

Chapter 2

ANTE-CHAMBER TORCH IGNITERS

(Derwent and Nene aero-engines)

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PRELIMINARY INFORMATION

1. The ante-chamber torch igniters fitted to Derwent and Nene aero-engines are of similar design and the information contained in this chapter applies equally to both engines.
2. The importance of cleanliness during re-conditioning of fuel system components cannot be over-emphasized, and care must be taken to avoid damaging components during handling and storage.

DISMANTLING

Atomizer and filter

3. Unscrew the three 2 B.A. nuts securing the electro-hydraulic valve to the atomizer housing and separate the two assemblies.

4. Unlock and remove the two tab-washed set-screws which secure the atomizer and remove the atomizer from the housing.

5. Remove the circlip from the filter recess and tap out the gauze filter.

H.T. electrode and gland nut

6. Remove the gland nut from the side of the ante-chamber and withdraw the H.T. electrode and the sealing washer.

Electro-hydraulic valve

7. It is recommended that a coil resistance and insulation check should be made as described in the test schedule before the valve is dismantled.

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8. Fit the valve to a suitable dismantling rig as shown in fig. 3 and fig. 4, then remove the circlip, locking ring and slotted nut.

9. The valve assembly can then be removed in the following order—joint washer, valve housing, pressure-filled joint ring, valve needle and armature with loose traverse pin and finally the armature spring.

CLEANING

10. The work bench should be covered with zinc sheeting or linoleum, and clean containers should be provided for the dismantled parts.

11. To facilitate the removal of carbon deposits, immerse the affected parts in Cresol/soap solution for a period of 30 to 90 minutes according to the condition of the parts.

12. On removal from the solution, the parts must be washed in clean kerosine using a clean lint-free cloth to remove carbon deposits. A dry compressed air jet may be used to clean very dirty parts, but on no account may a bristle or wire brush be used during cleaning.

