



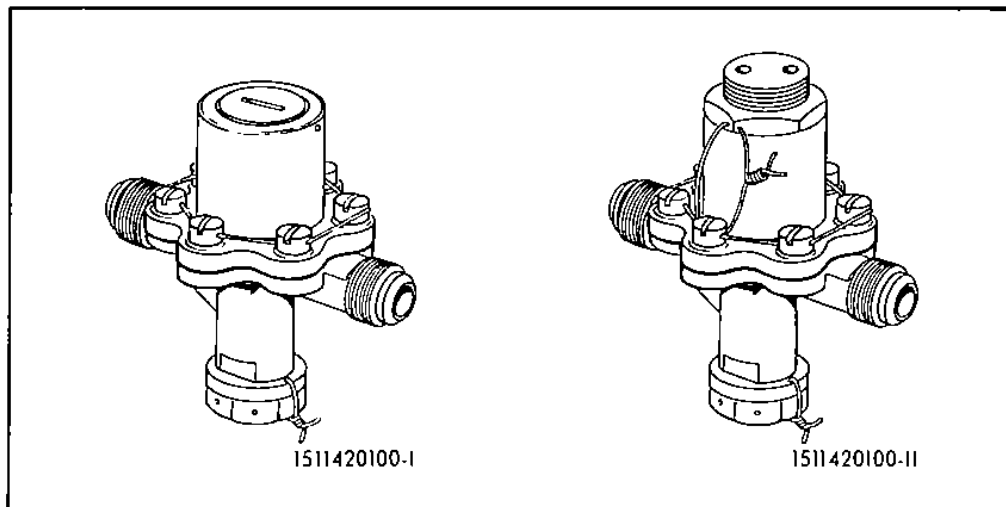
Essex Cryogenics Industries

8213 Gravois Avenue
St. Louis, Missouri 63123

COMPONENT MAINTENANCE MANUAL

AIR PRESSURE REGULATORS

**Part Numbers: 1511420100-1
1511420100-11**



38-40-01

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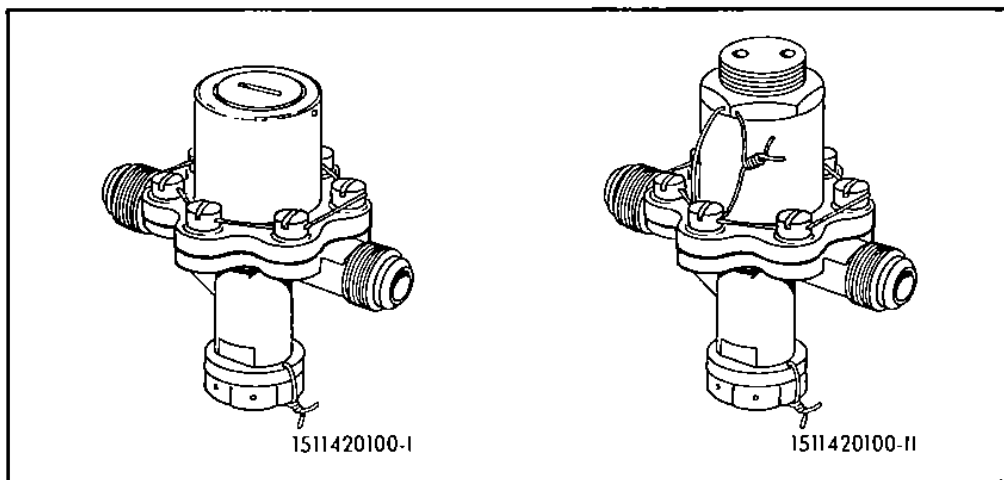
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1. Description and Operation.

A. Physical Description. (See figures 1 and 2.)

- (1) The Air Pressure Regulators (figure 1) are typical, spring-loaded diaphragm type units with threaded inlet and outlet connections. They are designed to operate from engine bleed air and maintain a constant, predetermined pressure in the potable water tanks of the aircraft.



Air Pressure Regulators
Figure 1

- (2) The body of the regulator is a single casting with an opening at the lower end, for installing the poppet, sealed with a threaded plug and O-ring. The diaphragm ("Bellofram") is secured between the body and cylinder. The cylinder, in which the spring is housed, is attached to the body by six screws. An adjusting retainer plug is threaded into the upper end of the cylinder for adjusting the spring tension.
- (3) The regulator is designed for continuous duty. In case of failure, the inlet-to-outlet passage through the body will remain open.
- (4) The sealing surface of the poppet is permanently coated with "Viton" fluoroelastomer in order to insure a seal when it is on its seat.

