

SECTION 9, CHAPTER 3

OPERATION AND SERVICING

List of Contents

	Para.		Para.
Introduction	1	Oil Filler Strainer	35
ENGINES IN TROLLEYS		Oil Tank Blanks	36
De-inhibiting	2	Oil Tanks	38
Oil System	8	Joint Face Leakage	39
Test Run	9	Pipe Connection Leakage	41
		Fuel Filter... ..	43
		Torch Igniter	45
ENGINES IN TRANSIT CASES		ADJUSTMENTS	
Trolley Preparation	10	Fuel Control Unit	47
Engine Removal	11	Spill Control Unit	51
Blanks and Masking	12	Pressure Switch	55
Trolley Installation	13	FAULT DIAGNOSIS	
STARTING-CHECKING-STOPPING		General	58
Introduction	14	Running Faults	59
Pre-start Inspection	15	DEFECT RECTIFICATION	
Starting	16	Solenoid Valves	62
Failure to Start	17	Torch Igniter	63
Checking	19	Fuel Blockage	65
Stopping	25	Drain Valve	66
AIRCRAFT ENGINE STARTING		Electrical Wiring	67
Positioning	27	Torch Igniter Sparking	68
Starting	28	Thermocouple Testing	70
After Starting	29	Oil System	71
SERVICING		Oil Dilution	72
General	30	Oil Pressure Gauge	73
Oil Filter	31	Air Delivery Valve	74
Oil Strainers	33	Air Delivery Hose	75
		Freedom of Rotation	76

List of Illustrations

	Fig.		Fig.
Spill T-Piece	1	Pipe Connection	6
Transit Case	2	Fuel Filter... ..	7
Blanks and Masking	3	Fuel Control Unit Adjustments	8
Oil Filter	4	Spill Control Unit Adjustments	9
Strainer and Housing	5	Pressure Switch Adjustment	10

Introduction

1. The following information describes the procedures for preparing engines of the type described in Chapter 2 for service. The first part is applicable to engines installed in trolleys and this is followed by engines fitted in transit cases.

ENGINES IN TROLLEYS

De-inhibiting

2. To de-inhibit engines and fuel tanks proceed as follows:

- Remove the "inhibited" notice from the trolley.

(A.L. 30, May 68)

(b) Remove the masking from the drain underneath the trolley.

(c) Ensure that any masking fitted to the hose sock and sonic venturi is removed.

(d) Ensure that tyre pressures are correct.

(e) If the trolley has been stored on blocks, remove it with the aid of the appropriate lifting equipment attached to the four lifting eyes.

3. A fuel tank is de-inhibited by opening the fuel tank filler cap and removing the bags containing the preservative, cyclohexylamine carbonate (c.h.c.).

Note.—If the fuel tank has been inhibited by an alternative method, such as spraying with an approved inhibitor, the tank must be removed and flushed thoroughly with aviation kerosine (Avtur).

4. On completion of fuel tank de-inhibiting, fit two charged batteries of the correct type.

WARNING . . .

Before connecting the batteries ensure that the starting selector switch is "OFF".

5. Connect, secure and stow the air delivery hose.

6. Fill the fuel tankage with the correct grade of fuel.

7. To de-inhibit the engine fuel system, proceed as follows:

(a) Disconnect the spill return pipe at the T-piece. Connect a length of slave pipe to the spill return pipe (Fig. 1), and route it outside the trolley to line up with a container.

(b) Fit a pressure blank to the T-piece spill pipe connection.

(c) Place a container under the trolley main drain.

(d) Check the starter motor limitations and operate the motor until oil free fuel issues from the spill return pipe.

(e) Disconnect the spill return slave pipe, remove the blank from the T-piece and reconnect the spill pipe. Ensure that fuel is not spilt unnecessarily.

(f) Remove the torch igniter and clean it and its filter in kerosine. Dry all parts using compressed air and refit the torch assembly to the engine.

Oil System

8. Since the specification of the lubricating oil used in the oil system is such that adequate protection against corrosion is afforded, no inhibiting procedure is necessary for the oil system. Visual examination should be made to check that leakage has not occurred. Check and top-up the contents as required.

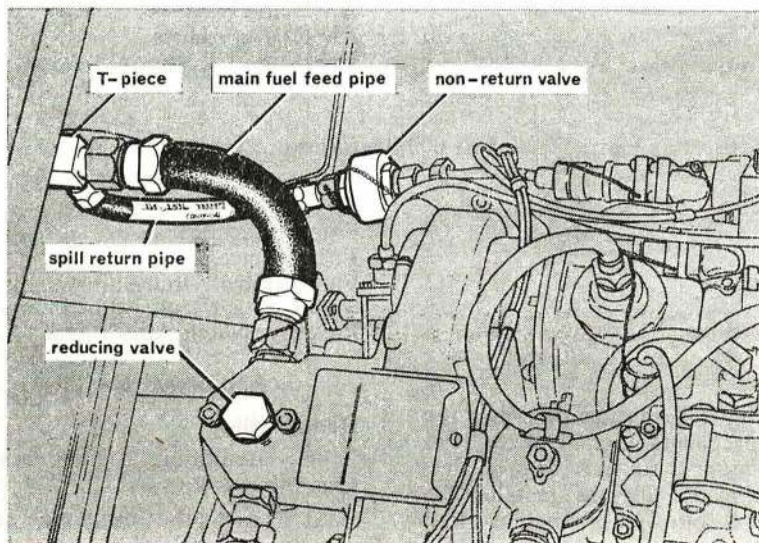


Fig. 1. SPILL T-PIECE

(A.L. 30, May 68)

- (4) Hand starter. Blank is left in place on installations not using the hand starter.
- (5) Fuel pressure reducing valve inlet.
- (6) Tachometer generator electrical connection.
- (7) Oil pressure gauge union.
- (8) Air intakes.
- (9) Relay box electrical connection.
- (10) Relay box electrical connection.
- (11) Fuel inlet housing drain.
- (12) Generator cooling air outlet.
- (13) Oil tank vent.

