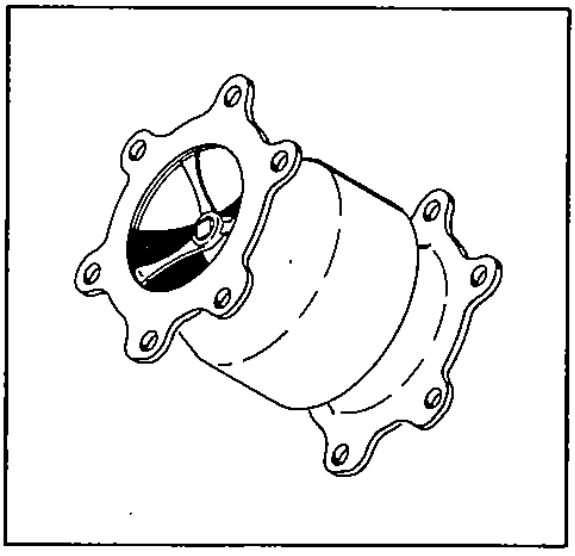
Essex Cryogenics Industries
8213 Gravois Avenue
St. Louis, Missouri 63123

OVERHAUL MANUAL

FUEL PUMP PRESSURE RELIEF CHECK VALVE

Part Number 53000-11



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LIST OF EFFECTIVE PAGES

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Record of Revisions

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Rev. No.	Date Inserted	Date Removed	Page Number	Rev. No.	Date Inserted	Date Removed	Page Number

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SERVICE BULLETIN LIST

Service Bulletin	Incorp.	Service Bulletin	Incorp.

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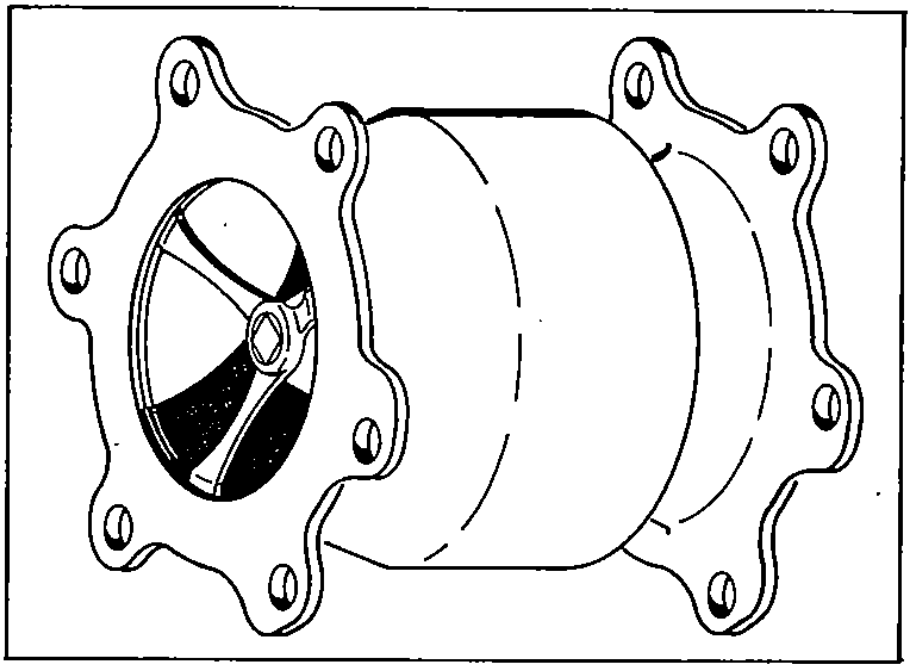
1. Description and Operation

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

(1) The Fuel Pump Pressure Relief Check Valve consists of a cylindrical flanged housing (9, figure 10) with a spring-loaded, poppet (6) that opens in response to a predetermined fuel pressure. (See figure 1).



