Chapter 10

SOLENOID VALVE, TYPE FAW

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Introduction

1. The valve is designed as a solenoid operated on and off valve which is installed in an aircraft system to control the flow of fluid. A typical valve is described in the chapter with the variants described in the appendices.

Fig. 1. Typical solenoid valve

DESCRIPTION

General

2. The valve consists of a cylindrical body which houses a solenoid, a body tube assembly and an armature. The solenoid coil is wound on a centre tube, two leads being brought from the coil windings to a terminal block on the valve body to provide electrical connection to the solenoid.

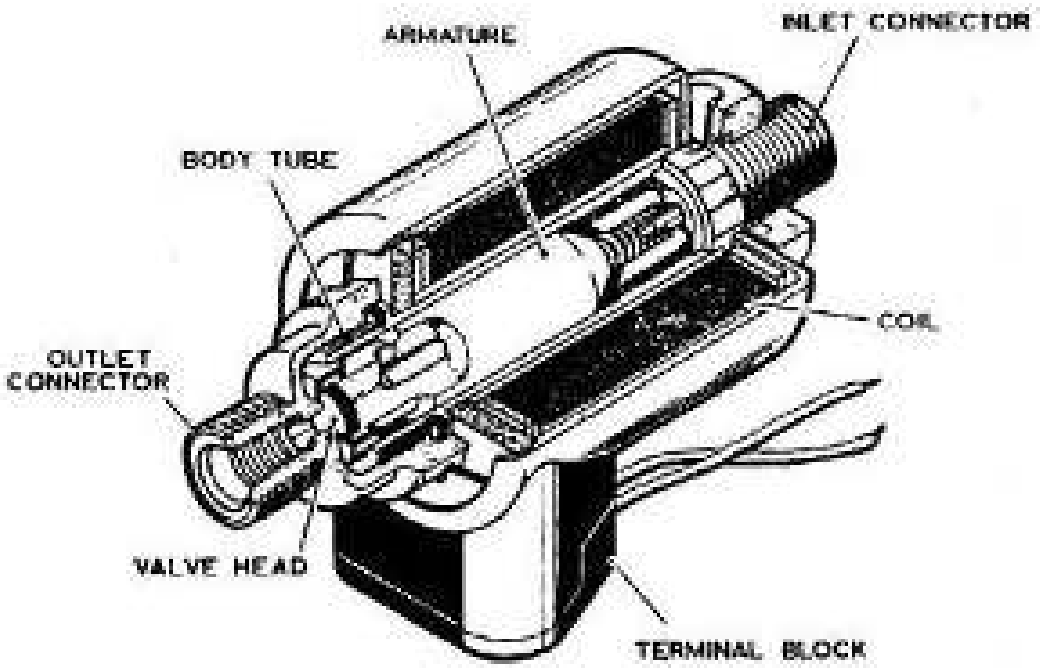

Fig. 2. Sectioned view of valve

3. The body tube is fitted into the centre tube and carries an inlet and outlet connector. The outlet connector has an integral valve seat and is tapped to take a metering jet.

4. The armature, which has a neoprene valve head retained by a ferrule, is housed in the body tube with a spring located between the armature and the inlet connector to load the valve head on the valve seat when the valve is closed. Radial holes in the armature communicate with the hollow core which is aligned with the bore of the inlet connector.

OPERATION

5. When the solenoid is energised the armature is drawn into the body tube, against the opposing spring pressure, to lift the valve head from the valve seat and permit fluid to flow from the inlet connector, through the armature core and drillings, to the outlet connector.

6. When the solenoid is de-energised the armature moves out of the body tube, under spring pressure, to load the valve head on the seat and stop the flow of fluid through the valve.

INSTALLATION

7. Reference should be made to the appropriate Aircraft Air Publication prior to installing the valve in the system. The direction of flow through the valve is indicated by an arrow and the word 'FLOW' engraved on the valve body.

