

## Chapter 5

# CONTROL VALVE ASSEMBLY

(Ghost Part No. 49305 and 603244)

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#### GENERAL

1. The reconditioning of the control valve must not be undertaken unless a suitable test rig is available.
2. During these operations and particularly when assembling the unit a high standard of cleanliness is necessary. It is advisable to have clean trays available in which to place the components of each control valve and thus prevent the interchanging of similar parts on different units.
3. When dismantling the control valve all

consumable parts such as joint washers, sealing rings, tab-washers and split-pins must be discarded.

4. After preliminary cleaning and flushing, a visual examination of each control valve assembly must be made for external damage or deficiencies.

5. No special tools are required for dismantling or re-assembling the control valve. The following four setting rings and a small bore gauge are required for inspection purposes.

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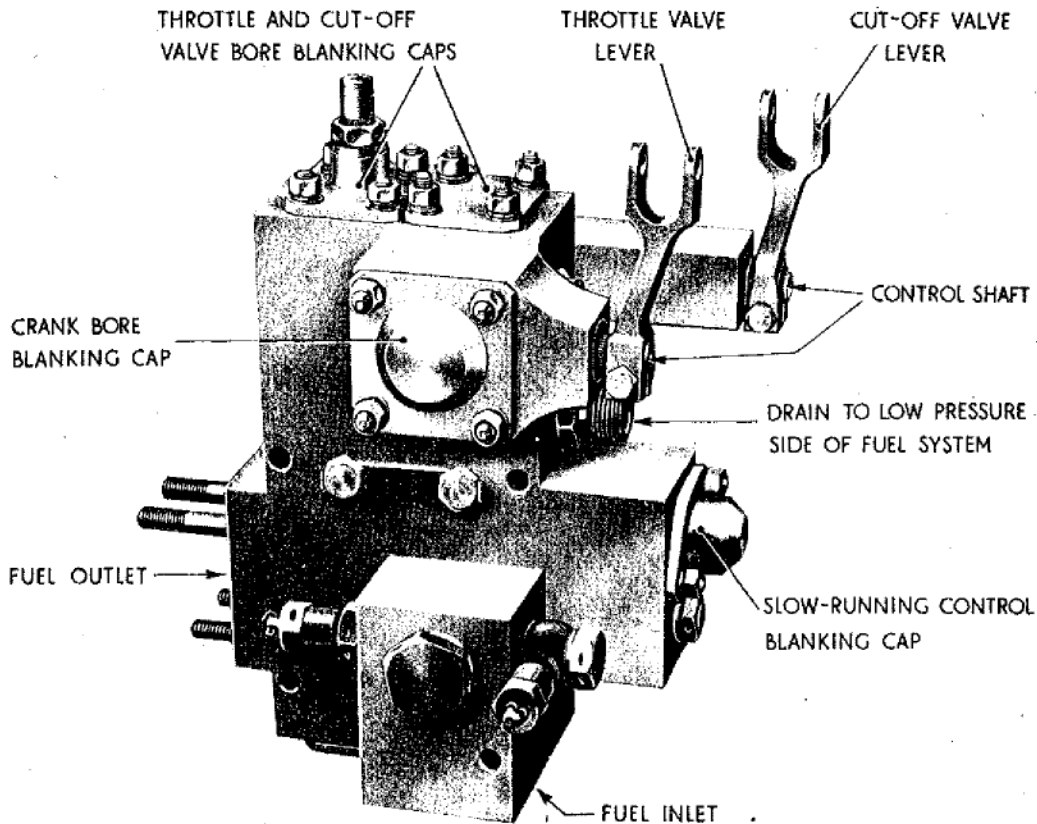


Fig. 1. Control valve assembly

T.73131	Valve sleeve bore
T.73129	Throttle and cut-off valve eye end bore
T.74107	Operating lever bore in trunnion
T.74108	Control shaft bore in body

#### DISMANTLING

##### Throttle valve lever assembly

6. (1) Unscrew the four nuts and remove the crank bore blanking cap. Extract the sealing ring.
- (2) Unlock and remove the nut clamping the operating lever to the inner end of the serrated control shaft and withdraw the control shaft complete with the throttle lever.
- (3) Withdraw the throttle operating lever from the body of the control valve assembly.
- (4) Unscrew and remove the 2 B.A. nut clamping the throttle lever to the control shaft, and draw the lever from the shaft.