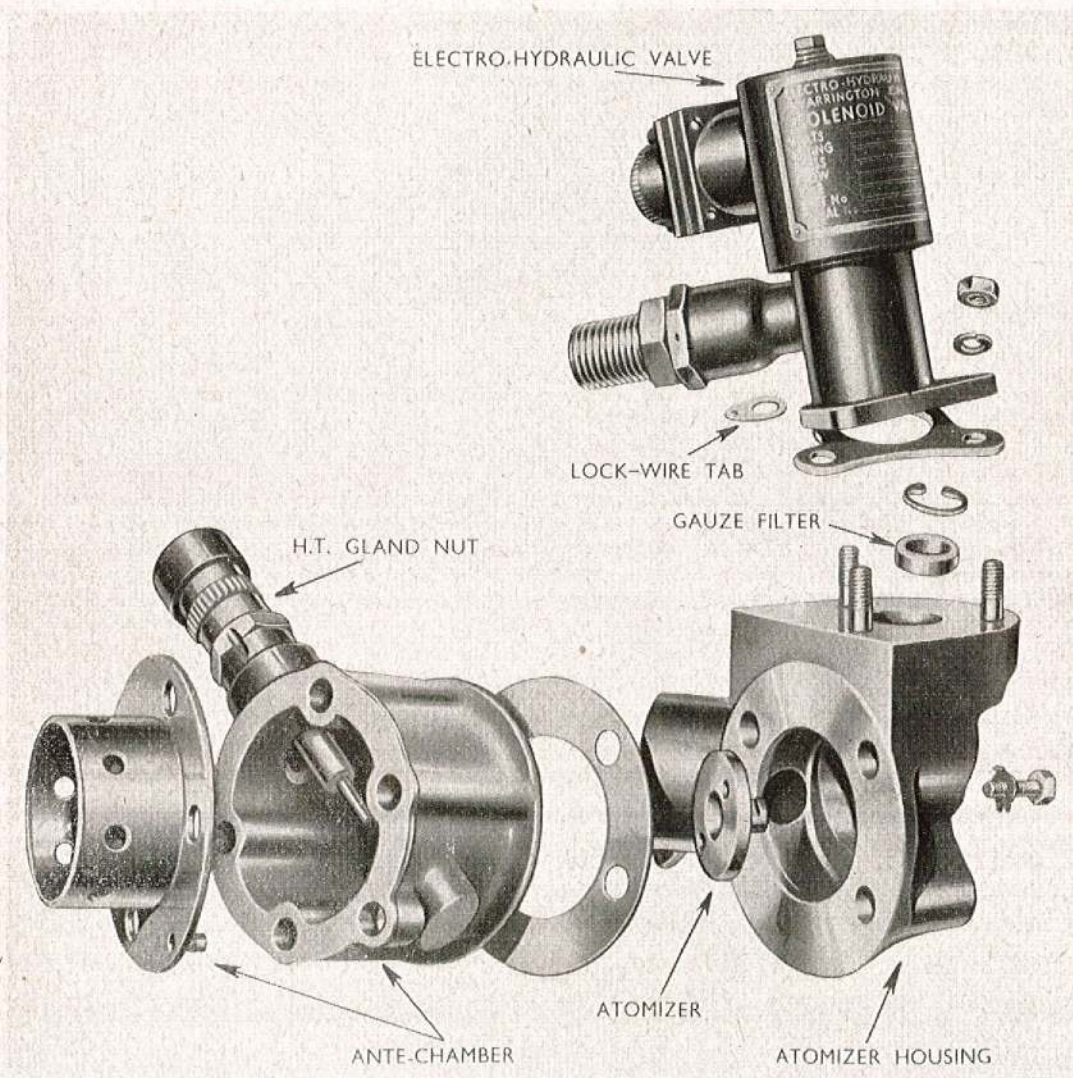


Fig. 1. Exploded view of torch igniter

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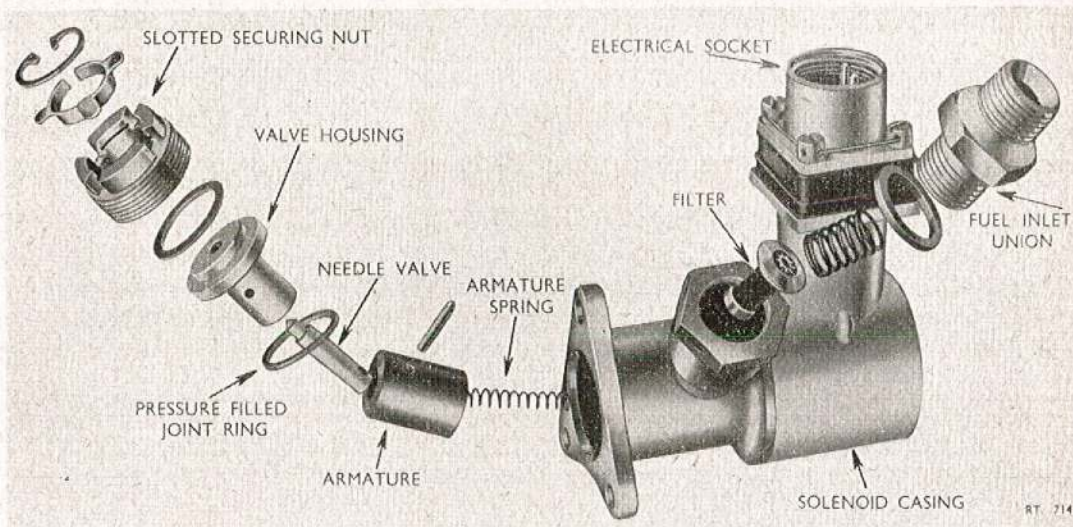


Fig. 2. Exploded view of electro-hydraulic valve

INSPECTION

Redundant parts

13. Check that all essential modifications are embodied in accordance with the E leaflets contained in Volume 2, Part 1, of the appropriate aero-engine Air Publication. Parts made redundant by the embodiment of modifications must be set aside during inspection.

Consumable parts

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

- The joint washer between the electro-hydraulic valve and atomizer housing.
- The joint washer between the atomizer housing and the ante-chamber.
- The sealing washer between the H.T. electrode and the ante-chamber.
- The sealing washer and pressure filled ring in the electro-hydraulic valve.
- The lockwashers from all retaining set-screws and from the H.T. electrode gland nut.

