

Chapter 3

COMBINED CONTROL UNITS, TYPES CCU. 46, 48, 60,
108 AND 109

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CALIBRATION CODES

Code	App.
BC and 108	1
BH	2
109	3

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Introduction

1. These instructions apply to types 46/19BC, 60/19BC and 108 for Palouste engines and CCU.48/19BH, 60/19 BH and 109 for Artouste engines. The units are basically identical with the exception of revised clearances on certain moving parts, modified governor cams and plungers.

2. The type number, e.g. 46/19BC, comprises the basic type designation (46), followed by the stroke number (/19) which

indicates the engine installation and therefore the connections required, whilst the final letters (BC) indicate the calibration code to which the unit must be tested. On later units a new system of designation is introduced in which a three figure number, e.g., 108, indicates a particular type and its installation and calibration features.

3. During the reconditioning of the unit, and particularly when assembling, a high standard of cleanliness must be maintained.

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Key to fig. 1

- | | | | | | |
|----|--------------------------------|----|--|----|------------------------------------|
| 1 | DISTANCE PIECE (2 OFF) | 26 | SPRING AND SHIM WASHER/S | 51 | SHIM WASHER/S |
| 2 | MAIN BODY | 27 | PLUG AND SEALING RING | 52 | TAIL BEARING |
| 3 | VALVE SEAT | 28 | GOVERNOR PLUNGER ORIFICE | 53 | THRUST RING |
| 4 | SHIM WASHER/S | 29 | THROTTLE VALVE SLEEVE | 54 | CARBON THRUST PAD |
| 5 | VALVE CASE | 30 | ORIFICE BLEED SCREW | 55 | GOVERNOR PLUNGER AND SHIM WASHER/S |
| 6 | PRESSURISING VALVE | 31 | GOVERNOR BODY | 56 | SPRING SEAT |
| 7 | SPRING & SHIM WASHER/S | 32 | DOME NUT | 57 | SPRING |
| 8 | VALVE COVER | 33 | STOP PLATE | 58 | SHIM WASHER/S |
| 9 | BLANK PLUG & BONDED SEAL | 34 | CAMPLATE SPINDLE COVER | 59 | SPRING |
| 10 | MAIN BODY COVER | 35 | DISC CONTROL PLATE | 60 | SHIM WASHER/S |
| 11 | ORIFICE BODY | 36 | STOP SCREW (2 OFF) | 61 | GUIDE ROD AND PLATE |
| 12 | LOCK NUT AND BONDED SEALS | 37 | CAM SPINDLE | 62 | CIRCLIP |
| 13 | DOME NUT | 38 | OUTLET CONNECTION TO ALTITUDE COM-
PENSATOR | 63 | SPRING SLEEVE |
| 14 | ACCELERATION BLEED SCREW | 39 | GOVERNOR BODY | 64 | STOP SLEEVE AND SHIM WASHER/S |
| 15 | SEALING PLUG AND BONDED SEAL | 40 | SPRING | 65 | GOVERNOR WEIGHTS (4 OFF) |
| 16 | SPRING PLATE AND SHIM WASHER/S | 41 | THROTTLE VALVE PLUNGER | 66 | CIRCLIP AND WASHER |
| 17 | VALVE CASE | 42 | LAMINATED OR PLAIN SHIM WASHER | 67 | PINS (4 OFF) |
| 18 | SPRING | 43 | CAM FOLLOWER | 68 | GOVERNOR CARRIER |
| 19 | RELIEF VALVE | 44 | THROTTLE VALVE CAM | 69 | SPLINED COUPLING |
| 20 | SHIM WASHER/S | 45 | GASKET | 70 | WASHER AND CIRCLIP |
| 21 | VALVE SEAT AND SEALING RING | 46 | GOVERNOR BODY COVER PLATE | 71 | CARBON BUSH |
| 22 | VALVE SEAT AND SEALING RING | 47 | BOLT (2 OFF) | 72 | BOLTS (2 OFF) |
| 23 | SHIM WASHERS | 48 | GOVERNOR CAM | 73 | BLANKING PLATE |
| 24 | VALVE CASE AND SEALING RING | 49 | VERNIER COUPLING | 74 | DISTANCE PIECES (2 OFF) |
| 25 | NON-RETURN VALVE | 50 | CAMPLATE | 75 | BLANK PLUG AND BONDED SEAL (3 OFF) |

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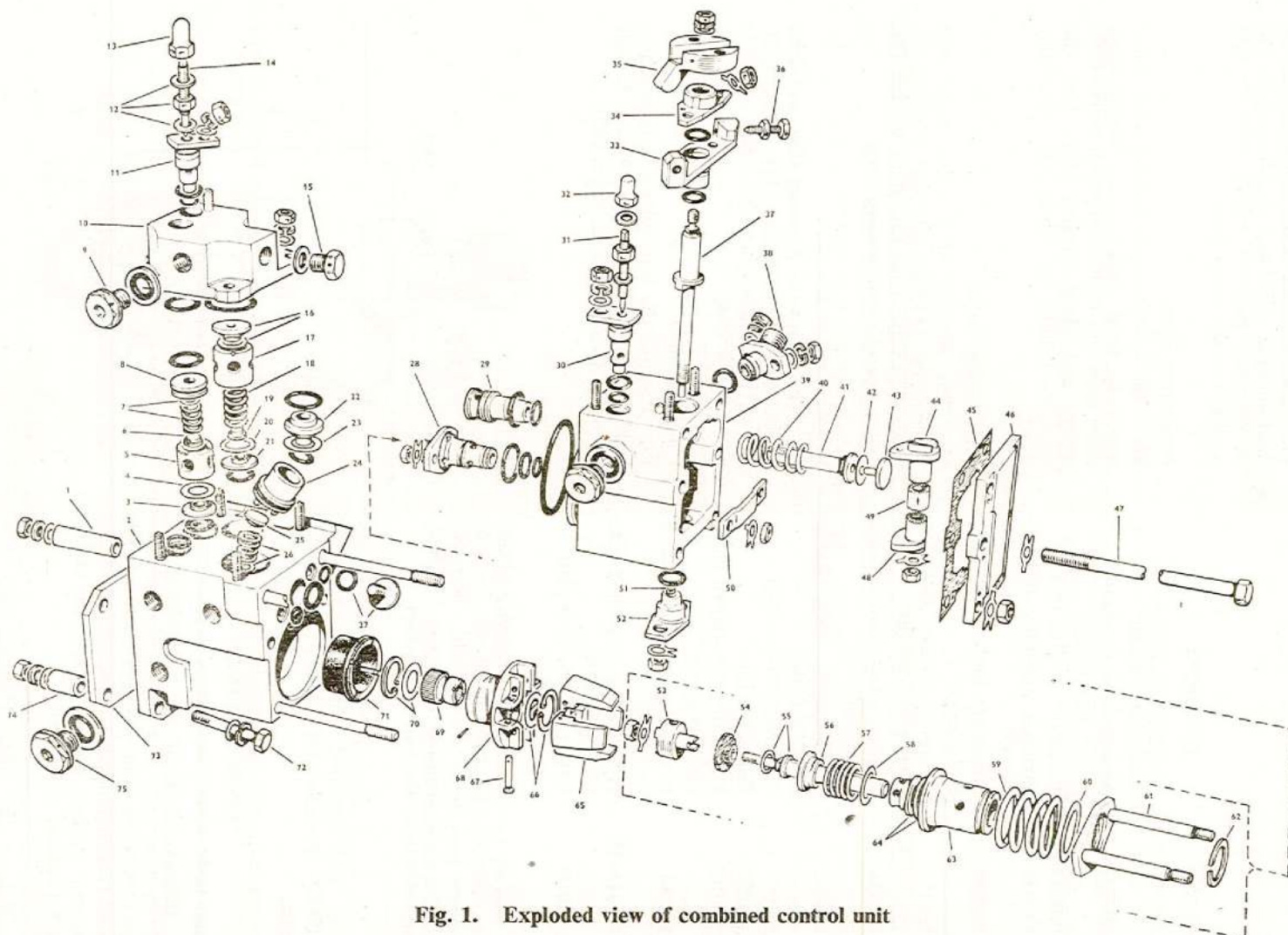


Fig. 1. Exploded view of combined control unit

4. Joint washers, gaskets, sealing rings, split pins, tabwashers and locking wire must be renewed, irrespective of condition.

Special tools

5.

<i>Tool No.</i>	<i>Description</i>
G.89693/89697	Sizing plugs, governor carrier and weight
G.89791/89796	Sizing plugs, governor carrier and weight
T.190007	Extractor, sealing rings
T.193939	Spanner, assembly of bleed screws
T.248403	Assembly tool, thrust ring and plunger
T.260310	Assembly fixture, governor carrier and weight
T.261036	Adjusting key, governor and weight to body
T.261098	Compression tool, guide rod and plate
T.261099	Assembly tool, circlip
T.262853	Pliers, circlip
T.280580	Extractor, non-return valve case from unit
T.280581	Extractor, t.v. plunger sleeve from unit
T.312215/H	Hydraclamp assembly fixture, complete
T.316017	Extractor, t.v. stop plate

6. Before commencing dismantling operations, remove the dust caps from the connections and drain off all fluid. Remove also the transportation bolts and blanking plate (73) from the end of the unit.

