Chapter 2

FLOW DISTRIBUTOR, TYPE FD 17 SERIES AND 29 SERIES

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LIST OF ILLUSTRATIONS

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General

1. The flow distributor is designed to meter fuel equally to all burners irrespective of the type of burner in use.

2. Variations of the basic type of flow distributor are available to suit individual burner installations, the differences being in the number of outlet unions, the installation fittings and the calibration.

3. A typical complete type number (FD 17/15E) consists of the basic type designation (FD 17), followed by a stroke number (/15) which is a reference indicating the installation code, and the final letter (E) to indicate the schedule to which the particular unit has been calibrated. A view of a typical unit dismantled, is shown in fig. 1.

4. The instructions contained in this chapter concerning dismantling and reassembling generally apply to all derivations of the basic type; specific details and calibration figures for the various types are provided in the appendices to this chapter.

5. It is important that the unit is handled with care at all times and not subjected to severe shock, otherwise the calibration of the unit may be affected or slight distortion may ensue resulting in sticking of the metering plunger.

6. The importance attached to cleanliness while handling any components cannot be over-emphasized and extreme precautions must be observed at every stage of assembling and testing to ensure that all details are thoroughly clean.

7. To avoid damage to the hexagon corners of nuts, bolts and unions, box or ring spanners should be used where possible.

8. On time expired units all joint and other sealing washers must be renewed, also any split pins, tab-washers or locking wire whenever such are disturbed.

9. In instances where a unit is to be assembled temporarily, it is recommended that slave unions, nuts and washers should be used; such components however, should be distinguishable to avoid their retention on final assembly.

SPECIAL TOOLS

General

10. Special tools and test rigs are necessary for the repair and overhaul of the flow distributor; such tooling and test rigs are listed below.

Part No.	*Description*
T.160988	Adjusting tool—range adjusting screw.
T.167552	Adapter—micrometer head—port calibration.
T.177125	Spanner—bottom cover retaining nuts.
T.190008	Adapter—inlet connection—test rig.
T.190009	Guide rod—spring anchorage assembly.
T.208260	Adapter—hydraulic clamping fixture.
T.208260/H	Adapter and fixture—dismantling and assembling.
T.210860	Adapter—plunger loading—port calibration.
—	Test-rig—port calibration.
—	Test-rig—performance calibration.

CHECKS AND PRECAUTIONS BEFORE DISMANTLING

General

11. Study any complaints reported with

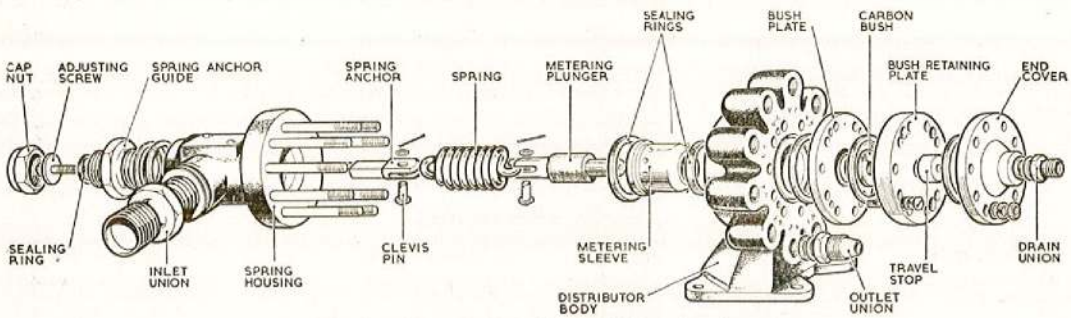

Fig. 1. Dismantled view of flow distributor

the unit then examine the exterior for any visible sign of damage or interference, giving particular attention to the locking wire on the adjusting screw locknut. Ensure that all unions have been blanked off completely to prevent the entry of foreign matter to the interior of the unit.

12. If the general condition of the distributor is suitable, the unit should be mounted on the performance test rig and a calibration check carried out in accordance with the appropriate schedule in the appendix of this chapter. If the unit has been reported as leaking however, it should be leak-tested first under the conditions specified in the test schedule in order to locate the source and nature of the leak and facilitate investigation.

DISMANTLING THE FLOW DISTRIBUTOR

General

13. One or more clean and dry metal boxes should be placed close to the work to receive the components so that they may be stored safely pending inspection.

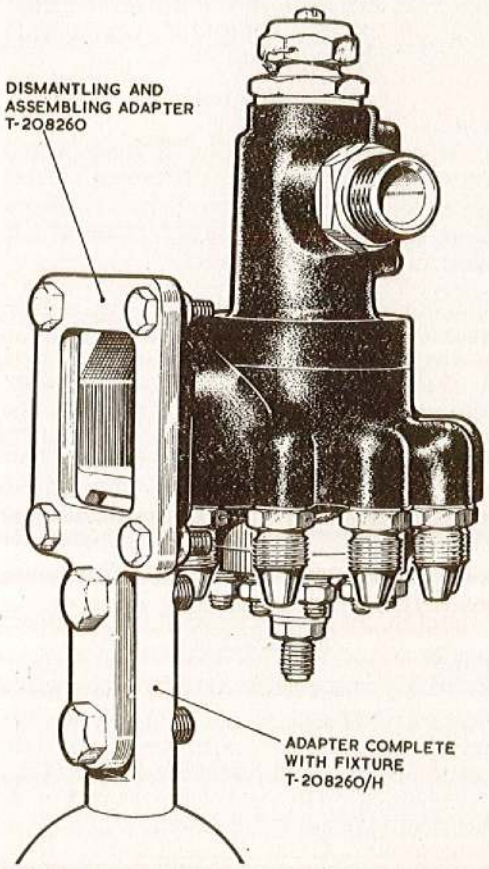

Fig. 2. Dismantling and assembling fixture

14. It is recommended that not more than one dismantled unit be present on the bench at any one time ; this will avoid an accidental transfer of parts from one assembly to another so reducing the possibility of a shortage of items on re-build. Scrap all tab-washers, split pins and lock-wire on removal. Mount the unit on the dismantling fixture T.208260 as shown in fig. 2.

Removing the installation fittings

15. Installation connections assembled to this unit comprise unions or adapters, with suitable sealing washers, which are fitted to the inlet and to the outlet ports and to the drain outlet. Certain outlet adapters may form " bias-flow " unions to compensate for individual burner requirements and are positionally-numbered accordingly. When a unit is received it should be complete with dust caps on each union or adapter.

16. Unscrew the fittings and remove them together with their joint washers which consist of a rubber ring surrounded by a steel ring.

Removing the spring housing

17. With the spring housing uppermost unlock and remove the adjusting screw cap-nut from the end of the spring housing, remove the adjusting screw and screw in the guide rod T.190009 (*see fig.* 3.) Invert the unit, remove the retaining nuts, spring washers and plain washers from the distributor body end cover and remove the cover, sealing ring and plunger travel stop. Invert the unit again to bring the spring housing uppermost and ease it away from the distributor body, holding the guide rod down meanwhile so that the metering plunger assembly will not be withdrawn from the distributor body.

