

Assembly and Operating Instructions of British Railways Standard Class 5MT



General Information on the prototype BR 5MT

In 1948 with the formation of British Railways from the 'Big Four' independent companies, the development of a new range of standard steam locomotives which could be used throughout the entire system became a high priority. Mr. Robert Riddles and his team of designers were soon at work. In total 12 new designs were created by Mr. Riddles' team. In 2007 Aster Hobby Co Inc created a live steam model of the BR Standard Class 9F which included 'Evening Star' the last steam locomotive built for British Railways, and in 2010 Aster produced the BR Standard Class 5MT. Working in the new partnership between Aster Hobby Co Inc and Accucraft Trains Inc, a new version of the BR Standard 9F was introduced in 2018, followed by a new version of the BR 5MT in 2019.

No fewer than 172 BR 5MT were built for use throughout the UK of which 30 were constructed with cam operated rotary Poppet valves driven by Caprotti valve gear. The only other significant difference between the locomotives was the variation in tenders chosen to suit local operating requirements. In this revised version, Aster has adopted the BR 1C tender format (which can be easily adapted by the owner to the BR 1B format by the simple addition of a bulkhead within the coal space).

The BR 5MT was a true Mixed Traffic design being equally at home on an express passenger services as well as local passenger trains and fast freight operations. Several were painted in the attractive lined green livery, a variation that Aster has offered in this production.

Aster Hobby Co Inc and Accucraft Trains Inc acknowledge the ownership of 73082 Camelot as the property of the 73082 Camelot Locomotive Society and 73096 as the property of The Mid-Hants Railway.

Technical Specifications of the BR5MT

Model	BR standard class 5MT
Weight	4.5kg (Locomotive 3.2kg , Tender 1.3kg)
Length	Locomotive 397mm , Tender 226mm
Height	123mm
Width	87mm
Cylinder	2 Cylinders with functional drain valves Cylinder bore 13mm, stroke 22mm
Valve	Piston valves Bore 6mm, stroke 6mm
Valve Gear	Walschaerts' valve gear
Wheel Arrangement	4-6-0
Main Driving Wheels	Cast iron Dia 58mm
Pilot Truck Wheels	Cast iron Dia 28mm
Axle Driven Pump	Fitted to the second driving axle Bore 5mm , ram stroke 6mm
Boiler	C type with two smoke tubes Water capacity: 210cc at 80%, full working pressure: 4kg/cm ²
Boiler Fittings	Safety valves, pressure gauge, regulator valve, blower valve, check valve, blow down valve, superheater
Lubrication	Roscoe Displacement type lubricator
Burner	Alcohol burner with three vertical tubes
Tender	Fitted with a removable alcohol tank capacity: 180cc And a stainless steel water tank with hand pump capacity: 250cc
Minimum Radius	2M

General Assembly and Operating Notes

This assembly and operating instruction booklet shows you how to assemble and operate Aster British Railways standard Class 5MT locomotive. Read thoroughly this booklet with the Assembly Illustrations in order to get familiar with the assembling and operating procedures in advance.

The assembly of the BR5MT locomotive should be accomplished section by section in accordance with the instructions provided in this booklet and the Assembly Illustrations.

Approx. 500 pcs of components are contained in this kit all given with the particular parts numbers. Part 1-8, for example, is a part of the section 1 package, shown on the illustration section 1 as the item 8 cylinder block. Occasionally, parts are shown on illustrations listing both a section number and item number such as 5-16 in illustration 8. This occurs when it is necessary to identify that a part from a different section, in this case section 5, is installed in section 8.

In the kit, symmetrical parts are provided, described for example as 1-1 crosshead L and 1-2 crosshead R. Note right hand and left hand sides of the locomotive correspond to the common definition of right and left for a person facing forward when standing at the rear of the locomotive. Study the illustrations carefully to install the correct part called for on the correct side.

Note all the dimensions given in the illustrations and instructions are in the **metric scale**. Also, take notice of ⇨ **sign** which frequently appears in the Illustrations. This arrow sign indicates the use of **silicone packing compound** provided in kit. Properly applied compound prevents possible leakage of steam and water from the joints and the mating surfaces. Make sure no excess compound interferes with the smooth motion of moving parts and clog with the inner bore of pipes and bolts. The compound may become solid and useless in years. In such case, try to find Loctite Gasket Eliminator 510.

Below tools and supplies are contained in kit for assembly and operation;

“L” hex wrenches for M2 and M2.6 set screws

Fine emery paper

Ceramic insulation sheet

Plastic syringe (for operation)

Wires for dummy pipings

Boiler Test Certificate

Packing compound

In addition to the above, the following tools and supplies are necessary to assemble a kit;

Box type wrench (3mm)	A sheet of plate glass or level block
Crosshead screw drivers	Test Roller sets
Open end wrenches	Sharp scissors or tailoring shears
(3 , 4 , 5 , 5.5 , 6 , 7 , 8 and 10mm)	Air Compressor Source
Flat head screw drivers	Light Machine Oil
Needle nose pliers	Fine files
Tweezers	Thread locker such as Loctite 222
Metric Ruler or scale (1mm = 0.0394 in.)	Epoxy Clear Adhesive
A strip of double-sided adhesive tape	

Please lubricate any moving and sliding surfaces with a drop of **light machine oil** during assembly. Always remember to lubricate O-rings, which are used to create water and steam tightness. If you wish to use the thread locker on the specified threaded fasters of running gear, the adequate amount of the thread locker such as **Loctite 222** would be suitable. If Loctite 222 is not available, try to find a low strength thread locker which enables easy disassembly with regular hand tools without sharing the screws. Careful use of the proper amount of epoxy adhesive may also be necessary to hold detail fittings in place. Strictly follow the manufacturer's instructions.

Most of the parts contained are fully machined and interchangeable components. Check each part before assembly & installation and remove a burr or excess paint if necessary. Occasionally, tolerances build-ups (accumulations) may cause misalignment of the parts, which can be rectified by minor filling or readjustment work. In any case, do not force parts into position. Allow yourself adequate time to complete each section and do not push yourself beyond the comfortable limit. Do not become discouraged if you should face a problem. Keep in mind that assembling a live steam kit always requires your patience.

Be careful not to damage or lose any of the components and hardware supplied. Locate only parts and hardware necessary for the section you are going to assemble in advance to starting assembly. Refer to the Parts List and Hardware and Supplies List provided in this booklet.

The operation and maintenance of this Gauge One live steam locomotive is fully described in the section towards the end of this booklet. Please read this carefully before operating the locomotive.

Parts List

parts no. and description		quantity per section																								
		1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
1. Assembly of Cylinders																										
1	crosshead L	1																								
2	crosshead R	1																								
3	slide bar (1)	2																								
4	slide bar spacer	2																								
5	slide bar (2)	2																								
6	cylinder rear cover	2																								
7	piston	2																								
8	cylinder block	2																								
9	cylinder front cover	2																								
10	drain valve spindle	2																								
2. Assembly of Main Frame																										
1	main frame cross member (1) / pilot truck pivot plate	1																								
2	pilot truck pivot pin	1																								
3	main frame L	1																								
4	main frame R	1																								
5	main frame front cross member	1																								
6	main frame cross member (2) / axle driven pump holder	1																								
7	rear cross member	1																								
8	weight (dia 20mm)	1																								
9	weight (dia 16mm)	1																								
10	dummy plug	2																								
3. Installation of Cylinder Assemblies / Assembly of Drain Valve Device																										
1	drain spindle lever			1																						
2	drain spindle arm			1																						
3	drain arm shaft			1																						
4	slide bar bracket L			1																						
5	slide bar bracket R			1																						
6	dummy lubricator support			2																						
4. Assembly of Expansion Link and Reversing Devices																										
1	inside pivot bracket (threaded)			2																						
2	spacer (1) wider			2																						
3	expansion link			2																						
4	spacer (2) narrower			2																						
5	outside pivot bracket			2																						
6	reversing arm shaft			1																						
7	flanged bushing			2																						
8	expansion link holder L			1																						
9	reverse lifting arm L			1																						
10	expansion link holder R			1																						
11	reverse lifting arm R			1																						
12	dummy cylinder yoke			1																						
13	dummy cylinder			1																						
5. Assembly and Installation of Main Driving Wheels and Axle Driven Pump																										
1	1st driving wheel set			1																						
2	2nd driving wheel set			1																						
3	3rd driving wheel set			1																						

parts no. and description		quantity per section																									
		1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25			
4	counterweight for the 1st & 3rd driver					4																					
5	counterweight for the 2nd driver					2																					
6	coil spring for the 1st driver					2																					
8	axle box retainer plate					6																					
9	axle driven pump body					1																					
10	axle driven pump ram					1																					
11	strap end (1) (threaded)					1																					
12	strap end (2)					1																					
13	eccentric strap (1)					1																					
14	eccentric strap (2)					1																					
15	teflon tape					1																					
16	pump ram pin					1		1																			
6. Installation of Side Rods																											
1	dummy brake shoe L					3																					
2	dummy brake shoe R					3																					
3	coupling rod L					1																					
4	dummy speed meter crank					1																					
5	coupling rod R					1																					
6	main rod L					1																					
7	main rod R					1																					
8	crosshead pin					2																					
9	return crank					2																					
10	eccentric rod					2																					
11	return crank pin					2																					
12	eccentric rod pin					2		1																			
13	exhaust block					1																					
14	smoke box bottom plate					1																					
7. Assembly of Piston Valves and Walschaert's Valve Gear																											
1	steam manifold block R					1																					
2	steam manifold block L					1																					
3	steam pipe					2																					
4	banjo bolt					2		1			1		2														
5	steam chest					2																					
6	valve piston					2																					
7	valve spindle					2																					
8	yoke					2		1																			
9	combination lever pin					8		1																			
10	combination lever					2																					
11	union link					2																					
12	radius rod					2																					
13	lifting link					2																					
14	lifting link pin					4																					
15	die block					2																					
16	die block pin					2																					
8. Assembly of Reverser																											
1	reverser holder					1																					
2	flanged bushing (1)					1																					
3	flanged bushing (2)					1																					
4	reversing roller					1																					
5	reverser screw					1																					
6	reverser wheel					1																					
7	reversing link					1																					

parts no. and description		quantity per section																								
		1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
8	reverse reach rod								1																	
9	reverse reach rod tumbuckle								1																	
10	dummy speed meter								1																	
11	cab support plate								1																	
12	flanged bushing (3)								1																	
11. Assembly and Installation of Water Lines and By-pass Valve																										
1	by-pass valve holder								1																	
2	by-pass valve body								1																	
3	water return pipe								1																	
4	axle driven pump banjo bolt (with slit)								1																	
5	feed water pipe								1																	
6	by-pass valve needle								1																	
7	by-pass valve handle								1																	
8	dummy lubricator crank								2																	
9	dummy lubricator link								2																	
10	dummy lubricator rod L								1																	
11	dummy lubricator rod R								1																	
12. Assembly and Installation of Buffers, Coupler, Oil tank and other detail fittings																										
1	buffer head								2															2		
2	buffer stock								2															2		
3	coil spring for buffer and 2nd and 3rd drivers					4			2															2		
4	buffer stock nut								2															2		
5	buffer shank								2															2		
6	coupler coil spring								1															1		
7	coupler								1															1		
8	oil tank holder (1)								1																	
9	oil tank								1																	
10	oil tank holder (2)								1																	
11	oil tank filler cap								1																	
12	front steam chest cover L								1																	
13	front steam chest cover R								1																	
14	rear steam chest fitting L								1																	
15	rear steam chest fitting R								1																	
16	drain cock nozzle L								1																	
17	drain cock nozzle R								1																	
18	dummy cylinder valve								2																	
19	cylinder cover L for green livery								1																	
20	cylinder cover R for green livery								1																	
21	cylinder cover L for black livery								1																	
22	cylinder cover R for black livery								1																	
23	dummy drain nozzle L								1																	
24	dummy drain nozzle R								1																	
25	smoke box saddle								1																	
26	smoke box rear saddle								1																	
27	front buffer beam								1																	
13. Assembly and Installation of Pilot Truck																										
1	guard iron L								1																	
2	guard iron R								1																	
3	pilot truck side frame L								1																	
4	pilot truck side frame R								1																	
5	pilot truck pivot frame								1																	
6	pilot truck equalizing plate								2																	

parts no. and description		quantity per section																												
		1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
7	pilot truck wheel set																								2					
9	pilot truck side spring holder																								1					
10	pilot truck side play leaf spring																								2					
11	pilot truck pivot coil spring																								1					
14. Assembly and Installation of Boiler (1)																														
1	regulator valve body																									1				
2	boiler																									1				
3	superheater																									1				
4	check valve cap																									1				
5	check valve																									1				
6	blower valve body																									1				
7	fire box																									1				
8	blower pipe																									1				
9	boiler plug																									1				
15. Assembly and Installation of Boiler (2)																														
1	boiler backhead plate																										1			
2	water gauge glass guide																										1			
3	boiler water pipe																										1			
4	banjo bolt																										2			
5	blow down valve body																										1			
6	gauge glass water pipe																										1			
7	gauge glass cap																										1			
8	water gauge glass																										1			
9	pressure gauge siphon tube																										1			
10	blow down valve needle																										1			
16. Assembly and Installation of Boiler (3)																														
1	boiler casing for green livery																											1		
2	boiler casing for black livery																											1		
3	dummy regulator crank for green livery																											1		
4	dummy regulator crank for black livery																											1		
5	fire box step L																											1		
6	fire box step R																											1		
7	dummy steam dome for green livery																											1		
8	dummy steam dome for black livery																											1		
9	safety valve																											2		
10	regulator valve needle																											1		
11	regulator valve handle																											1		
12	blower valve needle																											1		
13	blower valve handle																											1		
14	cab foot plate																											1		
15	superheated steam manifold block																											1		
16	blower nozzle																											1		
17	blower nozzle banjo bolt																											1		
18	check valve pipe																											1		
17. Assembly and Installation of Smoke Box, Cab and Reverser Rod																														
1	drain valve activation rod																												1	
2	drain valve handle																												1	
3	cab for green livery																												1	
4	cab for black livery																												1	
5	cab front window frame L																												1	
6	cab front window frame R																												1	

parts no. and description		quantity per section																								
		1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
19. Assembly and Installation of Draw Bar, Burner, and other detail fittings																										
1	draw bar																								1	
2	draw bar flanged bushing																								1	
3	burner holder (1)																								1	
4	burner																								1	
5	burner holder (2)																								1	
6	dummy injector valve																								1	
7	dummy injector pipe																								1	
8	handrail stanchion (1)																								6	
9	handrail stanchion (2)																								6	
10	handrail stanchion (3)																								2	
11	dummy steam manifold																								1	
12	dummy valve for green livery																								1	
13	dummy valve for black livery																								1	
14	dummy control valves for green livery																								1	
15	dummy control valves for black livery																								1	
16	dummy valve pipe																								1	
17	loco number plate for green livery																								1	
18	loco number plate for black livery																								1	
19	shed plate for green livery																								1	
20	shed plate for black livery																								1	
21	manufacturers plate																								2	
22	rear draw bar guide plate																								1	
20. Assembly of Tender (1)																										
1	Tender Frame																								1	
2	Tender Front Beam																								1	
3	Dummy Brake Shaft Bearing L.H.																								1	
4	Dummy Brake Shaft Bearing R.H.																								1	
5	Hand Pump Body																								1	
6	Cap																								1	
7	Suction Valve Seat																								1	
8	Pump Ram																								1	
9	Pump Link																								2	
10	Pump Lever																								1	
11	Cross Member																								2	
12	Ram Pin																								1	
13	Water Pipe																								1	
14	Water Return Pipe																								1	
15	Water Tank																								1	
16																										
17	Water and Fuel Tank Seat																								1	