SERVICING

8. Routine servicing consists of examination for damage, security of attachment leakage, insulation and bonding tests. If the serviceability of a valve is in doubt apply the tests given in Appendix 'A'. Valves which are found to be outside the specification given should be returned to Steers.

Appendix 'A'

STANDARD SERVICEABILITY TESTS

FOR

SOLENOID VALVE, TYPE FAW

Introduction

1. The tests described in this appendix should be applied at the following times:-

(1) Before installing a valve in the system.

(2) Whenever the serviceability of a valve is in doubt.

(3) At the appropriate servicing periods.

TEST EQUIPMENT

2. The following test equipment is required:-

(1) Bridge megger resistance tester, Type 'B' Ref. No. 5G/1708.

(2) Bonding tester, Type 'B' Ref. No. 5G/2126.

(3) A dry air supply controllable up to 75 lbs/in^2.

TEST PROCEDURE

3. All tests are to be carried out at normal room temperature (approximately 20°C).

Table 1

Test pressure, voltage, insulation and coil resistance values

Valve Type FAW/A/	Test Pressure lbs/in^2	Test Voltage V d.c. (Max)	(Min)	Insulation Resistance megohms	Coil Resistance
220	30	14·5	8	30	8·13 to 9·17
224	30	29	16	30	27·5 to 32·5
228	30	29	15	20	37 to 43
325	60	29	15	20	37 to 43
330	30	29	16	30	27·5 to 32·5
350	75	29	16	30	27·5 to 32·5
505	30	29	16	30	27·5 to 32·5
506	30	29	16	30	27·5 to 32·5
510	60	28·5	18	30	27·5 to 32·5
520	30	29	16	30	37 to 43

TESTING

Functional test

4. Connect the air supply to the inlet connector and apply the pressure stipulated in column 2, Table 1. Check to ensure that the valve opens when the solenoid is energised at the minimum voltage given in column 3, Table 1, and closes when the solenoid is de-energised.

Leakage test

5. Apply the test pressure given in column 2, Table 1, to the inlet connector and check to ensure that there is no leakage through the valve seat when the valve is closed.

Appendix 1

SOLENOID VALVES

TYPE FAW/A/220, 221, 228, 325, 330, 505, 508, 510, 520

LEADING PARTICULARS

Valve Type	Nominal Voltage	Rating	Ref. No.	Dimensions (ins.) Length	Width	Height
FAW/A/220	12	5 minutes	27V/3678	2·2	1·6	3·7
FAW/A/221	24	5 minutes	27V/3779	2·2	1·6	3·7
FAW/A/228	24	Continuous	27V/3462	2·2	1·6	3·7
FAW/A/325	24	Continuous	27V/4814	2·2	1·6	3·7
FAW/A/330	24	5 minutes	27V/4011	2·6	1·6	3·7
FAW/A/505	24	5 minutes	27V/5584	2·8	1·6	3·7
FAW/A/508	24	5 minutes	27V/5418	3·9	1·6	3·7
FAW/A/510	24	5 minutes	27V/5910	2·6	1·6	3·7
FAW/A/520	24	Continuous	27V/5764	3·9	1·6	3·7

Introduction

Types FAW/A/220, 221, 228, 325, 508, 520

1. These valves are similar to that described in the chapter.

Types FAW/A/330, 510, 505

2. These valves are similar to that described in the chapter but the electrical connection to the coil windings is made through a ten pole connector plug.

TESTING

Functional and leakage tests

3. Valves should be tested for leakage and for operation as described in Chap. 10, App.A, Para 2 to 5.

Insulation resistance

4. Connect a 500 V insulation resistance tester (Ref. No. 5G/1708) between the valve body and a connection to the valve solenoid. The insulation resistance should not be below the appropriate value appearing in Chap. 10, App. A, Table 1, Column 4; lower values of resistance may be accepted at the discretion of the Technical Officer.

Coil resistance

5. Connect the insulation resistance tester between the valve coil connection, test to ensure that the coil resistance conforms to the value given in Chap. 10, App. A, Table 1, Column 5.