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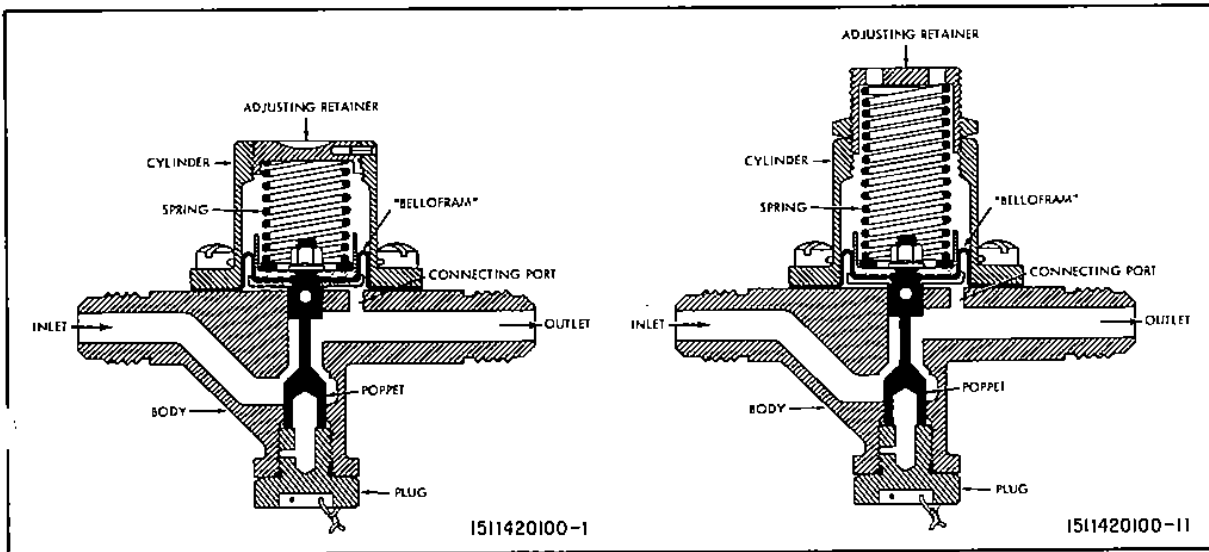
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B. Operation. (See figure 2.)

- (1) When at rest, the poppet is held in full open position by the spring, thus permitting a free flow of air through the body passages. When the pressure in the outlet passage approaches the preset regulated pressure, air passes through the connecting port to the underside of the "Bellofram" compresses the spring and moves the poppet to its seat, thus shutting off the inlet air.



**Sectional View of Air Pressure Regulators
Figure 2**

- (2) When the pressure drops in the outlet passage, the spring moves the poppet off its seat and permits enough higher-pressure air from the inlet passage to pass the seat and restore regulated pressure in the outlet passage.

C. Leading Particulars.

Figure 3 lists principal characteristics of the air pressure regulators.

Operating medium Engine bleed air (-1 and -11).

Ambient Temperature -25°F to +165°F (-1 and -11).

Internal Temperature +100°F to +450°F (-1 and -11).

**Leading Particulars
Figure 3 (Sheet 1 of 2)**

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Pressures:	1511420100-1	1511420100-11
Inlet	30 to 50 psig	38.5 to 50 psig
Outlet	30 (+5.0, -0.5) psig	38 (+5.5 - 0) psig
Proof	125 psig	125 psig
Burst	188 psig	188 psig
Leakage:		
External	0.010 LPM (max.) at nominal outlet pressure	0.010 LPM (max.) at nominal outlet pres- sure
Pressure drop	0.5 psi (max.) with 1 cfm flow at 30 psig and 100°F at inlet.	0.5 psi (max.) with 1 cfm flow at 35 psig and 100°F at inlet.
Dimensions:		
Length	3.50 inches (through ports)	3.50 inches
Width	2.25 inches (perpendicular to ports)	2.25 inches
Height	3.25 inches	3.70 inches
Weight	0.60 pounds	0.70 pounds

Leading Particulars
Figure 3 (Sheet 2 of 2)

NOTE: Item Serial Nos. 100 and up of the -1 and all of the -11 units are manufactured by Essex Cryogenics Industries, Inc., St. Louis, Mo. Prior units of the -1 were manufactured by Harris Manufacturing Co., Inc., St. Louis, Mo. All items are interchangeable, among their respective dash numbers.

