Chapter 5
FUEL CONTROL UNITS
Type BA.70573, BA.61076, BA.60351, BA.62403, BA.73323

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Preliminary information

1. The following list details F.C.U. type numbers and relative engine mark numbers.

BA.70573	Avon Mk. 1
BA.61076	Avon Mk. 107 and 108
BA.60351	Avon Mk. 109
BA.62403	Avon Mk. 113 and 114
BA.73323	Avon Mk. 115 and 116

2. The importance of maintaining the internal cleanliness of the unit at all times cannot be over emphasized, and to ensure that the parts are not contaminated with foreign matter during reconditioning, the exterior of the unit should first be cleaned. Check that all orifices are effectively blanked, then externally wash the unit in clean kerosine.

3. After the B.P.C. unit has been removed from the F.C.U., reference should be made to A.P.4282A, Vol. 2, Part 3, Sect. 3, Chap. 1, which gives detailed instructions for the reconditioning and initial rig test of the B.P.C. unit. It should be noted that the initial rig test of the unit must be completed in addition to the combined B.P.C. and F.C.U. calibration test.

Special tools

4. The following is a list of tools required for the reconditioning of the F.C.U.

Part No.	*Description*
HW.15840	Bench fixture
HW.16062	Adapter plate, for securing H.P. cock casing to HW.15840
HW.3499	Withdrawing tool, for split collet securing throttle valve lever hub
HW.11388	Withdrawing tool, for H.P. cock sealing bush
HW.16063	Adapter plate, for securing fuel filter housing to HW.15840
HW.16066	Withdrawing tool, for B.P.C. fuel return tube
HW.16065	Withdrawing tool, for non-return valve

DISMANTLING

5. During the dismantling of the unit all sealing rings, sealing washers and joint washers are to be removed and discarded.

6. Remove all locking wire, bonding leads and blanking plugs, then position the unit to give accessibility to the H.P. cock casing.

High pressure cock casing

7. The H.P. cock, throttle valve, pressurizing valve and the slow-running adjustment are attached to, or embodied in, the H.P. cock casing. Before dismantling these individual items it is advisable to remove the H.P. cock casing from the filter housing. Unscrew the $\frac{1}{4}$ in. nuts, plain and grover washers securing the H.P. cock casing to the filter housing. Remove the casing and attach it to the bench fixture HW.15840 fitted with the adapter plate HW.16062.

8. Unscrew and remove the main and primary fuel outlet unions from the H.P. cock casing.

Pressurizing valve

9. Remove the $\frac{1}{4}$ in. nuts, including one reach nut, plain and grover washers securing the cover to the H.P. cock casing. Detach the valve assembly and remove the valve seat, valve, spring seating cup, spring, spring seating washer and the spring adjusting washer. Ensure that the valve seat upper sealing ring is removed from the groove in the upper end of the valve housing in the H.P. cock casing.

Throttle valve

10. Unscrew the $\frac{1}{4}$ in. nuts, plain and grover washers and remove the throttle valve assembly from the H.P. cock casing.

11. Unlock and unscrew the $\frac{1}{4}$ in. nut securing the lever assembly to the pinion. Using the tool HW.3499, withdraw the split collet securing the lever hub (*fig.* 3). Remove the lever and hub assembly. Remove the 2 B.A. nut and grover washer securing the lever to the hub, then withdraw the 2 B.A. bolt and separate the lever and the hub. Remove the stop plate from the pinion. Bend back the double lockwasher tabs and unscrew the 2 B.A. nuts securing the pinion sleeve to the casing. Withdraw and separate the pinion sleeve and the pinion.

12. Unlock and unscrew the throttle valve locating screw from the casing. Remove the $\frac{1}{4}$ in. nuts, plain and grover washers securing the casing endplate, then remove the plate and withdraw the throttle valve. Unlock and unscrew the lever stop screws.

13. On BA.70573 units, unscrew the hollow bolt and remove the fuel inlet banjo connection. On other type units, unscrew the $\frac{1}{4}$ in. setscrews, plain and grover washers and remove the fuel inlet connection.

Idling adjustment assembly

14. Unscrew the cap-nut and remove the idling adjustment nut, remove and discard the two-piece sealing rings. Unscrew the

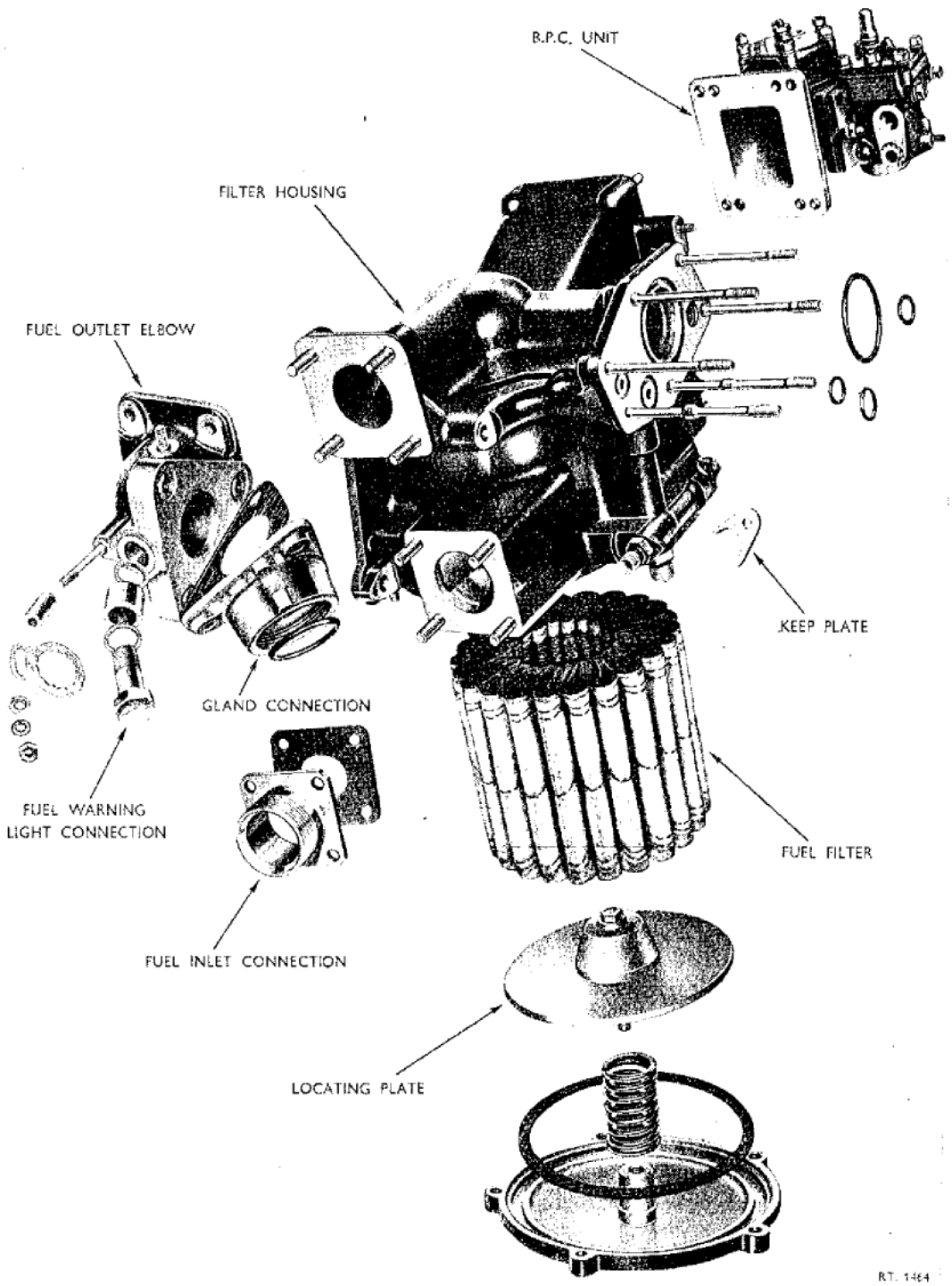

Fig. 1. Exploded view of filter housing (F.C.U. type BA.61076, BA.60351, BA.62403, BA.73323)