18. When the housing is free from the distributor body face, unscrew the guide rod, taking care to avoid lifting it until it is clear of the spring anchor threads, remove the rod and lift off the spring housing, leaving the plunger and spring assembly in the distributor body. Lift the spring and plunger out of the distributor and place the assembly in a safe position

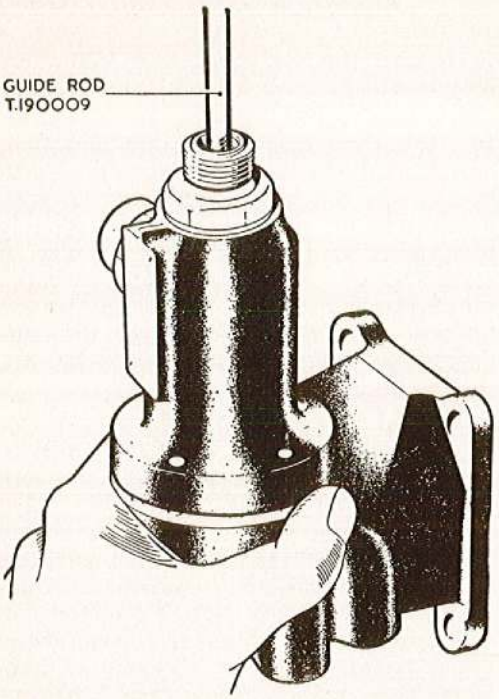

Fig. 3. Using the spring anchor guide tool

where no damage can occur to the carbon surface on the plunger.

Dismantling the spring housing

19. To remove the spring anchor guide from the end of the housing the housing should be replaced on the distributor body, the spring and plunger having already been removed, so that the housing can be held securely whilst the guide is being slackened. Unlock the guide, release it with a standard ring spanner and remove the guide complete with sealing rings. Remove the steel outer ring and sealing ring from the large end and remove the small sealing ring from the annular groove in the small end face of the guide. Before discarding the sealing rings inspect them for any defects which may have been a source of leakage.

Dismantling the spring and plunger assembly

20. To separate the plunger and spring anchorage from each end of the spring, remove the two split pins and washers and extract the clevis pins securing the assembly. Place the plunger in a safe position pending cleaning and inspection.

Dismantling the distributor body

21. Remove the four setscrews from the face of the carbon seal retaining plate, the end cover having been removed during removal of the spring housing (*para.* 17). Lift off the seal retaining plate and seal housing together with their sealing rings. Invert the seal housing over the palm of the hand and shake out the carbon seal and small sealing ring. Remove the sealing ring from the face of the seal retaining plate and from the face of the distributor body. Before discarding the rings inspect them for possible sources of leakage. Remove the distributor body from the dismantling fixture.

22. The extremely close clearances necessary between the plunger and the metering sleeve bore are obtained by machining the plunger to match the sleeve bore after the sleeve has been shrunk into the distributor body; *under no circumstances therefore must any attempt be made to remove a sleeve as it will be found impossible to refit it satisfactorily.* It cannot be emphasized too strongly that this matching of the plunger, sleeve and body during manufacture is essential to the correct performance of the distributor and for the same reason, should more than one unit be undergoing overhaul at the same time, great care must be taken to ensure that there is no possibility of components becoming interchanged.

CLEANING

General

23. If any defect in the unit is suspected to be due to the presence of foreign matter the part suspected should be inspected before cleaning, otherwise the cause of the defect may be washed away.

24. The components must be cleaned individually in kerosine immediately prior to inspection. It is recommended that parts should be pressure-washed using an appropriate bath and jet-nozzle supplied by a pump having adequate filtering facilities. Cloth, hard brushes and abrasives must not be used under any circumstances. After cleaning all components should be dried thoroughly under a compressed air blast, which must be free from water, and placed in clean dry containers.

INSPECTION

General

25. Visual inspection of the components is described in this section. Where dimensional checks are necessary, the appropriate details are given in the Schedule of Fits, Clearances and Repair Tolerances in Vol. 2, Part 2 of this Air Publication.

26. Every component should be inspected closely for signs of damage or wear and if

necessary the part should be discarded and a replacement demanded.

27. Scrupulous cleanliness is essential at all times. It is advisable that the surface of the bench be covered with zinc sheeting, bakelized fabric or linoleum; this will assist in maintaining the high standard of cleanliness required.

Distortion checks

28. Distortion checks should not be necessary but if distortion is suspected, a joint face may be checked by means of a surface plate and marking blue whilst the alignment of bores relative to each other or to joint face squareness should be checked in accordance with general inspection practice.

Permissible wear

29. Details which are subject to wear must be checked dimensionally in accordance with the schedule of Fits, Clearances and Repair Tolerances.

Redundant parts

30. It is usual during an overhaul to discard parts rendered redundant by modifications; sufficient details of such modifications must be available to the inspector therefore to enable redundant parts to be discarded and new parts to be embodied on re-assembly.

Scores and surface damage

31. In general, scores or surface damage on moving parts and joint faces will impair the operational efficiency of a unit and any part so affected should be rejected. Certain defects however, may be acceptable provided that the inspector in charge is satisfied that they are insufficient to impair the efficiency and safety of the unit.

Installation connections

32. Inspect all adapters and unions for cleanliness and general condition of their hexagons, threads and sealing faces. The union nipples on the distributor outlet adapters and the seatings in the inlet and drain unions must be free from damage and scores which may be a source of leakage.

Metering plunger

33. Examine the plunger for pitting, severe scoring, cracking and severe inclusion of foreign matter in the carbon surface. Should any such defects appear excessive no attempt should be made to rectify the matter; the plunger and the distributor body and sleeve assembly must be rejected and returned to the manufacturer for repair.

34. The metering edge at the clevis end of the plunger is of extreme importance to the efficient functioning of the distributor and inspection of this edge should be carried out with the aid of a magnifying glass. Ensure that the edge is clean and free from burrs, nicks and other damage.

35. Inspect the plunger generally for any other visible defect and subject the component to a magnetic crack-detection test, particular attention being paid to signs of radial cracking around the clevis pin holes in the fork. Following inspection for cracks ensure that the plunger, particularly the carbon surface, is washed thoroughly in a kerosine spray to remove all traces of the crack-detecting ink.

Distributor body and metering sleeve

36. Using a small magnifying mirror examine the metering sleeve bore for scoring and other damage. Minute longitudinal scratches are permissible provided that they do not run into the edges of the metering slots. No scoring whatever may be permitted between the run out of the metering slots and the edge of the bore and circumferentially between any portion of two adjacent ports.

37. See that the metering edge of the bore is free from damage, burrs and scores. Any razor-sharpness however should be polished out with fine emery paper, taking great care to avoid producing a visible chamfer or radius. Scrapers and other such tools must not be used to clean up this edge.

38. Examine the cast surfaces of the body for damage, cracks and corrosion, particularly for radial cracks around the inlet and outlet ports and around the retaining-bolt holes in the mounting flange. See that the sealing ring grooves are clean and that the sealing surface surrounding each port is free from damage. Check that the radial drillings are clean and free from

obstruction and that all threads are serviceable.

Carbon seal

39. Inspect the sealing bush for signs of cracking on the faces and chipping on the edges, particularly on the edge of the bore. See that there are no severe radial scores on the sealing face. The small sealing lip at one end of the bore must be free from chipping and severe scratching or scoring.

Control spring

40. Examine the spring visually for surface defects and for cracks, particularly adjacent to the attachment loops. See that no foreign matter is trapped between the coils and that no distortion is apparent.

Spring anchorage

41. Inspect the spring anchorage generally for damage and for signs of radial cracks around the clevis pin holes in the fork. Examine the holes for wear and see that the threads in the stem are clean and free from damage.

Spring adjusting screw and locknut

42. Examine the adjusting screw for damage to the threads, flange, spannering square and screwdriver slot. Roughness and severe scoring is not acceptable on the underside of the flange; a damaged surface here may allow fuel to leak across the sealing ring in the end face of the spring anchorage guide. It is not advisable to attempt to polish severe score marks from the flange face as out-of-squareness with the thread may result and create a further source of leakage.

