
42.	Pony Locator	W/M
43.	Insulated Wheels x 4 (P/N 108963/RP25)	T
44.	Axles x 4 (P/N 108997/Hom	T
45.	Axle Nuts x 8 (P/N 108836)	T

46.	Mechanical Lubricator	W/M
47.	Crossheads x 4	L/W
48.	Live Wheels x 4 (P/N 108964/RP25)	T
49.	Balance Weights Medium x 6	E
50.	Balance Weights Large x 2	E
51.	Axle Covers x 8	E
52.	Crankpins x 8 (P/N 108865)	T
53.	Coupling Rod x 1 Pair	E
54.	Coupling Rod x 1 Pair	E
55.	Coupling Rod x 1 Pair	E
56.	Crankpin Fixers x 10 (P/N 108871)	T
57.	Cylinder Main Body x 2	W/M
58.	Slidebars x 2	E
59.	Cylinder Front Detail x 2	W/M
60.	Cylinder Backs Large x 2	W/M
61.	Cylinder Fronts Large x 2	W/M
62.	Cylinder Fronts Small x 2	W/M
63.	Piston Valve Guides x 2	W/M
64.	Motion Bracket Front	E
65.	Motion Bracket	E
66.	Valvegear x 1 Pair	E
67.	Connecting Rods x 2 Pairs	E
68.	Cylinder Valves x 4	W/M
69.	Chassis Pivot Spacer	W/M
70.	Brake Shoe with Chassis Pivot Hole	E
71.	Brake Shoes x 3	E
72.	14BA 1/8" C/H Screws x 4 (P/N 108017)	T
73.	14BA Nuts x 4 (P/N 108030)	T
74.	Brake Stretchers x 4	E
75.	Pull Rod	E
76.	Pony Truck Bottom	W/M
77.	Pony Truck Wheel (P/N 108965/ Hom/RP25)	T
78.	Pony Truck Top	W/M
79.	Pony Truck Side Frames x 2	W/M
80.	M2 Nuts x 2 (P/N 108105)	T
81.	Spacer Screw (P/N 108386)	T
82.	Bogie Body	W/M
83.	Bogie Wheels x 2 (P/N 108965/Hom/RP25)	T
84.	Bogie Wheel Fixers x 2	W/M
85.	Bogie Arm	E
86.	Bogie Pivot Fixer	W/M
87.	M2 Nut (P/N 108105)	T
88.	Bushes x 8 (P/N 108646)	T
89.	Motor	-
90.	Chassis Frames L/H	E
91.	Chassis Frames R/H	E
92.	Chassis Spacers x 2 (P/N 108395/7.4mm long)	T
93.	Spacer Plate Front	E
94.	Pony Truck Spacing Plate	E

95.	Pony Truck Locator	W/M
96.	M2 C/H Screw (P/N 108085)	T
97.	M2 Nut (P/N 108105)	T
98.	Spacer Screws x 4 (P/N 108386)	T
99.	Geared Axle	T
100.	Live Wheels x 4 (P/N 108964/RP25)	T
101.	Axles x 4 (P/N 108997/Hom)	T
102.	Axle Nuts x 8 (P/N 108836)	T
103.	Keeper Plate Screws x 2	T
104.	Etched Screwdriver x 2	E
105.	Insulated Wheels x 4 (P/N 108963/RP25)	T
106.	Mechanical Lubricator	W/M
107.	Balance Weights Medium x 6	E
108.	Balance Weights Large x 2	E
109.	Axle Covers x 8	E
110.	Crankpins x 8 (P/N 108865)	E
111.	Coupling Rods x 1 Pair	E
112.	Coupling Rods x 1 Pair	E
113.	Coupling Rods x 1 Pair	E
114.	Crankpin Fixers x 10 (P/N 108871)	T
115.	Cylinder Main Body x 2	W/M
116.	Slidebars x 2	E
117.	Cylinder Front Detail x 2	W/M
118.	Cylinder Backs Large x 2	W/M
119.	Cylinder Fronts Large x 2	W/M
120.	Cylinder Fronts Small x 2	W/M
121.	Piston Valve Guides x 2	W/M
122.	Motion Bracket Front	E
123.	Motion Bracket	E
124.	Valvegear	E
125.	Gearbox (P/N 108654)	-
126.	Cylinder Valves x 4	W/M
127.	Chassis Pivot Spacer	W/M
128.	Brake Shoe with hole for Chassis Pivot	E
129.	Brake Shoe x 2	E
130.	Brake Shoe Mounting x 2	W/M
131.	Brake Shoe x 1 Pair	E
132.	Motor Seating	W/M
133.	Brake Stretchers x 4	E
134.	Keeper Plate	P
135.	Brake Pull Rod	E
136.	Bogie Body	W/M
137.	Bogie Wheels x 2 (P/N 108965/ Hom/RP25)	T
138.	Bogie Wheel Fixers x 2	W/M
139.	Bogie Arm	E
140.	Bogie Pivot Fixer	W/M

141.	M2 Nut (P/N 108105)	T
142.	Pony Truck Bottom	W/M
143.	Pony Truck Wheel (P/N 108965/Hom/RP25)	T
144.	Pony Truck Top	W/M
145.	Pony Truck Side Frames x 2	W/M
146.	M2 C/H Screw (P/N 108085)	T
147.	Spacer Screw (P/N 108386)	T
148.	M2 Nut (P/N 108105)	T
149.	Water Tank Footplate	W/M
150.	M2 Nut (P/N 108105)	T
151.	Front Tank Fixer	W/M
152.	M2 C/S Screws x 2 (P/N 108098)	T
153.	M2 Nut (P/N 108105)	T
154.	Water Tank	W/M
155.	Water Filler	W/M
156.	Coupling Beams x 2	W/M
157.	Bunker Footplate	W/M
158.	M2 Nut (P/N 108105)	T
159.	Bunker End	W/M
160.	Bunker	W/M
161.	Cast Coal	W/M
162.	Decking for Front Tank (Large)	E
163.	Decking for Front Tank (Small)	E
164.	Rivet Plate	E
165.	Sand Filler	W/M
166.	Sanding Ring	W/M
167.	Sanding Ring	W/M
168.	Rivet Plate	E
169.	Sand Filler	W/M
170.	Lifting Links x 2	E
171.	Lifting Links x 2	E
172.	Air Vent	L/W
173.*	Lamp Modern	L/W
174.*	Lamp Old Style	L/W
175.	Vacuum Pipe	L/W
176.*	K D Coupling	P
177.*	Coupling Spacer	W/M
178.*	Coupling	E
179.*	Coupling Fixer	W/M
180.	Oil Cans x 4	W/M
181.	Handrail Knobs x 6 Short (P/N 109566)	T
182.	Cow Catcher	L/W
183.	Checker Drop Plate	E
184.	Plastic Card	P
185.	0.4mm Ø Wire	-
186.	Sanding Ring	W/M
187.	Rivet Plate	E
188.	Sand Filler	W/M

189.	Sanding Ring	W/M
190.	Rivet Plate	E
191.	Sand Filler	W/M
192.*	Lamp Modern	L/W
193.*	Lamp Old Type	L/W
194.	Lamp Shroud	W/M
195.*	K D Coupling	P
196.*	Coupling Spacer	W/M
197.*	Coupling	E
198.*	Coupling Fixer	W/M
199.	Cow Catcher	L/W
200.	Handrail Knobs, Short x 10 (P/N 109566)	T
201.	Vacuum Pipe	L/W
202.	Handrail Knobs, Short x 3 (P/N 109566)	T
203.	Safety Valves x 3	L/W
204.	Top Feed	L/W
205.	Valve	L/W
206.	Brake Handle	L/W
207.	Steam Generator	W/M
208.	Pump (Reversing)	W/M
209.	Lever Bracket	W/M
210.	Reversing Lever	E
211.	Ash Pan Levers x 2	E
212.	Smokebox Door Handle	L/W
213.	Ladder	E
214.	Ladder	E
215.	Window Shades Side Window	E
216.	Window Shades Side Window	E
217.	Window Shades Rear Window	E
218.	Window Shades Rear Window	E
219.	Handrail Knobs Medium x 14 (P/N 108407)	T
220.	Handrail Knobs Short x 2 (P/N 109566)	T
221.	Steps x 2	E
222.	Steps x 2	E
223.	R/H Manifold	L/W
224.	L/H Manifold	L/W
225.	Continuous Blow Down Drainers x 2	W/M
226.	Etched Number Plates/Builders Plates	E

Wires:	Insulated Wire
	0.4mm Ø
	0.7mm Ø
	1mm Ø

36-1 0.3mod GEARBOX SYSTEM

150-6 thru 159-6 series
Proudly made in USA

LUBRICATION WARNING: Do NOT operate the gearbox before applying a gear oil such as LaBelle #102, STP, SLICK-50, etc. to the worm and gears. "Wear-in" without proper lubrication will "Wear-out" your new gearbox. Would you remove oil from your new car to break it in?