PART NO. & NAME		quantity per section																								
		1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
21. ASSEMBLY OF TENDER (2)																										
1	Tender Body																								1	
2	Access Door																								1	
3	Hand Grab(S)																								1	
4	Hand Grab																								2	
5	3 Lamps Iron																								1	
6	Lamp Iron																								1	
7	Hook																								2	
22. ASSEMBLY OF TENDER (3)																										
1	Dummy Sieve L.H.																								1	
2	Dummy Sieve R.H.																								1	
3	Water Delivery Pipe																								2	
4	Fuel Sump																								1	
5	Tender Wheels																								1 2	
6	Journal Box																								2 4	
7	Spring																								2 4	
8	Dummy Stay																								2	
9	Dummy Leaf Spring																								2 4	
23. ASSEMBLY OF TENDER (4)																										
1	Front Step																								2	
2	Rear Step L.H.																								1	
3	Rear Step R.H.																								1	
4	Rear Guard Iron L.H.																								1	
5	Rear Guard Iron R.H.																								1	
6	Rear Buffer Beam																								1	
7	Rear Buffer Beam Plate																								1	
8	Drawbar Pin																								1	
9	Drawbar Spring																								1	
10	Tender Front Deck																								1	
11	Dummy Water Pick Up and Hand Brake Handle																								2	
12	Dummy Water Pick Up and Hand Brake Handle																								2	
24. ASSEMBLY OF TENDER (5)																										
1																										
2																										
3																										
4	Hand Hold																								2	
5	Rear Step for Green / Black version																								1	
6	Fuel Tank																								1	
7	Fuel Tank Valve Needle																								1	
8	Cap																								1	
9	Water Tank Cover																								1	
25. COUPLING THE LOCOMOTIVE AND TENDER																										
1																										
2																										
3																										
4	Pump Extension Handle																								1	
5	Side Door Rear																								2	
6																										
7																										
8	Door Pin																								2	
9	Pipe Union																								1	
10	Union Nut																								1	

Hardware and other Supplies List

		1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Hexagonal Head Screw																									
H	HM2-4																1						4		
	HM3-6			4																					
Flat head screw																									
-	M2.3-8							4																	
	M2.6-6(BS)																			2					
Crosshead Screw																									
+	M1.4-3										2						4	7	2			4	8	0	
	M1.4-5					6													1						
	M1.4-6																					2			
	M1.7-3			4														0							
	M1.7-5	4				2																			
	M2-2.5																					4		2	
	M2-4(BS)																				0	2			
	M2-4	16	6	8	3	12	4		5	1	26	4		3	8	14	6	7	2	6	6	10	0		
	M2-5					2			1																
	M2-12						6				4				1						1				
	M2.6-6												1								1				
M3-4(BS)						1																			
Countersunk Screw																									
C+	M1.4-7				4																		2		
	M2-4		10				2					5						2							
Nut																									
N	M2					2	2	3			4					6				0					
	M2.6(BS)							1											6						
	M3		1																						
Set Screw																									
P	M2-2.5			2		2																			
	M2.6-3				2	1			1						2										
E-ring																									
E	φ3											2											2		
	φ4								1			4													
Spring & Plain (Flat) Washer																									
SW	φ3		1	4																					
	φ2						3					1													
W	φ2.6										1												1		
	φ4																						1		
Split Pin																									
SP	φ1								2	1													1		

	1	2	3	4	5	6	7	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Gland Nut, Lock Nut, and Stainless Steel Balls																									
GP-7	2																								
PR-6							8																		
PR-13	4																								
LN5-7										1	1		2	1						2					
LN8-10					1																				
LN8-10B													1												
GN5-2																1									
GN8-5					1																				
GN8-6-B																				2					
SB-φ3										2			1												
SB-φ4																				2					
O-rings																									
PN3-1.9																									1
PN3.2-1					1																				
PN4.5-1					1																				
PN5-1.9											1														
PN6-1															2										
PN7-1.9																				1				1	
PF3-1.9	2																								
PS2-1.5										1				1	2										
PS2-1.9							4																		
PS3-1.9							8																		
PS5-1.9																2									
HC-1 Tube End Fastener, Fiber Gasket, and Fuel & Water Tubes																									
HC-1																									3
FG-5																				2					
BT-φ5										※															○
ST-φ7										※															○
Wire																									
Wireφ0.8																				○					
Wireφ1																				○					
Wireφ1.5																				○		○			
Ceramic Sheet, Ceramic Burner Yarns, Plastic Window Glass Sheet, and other supplies																									
Ceramic sheet													○	○	○	○									
Ceramic Yarn																				○					
Plastic Sheet																				○					
W Sided Tape																				○				○	○
Emery Paper																				○					

Assembly Instructions

1. Assembly of Cylinders

In this section, you will assemble symmetrical right and left cylinders. Locate the parts and hardware necessary in advance to starting assembly referring to the parts, hardware and the other supplies list.

Pre-assembly note;

- Smooth motion of the piston rods 1-7 and crossheads 1-1 / 2 is critical for the reliable performance of the locomotive. Frequently check each moving part during assembly and patiently adjust relevant parts and hardware until smooth motion is verified.
- Make sure to apply silicone sealant (provided) where the ⇔ signs show. Take special care to minimum necessary amount of the sealant is used. The excess sealant must not get into the steam and drain passages.

1. Assembly of Left Hand Side Cylinder

1. Fit two PR13 piston rings into the prepared grooves of 1-7 piston head and apply a few drops of light machine oil (not provided in kit). Insert the piston into the cylinder block and run the piston back & forth a few times. (cylinder and piston sub-assembly)
2. Slip 1-6 cylinder rear cover, PF3-1.9 o-ring, GP7 gland nut over the piston rod. Make sure to spread a thin layer of silicone packing compound (provided in kit) onto the cylinder mating surface of the rear cover in advance. Apply a drop of light machine oil to the PF3-1.9 o-ring and compress the ring into the stuffing box of the cylinder cover by fastening the gland nut. Fasten four M2-4 crosshead screws diagonally to fit the 1-6 cylinder rear cover in place.
3. Align 1-1 crosshead L, 1-3 slide bar (1), 1-4 slide bar spacer, and 1-5 slide bar (2) and fasten two M1.7-5 crosshead screws from underneath as shown. Run the crosshead 1-1 back and forth several times checking for smooth reciprocation. (Crosshead and slide bar sub-assembly)
4. Connect above crosshead 1-1 and slide bar sub-assembly with the piston rod 1-7 contained in the cylinder and piston sub-assembly by fastening the 1-1 crosshead firmly over the piston rod threaded end. Carefully apply a drop of thread locker such as Loctite 222 (not provided in kit)

onto the threads to ensure tight fit of the parts.

5. Drop light machine oil onto the 1-10 drain valve piston and insert into the designated hole in the cylinder block, taking note of the correct orientation. Use pliers and run back & forth the spindle several times in the cylinder hole. (Wrap a soft cloth on the spindle before applying pliers)
6. Finally install 1-9 cylinder front cover with four M2-4 crosshead screws, applying a thin layer of packing compound on the mating surface.

Repeat the same sequence and make a R.H. symmetrical cylinder assembly using 1-2 crosshead R. After two cylinder assemblies are complete, keep them in a safe place until they are called for later in section 3.

2. Assembly of Main Frame

In this section, you will assemble the main frame of the locomotive. Locate parts and hardware necessary in advance to starting assembly.

Pre-assembly notes;

- Perfect alignment of both frame rails is critical for the reliable performance. Assembly of the main frame should take place on a perfectly flat and even table or work bench. (see the Fig.1) Using a plate of glass or a level block would be recommended.
 - Should you wish to model two dummy plug details situated on the rear side of both of the frame rails, the necessary holes and the extra plug parts are provided in kit. (part number : 2-10) Use an adequate amount of clear epoxy adhesive (not provided in kit) and install these parts in place prior to starting the major assembly work of this section. Make sure that these fittings are attached on the correct side of each frame.
1. Assemble 2-1 cross member (1) and 2-2 pilot truck pivot pin by means of a N-M3 nut and SW ϕ 3 spring washer as shown in the Fig.2 balloon. (pilot truck pivot sub-assembly)
 2. Assemble 2-3 / 4 main frames, 2-5 front cross member, 2-6 cross member (2), 2-7 rear cross member by fastening six M2-4 crosshead screws and four C-M2-4 countersunk screws, as

illustrated. To distinguish two frames, locate oval opening made only on the right hand side frame 2-4, near 2-10 dummy plug hole.

3. Install 2-8 weight (dia 20mm) and 2-9 weight (dia 16mm) for the increased traction effort of the locomotive, fastening two C-M2-4 countersunk screws from right hand side of the frame.
4. Turn the main frame assembly up side down on a soft cloth (not provided in kit) and install already made pilot truck pivot sub-assembly in place using four C-M2-4 countersunk screws as illustrated.

Check that the frames are assembled in a perfect alignment on the flat surface. After alignment of both frames is verified, confirm that all the screws are fully tightened.

3. Installation of Cylinder Assemblies & Assembly of Drain Valve Device

In this section, you will install two cylinder assemblies (made in section 1) on the chassis and assemble the drain valve device. Locate the parts and hardware necessary in advance to starting assembly.

1. Assembly of Drain Valve Devices (refer to Fig.1 balloon)

Insert 3-3 drain arm shaft into the prepared holes on the main frames and fit 3-1 drain spindle lever and 3-2 drain valve arm on each correct end of the shaft. After verifying the fork end portions of above lever and arm are perfectly in phase, tighten P-M2-2.5 set screws using suitable L shaped hex key (provided in kit).

2. Installation of Cylinder Assemblies

1. Refer to Fig.2 balloon on the bottom of the illustration. Locate two small holes on the cylinder blocks' main frame mating surface shown with ⇔ signs. These holes were necessary for the cylinder fabricating process and must be plugged with an adequate amount of silicone packing compound in advance to installing the cylinder assemblies on the chassis.
2. Now, fit the cylinder assemblies in place on the correct side of the chassis, fastening four H-M3-6 hex screws with SW ϕ 3 spring washers from inside of the chassis as illustrated. The fork ends of the already installed drain lever and arm (3-1 and 3-2) must engage with the grooves of the drain spindles 1-10, as illustrated Fig. 3 and 4.

3. Install 3-4 / 5 slide bar brackets and 3-6 side bar fittings in place, using two M1.7-3 crosshead screws and four M2-4 crosshead screws.

Run the crossheads back and forth and check if the smooth reciprocation of the crossheads and the piston rods are obtained. If not, patiently adjust relevant screws and the parts until the smooth motion of above parts is verified.

4. Assembly of the Expansion Link and Reversing Device

In this section, you will assemble the expansion links and the locomotive's reversing devices. Locate the parts and hardware necessary in advance to starting assembly.

1. Assembly and Installation of Expansion Links

1. Refer to Fig.1 and 2 balloons and make a pair of symmetrical expansion link sub-assemblies, using 4-1 inside pivot brackets, 4-2 spacers, 4-3 expansion links, 4-4 spacers, 4-5 outside pivot brackets and four C-M1.4-7 countersunk screws. Note of the correct orientation of each part. (expansion link sub-assemblies L and R)
2. Locate a 4-6 reversing arm shaft and slip 4-10 expansion link holder R and 4-11 reversing arm on the right hand end of the shaft. Tighten a P-M2.6-3 set screw and set the 4-11 arm. The arm and the curved center section of the shaft 4-6 must be out of phase by 90 degrees. Now install above sub-assembly in place by inserting the shaft into the designated holes of the 2-6 cross member, applying a 4-8 flanged bushing as shown. Slip fit another 4-7 flanged bushing, 4-8 expansion link holder L. Fasten both expansion holders L and R by means of two M2-4 crosshead screws. Now fit 4-9 reverse lifting arm L on the left hand side end of the shaft and insert and loosely fasten a P-M2.6-3 set screw by means of a suitable L shaped hex wrench.

2. Setting the Reversing Arms

Locate a dia 1mm wire supplied in it to model the dummy pipings on the locomotive in a later section. Refer to the Fig.3 and carefully align 4-11 reversing arm parallel with the longer section of the 4-9 reverse lifting arm by using the wire as an alignment tool as shown. Rest the wire on the main frame

rails and then check the wire is free from warpage or distortion. Finally tighten the loosely fastened set screw P-M2.6-3.

5. Assembly and Installation of Main Driving Wheels and Axle Driven Pump

In this section, you will install the main driving wheels and the axle driven pump devices on the chassis. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly Notes:

- The eccentric straps (5-13/14) were bolted together for machining at the Aster factory and provided assembled. Use a color marker to identify the correct mating orientation before disassembling them for installation.
- Two kinds of the coil springs are used in this section. Check the illustrated dimensions and use the correct coil springs in place for the improved balance and traction force of the assembled locomotive.
- Provide an adequate amount of light machine oil to all moving and sliding surfaces during assembly.

1. Installation of Driving Wheels

1. Attach 5-4 counterweights to the prepared seating on the 5-1 and 5-3 driving wheels spokes and hold them in place, fastening M1.4-5 crosshead screws through the wheel spokes. Do the same to install wider counterweights 5-5 on the 5-2 2nd driving wheel spokes.
2. Turn over the chassis assembly on a soft cloth and install three driving wheel sets in place by properly inserting the brass rectangular axle boxes into the prepared cut-outs on the frame rails. Fit 5-6 and 12-3 coil springs in place simultaneously. The axle boxes must loosely fit in each frame cut-out. If they are binding, carefully use a needle file and remove excess paint coat left on the axle box contacting surface of the frame cut out. Drop some light machine oil to the sliding surface of each axle box.
3. Now, lay the chassis on its side and attach 5-8 axle box retainer plates to the inside of each frame and then fasten M2-4 crosshead screws through the wheel spokes.