43. See that the locknut hexagon is not damaged and that the threads are satisfactory. Check that the locking wire holes are clean and that their edges are smooth, a sharp edge or burr may fracture the wire.

Spring anchorage guide

44. Inspect the guide for general condition and see that the hexagon is undamaged. The surface of the flange adjacent to the larger thread should be free from scores as these could be a source of leakage between the face and the joint ring. Check that the threads are undamaged, that the sealing ring groove in the small end face is clean and that the square guide hole through the centre is free from obstruction.

Clevis pins

45. Examine the clevis pins for excessive wear and cracks. See that the split pin holes are clear.

Spring housing

46. Inspect the spring housing generally for signs of damage and cracks also for the presence of corrosion. See that the small end and fuel inlet boss facings are undamaged and that the threads are in good condition. Severe scoring or damage marks are not permissible on either of these faces or on the large end facing owing to the risk of leakage. See that the studs are tight, that none are bent and that the threads are in good condition. The locking wire lug on the small end of the housing must be free from cracks and damage and the hole must be clear.

Carbon seal housing and retaining plate

47. Examine the seal housing generally for cleanliness, checking that the sealing face at the bottom of the housing recess is thoroughly clean and free from radial scores. See that there are no scores on the faces of the housing.

48. See that the sealing ring groove in the face is clean, that the central hole is free from obstruction and that the face surrounding the hole on the sealing ring side is undamaged; this face retains the carbon seal in position and any deviation from flatness will cause out-of-squareness of the carbon seal when the distributor is assembled. Check that the four counterbores for the retaining screws in the outer face are clean.

End cover and plunger travel stop

49. Inspect the threads and face of the tapped boss for cleanliness checking that the boss facing is flat and free from damage, as this is a sealing face. See that the sealing ring groove in the inner face is clean and check that the plunger travel stop is a good fit in the central counterbore.

REBUILDING THE FLOW DISTRIBUTOR

General

50. It is essential to ensure that all details, the assembly bench and all tools are clean before commencing to re-build the unit.

51. Prior to assembly it is essential that all sealing rings are immersed completely in kerosine for a period of not less than

24 hours to permit maximum swelling to take place under absorption of fuel.

52. Initially the distributor is to be assembled with certain slave components to facilitate an intermediate rig-test for calibration of the metering ports, after which the complete unit is to be rebuilt and subjected to a final calibration and performance test.

Assembling the distributor body

53. Mount the body on the assembling fixture T.208260, locate a square-section rubber sealing ring in the circular groove surrounding the central bore in the distributor body outlet face and insert the metering plunger into the sleeve bore so that the plunger pilot protrudes from the outlet face. Fit a sealing ring to the counterbore in the carbon seal housing, place the housing, counterbore outermost, over the plunger pilot and locate the housing spigot in the distributor body, registering the four small holes with the small tapped holes in the body facing. Place the carbon seal over the plunger pilot and slide the seal down until it locates in the housing counterbore and is seated on the small sealing ring. *The seal has a small lip inside one end of the bore; this lip is the sealing edge and must be fitted towards the plunger.* On no account may the seal be fitted the other way round with the sealing edge towards the retaining plate and end cover. Fit a square-section sealing ring to the circular groove in the face of the seal retaining plate and slip this plate, sealing ring side first, over the plunger pilot. Register the four counterbored holes with the four small holes in the seal housing and with the four tapped holes in the distributor body face and fit the four retaining setscrews, first placing a spring washer and a plain washer over each screw. Run the setscrews down until the plates are nipped tightly then tighten the screws evenly a little at a time until they are tightened fully.

54. Whilst tightening the setscrews move the metering plunger in and out gently, taking care to avoid withdrawing it sufficiently to disengage the pilot from the carbon seal; the constant moving of the plunger will provide a check on the correct alignment of the seal, any sudden tightness indicating that the seal is being tightened unevenly. In this event slacken whichever screw was tightened immediately prior to the tightness occurring to the plunger and tighten the opposite screw, adjusting the setscrews similarly until they are all tight with the plunger free from interference.

55. If it is not possible to tighten the screws without causing the seal to interfere with the plunger free movement, remove the screws and rotate the seal through 90 degrees or 180 degrees, re-assemble and tighten again under similar conditions. Should the interference still be apparent it will be necessary to remove the screws again and rotate either or both the seal housing and retaining plate until the required freedom of the plunger is obtained with all setscrews tightened fully.

Fitting the port calibration adapters

56. In order to measure the flow through the metering ports it is necessary to fit a micrometer adapter to the distributor to measure the amount of plunger travel and a plunger-loading adapter to maintain the