Masking:

- A Air delivery valve bleed passage fish-tail.
- B Air delivery valve bleed screws.
- C Fuel pump drain.
- D Spill control unit spill union.
- E Spill control unit drain.
- F Combustion chamber drain.
- G Oil filler cap and dipstick; remove and store until required.

Trolley Installation

13. With the engine installed, the packaged unit can then be installed in the trolley and the fuel tankage filled with the correct grade of fuel. De-inhibiting of the fuel system (para. 7) should then be carried out. Check the contents of the oil tanks and top-up if required. Make a visual check to see if any

leakage of oil has occurred. Test run the engine as per paragraph 9.

STARTING—CHECKING—STOPPING

Introduction

14. If the operator is not conversant with the details of the particular equipment being worked upon he must consult the relevant Air Publication, because the following information should be regarded merely as an example of the routine.

Pre-start Inspection

15. After preparing the engine for service, it is necessary to position and prepare the trolley and to inspect the engine to ensure its readiness for starting. In addition to the operations detailed in the servicing schedule this inspection must be carried out prior to every start as follows:

- (a) Position the starter trolley on firm ground and apply the brakes.
- (b) Lower and lock the stabilizers.
- (c) Secure the exhaust flap in the open position.
- (d) Check that the intake debris guard is free from obstruction.
- (e) Replenish the fuel and oil tanks as required.

Note.—When the engine is stationary it is

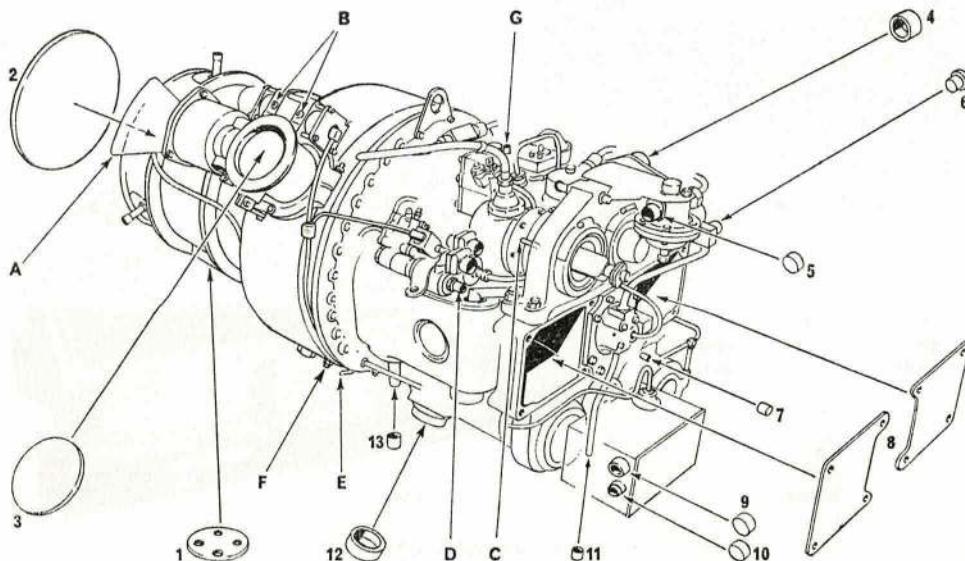


Fig. 3. BLANKS AND MASKING

possible for oil to drain from the tanks and through the pump to the lower accessory gearbox. Therefore, the oil level must be checked on completion of every engine run, and if it is found to have dropped on the pre-start inspection then this can be attributed to drainage.

(f) Ensure that the fuel and oil filler caps are secure.

(g) Fit the test control equipment required to simulate aircraft engine starting.

Starting

16. **Electric Starting.** After satisfactory completion of the pre-start inspection, start the engine as follows:

(a) Open the control panel lid and check that the emergency stop lever is in the "RUN" position.

(b) Select "ELECTRIC START" on the starting switch. The engine should start, accelerate and stabilize at idling speed. Check the oil pressure and exhaust temperature.

WARNING . . .

If the exhaust temperature during starting exceeds the figure quoted in the relevant Air Publication, stop the engine immediately (selector switch to "OFF").

Failure to Start

17. When an engine fails to start or has been subjected to an emergency shut-down, at least 20 seconds must elapse or until fuel ceases to flow from the fuel drain valve before a further attempt is made. During normal starting operations some fuel may issue from the drain valve.

18. After three unsuccessful attempts to start the engine the following action must be taken:

(a) Switch "OFF".

(b) After the engine has stopped, select "DEAD CRANK" until 1000 r.p.m. is indicated and then return the selector switch to "OFF".

(c) Allow the engine to run down, after which, another attempt to start can be made.

Note.—During the run down period listen for noises which may indicate rubbing of the compressor or turbine.

Checking

19. Acceptance checks can only be carried out at idling and maximum because these are the only running conditions. The figures quoted in the relevant Air Publication are equally acceptable whether the unit is undergoing a servicing run or starting an aircraft engine.

20. Under adverse weather conditions or when the engine is nearing the end of its life, the indicated pressures and/or temperatures may vary from the normal acceptance figures. This is permissible provided that the "OPERATING LIMITATIONS" are never exceeded.

21. When the engine has stabilized at idling speed, as an example the running conditions might be as follows:

R.P.M. ... 24,000±1,000

Jet Pipe Temperature ... 450°C.

Oil Pressure (Min.) ... 15 lb/sq. in.

WARNING . . .

Unless the sonic venturi is being tested, the engine may only be accelerated to maximum conditions when the hose is connected to a test orifice rig or to an aircraft.

22. Accelerate the engine to maximum conditions by operating the switch on the wander lead of the test orifice assembly.

WARNING . . .

If the jet pipe temperature exceeds 650°C. during acceleration from idling to maximum, the engine must be switched "OFF" immediately.

23. As an example, the running conditions at maximum speed should be as follows:

R.P.M. ... 35,000±100

Jet Pipe Temperature ... 530°C.

Oil Pressure ... 50±15 lb/sq. in.

24. Release the switch on the wander lead to allow the engine to return to idling conditions.

Stopping

25. To stop the engine, switch the starting selector switch to the "OFF" position. Opening this switch closes the high pressure fuel shut-off solenoid valve and cuts out the booster pump.