ASSEMBLY AND OPERATION SUGGESTIONS

FOR BEST RESULTS these components require some minor preparation before assembly. Inspect and remove all burrs from parts. These instructions can be formidable because we want you to have the knowledge to achieve a perfectly operating gearbox. Like riding a bike or skiing, the first time is the hardest; once you understand the fine points to consider as you assemble subsequent gearboxes, you will rarely need the instructions.

HELPFUL TOOLS:
- The PULLER (#45-4 or #55-4)
- Screwdrivers, miniature
- Lubricants

Also may be useful:
- Razor blade
- Fine files, flat and round
- The SENSIPRESS+ (#50-4)
- The Aligner (#33, or 38-4)
- The QUARTERER (#44-4, #64-4)
- Superglue (Loctite, ZAP, etc.)

GENERAL PROCEDURE:
1. Make sure you have all required parts.
2. Assemble worm to wormshaft.
3. Check fit all gears for free operation.
4. Fit wormshaft assembly to bearings and gearbox.
5. Check axle fit, fine tune gearbox as necessary.
6. Install axle gear, eliminate wobble if any
7. Assemble, lubricate and test operate

(1)PARTS LIST 36-1 0.3module GEARBOX SYSTEM PRODUCTS Product Stock # *(1xx-6 omitted)*

Part Nomenclature	Bore	Part#	150	151	153	154	158 R	158 F	159 R	159 F	price	44	45	64	65	66	67
Worm: 0.3 x 5mm right hand	2.4mm	1311-6		1		1		1		1	$5.00						
	2.0mm	1312-6									$5.00	1					
	1.5mm	1313-6									$5.00		1				
	1.2mm	1348-6									$5.00						1
Worm: left hand (black)	2.4mm	1317-6	1		1		1		1		$5.00						
	2.0mm	1334-6									$5.00			1			
	1.5mm	1335-6									$5.00				1		
	1.2mm	1349-6									$5.00					1	
Wormshaft:	2.4mm	1330-4	1	1	1	1	1	1	1	1	$1.50						
Bronze wormshaft bearing	2.4mm	358-6	2	2	2	2	2	2	2	2	$1.95						
	2.0mm	359-6									$1.95	2		2			
	1.5mm	360-6									$1.95		2		2		
	1.2mm	364-6									$1.95					2	2
Bronze thrust washer	2.4mm	103-4	2	2	2	2	2	2	2	2	$1.00						
	2.0mm	108-4									$1.00	2		2			
	1.5mm	110-4									$1.00		2		2	2	2
BallBrgWormshaft *Option* - RH	3/32"	1341-6		1		1		1		1	19.95						
(replaces all above parts.) - LH	3/32"	1342-6	1		1		1		1		19.95						
Reverse Wormgear (idler) 36T		1319-6	1		1		1		1		$5.50						
Wormgear, axle - 36T brass	3.0mm	1321-6	1				1				$5.00						
- 36T delrin	3.0mm	1323-6		1				1			$5.00						
- 36T brass	1/8"	1322-6			1				1		$5.00						
- 36T delrin	1/8"	1324-6				1				1	$5.00						
Gearbox side moulding: Idler	3.0mm	1325-6	2				2				$1.00						
Non-idler	3.0mm	1326-6		2				2			$1.00						
Idler	1/8"	1327-6			2				2		$1.00						
Non-idler	1/8"	1328-6				2				2	$1.00						
Bottom cover plate		1329-6	1	1	1	1	1	1	1	1	$1.00						
Assembly screws, 1.4x5mm		21145-5	6	4	6	4	6	4	6	4	$1.50						
Shaft support bearing assy.	2.4mm	370-6					2		2		$2.50						
Universal joint coupling set	2.4mm	484-6						1		1	$2.95						
Input shaft conversion kits	2.0mm	144-6		opt		opt		opt		opt	$6.00	x					
(provide input shaft components	1.5mm	145-6		opt		opt		opt		opt	$6.00		x				
to permit installing gearbox kit	2.0mm	164-6	opt		opt		opt		opt		$6.00			x			
directly on motor shaft of size	1.5mm	165-6	opt		opt		opt		opt		$6.00				x		
other than 2.4mm)	1.2mm	166-6		opt		opt		opt		opt	$6.00					x	
	1.2mm	167-6	opt		opt		opt		opt		$6.00						x

HiLo sets for articulated locomotives: R=rear engine gearbox, F=front DO NOT MIX PARTS.

DETAILED ASSEMBLY SUGGESTIONS

[2] Assemble the worm onto the wormshaft. All NWSL gearboxes are supplied with loose fit worms and knurled worm shafts (except HiLo gearbox kit). Note that worms will often go on shafts on one direction easier than the other due to the deburring process on the worm. We recommend that you install the long end of the wormshaft through the worm so that you can push on the short end of the wormshaft to minimize the possibility of bending the shaft. An easy way to do this is to drill a clearance hole (#41 drill) in a block of wood for the long end of the wormshaft and then push on the short end of the shaft through the worm (which is supported against the block of wood) using a common bench vise or the NWSL SENSIPRESS+. Our experience is that it is best to carefully place the worm in the correct location the first time rather than moving it back and forth as the knurl tends to break down with repeated movements. To secure the worm on non-knurled shafts use super bonding materials such as Loctite, Crazy Glue, ZAP, etc. or solder. In all cases inspect and remove any burrs or roughness at the interface of the end of the worm and shaft - remember that the end of the worm is a (thrust) bearing surface. If you wish NWSL to make the assembly for you, send the worm and wormshaft to NWSL with $3.00 handling and dimensional sketch showing where you wish the worm placed on the shaft.

[3] Check fit worm shaft bearings which should turn freely on the wormshaft - debur bearings if necessary. TEST assemble the gearbox. All screws are self-tapping and start easily with a push-turning action. Screws enter only from the right column of holes on the gearbox side moulding. Note that it is possible to distort the gearbox and seize (bind) the parts by overtightening the screws (just snug 'em). Additionally, the gearbox purposely does not close completely at the top, this to assure the housing clamps the wormshaft bearings so they cannot turn.

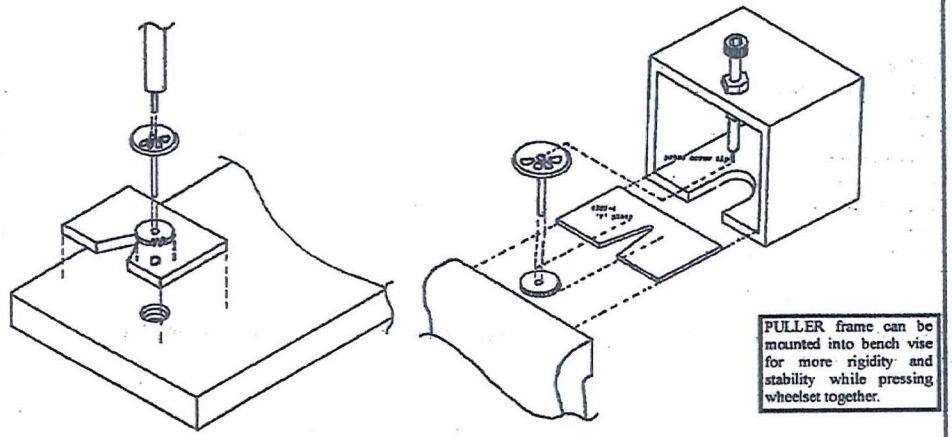
[4] Assemble the gearbox sides with wormshaft assembly installed first. Check to make sure that the wormshaft turns freely and that when installed, worm has a minimum of end play (use shim washers if necessary) to minimize the possibility of downhill lurch. We suggest gently tapping each end of the (installed) wormshaft assembly to help "seat" the wormshaft bearings in the gearbox housing and to give an accurate indication of the amount of end play in the gearbox.