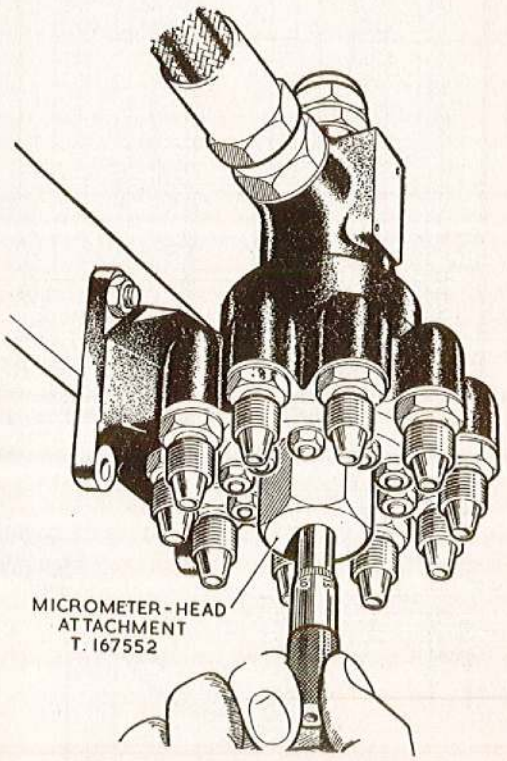

Fig. 4. Port calibration adapter

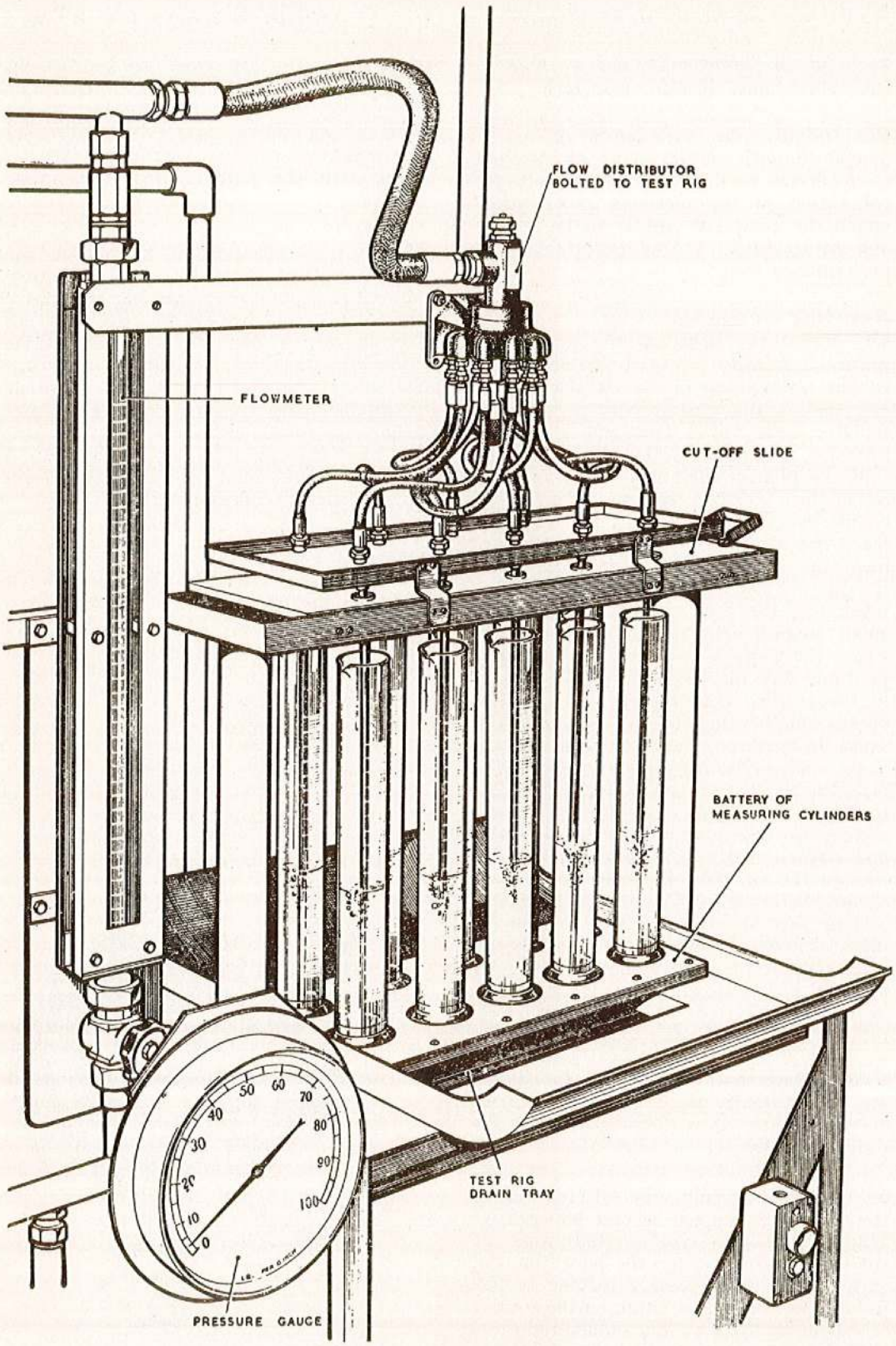

Fig. 5. Calibrating the ports

plunger in contact with the end of the micrometer at low fuel inlet pressures.

57. Fit a sealing ring over the large thread of the plunger-loading adapter T.210860 and screw the adapter into the end of the spring housing. A slave spring housing may be used if available, when the housing and adapter may be kept assembled permanently. Assemble the housing and adapter to the distributor body when the adapter loading plunger will rest on the end of the plunger fork.

58. Adjust the micrometer in the special adapter T.167552 to a reading of 0·500 in. and fit a rubber sealing ring to the annular groove in the face of the adapter. Locate the adapter so that the micrometer stem enters the central hole in the carbon seal retaining plate, register the holes in the adapter with the spring housing studs protruding from the seal retaining plate, press together firmly and fit plain washers, spring washers and retaining nuts to the studs. Tighten the nuts evenly and firmly to secure the assembly as shown in fig. 4.

59. Fit slave unions complete with sealing washers to the distributor body outlet ports and assemble the test-rig inlet adapter T.190008, complete with sealing ring, to the inlet connection on the spring housing.

RIG TEST (PRELIMINARY)

General

60. The purpose of the preliminary test is to check the individual and collective calibration of the metering ports, the specific calibration values being given in the appropriate schedule in Appendix 'B' of this manual. The test procedure is similar for all distributors and a standard basic schedule (*para.* 61 *to* 73 *and para.* 83 *to* 100) is applicable to all units; calibration values however may vary according to the requirements of different engine installations.

61. Throughout the tests the fuel used is to be Aviation Turbine fuel to Specification D.Eng.RD.2482 Latest Issue and the fuel temperature must be maintained at between 20 deg. C. and 26 deg. C.

Leakage test

62. Connect the unit to the metering port calibration rig as shown in fig. 5.

63. Check that the rig pump delivery control is set to minimum flow, that the delivery pressure cock is set to minimum restriction, that the low-range flowmeter cock is closed and that the high-range flowmeter cock is open. Switch on the rig pump motor and allow the rig to run for a few minutes to stabilize and attain its working temperature.

64. Move the plunger to close the ports by screwing the micrometer thimble in until the fuel delivery is reduced to droplets and adjust the rig pump delivery control until the inlet pressure is as stated in the appendix. Screw the micrometer head in gently, 0·001 in. at a time, until the flow ceases completely, indicating that the metering edge of the plunger has sealed off the ports. *Record the exact micrometer setting; this is the datum from which the calibration is obtained and must be found accurately since any error will affect the calibration throughout the range.*

65. Screw the micrometer head in a further 0·025 in. from the datum point and re-adjust the rig pump to produce the inlet pressure specified in the appendix. Maintain this condition for the period stated in the Appendix.

66. After the specified period place the empty measuring cylinders in position beneath the outlet nozzles and move the sliding cut-off plate to allow any fuel emanating from the nozzles to fall into the cylinders, checking the time with a stop-watch as the slide uncovers the nozzles. After one minute move the slide to the cut-off position; any fuel collected in the measuring cylinders must not exceed the quantity stated in the Appendix.

Calibrating the ports

67. Screw the micrometer head out to the datum point again, adjust the rig pump control to provide the inlet pressure stated in the Appendix, change over to the low-range flowmeter and screw the micrometer head out again gently until the specified flow is indicated on the flowmeter.

Note . . .

The value specified in the Appendix table is the flow per port and must be multiplied by the number of ports in the unit to obtain the total quantity to be indicated on the flowmeter.

68. When the test-rig indicators are steady at the specified values record the micrometer reading then move the cut-off slide over to permit the fuel delivery from the ports to enter the measuring cylinders.

69. Watch the measuring cylinders constantly and immediately the level in any one cylinder reaches the larger of the values in the "maximum variation" column move the slide to cut off the flow to the cylinders; the level of the fuel in each of the other cylinders must be within the limits stated, whilst the micrometer reading must be within the specified minimum and maximum measurements from the datum point. Record the quantity of fuel in each cylinder against the inlet pressure, flow and micrometer readings. Empty the measuring cylinders.

70. Repeat the procedure at each of the inlet pressure and flow values stated in the table, recording the micrometer reading and measuring cylinder readings at each check.

71. Should any readings be outside the limits stated in the third and fourth columns of the table, return the unit to the assembly bench, dismantle the assembly and examine the metering slots in the sleeve bore for slight burrs, nicks in the edges and foreign matter. Flush the delivery drillings thoroughly to ensure that these are quite clean and see that there is no damage in the delivery union bores. See that there is no obstruction in the bores of the flexible pipes connecting the distributor to the delivery nozzles on the test-rig, renewing these pipes if suspected to be defective.

72. Rebuild and re-test the distributor and if there is no improvement the body and sleeve assembly and the metering plunger must be rejected and replaced by new components. The rejected components must be returned to the manufacturer for repair. The re-built unit must be subjected to a complete re-test including the leakage test.

73. When the test results are satisfactory record the figures on the test certificate, which must be approved and signed by the inspector. Return the unit to the assembly bench for final assembly.