2. Assembly of Axle Driven Pump

1. Turn over the chassis again on a soft cloth. Locate an eccentric sheave which is fitted loose on the axle of the 2nd driving wheel set. Tighten a P-M2.6-3 set screw and hold the sheave tightly in the middle on the axle as shown with the Fig. 1 balloon. If the sheave is not fastened in correct (center) position, the axle driven pump rod 5-10 will become binding inside the pump housing 5-9, causing unsmooth rotation of the wheels.
2. Join 5-11 / 12 eccentric strap ends to the 5-13 eccentric strap using two M2-5 crosshead screws as illustrated. Now, temporarily disassemble 5-13/14 straps and fit them onto the 2nd driving wheels eccentric sheave. Make sure to apply 5-15 white Teflon tape and drop light machine oil in-between the eccentric sheave and the straps, providing reduced friction and increased wear protection. (Roll the tape around a pencil until it retains some circular orientation in advance.)
3. Loosely fasten a LN8-10 lock nut over the thread of the 5-9 pump body. Fit a PN3.2-1 o-ring in the groove of the axle driven pump ram 5-10 and then slip another o-ring PN4.5-1 and a GN8-5 gland over the ram. After applying a few drops of light machine oil onto the o-rings, insert the ram into above pump housing 5-9, fastening the glad nut GN8-5 until it slightly compresses the PN 4.5-1 o-ring. (axle driven pump sub-assembly)
4. Join the eccentric straps 5-11 / 12 with the flat rear end of the axle driven pump ram 5-10, fastening a 5-16 ram pin by means of a flat tip screw driver (not provided in kit). Provide light machine oil to the flat end of the ram as shown.
5. Position above axle pump sub-assembly in place into the semi-circle cut-out of the chassis cross member and hold it in place tightening a LN 8-10 lock nut by means of a suitable open end hex wrench (not provided in kit). Note the correct installing orientation of the 5-9 pump body as instructed with the Fig. 2 balloon.

Check that the pump ram runs smoothly without binding. If not, try to adjust the relevant hardware and parts as well as the position of the eccentric sheave contained in 2nd driving wheel set until smooth motion is verified.

6. Installation of Side Rods

You will install the side rods to the chassis in this section. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly Notes:

- Smooth motion of the rods and the crossheads is critical for the reliable performance of the locomotive. Frequently rotate the wheels to check for smoothness of above parts during assembly.
- Lubricate all moving parts with a drop of light machine oil during assembly.

1. Installation of Dummy Brake Shoes, Rods and Return Cranks

1. Lay the chassis on its right hand side on a soft cloth. Install three 6-1 dummy brake shoes L in place using M2-12 crosshead screws as shown.
2. Rotate each driving wheel until all three crank pins are pointing in the same direction. Then, install 6-3 coupling rod L by means of a C-M2-4 countersunk screw, a W- ϕ 2 plain washer and a N-M2 nut. Fit a 6-4 dummy crank on the 3rd driving wheels crank pin at the same time as shown.
3. Install 6-6 connecting rod L in place. Insert the small end of the rod into the crosshead from rear side and fasten 6-8 pin as illustrated.
4. Fit 6-9 return crank R on the 2nd driving wheels crank pin by temporarily fastening a P-M2-2.5 set screw, using the suitable L shaped hex key provided.
5. Now lay the chassis on left hand side and repeat the same sequence (1 to 4) to install three 6-2 dummy brakes R, a 6-5 coupling rod R, 6-7 connecting rod R, 6-9 return crank in place. Check that the wheels rotate smoothly without binding.

2. Setting the angle of the Return Cranks

Refer to Fig. 1 and 2 illustrations. Set the return cranks 6-9 on both sides to the position instructed in Fig 2 illustrations. A U-shaped return crank positioning key (6-15) is provided in kit, which may be used to correctly set the return cranks as per the following procedure : Fit the smaller end of the U key to the return crank's expansion rod hole and longer end to the wheel axle's center hole as shown with the Fig.1 balloon. After verifying that the legs of the U key are free from warpage or distortion, tighten the temporarily fastened P-M2-2.5 set screws.

3. Installation of Eccentric Rod

Install 6-10 eccentric rods in place on both sides of the chassis fastening a 6-11 return crank pin and a 6-12 eccentric rod pin. Note the correct installing orientation of the rods.

Verify that all the side rods and the crossheads move smoothly without binding. If the smooth motion of the parts is not verified, patiently adjust the relevant screws and parts.

2. Installation of Exhaust Block and the Smoke Box Bottom Plate

1. Locate a M3 thread on the 6-13 exhaust block. This hole was necessary during the manufacturing process and must be blocked in advance. Use a M3-4 (BS) brass crosshead screw and an adequate amount of silicone packing compound to plug the threaded hole in advance.
2. Position above exhaust block 6-13 inbetween two frames and fit 6-14 smoke box bottom plate over the block as shown, fastening four M2-4 crosshead screws. Note the exhaust nozzle comes out from the round opening of the bottom plate. The exhaust block is fit loose at this stage and will be held secure in place in section 7, when you install the steam manifold blocks 7-1 / 2.

7. Assembly and Installation of Piston Valves and Walschaert's Valve Gear

In this section, you will finish the assembly of piston valves and the Walschaert's valve gear. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly Notes:

- Taking 7-1 & 7-2 steam manifold blocks, fill the holes indicated with packing compound as illustrated with Fig.1 on the drawing. These holes were created during manufacture and are no longer required. Make sure that the minimum necessary amount of silicone sealant is used so that no excess sealant is clogging the steam passages.
- Three kinds of small headless shoulder pins are used in this section. Check Fig.4 illustrations for the sizes.

1. Installation of Steam Manifold Block and the Piston Valves

1. Refer to Fig.1 and make two symmetrical steam manifold block sub-assemblies. Assembly 7-1 / 2 steam manifold blocks L / R and 7-3 steam pipes using 7-4 banjo bolts and an adequate amount of packing compound. Refer to the Fig.2 and set the steam pipes in the instructed position.
2. Make two steam chest and piston valve sub-assemblies. Fully fasten the 7-7 spindle into the valve piston 7-6, providing a drop of thread locker such as Loctite 222 to the thread. Temporarily fasten N-M2 nut and the yoke 7-8 over the other end of the spindle. These M2 nuts and yokes will be adjusted and tightened in section 9 valve setting stage. Now fit PR6 piston rings in the grooves of the 7-6 piston valves and insert it into the 7-5 steam chest, after applying a few drops of light machine oil onto the installed o-rings. Run the piston back and forth inside the steam chest for a few minutes, until the piston runs smoothly without binding.
3. Install the steam manifold subassemblies and above steam chest subassemblies, fitting PS3-1.9 o-rings in place as shown. Use M2.3-8 minus head screws to fasten the manifold blocks on to each cylinder block.

2. Assembly and Installation of Combination Lever, Expansion rod and Expansion Link

Assemble and install 7-10 combination lever, 7-11 union link, 7-12 expansion rod, 7-13 lifting link, and 7-15 expansion link die block, using suitable shouldered pins 7-9 / 14 / 16. Refer to Fig.3 and check 7-15 die block for correct installing orientations. These blocks must run smoothly inside the expansion link. If a binding is noticed, check the installing orientation of the block as described above. It may also be necessary to de-burr the block sliding surface inside the expansion link. Use a very fine file and carefully eliminate the problem.

8. Assembly of Reverser

In this section, you will assemble the reversing mechanism. Locate the parts and hardware necessary in advance to starting assembly.

1. Fit 8-2 / 3 flanged bushings against the designated openings of the 8-1 reverser frame, taking note of the correct orientations of the parts. Hold 8-4 reversing roller in alignment with above flanged bushings and insert and fasten 8-5 reverser screw all the way from right hand side of the frame, as illustrated. Carefully clip a E- ϕ 4 e-ring into the prepared groove on the 8-5 reversing screw using pliers. Fasten 8-6 handle to the reversing screw 8-5, then tighten a N-M2.6 (BS) nut. Finally attach 8-7 reverser lever on the bottom of the 8-1 holder and tighten a 5-16 shouldered pin into the 8-4 roller through the opening of the holder. Fasten a M2-5 crosshead screw and N-M2 nut as shown, fitting a small flanged bushing 8-12 simultaneously. (reverser sub-assembly)
2. Assemble 8-8 reach rod, 8-9 reach rod turn buckle, 7-8 yoke and two N-M2 nuts. (reach rod sub-assembly) Set the reach rod sub-assembly is in the correct length as specified with the Fig.1.
3. Now, fasten M2-4 crosshead screws to fit above reverser sub-assembly onto the 8-11 cab support plate. Then install this reverser and foot plate assembly on the chassis, fastening two M2-4 crosshead screws from rear side as shown. Install 8-10 dummy speed meter simultaneously.
4. Finally install the reach rod sub-assembly in place, joining the reverser lever, the reach rod and reversing arm together using suitable shouldered pins 6-12 and 7-9 as illustrated.

9. Valve Setting

In this section, the valve setting is explained. Study the instructions and illustrations carefully beforehand and set the valves correctly to obtain the reliable performance of the assembled locomotive.

Pre-setting Notes;

- The piston valve system is employed in the BR5MT locomotive. In this section, it is required to time the admission and the exhaust of the steam by setting the amount of Lap 1, Lap 2 and Stroke 1 (S1), Stroke 2 (S2) of the valve pistons equally at the respective crank pin positions (① to ⑧).
- The illustration shows the left hand side view of the entire running gear. The illustration at the top of the page shows the running gear in Neutral Setting. Each of the remaining illustrations (① to ⑧) portray a side view of the entire valve mechanism relative to the specified crank pin position in forward setting (① to ④) and in backward setting (⑤ to ⑧). The setting will be carried out in following steps:
 1. verify the correct return crank setting
 2. set the neutral position
 3. set the piston valve

1. Verifying the correct setting of the return crank

Refer to the illustration on top.

In the correct return crank setting, the length between the return crank pin's center and the wheel axle center measures 7.0 mm. You have already achieved the correct setting in section 6 by means of the 6-15 jig provided. Again, refer to the Fig.1 illustration and the correlated instructions in section 6 and verify that the return cranks are in the instructed position.

2. Setting the neutral position

1. Confirm that the reverse reach rod parts are assembled in the specified length shown with Fig.1 of section 8.
2. Refer to the illustration at top of section 9 and set the reverser at the neutral position. In this

position the reversing wheel 8-4 is situated in the center position. Now, rotate the wheels and locate the crank pin at the foremost position and the piston at the front dead center position as shown. In this position, the expansion link 4-3 stands vertical and the rear end of the radius rod 7-12 comes in the center (neutral) position inside the expansion link. Rotate the wheels a few turns and check that the radius rods hardly move at above neutral position.

3. Setting the Piston Valves

1. Refer to the illustration ①. Set the valve gear to full forward position by means of the reverse gear handle 8-6, and locate the driving wheels crank pin in 0° position. In this position, the front end of the valve piston 7-6 comes out of the cylindrical steam chest 7-5 as **Lap 1**. Note the amount of the Lap 1.
2. Refer to the illustration ②. Further rotate the wheels in forward direction and set the crank pin in 90° position. In this position, the front end of the valve piston further comes out as **S1** (Stroke 1). Take note of the amount of S1.
3. Now give the wheels another quarter rotation until the crank pin situates at 180° as in the illustration ③. In this position, the rear end of the valve piston has come out of the steam chest as **Lap 2**. Verify Lap 2 and the Lap 1 in the position ① are equal. If that is not verified, adjust the amount of ⑥ either by increasing or reducing the amount of ④. Use a flat tip driver and turn the valve piston either in clockwise or counterclockwise direction to do so, as shown with the Fig.1 balloon.
4. Set the crank pin at the 270° position as shown and verify that the **S2** is in the equal amount with the S1.

Set the reverser handle at the backward position and repeat the same sequence described above.

Try to obtain **L1 = L2 and S1 = S2 condition** at the respective ⑤ to ⑧ crank pin positions. In design, the amount of the S1 and S2 in backward setting is slightly smaller than that in forward setting. Finally, confirm that the valve piston 7-6 and adjoining N-M2 nuts are tightened.

10. Air Test

After the valve setting, you will give the running performance test to the chassis. Locate hardware and parts necessary in advance.

Pre-testing notes;

- Prior to testing, it is necessary to temporarily install some components from later assembly stages. Locate two 7-4 banjo bolts, 16-15 superheated steam manifold block, 25-9 pipe union, 25-10 union nut, BT5 black tube, and ST7 translucent fuel tube and install them as shown in the illustration. Fold over the end of the ST7 tube and hold it folded by means of a big binder clip (not provided in kit).
- Lubricate all the moving and sliding surfaces such as side rod bearings, driver axle bearings, crosshead etc with a drop of light machine oil. Place your chassis assembly on Aster Test roller bench (not provided in kit) and connect the BT5 hose to your air pressure source like an air compressor.

Please note: The prolonged running of your chassis on air is not recommended. The point of the test is to ensure correct functioning.

Air testing;

Set the valve gear to full forward running position and push the 3-1 drain valve lever forward and set it in shut position. Apply air pressure pf approx. 1 kgf.cm². It may be necessary to give the wheels a few turns at the beginning. See if the wheels start to run smoothly on air pressure. Check for the smooth rotation of each driving wheel set and verify no parts are binding. Rotate the reversing handle and set the running gear to the neutral setting and then to the reverse setting, verifying smooth running both in forward and reverse directions.

After the test;

Remove the temporarily installed parts and keep them in a safe place until they are again called for in a later section.

11. Assembly and Installation of Water Lines and By-pass Valve

You will assemble and install water pipes and the by-pass valve in this section. Locate the parts and hardware necessary in advance to starting assembly.

1. Assembly and Installation of the By-pass Valve

1. Assemble and install 11-1 by-pass valve holder and 11-2 by-pass valve body in place fastening a M2-4 crosshead screw.
2. Insert a SB ϕ 3 stainless steel ball in the already installed axle driven pump housing 5-9 and install 11-3 water return pipe in place fastening a 11-4 slotted banjo bolt. Make sure to apply a thin layer of silicone sealant to the round mating edges of the water pipe end fittings and the axle pump body. Take special care to ensure no excess sealant goes into the pump body and water passage, interfering with the motion of the valve balls and water flow. Fasten the hex end nut of the water pipe to the by-pass valve body as shown.
3. Turn the chassis over on a soft cloth and install 11-5 feed water pipe, another dia 3mm stainless steel ball and 7-4 banjo bolt, applying silicone compound as shown.
4. Fit PS2-1.5 o-ring in the prepared groove on the 11-6 by-pass valve needle and fasten it into the by-pass valve body on the chassis. Then, fit 11-7 valve handle onto the end of the valve needle by means of a PM2.6-3 set screw. (Refer to the inset Fig. 5 in section 16 illustration and the picture showing the controllers locations in the operating instructions in this booklet for the ideal setting angle of the controlling handles.)

