Chapter Thirty-seven

PREPARING THE ENGINE FOR DISPATCH

Contents

Illustration

THIS CHAPTER, which is applicable to both the Ghost 48 Mk. 1 and 48 Mk. 2, describes the preparation of the engine for dispatch, following completion of the final test after overhaul; where information is applicable to one mark of engine only, this is indicated in the text. Instructions for protecting the engine against corrosion are given in chapter 20. Split pins locking highly stressed components should fit tightly in the hole through the bolt or stud and should be of the correct length. The legs of the split pins should be opened out in accordance with the methods specified in chapter 22. The bends of all split pins should be examined for cracks, especially in highly stressed components. Split pins must not be used more than once. When twisting locking wire, care should be taken to prevent cracking or fracture. Avoid anti-locking; ensure that all wire locking is carried out in a proper manner. The tool kit includes lockwire tool T.75482 (Fig. 1) which should be used as necessary. Locking wire should be used once only. Examine all tab-washers to ensure that the initially fixed limb was not sheared whilst tightening the nut. The nut-locking limb should be turned up to a flat of the nut, or bolt head, and not on a corner. Examine the bend for cracking. Tab-washers must not be used more than once. It will, of course, be understood that only external split pins and tab-washers can be examined at this stage.

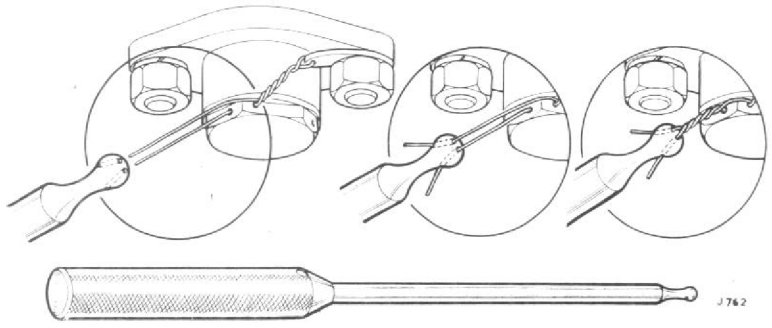

Fig. 1. Lockwire tool.

The engine will have been removed from the test bench as described in chapters 35 and 36, and will be received in the dispatch bay, mounted on a mobile stand.

PRELIMINARIES

On receipt of the engine, check the serial number of the engine against its accompanying documents, and scrutinise the engine test record and inspection cards for details of any special defects that may be listed therein.

Using lifting sling T.78478*, transfer the engine from the mobile stand to the engine erecting stand T.75592, as described in chapter 23, page 3.

Check that the engine is to the required standard. Remove the air-intake and turbine covers. Check the impeller and turbine disc for impact damage. Replace the covers.

Thoroughly clean the exterior of the engine by washing it with an approved cleaning solution. Wipe the engine dry.

BLANKING

During its removal from the test bench, the majority of openings and apertures in the engine will have been blanked off. Any openings which have been left unblanked must be blanked off as soon as possible after receipt of the engine in the dispatch bay. Similarly, if any blanks or covers are removed to perform operations specified in this chapter the blank or cover in question must be refitted immediately the operation has been completed. Blanking plates should be smeared with a thin film of a pure white lanolin, such as British Specification D.T.D.122, on the contacting face before assembly, to ensure the exclusion of both air and moisture. The use of red lanolin, as used for external protection, is dangerous, as it hardens when exposed to air, and does not readily soften in oil, or with temperature.

** This lifting sling can be used in conjunction with the flight lifting eye on the turbine shroud. If it is required to use lifting sling T.72797, the flight lifting eye must be replaced by workshop lifting eye T.74888 as described in chapter 23, page 2.*

Rubber blanking caps should be secured in position by locking wire. In all instances, to ensure that no opening has been left unblanked, check that the following blanks and transport parts are correctly fitted. The two engine mounting trunnions prefixed with an asterisk (*), and eight of the twelve bolts cannot be fitted until after the engine has been lifted out of the erecting stand.