(A.L.18, Dec. 56)

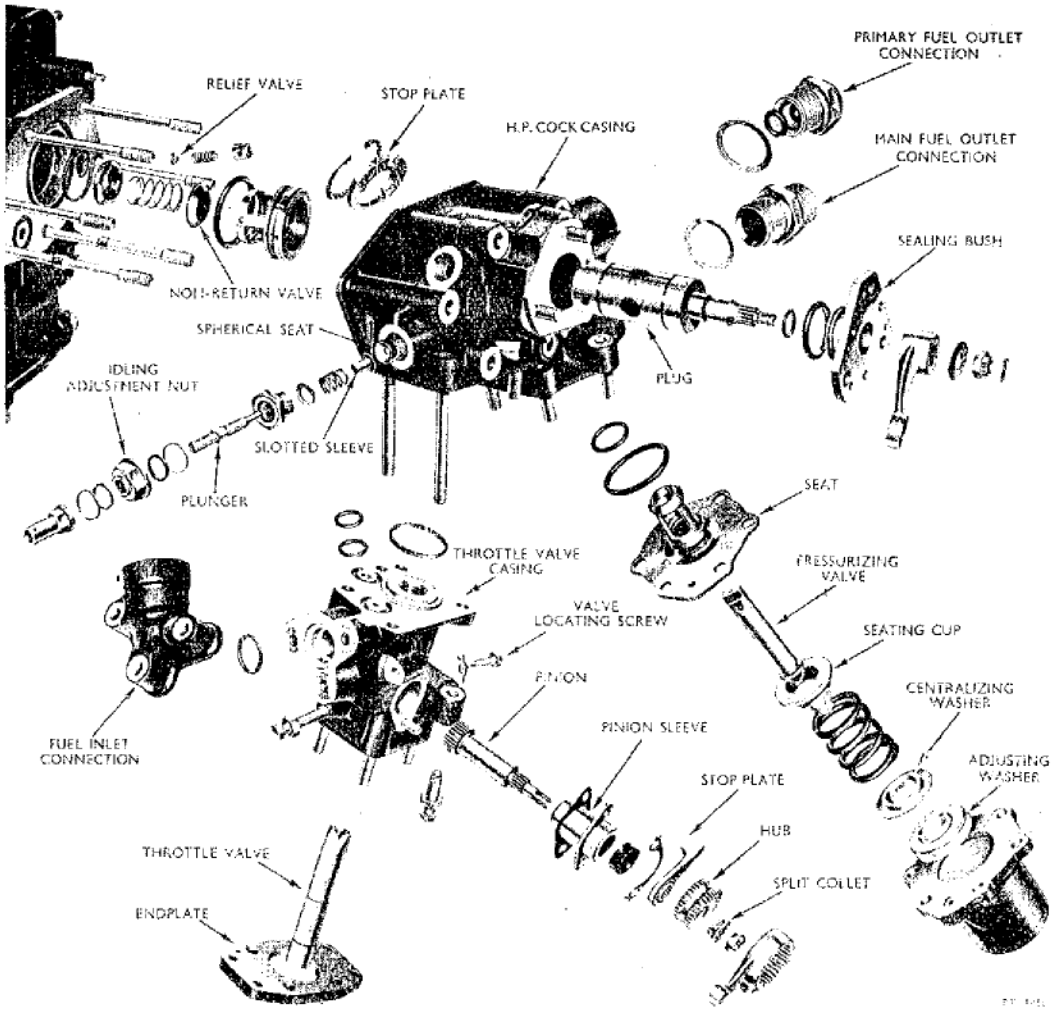

Fig. 2. Exploded view of H.P. cock casing (F.C.U. type BA.61076, BA.60351, BA.62403, BA.73323)

plunger and the plunger adapter, then withdraw the spring sealing washer, spring, slotted sleeve and the spherical seating.

H.P. cock

15. Unlock and remove the $\frac{1}{4}$ in. castellated nut and plain washer, then remove the operating lever. Unlock and unscrew the tabwashered $\frac{1}{4}$ in. nuts then, using the tool HW.11388, withdraw the sealing bush from the casing (*fig.* 4). Withdraw the H.P. cock plug from the casing. Remove the H.P. cock casing from the adapter plate, then remove the circlip and the stop plate from the casing. Remove the adapter plate from the bench fixture.

Barometric pressure control unit

16. When used with F.C.U. type BA.70573, disconnect the barometric pressure control fuel feed pipe from the unit and slacken off the gland nut securing the fuel return tube. Remove the $\frac{1}{4}$ in. nuts, plain and grover washers and detach the unit from the filter housing.

17. On all other types of unit, remove the $\frac{1}{4}$ in. nuts, plain and grover washers and detach the unit from the filter housing, simultaneously disconnecting the fuel feed attenuator tube and the fuel return tube.

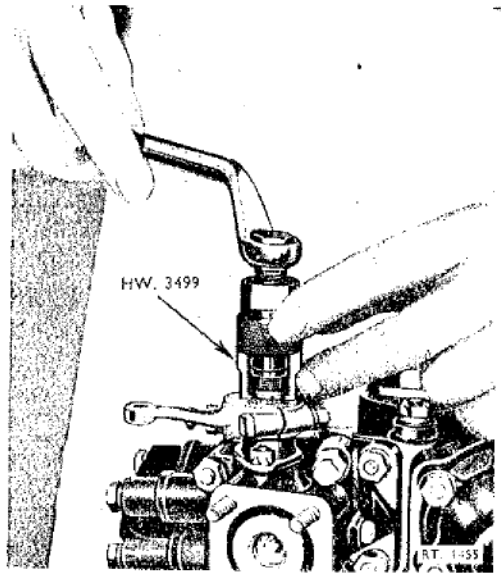

Fig. 3. Withdrawing split collet from throttle valve lever hub

Fuel filter assembly

18. Attach the fuel filter housing to the bench fixture fitted with the adapter plate HW.16063.

19. Remove the $\frac{1}{4}$ in. nuts, plain and grover washers securing the filter housing cover. Remove the cover and withdraw the filter. Unscrew the filter locating plate and remove the spring. Unscrew the 2 B.A. nut, plain and grover washer and remove the lockplate and distance piece securing the drain cock valve in the cover. Unscrew the slotted nut and remove the drain cock valve. Bend back the lockwasher tabs and unscrew the overboard spill connection from the cover.

Fuel filter housing assembly

F.C.U. type BA.70573

20. Remove the $\frac{1}{4}$ in. nuts, plain and grover washers securing the fuel filter inlet and outlet connections, then remove the connections from the housing.

21. Unscrew the gland nut securing the B.P.C. return tube to the filter housing, then remove the tube. Unscrew the cap-nut securing the B.P.C. fuel feed pipe to the jet attenuator body and disconnect the pipe. Remove the jet attenuator body from the filter housing, remove the grub screw from the end of the body and withdraw the spring, two orifice plates and the spacing washer. Remove the fuel filter drain connection.

