Chapter 2

THROTTLE VALVE, TYPE TVA.4

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

GENERAL

1. The unit described in this chapter is the Type TVA4. To this type number an installation code number 4 is added together with a calibration code letter C, hence the unit TVA4/4C illustrated in fig. 1 is a typical one. Installation and calibration codes vary with different engines.

2. The importance of cleanliness cannot be too highly emphasised and every precaution must be taken to ensure that all parts are thoroughly clean.

3. Where components are assembled temporarily for rig testing, it is recommended that slave nuts and washers be used.

SPECIAL TOOLS

4. The repair of these units necessitates the use of special tools which are listed below.

Tool No.	Nomenclature
R.36	Rig, test.
T.154353	Spanner, for adjusting screw and piston assembly.
T.157128	Tool, for insertion of orifice plate for slow-running control.
T.157133	Drift, for removal of orifice plate for slow-running control.
T.175621	Tool, for fitting pinion shaft seal.
T.175623	Extractor, for stop plate.
T.176333	Fixture, for inserting garter oil seals.
T.178456	Driver, box, for serrated plug.

record how far the stop screw projects through the lug for subsequent correct re-assembly.

CLEANING

16. All parts must be thoroughly cleaned and washed before re-assembly, using a para-wash machine having a kerosine bath and spray gun with adequate filtering facilities, suitable nozzle jets, and sufficient force to clean out all internal passages. Hard brushes, rag, or abrasives of any kind must not be used.

17. It is important that the bench upon which the washed parts are placed be scrupulously clean. It is recommended that the bench be covered with zinc sheeting or linoleum, and that several containers be available in which to keep the various parts as they are cleaned.

INSPECTION

Visual inspection

18. Every part of the unit must be visually inspected for damage and cleanliness. Nuts and screwed connections should be inspected for damage on the threads, faces, and spanner flats. The main body and fittings must be examined for superficial damage, damaged joint faces, bent studs, and any other form of damage which may make the parts unserviceable.

19. All parts must be examined for scores, pitting and corrosion ; light corrosion and score marks may be removed by careful stoning, unless there is danger of reducing running diameters below the permissible limits.

Distortion checks

20. Distortion checks are not normally necessary.

Permissible wear

21. All parts subject to wear should be dimensionally checked with the Schedule of Fits and Clearances.

Redundant and consumable parts

22. It is usual during inspection to reject all parts rendered redundant by the embodiment of essential modifications. Tab-washers, split pins, joint packings, rubber sealing rings, and other consumable parts will be scrapped during dismantling.

Scores and surface damage

23. Scoring on moving parts or joint faces, which may impair the operational efficiency of the unit, calls for the rejection of such parts.

REBUILDING THE THROTTLE VALVE

24. It is most important that the working parts of the throttle valve operate smoothly, these parts must not be interchanged without first making reference to the " Replacements " section.

Plunger and operating lever

25. Insert a 2 B.A. screw into the tapped bore of the plunger, and fit into position. Smear a thin coating of an approved zinc-oxide grease on the pinion shaft and offer the pinion shaft to the bearing, making sure that the thrust washer is in position ; at this stage the gear teeth must not be engaged.

26. Set the plunger to the datum previously measured. Fit the stop-plate over the hexagonal end of the pinion shaft to line up with the marks on the plate and shaft made during dismantling. Refit the stop screw, noting the remarks in para. 15. Turn the stop-plate and pinion shaft until the maximum speed stop is contacted, after which the pinion teeth should be engaged with the rack. Remove the stop-plate, using the extractor T.155048.

27. Fit the seal to the front end of the pinion shaft using the tool T.175621, taking care not to disengage the pinion teeth in the process. Fit the stop-plate to the shaft maintaining the correct relationship to the pinion shaft. Refit the adjusting clutch.

28. Fit the operating lever ensuring that it is at 30 deg. to the horizontal when the stop-plate is in contact with the idling stop, any necessary adjustment can be made by means of the adjusting clutch.

29. At this stage make sure that the teeth of the adjusting clutch engage with the teeth on the stop-plate and the lever. Fit the retaining nut and tighten, but do not fit the split pin.