7. To avoid damage to sealing surfaces, it is recommended that the extractor T.190007 be used for removal of sealing rings.

DISMANTLING

Main body cover (fig. 1)

8. Remove the dome nut (13), slacken off the locknut (12) and, using the spanner T.193939, screw out the acceleration bleed screw (14) and bonded seals. Remove the nut and washers and withdraw the orifice body (11) and sealing rings.

9. Release the four retaining nuts and washers and lift off the cover (10).

10. Remove the two blanking plugs and bonded seals (9 and 15) from the cover.

11. After removal of the main body cover, the following valves and attaching parts will be exposed, parts of which may be still retained in the cover bores.

Non-return valve

12. This comprises a sealing ring, valve seat (22), shim washer (23), sealing ring, valve case and sealing ring (24), valve (25), spring and shim washer (26). Use the extractor T.280580 to remove the valve case, fig. 2.

Pressurising valve

13. This consists of a valve cover and sealing ring (8) spring and shim washers (7), valve (6), valve case (5), shim washer (4), valve seat (3) and sealing ring.

Relief valve

14. This comprises a spring plate and shim washer/s (16), valve case (17), spring (18), valve (19), shim washer (20), valve seat (21) and sealing ring.

Governor body

15. Remove the four nuts and tabwashers from the end of the body (39) and lift off the cover plate (46) and gasket (45).

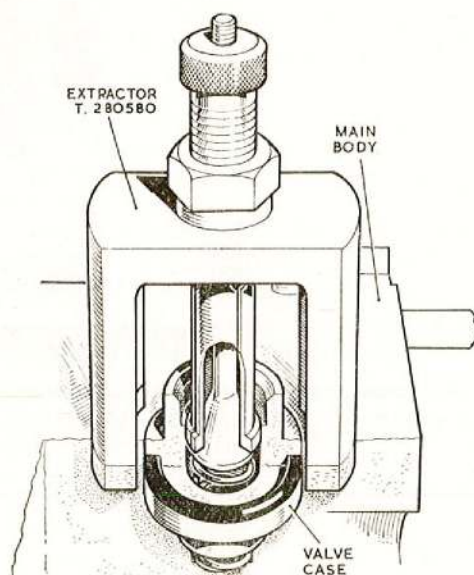


Fig. 2. Removing the n.r.v. case

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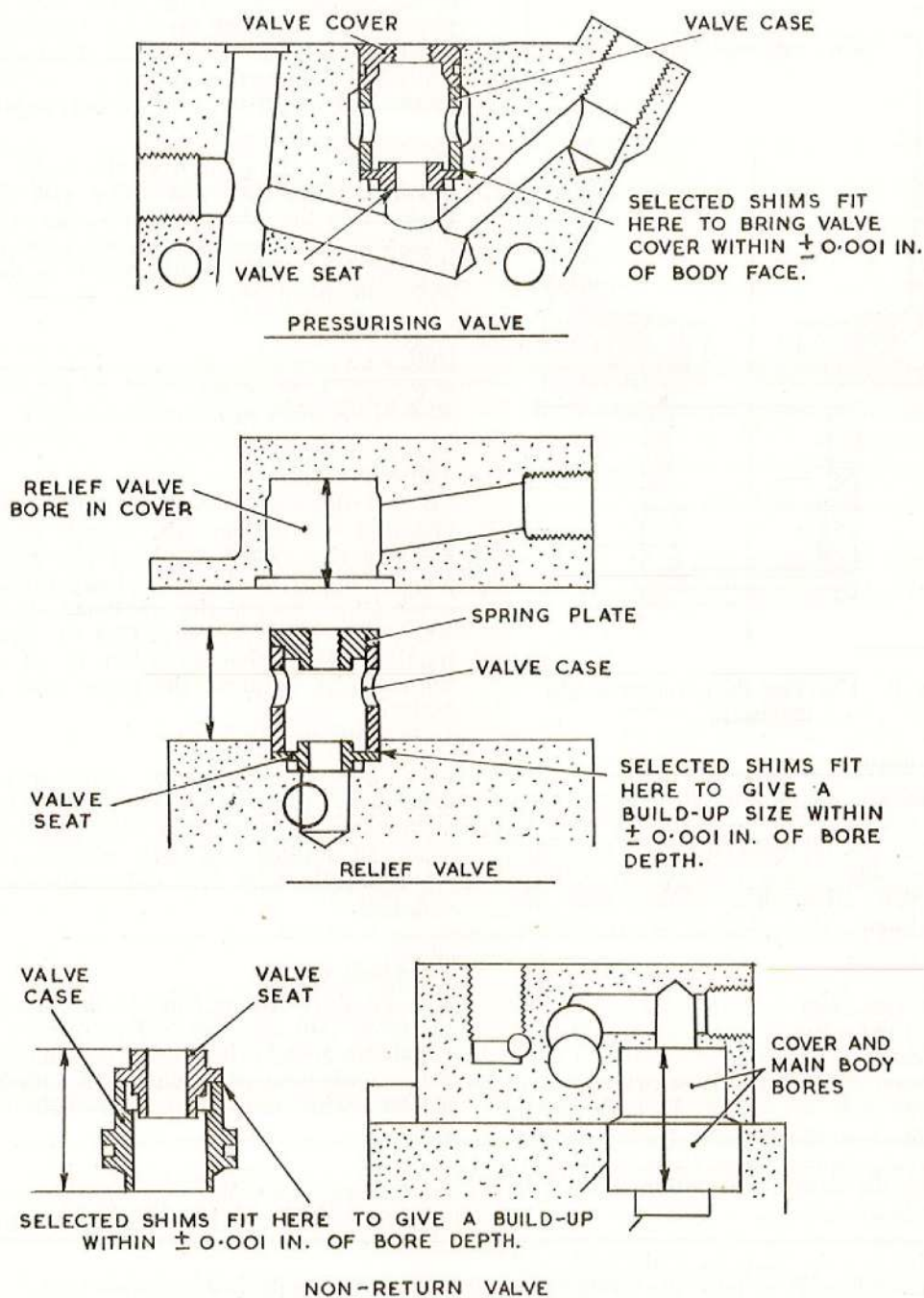


Fig. 7. Setting the main body valves

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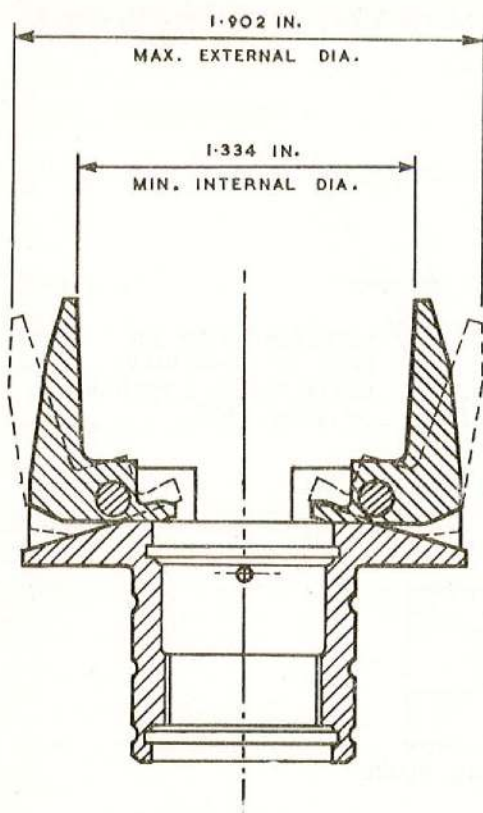


Fig. 8. Checking the governor weight diameters

Main body

58. Before assembling the pressurising valve, relief valve and non-return valve to the body, the following checks are necessary to determine certain dimensional settings. Note that other shim washer sizes are approximate, these being set to test rig requirements.

Pressurising valve

59. Fit the valve seat (3), valve case (5) and valve cover (8) V-slots uppermost, to the body bore. Place a depth micrometer across the body face, fig. 7 and check the depth from the top of the valve cover. Record the dimension and select shim washers (4) to bring the valve cover within ± 0.001 in of the body face.

60. Remove the parts from the body and fit the sealing ring into the body bore followed by the valve seat (3), selected shim washers (4), valve case (5) pressurising valve (6), spring and shim washers of approximately 0.060 in (7) and valve cover with sealing ring (8).

Relief valve

61. Fit the valve seat (21), valve case (17) V-slots uppermost, and spring plate (16) to the body bore. Measure from the top of the spring plate to the body face and measure the depth of the relief valve bore in the cover (10). Record the dimensions and select shim washers (20) to give a build-up size within ± 0.001 in of the bore depth.

62. Remove the parts from the body and fit the sealing ring and valve seat (21) followed by the selected shim washers (20), relief valve (19), spring (18), valve case (17), shim washers approximately 0.005 in thick and spring plate (16).

Note . . .

If the unit is to be rig tested, fit the blank RSK.373 in place of the valve seat (21).

Non-return valve

63. Fit the valve case (24) to the valve seat (22) and measure the overall length. Measure the overall depth of the corresponding bores in the main body (2) and cover (10). Record the combined depths and select shim washers (23) to give a build-up size within ± 0.001 in of the bore depths. Remove the parts from the body.