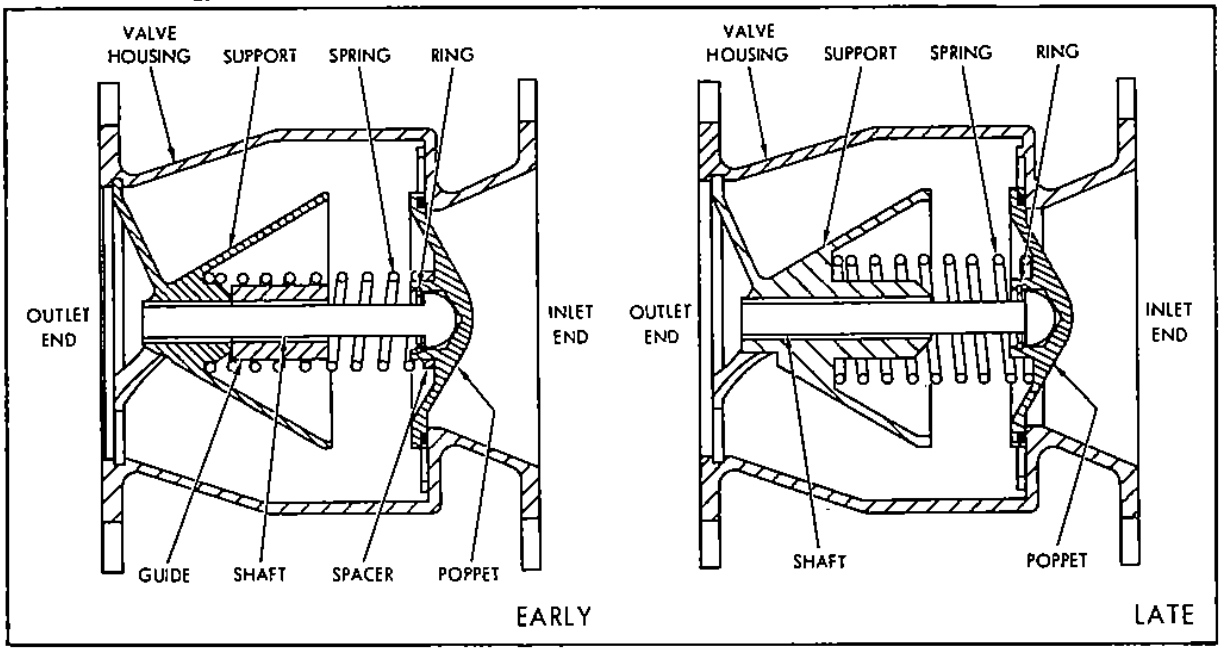
Fuel Pump Pressure Relief Check Valve, 53000-11
Figure 1

(2) The valves are located in the feed lines from the boost pump.

(3) The valve poppet (6 figure 10) is located at the inlet end of the valve and has an inseparable annular elastomeric ring that seals against a seat in the valve housing. (See figure 2.) The spring (3 or 3A, figure 10) keeps the valve poppet (6)closed until fuel pressure opens it.

(4) The outlet end has a support, (2 or 2A) that snaps into a groove inside the bore of housing (9). The purpose of this support is to position and guide the tail end of the poppet shaft, (8).

(5) A flange at the inlet end of the housing (9) contains six, equally-spaced mounting holes. Mounting holes at the outlet end are assymmetrically spaced to make incorrect mounting orientation impossible. The valve is installed in the engine feed line adjacent to the boost pump. The 0.328-inch diameter mounting holes are centered on a 3.812-inch diameter circle.



Cross Sectional View of the 53000-11 Check Valve Assemblies, Early and Late Versions
Figure 2

B. Operation. (See figure 2).

(1) The valve poppet (6, figure 10) is spring loaded to crack at between 3.5 and 4.5 psi with a 30 cc/min. fuel flow.

(2) When the fuel pressure from the pump exceeds operating pressure, the valve opens to permit fuel to by-pass, thus maintaining the desired fuel-line pressure between the pump and point of fuel delivery.