All other type units

22. Remove the 2 B.A. nut, plain and grover washer and detach the lockplate and distance piece from the fuel warning light banjo connection, unscrew the hollow bolt and remove the distance piece and sealing washers from the fuel outlet elbow. Unscrew the $\frac{1}{4}$ in. nuts, plain and grover washers and remove the fuel inlet connection and outlet elbow connection. Unscrew the $\frac{1}{4}$ in. setscrews, plain and grover washers and detach the gland connection from the fuel outlet elbow.

23. Unscrew the 2 B.A. nuts, plain and grover washers and remove the plate retaining the B.P.C. attenuator tube in the filter housing. Pull out the attenuator tube, then remove the spring ring from the end of the tube and withdraw the spring seating plug, spring, two orifice plates and the spacing washer.

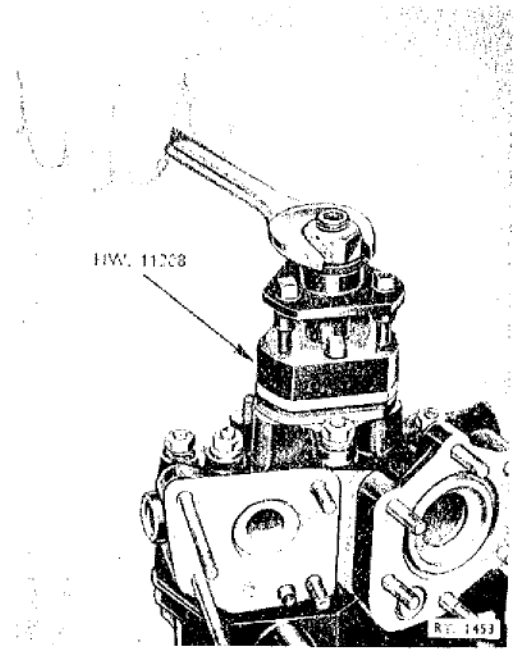

Fig. 4. Withdrawing H.P. cock sealing bush

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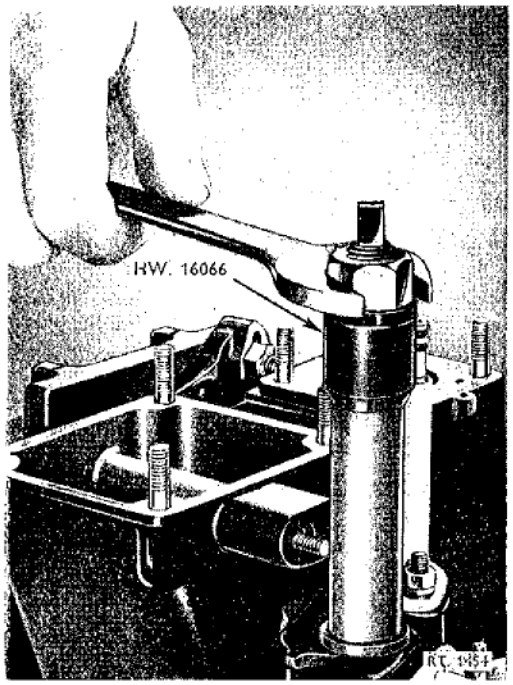

Fig. 5. Withdrawing B.P.C. fuel return tube (F.C.U. type BA.61076, BA.60351, BA.62403, BA.73323)

24. Remove and discard the sealing rings from the exposed end of the B.P.C. fuel return tube. Using the tool HW.16066, withdraw the tube from the filter housing (*fig.* 5).

Non-return valve

25. Using the tool HW.16065, withdraw the non-return valve housing from the joint face on the filter housing (*fig.* 6). Remove the spring clip retaining the valve assembly in the valve housing and remove the spring seating plate, spring and valve.

Relief valve

26. Remove the low pressure fuel relief valve spring cap, spring and valve from the low pressure fuel passage in the joint face on the filter housing.

27. Remove the filter housing from the adapter plate, and the adapter plate from the bench fixture.

CLEANING

28. The F.C.U. will normally be clean internally and it is most important to maintain this condition, a clean container in which to put the parts is an essential item if this is to be achieved. All parts must be cleaned and washed thoroughly before reassembling; a kerosine bath and spray gun is recommended for this purpose. No hard brushes or abrasives of any kind must be used. After washing, all parts must be dried by a compressed air blast; rag must not be used for this purpose.

INSPECTION

Redundant and consumable parts

29. All parts made redundant by the embodiment of modifications must be rejected during inspection.

30. The following parts must be discarded during dismantling, irrespective of their condition.

Joint washers
Rubber seals and sealing rings
Tabwashers
Locking wire and aluminium washers.

31. Two inspectional checks are common to all parts of the unit. Firstly, the visual inspection for obvious signs of damage, and secondly, as all internal parts are in contact with kerosine, the inspection of parts for corrosion. Damage and/or excessive corrosion will entail the rejection of the part or parts. Very slight scoring or corrosion may be acceptable but this will depend on the location of the affected surface and should be left to the discretion and experience of the inspector.

Dimensional checks

32. Parts which are subjected to wear must be dimensionally checked, and must be within the limits specified in the Schedule of Fits, Clearances and Repair Tolerances, A.P.4282D, Vol. 6, Part 3, Sect. 2.

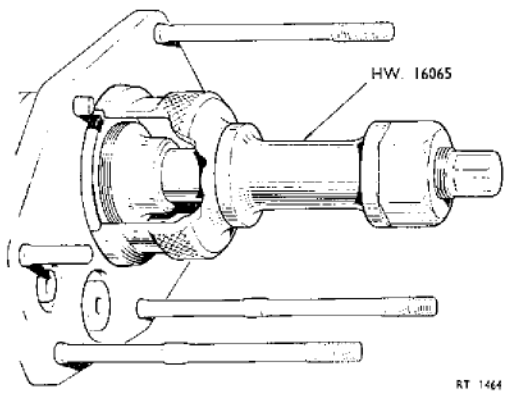

Fig. 6. Withdrawing non-return valve (F.C.U. type BA.61076, BA.60351, BA.62403, BA.73323)

Casings

33. Visually examine all casings for corrosion, cracks and damage, paying particular attention to joint faces and spigots. Check that all studs are in good condition and that inserts and unions are secure in the casing. Check all fuel passages for obstruction and damage.

34. Check the L.P. relief valve seat in the joint face of the filter housing for corrosion and damage, and the stop plug in the base of the pressurizing valve cover for security.

35. Inspect the seat in the idling adjustment housing in the H.P. cock casing for corrosion and damage. Check the H.P. cock plug sleeve for heavy running marks and scoring, if either or both of these are excessive the assembly must be rejected.

Springs

36. Examine all the springs for cracks, corrosion and distortion. Test the loading of the springs in accordance with the Schedule of Fits, Clearances and Repair Tolerances.

Plating

37. Signs of deterioration or flaking of the plating on any part will render it unserviceable and a replacement must be fitted. The rejected part or parts should be sent for re-plating.

Throttle valve

38. Examine the valve body for damage and scoring, paying particular attention to the fluted 'form' of the valve; light surface scores, barely visible, may be removed by polishing. Ensure that the splines on the pinion are in good condition. Check the internal seal groove in the pinion sleeve for corrosion. Inspect the throttle lever and hub for distortion and damage, paying particular attention to the splines. Check that the threads on the lever stop screws are in good condition and that there are no flats on the nippled ends.