2. Disassembly. (See figure 8.)

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NOTE: See Testing, for operational test and trouble shooting to establish the condition of unit or most probable cause of malfunction. This is to determine the extent of disassembly required without completely tearing down and re-building the unit.

A. Disassemble the regulator as follows:

- (1) Cut and remove all safety wires.
- (2) Mark along the edge of the flange of cylinder (3, figure 8) and body (15) so that items can be oriented in the same location during assembly.
- (3) Remove six screws (2).
- (4) Remove the spring (4 or 4A), then tilt the unit to drop out the spacer (5), if supplied.
- (5) If the "Bellofram" (8) sticks to the body (15), use a sharp knife to free it.
- (6) Select a long-point punch with a tip that will pass through the hole in upper end of the poppet (12). The hole will be visible underneath the "Bellofram", when pulled away from the body.
- (7) Insert the point of the punch through the hole in the poppet (12) and hold it while removing the self-locking nut (6).
- (8) Remove the piston (7), "Bellofram" (8) and piston cap (9) from end of poppet (12).
- (9) Hold the body (15) carefully in a soft-jawed vise and remove the plug (10). Remove the O-ring (11).
- (10) Push the poppet (12) out of the body (15).
- (11) For the -1
Clamp the cylinder (3) carefully in a soft-jawed vise and, with a long point punch slightly smaller than the spring pin (13), drive the pin (13), into the adjusting retainer (14) until it bottoms.

For the -11
Clamp the cylinder (3) carefully in a soft-jawed vise and remove the jam nut, (13A).



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(12) For the -1
Using a wide-blade screwdriver, unscrew and remove the adjusting retainer (14). Leave the spring pin in the retainer.

For the -11
Unscrew and remove the adjusting retainer (14A) using a spanner wrench.

3. Cleaning. (See figure 8.)

- A. Remove the "Bellofram" (8, figure 8) and O-ring (11).
- B. Immerse all remaining parts in a vapor degreaser and agitate them until clean. If foreign material is difficult to remove, use a soft bristle brush to aid cleaning.
- C. Remove the parts from the degreaser. Flush thoroughly with distilled or deionized water and dry with water pumped nitrogen.
- D. Lay the parts on a clean lintless cloth until ready for examination and assembly.

CAUTION: TRICHLORETHYLENE FUMES ARE TOXIC. BREATHING FUMES MAY BE A HAZARD TO HEALTH. PROLONGED BREATHING OF FUMES MAY BE FATAL.

NOTE: Equivalent substitutes may be used for listed items.

Trichlorethylene	Commercially available
Distilled or Deionized water	Commercially available

Cleaning Materials
Figure 4

4. Check. (See figure 8.)

- A. Check each part of the regulator assembly as follows:
 - (1) Check all screws (2, figure 8) for torn slots and distorted threads. Replace all screws showing damage.
 - (2) Check the cylinder (3) for damaged threads, cracks and warped flange. A warped flange can be detected by placing the cylinder (flange down) on a surface plate, or by laying a straight edge across the flange surface. Replace the cylinder for any of these conditions.



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- (3) Check the spring (4 or 4A) for breaks. If appearance is good, stand the spring endwise on a surface plate and notice if it leans or curves rather than standing vertically. If any "lean" is observed, replace the spring.
- (4) Check the spacer (5) if required for grooves where the spring contacts it. Replace it if grooves are obvious.
- (5) Check the self-locking nut (6) for damaged threads and wrench damage. Replace the nut for either condition.
- (6) Check the piston (7) for distortion. If the surface that contacts the "Bellofram" is "bulged" outward, replace it.
- (7) Check the piston cap (9) for distortion and replace it if surfaces are warped.
- (8) Check the plug (10) for damaged threads, wrench damage and rough O-ring sealing surface. Replace for any of these conditions.
- (9) Check the poppet (12) for damaged threads, tool damage, and score marks. Carefully examine the rubber seating surface for damage. If the seat contact is smooth and not grooved it will seat effectively. Replace the poppet if any of the preceding faults are present. If the poppet appears to be in good condition, perform measurements outlined in main paragraph 7.
- (10) Check the body (15) visually for damaged threads in screw holes, fittings and internal threads at poppet access opening. Also check it for cracks and tool damage. If the body is in good condition, perform the measurement check outlined in main paragraph 7.