Bonding resistance

6. Connect the bonding tester (Ref. No. 5G/2126) between the inlet and outlet connection and test to ensure that the bonding resistance does not exceed 0·025 ohm.

Appendix 2

SOLENOID VALVE, TYPE FAW/A/350

LEADING PARTICULARS

Ref. No.	*27V/5529*
Nominal voltage	*24V d.c.*
Rating	*5 minutes*
Overall dimensions:-	
Length	*2·6 ins.*
Width	*1·6 ins.*
Height	*3·7 ins.*

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Introduction

1. This valve is designed as a solenoid operated on and off valve which, when installed in an aircraft fuel system, will normally be open but will be held closed when the solenoid is energised.

DESCRIPTION

General

2. The valve consists of a cylindrical body which houses a solenoid, a body tube assembly and an armature. The solenoid coil is wound on a centre tube, two leads being brought out from the coil windings to the pules of a connector plug on the valve body to provide electrical connection to the solenoid.

3. The body tube is fitted into the centre tube and carries an inlet and outlet connector. The inlet connector has a conical valve seat machined at the inner end and the outlet connector is internally threaded to take a metering jet.

4. The armature which has a conical end fitted with a seal, is housed in the body tube with the seal adjacent to the valve seat. Two grooves are machined on the armature to communicate the inlet to the outlet connector when the valve is open.