26. When the engine has ceased to rotate, disconnect the hose and electrical lead from the test orifice rig and fit them in their stow-ages.

AIRCRAFT ENGINE STARTING

Positioning

27. The starter trolley must be positioned to give maximum operational speed and safety. The position will vary with the type of aircraft and must comply with the instructions given in the relevant aircraft Air Publication, but as far as is practicable the following requirements should be met:

- (a) Trolley to be on firm and level ground.
- (b) Exhaust gases should pass clear of the aircraft structure and unlikely to be blown over the operator.
- (c) The path of any movement of the trolley should be across the aircraft's air intakes and not its exhaust.
- (d) Ensure that the ground crew can see the instruments of the starter unit, and at the same time they themselves can be seen from the cockpit of the aircraft.

Starting

28. The starter trolley may be connected to the aircraft with the starter engine stopped or running at idling speed. The procedure for starting an aircraft engine is as follows:

- (a) Position the starter trolley correctly.
- (b) Apply the parking brakes, lower and lock the stabilizers.
- (c) Open the exhaust cover.
- (d) If the hose is not fitted, offer it through the sock and secure it to the sonic venturi with the band coupling. Pull up the draw string and tighten the sock around the hose.
- (e) Connect the hose to the aircraft.

WARNING . . .

The air delivery hose must always be connected before and disconnected after the electrical lead.

- (f) Plug in the electrical lead to the aircraft.
- (g) Start the starter trolley engine.
- (h) Give the required indication to the pilot that the trolley is connected and in readiness to start the aircraft propulsion engine.

After Starting

29. Actual control of the starting rests with

the pilot, and when starting is complete the pilot will give the signal indicating removal of the starter unit. Proceed as follows:

- (a) Ensure that the indicator light is out, showing that air is not being delivered.
- (b) Disconnect the electrical lead from the aircraft.
- (c) Disconnect the air delivery hose from the aircraft and stow the hose on top of the trolley.
- (d) Raise and lock the stabilizers.
- (e) Release the parking brake and move the starter trolley.
- (f) If another start is not required, stop the trolley engine by turning the starter selector switch to the "OFF" position.

SERVICING

General

30. The following information details some of the routine servicing instructions specified in the relevant Servicing Schedule, those servicing checks which are self explanatory being excepted. To enable the engine to function with maximum efficiency and to reduce the possibility of faults and failures to a minimum, routine servicing must be performed conscientiously.

Oil Filter

31. **Removal and Cleaning.** The oil filter (Fig. 4) is removed and cleaned as follows:

- (a) Position a suitable container to collect the drainage oil.
- (b) Unscrew the worm drive clip. Remove the taper clamps and filter bowl.
- (c) Unscrew the filter tube and remove the filter pack from the bowl.
- (d) Inspect the filter bowl for the presence of deposits requiring further investigation.
- (e) Remove the nut, tabwasher and spacers from the filter tube and withdraw the eleven filter discs and ten inter-disc spacers.

Notes.—

1. Note the number of spacers removed from beneath the tabwasher to aid reassembly.
 2. On some engines an end facing is provided instead of the spacers immediately beneath the tabwasher.
- (f) Inspect the filter discs and tube for the presence of foreign matter requiring further investigation.

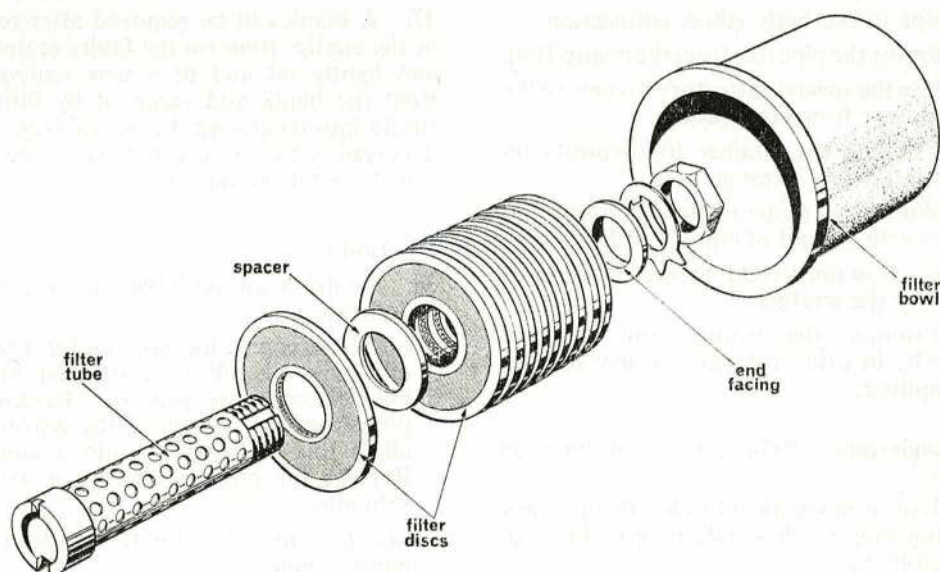


Fig. 4. OIL FILTER

(g) Wash all parts in clean kerosine and dry them with the aid of compressed air.

Note.—Rag must **NOT** be used to dry the filter discs.

32. **Assembly.** The oil filter is assembled as follows:

(a) Replace a filter disc followed by a spacer until the eleven discs and ten inter-disc spacers are fitted.

(b) Secure the filter discs and spacers by adding the required number of spacers (para. 31(e) note 1), tabwasher and nut to the filter tube. Tighten the nut to a torque loading of 50 lb in. and lock with the tabwasher.

Notes.—

1. Ensure that the correct number of spacers are fitted immediately beneath the tabwasher. Assembly is correct when the nut is flush with the edge of the centre tube.

2. On certain engines (para. 31(e) note 2), care must be taken not to overtighten the retaining nut, otherwise the filter discs may be damaged.

(c) Offer the filter pack, tapped hole leading, to the filter bowl, and use the cut-away end of the tube to screw it securely to the stud at the base of the bowl.

(d) Oil a new sealing ring sparingly and fit it to the filter block flange.