H.P. cock

39. Examine the plug and the stop plate for damage, scoring and corrosion, paying particular attention to the fuel channels in the body of the plug, and the sealing land on the shank of the plug. Check the inner face of the sealing bush flange for electrolytic corrosion; if this is excessive the part must be cadmium replated (A.P.880). Check the lever for distortion and damage to splines.

Pressurizing valve

40. Examine the bore of the valve seat for damage, scoring and corrosion; ensure that the lead in and lead out of the bore are not damaged, as the slightest burr on either of these will damage the plunger when assembled. Examine the plunger for damage and scoring, paying particular attention to the 'formed' end. Check that the plunger moves freely in the valve seat. Inspect the spring seating cup for damage and corrosion, ensure that the locating peg in the base of the cup is secure and check the flange, normally in contact with the spring, for undue wear.

Idling adjustment assembly

41. Inspect the spherical seat for damage and corrosion, and examine the face of the seat for excessive bedding of the slotted sleeve; this will be revealed by a circular indentation on the face. Inspect the section of the flange which locates in the slotted sleeve for scoring. Examine the slot in the slotted sleeve for damage and burrs. Ensure that the plunger is not a loose fit in the slotted sleeve. Examine the internal threads of the cap-nut and adapter for damage. Inspect the sealing face of the adjusting nut for scoring and damage.

Non-return valve

42. Check the extraction threads for damage. Examine the valve body for corrosion and damage, paying particular attention to the valve seat which must be in perfect condition. Inspect the valve disc for corrosion, damage and excessive wear on the seating face.

Relief valve

43. Check all parts for scoring and damage.

REBUILD

44. The following instructions cover the rebuild of the fuel control unit and also checks which are necessary during the rebuild of the sub-assemblies constituting the complete unit. Certain sub-assemblies are rig tested at various stages of their build or before being attached to the main assembly. Reference is made to these tests at the appropriate stages.

45. Before commencing the build of the unit, ensure that all the casings and the detail parts are clean and free from damage. Blow out all fuel passages with dry compressed air. Fit each sealing ring in a dry condition and, after fitting, lubricate the exposed surface with petroleum jelly PX–7.

46. Attach the filter housing to the fixture HW.15840 fitted with the adapter plate HW.16063.

Fuel filter housing assembly

F.C.U. type BA.70573

47. Fit the fuel filter inlet connections and the outlet gland connection to the filter housing, interposing new joint washers, then secure the connections with the $\frac{1}{4}$ in. nuts, plain and grover washers.

48. To ascertain the positional fitting of the parts referred to in this paragraph, see fig. 7. Insert a new sealing ring into the B.P.C. fuel return inlet in the filter housing. Fit the gland nut and gland washer on to the fuel return tube, then insert the tube into the inlet, locating the end of the tube in the sealing ring. Screw in the gland nut but do not tighten it at this stage. With the spacing washer interposed, fit the two orifice plates into the B.P.C. fuel feed attenuator body, insert the spring and secure the assembly with the grubscrew. With a new sealing washer fitted, screw the attenuator body into the B.P.C. fuel feed outlet in the filter housing and fully tighten. Fit a new sealing

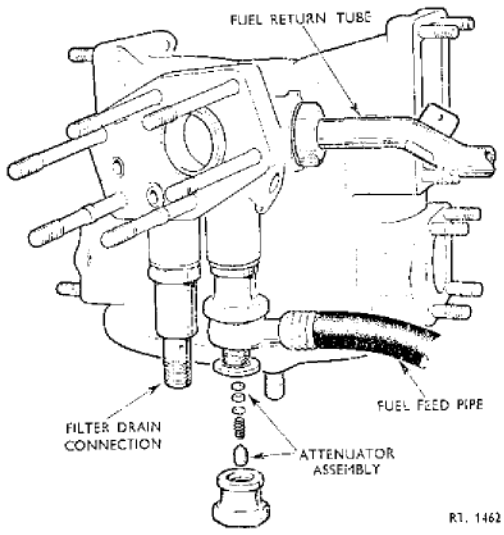

Fig. 7. Fuel feed and return connections to B.P.C. (F.C.U. type BA.70573)

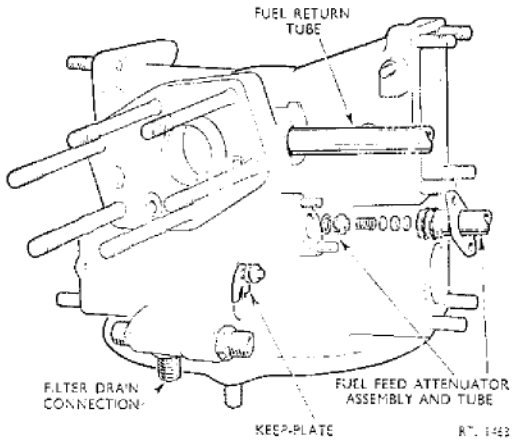

Fig. 8. Fuel feed and return connections to B.P.C. (F.C.U. type BA.61076, BA.60351, BA.62403, BA.73323)

washer to each side of the banjo connection on the B.P.C. fuel feed pipe, then fit the pipe to the attenuator body and secure it with the cap-nut. With a new sealing washer fitted, screw the filter drain connection into the filter housing and tighten it.

All other type units

49. Fit the fuel inlet connection, and a new joint washer, to the filter inlet on the starboard side of the housing, i.e. the side to which the fuel outlet connection is fitted. Fit the fuel outlet elbow, and a new joint washer, to the filter housing, then secure the inlet connection and the outlet elbow with the $\frac{1}{4}$ in. nuts, plain and grover washers. Fit the gland connection and a new joint washer to the outlet elbow and secure it with the $\frac{1}{4}$ in. setscrews, plain and grover washers. Insert a new sealing ring into the groove in the gland connection.

50. Fit the distance piece and the two new sealing washers to the hollow bolt which secures the fuel pressure warning light switch connection, then screw the bolt into the threaded boss on the fuel outlet elbow. Fit the distance piece to the lockplate retaining stud on the fuel outlet elbow, then fit the lockplate to the stud and to the head of the hollow bolt and secure it with the 2 B.A. nut, plain and grover washer.

51. To ascertain the positional fitting of the parts referred to in this paragraph, see fig. 8. With the spacing washer interposed, insert the two orifice plates into the B.P.C. fuel feed attenuator tube, insert the spring and the spring seating plug and secure the assembly

with the spring ring. Fit two new sealing rings to each end of the B.P.C. fuel feed attenuator tube and the B.P.C. fuel return tube. Press the attenuator tube and the fuel return tube into their respective fuel passages in the filter housing, then fit the attenuator tube retaining plate and secure it to the filter housing with the 2 B.A. nuts, plain and grover washers.

Non-return valve

52. Fit the valve into the valve housing with the chamfered face entering first, fit the spring and the spring seating plate and secure the assembly with the spring ring. With a new sealing ring fitted in the external groove on the valve housing, insert the assembly into the low pressure fuel passage in the joint face of the filter housing.

Relief valve

53. Insert the low pressure fuel relief valve, valve spring and spring cap into the small fuel passage adjacent to the non-return valve assembly.

Fuel filter assembly

54. With a new sealing washer fitted, screw the drain cock valve assembly into the valve housing on the filter cover and fully tighten. Fit the distance piece to the stud which retains the drain cock valve lockplate. Fit the lockplate to the stud and to the drain cock operating screw locknut, then secure the lockplate with the 2 B.A. nut, plain and grover washer and a new $\frac{1}{16}$ in. split-pin. Fit a new tabwasher to the overboard spill connection, screw the connection securely into the overboard spill fuel passages in the filter cover and bend up the locking tabs.