64. Fit shim washers of approximately 0.005 in and the spring (26) to the body bore followed by the non-return valve (25), valve case and sealing ring (24), selected shim washers (23), valve seat and small sealing ring (22).

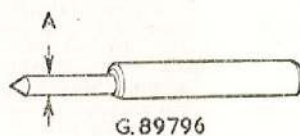
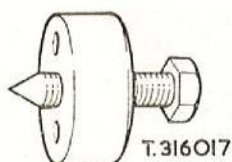
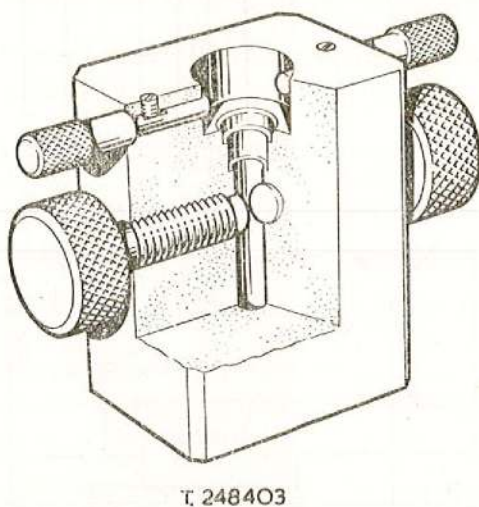
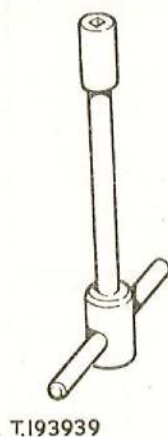
Main body cover

65. Fit three sealing rings to the bores in the cover (10) and one sealing ring to the remaining bore in the body. Assemble the cover to the body and secure with a washer, grover washer and nut on each of the four studs.

66. Fit the blank plug and bonded seal (9) and the sealing plug and bonded seal (15).

67. Assemble the orifice body (11) and sealing rings to the cover and secure with a washer, grover washer and nut. Fit the acceleration bleed screw (14) with the lock-nut, bonded seals and dome nut to the orifice body and secure.

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GAUGE NO.	DIA. 'A' INCHES
G.89693	O.1250
G.89694	O.1251
G.89695	O.1252
G.89696	O.1253
G.89697	O.1254
G.89791	O.1255
G.89792	O.1256
G.89793	O.1257
G.89794	O.1258
G.89795	O.1259
G.89796	O.1260

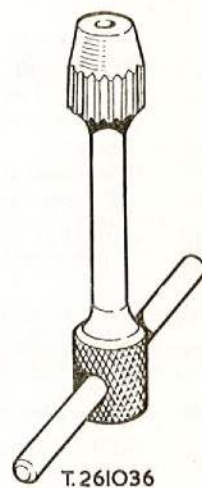
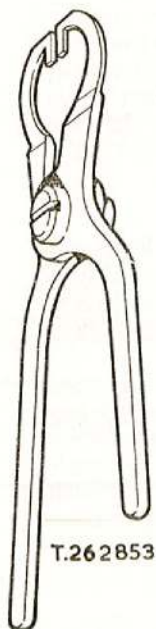


Fig. 9. Additional special tools
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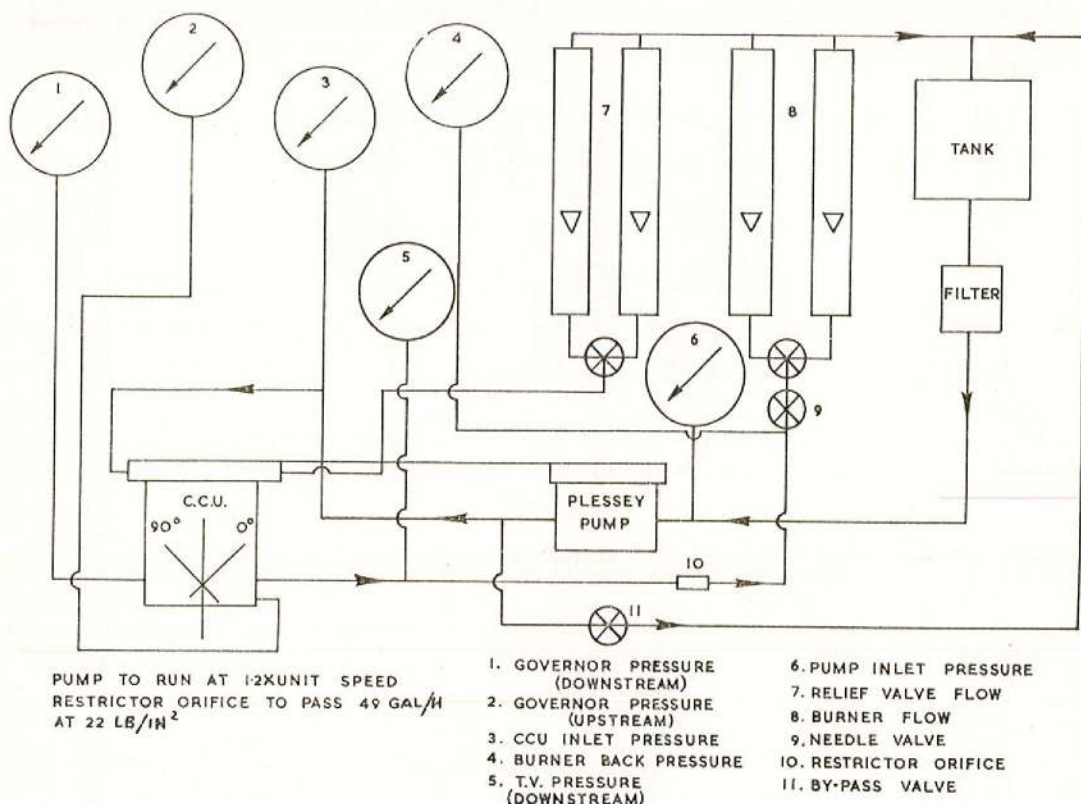


Fig. 10. Diagrammatic layout of test rig

Note . . .

If the unit is to be rig tested, fit the blank RSK.373 in place of the built-up acceleration bleed assembly.

Governor carrier and weights

68. Fit the splined coupling (69) to the governor carrier (68) and at each end fit a washer and circlip (66) and (70).

69. Assemble the four governor weights (65) to the carrier and retain them with the pins (67), using the tool T.260310, fig. 3. The pins must be selected to give an interference fit in the governor carrier of 0.0001 to 0.0002 in and a clearance fit in the governor weight of 0.0002 to 0.0004 in. A range of pins to three sizes should be available. Use the sizing plugs G.89693 to G.89697 and G.89791 to G.89796 to check the hole diameters, and a Precimeter gauge to check the pin diameters.

70. Check the internal diameter of the

weights when in the closed position, and the external diameter when in the open position, as in fig. 8. If beyond the limits stated, select other weights to suit. When satisfactory, fit new split pins, check the free movement of the weights then insert the assembly into the main body bore.

Assembling main body to governor body

71. Fit three sealing rings to the counterbores in the mating face of the main body and attach the governor body over the four studs. To ensure correct mating of the governor carrier with the thrust ring (53) it may be necessary to use the adjusting key T.261036. Insert this through the open end of the main body into the splined coupling and turn until a click is heard then push the bodies together. Assemble the gasket (45) and cover plate (46) and fit four tab-washers and nuts.

72. Fit the plug and sealing ring (27) to

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16. Separate the governor body from the main body (2), withdraw the exposed governor plunger assembly (53, 54, 55) and remove the stop sleeve and shim washer/s (64), spring (57), shim washer (58) and spring seat (56).

17. Place the plunger (55) in the tool T.248403 and remove the nut and tabwasher. Remove the plunger from the tool and lift off the thrust ring (53) carbon thrust pad (54) and shim washer (55).

18. Remove the nut and washers retaining the disc control plate (35). Fit the extractor T.316017 with two slave bolts into the two extraction holes and withdraw the plate from the governor body. Remove the two exposed nuts and tabwashers and lift off the camplate spindle cover (34).

19. Release the locknut and tabwasher at the bottom of the cam spindle (37) push up the t.v. cam (44) to release the sealing ring nip then withdraw the cam spindle, stop plate (33) t.v. cam, vernier coupling (49) and governor cam (48).

Note . . .

Before withdrawing the cams and coupling, lightly mark the assembled positions to facilitate rebuild.

20. Remove the cam follower (43), shim washer (42) throttle valve plunger (41) and spring (40) from the governor body. The throttle valve sleeve will remain in the main body when the bodies are separated.

21. Release the two nuts and tabwashers inside the lower portion of the body and remove the camplate (50). Withdraw the guide rod and plate assembly (61) complete with spring, from the opposite end of the body. Fit the parts to the compression tool T.261098, compress the spring (59) and remove the circlip (62) by using the pliers T.262853. Release the compression, remove the tool and withdraw the spring (59) sleeve (63) and shim washer (60) from the guide rod assembly.

22. Release the two nuts and tabwashers the cam-spindle tailbearing (52) and the bearing from the governor and remove the small shim washer (51) from the bore.

23. Release the two nuts and tabwashers located inside the large boss of the governor body and carefully tap out the governor orifice (28) complete with three sealing rings. Remove the large sealing ring from the body boss and a smaller seal from the adjacent face.