C. Leading Particulars

Figure 3 lists principal characteristics of the relief valve.

Fluids	
Operating	Turbine fuel JP-4, per MIL-T-5624G. Commercial turbine fuel, per ASTM-D1655. Fuels A or B with BIOBOR-JF additives of 270 PPM. Aviation gasoline with up to 30% aromatics.
Test fluid	Stoddard solvent, per Federal Spec. P-D-680.
Ambient temperature	-65°F to +160°F
Fluid temperature	-65°F to +135°F
Shock	15 G's (any direction)
Leakage:	
Internal	3 drops/min (max), at 0 to 60 psig.
External	Zero, at 0 to 60 psig.
Cracking pressure	3.5 to 4.5 psi, at 30 cc/min. fuel.
Reseat pressure	3.5 psi (min.) at 10 cc/min. fuel.
Pressure drop	3.8 psi (max.) at 60,000 lbs/hr. of JP-4 at 70°F.
Altitude	-1000 Ft. to 42,000 ft.
Attitude	Preferable -- None - independent of orientation.
Dimensions	
Length (between flange faces)	3.70 inches

Leading Particulars
Figure 3 (Sheet 1 of 2)

Diameter (maximum	4.50 inches
Diameter of housing (external)	3.20 inches
Diameter of housing (internal)	3.00 inches
Diameter of inlet port	1.80 inches
Diameter of outlet opening	2.28 inches
Number of mounting holes (each flange)	Six
Diameter of mounting holes	0.328 inch
Diameter of mounting hole circle	3.812 inches
Weight (maximum)	0.75 pounds

Leading Particulars
Figure 3 (Sheet 2 of 2)

2. Disassembly, (See figure 10).

   A. Disassemble the relief valve as follows:

      (1) Force the three legs of the support (2 or 2A) out of the retaining groove by carefully pushing the support (2 or 2A) toward the poppet (6). Angle the legs out of the housing (9), and remove the support from the check valve assembly.

      (2) Remove the poppet (6) and all associated parts from the housing (9) by tilting the housing until all the parts fall out.

3. Cleaning

   A. Immerse all units in clean Stoddard Solvent (Specification P-D-680), Mozel 18 or MEK solvent. Remove stubborn accumulations or stains with a small brush.

CAUTION: DO NOT DAMAGE THE RUBBER SEAL ON THE POPPET (6).

   B. Dry all parts with filtered, compressed air.

Stoddard solvent	Spec. P-D680
Mozel 18 solvent	MCAIR MMS401 (Mozel Chemical Co., St. Louis, Mo.)
MEK (methyl ethyl ketone) solvent	Federal Spec. TT-M-261

Cleaning Materials
Figure 4

4. Inspection. (See figure 10.)

A. When inspecting relief valve parts, remember that the following modes of failure are possible.

(1) Excessive internal leakage.

(2) Failure of the poppet (6 figure 10) to open.

(3) Failure of the poppet (6) to close.

(4) Failure to crack and reseat in accordance with specifications.

B. Inspect parts as follows:

(1) Inspect the poppet (6 figure 10) for distortion, mechanical damage, and a damaged seal. Replace the poppet for any of these conditions.

NOTE: Whenever it is necessary to replace any of the internal components of the Early valve, all internal components must be replaced.

Units with S/N's before 1113, should be upgraded to the later model configuration by rebuilding them using only B and un-coded component parts.

(2) Inspect the housing (9) for warped flanges, damage at flange holes, cracks and distortion between flanged ends. Also, check the seat for scratched or visible wear patterns. Replace for any of these conditions.

(3) Inspect the spring (3 or 3A) for evidence of weakening, wear at ends and distortion along the wound portion. Replace for any of these conditions. (An effective spring check is to compare it with a new spring out of parts stock. Give particular attention to angles of the ends which would indicate weakening of spring tension).