Description	*Ghost 48 Mk. 1*		*Ghost 48 Mk. 2*	
	Part No.	*Qty.*	*Part No.*	*Qty.*
Blanking cover, starter face	48863	1	48863	1
Blanking cover, air compressor face	49237	1	49237	1
Blanking cover, tachometer generator face	19138	1	19138	1
Collar-spacing, tachometer generator face	49081	3	49081	3
Blanking cover, port air-intake	92600	1	92600	1
Blanking cover, starboard air-intake	92599	1	92599	1
Blanking cover, hydraulic pump faces	49237	1	49237	2
Blanking cover, turbine disc	46758 or 602364 (Mod. 877)	1	46758 or 602364 (Mod. 877)	1
Bolt, blanking cover, turbine disc	6A1/7J	6	6A1/7J	6
Nut, blanking cover, turbine disc	A16Y/JP	6	A16Y/JP	6
*Trunnions, engine mounting	29658	2	29658	2
Trunnion, engine mounting	29659	1	29659	1
*Bolts, trunnion, engine mounting	6A1/3L	12	6A1/3L	12
*Spring washers, trunnion, engine mounting	AGS.162/G	12	S.P.47L	12
Blanking cap, air connection, diffuser casing	AGS.597-H	2	AGS.597-H	2
Blanking cap, fire extinguishing connection	AGS.597-D	1	AGS.597-D	1
Blanking cap, drain box outlet	1920-6	1	1920-6	1
Blanking cap, combustion chamber drain	1920-6	1	1920-6	1
Blanking cap, fuel tank pressurisation air supply adapter (Pre-mod. 811)	AGS.597/B	2	AGS.597/B	2
Blanking cap, fuel tank pressurisation air supply adapter (Mod. 811)	AGS.597/D	2	AGS.597/D	2
Blanking cap, thermometer	—	—	1920-6	1
Blanking cap, thermometer pocket	1920-6	1	—	—
Blanking cap, hydraulic pump connection drain box	AGS.596A	1	AGS.597B	2
Blanking plug, hydraulic pump drain pipe	AGS.595-A	2	AGS.595B	4
Blanking cover, generator faces	17087	2	98170	2
Blanking cap, low pressure filter inlet	AGS.597/J	1	48779	1
Blanking cap, B.P.C. air connection	AGS.597B	1	—	—
Blanking cap, flow control air connection	—	—	AGS.596B	1
Blanking plate, exhaust cone heater muff (Pre-mod. 362 only)	48246	2	—	—
Washer, blanking plate, exhaust cone heater muff (Pre-mod 362 only)	25874	2	—	—
Bolt, blanking plate, exhaust cone heater muff (Pre-mod 362 only)	N.148	8	—	—
Spring washer, blanking plate, exhaust cone heater muff (Pre-mod 362 only)	AGS.162/D (Pre-mod. 183) S.P.47L (Mod. 183)	8	—	—
Spacer L.P. filter pressure connection	46919	1	—	—
Blanking cover, exhaust cone support tubes (secure with bolt for cooling air pipe elbows A15Z-7E 8 off)	604240	4	604240	4
Blanking cap, turbine disc air cooling pipes	1920-6	8	1920-6	8
Blanking cover, turbine disc air cooling pipes	604241	4	604241	4
Bolt, for blanking cover 604241	6AI/6E	8	6AI/6E	8
Nut, for blanking cover 604241 bolt	A16Y-EP	8	A16Y-EP	8
Blanking nut, exhaust cone thermocouple connection	16001A	1	16001A	1

Any openings for which blanks are not provided, should be sealed off with adhesive tape, or by some other suitable means.

LOCKING (*Ghost 48 Mk. 1*)

Do not lock the distributor spill pipe union nut and the cap nut to the banjo pillar on the low pressure fuel filter, as, prior to installation, these parts must be removed in order to fit the fuel pressure warning switch; unless this unit is fitted to the engine already, in which case wire-lock these parts.

Turn the engine, in the stand, to the vertical position, with the air-intakes uppermost, and, using 22 S.W.G. stainless steel wire, lock the parts detailed in the following paragraphs.

Lock the oil pressure relief valve plug to the lock-wire tab, which is under one of the nuts securing the relief valve cap.

Lock the plug which blanks a cored passage in the sump, to the lock-wire tab which is under one of the nuts securing the adjacent pressure filter cover.

Lock the oil gallery plug on the side wall of the bottom wheelcase, adjacent to the hydraulic pump adapter, by turning up the lock-tab.