2. Installation of Detail Fittings

Fit 11-8 dummy lubricator crank in plate fastening a M1.4-3 crosshead screw. Install 11-10/11 dummy lubricator rod L/R in place by inserting and bending the legs of the SP ϕ 1 split pin as shown. Now attach 11-9 dummy lubricator link, carefully squeezing its fork ends on both sides as shown.

12. Assembly and Installation of Buffer, Coupler, Oil Tank and other Cylinder Fittings

You will assemble and install the buffer, coupler, drain cock and other dummy details in this section. Locate the parts and hardware necessary in advance to starting assembly.

The section 12 illustration is split in two pages.

1. Assembly and Installation of Front Buffer Beam and Lubricator Tank

1. Assemble and install 12-1 buffer heads, 12-2 buffer stocks, 12-3 buffer coil springs, 12-4 buffer stock nuts, 12-5 buffer shanks and 12-27 front buffer beam in front of the chassis as shown.
2. Insert the 12-7 coupler into the prepared opening of the front buffer beam and fit a 12-6 coil spring and W- ϕ 2.6 plain washer over the rod. Insert and bend the legs of the SP ϕ 1 split pin outward in the prepared hole on the coupler rod, compressing the coil spring by gently pushing the washer.
3. Assemble 12-8 oil tank holder (1), 12-9 oil tank, and 12-10 oil tank holder (2), fastening two M2-4 crosshead screws as shown. The tank must be held in the correct position in the holders as shown with the Fig.1 balloon. Install this oil tank and holder subassembly in place fastening four more M2-4 crosshead screws from both sides of the chassis main frame. Fasten 12-11 oil tank cap into the tank, fitting a PN5-1.9 o-ring in the prepared groove.

2. Assembly and Installation of Cylinder detail fittings

1. Install 12-12/13 front steam chest covers L/R and 12-14/15 rear steam chest fittings L/R in respective places, fastening M2-12 crosshead screws as shown.
2. Turn over the chassis on soft cloth and install 12-16/17 drain cock nozzles under the cylinder blocks by M2-4 crosshead screws after applying an adequate amount of packing compound on the contact surface as shown. After fastening the screws, carefully bend and reposition the nozzles in vertical to the chassis main frame as shown with the Fig.2 balloon.
3. Now install 12-18 dummy cylinder valves and 12-19/20 cylinder covers L / R (use 12-21 and 22 for the black livery) on each cylinder block, using M2-4 crosshead screws. Finally install 12-23 / 24 dummy drain cock nozzles L / R using M2-4 crosshead screws as illustrated.

3. Installation of Smoke Box Saddle

1. Fit 12-25 smoke box saddle and 12-26 smoke box rear saddle in place, using eight M2-4 crosshead screws as shown.
2. Tighten a LN5-7 lock nut over the threaded nozzle portion of the 6-13 exhaust block as illustrated.

13. Assembly and Installation of Pilot Truck

In this section, you will assemble and install the pilot truck. Locate the parts and hardware necessary in advance to starting assembly.

1. Assemble 13-1/2 guard irons, 13-3/4 pilot truck side frames and 13-5 pivot holder by means of M2-4 crosshead screws, C-M2-4 countersunk screws and N-M2 nuts as shown, taking note of the correct orientation of the parts. To identify the frames 13-3/4, locate two countersunk holes prepared for the C-M2-4 countersunk screws. These holes must go outside.
2. Attach 13-6 equalizing side plate alongside to the side frames and carefully fasten E- ϕ 3 e-ring in the groove prepared on the equalizing side plate's pivot as shown with the Fig.1.
3. Insert 13-7 pilot truck wheel sets and slide and push the brass flanged bushing into the side frame from inside. Carefully clip E- ϕ 4 e-rings into the groove on the wheels axle as shown with the Fig.1. The bushing's flange must be positioned in between the side frame and the e-ring as shown.
4. Now look at Fig.2 balloon. Place two 13-10 side play leaf springs in opposite orientations inside the 13-9 spring holder and turn down all four tabs of the 13-9 holder inside as shown. (leaf-spring assembly)
5. Place above leaf spring assembly inside the 13-5 pivot frame and fit 13-11 coil spring over the 2-2 pilot truck pivot bracket already assembled in the chassis. Finally fasten C-M2-4 countersunk from underneath to install the pilot truck assembly in place, applying a W- ϕ 2 plain washer as shown with the illustration.

14. Assembly and Installation of Boiler (1)

regulator & blower valves, superheater, fire box

In this section, you will assemble the boiler and fire box. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly notes;

- Extreme care are must be taken while handing the copper inner boiler 14-2.
- Apply an adequate amount of packing compound where the ⇨ symbol appears. Make sure no excess compound gets inside the steam or water passages of any of the components.

1. Assembly and Installation of Regulator Valve body and Superheater

1. Fit a LN8-10B lock nut to the 14-1 regulator body and insert and fasten the valve into the correct bushing of the boiler 14-2 as shown. Make sure to apply an adequate amount of sealing compound to the thread as illustrated. Set the regulator in the instructed position a shown with the Fig.4 balloon in the illustration. In this position, the tip of the regulator valve body is situated in the center of the big boiler bushing for the 14-9 plug, pointing straight up as shown with the Fig.1 balloon.
2. Insert the 14-3 superheater into the designated smoke tube in the boiler, fastening its hex end nut over the threaded nipple of the regulator body 14-1.

2. Assembly and Installation of Check Valve and Blower Valve body

1. Insert a SB ϕ 3 stainless steel ball in the 14-5 check valve body and fasten the 14-4 cap, applying a thin layer of silicone compound onto the contact edge as shown. Fasten a LN5-7 lock nut and insert and fasten above check valve assembly into the designated boiler bushing, making sure that the length between the round boiler tubing rear edge and the center line of the check valve body measures 23mm as shown with the Fig.3 balloon.
2. Insert 14-6 blower valve body into the correct bushing, fitting a LN5-7 lock nut as shown. Make sure to apply an adequate amount of packing compound as shown with ⇨ sign. Confirm that the tip of the valve body exits from the correct bushing in front, as shown with the Fig.2 illustration.

3. Installation of Fire Box and Blower Steam Pipe

1. Refer to the template A to make four cuts of the ceramic sheet heat insulation. Glue them inside the 14-7 stainless steel fire box, using a very thin layer of packing compound on the mating surface. Finally install the fire box in place on the boiler, fastening a M2.6-6 crosshead screw as shown.
2. Install 14-8 blower pipe in place by means of a 7-4 banjo bolt. Make sure to apply a thin layer of packing compound onto the round mating surfaces of the round pipe end fitting and of the designated boiler bushing as illustrated. Fasten the hex cap nut of the steam pipe over the one of the threaded branches of the blower valve body.
3. Finally fasten 14-9 boiler plug in place, thinly applying packing compound onto the round contact edge of the bushing, as illustrated.

15. Assembly of Boiler (2)

boiler backhead, gauge glass, blow down valve, and pressure gauge

In this section, the assembly of the boiler continues. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly notes;

- Take special care when handling delicate components such as gauge glass 15-8 and PG20 pressure gauge. Avoid damage to fine threaded brass fitting by accidental cross-threading and over-tightening.
- To familiarize yourself with the correct assembly sequence, it is highly recommended to give a trial fitting of all the parts once without tightening hardware and applying packing compound.
- Apply adequate amount of packing compound where ⇔ appears. Make sure no excess compound gets inside the steam or water passages of any of the components.

1. Installation of Boiler Back Head

1. Make a ceramic sheet cut to go onto the fire box in the checkered portion in the illustration, referring to the size instructed with the template B. Install the cut in place, applying an adequate

amount of packing compound on the fire box contact surface

2. . Verify that any gap in the area is covered with the ceramic sheet.
3. Install 15-1 boiler backhead plate in place fastening three M2-4 crosshead screws, fitting 15-2 water gauge glass guide simultaneously.

2. Assembly and Installation of Blow Down Valve

1. Fasten LN5-7 lock nut over the threaded end of 15-3 water pipe and install the pipe in place, fastening a 15-4 banjo bolt as shown. Make sure to apply packing compound onto thread of the LN5-7 lock nut and the mating surfaces on both sides of the round pipe end fitting.
2. Fasten 15-5 blow down valve body in place simultaneously, applying a thin layer of packing compound to its back head plate contacting edge.

3. Assembly of Water Level Gauge

1. Install 15-6 gauge glass water pipe in place, fastening 15-4 banjo bolt. Make sure to apply a thin layer of packing compound as shown. Locate the brass tender pump handle 27-4 and use it as an alignment tool by inserting it through the 15-6 water pipe, 15-2 gauge glass guide, and 15-5 blow down valve body. Confirm a smooth fit of the brass handle and if a binding is noticed, patiently adjust relevant parts.
2. Insert the gauge glass 15-8 through 15-6 water pipe and 15-2 guide and slip one PN6-1 o-ring and two GN8-6B gland nuts in opposite orientation onto the glass. Install another o-ring PN6-1 and carefully fasten the gland nuts over the threads on 15-6 water pipe and 15-5 blow down valve body. Do not fully tighten these gland nuts as the gauge glass may break. Position the gauge glass (the red line towards to the boiler backhead side) and carefully tighten the nuts, compressing the o-rings.
3. Finally fasten 15-7 cap, thoroughly applying a thin layer of silicone compound onto the round contact surface of the water pipe 15-6.
4. Fit a PS2-1.5 o-ring and fasten 15-10 needle valve into the valve body 15-5.

4. Installation of Pressure Gauge

1. Install 15-9 pressure gauge siphon tube in place, fastening the hex cap nut over the thread on the blower valve body.

2. Now fasten the hex cap nut on the other end over the thread on the PG20 pressure gauge as shown. When tightening the nut, hold the rectangular base portion of the pressure gauge, using a suitable open end wrench or pliers (both not provided in kit).

Boiler Leak Test

The assembled boiler must be tested for leakage. Conduct the test as described below after the packing compound applied on the joints has completely dried.

Pre-testing notes:

- Several components from section 16 must be temporarily installed in advance to the test. Refer to the illustrations and install 16-9 safety valves, 16-10 regulator valve needle, 16-12 blower valve needle, 16-16 blower nozzle and 16-17 banjo bolt.

Air-testing the boiler

1. Connect the one end of BT ϕ 5 black tube to your air pressure source such like a compressor or bicycle floor pump etc. Place the boiler assembly on blocks or on a pillow, and then connect the other end of the black tube to the barbed end of the pipe union portion of the by-pass valve body 15-5.
1. Open the blow down valve and close the regulator and blower valve.
2. Supply air pressure of approx. 3 to 4 [kgf/cm²] to the boiler. Check that the pressure gauge functions and that safety valve open when the pressure reaches to 4kg.
3. Spray soap water on all fittings of your pressurized boiler assembly. If a leak is present, soap bubble will appear around the problem area. Mark the area and try to repack the threads and joints after depressurizing the boiler.
4. Now open the regulator valve and check that the air escapes from the superheater. Close the regulator and then open the blower valve, confirming that the air escapes from the blower nozzle 16-16.

After the test, remove the temporarily fit parts until they are soon reinstalled in section 16.

16. Assembly and Installation of Boiler (3)

safety valves, boiler parts, and detail fittings

In this section, the assembly of the boiler continues. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly Notes;

- The illustration in this section is split in two pages.
- (green livery) The lower portion of the boiler / firebox casing below the running board level was painted black on the green BR 5MT locomotives. If you wish to model this detail then find the etched guide line provided on both sides of the casing. Mask thoroughly the portion above this line and then spray or brush paint the unmasked surface using a good quality model paint in a dull black color. Please check that the paint you intend to use does not have an adverse effect on the green paint by testing a small hidden patch beforehand. Advice on paint selection for this job can be obtained from your Aster dealer or distributor.

1. Mating the Inner Boiler and Boiler Casing / Installation of detail fittings and Safety Valves

1. Refer to Fig.1 balloon. Install 16-3 dummy regulator crank, and 16-5 / 6 fire box steps L/R in respective places on 16-1 boiler casing. (Use 16-2 and 16-4 for black livery) Secure the parts firmly in place by inserting and bending their tabs outward, using a flat tip screwdriver (not provided in kit). Carefully apply a drop of clear epoxy adhesive, if necessary.
2. Carefully insert the inner boiler assembly finished in section 15 into the boiler casing from the rear opening, making sure that the bushings of the inner boiler align with the respective round openings on the casing. Attach two tabs of the boiler backhead plate 15-1 to the rear upper edge of the boiler casing and fasten two 2-4 crosshead screws, as illustrated.
3. Fit 16-7 steam dome (16-8 for black livery) in place, fastening a M2-12 crosshead screw.
4. Fit two PS5-1.9 o-ring and fasten two safety valves 16-9 into the designated boiler bushing through the round opening on the casing. Do not fully tighten the valves using a wrench.
5. Cut a strip of ceramic sheeting referring to the provided template D and insert it into the gap between the boiler and the boiler casing as shown with the Fig.2. Smear a light coat of packing compound over the entire ring surface, creating perfect air tight seal.

2. Installation of the Boiler Assembly

1. Place above boiler assembly on the chassis. Carefully insert and tighten two M2-4 crosshead screws into the backhead and the designated threaded holes on the 8-11 cab support plate installed on the chassis.
2. Make another ceramic sheet cut to go on the smoke box saddle, referring to the template C. Install this ceramic sheet cut as well in place, thinly applying silicone packing compound on the mating surface of the ceramic sheet.

3. Installation of Needle Valves, Handles and Foot Plate

1. Install 16-18 check valve pipe in place as shown, tightening two hex cap nuts as shown in the Fig.4 balloon.
2. Fasten 16-10 regulator needle valve and 16-12 blower needle valve into the respective valve bodies, fitting a PS3-1.9 and PS2-1.5 o-rings in the prepared groove. Finally install 16-11 regulator valve handle and 16-13 blower handle fastening P-M2.6-3 set screws with the provided L shaped hex wrench. Adjust the installing angle of these handles, referring to the Fig.5 illustration as well as the cab handle picture in the operating instructions.
3. Attach 16-14 cab foot plate in place and fasten four M2-4 crosshead screws.

3. Installation of Steam Manifold Block, Blower Nozzle and Check Valve Pipe

1. Install 16-15 superheated steam manifold block in place, fastening two 7-4 banjo bolts. Make very sure to apply a thin layer of packing compound onto the respective mating surfaces as shown. Fasten the gland end nut of the superheater 14-3 over the threaded nipple of the manifold block simultaneously.
2. Join above steam manifold block with the 12-9 oil tank pipe, already installed in the chassis, using a PS2-1.5 o-ring and GN5-2 gland nut as illustrated.
3. Install 16-16 blower nozzle, fastening 16-17 banjo bolt in place. Make sure to fit a PS3-1.9 o-ring in place and to apply packing compound on both sides of the round end fitting of the nozzle.