24. Remove the outlet connection (38) and the blanking plug from opposite sides of the governor body.

Main body

25. Withdraw the governor carrier (68) and attached weights (65) from the body and remove the circlip carbon bush (71) and remove the circlip with washer (70) and splined coupling (69) from the carrier bore. Remove the four pins (67) and weights, using the tool T.260310 (fig. 3). Release an identical circlip and washer (66) from the exposed bore.

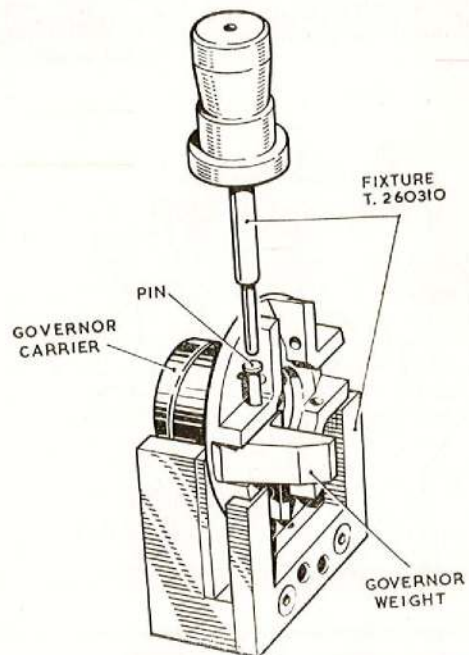


Fig. 3. Removing or assembling the governor weights

Note . . .

Although shown dismantled in fig. 1 for clarity purposes, the carbon bush is cemented into the body and should not be disturbed.

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26. Fit the main body to the hydraulic fixture T.312215/H (fig. 4) and secure it with slave bolts. Remove the throttle valve sleeve (29) from the bore above the governor carrier aperture, using the extractor T.280581 (fig. 5). Discard the sealing rings.

27. Remove the three blanking plugs and bonded seals (75) from the side of the body, and the sealing plug with sealing ring (27) from beneath the burner outlet connection.

CLEANING

28. The components should be pressure-washed in kerosene, using an appropriate bath and spray gun supplied by a pump which has adequate filtering facilities. Hard brushes, cloths and abrasives should not be used. After cleaning, the parts should be dried with a compressed air blast, which must be free from water, then placed in clean, dry containers.

29. Particular care is necessary when cleaning components with a micro-finish sealing face. In these instances a nylon brush with methylated or white spirit should be used for removing any gasket residue.

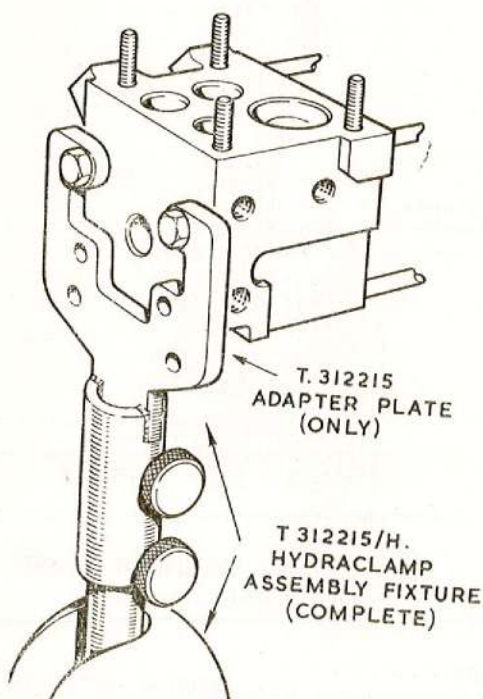


Fig. 4. Fixture for dismantling or assembling

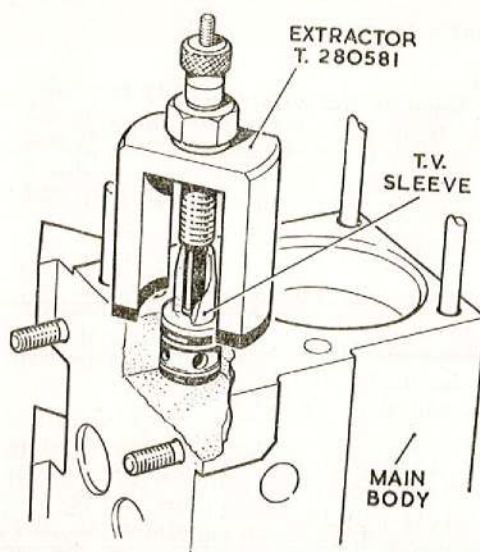


Fig. 5. Removing the throttle valve sleeve

INSPECTION

30. This inspection of the dismantled parts is to verify their condition before reassembly. Certain additional checks, however, are required during the assembling of the unit.

31. Where dimensional checks are necessary, reference must be made to the Schedule of Fits, Clearances and Repair Tolerances, A.P.4282A, Vol. 2, Part 2.

32. It is usual during inspection to reject any parts rendered redundant by modifications: information covering modifications should therefore be at hand.

33. In the case of suspected cracks or where there is doubt concerning the soundness of parts they must be tested by means of approved crack detection equipment.

Main body and attaching parts

34. Examine the body for general condition of joint faces, bores, seal leads, grooves, tapped holes and studs. Ensure that the carbon bush is firmly cemented in the body and that the bush is free from cracks or deep scoring.

Note . . .

The body and governor carrier are mating parts and should not be interchanged with similar components from another unit. The identifying mating number, e.g., XA500, is etched on each component.

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35. Inspect the governor carrier for a good polished surface on the bearing face and freedom from sharp edges. Dimensionally check the bearing face diameter in relation to the carbon bush bore. Closely examine for contact marks between the governor weights, spring and body bore. Reject any defective parts.

36. Check that the splined coupling is a good fit in the carrier and inspect the splines for fretting and corrosion.

37. Examine the cover, orifice body and acceleration bleed screw for general condition of the joint faces, seal leads, tapped holes and studs.

38. Inspect the pressurising valve, relief valve and non-return valve assemblies for general condition of seal leads, seating faces, threads and springs.

Governor body and attaching parts

39. Inspect the body and cover plate for general condition of joint faces, seal leads, grooves, bores, tapped holes and studs.

40. Examine the throttle valve plunger and sleeve assembly for damage. The two items are a mating assembly and are not interchangeable with similar parts. Check that the items have a smooth sliding movement and ensure that sharp edges are maintained on the plunger metering forms. Dimensionally check the parts in accordance with the Schedule of Fits and Clearances. Inspect the plunger spring for general condition and ensure that the contact face of the cam follower is not unduly marked by the cam.

41. Examine the governor plunger and orifice assembly for damage, scores and distortion. The two items are mated and are not interchangeable with other similar parts. Test the items for good sliding movement and carry out the dimensional checks.

42. Inspect the plunger attaching parts, i.e., the stop sleeve, spring, spring seat, carbon thrust pad and thrust ring for general condition. Ensure that the carbon pad is not cracked or chipped and that the bearing surfaces of the metal parts are smooth and polished. The depth of any contact marks

from the heels of the governor weights must not exceed 0.0002 in.

43. Examine the cam spindle, tail bearing, throttle cam, vernier coupling and governor cam for general condition. Ensure that the profiles are smooth and polished and that the vernier serrations mesh correctly.

44. Inspect the stop plate, camplate spindle cover and disc control plate for general condition of joint faces, bores, seal leads, grooves and tapped holes. Ensure that the lug on the control plate is not unduly worn due to contact with the stop screws.

45. Inspect the spring sleeve, spring, guide rod and plate assembly and the camplate for general condition. Ensure that the guide rods are parallel to each other, square to the base plate and securely riveted. Check that the rods fit freely to the bores in the governor body.

46. Inspect the outlet connection to the altitude compensator for general condition of the seal groove, threaded connection and mounting flange.

ASSEMBLING

Governor body

47. Fit three sealing rings to the governor plunger orifice (28) and attach it to the body internal studs. Secure it with two tabwashers and nuts.

48. Fit a sealing ring on the throttle valve sleeve (29), and a smaller sealing ring in the body counterbore then push the sleeve into the body bore. From the opposite end of the body, assemble to the sleeve the spring (40), throttle valve plunger (41) laminated or plain shim washer (42) and cam follower (43).