Wire-lock the union nuts on the pipes tabulated as follows:—

Pipe	*To*
Distributor to low pressure filter	Union on distributor
Fire extinguishing system	Adjacent union nuts
5 Distributor to burner (rigid) (port)	Unions on distributor
5 Distributor to burner (rigid) (port)	Support brackets
5 Distributor to burner (flexible) (port)	Pear tab on burner diaphragm cover
5 Distributor to burner (flexible) (port)	Connection studs on support brackets
Control valve to distributor	Union on distributor
Oil drain on port intake (upper)	Union on intake
Oil drain on port intake (lower)	Union on intake
High pressure filter to fuel pump	Banjo bolt on filter
High pressure filter to control valve	Banjo union on filter
Low pressure filter to fuel pump	Banjo bolt on pump
Pump to pump (servo)	Union on rear pump
Pump to pump (servo)	Union on front pump
Pump to pump (delivery)	Union on rear pump
Pump to pump (delivery)	Union on front pump
High pressure filter to fuel pump	Banjo union on pump
Bleed from front pump	Banjo bolt on pump
Bleed from rear pump	Banjo bolt on pump
Bleed from front pump	Cap nut to union, and union to bracket
Bleed from rear pump	Cap nut to union, and union to bracket
Pump to B.P.C. (servo)	Banjo cap nut on pump
Pump to B.P.C. (delivery)	Banjo cap nut on pump
Control valve to B.P.C. to pump	Pear tab on pump
Combustion chamber drain (port)	Pear tab on combustion chamber flanged connection
Combustion chamber drain (port)	Pear tab on centre flanged connection
Combustion chamber drain (port)	Pear tab on drain release valve
Combustion chamber drain (starboard)	Pear tab on drain release valve
Combustion chamber drain (starboard)	Pear tab on centre flanged connection
Combustion chamber drain (starboard)	Pear tab on combustion chamber flanged connection
Pump to pump (seal drain)	Union on rear pump
Pump to pump (seal drain)	Union on front pump

Continued overleaf

Pipe	*To*
Rear pump to drain box	Union on pump
Rear pump to drain box	Union on drain box
Breather to drain box	Union on breather
Breather to drain box	Union on drain box
Diffuser bolt No. 13 to drain box	Union on drain box
Diffuser bolt No. 13 to drain box	Banjo bolt on diffuser bolt
Diffuser bolt No. 13 to centre casing	Pear tab on casing
Diffuser bolt No. 13 to centre casing	Union on bolt
Diffuser bolt No. 11 to sump, Pre-mod. 483	Banjo bolt on sump
Diffuser bolt No. 11 to sump, Pre-mod. 483	Pear tab on bolt
Diffuser bolt No. 11 to centre casing, Pre-mod. 483	Union on bolt
Diffuser bolt No. 11 to centre casing, Pre-mod. 483	Union on casing
Centre casing to sump, Mod. 483	Banjo bolt on sump
Centre casing to sump, Mod. 483	Pear tab on casing
Fire extinguishing system (bottom)	Adjacent unions
Diffuser bolt No. 8 to oil spray (front), Pre-mod. 483	Adjacent unions
Diffuser bolt No. 8 to oil spray (rear), Pre-mod. 483	Union on bolt
Diffuser bolt No. 8 to centre casing, Pre-mod. 483	Pear tab on casing
Diffuser bolt No. 8 to centre casing, Pre-mod. 483	Union on bolt
Centre casing to oil spray, Mod. 483	Adjacent unions
Centre casing to oil spray, Mod. 483	Pear tab on casing
5 Distributor to burner (rigid) (starboard)	Unions on distributor
5 Distributor to burner (rigid) (starboard)	Support brackets
5 Distributor to burner (flexible) (starboard)	Pear tab on burner diaphragm cover
5 Distributor to burner (flexible) (starboard)	Connection studs on support brackets
Oil drain on starboard intake (upper)	Union on intake
Oil drain on starboard intake (lower)	Union on intake
Pump to B.P.C. (servo)	Union on delivery pipe
Pump to B.P.C. (delivery)	Union on servo pipe
B.P.C. to A-F.R.C.	Banjo bolt on B.P.C.
Control valve to B.P.C. to pump	Banjo bolt on B.P.C.
Control valve to B.P.C. to pump	Union on control valve
Control valve to A-F.R.C. (metered feed)	Union on control valve
Control valve to A-F.R.C. (low pressure)	Union on control valve
Control valve to high pressure filter	Banjo bolt on control valve
Control valve to distributor	Banjo bolt on control valve
Control valve to A-F.R.C. (metered feed)	Union on A-F.R.C.
Control valve to A-F.R.C. (low pressure)	Banjo bolt on A-F.R.C.
B.P.C. to A-F.R.C.	Banjo bolt on A-F.R.C.
Diffuser bolt No. 16 to A-F.R.C.	Banjo union on A-F.R.C.
Diffuser bolt No. 16 to A-F.R.C.	Union on bolt
No. 8 expansion chamber to diffuser bolt No. 16	Union on rear of bolt
No. 8 expansion chamber to diffuser bolt No. 16	Banjo bolt on chamber
Fire extinguishing system (starboard)	Adjacent unions