- (5) Extract the circlip followed by the washer, seal and distance piece from the control shaft bore in the body.

##### Throttle valve

7. (1) Unscrew the four nuts and remove the throttle bore blanking cap.
- (2) Extract the sealing ring from the bore in the control valve body.
- (3) Withdraw the throttle valve complete with trunnion. Separate the trunnion from the eye of the throttle valve.

##### Cut-off valve lever assembly

8. The cut-off valve lever assembly is dismantled in precisely the same manner as the throttle valve lever assembly (*para. 6*).

##### Cut-off valve

9. The cut-off valve is dismantled in a similar manner to the throttle valve (*para. 7*).

##### Slow-running adjusting screw

10. (1) Unscrew the two nuts and remove the slow-running control blanking cap.

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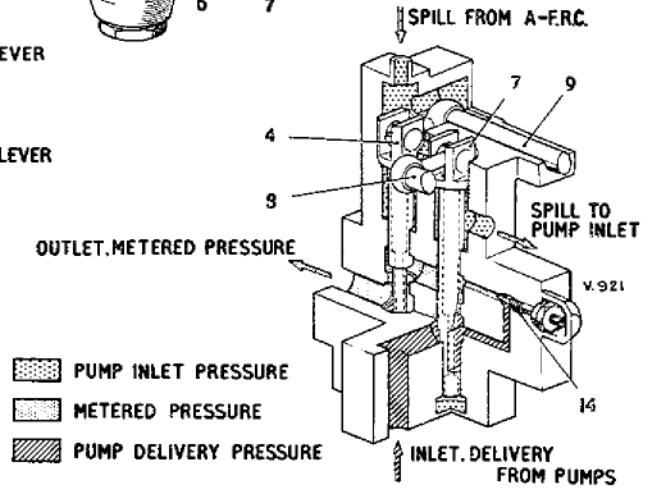
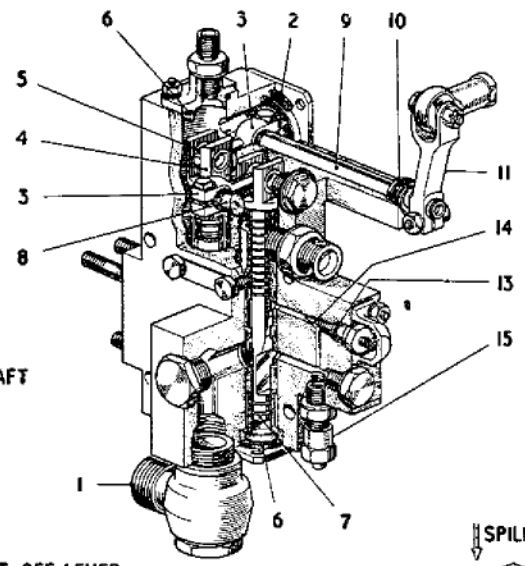
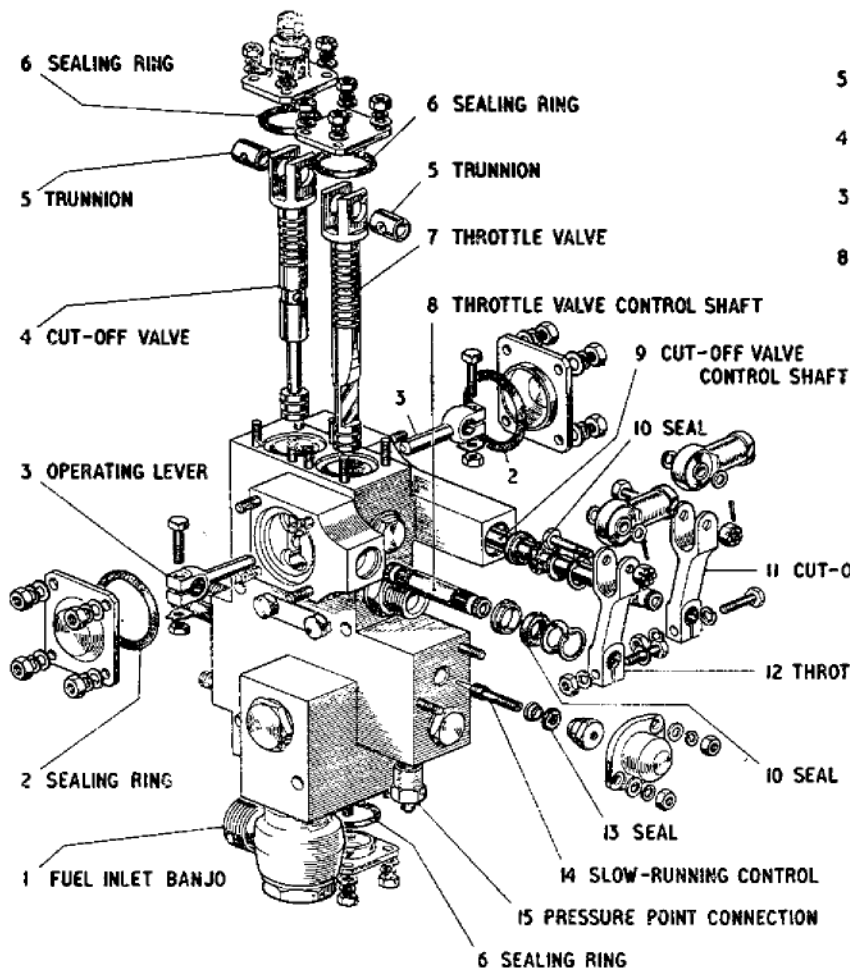