FINAL ASSEMBLY

General

74. Remove the retaining nuts and washers from the test-rig micrometer adapter, remove the adapter and draw off the spring housing from the distributor body. Unscrew the plunger loading adapter and remove the test rig adapter from the inlet port. Do not disturb the carbon seal retaining plate setscrews otherwise the alignment of the seal will be affected.

Assembling the spring and plunger

75. Position the tension spring so that one end loop is between the clevis fork on the metering plunger, insert a clevis pin, place a thin steel washer over the exposed end of the pin and secure the assembly with a new split pin, the legs of which are to be bent round the clevis pin. Fit the spring anchor likewise to the other end of the spring.

76. It will be found that in some units the inner end of the anchorage is extended and, when assembled, abuts the end of the plunger fork to pre-load the spring. In this case, to insert the anchorage clevis pin, the spring must be extended slightly; a number of thin packing plates 0·010 in. to 0·020 in. thick may be inserted between the spring coils to hold the spring in the extended position whilst the clevis pin is inserted. It must be understood that the packing plates must be spaced at regular intervals around and along the spring to avoid any possibility of distortion. *Count the plates as they are removed and ensure that all are accounted for after fitting and securing the anchor.*

Assembling the spring housing

77. Assemble the spring housing and spring anchor guide belonging to the unit. Fit a rubber sealing washer and steel outer washer over the large thread on the spring anchor guide and screw the guide into the housing. Ensure that the steel washer is located correctly around the rubber ring and pull the guide down tightly on to the steel washer. Fit a similar sealing ring and steel washer to the inlet union and screw in tightly into the housing inlet boss.

Fitting the spring housing

Note . . .

When fitting the spring housing to the distributor body on final assembly it is essential that the inlet port on the spring housing is in the correct relationship to the mounting flange on the distributor body to suit the particular engine installation for which the

distributor will be required. Once the unit has been calibrated the housing and body must not be separated otherwise it will be necessary to re-calibrate the unit.

78. Place the screwed end of the guide rod T.190009 into the spring anchor guide, passing the rod through as far as possible. Insert the assembled metering plunger carefully into the metering sleeve, taking care to avoid damaging the carbon surface on the edge of the sleeve bore whilst pushing the plunger fully into the sleeve. Offer up the spring housing until the end of the guide rod can be screwed into the tapped stem of the spring anchor. Register the spring housing studs with the holes in the distributor body and lower the housing gently whilst exerting a slight upward pull on the guide rod. When the housing is lowered sufficiently for the anchor guide in the housing to foul the anchor stem rotate the guide rod slightly to register the square section anchor stem with the square hole through the guide. When the anchor stem can be felt to have entered the guide lower the housing fully on to the distributor body.

79. Hold the spring housing in position, invert the unit and fit the distributor body end cover, which must have a sealing ring located in the groove on the inner face and the plunger travel stop plug located firmly in the counterbore. Fit the plain washers spring washers and retaining nuts and tighten evenly and fully.

80. Invert the unit again, remove the guide rod from the spring housing and fit a small sealing ring to the groove in the end face of the spring anchor guide. Screw in the spring adjusting screw until the underside of the flange contacts the sealing ring, fit the retaining nut and tighten finger tight as the screw will require adjustment on the test-rig.

81. Fit rubber sealing rings and steel outer washers to the appropriate delivery unions and screw the unions tightly into the distributor body delivery ports.

Note . . .

In certain installations specific ports must be fitted with biassed unions. These unions must be flow-tested independently as stated in the relevant Appendix before they are fitted to the distributor after calibration.

82. Complete the assembly by fitting the drain union, with its appropriate sealing ring, to the drain port in the centre of the body end cover. Tighten the union securely. Unless the unit is to be rig-tested immediately seal all open connections with dust caps to exclude foreign matter.

RIG TEST (FINAL)

General

83. The purpose of the following test is to check the relationship of applied pressure to collective flow from the delivery ports.

84. Throughout the test the fuel is to be Aviation Turbine fuel to Specification D.Eng.RD.2482 Latest Issue and its temperature is to be maintained at between 20 deg. C. to 26 deg. C.

85. In this rig-test, as shown in fig. 6, the distributor delivery unions are connected to a common collecting box having a single outlet pipe which returns the fuel through a pressure gauge tapping point and a manually-variable restricting cock to the rig tank. The pressure gauge indicates the fuel delivery pressure whilst the cock enables a controllable pressure to be applied downstream of the flow distributor so as to simulate the combined restriction imposed by the burners in an actual engine installation.

Calibrating the distributor

86. Install the unit on the test rig as shown in fig. 6, and see that the high range flowmeter cock is open with the low range flowmeter cock closed. Check that the flow control is set to low and that the delivery pressure cock is open. Start the rig pump and allow it to run for a few minutes to stabilize and attain its working temperature.

87. Open the low range flowmeter cock, close the high-range cock and adjust the flow to provide the value stated against (A) in the appropriate table in the Appendix. Note that in some tables the value specified is for a single port and must be multiplied by the number of ports in the unit to obtain the value to be indicated by the flowmeter. Adjust the delivery restricting cock to raise the delivery pressure to the relevant value stated in the second column in the table, re-adjust the flow if necessary, as this may have fallen slightly, then note the indicated inlet pressure.