5. Repair.

- A. Repairs consist of replacement of damaged or worn parts.
- B. Always replace the O-ring and "Bellofram" during repair of the regulator.

6. Assembly. (See figure 8.)

- A. Assemble the air-pressure regulator as follows:

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- (1) Insert the poppet (12, figure 8) into the body (15), place a new O-ring (11) on the plug (10) and screw the plug into the body. Clamp the body in a soft-jawed vise and torque the plug to between 7 and 13 foot pounds.
- (2) Place the piston cap (9) on the end of poppet (12), place the "Bellofram" (8) on the piston cap and carefully insert the piston (7) into the recess of the "Bellofram" (8).
- (3) Start the self-locking nut (6) on the threaded end of poppet (12).
- (4) Raise the poppet to expose the hole just below the piston cap (9) and insert the point of a long point punch through this hole to keep the poppet from turning.
- (5) Hold the punch and tighten the nut (6) to between 22 and 25 inch pounds. Remove the punch.
- (6) Place the spacer (5) as required in the piston (7).
- (7) Rotate the "Bellofram" (8) to align all holes with mating holes in the body (15).
- (8) Orient the cylinder (3), by observing markings made during disassembly, place the cylinder in position and install the six screws (2) finger tight. Using an ordinary screwdriver, tighten all screws (2) until mild resistance is felt. Then, with a torque driver, tighten them to between 32 and 38 inch pounds.
- (9) Insert the spring (4 or 4A), making sure it rests on the spacer (5), when used.
- (10) For the -1
Place the adjusting retainer (14) on the spring (4), push down and start the retainer into its threads. Use a wide-blade screwdriver to run the retainer (14) into the cylinder (3) until the top of the retainer is approximately flush with the top surface of the cylinder. The retainer will be finally adjusted during the final testing procedure.

For the -11

Place the adjusting retainer (14A) on the spring (4A), push down and start the retainer into its threads. Use a spanner wrench to run the retainer (14A) into the cylinder (3) approximately two or more turns. The retainer will be finally adjusted during the final testing procedure. Thread on the jam nut but do not tighten yet.

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(11) Safety wire the six screws (2) and plug (10).

7. Fits and Clearances.

A. Measure the two bores for poppet bearing surfaces in the body (15, figure 8) as follows:

(1) Measure the upper (small) bore diameter which should not exceed 0.300 inch.

(2) Measure the lower (large) bore diameter which should not exceed 0.370 inch.

(3) Both bores should be smooth, and free of score marks. If either diameter exceeds the preceding dimension, replace the body.

B. Measure the poppet (12, figure 8) at upper and lower bearing points as follows:

CAUTION: USE CARE WHEN HANDLING THE POPPET TO AVOID DAMAGING THE "VITON" FLUOROELASTOMER SEATING SURFACE, ON THE TAPERED PORTION OF THE POPPET.

(1) Measure the upper (small) bearing surface at 60-degree increments around the circumference of the bearing area. The diameter at any increment should not be less than 0.2955 inch.

(2) Measure the lower (large) bearing surface as described in the preceding step. The diameter at any increment should not be less than 0.364 inch.

(3) Both bearing surfaces should be free of score marks and visible wear patterns. If either diameter is less than the preceding dimensions, replace the poppet.

8. Testing.

A. Equipment and Materials for Testing.

NOTE: Equivalent substitutes may be used for listed items.

<u>Equipment/Materials</u>	<u>Description</u>
Air pressure source	A regulated clean (filtered) air source capable of being adjusted from below 30 to in excess of 125 psig.

Test Equipment and Materials
Figure 5 (Sheet 1 of 2)

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<u>Equipment/Materials</u>	<u>Description</u>
Air reservoir	An air chamber having a capacity of approximately 175 cubic inches and strength to contain 75 psig or above.
Flowmeter	An orifice type flowmeter capable of handling in excess of 3.0 SCFM.
Gages:	
Manometers	One 72-inch mercury manometer (for the -1 test only) and one 24-inch water manometer, both calibrated in inches and down to tenths.
Pressure gages	Two dial-type pressure gages having a scale of 0 to 60 psi (one required to test the -1 unit, both required to test the -11 unit). One dial-type pressure gage having a range of 0 to 150 psi.
Valves	Four globe-type shutoff valves for controlling flow of air and selecting the desired manometer and gage.