Fig. 2. Throttle valve and cut-off valve

(A.L.20, Jan. 58)

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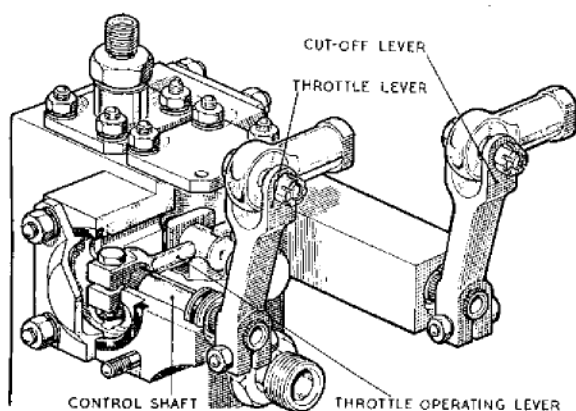


Fig. 3. Operating linkage

- (2) Remove the locking nut.
- (3) Screw out the slow-running adjusting screw, which will come away complete with its seal and distance piece.

#### Throttle and cut-off valve sleeves

11. The throttle and cut-off valve sleeves must not be removed from the body, as these are shrunk into position.

#### Miscellaneous

12. Complete the dismantling operations on the control valve assembly by removing the fuel inlet banjo bolt and the fuel drain connection. It is not necessary to remove the various blanking plugs.

#### CLEANING

13. Each component must be thoroughly cleaned in kerosine and finally flushed off in gasoline. Only approved cleaning processes may be employed, and all passages in the body must be blown through with dry compressed air at a pressure of not less than 20 to 25 lb. per sq. in. to ensure removal of any foreign matter.