17. Assembly and Installation of Smoke Box, Cab and Drain Valve Rod

In this section, you will assemble and install smoke box, cab and drain valve activation rod. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly notes;

- Plastic sheets are provided in kit to imitate the window glasses in the cabin window frames. These window glasses may deteriorate due to high temperature created during live steam operation. Replication of these window parts is quite straightforward using the parts supplied and a template.
- The illustration in this section is split in two pages.

1. Installation of Drain Valve Activation Rod & Handle

Assemble and join 17-1 drain valve activation rod and 17-2 drain valve handle with the 3-1 drain valve spindle lever which was already assembled in the chassis, fastening six N-M2 nuts. Tighten these M2 nuts setting the distance inside the nuts on the front end of the activation rod measures 4 mm as shown with the Fig.1 balloon. The rod is hanging loose until the cab is mounted later.

2. Assembly and Installation of the Drivers Cab

1. Make two plastic sheet cuts to go inside of the 17-5/6 front window frames L/R. Trace the shape of window glass on the provided plastic sheet by placing the sheet against the 1:1 scale template provided next to the Fig.2 balloon. (caution: do not use 17-9 side window glass plastic sheet which have two holes) Install the window glasses inside the frames 17-5 & 6 in correct orientation, carefully using epoxy clear adhesive. Finally install this window /glass set in the designated opening in front of the cab 17-3 (17-4 for black livery), inserting and bending the installing tabs outward.
2. Align and attach 17-7 side window frame (use 17-8 for black livery) and plastic window glass 17-9 to the cab side openings from inside. Insert the tabs of 17-10 wind shield frame (use 17-11 for black livery) into the aligned holes from outside and bend outward as shown.
3. Install 17-12 side gutters (use 17-13 for black livery), 17-14 roof gutters and a 17-15 rear roof gutter in place, by inserting and bending the tabs outward as shown. Do the same to install four pcs of 17-16 cab roof dummy hook in place.

4. Now attach 17-19 / 20 roof ventilators (1) / (2) and two 17-18 ventilator plates onto the cab from outside and inside and hold them fastened by means of four 1.4-3 crosshead screws as shown.
(the cab assembly)
5. Install above cab assembly in place on the locomotive, fastening four M2-4 crosshead screws from downward as illustrated. Make sure that the drain valve handle 17-2 enters the designated slot prepared on the cab.

3. Assembly and Installation of the Smoke Box

1. Install 17-22 dummy whistle and 17-23 / 24 dummy whistle valves (1)/ (2) in place on the smoke box 17-21, by means of the respective installing tabs.
2. Refer to the template E and make a precise heat insulation sheet to go inside of the smoke box. Now install the sheet in place, applying a thin layer of packing compound onto the mating surface.
3. Fit 10-25 chimney, 17-26 chimney base, 17-27 chimney plate 17-26 inner chimney to the smoke box and tighten the inner chimney from inside using pliers. (smoke box sub-assembly)
4. Install above smoke box assembly in place on the locomotive, fastening M2-4 crosshead screws. Check the position of the blower nozzle 16-16 through the chimney. The nozzle must point straight-upward to the center of the chimney. Adjust the position of the nozzle by means of pliers, if necessary.
5. Make a round insulation sheet to go inside of the 17-29 smoke box door (template F) and install it by applying a thin layer of silicone sealant as shown. Now fit the smoke box door in place, fastening three M2-4 crosshead screws as shown.
6. Finally install two 17-30 handles on the smoke box front door, fastening a H-M2-4 hex bolt.

18. Assembly and Installation of Detail Fittings

In this section, you will install detail fittings. Locate the parts and hardware necessary in advance to starting assembly.

Pre-assembly notes;

- (green livery) The lower portion of the boiler / firebox casing below the running board level was painted black on the green BR 5MT locomotives. If you wish to model this detail then find the etched guide line provided on both sides of the casing. Mask thoroughly the portion above this line and then spray or brush paint the unmasked surface using a good quality model paint in a dull black color. Please check that the paint you intend to use does not have an adverse effect on the green paint by testing a small hidden patch beforehand. Advice on paint selection for this job can be obtained from your Aster dealer or distributor.

1. Assembly and Installation of Front Deck and detail fittings

1. Refer to the Fig.1 balloon. Fit four 18-3 steps (outside) and two 18-4 steps (inside) in position on the 18-1 front deck (use 18-2 for black livery) and bend the tabs firmly outward. Place the deck in front of the locomotive.
2. Insert 18-26 hand grabs into the prepared holes on both sides of the 18-6 front deck (2) and secure them firmly in place, applying a drop of clear epoxy adhesive (not provided in kit) as shown. After the adhesive has completely dried, fit 18-5 oil tank cover onto the 18-6 front deck and fit them in place on the locomotive, fastening two C-M2-4 countersunk screws as shown. Install 18-7 lamp iron on the installed front deck, fastening a M2-2.5 crosshead screw.
3. Insert and fasten two M2-4 crosshead screws, holding the 18-7 lamp irons and 18-8/9 front steps L/R (18-10/11 for black livery) together on both sides of the front deck 18-1/2 as shown.
4. Install 18-12 dummy air hose in place, fastening two more M2-4 crosshead screws from underneath, as illustrated.

2. Assembly and Installation of Running Board and detail fittings

1. Attach 18-13 dummy control valve (18-14 for black livery) in place onto the left hand side down the fire box and fasten a M1.4-3 crosshead screw. Make sure that the dummy pipings of the valve

enter into the openings prepared in front of the cab.

2. Locate 18-15 running board L (18-17 for black livery) and fit a 18-19 dummy sand box and 18-20 dummy reach rod (18-21 for black livery) by bending the tabs outward as illustrated. Fit the 18-22 dummy steam pipe into the rectangular cut-out on the running board and install the whole running board in place onto the left hand side of the locomotive, fastening a M1.4-3 crosshead screw in front.
3. Do the same with the right hand side running board 18-16 (18-18 for black livery), after installing two 18-19 dummy sand boxes as shown. Make sure to fit 18-22 dummy steam pipe R simultaneously.
4. Attach 18-23 dummy ejector valve in place, inserting its locating tab in front into the smoke box cut-out. Hold it in place with a M1.4-3 crosshead screw as shown.
5. Finally install 18-24 dummy pipe cover (18-25 for black livery) on the left hand side of the locomotive, fastening three M1.4-3 crosshead screws. Make sure that the end of the dummy piping running forward from the 18-13 /14 valve fits into the designated opening on the rear end of the pipe cover.

19. Assembly and Installation of Draw Bar, Burner and other Detail Fittings

In this section, you will complete the assembly of the locomotive. Locate the parts and hardware necessary in advance to starting assembly.

The illustrations for the section 19 are split in two pages.

1. Installation of Draw Bar and Burner

1. Install 19-22 rear draw bar guide plate fastening two M2-4 crosshead screws. Turn over the locomotive upside down on a soft cloth or on a pillow and insert the 19-1 draw bar into the prepared slot on above guide plate and fasten a M2.6-6 crosshead screw, applying 19-2 flanged bushing in place as illustrated.
2. Align approx. 24 to 26 strands of ceramic yarn and make three burner wicks. Insert the wicks all the way into each round vertical tubes of 19-4 burner. Note these wicks must loosely fit inside

each tube, protruding approx. 15mm from the tube edge. The correct density and the length of the wicks are critical for good combustion, ultimately, the performance of the locomotive. Wicks will carbonize in repeated live steam operations. Check them for the condition from time to time and replace per the instruction above, if necessary.

3. Fit the 19-3/5 burner holders around the end of the burner tube and hold them together, fastening two M2-4 crosshead screws. If the burner is loose, carefully tighten the holders with pliers. Install the burner precisely vertically inside the stainless steel fire box 14-7, fastening two more M2-4 crosshead screws from both sides as shown. The front flanged end of the burner tube should enter the round opening of the fire box.

2. Installation of detail fitting and dummy pipings

1. Turn the locomotive on its left hand side. Install 19-6 dummy ejector valve and 19-7 dummy ejector piping in place on the right hand side of the fire box, fastening a M2-4 crosshead screw. Refer to the template 2 and 3 to make two dummy pipings for above ejector valve. Install them in place, carefully using clear epoxy adhesive on the joint (not provided in kit).
2. Place the locomotive on its wheels. Fasten 19-8, 19-9 and 19-10 handrail stanchions into the respective boiler casing & smoke box threaded holes, using a suitable L shaped wrench as shown with the Fig.2. The holes of all stanchions must be orientated parallel to the running boards. Make two hand railings to go on both sides of the boiler, using the wires ϕ 1mm, formed against the template 12 and 13. Insert them into the aligned stanchion holes as shown.
3. Install 19-11 steam manifold, 19-12 dummy valve fitting (use 19-13 for black livery) and 19-14 dummy control valve (19-15 for black livery) in place as shown, using a M1.4-5 and two M1.4-3 crosshead screws. Make two insulated dummy pipings to go with above casting parts, by means of ϕ 1.5mm wire (template 6 and 7). Install these piping and 19-16 dummy piping in place as shown.
4. Now refer to the template 8, 11 and 15. Make three dummy pipings using wire ϕ 1.5 and ϕ 0.8 to go around boiler casing and the smoke box on the right hand side. Install them in place carefully using clear epoxy adhesive to the joints.
5. Now refer to template 5,9,10 and 14. Make four dummy pipings using dia 1mm wire, and ϕ 1.5mm wire to run on the left hand side of the locomotive around the fire box area and install them in place.

6. Make two handrailings to go on both rear sides of the drivers cab as shown. (template 1) Fasten two 19-8 handrail stanchions in place and insert and position above handrails.

3. Installation of locomotive plate, shed plate and builder's plates

1. Refer to the Fig. 3. Place 19-17 locomotive number plate and 19-19 shed plate (use 19-18 and 19-20 for the black livery) face down on the emery paper. Polish the surface by running the plates a few times on the emery paper, until the brass lettering appears on the polished surface. Remove the grits and install these plates on the smoke box door, inserting the positioning tabs into the designated holes as shown.
2. Locate a strip of double-sided adhesive tape provided in kit and make two oval cuts against the 19-21 builder's plates. Peel off the backing paper of the tape and install two plates 19-21 in place.

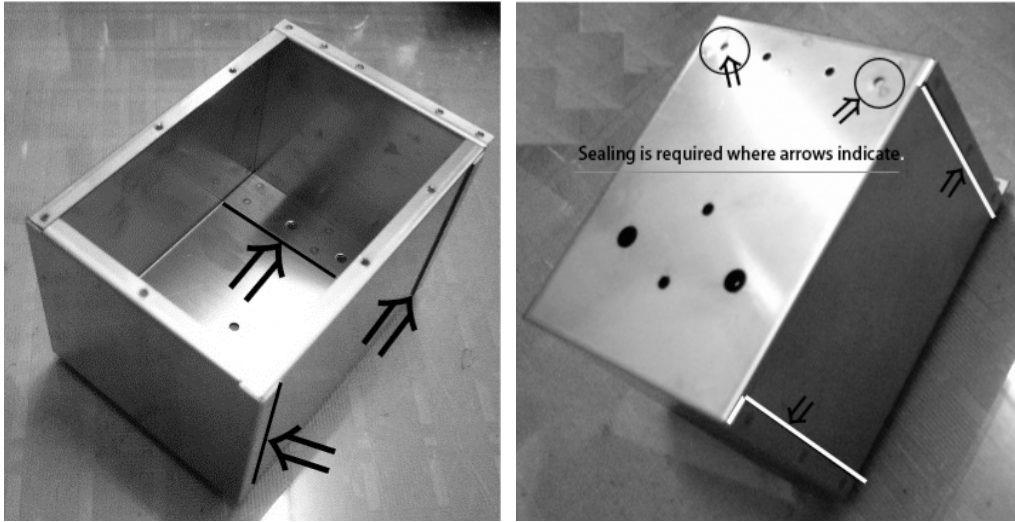
Please note that as built there are two dummy whistles represented on this model. One is behind chimney and second is on top of the firebox just ahead of the front of the cab. When this class was built, all locomotives had whistles mounted behind the chimney. In the latter days many had the whistle repositioned ahead of cab. We leave it to the customer to decide which position to mount the dummy whistle.

20. Assembly of Tender (1) - tender frame, hand pump & water tank

In this section, you will assemble tender frame, hand pump and water tank. Locate parts and hardware necessary in advance referring to the Assembly Illustration, the Parts List and the Hardware List.

Pre-assembly Notes;

- Apply packing compound to the place where the sign ⇔ is shown as well as to all the seams of stainless steel water tank 20-15 in order to avoid water leakage from the area. After using the packing compound, make sure to wash your hands before going on to the next step.



1. Installation of dummy fittings on the Tender Frame

1. Insert the lugs of 20-3 dummy brake shaft bearing L and 20-4 dummy brake shaft bearing R to the correct holes on 20-1 tender frame and carefully bend them outward as shown with Fig 34.
2. Install 20-2 tender front beam in place to 20-1 tender frame using M2-4 screws.

2. Assembly and Installation of Water Tank and Hand Pump

1. Make hand pump assembly as shown with Fig. 35 using 20-5 hand pump body, 20-6 cap, 20-7 suction valve seat, 20-8 pump ram, 20-9 pump link, 22-10 pump lever, two 22-11 cross members, 20-12 ram pin, two SB- ϕ 4 stainless steel balls, a PN7-1.9 o-ring and six N-M2.6 (BS) nuts, applying adequate amount of packing compound to the thread of 20-6 cap and 20-7 suction valve seat. Make sure that no excess packing compound interferes with the motion of the stainless steel ball. Apply a drop of light machine oil (not provided in kit) to PN7-1.9 o-ring, and check the smooth stroke of the ram.
2. Connect the threaded protrusion of 20-5 hand pump body to the pipe of 20-13 water pipe fastening the nut of 20-13 water pipe.
3. Apply adequate amount of packing compound to the thread of 20-14 water return pipe and the hole on 20-15 water tank which will be contacting 20-14 water return pipe and fit FG-5 fiber gasket to the thread of 22-14 water return pipe. Fasten 20-14 water return pipe into 20-15 water tank using LN5-7 Lock Nut.
4. Apply adequate amount of packing compound to the thread of 20-13 water pipe and the remaining 3 holes on 20-15 water tank as instructed with the signs and fit FG-5 fiber gasket to the

thread of 20-13 water pipe. Install the hand pump assembly and water pipe in the water tank 20-15, fastening a LN5-7 lock nut to secure 20-13 Water Pipe. Place the water tank on the 20-17 water & fuel tank seat, fastening M2.6-6 (BS) minus head screws from underneath as shown. Make sure to apply packing compound to the threads of screws.