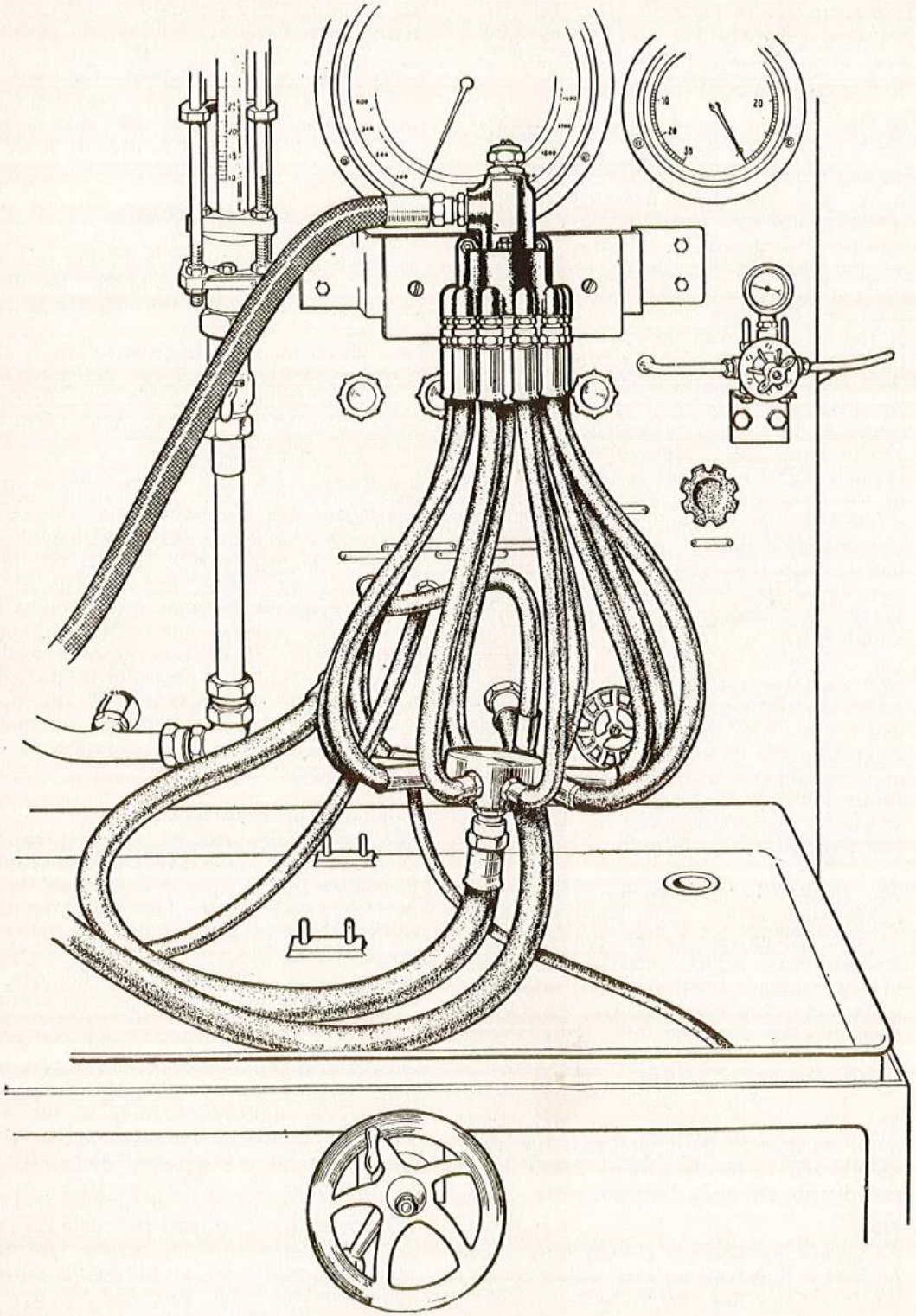

Fig. 6. Performance calibration test

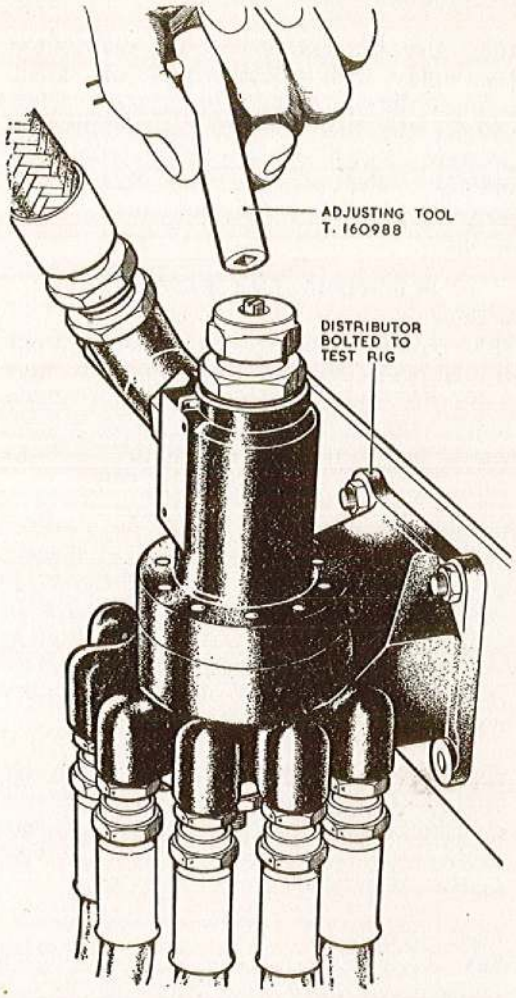

Fig. 7. Adjusting the range spring

88. Should the inlet pressure be outside the limits stated in the third and fourth columns of the table the spring adjusting screw must be altered. Slacken the locknut and, using tool T.160988, as shown in fig. 7, rotate the adjusting screw clockwise to increase or anti-clockwise to decrease the inlet pressure, setting the adjustment so that the pressure is midway between the minimum and maximum values stated. Tighten the locknut fully and check the inlet pressure again as this may have altered slightly due to compression of the sealing ring under the adjusting screw when tightened down by the locknut. For this reason each time an adjustment is made the locknut must be tightened fully before the inlet pressure is observed.

89. With the inlet pressure steady within the limit stated for point ' A ' increase the flow and delivery pressure to the values stated at point ' B ' and again observe the inlet pressure, which must be between the limits stated at this point.

90. If the inlet pressure at point ' B ' is outside either limit, re-adjust the spring adjustment screw to bring the inlet pressure just within the limit, reduce the flow and delivery pressure to the values stated at point ' A ' and check the inlet pressure again ; this will probably have altered but should still be within the stated limits at this point.

91. Should it be found that the inlet pressure is on or below the minimum limit stated for point ' A ' and on or above the maximum limit stated for point ' B,' the spring rating is incorrect and the spring must be changed for one of a higher rating. Where the opposite is the case and the pressure is above the point ' A ' maximum whilst being below the point ' B ' minimum, a lower rated spring is required.

Performance test

92. When the specified conditions have been obtained satisfactorily at the two points stated, the performance of the distributor is to be tested at each point in the table.

93. Commence the test at the lowest flow value stated in the table and record the inlet pressure obtained at each point up to the highest flow value stated. Recheck at each point whilst reducing the flow to the starting point, recording the observed inlet pressure at each point against the pressure observed previously.

94. Compare the two sets of figures obtained. Should there be a discrepancy between any two adjacent values and the discrepancy is such that one value is outside the corresponding limit in the Appendix table, the distributor must be dismantled and the plunger, metering sleeve bore and carbon seal examined closely for foreign matter or other defects which may cause interference with the smooth and progressive working of the plunger.

95. Before removing the carbon seal retaining plate, check that the plunger is

sliding quite freely over the whole length of its travel. If the plunger is satisfactory in the free condition, examine the loops of the tension spring, particularly where a new spring has been fitted to the unit. It may be found that a loop is off-centre, causing a side load to be applied to the plunger under working conditions. This may occur also if the spring loop is not a free fit within the plunger fork or if the clevis pin is too tight a fit within the spring loop. In either case a new spring must be fitted.

96. When the unit has been re-built it must be re-calibrated (*para.* 86 *to* 91) before commencing to repeat the performance test (*para.* 92 *to* 94). Check the performance over the range stated in the table two or three times to ensure that the unit is quite satisfactory and record the observed results on the test certificate.

Final leakage tests

97. When the performance test is satisfactory, the unit must be subjected to final leakage tests under the conditions specified in the relevant appendix. It is important that the appropriate installation fittings are fitted to the distributor and following a successful leakage check these fittings should not be disturbed.

98. With some distributors, some of the outlet unions may have restricted bores in order to disproportion the flow to certain burners. These unions must be tested for flow independently of the distributor in accordance with the separate calibration table given in the appropriate test schedule. These unions are numbered and must be fitted at this stage to their correspondingly numbered delivery ports in the distributor body.

99. Apply the inlet pressure stated in the Appendix and check the leakage from the drain outlet port. Should this leakage exceed the amount stated in the Appendix, change the carbon seal as described in para. 53 to 55, in which event the unit must be re-calibrated completely.

100. Dry the exterior of the distributor thoroughly with a compressed air blast, connect the drain union to rig-pump inlet, restrict the fuel delivery to provide the pressure stated in the Appendix and maintain the pressure for the period specified, during which there must be no leakage.

PREPARING FOR DESPATCH

Locking

101. After removing the distributor from the test-rig, drain all fuel from the unit and wire lock the spring anchor guide flange, the adjusting screw locknut and, where required, the installation fittings with 22 S.W.G. stainless steel wire.

Inhibiting

102. The distributor is to be flushed thoroughly with oil and inhibited in accordance with the detailed information contained in A.P.4471A " The preservation of aero-engines, engine change units, accessories, propellers and associated equipment."