49. Into the body assemble the throttle valve cam (44), the vernier coupling (49), arrow pointing upwards, the governor cam (48) and retain them with the cam spindle (37). Fit a tabwasher and nut but do not bend over the tab at this stage. Fit the stop plate (33) and sealing rings to the body, followed by the cam spindle cover (34). Fit

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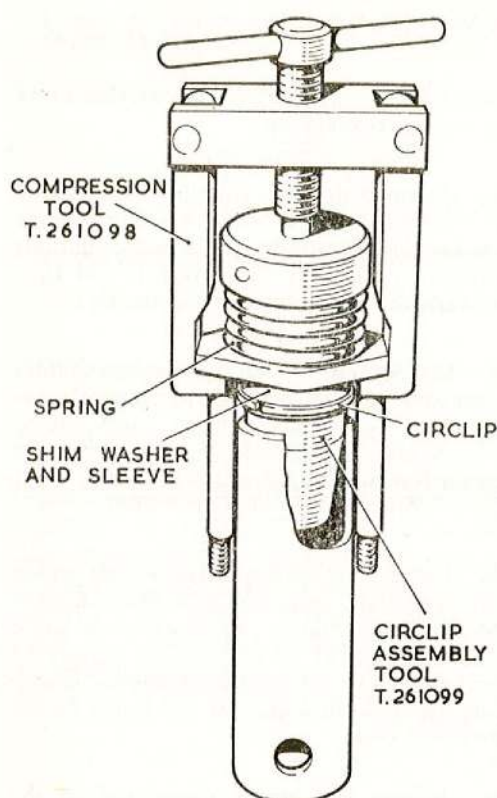


Fig. 6. Fitting the spring sleeve circlip

two tabwashers and nuts but do not tighten them. Loosely assemble the two stop screws (36). Fit the control plate (35) and secure it to the cam spindle with a washer, grover washer and nut. Tighten the nut to a torque of 20 lb in maximum.

50. Insert the small shim washer/s (51) into the tail bearing (52), place a sealing ring over the bearing shoulder and assemble to the two studs in the base of the body. Fit two tabwashers and nuts but do not lock them.

51. Check the end-float of the cam spindle. This should be between 0.005 and 0.010 in whilst maintaining a minimum clearance gap of 0.013 in between the camplate spindle cover (34) and the disc control plate (35). If necessary, add to or subtract from the small shim washers in the tail bearing from the range of different thicknesses provided.

52. Assemble the shim washer/s (60), spring (59) and spring sleeve (63) to the guide rod

and plate assembly (61). Fit the parts to the compression tool T.261098 (fig. 6) compress the spring sufficient to push the sleeve through the guide rod plate then fit the circlip (62) using the tool T.261099. Remove the tools and check that the spring is seating square and that there is free movement of the sleeve.

53. Fit the built-up assembly to the governor body (39) and assemble the camplate (50) to the guide rods. Fit but do not lock the two tabwashers and nuts.

54. Assemble the governor plunger and shim washer (55) to the carbon thrust pad (54) and thrust ring (53). Loosely assemble the tabwasher and nut and fit the plunger to the assembly tool T.248403. Locate the top pegs of the tool in the thrust ring holes, secure the plunger with the large knurled screws and tighten the plunger nut to a torque of 15 lb in. Remove from the tool, lock the tabwasher and fit the spring seat (56), spring (57), shim washer (58) and stop sleeve and shim washer (64) to the plunger. Fit the built-up assembly to the governor plunger orifice (28).

55. Fit a sealing ring to the orifice body (30) and a smaller seal in the governor body bore. Loosely assemble the governor bleed screw (31) with bonded seals, locknut and dome nut (32) to the orifice body and fit to the governor body. Fit a washer, grover washer and nut.

Note . . .

If the unit is to be rig tested, fit the blank RSK.373 (fig. 12) in place of the built-up governor bleed assembly.

56. Fit a sealing ring to the altitude compensator outlet connection (38) and assemble to the side of the body. Secure with two washers, grover washers and nuts. The nut nearest to the two body mating faces is drilled for wirelocking purposes.

Note . . .

If the unit is to be rig tested, fit the blank and seal to the connection cover.

57. Fit a sealing ring around the large boss on the body mating face and fit the blanking plug and bonded seal into the side of the body. Store in a safe place pending assembly to the main body.

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the main body and three blank plugs and bonded seals (75) to the opposite side.

73. If rig testing is not being immediately carried out, fit the blanking plate (73) with bolts (47) and (72) and the distance pieces (1) and (74). Fit dust plugs to all open apertures.

74. Rig test fittings for the main inlet and outlet and the burner and torch igniter outlet are specified in the test instructions.

TESTING

General

75. The fuel specification, inlet pressure, temperature limits and calibration values must be as specified in the relevant appendix at the end of this chapter.

76. The pressure tests and valve setting test para. 79 to 82, should be carried out on a separate source of supply such as a burner test rig which has facilities for supplying fuel at the required pressures and checking any resultant leakage.

77. For all other tests, the unit is connected to the rig R.212, shown diagrammatically in fig. 10. Except for those tests detailed in para. 74 to 77 a back pressure

must be maintained downstream at the restrictor orifice by restricting the flow on the needle valve in the burner flow line. The value of the pressure depends upon unit speed, and reference should be made to the graph (fig. 11).

78. The rig inlet by-pass valve must be closed for all governor tests. The acceleration bleed and governor bleed assemblies should be removed and replaced by the blanks, fig. 12. Ensure also that the blank has been fitted in place of the relief valve seat.

Pressure tests

79. Fit the test fittings to the unit as shown in fig. 12 and connect up to the pressure test rig. Apply fuel at 400 lb/in² (indicated on the gauge connected to the torch igniter connection) and check for leakage on the flowmeter connected to the unit outlet. Maximum permissible leakage is 1.5 g/h. If beyond the limit, replace the governor plunger and orifice assembly and repeat the test.

80. When satisfactory, remove the blank from the relief valve and fit the valve seat (item 21, fig. 1).

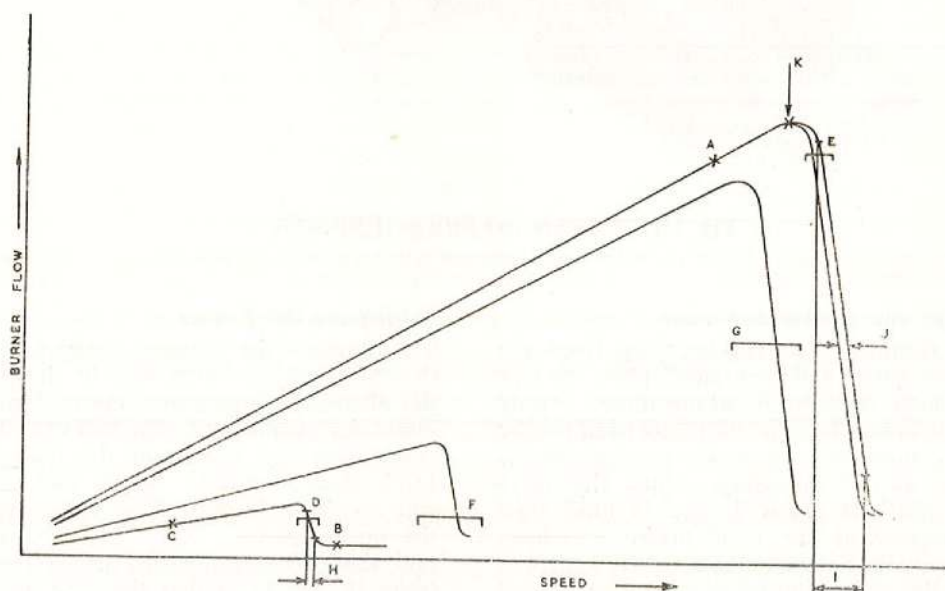


Fig. 11. Governor setting graph

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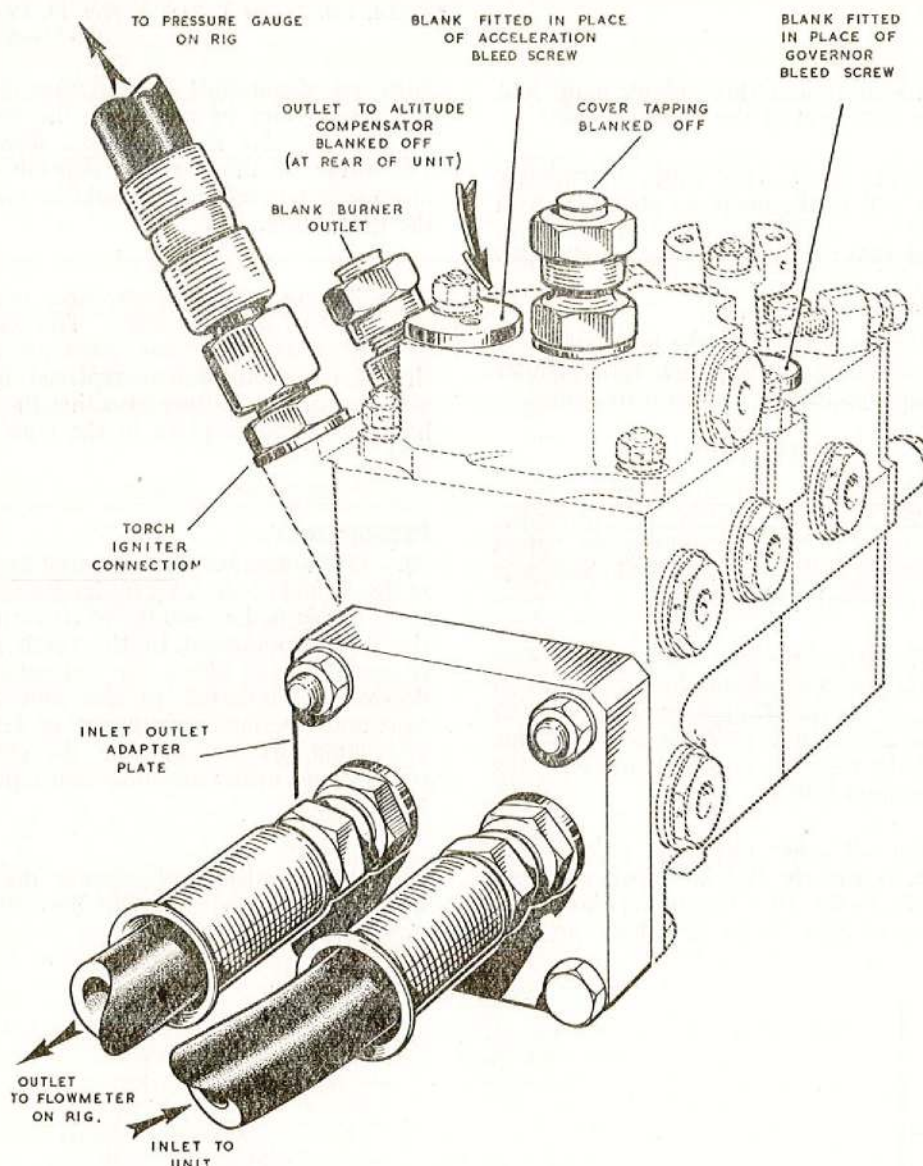