21. Assembly of Tender (2) - tender body

In this section, you will install the tender body. Locate parts and hardware necessary in advance referring to the Assembly Illustration, the Parts List and the Hardware List.

1. Fit 21-2 access door in place in the front of 21-1 tender body and carefully bend the tabs outward to secure 20-2 access door.
2. Fit 21-4 hand grabs (longer), 21-3 hand grab (short), 21-5 lamps iron, 21-6 lamp iron, and 21-7 hook in place to the rear surface of 21-1 tender body and carefully bend each lug outward to secure the fittings.
3. Install the tender body on 20-17 water and fuel tank seat and fasten six M2-4 screws from underneath as shown.

22. Assembly of Tender (3) - wheels, fuel sump & water pipes

In this section, you will install wheels, fuel sump and water pipes.

1. Apply adequate amount of packing compound to the thread of M2-4 (BS) screws and the holes on 20-15 Water Tank which are contacting M2-4 (BS) screws and fasten M2-4 (BS) screws into the hole on 20-1 Tender Frame through 20-15 Water Tank.
2. Fasten M2-4 screws in place to secure 21-1 Tender Body to 20-1 Tender Frame.
3. Fit 22-1 Dummy Sieve L.H. and 22-2 Dummy Sieve R.H. in place to 20-1 Tender Frame, inserting the pins of 22-1 Dummy Sieve L.H. and 22-2 Dummy Sieve R.H. into the correct holes on 21-1 Tender Body. The hole of 22-1 Tender Frame may require filing to fit hook of 22-1 and 22-2

Dummy Sieves.

4. Cut Wire- ϕ 1.5 (Black) to approximately 73.5mm and bend it referring to the inset illustration. Insert one end of this wire to the hole of 22-1 Dummy Sieve L.H. (22-2 for R.H.) and the other end to the hole on 20-2 Tender Front Beam.
5. Carefully connect the pipe of 22-3 Water Delivery Pipe in place to 20-14 Water Return Pipe and 20-13 Water Pipe fastening a nut of 22-3 Water Delivery Pipe.
6. Install 22-4 Fuel Sump to 20-17 Water and Fuel Tank Seat and fasten M2-2.5 screws from underneath of 22-4 Fuel Sump.
7. Fit 22-8 Dummy Stay in place to 20-1 Tender Frame inserting the pins of 22-8 Dummy Stay in place to 20-17 Water and Fuel Seat.
8. Fit 22-9 Dummy Leaf Spring in place to 20-1 Tender Frame using M1.4-3 screws.
9. Insert the pin of 22-5 Tender Wheels to the correct hole of 22-6 Journal Box. Put 22-7 Spring to the hole on 22-6 Journal Box and install 22-5 Tender Wheels in place to 20-1 Tender Frame, fitting 22-7 Spring to the hole on 22-9 Dummy Leaf Spring. Verify the smooth rotation of the tender wheels.
10. Pour water in the tank and pump water several times by means of 25-4 Pump Extension Handle. Place your finger to the end of 22-3 pipe and check the water pressure. Observe that the water is forced out from the pump and pushes against your finger. If the pressure is low, then check that SB- ϕ 4 Stainless Steel Balls are not missing from your hand pump assembly and that water passages of the pipes are not clogged with excessive packing compound.

23. Assembly of Tender (4) - wheels, draw bar and detail fittings

In this section, you will install wheels and draw bar and detail fittings on the tender.

1. Installation of Tender Wheels

1. Fit the remaining 22-9 dummy leaf springs in place to 20-1 tender frame using M1.4-3 screws.
2. Insert the pins of the remaining 22-5 tender wheels to 22-6 journal box and put the remaining 22-7 spring to the hole on 22-6 journal box. Install 22-5 tender wheel to 20-1 tender frame. Verify the smooth rotation of tender wheels.

3. Install 23-1 front step in place to 20-2 tender front beam using M2-4 crosshead screws.
4. Install 23-2/3 rear step L /R in place to 20-1 tender frame, attaching 23-4/5 rear guard iron L/R simultaneously. Fasten M2-4 screws to secure them.

2. Assembly of Rear Buffer

1. Insert the pin of 12-1 buffer head to the hole of 12-2 buffer stock, fitting 12-3 buffer coil spring into 12-1 buffer head. Attach 23-7 rear buffer beam plate to 23-6 rear buffer beam and fasten 12-4 buffer stock bolt into the aligned holes of 23-7 rear buffer beam plate, 23-6 rear beam and 12-2 buffer stock. Fasten 12-5 buffer shank to secure the rear buffer.
2. Insert the pin of 12-7 hook coupler into the aligned square holes of 23-6 rear buffer beam and 23-7 rear buffer beam plate, slip-fitting 12-6 coupler spring and w- ϕ 2.6 washer to the pin of 12-2 hook coupler. Insert SP- ϕ 1 split pin into the hole on the pin of the hook coupler and carefully bend the split pin outward.
3. Install 18-12 dummy hose in place to 23-6 rear buffer beam and fasten M2-4 crosshead screws from underneath.
4. Install the above rear buffer beam assembly in place to 20-1 tender frame using HM2-4 hex head screws.

3. Assembly of Tender Front Deck

1. Install 23-10 tender front deck in place to 21-1 tender body fastening H-M2-4 crosshead screws to secure it.
2. Insert 23-8 drawbar pin in place to the central hole on 23-10 tender front deck and 20-2 tender front beam, fitting 23-9 coil spring and a W- ϕ 4 washer in place.
3. Fit two E- ϕ 3 e-rings to the grooves on 23-8 drawbar pin and carefully clip it with your pliers.
4. Attach 23-11 dummy water pick up and handbrake handle base in place to 23-10 tender front deck, fitting 23-12 dummy water pick up and handbrake handle to 25-11 and fasten M1.4-6 screws to secure them.

24. Assembly of Tender (5) - fuel tank

1. Insert the pins of 24-4 hand hold in place to 21-1 tender body and carefully bend the pins to secure.
2. Install 24-5 rear ladder in place to 23-1 tender body fastening M2-2.4 screw from the top of 24-5 rear ladder and from underneath.
3. Fit PN3-1.9 o-ring to the groove of 24-7 fuel tank valve needle and fasten it into the designated piping of the 24-6 fuel tank.
4. Apply PN7-1.9 o-ring to the thread of 24-8 fuel tank cap and fasten 24-8 fuel tank cap into the threaded hole on the fuel tank.
5. Fit 24-9 water tank cover on 21-1 tender body.

25. Assembly of Tender (6) - Coupling Locomotive and Tender

In this section, you will finish the assembly of tender and couple it with the locomotive.

1. Installation of detail fittings and Water Lines

1. Cut 2 pieces of BT- ϕ 5 Black Tube to measure approximately 70 mm referring to the illustration. Fit HC-1 fasteners over the ends of BT- ϕ 5 Black Tube pieces but do not crimp them yet. Insert 25-9 Pipe Union into 25-10 Union Nut and fit the end of BT- ϕ 5 tube of 70 mm. Fit the rear end of this BT- ϕ 5 tube of 70 mm to the left side of 22-3 Water Delivery Pipe. Fit the rear end of the other BT- ϕ 5 tube to the right side of 22-3 Water Delivery Pipe.
2. Cut ST- ϕ 7 Silicon Tube to measure approximately 75 mm as shown. Fit one end of ST-7 silicon tube to the pipe of 19-4 Burner and the other to the pipe of 22-4 Sump.
3. Fit 25-5 Side Door in place to 21-1 Tender Body and insert 25-8 Door Pin to secure the side door.
4. Attach the Tender Rear Plate and the Water Capacity Plate in place to the rear side of the tender by means of double sided adhesive tape. The correct positions to attach those plates are as shown with the illustration.
5. Install 27-5 tender side doors for green/black livery in place, by inserting the 27-8 side door bar

into the aligned hinge holes of the door and the tender body as shown.

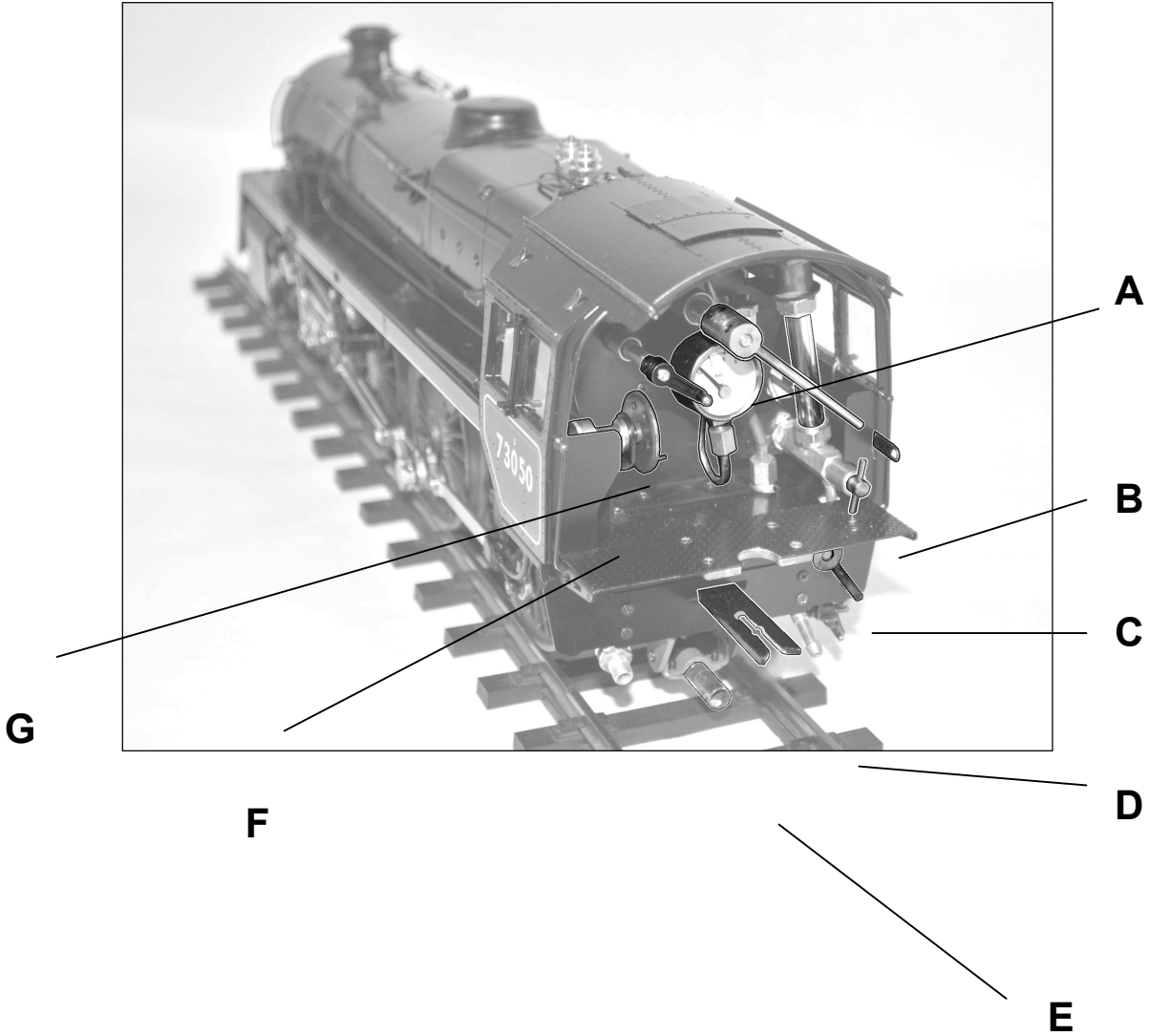
2. Coupling the Locomotive and the Tender

1. Now press the drawbar pin 23-8 downward and insert the drawbar 19-1 into the slot in front of the tender front beam at the same time. Release the draw bar pin either in front or rear hole on the drawbar. Note two holes are provided on the drawbar. The front hole is made to couple the locomotive and the tender closer for the display purpose. The rear hole is made to set the locomotive negotiate on the R2M curves for layout operation.
2. Push the silicone fuel tube over the end of the horizontal burner tube under the locomotive. The tube must fit in a straight line between the locomotive and the tender. Kinks or excessive sagging in the tube will cause restricted fuel supply to the burners. Fasten the 25-10 union nut to the threaded brass fitting of 11-5 water delivery pipe. Connect the other water tube with the 11-2 by-pass valve body as shown. Finally cramp all three HC1 fasteners on each end of the water delivery black pipes, carefully using needle nose pliers.
3. Fit 25-4 hand pump extension handle over the pump lever 20-10 when pumping water into the boiler during live steam operation.

Operating Instructions

1. Functional Descriptions

It is important for the driver to understand the function of each basic component so that optimum performance can be obtained consistently with safety. The brief descriptions are as follows;



The controlling handles in the cab

- A. Regulator Valve Handle
- B. Drain Cock Lever
- C. Blow Down Valve
- D. By-pass Valve
- E. Draw Bar
- F. Reverser Handle
- G. Blower Valve Handl

SAFETY VALVES: (Part number 16-9) Two safety valves are located on top of the boiler and prevents the boiler pressure from exceeding 3.5 to 4.0 Kg/cm² (4 bar) during operation. They contain a spring loaded ball set in a housing. When pressure reaches maximum working pressure, the safety valve opens, the valve spindle lifts and steam is released until a predetermined pressure drop is achieved and the spindle drops. The safety valve should be frequently checked, to assure it is not stuck shut by gently lifting up the valve spindle with tweezers. Do not tamper with the valve adjustments.

REGULATOR: (handle A in the picture) is a needle valve located on the centre of the boiler backhead (parts number 14-1 & 16-10). It controls the steam flow into the cylinders and governs the locomotive's speed and power. As the locomotive rolls and pitches along the track, water droplets are tossed about inside the boiler and may be picked up and held in suspension by the steam. In this condition the steam is known as wet steam and can do damage to the running gear if it should cause the cylinders to jam. To prevent this from occurring, Aster has designed the regulator to take steam from the boiler steam dome so that it picks up only dry steam.

BLOWER: (handle G in the picture) This engine requires a forced draft to maintain a proper fire. The exhaust blast usually creates sufficient draft to do this while moving but when stopped, the locomotive's blower system must be activated. When the locomotive is being steamed up, an external suction fan (available from Aster) must be placed in the chimney so that the fire can be lit and steam raised. When the pressure in the boiler reaches to 1 to 2 kg/cm², the suction fan can be removed and the locomotive's blower system can be used to maintain the draft.

BY-PASS VALVE: (handle D in the picture) is a needle valve located on the right-hand side below the cab floor. It switches the flow of water between the boiler and the return water pipe to the tender. With the by-pass valve closed, water is fed into the boiler, and with it opened, water circulates between the axle pump and the tender water tank. You will learn by experience the proper setting, which will maintain the volume of water pumped into the boiler consistent with steam consumption.