103. After inhibiting, drain off the surplus oil and assemble dust caps or plugs to the distributor inlet, outlet and drain connections to avoid the ingress of foreign matter to the interior of the unit.

Final inspection

104. Check that all connections have been blanked off, check that the name plate is attached securely and ensure that the information on the plate corresponds with the details of the actual unit.

105. See that the test certificate is complete and approved.

Packing

106. Pack the distributor in the special transportation box and enclose two copies of the test certificate.

APPENDIX 1

CALIBRATION CODE 'E'

Note . . .
The values quoted in this appendix must be rigidly adhered to and reference should be made to the particular paragraph in the main chapter.

Port calibration *(refer to para. 65 and 66)*

1. Rig-tank pressure 10 to 15 lb. per sq. in. Fuel temperature 20 deg. to 26 deg. C. Inlet pressure 5 lb. per sq. in. Plunger set IN to 0·025 in. from datum.

2. Increase inlet pressure to 30 lb. per sq. in. and maintain for 5 minutes. After 5 min. the leakage per port must not exceed 10 c.c. per minute.

3. Port calibration table (*para.* 69).

Inlet pressure (lb. per sq. in.)	Mean flow per port (g.p.h.)	Plunger travel from opening point datum (in. micrometer reading)	Maximum variation between measuring cylinders. (c.c. per min.)
50	1·0	0·025 to 0·045	100 — 75
20	1·1	0·045 to 0·065	100 — 85
10	1·6	0·080 to 0·100	100 — 91
5	2·2	0·135 to 0·160	100 — 94
5	3·35	0·175 to 0·210	100 — 95
5	4·5	0·210 to 0·250	200 — 190
5	5·6	0·240 to 0·270	200 — 190
5	6·7	0·265 to 0·295	200 — 190

Performance calibration

4. Calibration table (*refer to para.* 87).

Mean flow per port (g.p.h.)	Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)	
		Minimum	Maximum
2	0·5	Record only	Record only
'A' 5	6·0	220	280
10	25·0	310	365
20	100·0	440	490
30	225·0	550	600
40	400·0	670	715
50	625·0	805	845
'B' 55	758·0	885	920
70	1250·0	—	1310

Leakage test *(refer to para. 99 and 100)*

5. The leakage from drain must not exceed 150 c.c. per min. at an inlet pressure of 1,000 lb. per sq. in. and delivery pressure of 800 to 900 lb. per sq. in.

6. There must be no external leakage during a period of 5 min. at a delivery pressure of 1,500 lb. per sq. in. with a rig-pump inlet pressure of 40 lb. per sq. in.

CALIBRATION CODE 'G'

Note . . .
The values quoted in this appendix must be rigidly adhered to and reference should be made to the particular paragraph in the main chapter.

Port calibration (*refer to para. 65 and 66*)

1. Rig-tank pressure 10 to 15 lb. per sq. in. Fuel temperature 20 deg. to 26 deg. C. Inlet pressure 5 lb. per sq. in. Plunger set IN to 0·025 in. from datum.

2. Increase inlet pressure to 30 lb. per sq. in. and maintain for 15 minutes. After 15 min. the leakage per port must not exceed 10 c.c. per minute.

3. Port calibration table (*refer to para.* 69).

Inlet pressure (lb. per sq. in.)	Mean flow per port (g.p.h.)	Plunger travel from opening point datum (in. micrometer reading)	Maximum variation between measuring cylinders. (c.c. per min.)
50	1·0	0·025 to 0·045	100 — 75
20	1·1	0·045 to 0·065	100 — 85
10	1·6	0·080 to 0·100	100 — 91
5	2·2	0·135 to 0·160	100 — 94
5	3·35	0·175 to 0·210	100 — 95
5	4·5	0·210 to 0·250	200 — 190
5	5·6	0·240 to 0·270	200 — 190
5	6·7	0·265 to 0·295	200 — 190

Performance calibration

4. Calibration table (*refer to para.* 87)

Mean flow per port (g.p.h.)	Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)	
		Minimum	Maximum
2	0·5	Record only	Record only
'A' 5	6·0	220	280
10	25·0	310	365
20	100·0	440	490
30	225·0	550	600
40	400·0	670	715
50	625·0	805	845
'B' 55	758·0	885	920
70	1250·0	—	1310

Final leakage test (*refer to para. 98 to 100 inc.*)

5. The restricting (bias) unions are to be assembled after the distributor has been calibrated. These unions must be selected to provide the individual flows specified in the following table.

Pressure drop (lb. per sq. in.)	Flow (gall. per hour)	
	No. 4 PORT	No. 9 PORT
100	14·5	20·0
1000	45·0 to 46·0	60·5 to 61·5

6. The leakage from drain must not exceed 150 c.c. per min. at an inlet pressure of 1,000 lb. per sq. in.

7. There must be no external leakage during a period of 5 min. at a delivery pressure of 1,500 lb. per sq. in. and rig-pump inlet pressure of 40 lb. per sq. in.

APPENDIX 3

CALIBRATION CODE 'H'

Note . . .

The values quoted in this appendix must be rigidly adhered to and reference should be made to the particular paragraph in the main chapter.

Port calibration *(refer to para. 65 and 66)*

1. Rig-tank pressure 10 to 15 lb. per sq. in. Fuel temperature 20 deg. to 26 deg. C. Inlet pressure 5 lb. per sq. in. Plunger set IN to 0·025 in. from datum.

2. Increase inlet pressure to 30 lb. per sq. in. and maintain for 15 minutes. After 15 min. the leakage per port must not exceed 10 c.c. per minute.

3. Port calibration table (*refer to para.* 69).

Inlet pressure (lb. per sq. in.)	Total flow (g.p.h.)	Plunger travel from datum (in. micrometer reading)	Maximum variation between measuring cylinders c.c. per min.		
			Normal	No. 4 port	No. 9 port
50	9·5	0·025—0·045	100— 75	76— 57	87— 65
20	10·8	0·045—0·065	100— 85	76— 65	87— 74
10	15·2	0·080—0·100	100— 91	76— 69	87— 79
5	21·5	0·130—0·155	100— 94	76— 71	87— 82
5	32·3	0·170—0·205	100— 95	76— 72	87— 82·5
5	43·1	0·210—0·250	200—190	152—144	174—165
5	53·9	0·240—0·270	200—190	152—144	174—165
5	64·7	0·270—0·295	200—190	152—144	174—165

Performance calibration

4. Calibration table (*refer to para.* 87).

Mean flow per port (g.p.h.)	Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)	
		Minimum	Maximum
20	0·5	Record only	Record only
'A' 50	6·0	230	280
100	25·0	315	365
200	100·0	450	490
300	225·0	560	600
400	400·0	670	715
500	625·0	815	850
'B' 550	758·0	890	925
700	1250·0	—	1290

Final leakage tests *(refer to para. 98 to 100 inc.)*

5. The restricting (bias) unions are to be assembled after the distributor has been calibrated. These unions must be selected to provide the individual flows specified in the following table.

Pressure drop (lb. per sq. in.)	Flow (gall. per hour)	
	No. 4 PORT	No. 9 PORT
200	Record	Record
600	93—95	142—145
1000	Record	Record

6. The leakage from drain must not exceed 150 c.c. per min, at an inlet pressure of 1,000 lb. per sq. in.

7. There must be no external leakage during a period of 5 min. at a delivery pressure of 1,500 lb. per sq. in. and rig-pump inlet pressure of 40 lb. per sq. in.

CALIBRATION CODE 'J'

Note . . .

The values quoted in this appendix must be rigidly adhered to and reference should be made to the particular paragraph in the main chapter.