OPERATION

5. When the solenoid is energised the

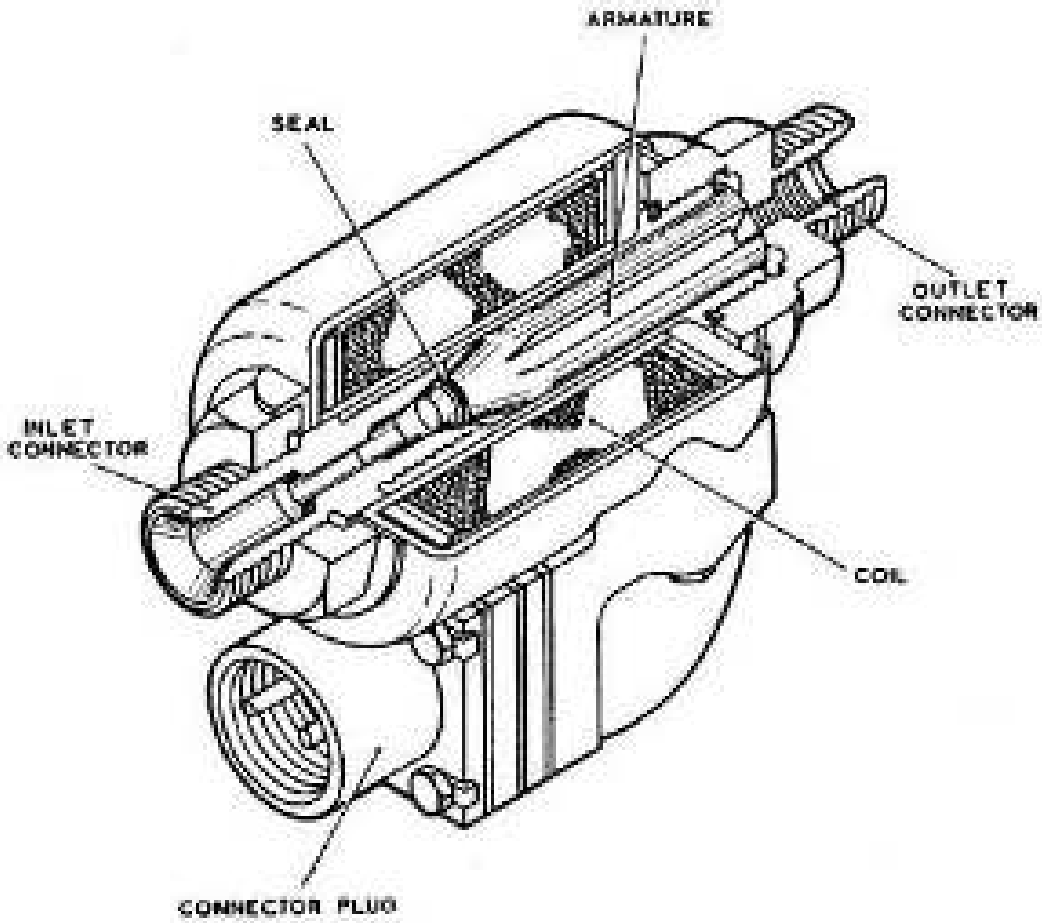

Fig. 1. Sectioned view of valve

armature is drawn into the body tube to load the seal on the valve seat to close the valve and stop the flow of fuel from the inlet to the outlet connector.

6. When the solenoid is de-energised the armature moves towards the outlet connector under the pressure of fuel acting on the end of the armature, to open the valve and permit fuel to flow from the inlet connector, along the grooves on the armature, to the outlet connector.

INSTALLATION

7. Reference should be made to the appropriate Aircraft Air Publication prior to installing the valve in the system. The valve must be installed with the axis through the inlet and outlet connectors vertical and the inlet connector uppermost. The direction of flow through the valve is indicated by an arrow and the word 'FLOW' engraved on the valve body.

TESTING

Functional and leakage tests

8. Valves should be tested for leakage and for operation as described in Chap. 10, App. A, Para. 2, to 5. It should be noted when carrying out this test that the valve closes when the solenoid is energised.

Insulation resistance

9. Connect a 500 V insulation resistance tester (Ref. No. 5G/1708) between the valve body and a connection to the valve solenoid. The insulation resistance should not be below the appropriate value appearing in Chap. 10, App. A, Table 1, Column 4; lower values of resistance may be accepted at the discretion of the Technical Officer.

Coil resistance

10. Connect the insulation resistance tester between the valve coil connection, test to ensure that the coil resistance conforms to the value given in Chap. 10, App. A, Table 1, Column 5.

Bonding resistance

11. Connect the bonding tester (Ref. No. 5G/2126) between the inlet and outlet connector and test to ensure that the bonding resistance does not exceed 0·025 ohm.

Appendix 3

SOLENOID VALVE, TYPE FAW/A/501

LEADING PARTICULARS

Ref. No.	*27V/5399*
Nominal voltage	*24V d.c.*
Rating	*Continuous*
Overall dimensions:-	
Length	*2·2 ins.*
Width	*1·6 ins.*
Height	*3·7 ins.*

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LIST OF ILLUSTRATIONS

Introduction

1. The valve is designed as a solenoid operated fuel valve which, when installed in an aircraft system, will normally be open but during re-fuelling will be held closed against a fuel pressure of 50 lbs/in^2, with momentary surges of up to 100 lbs/in^2, when the solenoid is energised.

DESCRIPTION

General

2. The valve consists of a cylindrical body which houses a solenoid, a body tube assembly and an armature. The solenoid coil is wound on a centre tube, two leads being brought out from the coil windings to a terminal block on the valve body to provide electrical connection to the solenoid.

3. The body tube is fitted into the centre tube and carries an inlet and outlet connector. The inlet connector has a conical face machined at the inner end and a spring loaded valve seat fitted into the bore.

4. The armature which is machined with a conical valve head, is housed in the body tube with the valve head aligned with the valve seat, and a return spring fitted to the armature to hold it away from the valve seat when the solenoid is not energised. Radial holes in the armature head communicate with the hollow core