Inspect the aluminium sealing washer from the fuel inlet union and renew it if necessary.

Surface damage

15. Examine all component parts closely for surface damage that may have affected the

protective coating. If there is any flaking of the plating the defective part must be replaced. Any slight indentations should be clearly marked to facilitate blending out prior to this operation.

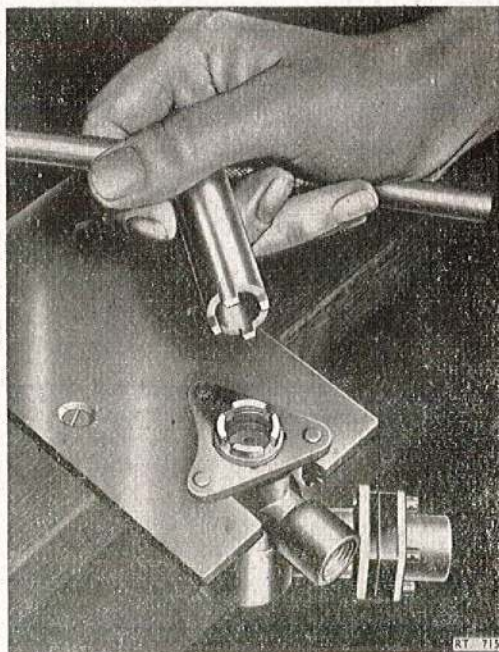


Fig. 3. Dismantling the electro-hydraulic valve

Atomizer housing

16. Ensure that the passages are unobstructed and inspect the seating face for damage; slight burrs or scratches may be removed with a scraper, deep scratching or scoring entails rejection.

17. Inspect the studs for security and check that the exposed threads are undamaged.

Atomizer

18. Ensure that the atomizer seating face is in perfect condition and check that the securing setscrews are a good fit in the atomizer. Ensure that the fuel metering orifices are unobstructed and free from damage.

Body and electrode

19. Inspect the seating faces for damage, ensure that the locating peg in the base plate is secure, and inspect the gland nut securing threads for damage.

20. Inspect the earth electrode for distortion, cracking at the root weld, and erosion due to sparking. A certain amount of erosion is normal and is acceptable up to a 25 per cent reduction in the cross sectional area of both the earth and H.T. electrodes.

H.T. electrode and gland nut

21. Ensure that the H.T. electrode is not distorted and inspect the insulation around the electrode and inside the gland nut; any cracking or flaking of the insulation or signs of distortion will entail rejection of the unit. Inspect the threads on the gland nut and ensure that the locking serrations are undamaged.

Electro-hydraulic valve

22. Inspect all joint faces for damage and examine the needle valve seating for pitting and scoring.

23. Ensure that the fuel inlet union and valve securing nut threads are undamaged and a good fit in the solenoid casing.

24. Carefully examine the filter, paying particular attention to the seatings on the end faces.

25. Inspect the pins in the electrical socket on the solenoid casing for security and pitting and ensure that the plug-retaining threads are undamaged. It is not practical to recondition the coil assembly so damage to this or the solenoid casing will entail rejection of the unit, but the removable parts, if sound, may be used to repair other units.

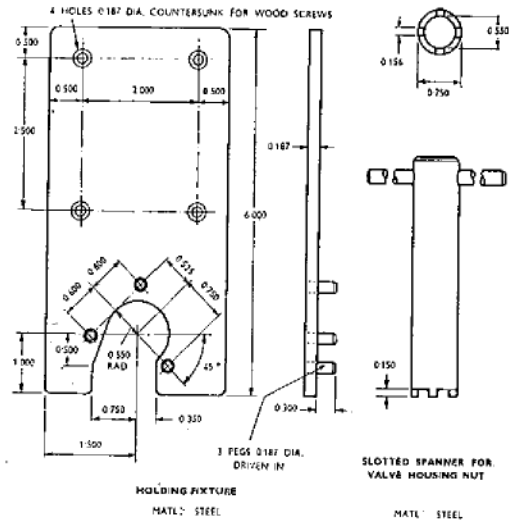


Fig. 4. Electro-hydraulic valve holding fixture

REPAIR

Surface damage

26. Slight surface damage on the atomizer housing or on the ante-chamber may be blended out into the surrounding metal. This will necessitate renewal of the anti-corrosive treatment as recommended in A.P.880B, Volume 1.