5. Repair

A. Repairs consist of replacing internal worn or damaged parts. The housing (9) unless damaged, should be reused.

B. After replacing parts, perform complete tests.

6. Assembly. (See figure 10).

A. Assemble the relief valve as follows:

(1) Insert the shaft (8, figure 10) into the poppet (6), and secure them together with the snap ring (7).

(2) Orient this assembly so that is passes through the hole in the outlet end of the valve housing (9) and the poppet (6), is adjacent to the inlet of the valve housing (9).

(3) Install the 53037-1 spring, (3A) on the shaft (8).

(4) Install the 53029-3 support, (2A), on the shaft (8) and carefully lock the three legs of the support (2A) in the annular ring adjacent to the outlet of the valve.

NOTE: Exercise extreme care in this installation so that the legs are not distorted.

CAUTION: EXERCISE CARE TO AVOID DAMAGING THE POPPET SEAL.

(5) Operate the poppet (6) by opening and closing it with fingers in order to make sure it is assembled properly.

B. After assembly, the valve should respond to the following checks:

(1) The poppet (6) must not bind and its shaft (8) should slide free in the support (2A).

(2) The seal on the poppet, (6) must be in contact with its seat on the housing (9).

7. Fits and Clearances - Not applicable.

8. Testing.

A. Proof, and External Leakage Test. (See figure 5.)

(1) Mount the relief valve in a test fixture, as shown in Figure 5. Make sure the valve is in a horizontal position as opposed to the vertical position. Use clean water in the container.

(2) With the inlet port open, apply an air pressure of 120 psig to the outlet port for a minimum of one minute.

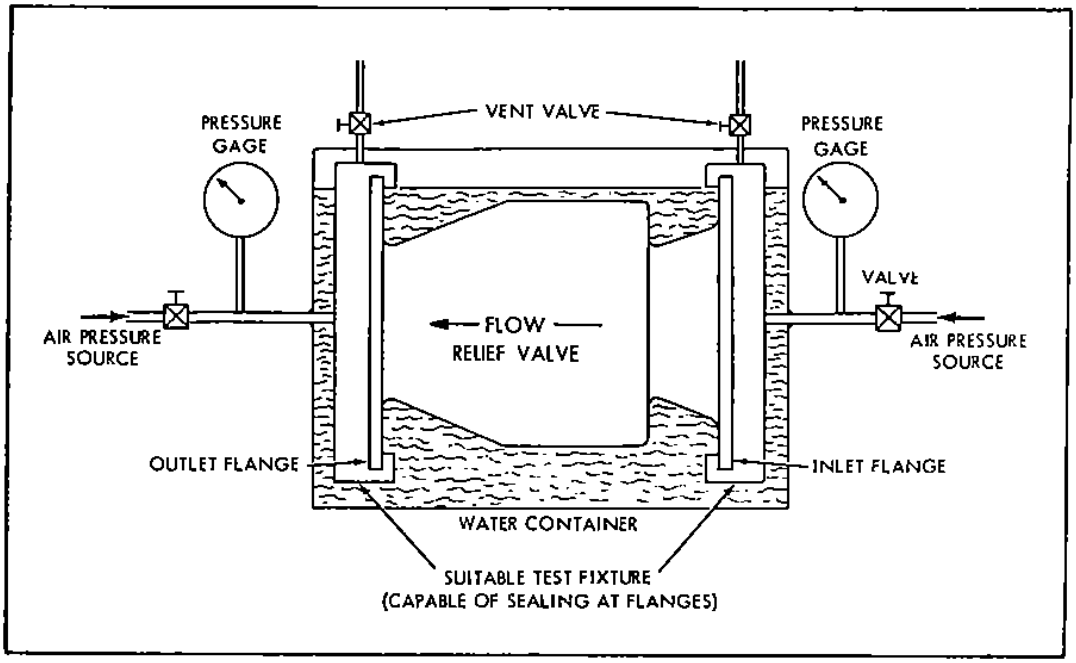
(3) Release air pressure, close the outlet port and apply an air pressure of 120 psig to the inlet port for a minimum of one minute.