(e) Secure the filter bowl to the block by means of taper clamps and a wormdrive clip.

Oil Strainers

33. **Removal and Cleaning.** The oil strainers (Fig. 5) front and rear main bearings, are

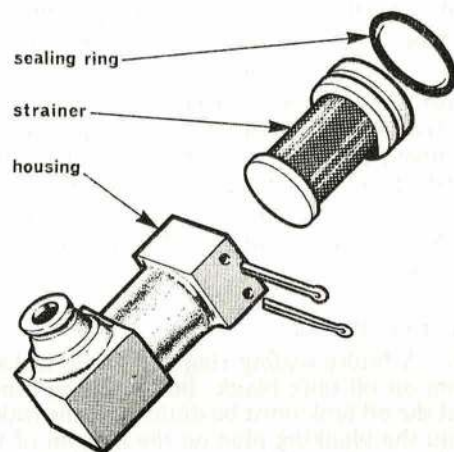


Fig. 5. STRAINER AND HOUSING

removed and cleaned as follows:

(a) Remove the two split pins securing the
(A.L. 30, May 68)

- oil pipe to the body elbow connection.
- (b) Spring the pipe free from the connection.
- (c) Use the special extractors to remove the oil strainer from its housing.
- (d) Examine the strainer for deposits requiring further investigation.
- (e) Wash the strainer in clean kerosine and dry it with the aid of compressed air.

Note.—Rag must **NOT** be used to clean or dry the strainer.

- (f) Examine the strainer for damaged strands. In case of damage a new strainer is required.

34. Replacing. Refit the oil strainer as follows:

- (a) Use clean engine oil to lightly oil a new sealing ring which should then be fitted to the strainer.
- (b) Fit the strainer into its housing and press it firmly into position.
- (c) Spring the pipe into position and apply direct pressure whilst fitting the two split pins. Spread the legs of the split pins.

Oil Filler Strainer

35. To remove, inspect and replace this strainer, proceed as follows:

- (a) Extract the large circlip that secures the strainer and remove the strainer.
- (b) Wash the strainer in clean kerosine and dry it with the aid of compressed air.

Note.—Rag must **NOT** be used to clean or dry the strainer.

- (c) Examine the strainer for damaged strands paying particular attention to the tinned portion. A damaged strainer must be replaced by a new or serviceable item.
- (d) Locate the strainer on its shoulder in the filler neck and refit the circlip into its groove.

Oil Tank Blanks

36. A faulty sealing ring will cause leakage from an oil tank blank. Before fitting a new seal the oil tank must be drained. If the leak is from the blanking plug on the bottom of the tank with the oil scavenge return pipe fitted, the pipe must be removed. Extract the split pins securing the pipe to the oil pump filter block and to the plug at each side of the oil tanks. Pull the pipe bobbins out of the connections.

37. A blank can be removed after removal of the circlip. Remove the faulty sealing ring and lightly oil and fit a new sealing ring. Refit the blank and secure it by fitting the circlip into its groove. If the scavenge pipe is damaged a new one will have to be fitted. Finally, refill the oil tanks.

Oil Tanks

38. To drain and refill the oil tanks proceed as follows:

- (a) If the engine has not run for a number of hours oil will have drained into the lower accessories gearbox. Remove the plug from the bottom of the gearbox and allow this oil to drain into a container. Replace the plug and secure it with new split pins.
- (b) Disconnect the low tension lead to the ignition unit.
- (c) Disconnect the oil pressure supply pipe after first placing a container below to receive the oil.
- (d) Select "ELECTRIC START" and run for 15 seconds. Allow a cooling period and run for a further 15 seconds. Normally two running periods are sufficient to empty the oil system, but under adverse conditions another run may be required.
- (e) When drainage is complete, refit the pressure supply pipe and secure it with new split pins.
- (f) Remove the oil filter and strainers. Clean and refit them as detailed previously (para. 31–34).
- (g) Refill the oil tanks.
- (h) Connect the low tension lead to the ignition unit.

Joint Face Leakage

39. Oil leakage from the joint faces of engine components may be cured by checking the securing nuts for tightness. If the leakage persists a new oil seal must be fitted.

40. Oil leakage from an engine accessory flange indicates a defective oil sealing ring. To rectify, the accessory must be removed and a new ring fitted.

Pipe Connection Leakage

41. If oil or fuel is found leaking from a pipe connection (Fig. 6), the joint must be dis-

connected and a new sealing ring fitted as follows:

- (a) Remove the split pins or circlip securing the connection.
- (b) Spring the pipes apart and remove the sealing ring.
- (c) Lightly oil the new ring and fit it on the bobbin.
- (d) Spring the pipes into engagement and press firmly into position.
- (e) Fit new split pins or, if applicable, the original circlip provided that it is serviceable, otherwise fit a new circlip.

Note.—If the sealing ring on an oil pipe connection has disintegrated, the strainer and filter must be checked for the missing pieces. If they are not recovered, the oil system must be checked throughout so as to prevent any blockage resulting in oil starvation and consequent damage.

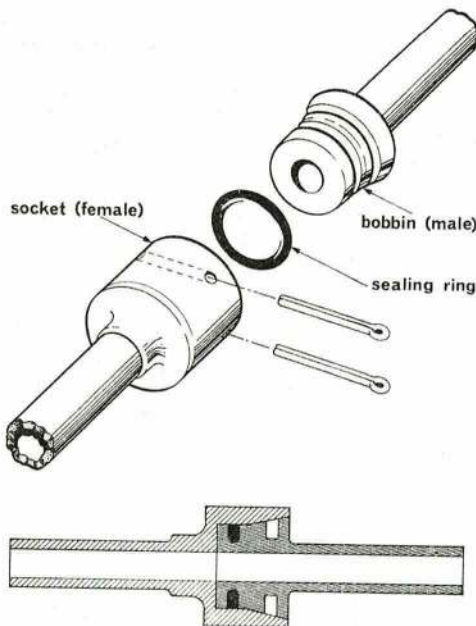


Fig. 6. PIPE CONNECTION

42. If test running shows that the leakage still persists, the connection should be further examined for malalignment and the male and female ends for damage.