Stud replacement

27. When the required interference fit cannot be obtained by fitting a stud of the same part number and nominal diameter, an over-size stud may be fitted in accordance with the repair instructions contained in Vol. 6, Part 4.

ASSEMBLING

Electro-hydraulic valve

28. Connect the needle valve to the armature by the transverse pin. Place the spring in the bore of the armature and, holding the solenoid casing with the open end downwards, insert the assembly into the casing. Turn the casing over to bring the open end uppermost and fit it to the holding fixture as shown in fig. 3.

29. Add a pressure-filled joint ring then fit the valve housing taking care to locate it on the needle without damage to either part. Add a copper joint washer and fit the slotted retaining nut. The nut must be finally tightened to accommodate the lock-washer which is fitted with its tabs located in the slots in the solenoid casing. Finally, fit the circlip to retain the lock washer and remove the unit from the holding fixture.

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Atomizer housing

30. Fit the atomizer plate to the housing with the projection inwards and secure with the two tab-washed set-screws. Fully tighten and lock the set-screws. Fit the filter into the bore of the three-studded facing and retain it with a circlip.

31. During rig test, assemble the electro-hydraulic valve to the atomizer housing, interposing a joint packing, and secure with nuts and spring washers; ensure that the drilled tab is fitted on the stud adjacent to the hydraulic valve fuel inlet connection. It will be noticed that atomizer housings are handed for fitting to the port and starboard side of the engine, and that the electro-hydraulic valves can only be fitted in the correct position.

H.T. electrode and gland nut

32. Assemble the H.T. centre electrode to the ante-chamber, interposing a gland washer. Fit the locking sleeve and gland nut, ensuring that the tab on the sleeve engages with the slot in the ante-chamber.

33. Fully tighten the gland nut but do not lock it; this is done during rig test. Set the gap between the earth and H.T. electrodes to 0.075 in. The unit is then ready for rig testing.

TEST PROCEDURE

34. All the data required for the complete rig test of the torch igniter is contained in the test schedule (Appendix A) at the end of the chapter. The following paragraphs are complementary to the test schedule and describe the work necessary to perform the various tests.

Atomizer

Atomization and flow test

35. Fit the fuel inlet adapter J.44293 to the atomizer housing and mount the assembly on the fuel test chamber of the rig J.44470. It should be noted that there are alternative top fittings for the fuel test chamber, the one required for ante-chamber igniters being J.50604.

36. Supply fuel under pressure to the adapter and check that the fuel is being atomized correctly on delivery. Close the cut-off valve in the return pipe to the fuel tank and check the rate of flow through the atomizer by measuring with a stop watch the time taken to fill the flow bottle in the return pipe line; the capacity of the bottle

between the top and bottom calibration lines is 132 c.c.

Electro-hydraulic valve

Resistance tests

37. Measure the resistance of the coil at room temperature, also the resistance of the insulation, the latter being measured between the winding and the body.

Air leakage test

38. Before making this test it is advisable to wet the seat of the valve with fuel. Mount the valve on the air leakage test stand of the rig with the fuel inlet in the vertical position, interposing a joint packing. Connect the fuel connection from the column of fuel to the inlet of the valve and check that the fuel in the column is within the two levels marked on the sight glass. Connect the air pressure pipe from the rear of the stand to the top of the spark test chamber using the adapter J.48494.

39. Turn on the air pressure to the spark test chamber then slowly open the valve in the fuel column and watch the sight glass for air bubbles, which indicate leakage past the valve seat or past the pressure filled sealing ring. Remove the valve from the stand when the test has been completed.