55. Fit a new sealing ring into the groove in the filter cover. Fit the spring to the filter locating plate then, with the plate attached to the locking stud, screw the assembly into the filter cover and fully tighten. Insert the filter element into the filter housing, then secure the filter cover to the housing with the $\frac{1}{4}$ in. nuts, plain and grover washers.

Barometric pressure control

56. When fitted to the F.C.U. type BA.70573, insert a new sealing ring into the fuel return tube adapter. Fit the gland nut and gland washer to the fuel return pipe, this being already attached to the fuel control unit filter housing. Fit the B.P.C. unit to the filter housing, simultaneously inserting the exposed end of the fuel return tube into the adapter in the B.P.C. valve housing. Secure the unit to the filter housing with the $\frac{1}{4}$ in. nuts, plain and grover washers. Tighten the two fuel return tube gland nuts sufficiently to nip the sealing rings and finally, secure the fuel feed pipe to the connection at the base of the B.P.C. valve housing.

57. On all other types of unit, fit the B.P.C. unit to the fuel control unit filter housing, simultaneously inserting the fuel return tube into the adapter in the B.P.C. valve housing and the fuel feed attenuator tube into the connection at the base of the B.P.C. valve housing. Secure the unit to the filter housing with the $\frac{1}{4}$ in. nuts, plain and grover washers.

H.P. cock

58. Insert the stop plate into the H.P. cock casing with the slot in the rim located on the lug on the end of the casing sleeve; care must be taken to insert the stop plate evenly to prevent jamming. Fit the stop plate retaining circlip into the groove in the casing.

59. Attach the casing to the bench fixture HW.15840 fitted with the adapter plate HW.16062. Insert the plug into the casing sleeve, the lug on the end of the plug locating on the cut-away section in the stop plate: ensure that the plug is entered evenly as the slightest damage to the plug or the sleeve will render the assembly unserviceable. Fit a new sealing ring into the external groove in the sealing bush and in the shank of the plug. Press the bush into the casing with the flange locating on the three unequally spaced studs. Secure the bush to the casing with the tabwashered $\frac{1}{4}$ in. nuts but do not bend up the locking tabs at this stage.

60. Fit the H.P. cock lever to the splined end of the plug; the approximate position of the lever is indicated on the exploded view of the H.P. cock casing (*fig.* 2), the final position being determined on engine installation. Fit the $\frac{1}{4}$ in. plain washer, then screw on and tighten the castellated $\frac{1}{4}$ in. nut, but do not fit the split pin at this stage.

61. Check the end float of the H.P. cock plug by inserting a feeler gauge between the end of the plug and the stop plate. The end float must be within the limits specified in the Schedule of Fits, Clearances and Repair Tolerances, any necessary adjustment is made by fitting a thicker or thinner stop plate.

62. Insert a new sealing ring into the primary fuel outlet connection then, with new sealing washers fitted, screw the main and primary fuel outlet connections into the casing and fully tighten. At this stage the H.P. cock assembly is to be passed to rig test for a low temperature torque check (*see para.* 90).

Idling adjustment

63. Insert the spherical seat into the H.P. cock casing with the spherical face uppermost. Screw the plunger, finger-tight, into the adapter. With a new sealing washer fitted to the adapter, and the spring seating washer, spring and slotted sleeve fitted to the plunger, insert the assembly into the H.P. cock casing; it will be found easier to fit the assembly by using this method than by inserting each part individually into the casing. Screw the adapter into the casing and tighten it. Fit a new combination sealing ring to each face of the idling adjustment nut, then fit the nut to the square section of the plunger body. Fit and tighten the cap-nut.

Pressurizing valve

64. Place the valve-seat upper sealing ring into the groove in the valve housing in the H.P. cock casing, then fit the valve-seat lower sealing ring and the low-pressure fuel passage sealing ring to the joint face on the casing.

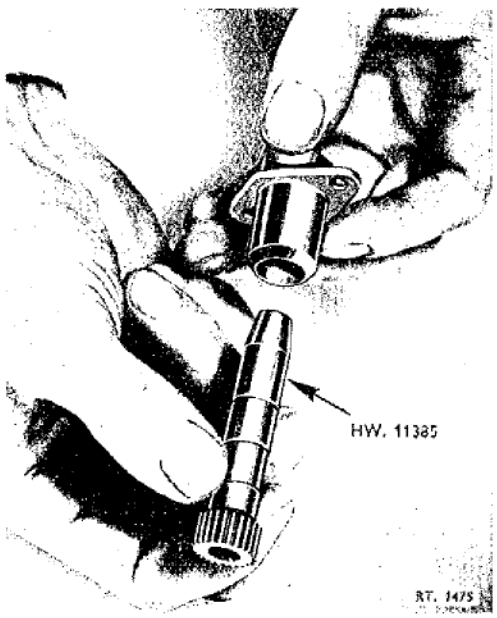

Fig. 9. Fitting sleeve to throttle valve pinion

65. Insert the valve into the valve seat and check that it reciprocates freely. Fit the spring adjusting washer, spring centralizing washer, spring and spring seating cup into the cover. With a new joint washer interposed, fit the valve seat to the cover with the end of the valve located on the centre piece in the spring seating cup.

66. Prior to the unit being fitted to the H.P. cock casing it is to be rig tested for spill leakage (*para.* 96).

67. On completion of the rig test renew the joint washer between the valve seat and the cover then fit the unit to the H.P. cock casing. Fit the plain and grover $\frac{1}{4}$ in. washers to the casing studs, then screw on and tighten the $\frac{1}{4}$ in. nuts including one reach-nut which secures the clip of the flexible pipe (servo fuel to B.P.C.); it is important that these nuts are tightened evenly to avoid sticking of the pressurizing valve.

Throttle valve

68. Insert the throttle valve into the casing, with the lateral splines on the body positioned to receive the splines on the pinion. With the tabwasher fitted to the casing, screw in and tighten the throttle valve locating screw and bend up the locking tabs. Secure the end plate to the base of the casing with the $\frac{1}{4}$ in. nuts, plain and grover washers.

69. Fit a new rubber seal into the recess in the flanged end of the pinion sleeve, and the assembling cap HW.11385 to the end of the pinion. Insert the pinion into the sleeve (*fig.* 9). Fit a new joint washer to the flange on the casing then fit the pinion and sleeve assembly with the splines on the pinion meshing with the splines on the throttle valve. To secure the pinion sleeve, fit the double tabwasher, then screw on and tighten, but do not lock, the 2 B.A. nuts.

70. Using a feeler gauge between the stop plate and the sleeve, check the end float of the throttle valve pinion; this must be within the limits specified in the Schedule of Fits, Clearances and Repair Tolerances.

71. With the $\frac{1}{4}$ in. locknuts fitted, screw the stops into the threaded bosses on the casing.

72. When the throttle valve lever assembly is fitted, as described in the next paragraph, the stop plate is positioned to operate between the two stop screws and give approximately full throttle movement. The lever and hub assembly should be fitted with

the arm of the lever projecting in the same direction as the H.P. cock lever; the final position of the lever and the hub is determined on engine installation.

73. Fit the lever on to the hub and secure it with the 2 B.A. bolt, grover washer and nut. Fit the stop plate then the lever and hub assembly on to the splines on the exposed end of the pinion. Pass the split collet, split end first, over the end of the pinion and press it into the tapered recess in the hub. Secure the complete assembly with the $\frac{1}{4}$ in. castellated nut but do not fit the split pin at this stage.

