

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

Component Group: Propellant Valves
 CIL Item: D500-06
 Component: GOX Control Valve
 Part Number: RS010141
 Failure Mode: Piece part structural failure.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 6/30/99
 Change #: 1
 Directive #: CCBD ME3-01-5228
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Phase	Failure / Effect Description	Criticality Hazard Reference
PSMCD 4 1	Fire from GOX impact or rubbing. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A.	1 ME-C3P,D. ME-C3S, ME-C3M, ME-C3A,C

SSME FMEA/CIL
DESIGN

Component Group: Propellant Valves
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Design / Document Reference

FAILURE CAUSE: A: Internal structural failure of; Poppet, Check valve poppet, GCV retainer, Check valve retainer, Spring, Stem, Guide, Poppet spring, Guide retainer ring, Check valve snapping.

THE VALVE PIECES WHICH COULD ENTER THE GOX FLOW AREA ARE THE GCV POPPET (1), GCV RETAINER (2), THE CHECK VALVE POPPET (3), RETAINER (4), SPRING (5), STEM (6), GUIDE (7), POPPET SPRING (8), GUIDE RETAINER RING (9), AND CHECK VALVE SNAP RING (10). THE GCV POPPET AND THE CHECK VALVE POPPET ARE MADE FROM HEAT TREATED 440C CRES BAR. 440C IS USED FOR ITS HIGH HARDNESS, WEAR RESISTANCE, AND CORROSION RESISTANCE (11). THE GCV AND CHECK VALVE RETAINERS AND STEM ARE MADE FROM HEAT TREATED INCONEL 718. INCONEL 718 WAS SELECTED FOR ITS HIGH STRENGTH, WELDABILITY, TOUGHNESS, AND RESISTANCE TO CORROSION CRACKING AND STRESS CORROSION CRACKING (11). THE GCV POPPET SPRING PREVENTS POPPET FLUTTER CAUSED BY FLOW. THE CHECK VALVE AND POPPET SPRINGS (5) (8) AND THE GUIDE RETAINING RING (9) ARE MADE FROM COLD WORKED 302 CRES. IT IS USED FOR ITS RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING, AND ITS COLD-WORKED STRENGTH (11). SPRING FRACTURES IN ADJACENT COILS WOULD BE RETAINED BY THE RETAINER. THE GUIDE MATERIAL IS A CU-NI-ZN ALLOY WHICH WAS SELECTED FOR ITS LOW FRICTION (11). THE GUIDE IS DRY-FILM LUBRICATED FOR ADDITIONAL FRICTION REDUCTION. THE CHECK VALVE SNAP RING IS BE-CU (10). THE MATERIAL WAS SELECTED FOR ITS SHEAR STRENGTH AND AVAILABILITY IN STANDARD SNAP RINGS. BE-CU IS CORROSION AND STRESS CORROSION RESISTANT. ALL THESE MATERIALS MEET THE STANDARD LOX/GOX COMPATIBILITY REQUIREMENTS (12). THE HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE GCV MEETS CEI REQUIREMENTS (13). THE MINIMUM FACTORS OF SAFETY FOR THE GCV MEET CEI REQUIREMENTS (14). THE GCV WAS CLEARED FOR FRACTURE MECHANICS/NOE FLAW GROWTH, SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (15). THE GOX CONTROL VALVE HAS COMPLETED DVS TEST REQUIREMENTS (16), INCLUDING VIBRATION (17), AND ENDURANCE (18). THE REDESIGNED CHECK VALVE HAS SUCCESSFULLY COMPLETED VERIFICATION TESTING (19).

(1) RS010144; (2) RS010146; (3) RS010155; (4) RS010156; (5) RS010157; (6) RS010145; (7) RS010148; (8) RS010147; (9) RS010158; (10) RS010141; (11) RSS-8582; (12) RL10017, (13) RL00532 CP320R0003B; (14) RSS-8548, CP320R0003B, (15) NASA TASK 117; (16) DVS-SSME-517; (17) RSS-517-40, RSS-517-60; (18) RSS-517-50, (19) VRS 317

**SSME FMF CONTROL
INSPECTION AND TEST**

Component Group: Propellant Valves
 CIL Item: D500-06
 Component: GOX Control Valve
 Part Number: RS010141
 Failure Mode: Piece part structural failure.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 8/30/99
 Change #: 1
 Directive #: CCBD ME3-01-5226

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	POPPET - GCV POPPET - C/V RETAINER - GCV RETAINER - C/V SPRING - C/V STEM GUIDE SPRING - POPPET RETAINER RING - GUIDE SNAP RING-C/V		RS010144 RS010155 RS010146 RS010156 RS010157 RS010145 RS010146 RS010147 RS010158 MS16625
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS010144 RS010155 RS010146 RS010156 RS010157 RS010145 RS010148 RS010147 RS010158
		POPPETS HEAT TREAT IS VERIFIED PER SPECIFICATION AND DRAWING REQUIREMENTS.	RA1111-002 RS010144 RS010155
		RETAINERS AND STEM HEAT TREAT IS VERIFIED PER SPECIFICATION AND DRAWING REQUIREMENTS.	RA0611-020 RS010146 RS010156 RS010145
		SPRINGS ARE VERIFIED TO BE FREE FROM NICKS, SCRATCHES, OR OTHER SURFACE IMPERFECTIONS WHICH WOULD BE DETRIMENTAL TO SPRING FUNCTION	RA0102-012
	ASSEMBLY INTEGRITY	ASSEMBLY CHECKOUT, PROOF, AND FUNCTIONAL TESTING VERIFIES PART INTEGRITIES.	RL00490
	HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING.	RL00461
		VALVE LEAK TEST VERIFIES CHECK VALVE INTEGRITY. TESTS ARE PERFORMED PRIOR TO EACH LAUNCH. (LAST TEST)	OMRSD V41BC0.150

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CIL Item: DS00-06
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Part Number: RS010141
Failure Mode: Piece part structural failure.

Prepared: P. Lowmore
Approved: T. Nguyen
Approval Date: 6/30/99
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
Failure History:	Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA) Reference: NASA letter SA21/88/308 and Rockaldyne letter 88RC09761.		
Operational Use:	Not Applicable.		

SSME FMEA/CIL
WELD JOINTS

Component Group: Propellant Valves
 CIL Item: D500
 Component: GOX Control Valve
 Part Number: RS010141

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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		