Fig. 12. Pressure test fittings (RSK.373)

Setting the pressurising valve

81. Remove the blanking plug from the burner outlet and fit a small pipe, the end of which is open to atmosphere. Apply fuel at pressure to the unit inlet until burner flow commences. Note the pressure on the gauge and if necessary, adjust the valve shim washers (*item 7, fig. 1*) until flow commences at the stated pressure. Check for valve leakage as stated in the appendix with the open pipe inserted in a graduated container.

Setting the relief valve

82. Remove the pressure gauge pipe from the torch igniter outlet and fit the pipe to the altitude compensator connection. Remove the open ended pipe from the burner connection and blank off the burner and torch igniter outlets. Apply fuel at pressure to the unit until flow is indicated on the rig flowmeter. Note the fuel pressure, and where necessary, adjust the shim washers (*item 16, fig. 1*) so that the flow just commences at the stated pressure. Check for

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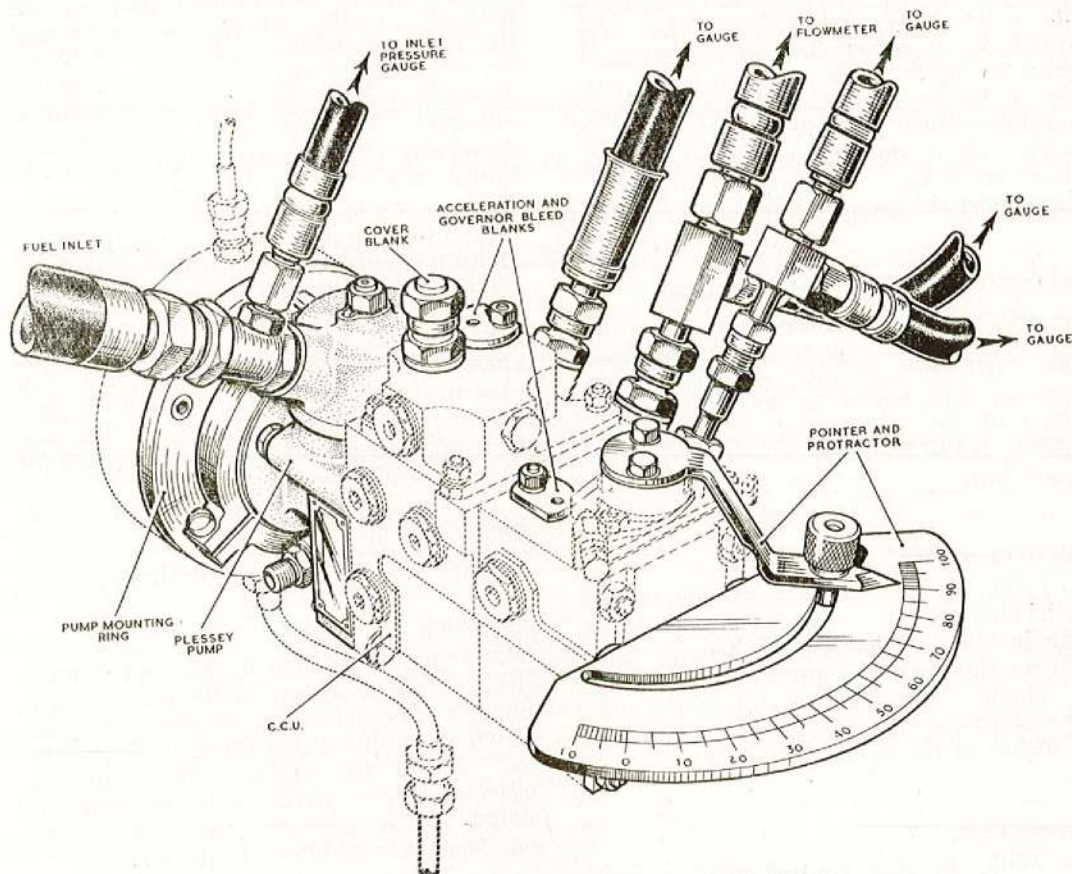


Fig. 13. Calibration test fittings (RSK.373)

valve leakage as stated in the appendix. When satisfactory, remove the unit from the rig.

Governor cut-off

83. Remove the inlet-outlet adapter plate and mount the unit on the calibration rig. 212 (fig. 13). With the unit running at 2500 rev/min and the disc control plate set at minimum angle, check that the burner flow is less than 4 g/h. If beyond the stated limit, replace the governor plunger and orifice assembly and repeat the test.

Acceleration bleed

84. Remove the blank and fit the acceleration bleed screw assembly. With the unit running at the stated speed and the disc control plate set at maximum, open the bleed screw fully and check the burner flow which should reduce to the value stated in the appendix.

85. Close the acceleration bleed screw to give the required burner flow.

Governor by-pass flow

86. Remove the blank from the governor body and refit the governor bleed screw assembly. With the unit running at the stated speed and the disc control plate at minimum, open the bleed screw fully and check the burner flow which should increase to the value stated in the appendix.

87. Adjust the speed and reset the bleed screw to give the required burner flow.

Non-return valve

88. Switch off the rig, disconnect the burner flow line and connect a small pipe, the end of which is open to atmosphere. Apply the stated pressure to the supply tank and check for leakage from the non-return valve by means of a graduated container.

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89. If the valve is passing fuel in excess of the figure stated, the possible cause is a bad valve seating. Remove the cover from the main body and withdraw the valve assembly. Examine the valve plate and valve seating for score marks or high spots. Rub down on a block with very fine carborundum paste and then polish on clean paper. Wash thoroughly, re-assemble and check for leakage. It may be necessary to shim under the spring if leakage is excessive.

Setting the starting acceleration flow

90. Run the unit at the speed stated in the appendix and check the starting acceleration flow. If necessary, adjust the shim washer (item 42, fig. 1) between the throttle valve cam follower and plunger. Add shims if the flow is too high and subtract if the flow is too low.

Governor setting

91. Run the unit at the conditions stated in the appendix and set the governing points by adjustment of the shim washers (58) and (60) on the governor springs and between the plunger (55) and thrust ring, and also by variation of the governor cam position by means of the vernier coupling.

Governor rate

92. With the disc control plate at the minimum setting, increase the speed and note the change in rev/min necessary to give the flow change. The speed change must not exceed that stated in the appendix.

93. With the disc control plate at the maximum setting, increase the speed and note the rev/min change necessary to give the flow change. The speed change must not exceed that stated in the appendix. Adjust the shim washers (55) as required, at the same time adding to or subtracting from the shim washers (64) to bring the unit into the curve, fig. 14 and 15.

Governor hysteresis

94. With the disc control plate at the maximum setting, increase the speed until the required flow is obtained. Note the rev/min, increase the speed further as stated and then decrease until the previous flow is obtained. The change of speed between decreasing and increasing flows must not exceed that stated in the appendix.

95. If the unit hysteresis is above the stated figure it is usually due to the spring sleeve fouling the guide rod assembly. Remove it from the unit and dismantle it. Score marks will be apparent on the sleeve and guide rod. Polish these items lightly with superfine emery and buff. Wash thoroughly before re-assembling. Another cause may be a tight hinge movement of the governor weights on the carrier.

Endurance test

96. Run the unit as stated in the appendix.

Inspection

97. Separate the two bodies and remove the governor weight assembly and governor plunger assembly. Check the governor weights and thrust ring for fretting and the carbon bush for scoring. The degree of bearing witness marks to be permitted is stated in the appendix. Re-assemble the unit and lock all internal tabwashers.

Calibration checks

98. Carry out the tests detailed in para. 86, 88, 90 and 91, and then lock all external adjustments.

Leakage test

99. Disconnect the unit from the rig and fit the inlet/outlet adapter plate. With the unit full of fuel, apply 40 lb/in² pressure to the unit outlet and maintain for 5 minutes. There should be no leakage.

Inhibiting

100. Refer to A.P.4471A.

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APPENDIX 1

CALIBRATION CODE BC AND 108

General

1. This appendix is to be used in conjunction with the testing instructions contained in the chapter. AVTUR fuel must be used and be maintained at a temperature of 20 to 30°C.