#### INSPECTION

##### Control valve body and valve sleeves

14. (1) Examine the body for damage and check the threads in all tapped holes for signs of burrs or other damage.,
- (2) Ensure that all studs are secure, square to the face, and undamaged.

15. As the throttle and cut-off valve sleeves are virtually an integral part of the control valve body, these three components must be inspected together.

- (1) Examine the sleeves for good general condition.

- (2) Check the throttle and cut-off valve in the bore of the sleeves and note that there is not excessive clearance.
- (3) Examine the bores of the sleeves carefully for signs of scoring, which if only slight can be removed by lightly blending with fine abrasive paper.
- (4) Using a small bore gauge 0.250 in. to 0.500 in., and the setting ring T73131, check the dimensions of the bores of the sleeves against the limits given in the Schedule of Fits and Clearances, and Repair Tolerances, Vol. 6, Part 3. If either of the sleeves are worn beyond the permissible limits, the control valve assembly must be returned for rectification.

#### Cut-off valves

16. (1) Dimensionally check the diameter of the cut-off valve. If wear is in excess of the figures given in Vol. 6, Part 3, and the stipulated clearance between the cut-off valve and its sleeve cannot be maintained, a replacement valve must be fitted.

- (2) Examine the valve for signs of scoring; if only slight this should be dressed out by use of fine abrasive paper.
- (3) Inspect the eye end of the cut-off valve for wear, and using a small bore gauge, 0.250 in. to 0.500 in., and setting ring T73129, check the dimensions of the bore in the cut-off valve, and the outside diameter of the trunnion.

#### Throttle valve

17. (1) Dimensionally check the diameter of the throttle valve. If wear is in excess of the figures given in Vol. 6, Part 3, and the stipulated clearance between the throttle valve and its sleeve cannot be maintained, a replacement valve must be fitted.

- (2) Check the throttle valve for any signs of wear, and examine thoroughly for signs of scoring, any slight marks must be lightly blended out, using fine abrasive paper.
- (3) Inspect the eye end of the valve for wear and, using a small bore gauge 0.250 in. to 0.500 in., and setting ring T73129, check the dimensions of the bore in the throttle valve and the outside diameter of the trunnion.

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**Cut-off valve lever assembly**

18. The several small components forming the securing and seal retaining device at the end of the control shaft, should be examined carefully for signs of undue wear or cracking.

- (1) Inspect the cut-off valve operating lever and cut-off valve lever for serviceability.
- (2) Check the operating lever bore in the cut-off valve trunnion using a small bore gauge 0.250 in. to 0.500 in., and the setting ring T74107.
- (3) Using the same gauge but with the setting ring T74108, check the control shaft bore in the control valve body. Check the outside diameter of the control shaft.

**Throttle valve lever assembly**

19. Inspect in a similar manner to the cut-off valve lever.

**Slow-running adjusting screw**

20. (1) Examine the screw and lock-nut for damage.
- (2) Check the screw in its location in the control valve assembly.
- (3) Visually examine the cap.

**Miscellaneous**

21. Examine the fuel inlet banjo and bolt, and the fuel drain for serviceability.

**ASSEMBLING**

22. A control valve body to which replacement studs, etc. have been fitted, or which has been subjected to processing, machining or similar operations, must again be thoroughly flushed, and all passages blown through with compressed air to ensure complete freedom from swarf or dirt.

23. Attention must be given to the correct fitting of glands and seals at all the various points throughout the rebuild. As indicated in para. 3 of this chapter, the fitting of new parts within the category of consumable spares is obligatory.

**Cut-off valve**

24. (1) Insert the distance piece into the counter bore in the body, and renew the seal, inserting it with its groove located over the distance piece, replace the washer and secure with a Seeger circlip.