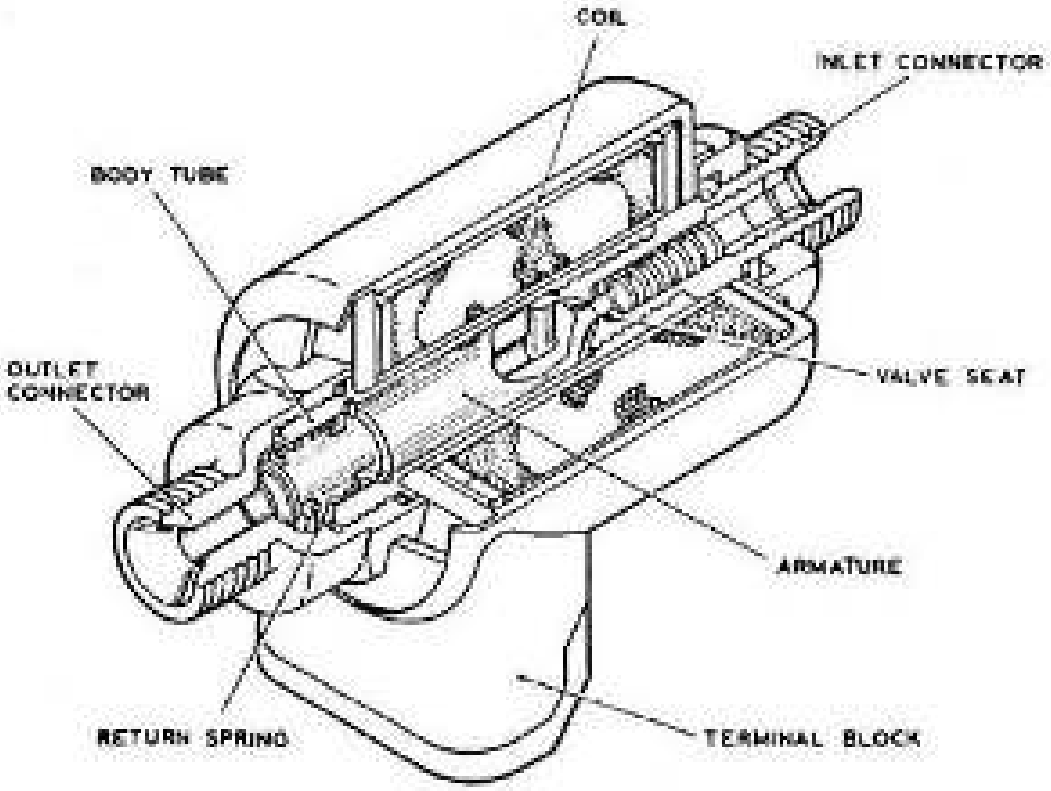

Fig. 1. Sectioned view of valve

which is aligned with the bore of the outlet connector.

OPERATION

5. When the solenoid is energised the armature is drawn into the body tube, against the opposing spring pressure, to load the head of the armature to the valve seat and stop the flow of fuel through the valve.

6. When the solenoid is de-energised the armature is drawn away from the valve seat, under the action of the return spring, to permit fuel to flow through the drillings and hollow core of the armature to the outlet connector.

INSTALLATION

7. Reference should be made to the appropriate Aircraft Air Publication prior to installing the valve in the system. The direction of flow through the valve is indicated by an arrow and the word 'FLOW' engraved on the valve body.

SERVICING

8. Routine servicing consists of examination for damage, security of attachment, leakage, insulation and bonding tests. If the serviceability of a valve is in doubt apply the tests given in para. 10 to 16. Valves which are found to be outside the specification given should be returned to Stores.

TESTING

Test equipment

9. The test equipment required is as laid down in Appendix 'A' to the chapter, plus the following additional items:-

(1) Rotameter Flow Tester, Ref. No. 6C/1166.

(2) A dry air supply controllable up to 110 lb/in².

Functional test

10. With no air pressure applied to the inlet connector check to ensure that the valve closes when the solenoid is energised at 13 V d.c.

11. Energise the solenoid at 28 V d.c. and check to ensure that the valve opens when the solenoid is de-energised.

12. Connect the air supply to the inlet connector, apply an air pressure of 110 lbs/in² and check to ensure that the valve closes when the solenoid is energised at 28 V d.c. Slowly reduce the applied voltage and check to ensure that the valve does not open until the voltage is below 11 V d.c.