(4) Release air pressure and apply 60 psig to the inlet port (outlet port still closed) for a minimum of 15 seconds.

(5) With clean water covering the valve completely, there shall be no external leakage with 60 psig applied to the inlet port.

(6) If leakage should occur at 60 psig, or if any distortion or damage occurs when 120 psig is applied, the valve shall be rejected for repairs and re-testing.

(7) Record results of this test.



Proof, and External Leakage Test
Figure 5

B. Check Direction Leakage Test (See figure 6.)

(1) Mount the relief valve in a suitable test fixture, as shown in Figure 6. The unit is mounted horizontally. Use a suitable graduate to catch and measure the test fuel that leaks past valve door during the test.

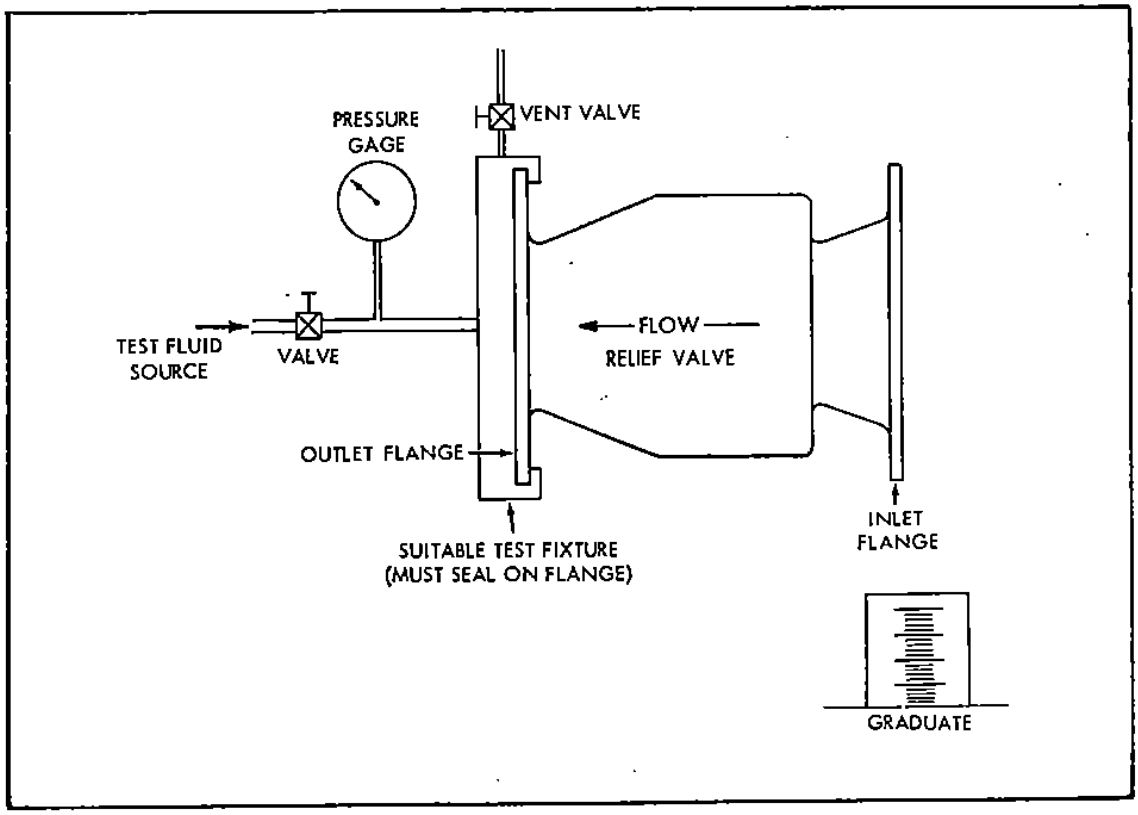
(2) With the inlet port open, apply a test-fluid pressure of between 1.0 (27.7 inches of water) and 2.0 (55.4 inches of water) psig at the outlet port. Permissible leakage is three drops per minute (maximum).