Test Equipment and Materials
Figure 5 (Sheet 2 of 2)

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B. Test Setup (See Figure 6.)

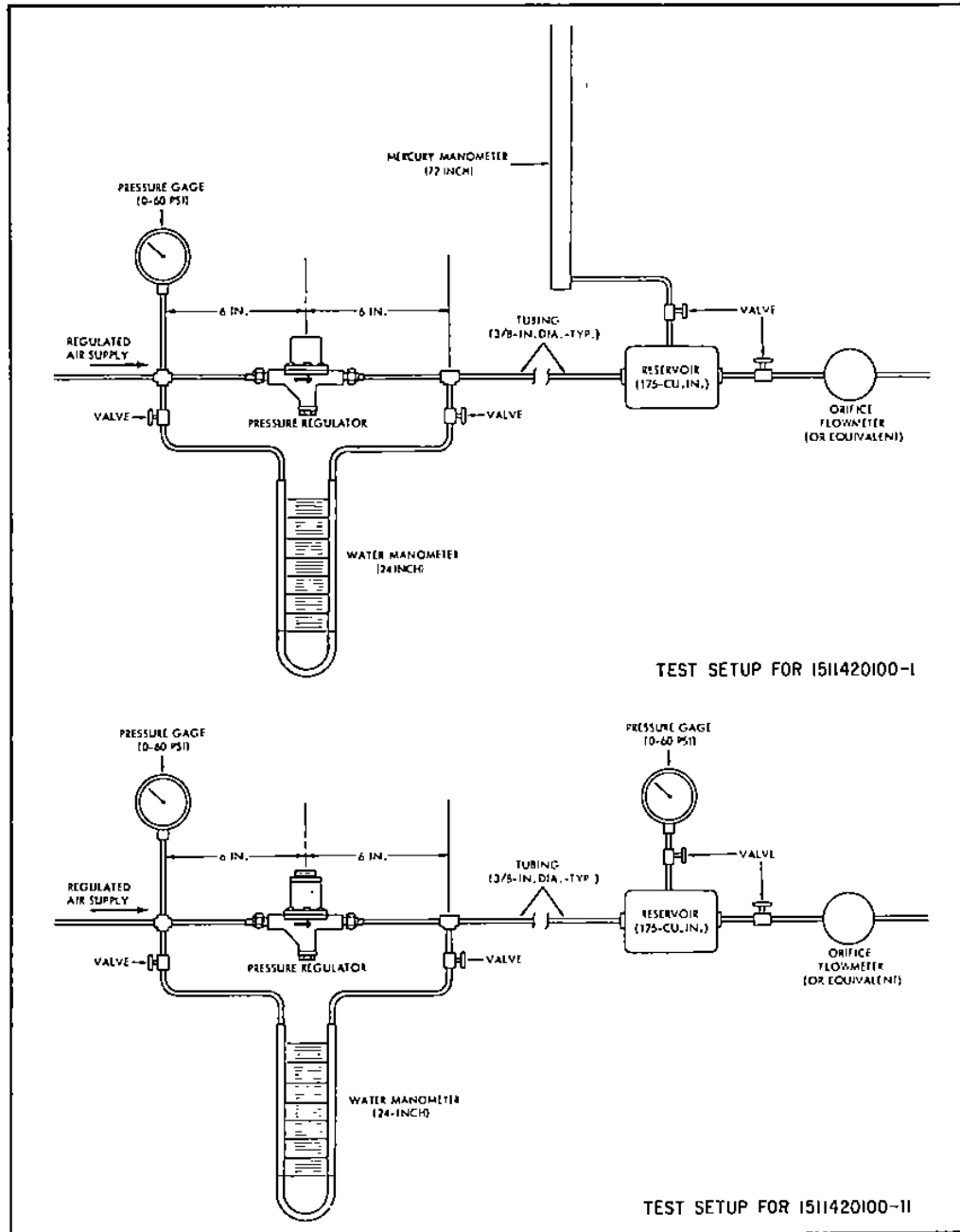


Figure 6

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C. Operational Test and Trouble Shooting.