Atomizer and electro-hydraulic valve assembly

Valve operation test

40. Remove the fuel inlet adapter and fit the electro-hydraulic valve to the atomizer housing mounted on the fuel test chamber of the rig. Operate the valve a number of times and check that the armature is not held in the open position by residual magnetism (Part (a) of the test given in the schedule).

41. Next set the fuel inlet pressure and check that the valve opens when the coil is energized by a low voltage current (part (b) of the test) then switch off the electrical supply and check that the valve cuts off the fuel flow completely. Repeat the test according to the schedule and make the increased voltage check (part (c) of the test).

Heat cycle test

42. Open and close the valve according to the schedule and check the current taken by the coil.

Seat proof test

43. Operate the valve a number of times in rapid succession and ensure that there is no leakage from the seat at the end of the test.

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Final test

44. Repeat the valve operation test described earlier and check the insulation resistance of the unit. Finally, remove the assembly from the fuel test chamber.

Igniter plug

Function test

45. Fit a pressure blank into the air pipe connection on the atomizer housing, then mount the ante-chamber and atomizer and valve assembly on the spark test chamber, interposing a packing between the two joints. Connect the H.T. lead to the plug, then build up an air pressure inside the chamber and switch on the H.T. supply. Maintain these conditions for the requisite period and check for misfiring at the plug gap.

Air leakage test

46. Disconnect the H.T. lead from the plug

then pass a length of rubber pipe over the plug screen tube and fit it to the boss on the ante-chamber. Immerse the free end of the pipe in a vessel of test fuel, then turn on the air pressure to the test chamber and watch for bubbles in the fuel, indicating a leak past the gland.

47. On completion of the test, remove the assembly from the test rig and lock the gland nut by indenting the locking ring into the slot in the nut, using a punch.

INHIBITING AND PACKING

48. All ante-corrosive treatment, application of preservatives and packaging should be carried out in accordance with the Services Packaging Manual and the specialized instructions issued by the appropriate Maintenance Unit.

Appendix A
TEST SCHEDULE
ANTE-CHAMBER TORCH IGNITERS

Fuel

Aviation turbine fuel to Specification D.Eng.R.D.2482 at a temperature of between 20 and 26 deg. C. and a maximum specific gravity of 0.810.

Test	Period	Volts d.c.	Fuel inlet pressure lb. per sq. in.	Valve operations in period given	Remarks
1. ATOMIZATION AND FLOW TEST					
	The flow through the atomizer must be between 60 and 70 c.c. per minute		25		Check that the fuel is discharged in a fine consistent mist
Electro-hydraulic valve					
2. RESISTANCE TESTS					
	(a) Coil resistance at room temperature (Approx. 20 deg. C.) must be between 8.8 and 7.2 ohms.				
	(b) Insulation resistance between the winding and the body must not be less than 20 megohms when measured with a 500-volt Megger.				
3. AIR LEAKAGE TEST					
	3 minutes minimum		3 ft. (max.) head of fuel	—	With an air pressure of 75 lb. per sq. in. acting on the underside of the valve, air must not leak past the valve seat or the pressure-filled seal.
4. VALVE OPERATION TEST					
(a)	15 sec.	32	—	3	Check that the valve is not held open by residual magnetism. There must be no leakage when the valve is closed.
(b)	—	6	50	3	
(c)	—	29	50	3	
Atomizer and electro-hydraulic valve assembly					
5. HEAT CYCLE TEST					
	30 sec. open and 2 min. closed	29	—	4 consecutively	Current taken by the coil at the end of the test must not be less than 2.47 amps.
6. SEAT PROOF TEST					
	1 min.	—	—	24	There must be no leakage from the valve seat.
7. FINAL OPERATION TEST					
	Repeat parts (b) and (c) of test No. 1 and part (b) of test No. 2.				

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APPENDIX A—cont.

Igniter plug

Test	Period	Volts	Air pressure lb. per sq. in.	Remarks
8.	FUNCTIONAL TEST 3 sec.	12,000 peak	20	No misfiring at the plug gap is permissible.
9.	AIR LEAKAGE TEST 1 min.	—	100	No leakage is permissible.

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