- (2) Put the trunnion into the eye end of the cut-off valve, and then insert the valve into its sleeve in the body.
- (3) Engage the cut-off valve operating lever in its bore in the cut-off valve trunnion.
- (4) Insert the cut-off valve control shaft through the washer, seal, and distance piece so that the serrations on its inner end mate with those in the operating lever.
- (5) Clamp the control shaft in position with the 2 B.A. bolt, special tab-washer and nut. Care must be taken that the locking washer does not turn when the nut is being tightened as it may foul the crank bore and restrict the free movements of the cut-off valve. Turn up the tabs on the locking washer.
- (6) Assemble the cut-off valve lever to the outer end of the serrated control shaft, and secure it with the 2 B.A. retaining bolt and two spring washers.
- (7) Position the crank bore sealing ring and blanking cap, secure with four nuts, spring and plain washers.
- (8) Replace the sealing ring at either end of the valve bore and assemble the two blanking caps, secure with four nuts, spring and plain washers.
- (9) Upon completion of this assembly ensure that the valve operates under its own weight.

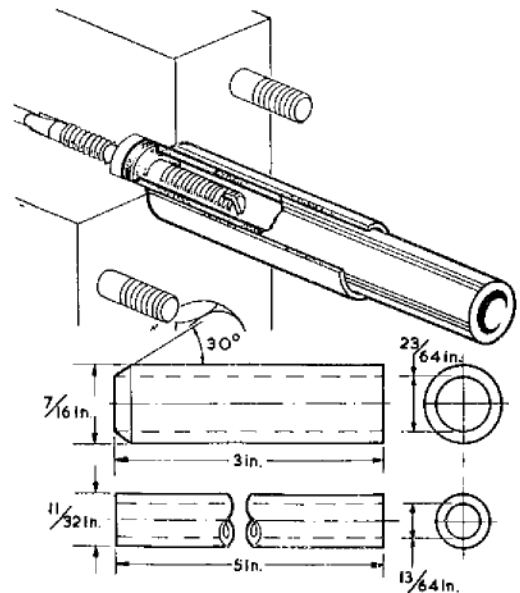


Fig. 4. Tool for inserting S.R. adjusting-screw seal

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### Throttle valve

25. The assembly of the throttle valve is precisely the same as the cut-off valve and therefore reference should be made to para. 25.

### Slow-running adjusting screw

26. To facilitate replacement of the seal in the following operations a locally made tool on the lines indicated in fig. 3 should be used.

- (1) Screw the larger diameter end of the slow-running screw into the control valve assembly body.
- (2) Position the seal over the distance piece and place them both over the end of the slow-running screw, then, using the tool

as shown in fig. 3, press the seal and distance piece into position.

- (3) Screw the locking nut on to the end of the slow-running screw.
- (4) The slow-running control blanking cap can now be replaced, but the two nuts should not be tightened until after the final adjustment.

### Miscellaneous

27. Complete the assembling operations by refitting the fuel inlet banjo bolt and pillar with its two aluminium washers, the fuel drain connection and its washer, and any other blanking plug which might have been removed.