- (1) Perform a proof-pressure test on the air pressure regulator as follows:
 - (a) Cap the inlet port to provide an air seal.
 - (b) Apply a pneumatic pressure of 125 psig to the outlet port and maintain this pressure for a minimum of one minute.
 - (c) Check carefully for evidence of distortion. There shall be no evidence of rupture, permanent deformation or leakage. Notate the results of this test.
- (2) Perform an external leakage test of the regulator as follows:
 - (a) With the inlet port still capped, apply a pneumatic pressure of 50 psig to the outlet port for one minute.
 - (b) There shall be no evidence of external leakage. Notate the results of the test.
- (3) Perform a functional test of the regulator as follows:
 - (a) For the -1
Mount the regulator in a test setup as shown in figure 6. Be sure the two six-inch dimensions shown are observed and that inlet and outlet ports are correctly oriented.
 - (b) Set the inlet air pressure to 30 psig, at between 50°F and 90°F.
 - (c) Adjust the flowmeter valve to provide a flow rate of 2.88 SCFM (equivalent to one CFM at 30 psig and 100°F).
 - (d) Adjust the inlet pressure to 50 psig and rotate the adjusting retainer (14, figure 8) until the outlet pressure is 65 inches Hg, as indicated on the 72-inch manometer.

NOTE: Open and/or close the valves shown in figure 6 to the various instruments when required.

- (e) Adjust the inlet pressure to 30 psig, then to 35 psig while observing the outlet pressure on the 72-inch manometer for both settings. The outlet pressure shall remain between 60 inches Hg and 69.2 inches Hg during all above inlet pressures of 30, 35 and 50 psig. Readjust the adjusting retainer (14, figure 8) if necessary to retain these values.

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- (f) If the regulator fails to respond within the limits stated, disassemble it, make necessary corrections and recheck according to instructions in this paragraph.
- (4) Perform a pressure drop test of the regulator as follows:
- (a) Adjust the flowmeter to provide a flow rate of 2.88 SCFM (equivalent to one CFM at 30 psig and 100°F) with 30 psig inlet air pressure, at between 50°F and 90°F.
 - (b) The pressure drop across the regulator shall not exceed 0.5 psig which corresponds to 13.8 inches of water as indicated on the 24-inch manometer. If this value is exceeded, disassemble the regulator, make corrections and perform all preceding tests.
- (5) Notate all the above data.
- (6) Remove the regulator from the test setup and secure the adjusting retainer as follows:
- (a) Clamp the regulator carefully in a soft-jawed vise.
 - (b) Locate the former pin hole near the upper end of the cylinder (3, figure 8) and drill a new hole approximately 180-degrees from the previous hole 0.010 inch down from the top edge of the cylinder. The hole shall be 0.062 (+0.003, -0.000) inch diameter and 0.260 inch deep.
 - (c) Remove all cuttings with compressed air and press a new spring pin (13, figure 8) into the hole. The end of the pin should be flush to approximately 1/32 inch above or below the periphery of the cylinder.
- (7) Perform a functional test of the regulator as follows:
- (a) For the -11
Mount the regulator in a test setup as shown in figure 6. Be sure the two six-inch dimensions shown are observed and that inlet and outlet ports are correctly oriented.
 - (b) Set the inlet air pressure to 38.5 psig, at between 50°F and 90°F.
 - (c) Adjust the flowmeter valve to provide a flow rate of 2.88 SCFM (equivalent to one CFM at 38.5 psig and 100°F).

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- (d) Adjust the inlet pressure to 50 psig and rotate the adjusting retainer (14A, figure 8) until the outlet pressure is 38.5 psig, as indicated on the 0 - 60 psig gage.

NOTE: Open and/or close the valves shown in figure 6 to the various instruments when required.

- (e) Adjust the inlet pressure to 45 psig, while observing the outlet pressure on the 0 - 60 psig gage. The outlet pressure shall remain between 38.5 psig minimum and 43.5 maximum psig during all above inlet pressures of 45 and 50 psig. Readjust the adjusting retainer (14A, figure 8) if necessary to retain these values.
 - (f) If the regulator fails to respond within the limits stated, disassemble it, make necessary corrections and recheck according to instructions in this paragraph.
- (8) Perform a pressure drop test of the regulator as follows:
 - (a) Adjust the flowmeter to provide a flow rate of 2.88 SCFM (equivalent to one CFM at 38.5 psig and 100°F) with 38.5 psig inlet air pressure, at between 50°F and 90°F.
 - (b) The pressure drop across the regulator shall not exceed 0.5 psig which corresponds to 13.8 inches of water as indicated on the 24-inch manometer. If this value is exceeded, disassemble the regulator, make corrections and perform all preceding tests.
 - (9) Notate all the above data.
 - (10) Remove the regulator from the test setup and secure the adjusting retainer as follows:
 - (a) Clamp the regulator carefully in a soft-jawed vise.
 - (b) Tighten down the jam nut (13A) and lockwire this nut in position to one of the screws (2).