2. The fuel inlet pressure is to be maintained at 8 ± 1 lb/in² gauge, checked at the pump inlet union.

3. The fuel delivery pressure to be applied is shown on the curve in fig. 1.

4. The restrictor (10) in the diagrammatic layout is to be a 10.4 F. No.

5. The disc control plate maximum and minimum positions should be $45^\circ \pm 1^\circ$ either side of the unit centre line.

Pressure tests

6. As described in para. 79 and 80.

Setting the pressurising valve (para. 81)

7. Pressurising valve to open at 60 ± 1 lb/in². The leakage at 50 lb/in² must not exceed 10 cc/min.

Setting the relief valve (para. 82)

8. Relief valve to open at 120 ± 2 lb/in². The leakage at 110 lb/in² must not exceed 2.5 gal/h.

Governor cut-off

9. As given in para. 83.

Acceleration bleed (para. 84 and 85)

10. The burner flow should reduce to 35 gal/h or less.

11. The flow should be set to 37 to 38.5 gal/h at 3750 rev/min, Point A on fig. 11.

Governor by-pass flow (para. 86 and 87)

12. Burner flow should increase to 12 gal/h or more.

13. Burner flow should be 5 to 5.5 gal/h at 2500 rev/min, Point B.

Non-return valve (para. 88 and 89)

14. At 30 lb/in² boost pressure the leakage must be less than 15 cc/min.

Setting the starting acceleration flow (para. 90)

15. With the disc control plate at minimum, the flow should be set to 7.25 to 8.5 gal/h at 1000 rev/min, Point C.

Governor setting (para. 91)

16. The governor settings shown in the following table should be obtained. To obtain the settings at 20° and 80° adjust the position of the governor cam by slackening off the nut at the base of the cam spindle and rotating the vernier coupling. To obtain early governing of the unit open the cam angles and vice-versa. It may be necessary to add or reduce the shim washers beneath the plunger stop sleeve to bring the unit back into the curve, fig. 1. At the maximum angle the highest recorded flow (Point K) must occur within the box limits (4100 rev/min, 41 to 42 gal/h) and (4200 rev/min, 41 to 42 gal/h). Record the flow and speed.

Lever setting	Speed (rev/min)	Burner flow (gal/h)	Fig. ref.
Minimum	1800—1850	9.5	Point D
Maximum	4350—4400	36	Point E
20°	2150—2550	10	Point F
80°	3900—4300	30	Point G

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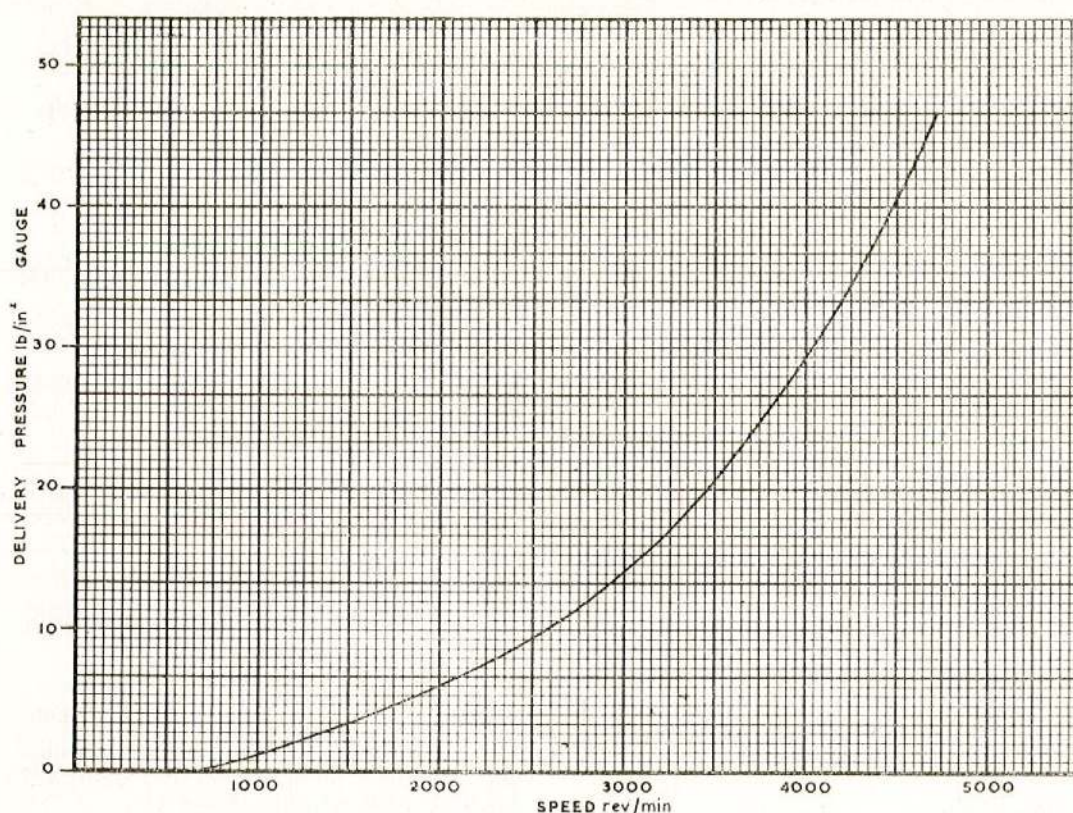


Fig 1. Performance curve for codes BC, BH and 108

Governor rate (para. 92 and 93)

17. Increase the speed until the unit is governing and the burner flow is 8.5 gal/h. A further increase in speed to decrease the flow to 5.5 gal/h must not exceed 260 rev/min, Point H.

18. Increase the speed to 4800 rev/min at which point the flow should be 22 gal/h maximum. Increase the speed until the unit is governing and the burner flow is 36 gal/h. A further increase in speed to decrease the flow to 15 gal/h must not exceed 600 rev/min, Point I. If the flow exceeds the limits for the above checks, add shim washers to the governor plunger to obtain early governing. It may be necessary to add or reduce the shim washers beneath the stop sleeve to bring the unit back into the curve (fig. 1).

Governor hysteresis (para. 94 and 95)

19. After running up to 4800 rev/min and hysteresis at the 30 gal/h flow must not exceed 100 rev/min, Point J.

Endurance test (para. 96)

20. Run the unit to the following cycles:—

Period (minutes)	Control setting	Speed (rev/min)
25	20°	2500
5	20°	1500
10	Max.	4600
20	Max.	4100

Inspection (para. 97)

21. The depth of the contact marks on the thrust ring from the heels of the governor weights must not exceed 0.0002 in. There should be no contact marks between the governor weights, spring and the body bore.

Final calibration (para. 98)

22. Carry out the tests detailed in para. 11, 13, 15 and 16. Lock all external adjustments.

Final leakage test

23. As detailed in para. 99.

RESTRICTED

APPENDIX 2

CALIBRATION CODE BH

General

1. This appendix is to be used in conjunction with the testing instructions given in the chapter. AVTUR fuel must be used and be maintained at a temperature of 20 to 30°C.

2. The fuel inlet pressure is to be maintained at $8 \pm 1 \text{ lb/in}^2$ gauge, checked at the pump inlet union.

3. The fuel delivery pressure to be applied is shown on the curve in fig. 1 of Appx. 1.

4. The restrictor (10) in the diagrammatic layout is to be a 10.4 F. No.

5. The disc control plate maximum and minimum positions should be $45^\circ \pm 1^\circ$ either side of the unit centre line.

Pressure tests

6. As described in para. 79 and 80.

Setting the pressurising valve (para. 81)

7. Pressurising valve to open at $60 \pm 1 \text{ lb/in}^2$. The leakage at 50 lb/in² must not exceed 10 cc/min.

Setting the relief valve (para. 82)

8. Relief valve to open at $120 \pm 2 \text{ lb/in}^2$. The leakage at 110 lb/in² must not exceed 2.5 gal/h.

Governor cut-off

9. As given in para. 83.

Acceleration bleed (para. 84 and 85)

10. The burner flow should reduce to 37 gal/h or less.

11. The flow should be set to 54 to 56.5 gal/h at 3500 rev/min, Point A on fig. 11.

Governor by-pass flow (para. 86 and 87)

12. Burner flow should increase to 12 gal/h or more.

13. Burner flow should be 8.1 to 9.0 gal/h at 2500 rev/min, Point B.

Non-return valve (para. 88 and 89)

14. At 30 lb/in² boost pressure the leakage must be less than 15 cc/min.

Setting the starting acceleration flow (para. 90)

15. With the disc control plate at minimum, the flow should be set to 13.5 to 16.0 gal/h at 1000 rev/min, Point C.

Governor setting (para. 91)

16. Adjust the flow and pressure drop, i.e., flow number of the unit, by means of the shim washers on the governor plunger. This pressure drop is the difference between the upstream of the governor (gauge 2 on the diagrammatic layout) and downstream of the throttle valve (gauge 5). At 90° control setting and 3500 rev/min, Point A, the pressure drop must be within the following limits for any particular acceleration flow.