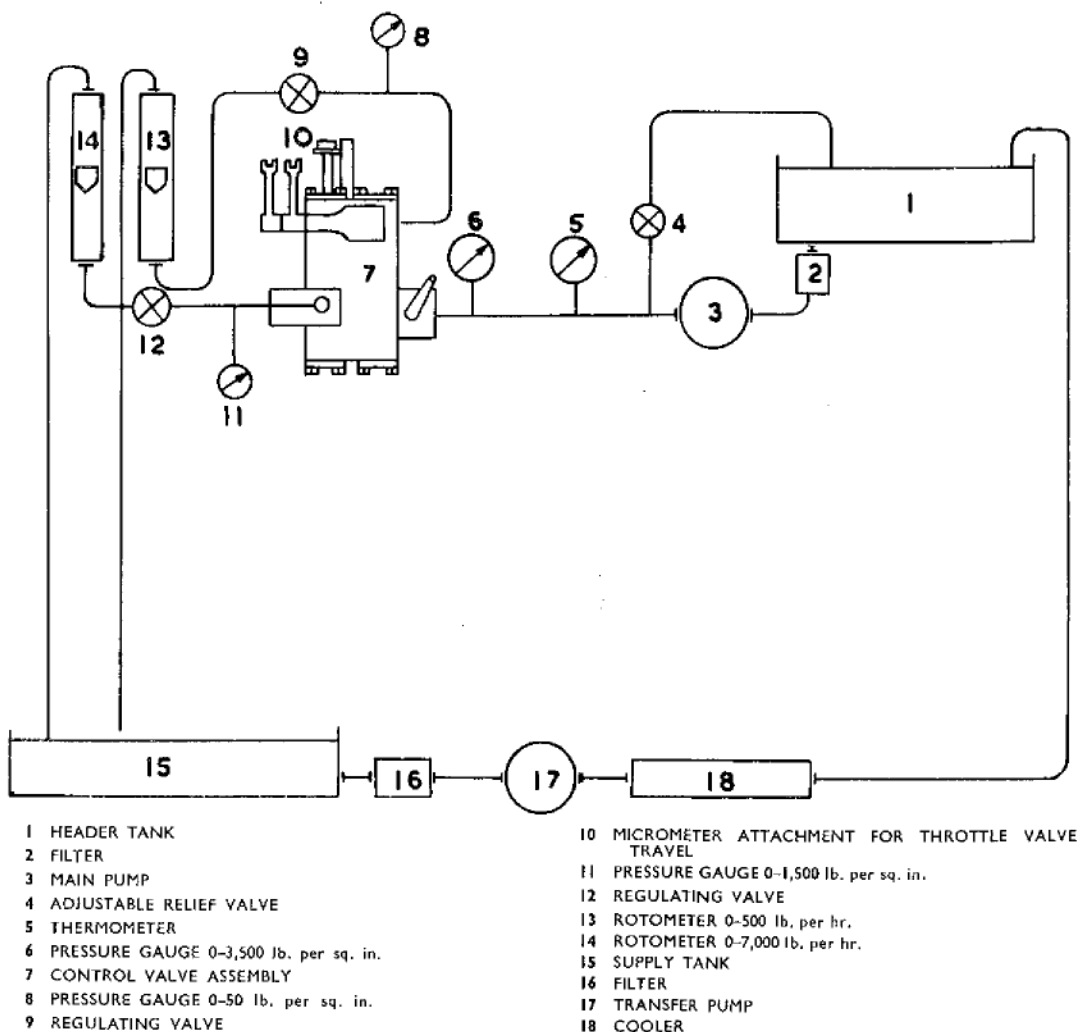


Fig. 5. Diagrammatic layout of test rig

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**RIG TESTING****General**

**28.** Record all calibrations and test results for subsequent entry into the official test record sheet. Unless new parts have been fitted all tests and calibrations carried out after overhaul are in the nature of check calibrations and normally no adjustment should be necessary.

**29.** The fuel used throughout the test is aviation kerosine to specification D. Eng. RD.2482. The temperature of the fluid entering the control valve assembly must be between 20 and 25 deg. C. The fluid must be supplied through a fabric or fine mesh filter.

**30.** The test equipment necessary is illustrated diagrammatically in fig. 4. The air fuel ratio control drain connection, if fitted, must be blanked off before testing. Care must be taken to isolate the low-pressure gauges before high-pressure tests are carried out.

**31.** Damage will occur to the gauges if the rate of pressure rise in the system is too high. Before opening the cut-off valve against the full supply pressure, it is important to first close the throttle valve.

**Leakage test**

**32.** For the following test the outlet pressure regulating valve, item 12 on fig. 4, must be fully open.

**33.** Remove the slow-running adjustment blanking cap, and with the adjustment fully closed, the throttle valve closed, and the cut-off valve open, apply an inlet pressure of 1,240 lb. per sq. in. The leakage past the outlet connection must not exceed 350 lb. per hr.