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<u>Malfunction</u>	<u>Probable Cause</u>	<u>Corrective Action</u>
External leakage.	Loose, or damaged line connections to regulator.	Remove the regulator and repair flares or replace lines.
	Loose screws (2, figure 8)	Tighten screws to between 32 and 38 inch pounds.
	Leak in "Bellofram".	Repair the regulator.
	Loose plug or damaged O-ring.	Remove the plug (10, figure 8), replace the O-ring and torque the plug to between 7 and 13 foot pounds.
Outlet pressure fluctuates.	Crack in body.	Repair the regulator.
	Damaged poppet seat.	Repair the regulator.
	Poppet binding in body.	Repair the regulator.
	Foreign material causing poppet to stick momentarily.	Repair the regulator.
	Broken or binding spring.	Repair the regulator.
	Damaged "Bellofram".	Repair the regulator.
	Loose nut on upper end of poppet.	Repair the regulator.
Outlet pressure consistently too high.	Improper adjustment.	Test and adjust regulator as described in main paragraph 8.
	Damaged poppet seat.	Repair the regulator.
	Broken "Bellofram".	Repair the regulator.
	Sticking poppet.	Repair the regulator.

Trouble Shooting
Figure 7 (Sheet 1 of 2)

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<u>Malfunction</u>	<u>Probable Cause</u>	<u>Corrective Action</u>
Outlet pressure too low.	Improper adjustment.	Test and adjust regulator as described in main paragraph 8.
	Weak spring.	Repair the regulator.
	Poppet sticking.	Repair the regulator.

NOTE: After making repairs, be sure to perform tests and adjustments outlined in main paragraph (8).

Trouble Shooting Figure 7 (Sheet 2 of 2)

9. Trouble Shooting.

NOTE: See Testing Paragraph for Operational Test and Trouble Shooting.

10. Storage Instructions.

- A. Unless the regulator is scheduled for immediate installation in the aircraft, preserve it immediately after testing as follows:
- (1) Cap outlet and inlet ports with a proper size plastic cap on each port.
 - (2) Place the regulator in a polyethylene bag (Specification MIL-B-22205, Type III) and secure the bag with at least two turns of cloth-backed, waterproof adhesive tape (Specification PPP-T-0060C, Type 3, Class 1).
 - (3) Wrap the regulator in moisture-vaporproof, Kraft foil barrier bag (Specification MIL-B-117, Type II, Class E). Heat seal the bag after wrapping.
 - (4) Pack wrapped regulators in individual boxes or padded cartons for handling and/or storage.
- B. Storage.
- (1) Store in original containers, indoors, protected from extremes of temperature and/or moisture.
 - (2) Issue preserved items from stock on a first-in, first-out basis.