CHECK VALVE: (Part number 14-5) The check (or clack) valve provides a means of supplying water to the boiler while the locomotive is under steam. It consists of a valve body with a seat upon which rests a stainless steel ball. A water line fitting is connected to the check valve body. When the boiler is pressurized, the ball is forced tightly on its seat and steam cannot leak past it. If a water pump is connected to the filler line fitting, water can be pumped into the boiler, since the water, which is incompressible and is being pumped in at a pressure higher than that of the boiler, forces the ball off of its seat. The check valve of this model (Part number 14-5) is located in the upper right position on the boiler backhead (see its location in Illustration Section 16) and is connected to valve box of the axle driven pump.

WATER GAUGE: This model is fitted with a gauge, which indicates the level of water in the boiler. For normal running a $\frac{3}{4}$ full position is recommended. When the water level is low, false readings may occur, in which case be sure to add water to return to the $\frac{3}{4}$ full position. A blow down valve is also fitted which can be briefly opened when the loco is in steam to confirm water level.

PRESSURE GAUGE: The function of the pressure gauge is to show the steam pressure in the boiler. A dial type gauge is provided which connects to the boiler by means of a siphon tube and fittings.

CYLINDERS: The two cylinders are located on the left and right hand side of the mainframes. Their function is to convert the thermal energy contained in the steam into mechanical energy, which can be used to perform useful work. The two cylinders of BR5MT class are on the angle of 2.5 degrees and designed 'out of phase' by 90 degrees so that the locomotive will start with the wheels in any position.

CYLINDER DRAIN COCKS: (handle B in the picture) The locomotive is equipped with working cylinder drain cocks which permit the escape of water particles without damage to the piston valves when the locomotive is being started from cold. The handle is situated on the right hand side of the cab. Pulling the handle backwards opens the cocks. The drain valve must be activated when starting the locomotive and must be returned to the closed position after the locomotive has started and the cylinders have warmed through.

BOILER: A type "C" is used on this model and consists of a copper tube with two end plates and 2 fire tubes. A stainless steel firebox is fitted at the bottom of the boiler. Thermal energy from alcohol fuel converts the boiler's water into steam. A portion of the thermal energy contained in the steam is next converted into mechanical energy when the steam is expanded in the cylinders.

Please note that a Boiler Test Certificate is included with this model. This is evidence of an initial test being carried out by the manufacturer. In the United Kingdom this certificate should be shown to the Boiler Tester when submitting the boiler or model for testing.

Aster Hobby Co. Inc strongly recommends that all Aster boilers and safety valves are hydraulically tested from time to time to ensure safe operation. The procedure published by Gauge One Model Railway Association is particularly recommended. If you are unsure as to how these tests are performed then your closest Aster Dealer or Distributor will be pleased to advise you.

BLOW DOWN VALVE: (handle C in the picture) A boiler blow-down valve is designed in the BR5MT locomotive. This valve is to expel water left in the boiler after operation and before the locomotive is put in storage. Before opening the blow down valve, check that the fire is completely extinguished. For the correct function of the blow down valve, it may be necessary that the boiler has minimal pressure. Be careful at the hot water expelled from the opened valve.

This valve is situating right under the gauge glass. Sometimes, air bubbles may be trapped in the gauge glass while the locomotive is under pressure, causing a false water level reading. In such case, it may be necessary to very briefly open the blow down valve to rinse these bubbles with hot boiler water. Be very careful with the hot water expelled when the valve is opened.

BURNER: The alcohol type burner is fitted at the bottom of the firebox. The ceramic yarns are installed in each of the three vertical tubes, providing thermal energy to generate steam in the boiler. The yarns will carbonize after repeated live steam operations. From time to time check the status of the yarns after operation and replace them if necessary, referring to the assembly instructions in section 19.

LUBRICATOR: A Roscoe displacement type lubricator is situated behind the front buffer beam under a cover 18-5. The lubricator consists of an oil tank and a tube (12-9) that connects it to a steam

manifold (16-15) which in turn feeds both cylinders. When the steam enters the lubricator tank, it condenses into water and sinks to the bottom of the tank. This is because a unit amount of water weighs more than an identical unit amount of oil. The oil is displaced (forced) out of the tank, through the same line by which the steam entered, and is picked up by the steam flow where it enters the cylinders and lubricates them. This process is repeated until the supply of oil is exhausted. The oil slurry left in the tank must be removed and the tank filled with fresh oil leaving a little space at the top of the tank to encourage displacement on the next run.

REVERSER: (handle F in the picture) The reverser handle is located inside the cab on the left hand side. The reliable roller type reverser is employed in the 5MT, enabling the forward-reverse setting of the valve gear freely. The reverser setting controls the steam cut-off of the two cylinders. When the reverse roller is positioned in the left side of the reverser holder, it allows the locomotive to run forward. When the roller is in the right hand side of the holder, the locomotive runs backward. However when the roller is situating in neutral (central) position, no steam enters the cylinders hence the locomotive will not move.

2. Preparations for Operation

Below items are necessary for the live steam operations:

OIL: **Steam cylinder oil**, which can be obtained from most live steam clubs or Aster and Accucraft distributors and dealers, should be used in the lubricator. Straight mineral oil can be used if steam cylinder oil is not available. Do not use automobile oil since it may contain abrasives which will damage the cylinders; it may also leave deposits in the steam passages and lines which will eventually cause them to become clogged. **Light machine oil** should be used regularly to lubricate all bearings, valve motion, axles, etc.

WATER: **Distilled water**, manufactured by the distillation process is recommended. **DO NOT USE DE-IONISED WATER AS IT MAY ATTACK FITTINGS AND SOLDERED JOINTS.** Do not use tap water because it usually contains minerals, which will be deposited inside the boiler and in steam

passages. A good alternative is filtered rainwater. Good water quality is extremely important for successful operation and longer life of the boiler and fittings.

FUEL: Use only **anhydrous ethyl or denatured methylated alcohol** which can be obtained at a scientific supply house or a Pharmacist. **DO NOT USE RUBBING ALCOHOL SINCE IT CONTAINS A LARGE PERCENTAGE OF WATER AND IS TOTALLY UNSUITABLE FOR USE AS A FUEL.**

Be sure to recap the supply can of alcohol as soon as possible since it will absorb water from the atmosphere and become contaminated.

SAFETY PRECAUTIONS: THINK SAFETY FIRST, LAST AND ALWAYS WHEN OPERATING THIS LOCOMOTIVE. HAVE FIRE FIGHTING EQUIPMENT AVAILABLE PRIOR TO STEAMING UP; IT IS USUALLY TOO LATE TO SEARCH FOR IT AFTER A FIRE HAS STARTED! TO PREVENT ACCIDENTS WHICH COULD CAUSE SEVERE INJURIES, OBSERVE THE FOLLOWING PRECAUTIONS; (1) ADD A FEW DROPS OF RED FOOD COLOURING TO THE ALCOHOL SUPPLY SO THAT IT WILL NOT BE ACCIDENTALLY MISTAKEN FOR WATER. (2) THE ALCOHOL SUPPLY SHOULD BE LABELLED 'POISON' AND BE STORED IN A COOL LOCATION AWAY FROM THE IMMEDIATE VICINITY OF THE TRACK AND OUT OF THE REACH OF CHILDREN.

If alcohol is spilt when filling the tender fuel tank, move the loco and tender away from the spill and mop up thoroughly.

Live Steam operation should always be conducted OUT OF DOORS AND NEVER INDOORS.

Have a bucket of water, wet towels and/or a spray bottle of water handy at all times to extinguish fires, which may result if the locomotive derails. It is very difficult to see and alcohol fire in direct sunlight however it is a good idea to assume that one has been started if the locomotive derails. Smother any fire with the wet towels or spray water on it until it goes out.

On extremely hot days, the alcohol tank may overheat when the tender is left exposed for long hours to direct sunlight causing the fuel to vaporize and possibly start fires along the track. Wear gloves when operating and handling the locomotive. The controls on the backhead may be hot enough to burn your fingers while raising steam and running the locomotive.

Aster live steam models are not suitable for operation by children under the age of 16 years even with adult supervision. Children should be kept a safe distance from model steam locomotives at all time when they are being fired up and run. Sudden and unexpected emissions of scalding water and steam can cause severe injury to children. PLEASE TAKE CARE.

TRACK: Your track should be as smooth as possible on straight runs and slightly banked to the inside on all curves. This will prevent derailments and reduce the possibility of accidents.

HAND TOOLS:

Have small screw drivers, nut drivers, wrenches and pliers available to tighten any loose fasteners and to make small repairs and adjustments which may be necessary. A large flap tip screw driver is necessary to fasten/unfasten the lubricator cap 12-11.

SPECIAL EQUIPMENT:

The following items will be necessary to service and steam the locomotive:

1. **A Suction Starter Fan**
for firing up the boiler. It is usually battery operated and sits at the top of the chimney.
Aster and Accucraft Suction Fans are available from your their Dealers & Distributors.
2. **An Oil Injector Syringe**
that is used to fill the lubricator and empty distillate after the run.
3. **Cotton Gloves**
to protect the driver's hands.
4. **A Funnel**
to pour alcohol into the fuel tank.
5. **A Small Mirror**
to check the condition of the burner flame.

3. Operating Procedures

If you have never operated a Gauge One Live Steam locomotive before, have an experienced person in attendance to help with the first few runs.

- (1) Place the locomotive and the tender on its side on a soft cloth and lubricate all moving parts such as sliding surfaces, bearings, rods and links, using light machine oil. Silicone anti-seize lubricant can also be added, if you wish. See the Assembly instruction section 27, coupling the locomotive and the tender.
- (2) Place the locomotive on the track and connect the locomotive and the tender by means of the draw bar (**E in the picture**). Connect the water and the fuel lines as shown with the section 27 illustration.
- (3) Fill the lubricator, which is located behind the front buffer beam, with steam cylinder oil using an oil syringe leaving a small air space above the oil. Replace the filler cap and tighten it until the o-ring is compressed.
- (4) Pour water in the tender water tank. Open the regulator valve (**handle A in the picture**) before and pump water into the boiler using an extension handle (27-4) over the pump lever in the tender water tank until the water in gauge glass is at least $\frac{3}{4}$ full. Replenish water in the tender tank as it empties. Close the regulator.
- (5) Close the fuel tank needle valve (26-7) and remove the filler cap (26-8). Fill the fuel tank with 180ml of denatured methylated alcohol / ethyl alcohol using a clean funnel. Replace the filler cap and tighten it until the o-ring is compressed. Add a drop of oil around the o-ring to assure an airtight seal. Give the fuel tank needle valve one turn and let the sump fill. Check for fuel leaks. If any are found, they must be corrected prior to lighting the fire. Most small leaks occur because the filler cap is not properly tightened. Leave the locomotive a few minutes until all burner strands have soaked up the alcohol.
- (6) Place the suction fan in the chimney orifice and switch it on. Ignite the burner under the frame. Check the condition of the fire, using a small mirror under the burner. The flame should burn predominantly blue. An alcohol fire cannot easily be seen in bright light so it is best to light and observe the fire in the shade. If the fire burns predominantly yellow, the fuel may be contaminated

or the burner wicks are not in condition. They must be replaced, if necessary. Refer to the section 19 assembly instructions for correct burner yarn condition.

- (7) In a few minutes, the pressure gauge will show a reading of 1 kg/cm². At this point, 'crack' open the locomotive's blower valve and remove the suction fan from the chimney. The pressure should continue to rise and when it reaches about 3.5 or 4 kg/cm², the safety valve will then pop.
- (8) Set the reverser (**handle F in the picture**) for the direction you want to start with and open the cylinder drain cocks (**handle B in the picture**) fully. Now open the regulator slightly and push the locomotive gently towards the running direction. The driver should be wearing gloves at this stage. Hot water will be expelled from the chimney and the cylinder drain cocks. **BE CAREFUL TO KEEP YOUR HANDS AND FACE CLEAR OF THE EXHAUST FROM THE CHIMNEY & DRAINCOCKS AND THE RELEASED STEAM FROM THE SAFETY VALVES TO AVOID BEING BURNED.** When the cylinders have been cleared, the locomotive will run smoothly and can be connected to the train. Close the cylinder drain cocks when all condensate has been ejected.
- (9) Adjust the regulator setting to suit the track and load being hauled. The blower valve should be closed when the locomotive is running unless a very heavy load is being hauled at a low speed. In this situation, it may be necessary to crack open the blower valve to maintain sufficient draft. Experience will show how to obtain optimum performance. The cylinder drain cocks are usually closed during normal running.

If the locomotive sounds 'hoarse' during the run then insufficient oil may be reaching the cylinders. Check the flow of oil from the lubricator.

The locomotive will run non-stop for about 20 minutes before it needs to be checked. If the regulator is set for optimum performance and the feed water by-pass valve is closed, in this ideal state, steam consumption is optimized - water is being fed into the boiler at the same rate as it is being evaporated and consumed by the cylinders.

If the engine stops, check the fire. If it is out, the fuel supply has been exhausted. Close the blower valve and fuel tank needle valve, let the engine cool for a few minutes and add fuel, oil and

water as required. **IF THE FIRE IS STILL BURNING, THE WATER SUPPLY HAS BEEN EXHAUSTED. CLOSE THE FUEL NEEDLE VALVE AND EXTINGUISH THE FIRE. WHEN THE DRAFT CEASES, THE FIRE BECOMES OXYGEN STARVED AND DIES OUT ALTHOUGH THE FIRE WILL HUNT FOR OXYGEN AND MAY POP OUT FROM UNDER THE BOTTOM OF THE FIREBOX FOR A BRIEF PERIOD. HAVE A SPRAY BOTTLE OF WATER OR A WET TOWEL AT HAND TO EXTINGUISH ANY FIRES WHICH MAY RESULT. LET THE BOILER COOL FOR 20 MINUTES BEFORE ADDING WATER. NEVER ADD WATER TO AN OVERHEATED BOILER AS THIS COULD CAUSE SEVERE DAMAGE TO THE BOILER.** After the engine has cooled, add fuel, oil and water as required.

- (10) To continue the run, add more water to the tender water tank and add more fuel to the fuel tank but remember to close the fuel tank needle valve before opening the filler cap. After refilling the fuel tank and closing the filler cap, open the needle valve again. Remove the oil and water slurry from the lubricator tank and refill with fresh steam oil if necessary.
- (11) After a run and before the loco starts to cool, it is a good idea to crack open the regulator and blower valve otherwise they may 'freeze'. If this should occur NEVER force the controls open. Instead relight the fire and when working pressure has resumed the controls should 'unfreeze'.