30. Using feeler gauges, check that the end float between the stop plate and the main body is as quoted in the Schedule of Fits and Clearances. If this figure is not obtained a different thrust washer must be chosen from the range 27088-108 and fitted in place of the existing one. Ensure that the clearance between the bottom face of

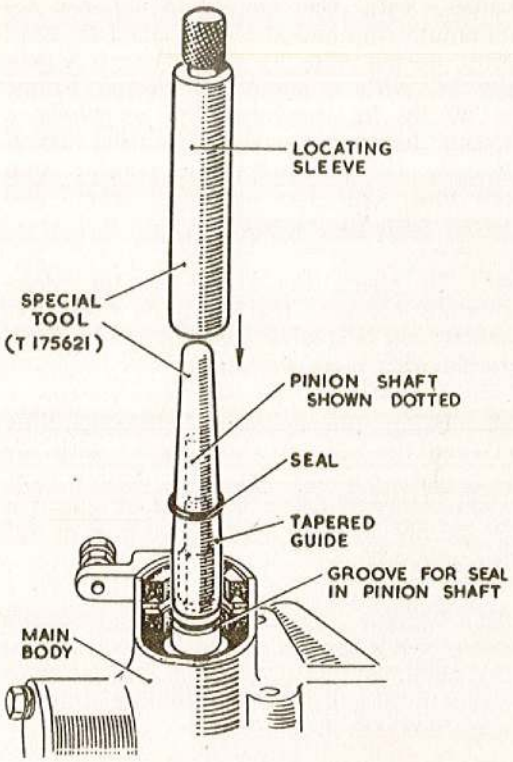

Fig. 5. Use of tool T.175621 for fitting seal to pinion shaft

the stop-plate and the upper face of the pinion sleeve is between 0·007 in. and 0·012 in. and temporarily fit the castellated nut on the pinion shaft.

31. Make sure that there is complete freedom of movement over the whole plunger range, and that the backlash does not exceed ½ deg.; then remove the 2 B.A. screw from the top of the plunger. Refit all installation unions which have been removed, taking care to interpose aluminium washers.

32. Retain the rubber sealing ring in the top cover with a smear of petroleum jelly (Stores Ref. 34D/656), fit a joint washer, then fit the cover to the main body and secure with three plain washers spring washers and set-screws.

Slow-running control

33. Insert the orifice plate of the slow-running control into the main body using the tool T.157128. Lower the spring into position around the orifice plate. Screw the piston adjusting assembly into the adapter, lower the plain washer and rubber sealing ring into the slow-running chamber and screw the adapter, with plain sealing washer, into the main body until finger tight.

34. Tighten the piston fully down against the orifice plate and loosely assemble the lock-nut on to the threaded portion of the piston, also a slave capnut and plain washer on to the adapter. Refit the serrated plug to the main body, if removed, using the box driver T.178456.

REPLACEMENTS

35. If a replacement main body is necessary this is supplied complete with fitted sleeves for both plunger and pinion shaft. No attempt must be made to fit replacement sleeves into existing bodies.

36. Replacement plungers and piston shafts must be lapped to suit their respective sleeves and to the limits given in the Schedule of Fits and Clearances.

37. The idling control adjusting screw and piston assembly is supplied as a unit. All the remaining parts are interchangeable.

RIG TESTS

Note . . .

Carefully tabulate all test results on the approved record sheet.

38. Unless stated otherwise the fuel used throughout the tests is to be Aviation turbine fuel to specification D.Eng.RD.2482 latest issue, the temperature to be between 20 deg. C and 26 deg. C., maximum specific

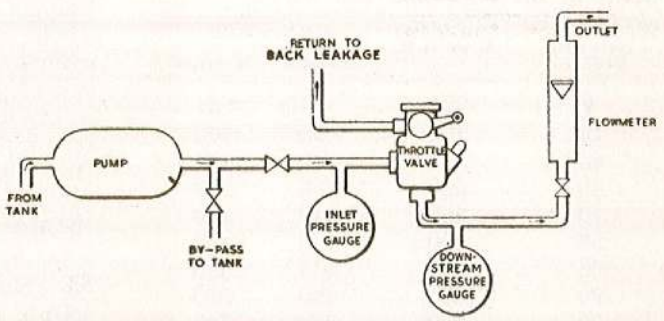

Fig. 6. Diagrammatic layout of test rig

gravity 0·180. The fuel should be checked at regular intervals to ensure that it complies with the specification.

39. The following tests are to be made :—

Calibration
Leakage (internal)
Torque
Leakage (external)

Calibration test

40. Mount the throttle valve on the test rig as shown in fig. 6 and tighten all installation unions.

41. Unscrew the castellated nut which secures the operating lever to the pinion shaft and remove together with the operating lever.

42. Mount the protractor and pointer (supplied with the Type R.36 test rig) on the unit, and secure with the castellated nut.