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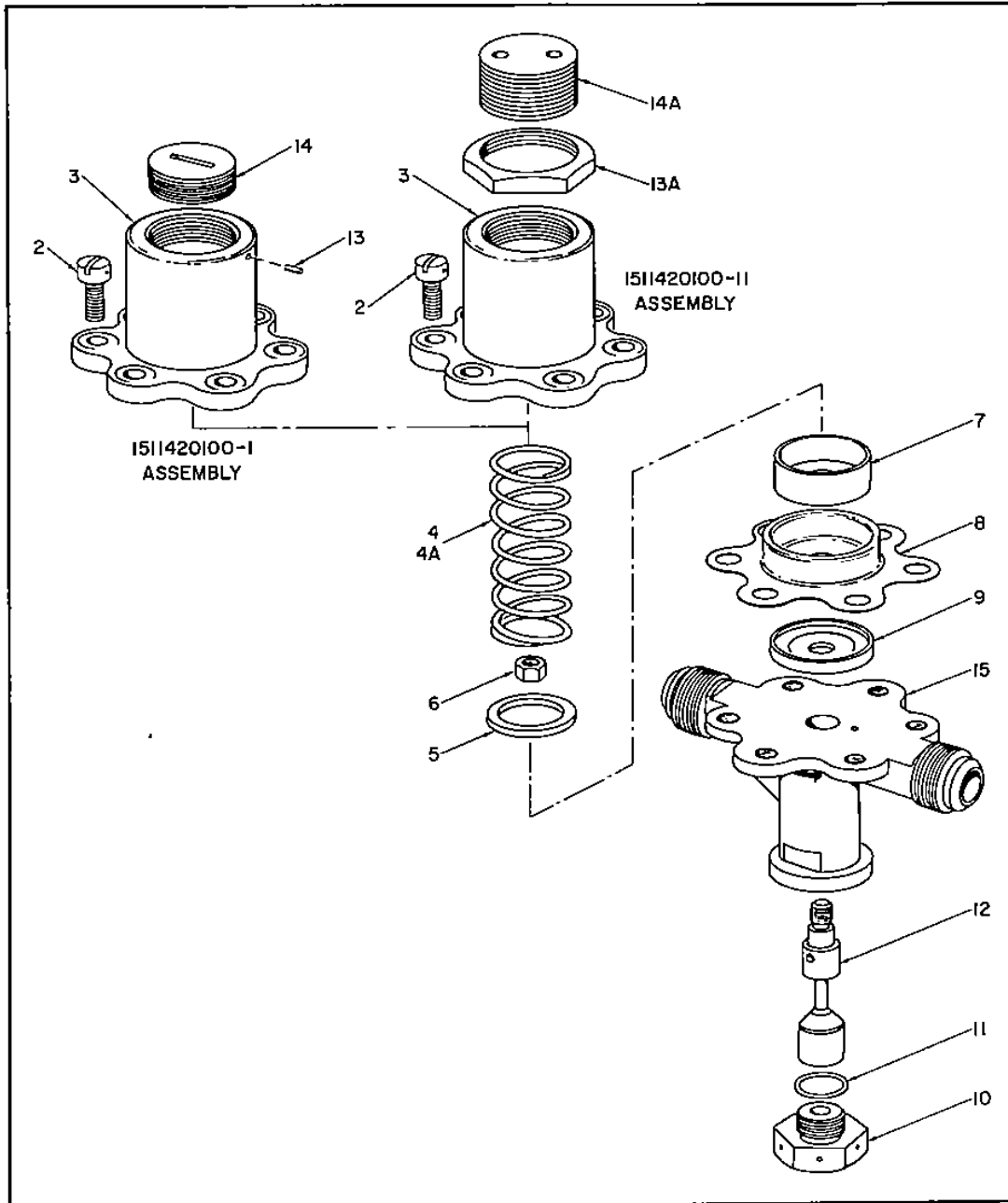


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11. Special Tools, Fixtures and Equipment. (Not applicable.)



Air Pressure Regulators
Figure 8

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12. Illustrated Parts List.

All items coded A are used on the -1 configuration only.
All items coded B are used on the -11 configuration only.
Non-coded items are used on both the -1 and -11 configuration Air Pressure Regulators.

Fig.	Item	Part Number	1	2	3	4	5	6	7	Nomenclature	Effect Code	Units Per Assy..
8	-1	1511420100-1								Regulator - Pressure, Air	A	RF
	-1A	1511420100-11								Regulator - Pressure, Air	B	RF
	2	MS35266-63								Screw		6
	3	1511420102-1								Cylinder		1
	4	1511420108-1								Spring	A	1
	4A	1511420113-1								Spring	B	1
	5	1511420111-1								Spacer		As Req'd.
	6	MS21042-08								Nut, Self-locking		1
	7	1511420106-1								Piston		1
	8	1511420104-1								Bellofram		1
	9	1511420105-1								Cap, Piston		1
	10	AN814-4JL								Plug		1
	11	MS33668-1/4								Packing, O-Ring*		1
	12	1511420107-1								Poppet		1
	13	MS171431								Pin, Spring	A	1
	13A	1511420114-1								Jam Nut	B	1
	14	1511420103-1								Retainer, Adjusting	A	1
	14A	1511420112-1								Retainer, Adjusting	B	1
	15	1511420101-1								Body		1
										- Item Not Illustrated		
										* Fluorosilicone Rubber Compound Per MIL-R-25988		