Turn the engine through 180 degrees so that it is in its normal installed attitude.

Lock all the tab-washers on the turbine and nozzle shrouds, except the three bolts which secure the workshop lifting eye, as these bolts will have to be removed in order to fit the flight lifting eye after the engine has been lowered on to the transport stand or into the transit case.

PRIMING THE REAR BEARING (*Ghost 48 Mk. 1*)

Remove the banjo bolt, which connects the flexible pipe from No. 10 diffuser bolt to the rear bearing metering pump. Prime the rear bearing by using a syringe connected with a length of pipe and suitable adapter, to the banjo on the diffuser bolt, and gently force clean filtered oil of correct specification into the rear bearing feed pipe, until a flow of oil is observed from the drain. The rear bearing must not be primed while the engine is in a vertical position in the dismantling and assembly stand, as oil may be pumped through the bearing into the rear bearing air filter. The resultant oil soakage of the felt element may reduce the air flow through the filter and cause high rear bearing temperature.

Reconnect the feed pipe, and lock the metering pump banjo bolt to the union nut on the feed pipe, to the union nut on the flexible pipe which supplies oil to the oil pump cover, and to the union in the oil pump cover. Lock the oil feed pipe union nut to the banjo bolt on No. 10 diffuser bolt.

LOCKING (*Ghost 48 Mk. 2*)

Turn the engine, in the stand, to the vertical position, with the air-intakes uppermost, and wire-lock in accordance with the following instructions:—

Lock the oil pressure relief valve plug to the lock-wire tab, which is under one of the nuts securing the relief valve cap.

Lock the drain plug in the low pressure filter cover to the lock-wire tab.

Lock the air-intake plug to the lock-tab.

Lock the top wheelcase air compressor drive housing breather plug to the air compressor drive housing oil feed banjo pillar.

Lock the top wheelcase oil filler to the oil feed banjo pillar, by means of the locking tab (Mod. 998).

Wire-lock the union nuts on the pipes tabulated as follows:—

Pipe	*To*
Top wheelcase to air compressor drive housing	Union on wheelcase
Top wheelcase to air compressor drive housing	Union on compressor drive housing
Top wheelcase to generator drive casing	Union on wheelcase
Top wheelcase to generator drive casing	Union on generator drive casing
Top wheelcase to oil sump (restrictor)	Banjo bolt on wheelcase
Centre casing to oil spray (front section)	Adjacent union and pipe union nut
Centre casing to oil spray (rear section)	Adjacent union and pipe union nut
Fire extinguishing system (port)	Adjacent union nuts
Low pressure filter to fuel pump	Pear tab on filter
Circulating pump to fuel pump (cooling return)	Banjo bolt on pump
Circulating pump to fuel pump (cooling feed)	Union on pump
A-F.R.C. to fuel pump (spill)	Union on pump
A-F.R.C. to fuel pump (servo)	Banjo bolt on pump
A-F.R.C. to fuel pump (feed)	Banjo bolt on pump
A-F.R.C. to fuel pump (feed)	Union on A-F.R.C.
A-F.R.C. to circulating pump (feed)	Union on A-F.R.C.
A-F.R.C. to fuel pump (spill)	Union on A-F.R.C.
A-F.R.C. to flow control (servo)	Union on A-F.R.C.
A-F.R.C. to fuel pump (servo)	Union on A-F.R.C.
A-F.R.C. to expansion chamber No. 5	Union on A-F.R.C.
Oil sump (restrictor) to top wheelcase	Banjo bolt on restrictor
Restrictor to front bearing (union on intake)	With tab washer
Restrictor to front bearing	Union on air-intake
Restrictor to front bearing	Union on restrictor