[5] When satisfied the worm assembly operates properly in the gearbox and that the axle is perpendicular to the worm, check the axle slot for snug but not tight fit to the axle when the bottom cover plate is fitted using a non-geared axle of appropriate size shaft/axle material. When the axle is properly installed, it should have little or no up and down movement. We burnish the axle slot area of the gearbox by hand turning a piece of axle size shafting until the material turns freely. Gearboxes for 1/8" axle may require that you file a slight axle clearance notch in the bottom cover with a round file so that the axle doesn't bind. Gearboxes for 3/32" (2.4mm) axles and some 3mm axle gearboxes will have excessive up and down movement of the axle in the gearbox. Carefully file the bottom of the gearbox by running the assembled gearbox over a large, sharp, fine flat file (or a piece of sandpaper secured to a flat surface) until the axle is snugly but not tightly held when the bottom cover plate is installed. This is a trial fit operation and we use a piece of correct diameter axle stock and a single edge razor blade held against the bottom to easily see when enough material has been removed. NEVER file the axle slot in the gearbox side as this will detrimentally affect the gear spacing which is critical to proper operation.

The axle should turn freely but not wobble or "slop" in the axle slot when you have properly prepared it. When you are satisfied that all of the parts fit properly and freely, disassemble the gearbox, check all parts for cleanliness (if you sanded the bottom edge, wash the parts to remove any sanding residue) and reassemble the gearbox with idler(s) as per the above hints, lubricating all parts as you go. You MUST use a gear oil such as LaBelle #102 or suitable grease on the worm and wormgear(s) (while acetal plastic is considered self-lubricating, lubrication extends life by a factor of 10!) See lubrication note above & following.

[6] Install axle gear very carefully on the axle to assure it is square (doesn't wobble). See illustrations below for suggestions on pressing axle into gear using NWSL tools **THE SENSIPRESS+** or **THE PULLER**. If gearing an existing driver/wheelset, it is best to remove the non-insulated wheel only - an insulated wheel is often more difficult to re-assemble without wobble (if insulated at the axle). The **ALIGNER** tool (#33-4, #38-4) from NWSL can be useful here in assuring 'square' assembly and sometimes can remove existing wobble). If you did not mark the axle end/wheel hub to assure correct orientation when reassembling a quartered driver such as a steam locomotive, use **THE QUARTERER** (#44-4) or **QUARTERER II** (#64-4) from NWSL or similar.
(note: **THE PULLER** was not intended for re-assembly of components due to the difficulty in maintaining component alignment and avoiding wheel wobble - proceed extremely carefully if YOU do use it.)

METHODS TO INSTALL GEAR ONTO DRIVER AXLE



PULLER frame can be mounted into bench vise for more rigidity and stability while pressing wheelset together.

Using the Sensipress+

Using the PULLER or PULLER II

1506-0302ca

LUBRICATION Although this gearbox is molded of acetal engineering plastic which is considered self-lubricating, NWSL recommends that all bearing points should be lubricated with a light lubricant such as LaBelle #108. The gear working surfaces should be lubricated with a gear oil such as LaBelle #102. *ANY LUBRICANT MUST BE PLASTIC COMPATIBLE!* For longer life of your gearbox components, re-lubricate about every 50 hours of operation or annually, whichever comes first.

CAPACITY This gearbox can be considered suitable for all HO scale and smaller locomotives and similar size S and O scale models. Very heavily weighted HO models should use gears with tooth size larger than 0.3mod (such as the 0.4mod [#240-6 series]).

INSTALLATIONS Use the axle size to fit your existing model or rebuild requirements and ratio to fit your operating speed range preference. Combine with #480-6 series universal couplings and NWSL motor for complete premium power system for your model.

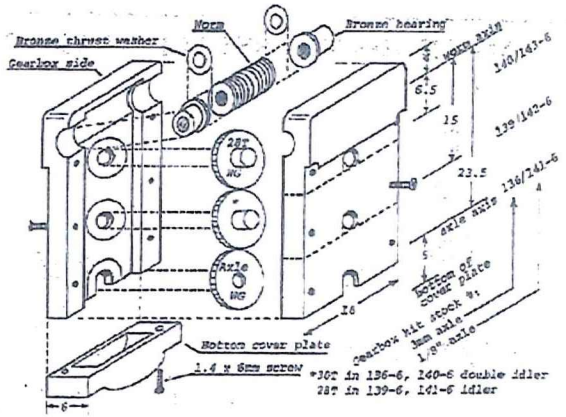
DRIVER SIZE Drivers of minimum diameter 58" (HO scale) and larger fit directly permitting railhead clearance. Smaller drivers may be accomodatable with removal of some of all of the bottom cover plate (43" HO is absolute minimum if railhead clearance is required).

Note 1: Prices indicated and specifications are subject to change without notice

Note 2. Ball-bearing version kits are designated with a '1' preceding the standard kit stock # (ie. #150-6 in ball bearing version is #1150-6). Ball bearings are applied only on the high speed shaft (wormshaft) for maximum efficiency, economy and life. A gearbox that is heating significantly should be converted to ball-bearing to eliminate the worm thrust heat generation and gearbox housing failure.

DISASTER: If disaster befalls you during installation and a part is damaged beyond usability, NWSL will be pleased to supply a replacement - just send the damaged part taped to a piece of cardstock (or similar protection from postal machinery) with your request letter and $3.00 handling fee to:
NWSL DISASTER SECTION
PO Box 16485
Seattle WA 98116-0485 USA

Be sure to indicate the stock # of the gearbox kit (upper right corner of label).



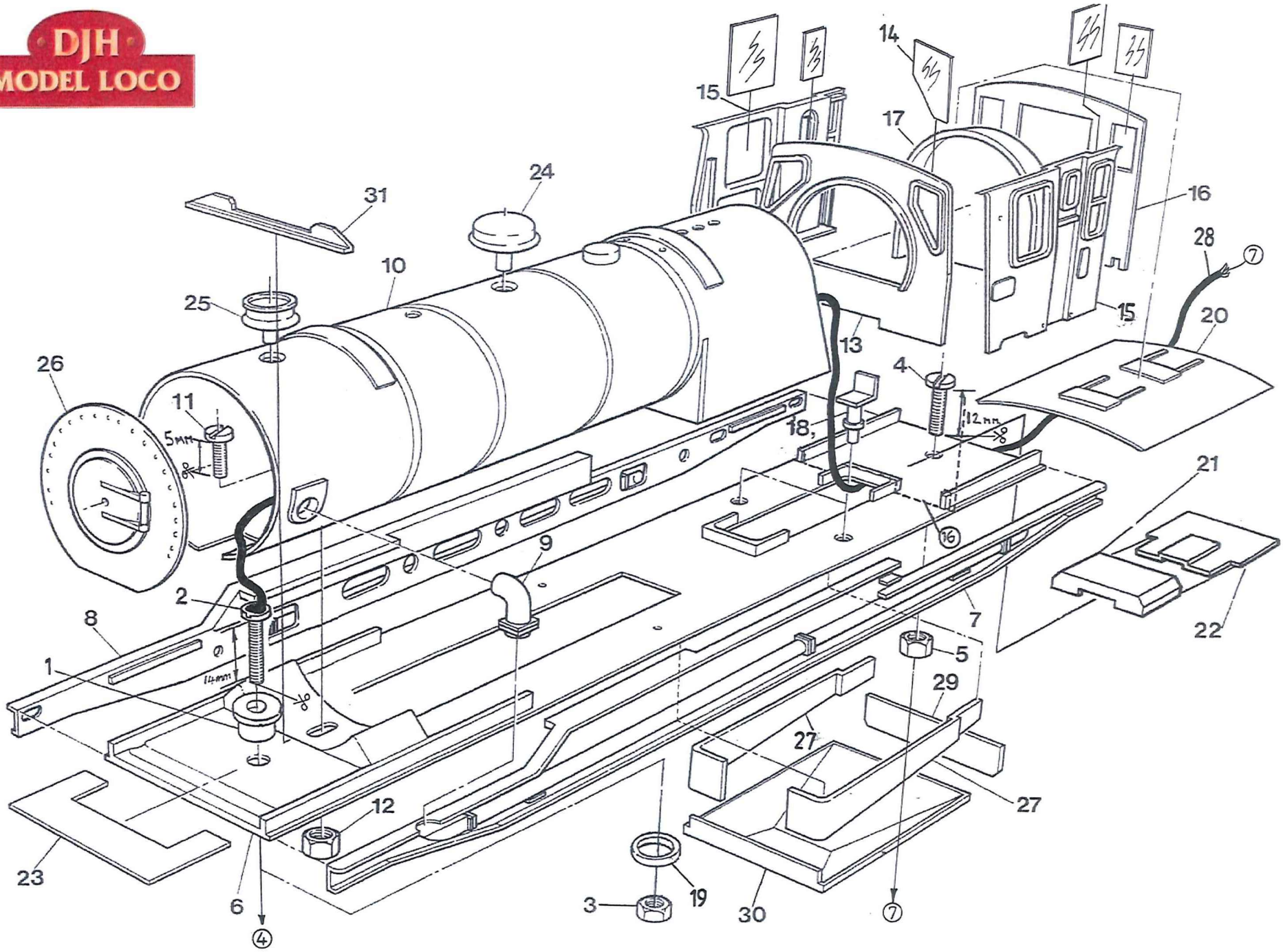
Typical gearbox components and layout.