Port calibration *(refer to para. 65 and 66)*

1. Rig-tank pressure 10 to 15 lb. per sq. in. Fuel temperature 20 deg. to 26 deg. C. Inlet pressure 5 lb. per sq. in. Plunger set IN to 0·025 in. from datum.

2. Increase inlet pressure to 30 lb. per sq. in. and maintain for 15 minutes. After 15 min. the leakage per port must not exceed 10 c.c. per minute.

3. Port calibration table (*para.* 69).

Inlet pressure (lb. per sq. in.)	Mean flow per port (g.p.h.)	Plunger travel from opening point datum (in. micrometer reading)	Maximum variation between measuring cylinders. (c.c. per min.)
50	1·0	0·025 to 0·045	100— 75
20	1·1	0·045 to 0·065	100— 85
10	1·6	0·080 to 0·100	100— 91
5	2·2	0·135 to 0·160	100— 94
5	3·35	0·175 to 0·210	100— 95
5	4·5	0·210 to 0·250	200—190
5	5·6	0·240 to 0·270	200—190
5	6·7	0·265 to 0·295	200—190

Performance calibration

4. Calibration table (*refer to para.* 87).

Mean flow per port (g.p.h.)		Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)	
			Minimum	Maximum
	2	0·5	Record only	Record only
'A'	5	6·0	220	280
	10	25·0	310	365
	20	100·0	440	490
	30	225·0	550	600
	40	400·0	670	715
	50	625·0	805	845
'B'	55	758·0	885	920
	70	1250·0	—	1310

Final leakage tests *(refer to para. 98 to 100 inc.)*

5. The restricting (bias) unions are to be assembled after the distributor has been calibrated. These unions must be selected to provide the individual flows specified in the following table.

Pressure drop (lb. per sq. in.)	Flow (gall. per hour)	
	No. 4 PORT	No. 9 PORT
100	Record	Record
500	63—64	73—74
1000	Record	Record

6. The leakage from drain must not exceed 150 c.c. per min. at an inlet pressure of 1,000 lb. per sq. in.

7. There must be no external leakage during a period of 5 min. at a delivery pressure of 1,500 lb. per sq. in. and rig-pump inlet pressure of 40 lb. per sq. in.

APPENDIX 5

CALIBRATION CODE 'L'

Note . . .

The values quoted in this appendix must be rigidly adhered to and reference should be made to the particular paragraph in the main chapter.

Port calibration *(refer to para. 65 and 66)*

1. Rig-tank pressure 10 to 15 lb. per sq. in. Fuel temperature 20 deg. to 30 deg. C. Inlet pressure 5 lb. per sq. in. Plunger set IN to 0·025 in. from datum.

2. Increase inlet pressure to 30 lb. per sq. in. and maintain for 15 minutes After 15 min the leakage per port must not exceed 10 c.c. per minute.

3. Port calibration table (*refer to para.* 69).

Inlet pressure (lb. per sq. in.)	Total flow (g.p.h.)	Plunger travel from datum (in. micrometer reading)	Maximum variation between measuring cylinders c.c. per min.		
			Normal	No. 4 port	No. 9 port
50	9·5	0·025—0·045	100— 75	76— 57	87— 65
20	10·8	0·045—0·065	100— 85	76— 65	87— 74
10	15·2	0·080—0·100	100— 91	76— 69	87— 79
5	21·5	0·130—0·155	100— 94	76— 71	87— 82
5	32·3	0·170—0·205	100— 95	76— 72	87— 82·5
5	43·1	0·210—0·250	200—190	152—144	174—165
5	53·9	0·240—0·270	200—190	152—144	174—165
5	46·7	0·270—0·295	200—190	152—144	174—165

Performance calibration

4. Calibration table (*refer to para.* 87).

Mean flow per port (g.p.h.)		Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)	
			Minimum	Maximum
	2	0·5	Record only	Record only
'A'	5	6·0	230	280
	10	25·0	315	365
	20	100·0	450	490
	30	225·0	560	600
	40	400·0	670	715
	50	625·0	815	850
'B'	55	758·0	890	925
	70	1250·0	—	1290

Final leakage tests *(refer to para. 98 to 100 inc.)*

5. The restricting (bias) unions are to be assembled after the distributor has been calibrated. These unions must be selected to provide the individual flows specified in the following table.

Pressure drop (lb. per sq. in.)	Flow (gall. per hour)	
	No. 4 PORT	No. 9 PORT
200	Record	Record
600	60·5—61·5	99—101
1000	Record	Record

6. The leakage from drain must not exceed 150 c.c. per min. at an inlet pressure of 1,000 lb. per sq. in.

7. There must be no external leakage during a period of 5 min. at a delivery pressure of 1,500 lb. per sq. in. and rig-pump inlet pressure of 40 lb. per sq. in.

APPENDIX 6

CALIBRATION CODE 'R'

Note . . .

The values quoted in this appendix must be rigidly adhered to and reference should be made to the particular paragraph in the main chapter.

Port Calibration *(refer to para. 63 to 73, also 98)*

1. Rig tank pressure 10 to 15 lb. per sq. in. Fuel temperature 20 to 26 deg. C. Inlet pressure 5 lb. per sq. in. Plunger set IN 0·025 in. from datum.

2. Increase inlet pressure to 30 lb. per sq. in. and maintain for 15 min. when the leakage per port must not exceed 10 cc. maximum.

3. Port calibration table.

Inlet pressure (lb. per sq. in.)	Total flow (g.p.h.)	Plunger travel from opening point datum (in. micrometer reading)	Maximum variation between measuring cylinders (cc. per min.)		
			No. 4 and 5 ports	No. 9 and 10 ports	'Remaining ports
50	9·5	0·025 to 0·045	76 to 57	87 to 65	100 to 75
20	10·8	0·045 to 0·065	76 to 65	87 to 74	100 to 85
10	15·2	0·080 to 0·100	76 to 69	87 to 79	100 to 91
5	21·5	0·130 to 0·155	76 to 71	87 to 82	100 to 94
5	32·3	0·170 to 0·205	76 to 72	87 to 82·5	100 to 95
5	43·1	0·210 to 0·250	152 to 144	174 to 165	200 to 190
5	53·9	0·240 to 0·270	152 to 144	174 to 165	200 to 190
5	64·7	0·270 to 0·295	152 to 144	174 to 165	200 to 190

Performance calibration *(refer to para. 87)*

4. Calibration table.

Total flow (g.p.h.)	Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)
42	27	255 to 275
60	65	270 to 320
100	103	340 to 380
200	150	455 to 495
300	200	545 to 585
400	265	635 to 675
500	350	718 to 758
600	440	800 to 840
700	535	872 to 908
800	665	927 to 963
900	817	970 to 1006
1000	973	1035 to 1085
1100	1139	1185 to 1250
1200	1385	1445 to 1520

Hysteresis is to be within calibration limits and must not exceed 10 lb. per sq. in.

Note . . .

This calibration is to be obtained with two restrictions assembled, which have been lapped to the flow stated below :—(Refer to para. 98).

Pressure drop (lb. per sq. in.)	Flow (g.p.h.) No. 9 and 10 ports
200	Record
600	142 to 145
1000	Record

Final leakage tests *(Refer to para. 93 to 100)*

5. At inlet pressure of 1,000 lb. per sq. in. (maximum), the tail seal leakage is to be 150 cc. minimum.

6. With an outlet pressure of 1,500 lb. per sq. in., no external leakage is permitted with an inlet pressure of 40 lb. per sq. in. over a period of 5 min.

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