As the locomotive is operated, it becomes "run-in" and its performance will improve. This usually takes no more than a few hours of running.

4. Trouble Shooting

When the Aster BR5MT locomotive is in good operating condition, properly lubricated, provided with distilled water for the boiler, a good grade of fuel for the burner and steam cylinder oil, It can pull its maximum load of 6-8 average weight coaches at a constant speed for about minimum 25 minutes. It will operate equally well in either forward or reverse.

Typical problems and remedies are as follows:

STEAM GENERATION PROBLEMS

If it takes more than ten minutes to generate steam to working pressure, or if the boiler pressure quickly drops during a run of a few metres and the boiler was properly filled with distilled water, proceed as follows:

If the problem persists, check to see that there is proper draft as follows;

- A.** Does the suction fan provide sufficient draft? A small fan may not be powerful enough to do the job. Use an ASTER fan and fresh batteries. Are the battery leads connected to the suction fan correctly so that the fan is pulling air through the fire-box and not blowing air into the smoke-box?
- B.** Check the fuel supply for contamination. Uncontaminated fuel will burn predominantly blue. Contaminated fuel will burn in yellow and should be replaced.
- C.** The burner wicks may be wet with water and do not light properly. Check also for the correct density and the length of the wicks. Refer to the instructions in section 19.
- D.** A trapped air bubble in the silicone fuel tube may restrict the alcohol flow to the burner. Also kinks and sagging of the tube will cause above air bubble trouble in the fuel line.

Is the suction fan raising pressure but the locomotive's blower system is not able to maintain it, check the following

- E.** Is the blower pipe nozzle blocked?
- F.** Is the blower pipe nozzle positioned so that the nozzle discharges directly up the chimney?
- G.** Is the smoke-box door properly sealed?

REMEMBER, A FORCED DRAFT BOILER ALWAYS REQUIRES A DRAFT

A SUCTION FAN IS ALWAYS NECESSARY WHEN FIRST RAISING STEAM OTHERWISE THE FIRE WILL NOT BE SUFFICIENTLY INTENSE. ONCE STEAM IS RAISED AND THE SUCTION FAN REMOVED, THE LOCOMOTIVE'S BLOWER MUST BE CRACKED OPEN TO MAINTAIN DRAFT WHEN THE LOCOMOTIVE IS STATIONARY. DURING THE RUN, THE EXHAUST BLAST NORMALLY PROVIDES ENOUGH DRAFT TO KEEP THE FIRE BURNING BRIGHTLY. HOWEVER IF THE SPEED IS LOW AND THE LOAD HEAVY, IT MAY BE NECESSARY TO CRACK THE BLOWER VALVE OPEN SO AS TO PROVIDE ADEQUATE DRAFT WHILE RUNNING.

STEAM LEAKAGE

Slight steam leakage from piston valve devices is normal, however if the steam is continuously leaking from ends of the steam chests (Part number 7-5) during operation, then check if the piston rings are set in grooves of the valve piston (Part number 7-6). If a leak persists, please contact your Aster dealer and Distributor.

Check the steam lines from the regulator to the cylinders to be sure there are no loose fittings which are causing the leak. Tease out carefully the o-rings in the stuffing boxes of pistons. Worn out o-rings in the stuffing boxes of pistons cause steam leakage and steam leaks can sometimes be seen coming from the gland nuts on the valves. Tighten the gland nuts and/or replace the o-rings per the assembly instructions. It is normal for these glands to have slight steam leak which cannot be completely eliminated. Only if the leak is excessive, tighten the gland nut per the instructions.

UN-EVEN PERFORMANCE

If your locomotive runs better in forward than in reverse, or vice versa, check again your valve settings referring to the instructions and illustration of Section 9.

If the rotation of the wheels is stiff at front or rear dead centre, the pistons are not secured tightly to the crosshead, which may be causing the pistons to hit on either the front or rear cylinder cover.

Metal particles or foreign material in the wheel bearings will cause the wheels to seize. Clean out any foreign material and lubricate the wheel bearings using light machine oil.

CHECK VALVES

Slight leakage from the check valve filler line fitting is normal while the boiler is developing its working pressure. If the leakage continues after the boiler is developing its working pressure and after the safety valve has popped, causing hot water to back up in the tender water tank, there may be a bit of debris on the valve ball seat which can usually be removed by pumping water into the boiler. If the ball remains stuck, remove the check valve plug and carefully extract the ball using a small screwdriver. Clean the inside of the valve body, paying special attention to the seat, and replace the ball with a new one. Add a small amount of packing compounds to the threads of the check valve plug before installing it. Be careful not to get any compound inside the valve body.

FUEL LEAKS

If the burner or fuel tank leaks from any of its joints, return it to your dealer and obtain a replacement.

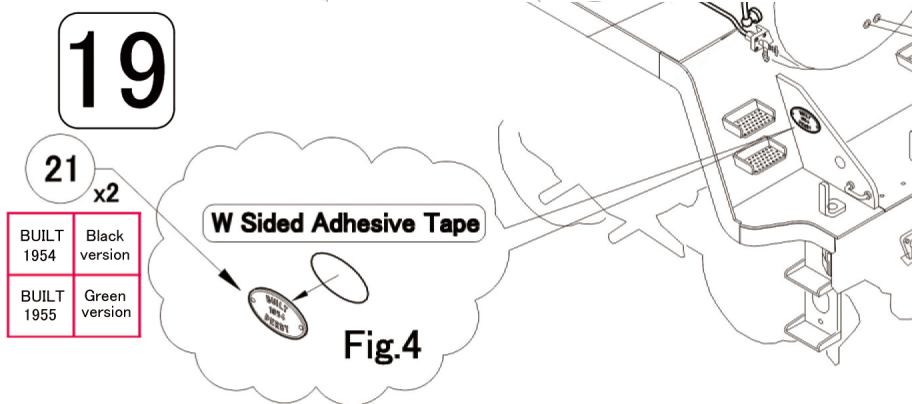
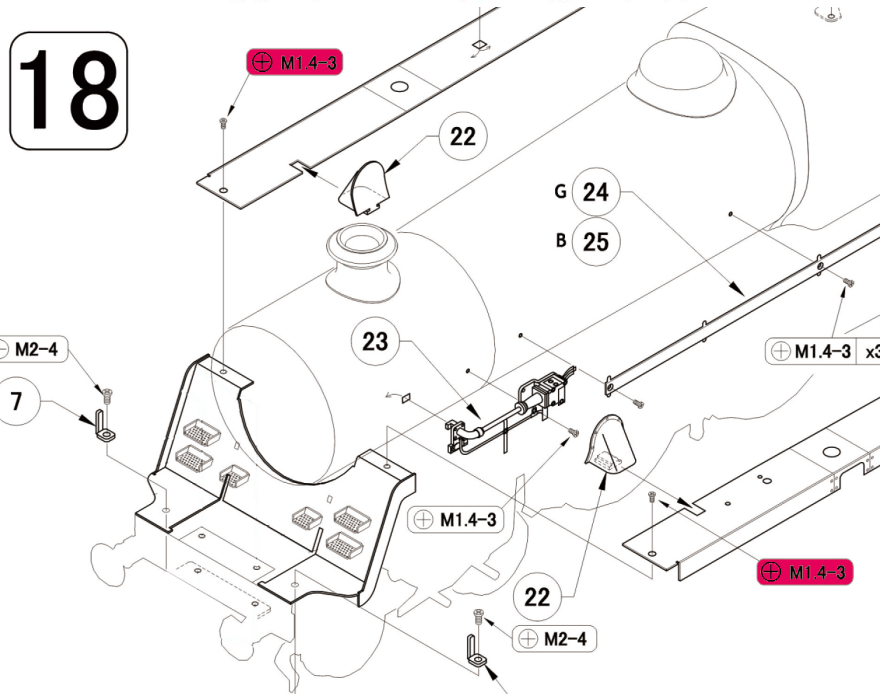
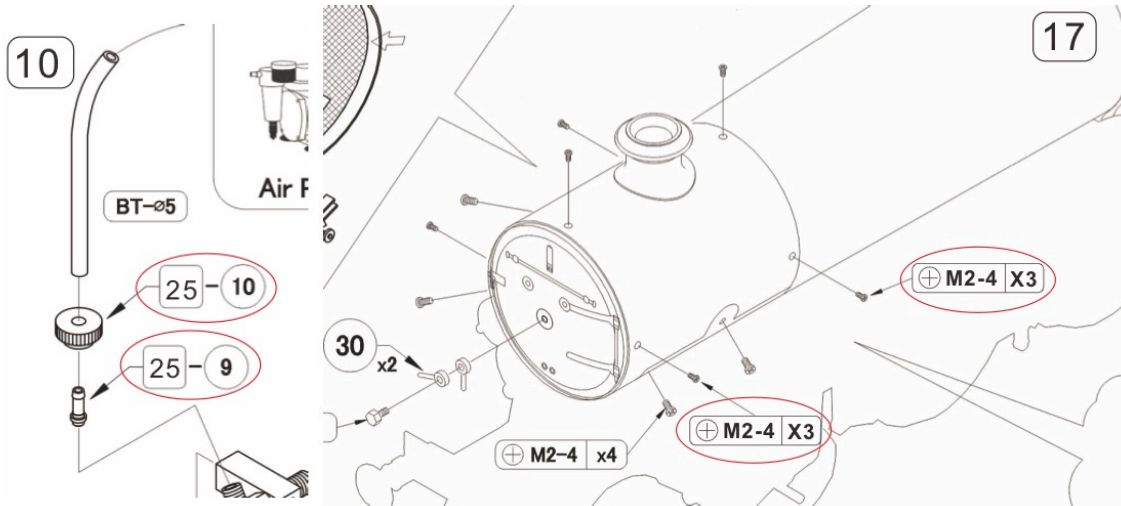
5. Maintenance

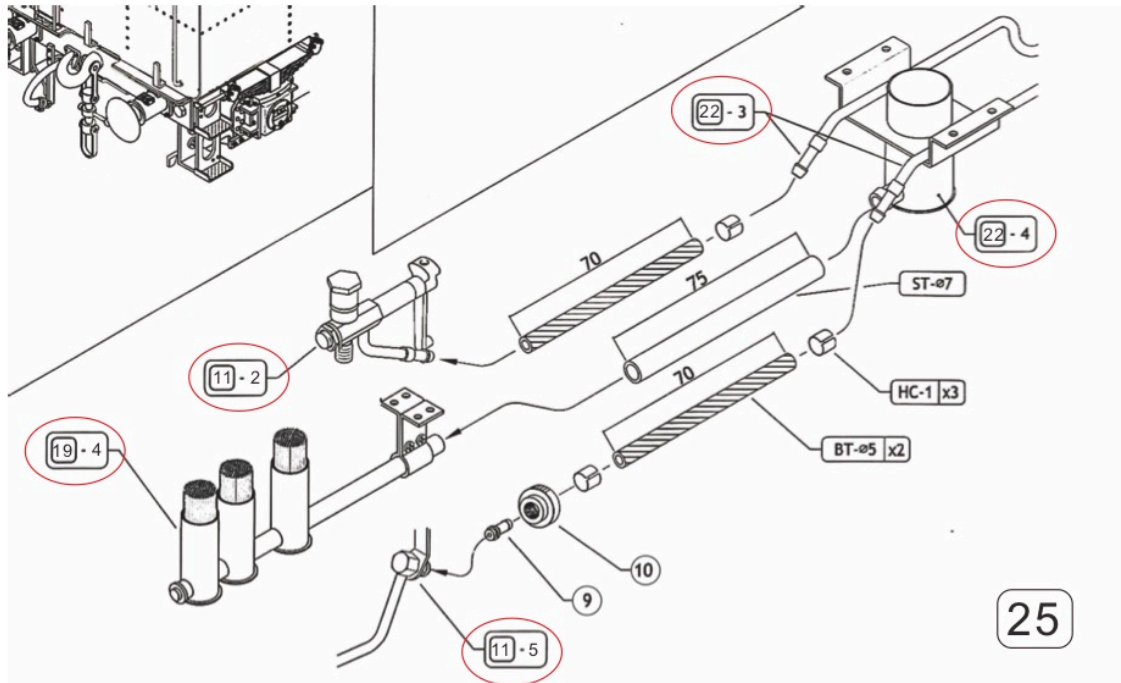
It is very important to keep your locomotive in good operating condition. Maintenance can be as enjoyable as operating. A well-maintained locomotive will reward you with many years of faithful service.

Key maintenance points are as follows;

- (1) After the day's run is completed, empty the boiler, fuel tank and lubricator and dispose of their contents in an environmentally safe manner. Refill the lubricator with fresh steam cylinder oil. If setting the locomotive aside for extended periods, it is particularly recommended that all the water is removed from the boiler by disconnecting loco from the tender, removing safety valves and emptying water completely.
- (2) Wipe the locomotive clean using a soft cloth so that it displays a clean "oily" gloss. Do not use cleaning solutions since they may damage the finish.
- (3) Check for loose or missing fasteners and tighten/replace as necessary.
- (4) Check the condition of the O-rings on the filler caps and replace them if necessary. All filler caps should be installed but not tightened.
- (5) If any leaks were noted during operation, eliminate them by tightening the appropriate fittings or re-sealing with packing compound.
- (6) Lubricate all moving parts with light machine oil.
- (7) Leave the regulator and blower valve slightly open when storing the locomotive or they may stick shut.
- (8) **VERY IMPORTANT** Rotate the wheels of the locomotive a few turns every few weeks to assure that the pistons do not become stuck. When steam cylinder oil is cooled, it becomes more viscous and the slide valves sometimes tend to become stuck in an "Off" position.

2019 Aster and Accucraft BR 5MT Assembly Illustrations Errata

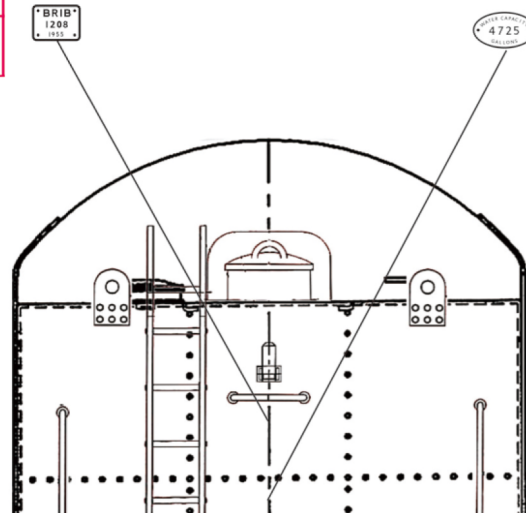




25

Tender Rear Side View

BRIB 1208	Black version
BRIB 1278	Green version



**ACCUCRAFT TRAINS
UNION CITY, CA, USA**

**ASTER HOBBY CO., INC.
YOKOHAMA, JAPAN**