NorthWest Short Line
www.NWSL.com
Box 423
Seattle WA 98111-0423 USA

1506-0302ca

DJH
MODEL LOCO

1



DJH MODEL LOCO

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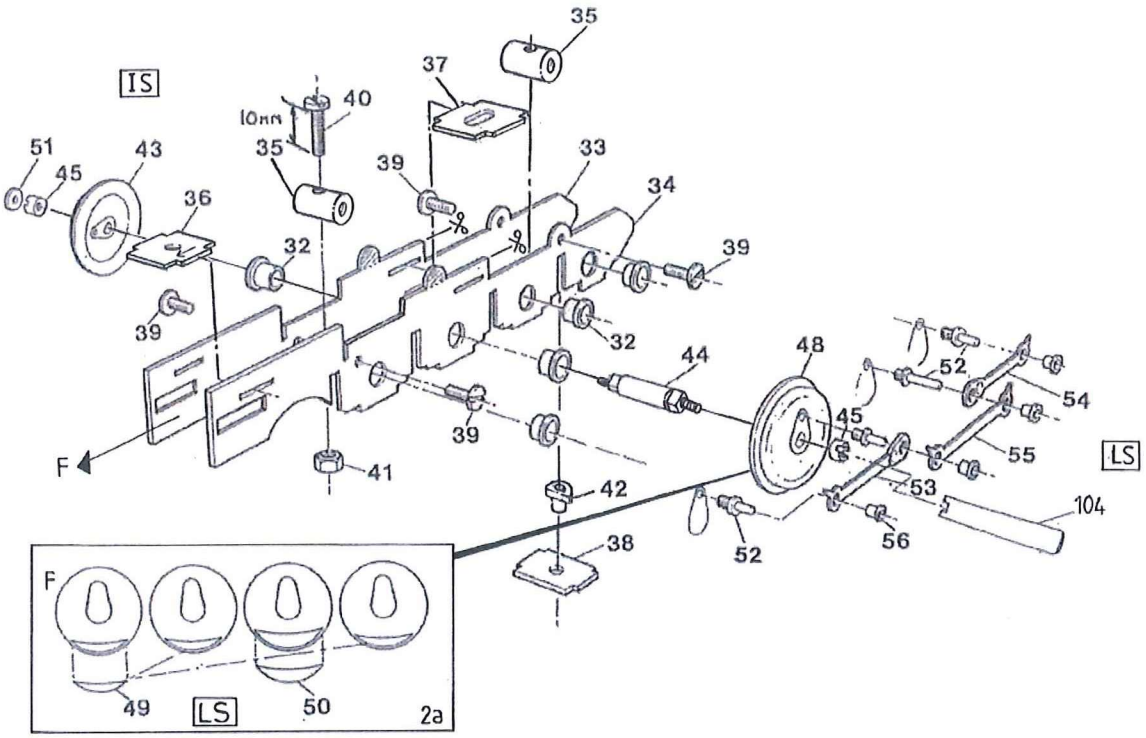
WATER TANK CHASSIS



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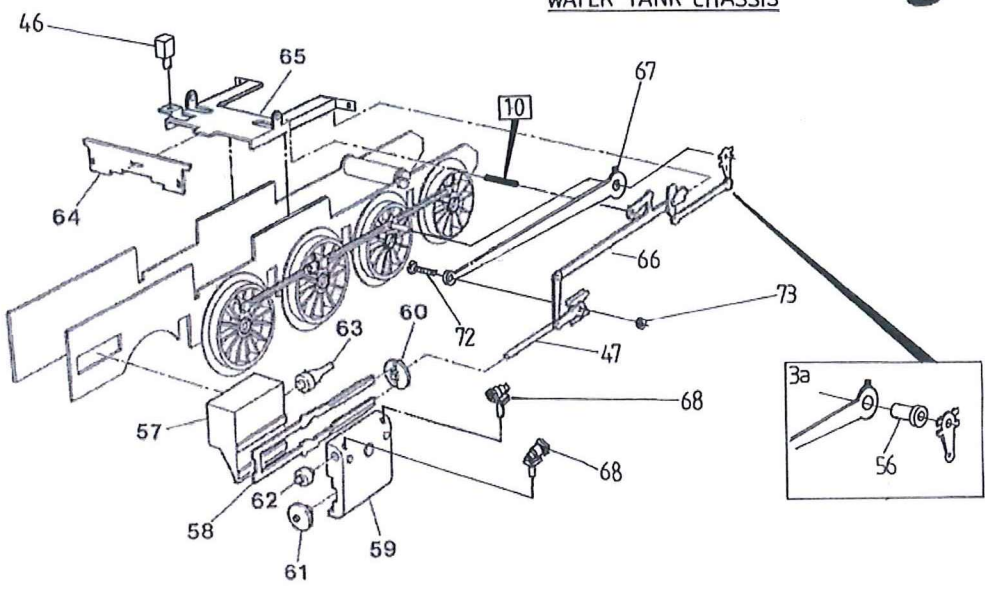

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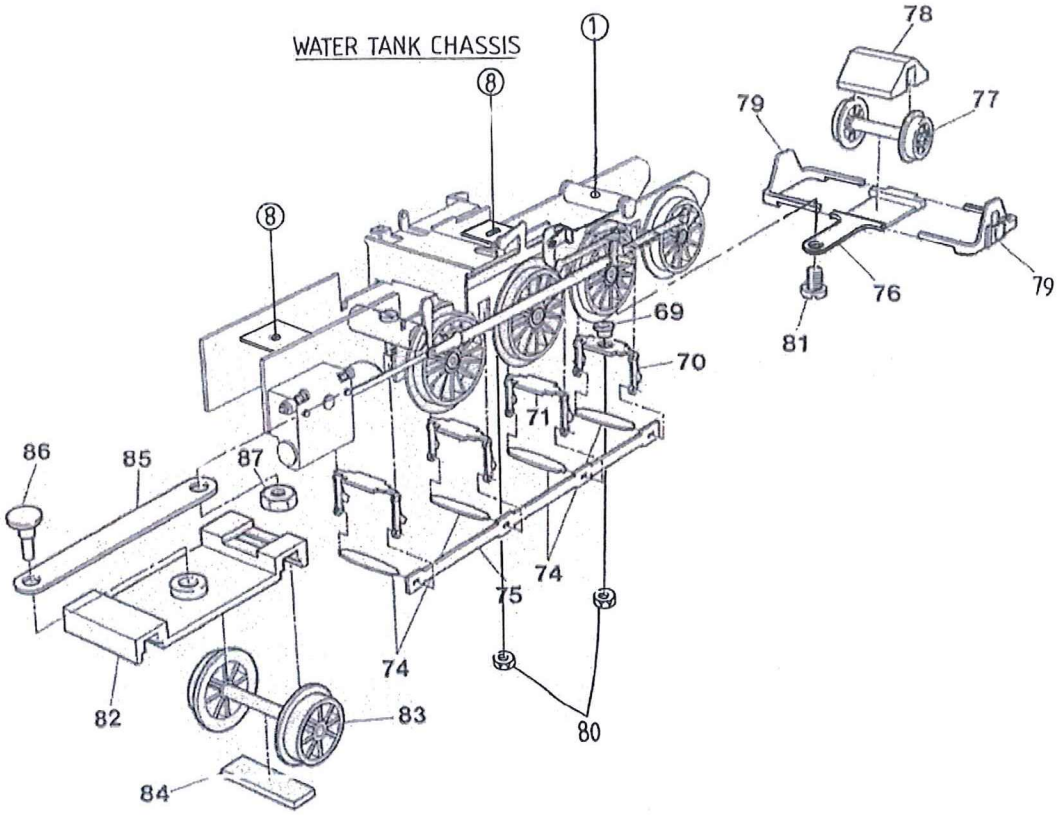