Fuel Filter

43. **Removing and Cleaning.** The fuel filter

(Fig. 7) should be removed and cleaned as follows:

- (a) Unlock and unscrew the inlet connection to the filter. Unlock and slacken the pipe connection at the reducing valve to allow the pipe to be swung clear of the filter.
- (b) Bend the tabwasher and slacken the dome securing nut sufficiently to allow the fuel to drain away. Waste rag placed under the filter will prevent the fuel flowing over the engine. Remove the nut, tabwasher and dome.
- (c) Invert the dome and remove the circlip. Because the filter element is spring-loaded, removal of the circlip will be aided by pressing the base plate against the element.

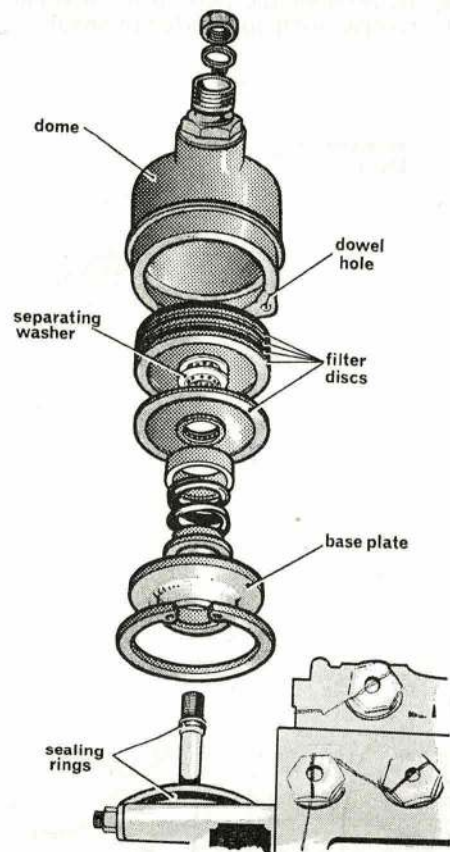


Fig. 7. FUEL FILTER

(d) Remove the element assembly. Place the parts in sequence to facilitate assembly.

(A.L. 30, May 68)

(e) Wash the filter discs by blocking one side of the centre hole with the thumb and applying clean kerosine under pressure to the other side. Use compressed air to dry the discs; rag must **NOT** be used.

Note.—This method should be adhered to otherwise there is a possibility that foreign matter on the outside of the discs may be washed into the centre where it cannot be removed by washing but may be carried into the control unit by the flow of fuel.

(f) Wash the rest of the parts in clean kerosine and use compressed air to dry them.

44. **Assembly.** Renew the sealing rings and proceed as follows:

(a) Reassemble the element in the dome in the reverse order to that for removal.

(b) Press down on the base plate and refit the retaining circlip.

(c) Lightly oil the large sealing ring and fit it on the pump body spigot.

(d) Place the dome assembly over the stud and ensure that it engages the locating dowel. Press into position, fit a new tab-washer and tighten and lock the securing nut.

(e) Position the fuel supply pipe and fit, tighten and wire-lock the two union nuts.

(f) Select "DEAD CRANK" on the starting switch for 15 seconds to pressurize the fuel system and examine the filter dome and pipe connections for signs of leakage.

Torch Igniter

45. Remove the torch igniter as follows:

(a) Disconnect the high tension lead.

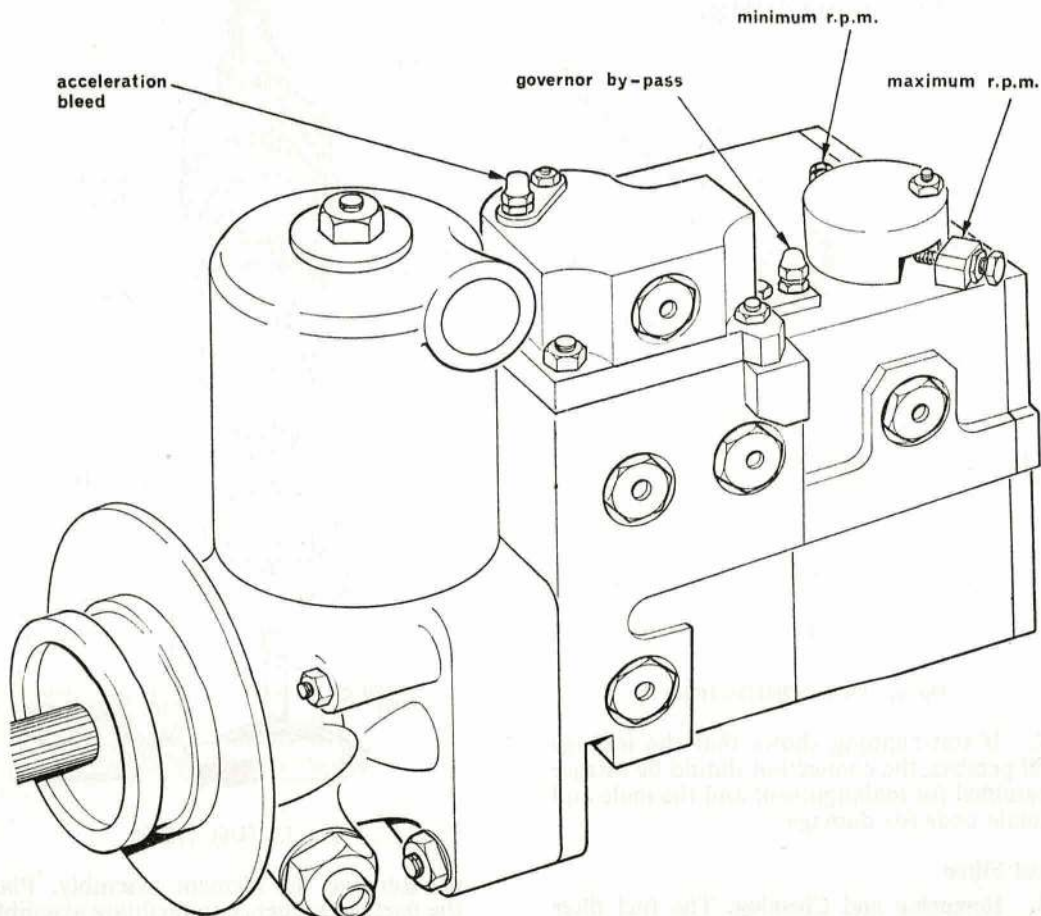


Fig. 8. FUEL CONTROL UNIT ADJUSTMENTS

(b) Remove the two split pins securing each end of the fuel feed pipe and remove the pipe.