Leakage test

13. Connect the flow meter, Ref. No. 6C/1166 to the outlet connector. Apply an air pressure of 110 lbs/in², energise the solenoid at 28 V d.c. to close the valve and check to ensure that the leakage through the valve seat does not exceed 2,360 c.c.s/minute.

Electrical tests

Insulation resistance

14. Connect the insulation tester, Ref. No. 5G/1708 between the valve body and a terminal on the terminal block and test to ensure that the insulation resistance is not less than 20 megohms at 500 V d.c.

Coil resistance

15. Connect the leads of the resistance tester, Ref. No. 5G/1708 between the terminals on the terminal block and test to ensure that the resistance of the coil windings is between 37 and 43 ohms.

Bonding resistance

16. Connect the bonding tester, Ref. No. 5G/2126 between the inlet and outlet connector and test to ensure that the bonding resistance does not exceed 0·025 ohm.

Appendix 4

SOLENOID VALVE, TYPE FAW/A/507

LEADING PARTICULARS

Ref. No.	*27V/5725*
Nominal voltage	*24V d.c.*
Rating	*Continuous*
Overall dimensions:-	
Length	*2·2 ins.*
Width	*1·6 ins.*
Height	*3·7 ins.*

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LIST OF ILLUSTRATIONS

Introduction

1. The valve is a solenoid operated on and off valve which has been designed for installation in a methanol injection fuel de-icing system on an aircraft. The valve will normally be open but will close when the solenoid is energised.

DESCRIPTION

General

2. The valve consists of a cylindrical body which houses a solenoid, a body tube assembly and an armature. The solenoid coil is wound on a centre tube, two leads being brought out from the coil windings to a terminal block on the valve body to provide electrical connection to the solenoid.

3. The body tube is fitted into the centre tube and carries an inlet and outlet connector. The inlet connector has a conical valve seat machined at the inner end and the outlet connector is internally threaded to take a metering jet.

4. The armature has a conical head at one end, fitted with a seal, a spring loaded ball relief valve fitted into the hollow core at the outlet end and four axial grooves machined down the side. The relief valve is set to open when the inlet pressure is between 55 and 65 lbs/in^2.