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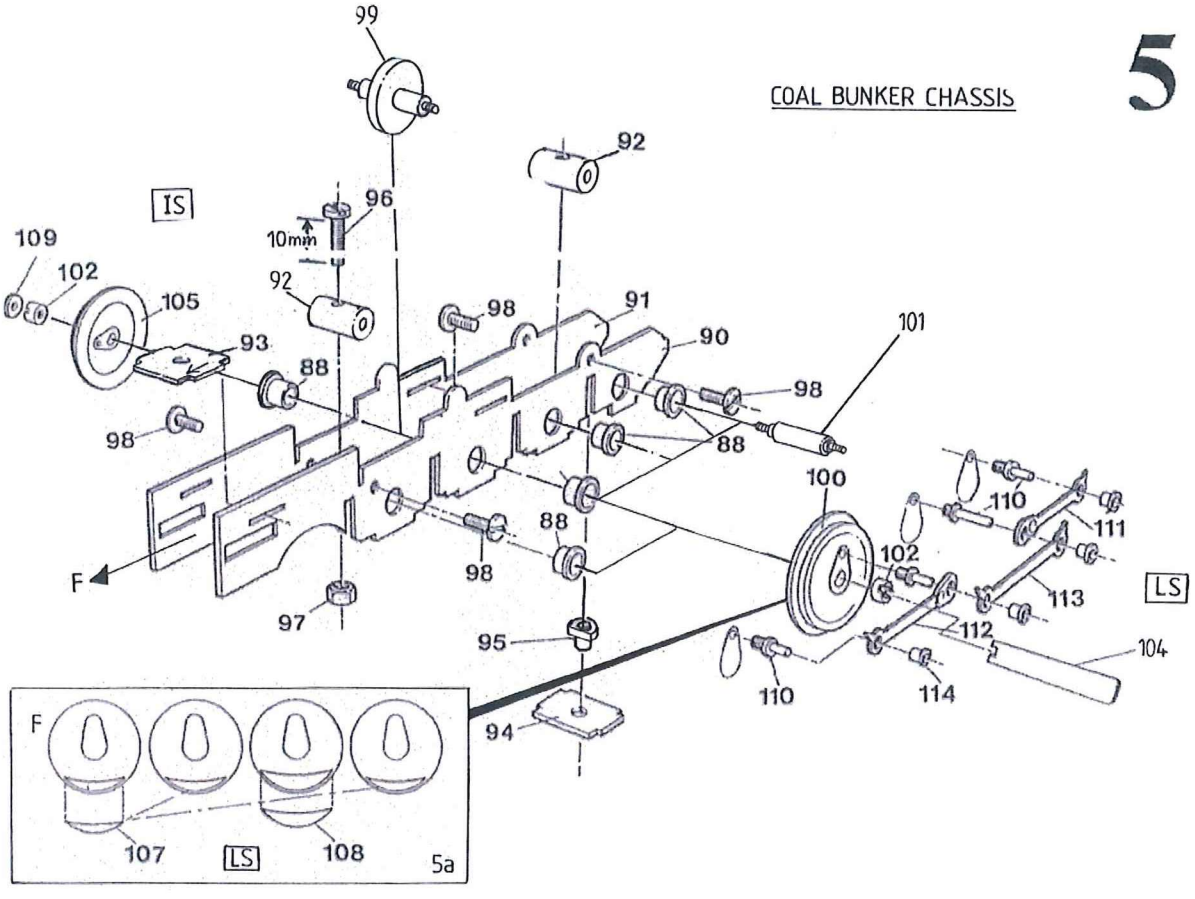
COAL BUNKER CHASSIS



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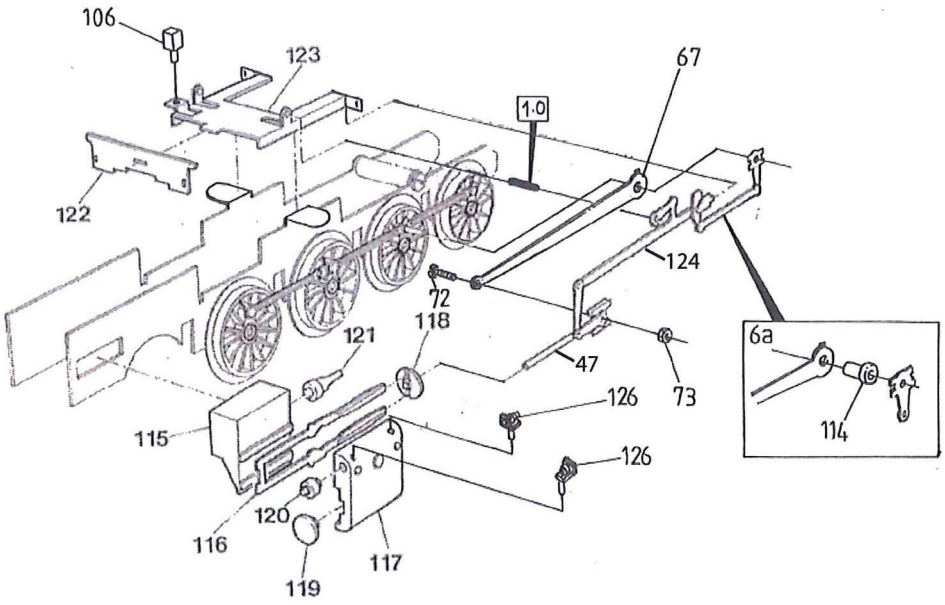

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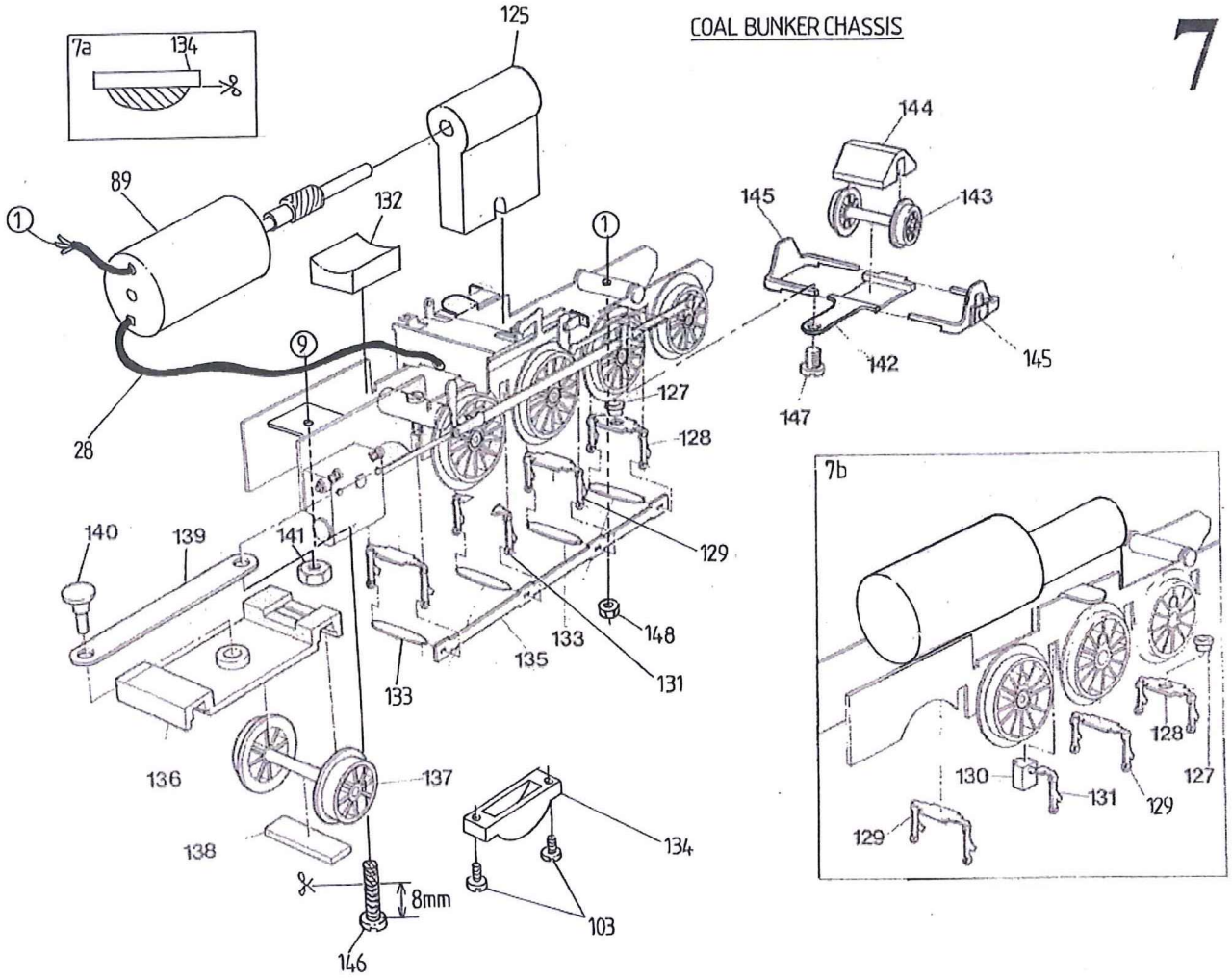