Continued overleaf

Pipe	*To*
Restrictor to oil pump cover	Union on restrictor
Restrictor to oil pump cover	Union on cover
Centre casing to metering pump	Banjo bolt on pump
Centre casing to metering pump	Pear tab on centre casing
Centre casing to oil sump (restrictor)	Banjo bolt on restrictor
Centre casing to oil sump (restrictor)	Pear tab on centre casing
Centre casing to oil spray (rear section)	Pear tab on centre casing
Drain box to top wheelcase breather (generator drive casing)	Union on drain
Fire extinguishing system (bottom)	Adjacent union nuts
Circulating pump to drain box	Union on drain
Centre casing to drain box	Union on drain
Centre casing to drain box	Adjacent unions
Combustion chamber drain (port)	Pear tab on combustion chamber flanged connection
Combustion chamber drain (port)	Pear tab on centre flanged connection
Combustion chamber drain (port)	Pear tab on drain release valve
Combustion chamber drain (starboard)	Pear tab on drain release valve
Combustion chamber drain (starboard)	Pear tab on centre flanged connection
Combustion chamber drain (starboard)	Pear tab on combustion chamber flanged connection
Circulating pump to manifold (spill)	Union on pump
Circulating pump to manifold (feed)	Union on pump
Circulating pump to fuel pump (cooling feed)	Union on circulating pump
Circulating pump to fuel pump (cooling return)	Banjo pillar on circulating pump
Circulating pump to flow control (spill)	Banjo bolt on circulating pump
Circulating pump to flow control (downstream)	Banjo pillar on circulating pump
Circulating pump to flow control (upstream)	Banjo pillar on circulating pump
Circulating pump to flow control (upstream)	Banjo on flow control
Circulating pump to flow control (spill)	Banjo bolt on flow control
Circulating pump to flow control (downstream)	Banjo bolt on flow control
A-F.R.C. to circulating pump (feed)	Banjo bolt on circulating pump
A-F.R.C. to flow control (servo)	Banjo bolt on flow control
A-F.R.C. to expansion chamber (No. 5)	Banjo bolt on chamber
Fire extinguishing system (starboard)	Adjacent unions
Top wheelcase breather (generator drive casing) to drain box	Banjo pillar on breather

Turn the engine through 180 degrees, so that it is in its normal installed attitude and continue locking as follows:—

Lock all the tab-washers on the turbine and nozzle shouds, except the three bolts which secure the workshop lifting eye, as these bolts will have to be removed in order to fit the flight lifting eye after the engine has been lowered on to the transport stand, or into the transit case.

PRIMING THE REAR BEARING (*Ghost 48 Mk. 2*)

Disconnect the rigid pipe from the banjo union on the Tecalemit metering pump. Prime the rear bearing by using a syringe, with a length of pipe and suitable adapter connected to the open end of the rigid pipe, and gently force clean filtered oil of the correct specification into the rear bearing feed pipe, until a flow of oil is observed from the drain. The rear bearing must not be primed, whilst the engine is in the vertical position, in the dismantling and assembly stand. If this is done, oil may be pumped through the bearing into the rear bearing air filter, and the resultant oil soakage of the felt element may, by reducing the air flow through the filter, be responsible for high rear bearing temperature.

Re-connect the feed pipe, and lock the meter-

ing pump banjo bolt to the union nut on the feed pipe, to the union nut on the flexible pipe which supplies oil to the oil pump cover, and to the union in the oil pump cover.

GENERAL INTERNAL PROTECTION

Instructions for protecting the engine against internal corrosion, are given in chapter 20.

EXTERNAL ANTI-CORROSIVE TREATMENT

Apply external protection to the engine as described in chapter 20.

LOOSE ENGINE PARTS

The engine parts listed at the foot of this page must be tied to the engine, the small parts being placed in a suitable linen bag.