(3) Increase test-fluid pressure to 30 psig and note leakage, which shall not exceed three drops per minute.

(4) Increase test-fluid pressure to 60 psig. Leakage shall still not exceed three drops per minute.

(5) If the valve fails to pass this test, return it for repairs and re-test.

(6) Record results of this test.



Direction Leakage Test Check
Figure 6

C. Cracking and Reseat Pressure Test. (See figure 7.)

(1) Mount the relief valve in a test fixture, as shown in figure 7. The valve is positioned horizontally.

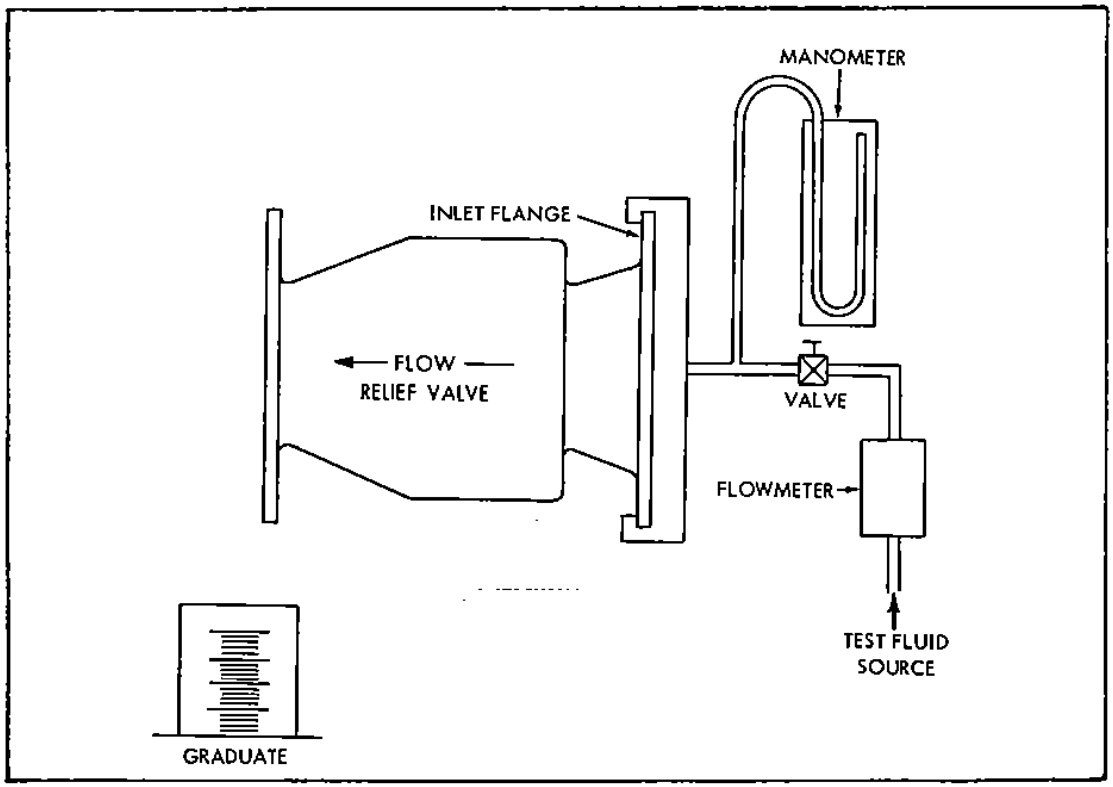
(2) With the outlet port open, apply test-fluid pressure slowly to the inlet port.

(3) When fluid flow through the relief valve reaches 30 cc/minute, the inlet pressure shall be between 3.5 (7.13 inches of mercury) and 4.5 (9.16 inches of mercury) psig.

(4) Increase the fluid flow to full scale on the flowmeter, then slowly decrease the fluid pressure. When the fluid flow decreases to 10 cc/minute, the pressure shall be 3.5 (7.13 inches of mercury) psig, minimum.