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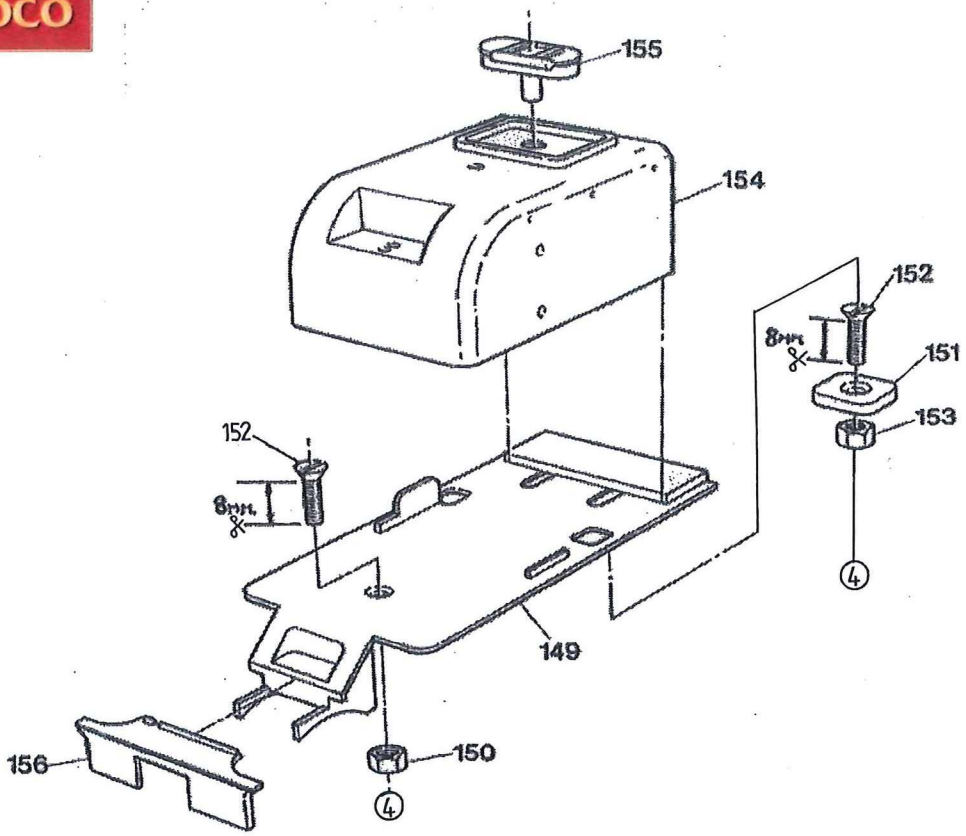

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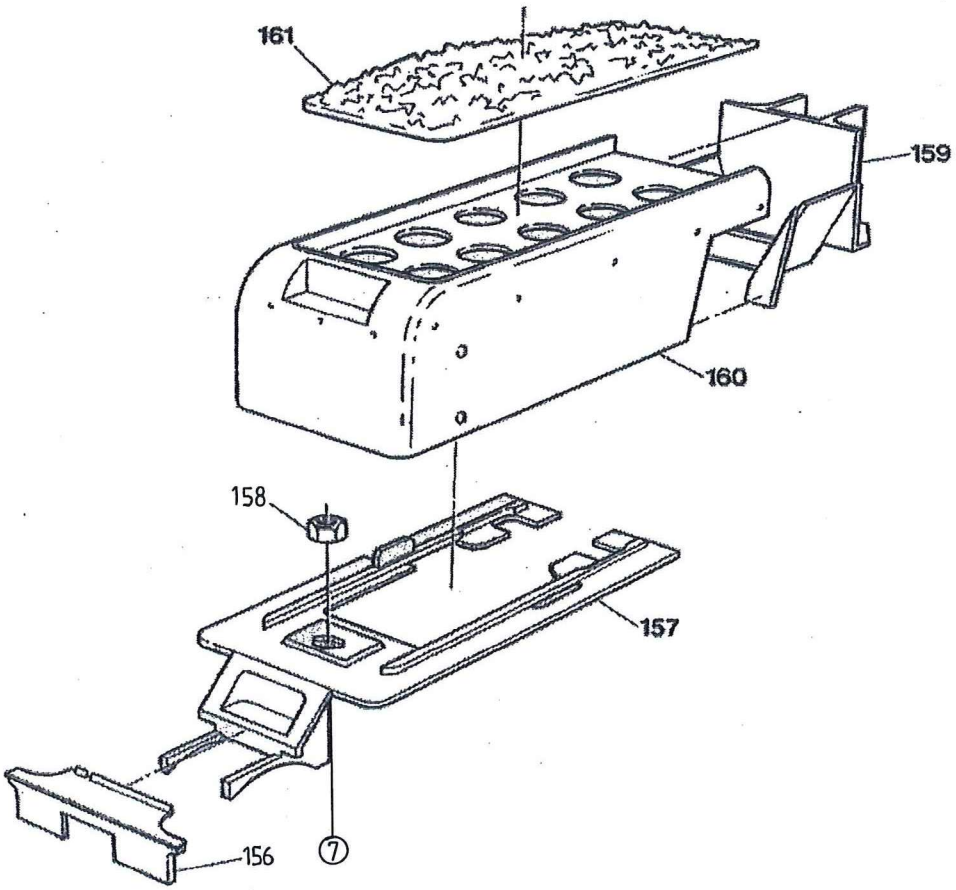