74. On the BA.70573 units, fit a new sealing washer to each face of the fuel inlet connection. Insert the hollow bolt into the connection, then screw the hollow bolt securely into the casing. On all other type units, fit the fuel inlet connection to the casing, interposing a new sealing ring, and secure it with the $\frac{1}{4}$ in. setscrews, plain and grover washers.

75. Prior to the unit being fitted to the H.P. cock casing, it is to be rig tested for spill leakage (*para.* 88).

76. On completion of the rig test, fit three new sealing rings to the joint face of the unit and secure it to the H.P. cock casing with the $\frac{1}{4}$ in. nuts, plain and grover washers.

High pressure cock casing

77. Fit new sealing rings to the fuel passages in the joint face on the filter housing, then fit the H.P. cock casing to the filter housing and secure it with the six $\frac{1}{4}$ in. nuts, plain and grover washers.

78. At this stage the fuel control unit is to be subjected to a complete rig test (*see para.* 93 *to* 112).

Remaining details

79. To complete the build of the unit after rig test proceed as follows. Secure the nuts retaining the throttle valve and H.P. cock levers with new $\frac{1}{16}$ in. split pins. Bend up the locking tabs to secure the nuts retaining the throttle valve pinion sleeve and the H.P. cock sealing bush. Inject 50 c.c. of Silicone fluid into the B.P.C. capsule casing through the ram pressure connection in the casing cover.

REPAIR

80. The repair of the fuel control unit is mainly effected by renewal of unserviceable parts; on receiving a new part, check the part number and ensure that the component is in good condition and fits correctly.

Stud replacement

81. When the required interference fit cannot be obtained by fitting a stud of the same part number and nominal diameter, an oversize stud may be fitted in accordance with an approved repair scheme.

TEST PROCEDURE

General

82. The data required for the complete rig test of the fuel control unit is contained in the test schedule (Appendix A) at the end of this chapter. The unit is to be fitted to the universal fuel rig J.51922 using the appropriate adapter.

83. A test certificate must be compiled recording the performance during calibration and must include a graph of the throttle valve and pressurising valve results, and the B.P.C. in combination with the control unit results. The test certificate and unit must be submitted to a test inspector for approval.

84. To obtain a calibration representing actual engine conditions it is essential to test the unit as a complete assembly including the feed pipe to the B.P.C. high pressure piston.

85. During the rig test the throttle valve inlet pressure must be taken from a point not more than 1 to 2 inches from the throttle valve inlet connection.

86. A measuring glass is required for the measurement of spill leakage during various tests.

Preliminary rig test (test schedule 1)

87. Prior to calibrating the combined unit it is necessary, due to the construction of the castings, to test the throttle valve and the pressurizing valve for spill leakage before they are attached to the control unit.

Throttle valve spill leakage

88. Clamp the throttle valve assembly to a suitable blanking plate, ensuring that the sealing rings between the plate and the joint face of the casing are in position, and that the spill drilling in the joint face of the casing is in line with the union in the blanking plate.

(A.L.18, Dec. 56)

Pressurizing valve spill leakage

89. Clamp the pressurizing valve assembly to the fixture provided, ensuring that the sealing rings are in position, then test the assembly at the conditions specified.

H.P. cock lever torque check

90. Subject the H.P. cock assembly to the temperature specified in the schedule for a minimum period of one hour then, using a suitable spring balance attached to the end of the H.P. cock lever, record the 'break-away' torque, i.e. the pull required to cause initial movement of the cock, and the 'moving' torque, i.e. the pull required to keep the cock in motion.

91. If the torque proves to be in excess of the maximum limit specified, the H.P. cock plug and the sleeve in the casing should be examined for scoring and/or the presence of foreign matter. Heavy scoring will entail the rejection of the assembly. In the case of slight scoring, an attempt may be made to remove this by polishing. It should be noted, however, that polishing may result in the H.P. cock spill leakage being increased above the maximum limit specified in Schedule 2, Test 4; if this should prove to be the case, the H.P. cock and casing must be rejected and a new assembly fitted. The presence of foreign matter will entail the washing of the affected part or parts in clean kerosine.

Note . . .
If either or both of the above operations are necessary the torque check must be repeated.

Barometric pressure control

92. Initial calibration of the B.P.C. unit is necessary before it is fitted to the control unit. Details of the calibration are given in A.P.4282A, Vol. 2, Part 3, Sect. 3, Chap. 1.

Fuel control unit rig test (test schedule 2)

Leakage past non-return valve

93. Blank off the pilot and main burner connections on the control unit. Disconnect the pipe from the H.P. fuel pumps to the throttle valve inlet connection. Connect the L.P. fuel supply from the booster pump to the fuel filter inlet. Connect a pipe, with a suitable variable restrictor spilling to atmosphere, to the fuel filter inlet; this pipe must have facilities for the connection of a 0–100 lb. per sq. in. pressure gauge between the fuel filter outlet and the variable restrictor. Set up to the conditions specified in the schedule, then check the spill leakage. If the leakage is in excess of the limit stated, the valve seat and the valve face should be checked for the presence of foreign matter before the assembly is rejected.

Relief valve spill leakage

94. With the burner connections and the throttle valve inlet connection blanked, operate the rig booster pump only, then adjust the variable restrictor until the fuel filter inlet pressure specified is obtained.

Leakage past relief valve

95. Adjust the variable restrictor until the filter inlet pressure specified is obtained. If the leakage past the valve is excessive the assembly should be examined for the presence of foreign matter and the spring load re-checked before the parts are rejected.

H.P. cock spill leakage

96. Connect the pilot and main burner outlets to the burner block and the throttle valve inlet to the H.P. pumps. Adjust the pump speed to give the fuel flow specified. It should be noted that the limit specified includes the spill leakage from the throttle and pressurizing valves.

Torque checks

97. Set up to the conditions specified then, with a suitable spring balance attached to the eye of the appropriate lever, operate the lever by applying an even pull on the spring balance; it is of the utmost importance that the spring balance be kept at an angle of 90 deg. to the lever throughout the full operating range. Record the indicated load.

Spill leakage from atmospheric drain (H.P. cock shut)

98. This test is made to measure the spill leakage past the H.P. cock to atmosphere at no flow conditions. Blank off the main and pilot outlet connections, then set up to the conditions specified. Leakage in excess of the limit specified will entail the rejection of the H.P. cock assembly.

Spill leakage from atmos pheric drain (H.P. cock open)

99. This test is to ascertain the spill leakage past the H.P. cock to atmosphere at flow conditions, taking into consideration the temperature to viscosity relationship of the fuel.

100. Connect the main and pilot connection to the burner block, adjust the throttle valve until the specified pilot burner pressure is obtained then check the spill leakage. Leakage in excess of the limit specified will entail the rejection of the assembly.

High pressure leakage

101. Isolate the B.P.C. by the cock in the servo line, then obtain the fuel flow and pump pressure specified and check the complete unit for leaks, paying particular attention to seals, joint faces and inserts; all leaks must be rectified.

Throttle and pressurizing valve calibration

102. A protractor clamped to the centre of the throttle valve pinion and a pointer, attached to a convenient point on the control unit casing, are necessary for the measurement of throttle movement.

103. Full details of this test are given in the schedule, the following points should, however, be noted.

104. If the hysteresis, i.e. the difference in pressure on ascending and descending checks is excessive, the pressurizing valve must be examined, notably for concentricity and squareness of the main casing bores and faces, and the 'nip' of the sealing rings. As mentioned in the assembly instructions, uneven tightening of the pressurizing valve cover may cause sticking of the plunger.

105. If the throttle valve calibration does not fall within the limits specified it must be rejected, and a replacement fitted; should this be necessary the throttle valve must be re-checked for spill leakage and torque.