(5) If the valve fails to pass this test return it for repairs and re-test.

(6) Record the results of this test.



Cracking and Reseat Pressure Test
Figure 7

D. Equipment and Materials for Tests

Equipment/Materials	Description
Test fluid	Stoddard Solvent (Spec. P-D-680)
	JP-4 fuel or (Spec. MIL-T-5624)
	Clean water - for proof and external leakage test only.
Gages	Mercury Manometer
	Pressure gage capable of reading in exoess of 120 psig.
	Low-reading pressure gage, capable of showing (accurately) pressure of below five psig.
Valves	Needle valves for handling test fluid and air.
Air Pressure Source	A pressure-regulated, filtered compressed air supply capable of being regulated from 3.5 to 120 psig. Two regulators will be required to cover this range.
Test Chamber	Large enough to immerse the entire relief valve in water, with end fixtures attached to the valve.
Test Fixtures	Two fixtures for attaching to and sealing on valve flanges.
Flowmeter	For accurately measuring 10 and 30 cc/minute fuel flow through the relief valve.

Test Equipment and Materials
Figure 8

9. Troubleshooting

Malfunction	Probable Cause	Corrective Action
Excessive Internal Leakage, w/valve apparently closed.	Foreign material on seat.	Clean the valve and re-test.
	Damaged poppet seal (6).	Replace the poppet (6)*
	Warped poppet (6).	Replace the poppet (6)*
	Scratched or damaged seat in housing (9).	Replace the housing (9)*
	Damaged or broken spring (3 or 3A).	Replace the spring (3 or 3A) with a (3A) spring.*
Failure of Poppet to Open.	Foreign material on the shaft (8).	Clean the valve and re-test.
	Bent shaft (8).	Replace the shaft (8)*
	Spring jammed (3 or 3A).	Replace the spring (3 or 3A) with a (3A) spring.*
Failure of Poppet to Close.	Edge of seal hanging up on seat in housing (9).	Replace the poppet (6)*
	Weak or broken spring (3 or 3A).	Replace the spring (3 or 3A) with a 3A spring.*
Failure of Poppet to Crack or Reseat Within Specifications	Weak or broken spring (3 or 3A).	Replace the spring (3 or 3A) with a (3A) spring.*
	Worn or damaged poppet (6) or shaft (8).	Remove the poppet (6) and shaft (8) and replace damaged or worn parts.*

Troubleshooting
Figure 9 (Sheet 1 of 2)

Malfunction	Probable Cause	Corrective Action
External Leakage at Flange Interface.	Scratched or rough flange face on housing (9).	Replace the housing (9). *
	Damaged mating part and/or seal.	Repair or replace mating part and/or seal.

NOTES: * When an early model unit (S/N's 1101 thru 1112) is disassembled, reassemble it to the late model configuration.

After making repairs be sure to re-test the relief valve as outlined in the Test Section.

Troubleshooting
Figure 9 (Sheet 2 of 2)

10. Storage Instructions.

A. Unless the relief valve is scheduled for immediate installation, all units shall be preserved immediately after testing as follows:

(1) Flush the interior of relief valve with aircraft engine corrosion preventive compound, Specification (MIL-C-6529, Type III.)

(2) Insert each valve in a polyethylene bag, Specification MIL-B-22205, Type III. Secure the bag to the valve with at least two turns of cloth-backed, waterproof adhesive tape, Specification PPP-T-0060C, Type 3, Class 1.

(3) Wrap preserved valves by heat sealing in moisture-vaporproof, Kraft-foil, barrier bags, Specification MIL-B-117, Type II, Class E.

(4) Protect the valves during handling and storage by packaging them in individual boxes or padded cartons.