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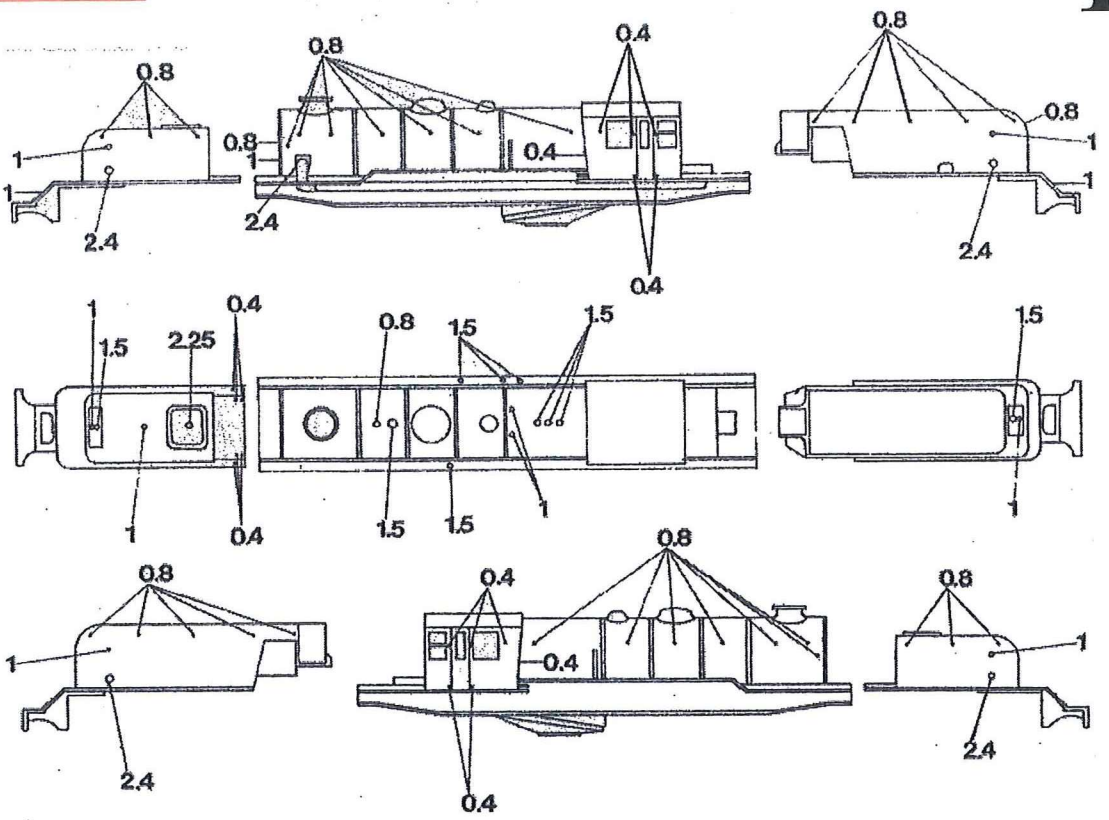

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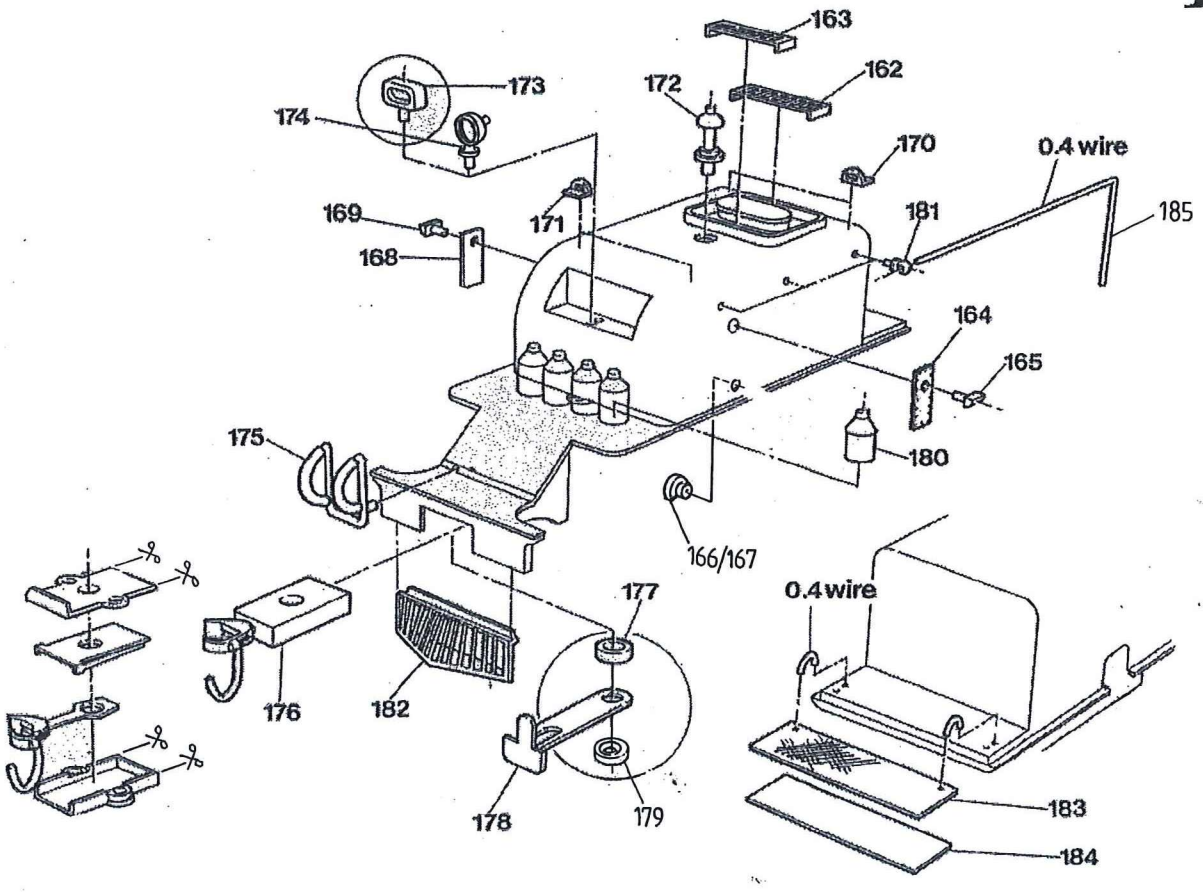

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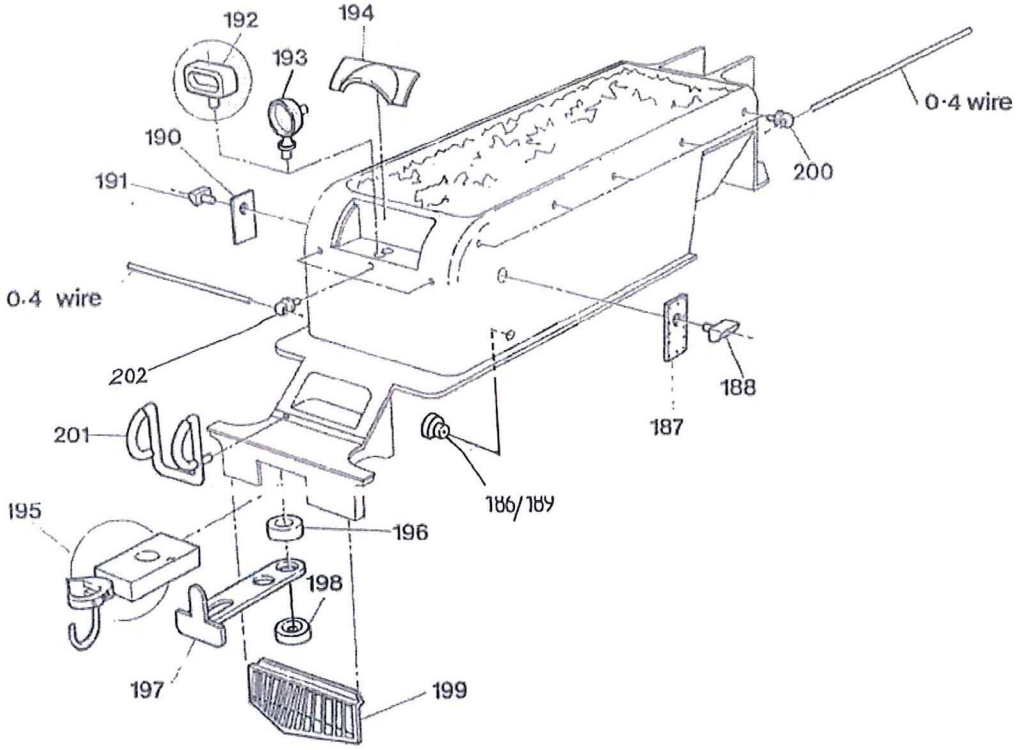