Flow (gal/h)	Pressure drop (lb/in ²)
54.0	38.0 to 29.0
54.4	39.0 to 29.5
55.0	39.5 to 30.0
55.5	40.5 to 30.5
56.0	41.0 to 31.5
56.5	41.2 to 32.0

17. The following governor settings should be obtained:—

Lever setting	Speed (rev/min)	Burner flow (gal/h)	Fig. ref.
Minimum	1800—1850	15	Point D
Maximum	4250—4300	42.5	Point E
20°	2100—2500	18	Point F
80°	3800—4200	30	Point G

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To obtain the settings at 20° and 80° adjust the position of the governor cam by slackening off the nut at the base of the cam spindle and rotating the vernier coupling. To obtain early governing of the unit open the cam angles and vice-versa. It may be necessary to add or reduce the shim washers beneath the plunger stop sleeve to bring the unit back into the curve (fig. 1, App. 1).

Governor rate (para. 92 and 93)

18. Increase the speed until the unit is governing and the burner flow is 15 gal/h. A further increase in speed to decrease the flow to 10 gal/h must not exceed 250 rev/min, Point A.

19. Increase the speed until the unit is governing and the burner flow is 42.5 gal/h. A further increase in speed to decrease the flow to 12.5 gal/h must not exceed 700 rev/min Point I. If the flow exceeds the limits for the above checks, add shim washers to the governor plunger to obtain early governing. It may be necessary to add or reduce the shim washers beneath the stop sleeve to bring the unit back into the curve (fig. 1, App. 1).

Governor hysteresis (para. 94 and 95)

20. After running up to 4800 rev/min and

hysteresis at the 30 gal/h flow must not exceed 100 rev/min, Point J.

Endurance test (para. 96)

21. Run the unit to the following cycle:—

<i>Period (minutes)</i>	<i>Control (setting)</i>	<i>Speed (rev/min)</i>
25	20°	2500
5	20°	1500
10	Max.	4600
20	Max.	4100

Inspection (para. 97)

22. The depth of the contact marks on the thrust ring from the heels of the governor weights must not exceed 0.0002 in. There should be no contact marks between the governor weights, spring and the body bore. Score marks on the governor plunger are not permitted.

Final calibration (para. 98)

23. Carry out the tests detailed in para. 11, 13, 15, 16 and 17. Lock all external adjustments.

Final leakage test

24. As detailed in para. 99.

APPENDIX 3

CALIBRATION CODE 109

General

1. This appendix is to be used in conjunction with the testing basic schedule. The fuel is to be AVTUR and is to be maintained at 20 to 30°C.

2. The fuel inlet pressure is to be maintained at 8 ± 1 lb/in² gauge, checked at the pump inlet union.

3. The fuel delivery pressure to be applied is shown on the curve in fig. 1 of this Appendix.

4. The restrictor (10) in the diagrammatic layout is to be a 10·6 F. No.

5. The disc control plate maximum and minimum positions should be $45^\circ \pm 1^\circ$ either side of the unit centre line.

Pressure tests

6. As described in para. 79 and 80.

Setting the pressurising valve (para. 81)

7. Pressurising valve to open at 60 ± 1 lb/in². The leakage at 50 lb/in² must not exceed 10 cc/min.

Setting the relief valve (para. 82)

8. Relief valve to open at 120 ± 2 lb/in². The leakage at 110 lb/in² must not exceed 2·5 gal/h.

Governor cut-off

9. As given in para. 83.

Acceleration bleed (para. 84 and 85)

10. The burner flow should reduce to 35 gal/h or less.

11. The flow should be set to 36·25 to 38·75 gal/h at 3500 rev/min, Point A on fig. 11.

Non-return valve (para. 88 and 89)

12. At 30 lb/in² boost pressure the leakage must be less than 15 cc/min.

Setting the starting acceleration flow (para.90)

13. With the disc control plate at minimum, the flow should be set to 9·3 to 10·6 gal/h at 100 rev/min, Point C.

Governor setting (para. 91)

14. Adjust the flow and pressure drop i.e., flow number of the unit, by means of the shim washers on the governor plunger. This pressure drop is the difference between the upstream of the governor (gauge 2 on the diagrammatic layout) and downstream of the throttle valve (gauge 5). At 90° control setting and 3500 rev/min, Point A, the pressure drop must be within the following limits for any particular acceleration flow.

Flow (gal/h)	Pressure drop (lb/in ²)
36·25	34 to 39
36·75	35 to 40
37·25	36 to 41
37·75	37 to 42
38·25	38·2 to 43
38·75	39·2 to 44·2

15. The following governor settings should be obtained:—

Lever setting	Speed (rev/min)	Burner flow (gal/h)	Fig. ref.
Maximum	4165	33·6 to 34·4	Point E

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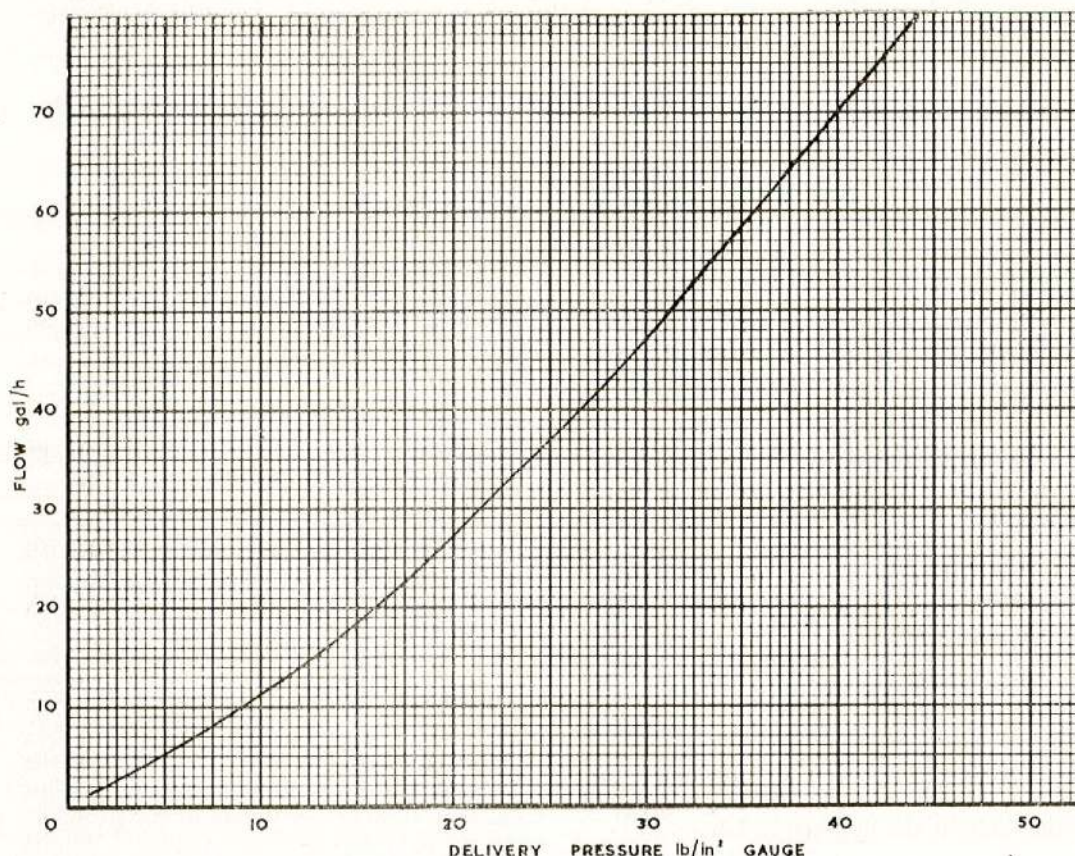


Fig. 1. Performance curve for code 109

To obtain the settings adjust the position of the governor cam by slackening off the nut at the base of the cam spindle and rotating the vernier coupling. To obtain early governing of the unit open the cam angles and vice-versa. It may be necessary to add or reduce the shim washers beneath the plunger stop sleeve to bring the unit back into the curve (fig. 1). At the maximum angle the highest recorded flow (Point K) must occur within the box limits (3950 rev/min 42 to 43 gal/h) and (4050 rev/min, 42 to 43 gal/h). Record the flow and speed.

Governor rate (para. 92 and 93)

16. Increase the speed until the unit is governing and the burner flow is 34 gal/h. A further increase in speed to decrease the flow to 4 gal/h must not exceed 700 rev/min, Point I.

17. If the flow exceeds the limits for the

above checks, add shim washers to the governor plunger to obtain early governing. It may be necessary to add or reduce the shim washers beneath the stop sleeve to bring the unit back into the curve (fig. 1 of this appendix).

Governor hysteresis (para. 94 and 95)

18. After running up to 4800 rev/min the hysteresis at the 30 gal/h flow must not exceed 100 rev/min, Point J.

Endurance test (para. 96)

19. Run the unit to the following cycles:—

Period (minutes)	Control (setting)	Speed (rev/min)
10	Max.	4500
20	Max.	4000

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Inspection (para. 97)

20. The depth of the contact marks on the thrust ring from the heels of the governor weights must not exceed 0.0002 in. There should be no contact marks between the governor weights, spring and the body bore. Score marks on the governor plunger are not permitted.

Calibration checks (para. 98)

21. Carry out the tests detailed in para. 11, 13, 14 and 15. Lock all external adjustments.

Final leakage test

22. As detailed in para. 99.

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