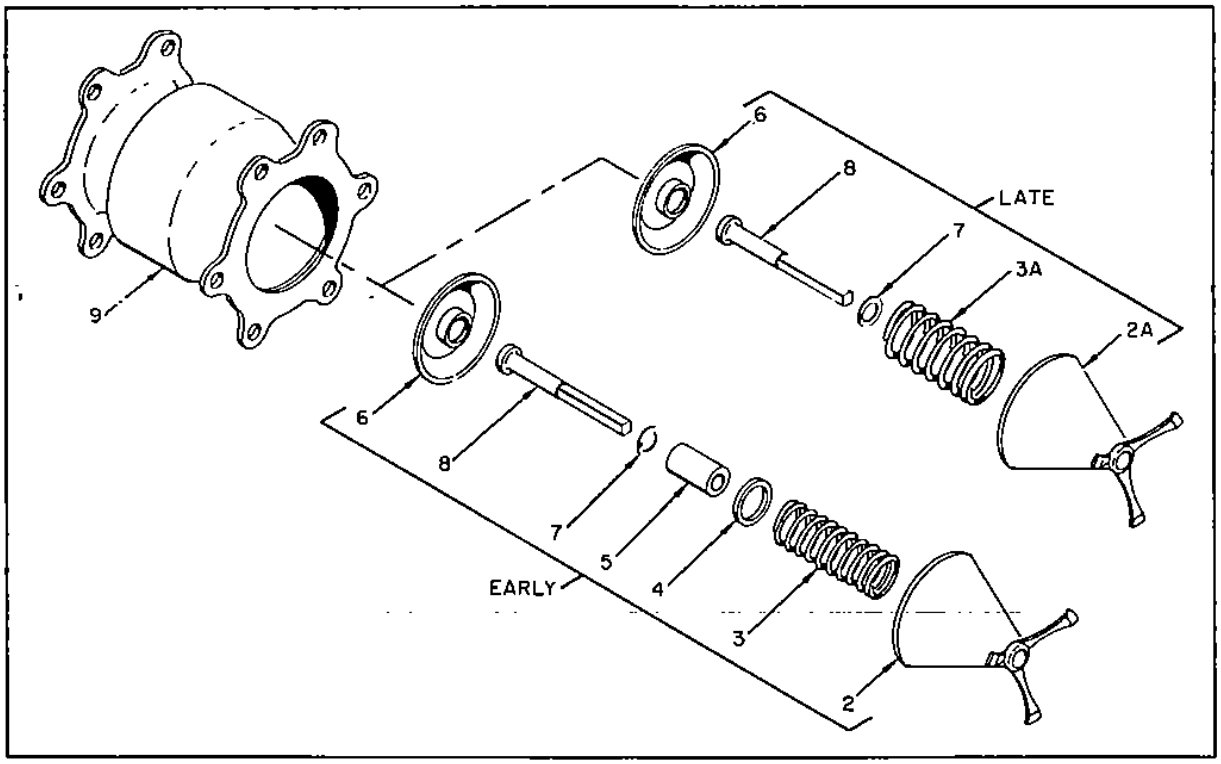
B. Storage

(1) Protect valves from extremes of temperature and moisture, by keeping them in original containers until ready for installation.

(2) Store packaged valves indoors until used.

11. Special Tools, Fixtures and Equipment - Not applicable.

12. Illustrated Parts List



Fuel Pump Pressure Relief Check Valve 53000-11, Early and Late Models
Figure 10

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Fig.	Item	Part Number	1234567 Nomenclature	Effect Code	Units Per Assy.
10	-1	53000-11	Valve - Fuel Pump Pressure Relief Check		RF
	2	53029-1	Support	A	1
	2A	53029-3	Support	B	1
	3	53032-1	Spring	A	1
	3A	53037-1	Spring	B	1
	4	53036-1	Spacer	A	1
	5	53035-1	Guide	A	1
	6	53030-1	Poppet		1
	7	RR50S	Ring		1
	8	53031-1	Shaft		1
	9	53009-1	Housing		1

-Item not illustrated

All items with an effectivity code of A are used on units with Serial Numbers from 1101 thru 1112. All items with an effectivity code of B are used on units with Serial Numbers 1113 and above. Non-coded items are used on both the early and late serial numbered units.