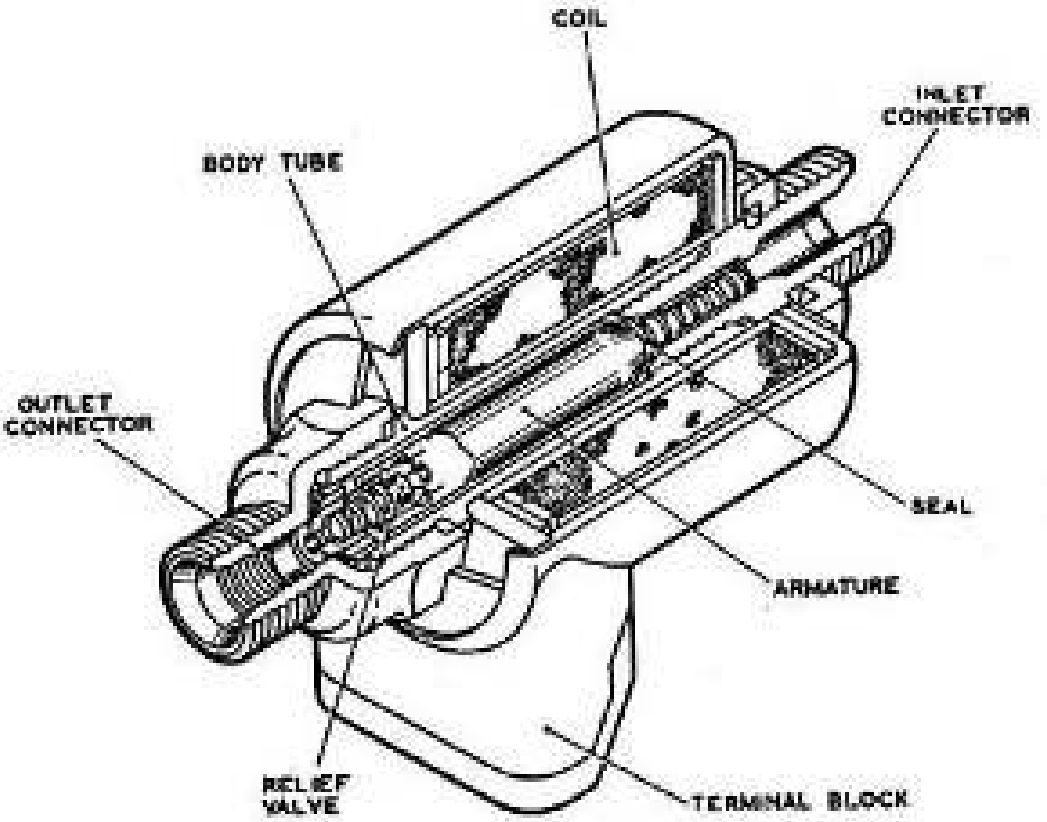

Fig. 1. Sectioned view of valve

The armature is fitted into the body tube with the seal adjacent to the valve seat and a return spring located between the head of the armature and a seating in the base of the inlet connector.

OPERATION

5. When the solenoid is energised the armature is drawn into the body tube to load the seal on the valve seat to stop the flow of fluid from the inlet to the outlet connector. Should the inlet pressure exceed 55 lbs/in^2 it will act, through the hollow core of the armature, on the top of the spring loaded ball to compress the spring and permit the fluid to flow past the ball to the outlet connector. When the inlet pressure drops below 55 lbs/in^2 the relief valve closes as the spring loads the ball on to its seating.

6. When the solenoid is de-energised the armature moves towards the outlet connector under the action of the return spring to open the valve and permit fluid to flow from the inlet connector, down the grooves in the side of the armature, to the outlet connector.

INSTALLATION

7. Reference should be made to the appropriate Aircraft Air Publication prior to installing the valve in the system. The direction of flow through the valve is indicated by an arrow and the word 'FLOW' engraved on the valve body.

SERVICING

8. Routine servicing consists of examination for damage, security of attachment, leakage, insulation and bonding tests. If the serviceability of a valve is in doubt

apply the tests given in para. 10 to 15. Valves which are found to be outside the specification given should be returned to Stores.

TESTING

Test equipment

9. The test equipment required is as laid down in Appendix 'A' to the chapter, plus the following additional item:-

(1) Rotameter Flow Tester, Ref. No. 6C/1166.

Functional test

10. Connect the air supply to the inlet connector and apply an air pressure of 40 lbs/in². Check to ensure that the valve closes when the solenoid is energised at 28 V d.c. and opens when the solenoid is de-energised.

11. Energise the solenoid to close the valve, apply 65 lbs/in² air pressure to the inlet connector and check to ensure that the relief valve opens.

Leakage test

12. Connect the flow meter, Ref. No. 6C/1166 to the outlet connector. Apply 45 lbs/in² air pressure to the inlet connector, energise the solenoid at 28 V d.c. to close the valve and check to ensure that the combined leakage through the main valve seat and relief valve seat does not exceed 944 c.c.s./minute.

Electical tests

Insulation resistance

13. Connect the insulation tester, Ref. No. 5G/1708, between the valve body and a terminal on the terminal block and test to ensure that the insulation resistance is not less than 20 megohms at 500 V d.c.

Coil resistance

14. Connect the leads of the resistance tester, Ref. No. 5G/1708 between the terminals on the terminal block and test to ensure that the resistance of the coil winding is between 37 and 43 ohms.

Bonding resistance

15. Connect the bonding tester, Ref. No. 5G/2126, between the inlet and outlet connector and test to ensure that the bonding resistance does not exceed 0·025 ohms.

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