(c) Remove the Allen screws or nuts and washers, as fitted, and withdraw the torch.

(d) If on inspection the torch igniter is found to be damaged it must be replaced by a new or serviceable item. A damaged joint washer or sealing ring must also be renewed.

46. The procedure for refitting the torch igniter is the reverse to that for removal. If a new one is fitted, ensure that the air pick-up hole faces the air flow. Looking into the aperture of the torch upper-mounting the pick-up hole should be at eight o'clock.

ADJUSTMENTS

Fuel Control Unit

47. The following adjustments can be made with the fuel control unit mounted on the engine. After each adjustment has been made the effect must be observed and, if necessary, further adjustment made. The positions of the screws are shown on Fig. 8.

48. **Acceleration Bleed Screw.** Remove the locking wire and the capnut. Turn the adjusting screw as required, "IN" to increase acceleration fuel supply and "OUT" to decrease. On completion of the adjustment and when it has been proved satisfactory by a test run, hold the adjusting screw whilst

tightening the locknut, replace and tighten and capnut and wire-lock both nuts.

Note.—The maximum movement of the acceleration bleed screw must not exceed one quarter of a turn at each adjustment.

49. **Governor By-pass Screw.** The governor by-pass screw is fitted for initial calibration of the engine governor and is set when the engine is bench tested. Under no circumstances should it be adjusted at unit level.

50. **Maximum R.P.M. Screw/Minimum R.P.M. Stop.** In practice the min. r.p.m. stop is adjusted in conjunction with the max. r.p.m. screw. In fact it merely acts as a lock on the throttle spindle; for example if the max. r.p.m. screw is adjusted $\frac{1}{2}$ turn anti-clockwise the min. r.p.m. stop must be turned $\frac{1}{2}$ turn clockwise in order to lock the spindle in that position. If it is required to turn the max. r.p.m. screw clockwise then the min. r.p.m. stop must be turned anti-clockwise first.

Spill Control Unit

51. The following adjustments can be made with the spill control unit fitted on the engine. After each adjustment a test run must be made and the effect observed until the required condition is obtained. The positions of the adjusting screws are shown on Fig. 9.

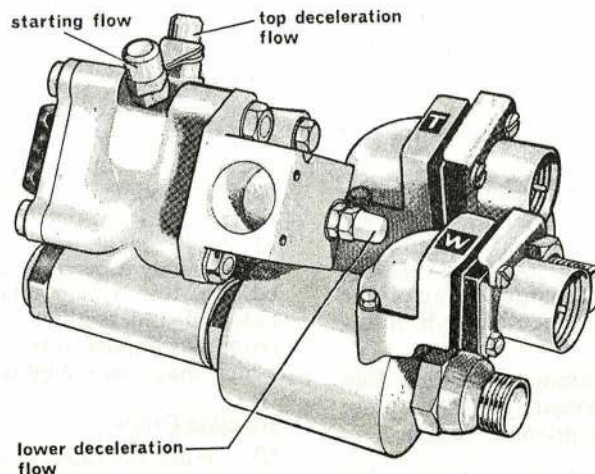


Fig. 9. SPILL CONTROL UNIT ADJUSTMENTS

52. Starting Flow Adjustment. Remove the locking wire and capnut. Using the special spanners supplied hold the adjusting screw and slacken the locknut. Turn the adjusting screw as required, "OUT" to decrease the starting flow and "IN" to increase.

Note.—The maximum movement of the starting flow adjustment must not exceed one quarter of a turn at each adjustment.

53. Top Deceleration Flow Adjustment. Remove the locking wire and capnut. Using the special spanners supplied hold the adjusting screw and slacken the locknut. Turn the adjusting screw as required, "OUT" to decrease the deceleration flow and "IN" to increase.

Note.—The maximum movement of the top deceleration flow adjustment must not exceed one eighth of a turn at each movement.

54. Lower Deceleration Flow Adjustment. Remove the locking wire and capnut. Using the special spanners supplied hold the adjusting screw and slacken the locknut. Turn the adjusting screw as required, "OUT" to decrease the lower deceleration flow and "IN" to increase.

Note.—The maximum movement of the lower deceleration flow adjustment must not exceed one eighth of a turn at each movement.

Pressure Switch

55. Checking. Operation of the pressure switch can be verified by observing the battery charge during the engine starting cycle, thus:

- Carry out the pre-start inspection and start the engine.
- As the engine begins to accelerate the ammeter should show a discharge of 7 amp. When a speed of approximately 7,000 r.p.m. is reached the ammeter reading should change to a discharge of 2 amp. The engine will continue to accelerate to idling speed.
- If the change in ammeter reading does not occur at approximately 7,000 r.p.m., adjust or replace the pressure switch.

56. Adjusting (Fig. 10). Certain starting system faults may be traced to the pressure switch. The switch can be adjusted in position,

but to gain access to the adjusting screw the compressor delivery pressure pipe must be disconnected from the switch. To make an adjustment, hold the adjusting screw, slacken the locknut and adjust as required; "IN" to decrease the speed and "OUT" to increase.

Note.—The maximum movement of the adjusting screw must not exceed one eighth of a turn at each adjustment.