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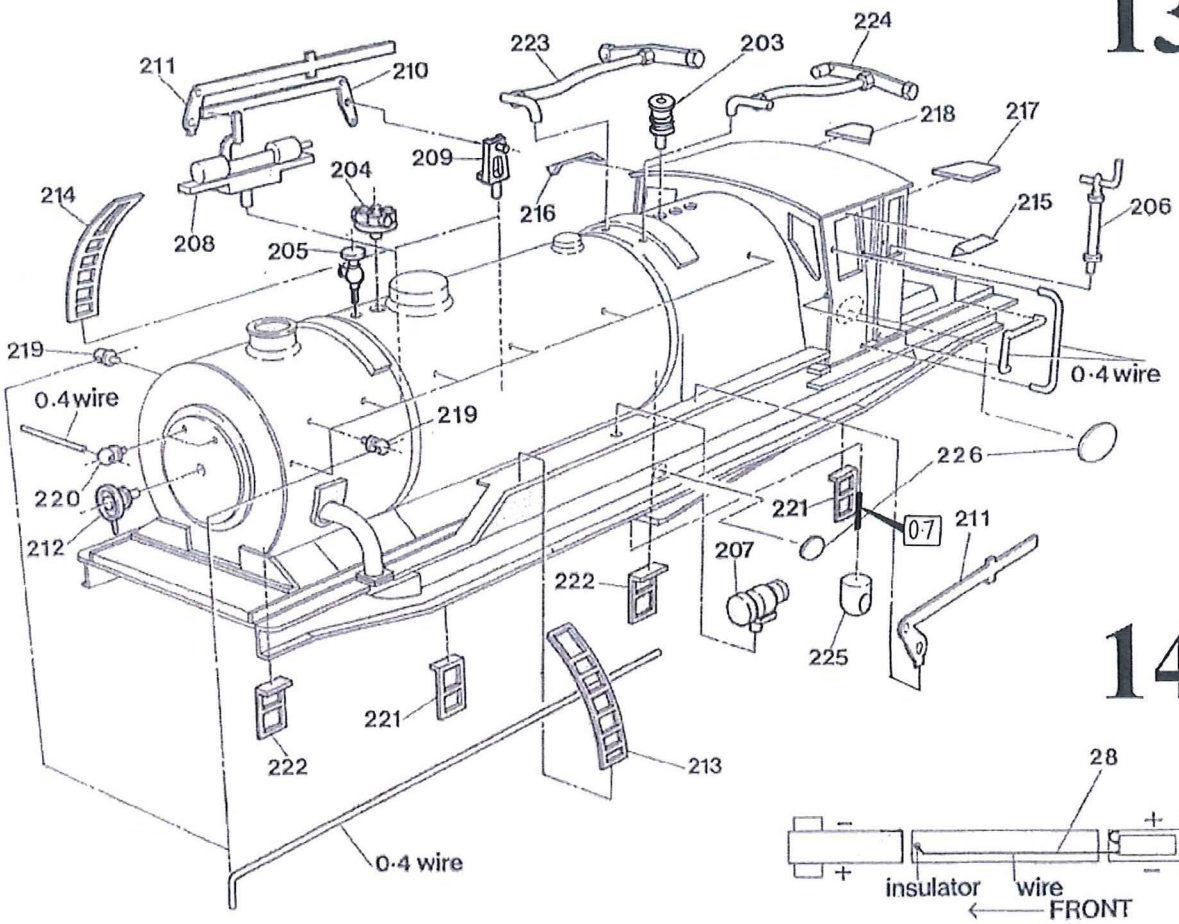

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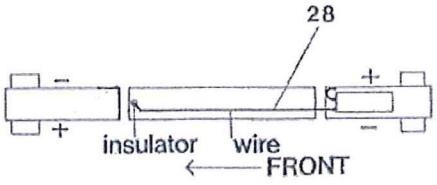

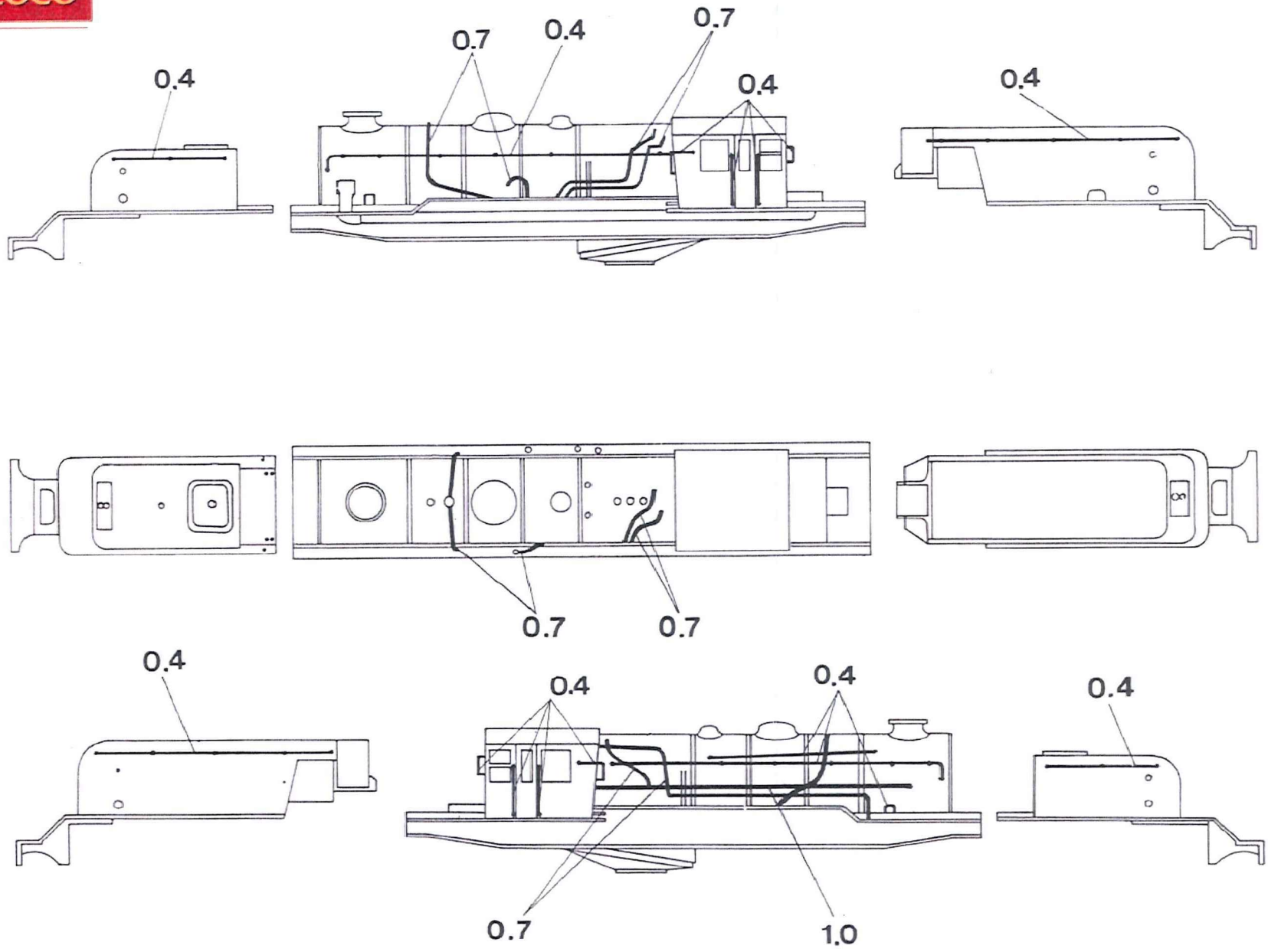
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DJH MODEL LOCO

REPLACEMENT PARTS REQUES T FORM

To enable us to provide a prompt, efficient response to your request we respectfully request that you complete the form attached IN FULL. We can only process requests made on this form. Please do not write or fax a covering letter as this form makes this unnecessary. Telephone requests will not be accepted.

Please note we only supply parts for the reasons boxed below. We do not sell parts for detailing or conversion purposes.

NAME: .....

ADDRESS: .....

.....

.....

KIT REF NO: .....

KIT NAME: .....

WHEN & WHERE PURCHASED (If Known) .....

CATEGORY

1 The following Part(s) were Not included in my kit when purchased new.

2 I am returning herein the following Part(s) received faulty for replacement Without charge (If part built return the appropriate section). Please pack well.

3 I have damaged/ lost the following Part(s) during assembly.

Part No.	Description	Qty	Category	For Office Use Only:- Comp Ref	Unit Cost	Total

DJH Engineering LTD, Project House, Consett Business Park, Villa Real, Consett, Co. Durham, DH8 6BP.
TEL: (01207) 500050. FAX: (01207) 599757.