

**SSME / FA/CIL
REDUNDANCY / SCREEN**

Component Group: Propellant Valves
 CIL Item: D500-04
 Component: GOX Control Valve
 Part Number: RS010141
 Failure Mode: Valve fails to open.

Prepared: P. Lowrmore
 Approved: T. Nguyen
 Approval Date: 5/30/99
 Change #: 1
 Directive #: CCBD ME3-01-5226
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Phase	Failure / Effect Description	Criticality Hazard Reference
S 4.1	<p>Loss of pogo suppression capability; controller pogo GOX flow check results in MCF and vehicle commanded shutdown. Mission scrub Loss of vehicle due to pogo may result if GCV failure is not detected.</p> <p>Redundancy Screens: VALVE SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY.</p> <p>A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Pass - Loss of a redundant hardware items is detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.</p>	<p>1R ME-83A,M,C, ME-88M</p>

SSME FMEA/CIL
DESIGN

Component Group: Propellant Valves
CIL Item: D500-04
Component: GOX Control Valve
Part Number: RS010149
Failure Mode: Valve fails to open.

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Design / Document Reference

FAILURE CAUSE: A: Piston seizure or binding.

THE LOCATION OF THE PISTON (1) IN THE HOUSING (2) BORE IS DETERMINED BY THE POPPET STEM (3). THE POPPET STEM GUIDES ON THE HOUSING THROUGH THE GUIDE (3) ON THE POPPET END AND ON THE PISTON SEAL (4) ON THE PISTON END. THE PISTON (1) TO HOUSING CLEARANCE MINIMIZES THE POSSIBILITY OF CONTACT BETWEEN THE TWO PARTS. THE PISTON AND HOUSING ARE HEAT TREATED INCONEL 718 WHICH WAS SELECTED FOR ITS STRENGTH, HARDNESS, AND WEAR RESISTANCE (5). THE PISTON SEAL IS GRAPHITE-FILLED POLYIMIDE. THE MATERIAL WAS SELECTED FOR ITS LOW COEFFICIENT OF FRICTION, STRENGTH, AND RIGIDITY.

(1) RS010149; (2) RS010142; (3) RS010146, RS010148; (4) RES1241; (5) RSS-8582

**FAILURE CAUSE: B: Damaged guide assembly.
C: Piston or guide housing galled.**

THE POPPET STEM GUIDE (1) MATERIAL IS A COPPER-NICKEL ZINC ALLOY. THE MATERIAL WAS SELECTED FOR ITS LOW COEFFICIENT OF FRICTION AND ITS STRENGTH (2). THE GUIDE FRICTION IS FURTHER REDUCED BY A COATING OF DRY-FILM LUBRICANT (1). THE GUIDE OPERATES IN A BORE OF THE HOUSING. THE HOUSING (3) MATERIAL IS HEAT TREATED INCONEL 718. THE MATERIAL WAS SELECTED FOR ITS STRENGTH AND HARDNESS (2). BOTH MATERIALS ARE CORROSION AND STRESS-CORROSION RESISTANT (2). THE PISTON (4) IS GUIDED BY A SPRING-LOADED GRAPHITE-FILLED POLYIMIDE SEAL. THE SEAL MATERIAL WAS CHOSEN FOR ITS LOW COEFFICIENT OF FRICTION, STRENGTH AND RIGIDITY. THE CLEARANCE BETWEEN THE PISTON AND HOUSING PREVENTS CONTACT AND GALLING BETWEEN THE HOUSING (3) AND PISTON. THE DESIGN ALSO INCORPORATES FEATURES WHICH MINIMIZE THE POTENTIAL OF GUIDE, PISTON, OR HOUSING DAMAGE. THE FLOW IMPINGES ON THE FACE OF THE POPPET WHICH MINIMIZES THE SIDE LOADS. THE POPPET OVERHANG ALSO MINIMIZES THE SIDE LOAD. THE LARGE PISTON STEM L/D PREVENTS DAMAGE CAUSED BY COCKING. THE SHORT STROKE MINIMIZES WEAR AND MINIMIZES THE POTENTIAL OF DAMAGE CAUSED BY CONTAMINATION.

(1) RS010148; (2) RSS-8582; (3) RS010142; (4) RS010149

FAILURE CAUSE: ALL CAUSES

POGO GOX PRESSURE CHECK WILL DETECT FAILURE TO OPEN AND WILL INITIATE LAUNCH SCRUB AND PREVENT FAILURE RESULTING IN CRITICAL 1 EFFECTS (1). THE GOX CONTROL VALVE HAS COMPLETED THE DVS TEST REQUIREMENTS (2) INCLUDING VIBRATION (3), AND ENDURANCE (4).

(1) CP408R0002 PT 1 3.2.3.6.4; (2) DVS-SSME-517; (3) RSS-517-40, RSS-517-60; (4) RSS-517-50

**SSME FM/CIL
INSPECTION AND TEST**

Component Group: Propellant Valves
 CIL Item: D500-04
 Component: GDV Control Valve
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A, B, C	PISTON HOUSING STEM GUIDE SEAL		RS010149 RS010142 RS010145 RS010148 RES1241
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	
		HEAT TREAT IS VERIFIED PER DRAWING REQUIREMENTS.	RS010149 RS010142 RS010145
		DRY-FILM LUBRICANT IS VERIFIED PER DRAWING REQUIREMENT.	RS010148
		PISTON, POPPET STEM AND GUIDE DIAMETERS ARE VERIFIED PER DRAWING REQUIREMENTS.	RS010149 RS010145 RS010148
ALL CAUSES	ASSEMBLY INTEGRITY	ASSEMBLY AND FUNCTIONAL TESTING VERIFY PROPER VALVE OPERATION.	RL00490
	HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING	RL00461

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SSME FMEA/CIL
WELD JOINTS

Component Group: Propellant Valves
 CIL Item: D500
 Component: GOX Control Valve
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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
GOX CONTROL VALVE	RS010141	1	EBW	II	X	X		
GOX CONTROL VALVE	RS010141	2	EBW	II	X			
GOX CONTROL VALVE	RS010141	3,4	EBW	II	X	X		
BELLOWS	RS010143	3,4	GTAW	II	X			
BELLOWS	RS010143	5,6	EBW	II	X	X		