106. The pressurizing valve characteristics can be moved along the axis of the graph by resetting the spring compression, using an adjusting washer from the range provided.

Fuel filter pressure-drop test

107. Fit the provided connections to the inlet and outlet flanges of the filter. Connect the filter inlet through a rotameter (0–1,200 gall. per hr.) to the booster pump outlet and the filter outlet via a variable restrictor to atmospheric spill.

108. Mount a paraffin manometer in a convenient position and connect one tube to the filter inlet and the other to the outlet pipe; it should be noted that the pressure 'pick-up' points must be 1 in. from the inlet and outlet connections respectively. An air feed must be connected through a damper to the open ends of the manometer, and air pressure applied to prevent the paraffin rising too high.

Combined B.P.C. and control unit calibration

109. Full details for this test are given in the schedule, the following points should, however, be noted.

110. If there is excessive hysteresis, check the B.P.C. pressure piston and push-rod for freedom of movement, and also check that there is sufficient oil in the capsule chamber.

111. If the values recorded do not lie within the limits specified on the graph, two adjustments are possible.

(1) If the altitude flow is high, the pump pressure can be reduced by adjusting the B.P.C. capsule loading. This must not alter the pump pressure outside the limits of:—

1,060 to 1,100 lb. per sq. in. (F.C.U. type BA.70573)

1,160 to 1,200 lb. per sq. in. (F.C.U. type BA.61076, BA.60351)

1,220 to 1,260 lb. per sq. in. (F.C.U. type BA.62403, BA.73323)

(2) If the above does not give sufficient correction, the amplification ratio of the B.P.C. may be increased by moving the eccentric sleeve containing the pressure piston closer to the B.P.C. pivot plate.

112. In the event of either adjustment being necessary, the throttle valve must be re-set to give the flow specified in the schedule before re-checking the altitude calibration

113. Once the B.P.C. has been calibrated with the control unit, the units must not be separated, or the connections removed, unless the calibrations are repeated and followed by a pressure test.

Appendix A

RIG TEST

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

TEST SCHEDULE 1

Preliminary rig test

Fuel specification D.Eng.R.D.2482

Fuel temperature 19 to 21 deg. C. (66·2 to 69·8 deg. F.)

Sub-assemblies	Test conditions
THROTTLE VALVE	Spill leakage test Apply 900 lb. per sq. in. fuel pressure (gauge) to the throttle valve inlet connection. Record the spill leakage over a period of 1 minute. Maximum permissible leakage=200 c.c. per minute
PRESSURIZING VALVE	Spill leakage test Apply 900 lb. per sq. in. fuel pressure (gauge) to the inlet union of the fixture. Record the spill leakage over a period of 1 minute. Maximum permissible leakage=200 c.c. per minute
HIGH PRESSURE COCK	Lever torque check Ensure that the H.P. cock is wet with kerosine, then subject the assembly to a temperature between minus 40 and minus 45 deg. C. (minus 40 to minus 49 deg. F.) for a minimum period of 1 hour (*a*) Breakaway torque Pull on $2\frac{1}{4}$ in. lever not to exceed 10 lb. (*b*) Moving torque Pull on $2\frac{1}{4}$ in. lever not to exceed 5 lb.
BAROMETRIC PRESSURE CONTROL	Initial calibration. See test procedure

TEST SCHEDULE 2

FUEL CONTROL UNIT RIG TEST

Fuel specification D. Eng.R.D.2482
Fuel temperature 19 to 21 deg. C. (66·2 to 69·8 deg. F.)

B.P.C. capsule pressure=30 in. Hg.abs.
Pump speed=5,000 r.p.m. (F.C.U. type BA.70572)
Pump speed=Max. r.p.m. (F.C.U. other types)
Fuel pressure=10 to 15 lb./sq. in. (filter inlet) unless otherwise stated

Test	F.C.U. type	Throttle setting degrees	H.P. cock position	Fuel flow Imp. gall./hr.	Remarks
1	Leakage past non-return valve				
	All types	Fully open	Shut	100 (L.P. fuel flow)	Fuel filter inlet pressure=25 lb./sq. in. Record the spill leakage from the throttle valve inlet connection over a period of one minute
		Maximum leakage=15 c.c. per minute			
2	Relief valve spill leakage				
	All types	Fully open	Shut	—	Fuel filter inlet pressure=34 lb./sq. in. Record the spill leakage from the overboard drain connection for a period of one minute
		Minimum spill leakage=100 c.c. per minute			
					It is important that the maximum pressure limit of 34 lb./sq. in. is not exceeded, as this would result in damage to the B.P.C. diaphragm
3	Leakage past relief valve				
	All types	Fully open	Shut	25	Fuel filter inlet pressure=25 lb./sq. in. Record the spill leakage from the overboard drain connection for a period of one minute
		Maximum leakage=15 c.c. per minute			
4	H.P. cock spill leakage				
	BA.70573	Fully open	Open	700	Record the spill leakage from the low pressure filter inlet for a period of one minute
		Maximum spill leakage=700 c.c. per minute			
	BA.61076, BA.60351	Fully open	Open	750	
		Maximum spill leakage=700 c.c. per minute			
	BA.62403, BA.73323	Fully open	Open	750	
		Maximum spill leakage=750 c.c. per minute			

TEST SCHEDULE 2—*contd.*

Test	F.C.U. type	Throttle setting degrees	H.P. cock position	Fuel flow Imp. gall./hr.	Remarks
5	Torque required to close H.P. cock				
	All types	As required for fuel flow	Open	300	Attach a spring balance to the end of the H.P. cock lever and record the load required to fully close
		Maximum pull on $2\frac{1}{4}$ in. lever =5 lb.			
6	Torque required to open H.P. cock			—	
	All types	As required for fuel flow	Open	150	After setting with H.P. cock fully open, fully close the H.P. cock, attach a spring balance to the end of the H.P. cock lever and record the load required to fully open
	BA.70573	Maximum pull on $2\frac{1}{4}$ in. lever =3 lb.			
	BA.61076, BA.60351, BA.62403, BA.73323	Maximum pull on $2\frac{1}{4}$ in. lever =4 lb.			
7	Torque required to open and close H.P. cock (no flow)				
	BA.70573	Maximum pull on $2\frac{1}{4}$ in. lever to open and close=1·5 lb.			Stop the pumps and turn off the inlet fuel pressure, attach a spring balance to the shut-off cock lever and record the load required to fully open and fully close the cock
	BA.61076, BA.60351, BA.62403, BA.73323	Maximum pull on $2\frac{1}{4}$ in. lever to open and close=2 lb.			
8	Torque required to open throttle valve				
	All types	As required for fuel flow	Open	150	Attach a spring balance to the end of the throttle valve lever and record the load required to fully open
	BA.70573	Maximum pull on $2\frac{1}{4}$ in. lever =4 lb.			
	BA.61076, BA.60351, BA.62403, BA.73323	Maximum pull on $2\frac{1}{4}$ in. lever =5 lb.			
9	Torque required to close throttle valve				
	BA.70573	As required for fuel flow	Open	700	Attach a spring balance to the end of the throttle valve lever and record the load required to fully close
		Maximum pull on $2\frac{1}{4}$ in. lever =4 lb.			
	BA.61076, BA.60351, BA.62403, BA.73323	As required for fuel flow	Open	900	
		Maximum pull on $2\frac{1}{4}$ in. lever =5 lb.			