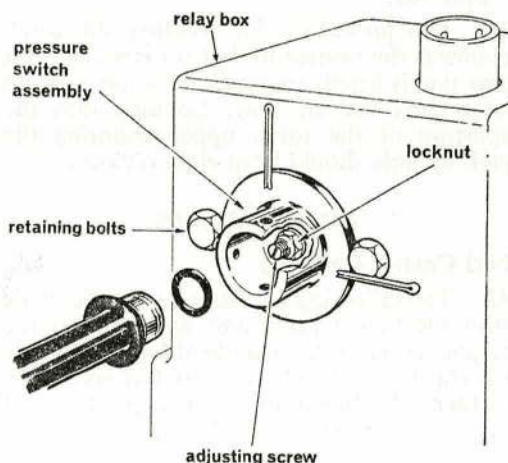


Fig. 10. PRESSURE SWITCH ADJUSTMENT

57. If the required condition is not obtained within a reasonable range of adjustment, a new or serviceable switch should be fitted. A new switch is pre-set on manufacture but, as a pre-installation check on a serviced switch, a pressure of $1\frac{1}{4}$ lb per sq. in. is required to trip the switch.

FAULT DIAGNOSIS

General

58. The following information deals with faults which may be met during operation of the starter trolley. The behaviour of the engine should be carefully observed at all times, and any abnormality in functioning or of gauge readings should be investigated immediately it becomes apparent or is reported. In this way, minor troubles can be detected and rectified and so are prevented from developing into serious engine faults which may cause engine failure.

Running Faults

59. When the cause of a running fault is not apparent, a process of systematic elimination of the possibles should be adopted. Thus, the faults detailed in the following table are in

the sequence most likely to lead to early rectification.

60. The partial failure of an engine component may not cause immediate and complete failure of the engine, but will usually be indicated by loss of power, rough running and vibration.

61. Fuel system adjustments are critical. Alterations to the various adjusting screw settings must adhere to the information given in paragraphs 47 to 55.

Note.—Although no limits of adjustment are given, care must be taken that any alteration is having the desired result. If, for example, after altering an adjusting screw one full turn by $\frac{1}{4}$ turn increments, no change in engine condition is apparent, check before further adjustment that the correct screw is being adjusted.

DEFECT RECTIFICATION

Solenoid Valves

62. To check for correct operation of the fuel system solenoid valves, hold the valve body and switch the starting selector to "ELECTRIC START" and "OFF". A distinct impulse should be felt each time the switch is operated.

WARNING . . .

On any occasion, other than those for which a procedure is given, that it is required to turn the engine by the electric starter, the electrical plugs to the high pressure fuel solenoid and torch igniter solenoid must be disconnected.

Torch Igniter

63. Before checking the fuel spray, disconnect the electrical plug from the high pressure fuel shut-off solenoid and the low tension input to the ignition unit. Disconnect the fuel and electrical supplies to the torch igniter and remove the torch. Refit the torch to the fuel pipe so that the torch points away from the engine.

64. Select "ELECTRIC START" and observe the fuel spray which should be finely divided and in the form of a cone. If there is no spray or the spray is irregular in form, the torch is blocked and must be replaced by a new or serviceable torch. If the spray is feeble

and fuel drips from the torch, the pressurizing valve of the fuel control unit is defective and will necessitate replacement of the fuel control unit by a new or serviceable unit.

Note.—Before any rectification of the fuel system is undertaken the low tension input to the ignition unit must be disconnected.

Fuel Blockage

65. If fuel obstruction is evidenced, the system must be checked systematically. Move the starting selector switch to the "DEAD CRANK" position, thereby operating the booster pump. Unless the blockage is downstream of the high pressure fuel shut-off cock, render the solenoid valve inoperative by removing the electrical connection.

Drain Valve

66. The operating movement of the fuel drain valve is so small that a slight carbon deposit could cause it to stick. If the valve is suspect it should be removed and cleaned, and if its operation is still not satisfactory a new or serviceable valve must be fitted.

Electrical Wiring

67. Faulty connections, faulty insulation and lack of continuity will cause electrical system failures. Wiring diagrams and general information on the electrical system will be found in the relevant Air Publication.

Torch Igniter Sparking

68. Before checking the torch igniter for efficiency of sparking, disconnect the high pressure fuel and torch igniter solenoid electrical plugs. Disconnect the fuel and electrical supplies to the torch, remove the torch and reconnect the electrical lead.

69. Select "ELECTRIC START", and if a spark cannot be seen but a "cracking" sound issues from the torch, an internal breakdown is indicated and a new or serviceable torch igniter must be fitted.

Thermocouple Testing

70. The exhaust gas temperature measuring system as a whole should be checked and tested in accordance with A.P. 1275A, Vol. 1, Sect. 17, Chap. 8, Appendix 1.

(A.L. 30, May 68)

Oil System

71. A process of systematic elimination should be used to detect a blockage or a connection drawing air. The increase of pressure caused by a blockage may itself cause sealing rings to fail. In such instances any defective rings must be renewed.

Oil Dilution

72. If the air supply to the fuel tube labyrinth is faulty fuel will leak into the oil system. The pipe connecting the fuel inlet housing with the air intake casing should therefore be checked for leaks or obstructions which must be rectified.

Oil Pressure Gauge

73. If it is suspected that the oil pressure gauge is faulty it should be checked against a master gauge. If it is found to be faulty, fit a new oil pressure gauge.

Air Delivery Valve

74. A compressed air supply of between 20 to 40 lb/sq. in. directed at the pressure inlet should cause the valve to move to the delivery

position. When the air supply is removed the valve should return, under spring pressure, to the bleed position. As a check with the valve in situ no air should pass the delivery port when the engine is idling, nor pass the bleed port when the engine is at maximum r.p.m. Because the temperature of the air is approximately 210°C. care must be taken if the hand is used to detect a leak.

Air Delivery Hose

75. The sealing ring in the air delivery hose aircraft connection and in the connection at the sonic venturi must be renewed if swollen, burnt or disintegrating. A piece of wire can be used to remove a damaged ring, and a new ring can be fitted by pushing it squarely down the bore of the connection until it fits into the recess.

Freedom of Rotation

76. To check the rotating parts of the engine for freedom, operate the starting switch to the "DEAD CRANK" position for a period not exceeding 15 seconds, then listen for rubbing noises as the engine runs down.