**Setting the throttle valve for calibration tests**

**34.** Remove the throttle valve bore blanking cap and fit a micrometer attachment to measure the control valve travel. Open the throttle valve until the condition indicated in the calibration table for the 1.000 in. position with an outlet pressure of 15 lb. per sq. in. is obtained. Reduce the valve position at which this condition is obtained by 1.000 in. and use this as the datum (zero position) for subsequent calibration.

**Setting the slow-running adjustment**

**35.** With the throttle valve in the 0.100 in. position, adjust the slow-running screw to

give a total flow of 800 lb. per hr. with an inlet pressure of 1,190 lb. per sq. in. and an outlet pressure of 15 lb. per sq. in. Lock the slow-running adjustment in this position and refit the blanking cap.

**Throttle valve flow test**

**36.** By means of the micrometer adjustment provided on the test rig, open the throttle valve progressively from the zero position in the steps indicated in the calibration table and measure the flow at each stage with the specified inlet pressure and a constant outlet pressure of 15 lb. per sq. in. Plot these values and compare with the design flow given in the table. The flow must lie on a smooth curve within the limits given, and if necessary the slow-running adjustment, the datum position, and finally the valve profile may be adjusted to give the best agreement with the design curve. The flow from the drain connection (combined leakage along the cylindrical portions of the valves) must not exceed 250 lb. per hr. with the throttle valve in any position. When a satisfactory calibration has been completed remove the micrometer attachment and replace the throttle valve bore blanking cap.

**CALIBRATION TABLE**

Valve travel (inches)	Inlet pressure (lb. per sq. in.)	Flow (lb. per hr.)	
		Min.	Max.
0	1,215	740	815
0.100	1,190	785	815
0.200	1,165	970	1,070
0.300	1,135	1,410	1,525
0.400	1,100	1,940	2,070
0.500	1,055	2,540	2,700
0.600	980	3,150	3,350
0.700	885	3,750	3,990
0.800	760	4,350	4,620
0.850	655	4,650	4,950
0.900	493	4,950	5,270
0.925	385	5,090	5,430
0.950	256	5,250	5,690
0.975	162	5,410	6,080
1.000	115	5,550	6,330

**Throttle lever load test**

**37.** Close the throttle valve, and apply an inlet pressure of 1,340 lb. per sq. in. With

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an unrestricted outlet, the force applied to the lever necessary to move the throttle valve from the closed position to the fully open position and back to the closed position, must not exceed 15.0 lb. in.

**Cut-off lever load test**

**38.** With the throttle valve fully open, an inlet pressure to give a flow of 5,000 lb. hr. with an unrestricted outlet, the force, applied to the cut-off lever, necessary to move the cut-off valve from the open position to the closed position and back to the open position, must not exceed 15.00 lb. in.

**Cut-off valve leakage test**

**39.** Close the throttle valve and the cut-off valve, and with the outlet unrestricted, apply an inlet pressure of 1,240 lb. per sq. in.; the leakage from the outlet connection must not exceed 15 lb. per hr.

**High pressure test**

**40.** During the following test the drain connection must be open. With the throttle valve open, the high pressure cut-off valve open, and the outlet regulating valve closed, apply an inlet pressure of 3,200 lb. per sq. in. There must be no visible leakage from the control valve assembly at any point.

**Low pressure test**

**41.** Apply a pressure of 30 lb. per sq. in. at the drain connection. There must be no visible leakage from the control valve seals or any other joint.

**FINAL INSPECTION AND INHIBITING**

**42.** Ensure that all nuts and bolts are secure, and also test manually the satisfactory operation of the working parts. External locking and wiring operations will be carried out at installation.

**43.** Inhibit the unit as described in A.P.4471A.

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