TEST SCHEDULE 2—*contd.*

Test	F.C.U. type	Throttle setting degrees	H.P. cock position	Fuel flow Imp. gall./hr.	Remarks
10	Spill leakage from atmospheric drain (H.P. cock shut)				
	All types	Shut	Shut		Fuel filter inlet pressure=25 lb./sq. in. Measure the leakage from the atmospheric drain for a period of one minute
	BA.70573, BA.61076, BA.60351, BA.62403, BA.73323	Maximum leakage=20 c.c. per minute			
	BA.70573, BA.61076, BA.60351, BA.62403, BA.73323	Maximum leakage=30 c.c. per minute			
11	Spill leakage from atmospheric drain (H.P. cock open)				
	All types	As required for pilot burner pressure	Open	—	Adjust the throttle valve until a pilot burner pressure of 900 lb./sq. in. (gauge) is recorded. Measure the spill leakage from the atmospheric drain for a period of one minute
		For permissible leakage refer to the 'Maximum leakage from atmospheric spill' graph (*fig.* 1)			
12	High pressure leakage				
	All types	Fully open	Open	600	Isolate the B.P.C. by the cock in the servo line, and adjust the throttle valve until the required fuel flow is obtained at a pump pressure of 1,800 lb./sq. in.
		No leakage other than spill			Check the control unit for leakage
13	Throttle and pressurizing valve calibration				
	BA.70573	—	Open	—	Clamp a protractor to the centre of the throttle valve spindle and a pointer to the control unit
		Check that the B.P.C. controls the pump pressure at 1,060 to 1,100 lb./sq. in. (gauge) and that the variable restrictor is set to record an upstream pressure of 44 lb./sq. in. at 600 gall./hr.			
		Fully close the idling bleed, then close the throttle valve until the stop plate is 2 to 6 degrees from the casing boss. The idling fuel flow at these conditions must be between 50 to 65 gall./hr.			If the flow is not within the limits, remesh the stop plate on the pinion, reset the stop plate to within 2 to 6 degrees of the casing boss and repeat the check
		Check that there is a throttle movement of 85 degrees			If there is insufficient throttle movement after the required flow has been obtained, a new throttle valve orifice must be fitted and the flow check repeated

Test	F.C.U. type	Throttle setting degrees	H.P. cock position	Fuel flow Imp. gall./hr.	Remarks
13	Throttle and pressurizing valve calibration (*contd.*)				
		Lock the idling stop screw with the stop plate 2 to 6 degrees from the casing boss, then adjust the protractor until the '0' degree position is in line with the pointer. Open the throttle to 80 degrees and lock the fully open stop screw			
		Set the throttle at '0' degrees then open the idling bleed until a flow of 95 gall./hr. is obtained			
		Record the fuel flow and pilot burner pressure with the throttle set at the following angles:— 0, 5, 10, 20, 30, 40, 50, 60, 65, 70, 75 and 80 degrees (ascending and descending). Plot the results and check that they lie within the limits shown on the calibration graph (*fig.* 2)			The hysteresis of the pilot pressure must not exceed 10 lb./sq. in. If the fuel flow does not conform to the limits, the throttle valve must be rejected
		On completion of the foregoing tests, set the idling bleed to give 103 to 105 gall./hr. fuel flow with the throttle fully closed.			
	BA.61076 BA.60351 BA.62403 BA.73323		Open		Clamp a protractor to the throttle valve spindle and a pointer to the control unit
	Check that the B.P.C. controls the pump pressure at:—				
		BA.61076, BA.60351 1,160 to 1,200 lb./sq. in. BA.62403, BA.73323 1,220 to 1,260 lb./sq. in.			
		Fully close the idling bleed then close the throttle valve until the stop plate is within 6 to 10 degrees of the casing boss. The idling fuel flow at these conditions must be between 44 to 65 gall./hr.			If the flow is not within the stipulated limits, re-mesh the stop plate on the pinion shaft and/or re-mesh the pinion shaft and plunger. Reset the stop plate to within 6 deg. to 10 deg. of the casing boss and re-check the flow
		Check that there is a throttle movement of at least 90 degrees			If there is insufficient throttle movement after the required flow has been obtained, a new throttle valve orifice must be fitted, and the check repeated

TEST SCHEDULE 2—*contd.*

Test	F.C.U. type	Throttle setting degrees	H.P. cock position	Fuel flow Imp. gall./hr.	Remarks
13	Throttle and pressurizing valve calibration (*contd.*)				
		Lock the idling stop screw with the stop plate 6 to 10 deg. from the casing boss then adjust the protractor until the '0' degree position is in line with the pointer. Open the throttle to 80 degrees and lock the fully open stop screw			The throttle movement is to be increased from 80 to 90 degrees when reheat is fitted
	BA.61076 BA.60351 BA.62403 BA.73323	Set the throttle at '0' degrees and open the idling bleed until a flow of 112 gall./hr. is obtained. Record the fuel flow and pilot burner pressure with the throttle set at the following angles:— 0, 10, 20, 30, 40, 50, 55, 60, 65, 70, 75 and 80 degrees (ascending and descending). Plot the results and check that they conform to the limits shown on the appropriate calibration graph (*fig.* 3 *and* 4)			During the calibration the throttle valve inlet pressure must be maintained at the following :— BA.61076 and BA.60351 1,180 lb./sq. in. BA.62403 and BA.73323 1,240 lb./sq. in. The hysteresis of the pilot pressure must not exceed 10 lb./sq. in.
14	Fuel filter pressure drop check				
	BA.61076 BA.60351 BA.62403 BA.73323	As required for fuel flow	Closed	600	Fuel filter inlet pressure=15 lb./sq. in.
		Close the variable restrictor and obtain the filter inlet pressure quoted			
		Open the variable restrictor and record the pressure drop in inches of paraffin			
	BA.70573	Maximum pressure drop at 600 gall./hr.=8·5 in. Par.			If the pressure drop is higher than the stipulated limit, fit a new element and re-check. It will be necessary to examine the filter cover joint for leakage after fitting a new element, and for this purpose apply 30 lb./sq. in.
	BA.61076 BA.60351 BA.62403 BA.73323	Maximum pressure drop at 600 gall./hr.=12·0 in. Par.			

Test	F.C.U. type	Throttle setting degrees	H.P. cock position	Fuel flow Imp. gall./hr.	Remarks
	CALIBRATION OF B.P.C. WITH CONTROL UNIT				
15	Initial setting BA.70573	As stated	Open		
		Check the day's barometric pressure			
		Set the throttle valve inlet pressure to 1,100 lb./sq. in. Open the throttle valve until the flow is equivalent to that called for on the calibration graph (*fig.* 5) at 30 Hg. atmospheric pressure. While at this condition, and using the same graph, adjust the B.P.C. by means of the capsule adjustment to the flow corresponding to the day's atmospheric pressure			
		Adjust the throttle to give 200 gall./hr. flow and record the throttle valve inlet pressure. Energize the upper fuel pump solenoid thereby subjecting the B.P.C. to full stall pressure. De-energize the pump solenoid and record the throttle valve inlet pressure. If this pressure has changed, the unit should be repeatedly subjected to stall pressure until the throttle inlet pressure remains unaffected under normal conditions			
	BA.61076 BA.60351	As required for fuel flow	Open		
		With the throttle valve inlet pressure set to 1,180 lb./sq. in., and using the calibration graph (*fig.* 6), apply the same procedure as for F.C.U. type BA.70573			
	BA.62403 BA.73323	As required for fuel flow	Open		
		With the throttle valve inlet pressure set to 1,240 lb./sq. in., and using the calibration graph (*fig.* 7), apply the same procedure as for F.C.U. type BA.70573