43. Commencing with the stop-plate against its minimum stop, record the flow through the unit at the specific pressure drop listed in the accompanying calibration table. Ensure that allowance is made for the pressure drop in the rig pipework ; this figure may be ascertained by substituting a plain union for the throttle valve test unit, the resulting reading being added to the pressure drop listed in para. 45. As an alternative, however, gauges may be fitted to the inlet and outlet connections giving a direct pressure drop value across the unit.

44. Move the lever through 10-degree stages of movement up to a maximum of 80 degrees, at which reading the stop-plate should be against the maximum stop-screw.

45. All values must comply with those listed in the following table :—

Lever angle from idling stop Degrees	Pressure drop lb. per sq. in.	Fuel flow G.P.H.	
		Minimum	Maximum
0	725	54	54
10	700	95	100
20	650	160	167
30	580	238	248
40	490	310	330
50	400	388	408
60	310	445	465
70	235	490	510
80	170	520	535

46. Open and close the throttle valve several times and ascertain that the flow values, with the stop-plate against its minimum stop and at the specified pressure drop, do not vary by more than 0·5 gall. per hr. with a maximum closing torque of 20 lb. in., measured by attaching a spring balance to the operating lever. Remove the protractor and pointer from the unit, refit the operating lever, and secure with the castellated nut.

47. To check the range of the slow-running control, first remove the slave capnut off the slow-running adapter together with plain washer.

48. Using the spanner T.154353, fully slacken the adjusting screw and with the stop-plate against its minimum stop, ascertain that a flow value of 62 gall. per hr. is obtained at a pressure drop of 725 lb. per sq. in.

49. Tighten the adjusting screw fully down and with the stop-plate still against its minimum stop ascertain that a flow value of 40 gall. per hr, is obtained at the same pressure drop value.

50. When satisfactory screw in the adjustment screw, until, with the stop-plate still against its minimum stop a flow value of 54 gall. per hr., at a pressure drop of 725 lb. per sq. in. is obtained.

51. Tighten the lock-nut to secure the adjusting screw and temporarily refit the slave washer and capnut on the slow-running adapter.

Internal leakage test

52. With the unit mounted on the rig as above and the pressure drop and flow as specified in the calibration table, allow the leakage to atmosphere throughout the whole lever range to run into a measuring cylinder. The total leakage must not exceed 0·5 c.c. per minute. If the leakage is excessive inspect the garter seals, and renew if necessary ; alternatively examine the plunger and sleeve for scratches or scores and check the fit of the plunger in the sleeve.

53. Similarly measure the leakage from the return to pump suction ; this must not exceed 400 c.c. per minute.

Torque test

54. With the unit mounted on the rig as before, move the stop-plate against its minimum stop. Adjust the fuel inlet pressure to 950 lb. per sq. in. and the downstream pressure to 225 lb. per sq. in. and by applying a spring balance to the operating lever ascertain that the torque required to open the valve does not exceed 8 lb. in.

55. Move the stop-plate against its maximum stop and with a similar fuel inlet pressure as above and a downstream pressure of 780 lb. per sq. in., ascertain that a torque of 8 lb. in. is not exceeded. In the event of excessive torque examine the plunger for tightness in its sleeve or incorrect meshing of the teeth between plunger and pinion.

External leakage test

56. With the unit still mounted on the rig, thoroughly dry the exterior of the unit and move the stop-plate against its maximum stop and close the downstream restriction.

57. Set the fuel boost pressure to 25 lb. per sq. in. and the inlet pressure to the unit at 1,500 lb. per sq. in. for a period of 3 minutes.

58. Ascertain that no external leakage other than through the atmospheric drain connection exists.

INHIBITING

59. Hold the operating lever against its minimum stop and inject flushing oil to specification D.T.D.587, latest issue, into the inlet connection until the unit is filled.

60. Move the operating lever to lift the plunger and allow the oil to drain out from the outlet connection.

61. Return the operating lever against its minimum stop, place a blanking cap on the outlet connection and again inject flushing oil until the unit is full, operating the lever meanwhile to ensure that oil is passed round the plunger.

62. Secure a blanking cap over the inlet connection, and ensure that all remaining exposed unions are blanked off.

PREPARATION FOR DESPATCH

Final wire-locking

63. Insert a split pin through the castellated nut and pinion shaft to lock the operating lever, and wire-lock the unit to standard instructions, using 20 S.W.G. stainless steel wire.

Packing

64. Pack each unit in a separate container together with a copy of the readings obtained on test.