FINALLY

Finally, check the engine to ensure that the inhibiting is to the required standard, and record the date at which the preservation process was completed. Make a final check on all the locking.

If the engine is to be 'cocoon' packed, refer to the instructions in chapter 20, page 17.

Attach lifting sling T.78478* to the lifting eyes on the engine and ensure that the eye on the sling beam is positioned so that the load will balance evenly. Couple the sling to a crane, or other suitable lifting tackle, and just take the weight of the engine on the crane. Remove the eight bolts which secure the engine to the erecting stand. Taking care that the engine does not swing and so become damaged through contact with the stand, raise the engine slowly until it is clear of the stand. Either move the stand clear of the engine, or move the engine clear of the stand, and raise, or lower, the engine to a convenient height for the next operation.

Using eight of the twelve trunnion bolts and spring washers, secure the pair of engine mounting trunnions to the diffuser casing at three and nine o'clock; the third trunnion should have been fitted at the six o'clock position already.

Place the rubber bushes, which are supplied with the packing case, on the trunnions at three and nine o'clock on the diffuser casing.

Carefully lower the engine into the stand which is attached to the base of the packing case, and secure it by fitting the three trunnion caps—one on each side of the diffuser casing and the third at the rear of the turbine blanking cover. Uncouple the lifting sling.

IF SLING T.72797 HAS BEEN USED

Unscrew the three $\frac{5}{16}$ in. B.S.F. bolts securing the workshop lifting eye to the nozzle and turbine shroud flanges, remove the clamping plate and lifting eye. Position from the discharge nozzle side, two double tab-washers (Part No. N.5464) the three lifting eye bolts, and the adjacent bolt which secures the two shrouds only. Assemble the flight lifting eye (Part No. 46153) over the bolts, and secure with a triple tab-washer (Part No. N.5107) and three $\frac{5}{16}$ in. B.S.F. nuts; a fourth nut must be fitted to the adjacent bolt. Lock the bolt heads and the nuts.

Having ensured that the loose engine parts are attached to the engine, couple a suitable four-piece chain sling to the rings at the top of the upper portion of the packing case and carefully lower it over the engine; take great care that the upper portion of the packing case does not swing and damage the engine.

Fit the four bolts and nuts to secure the lower ends of the steel straps on the upper portion of the

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Description	*Ghost 48 Mk. 1* Part No.	Qty.	*Ghost 48 Mk. 2* Part No.	Qty.
Pipe, cooling air, turbine disc (rear section, long) } Blank with blanking cap 1920-6 4 off and blanking cover 604241 4 off secured with bolts 6A1/6E 8 off and nuts A16Y-EP 8 off.	94054	2	94054	2
Pipe, cooling air, turbine disc (rear section, short) }	94052	2	94052	2
Thermocouple assembly, complete with pyrometer cable, for exhaust cone	29171	1	29171	1
Bolt for exhaust cone	N.3398	30	N.3398	30
Nut for exhaust cone bolt	A16Z-JP	30	A16Z-JP	30
Tab-washers for exhaust cone bolts	N.5103	30	N.5103	30
Drain pipe and adapter for propelling nozzle	97453 (Pre-mod. 947) 603413 (Mod. 947)	1	97453 (Pre-mod. 947) 603413 (Mod. 947)	1

** See footnote on page 1*

packing case to the upper ends of the corresponding straps, which are fixed to the base.

PACKING EXHAUST CONE AND FIREGUARD

Place a copper washer, Part No. 28228, over each of the four front support tubes, and secure it by fitting blanking cover 604241 and two bolts, Part No. A15Z-7E. Screw blanking nut 16001A on to the thermocouple connection which is at 12 o'clock on the rear end of the outer exhaust cone. Before the exhaust cone and fireguard can be packed, they must be assembled together. Insert the exhaust cone into the fireguard so that the drains align. Fit the eight set-bolts and washers, screwing the set-bolts through the drillings in the fireguard into the stiffnuts which are riveted to the fireguard supports on the exhaust cone. If mod. 362 has not been embodied, secure the fireguard to the exhaust cone, and blank off the heater muff outlets by fitting washer 25874, blanking plate 48246, spring washers S.P.47L, and bolts N.148. Place the complete assembly in the wooden transit case so that it rests upon the supports. Strap the assembly in position and screw down the lid of the case.