FAULTS — CAUSES — REMEDIES

Fault	Possible Cause	Remedy
1. Starting circuit remains inoperative when either "ELECTRIC START" or "DEAD CRANK" is selected.	Fuse F.1 blown. Batteries discharged.	Fit new fuse. Fit serviceable batteries.
2. Fuel booster pump functions when "ELECTRIC START" is selected but starter motor remains inoperative.	Relay RL. 1 defective. Microswitch actuator in air pressure switch sticking. Starter motor defective.	Fit new relay. Fit new or serviceable air pressure switch. Fit new or serviceable starter motor.
3. Starter motor operates when "ELECTRIC START" or "DEAD CRANK" is selected but engine does not turn.	Roller clutch stuck in disengaged position. Starter motor drive sheared.	Fit new or serviceable roller clutch assembly. Fit new or serviceable starter.
4. Starter motor turns engine and accelerates but engine fails to light up.	Insufficient cranking speed caused by discharged batteries. No electrical supply or supply intermittent to torch igniter. No spark at torch igniter, suspect faulty electrode. No fuel supply at torch igniter inlet connection. Irregular or no spray from torch igniter. Feeble spray or fuel drips from torch igniter.	Fit serviceable batteries. Check h.t. cable connections and voltage from booster coil. Fit new or serviceable booster coil and/or torch igniter as required. Fit new or serviceable torch igniter. Check operation of torch igniter solenoid. Fit new or serviceable torch igniter. Defective fuel control unit pressurizing valve. Fit new fuel control unit.
5. Overheating and/or excessive flame during starting.	Accumulation of fuel in main casing. Starting fuel flow incorrect. Faulty pressure regulating valve. Air delivery valve main butterfly stuck open or partly open.	Check that the combustion chamber drain valve is operating. Adjust spill control starting flow adjustment screw "OUT" by $\frac{1}{4}$ turn increments anti-clockwise. Fit a new or serviceable item. Check operation of air delivery valve mechanism. If faulty, fit a new or serviceable air delivery valve.

Fault	Possible Cause	Remedy
6. Engine lights up but cuts out or fails to reach idling speed.	Pressure switch operating too early. Insufficient fuel at combustion chamber.	Check operation of switch and adjust as required. Adjust spill control starting flow adjustment screw "IN" by $\frac{1}{4}$ turn increments clockwise.
7. Engine slow in settling at idling r.p.m.	Fuel lower deceleration flow incorrect.	Adjust spill control lower deceleration screw "OUT" by $\frac{1}{8}$ turn increments anti-clockwise.
8. Engine fails to accelerate.	Faulty electrical connection to aircraft. Faulty spill control valve solenoid. Fuel control unit acceleration flow incorrect.	Check circuit. Check operation of solenoid. Adjust acceleration bleed screw "IN" by $\frac{1}{4}$ turn increments clockwise.
9. Engine slow to accelerate to maximum r.p.m. without excessive rise in jet pipe temperature.	Fuel control unit acceleration flow incorrect.	Adjust fuel control unit acceleration bleed screw "IN" by $\frac{1}{4}$ turn increments clockwise. Note—Adjustment of the acceleration bleed screw affects the starting and maximum r.p.m. flow, thereby necessitating the resetting of these two adjustments.
10. Excessive jet pipe temperature on acceleration.	Air delivery hose connection leaks.	Check sealing rings on air delivery hose connections to aircraft and sonic venturi.
11. Engine surges on acceleration.	Fuel unit acceleration flow. Air delivery valve not fully open.	Adjust fuel control unit acceleration bleed screw "OUT" by $\frac{1}{4}$ turn increments anti-clockwise. Check operation of solenoid valve controlling acceleration; fit a new or serviceable item if necessary. Renew the air delivery valve if solenoid is serviceable.
12. Apparent failure of air delivery valve to open.	Indicator light failure.	Change the lamp.
13. Failure of air delivery valve to open.	Air delivery valve solenoid unserviceable. Air delivery valve unserviceable.	Check the solenoid and, if required, fit a new one. Check the operation of the valve.
14. Incorrect maximum speed.	Maximum r.p.m. stop on fuel control unit incorrectly adjusted.	Adjust maximum r.p.m. stop as required.
15. On deceleration, engine cuts above 30,000 r.p.m.	Fuel top deceleration flow incorrect.	Adjust spill control top deceleration screw "IN" by $\frac{1}{8}$ turn increments clockwise.

Fault	Possible Cause	Remedy
16. Engine fails to decelerate below 30,000 r.p.m.	Fuel top deceleration flow incorrect.	Adjust spill control top deceleration screw "OUT" by $\frac{1}{8}$ turn increments anti-clockwise.
17. On deceleration, engine cuts below 30,000 r.p.m.	Fuel lower deceleration flow incorrect.	Adjust spill control lower deceleration screw "IN" by $\frac{1}{8}$ turn increments clockwise.
18. Engine cuts out under stable conditions.	High pressure fuel solenoid faulty.	Check operation of solenoid.
19. High oil pressure.	Faulty gauge. Blocked pipes or strainers. Faulty oil pump.	Fit new oil pressure gauge. Relieve blockage. Fit a new or serviceable oil pump. Note—Synthetic oil OX-38 must NOT be mixed with mineral oil. Mixture produces a high viscosity sludge giving excessive oil pressure.
20. Low oil pressure.	Insufficient oil. Faulty gauge. Fuel leaking into oil system. Faulty oil pump.	Check for leaks and oil level in the tanks. Fit a new oil pressure gauge. Check as for item 21. Fit a new or serviceable oil pump.
21. Oil level in tanks found to be rising.	Fuel leakage into the oil system.	Check fuel tube labyrinth pressure air supply. Check fuel tube sealing ring for serviceability.
22. Fuel or oil leaks from pipe or component connection.	Sealing ring unserviceable or not seating correctly.	Check the connection and if necessary renew the sealing ring.
23. Smoke issues from rear bearing breather during running.	High oil pressure. Inefficient scavenging.	Check as for item 19 "Possible Cause" items 2 and 3. Check that scavenge pump is not pumping air.

This file was downloaded
from the RTFM Library.

Link: www.scottbouch.com/rtfm

Please see site for usage terms,
and more aircraft documents.

