

**SSME / FA/CIL
REDUNDANCY SCREEN**

Component Group: Propellant Valves
 CIL Item: O600-06
 Component: Recirculation Isolation Valve
 Part Number: RS010161
 Failure Mode: Piece part structural failure.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 6/30/99
 Change #: 1
 Directive #: CCBD ME3-01-6226
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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
CIL Item: D600-06
Component: Recirculation Isolation Valve
Part Number: RS010164
Failure Mode: Piece part structural failure.

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Design / Document Reference

FAILURE CAUSE: A: Internal structural failure of: Seat, Poppet assembly, Poppet, Spring, Ring, Retainer ring, Seal.

THE PIECE PARTS TO WHICH THIS MODE APPLIES ARE, THE SEAT (1), POPPET ASSEMBLY (2) AND THE LOWER SEAL ASSEMBLY (3), RETAINER RING (4), AND SNAPPING (5). THE POPPET ASSEMBLY CONSISTS OF THE POPPET (6), SPRING (7), PLATE AND RETAINER (8). WHEN THE RIV IS IN THE OPEN POSITION, THE SPRING LOADS THE POPPET AGAINST THE RETAINER TO PREVENT POPPET FLUTTER CAUSED BY FLOW. THE SEAL ASSEMBLY INCLUDES THE LOADER, LOAD SPRINGS, AND THE SEAL. THE SEAT (1), PLATE AND RETAINER (2) MATERIAL IS HEAT TREATED INCONEL 718. THE MATERIAL WAS SELECTED FOR ITS STRENGTH, DUCTILITY, AND WELDABILITY (9). THE POPPET (6) IS HEAT TREATED 440C. THE MATERIAL WAS USED FOR ITS HARDNESS AND WEAR RESISTANCE (9). THE SPRING (7) AND SNAPPING (5) ARE BE-CU. THE MATERIAL WAS SELECTED FOR ITS STRENGTH AND ELASTIC MODULUS (9). THE SEAL RETAINER (4) IS 303 CRES AND THE SEAL LOADER IS 304 CRES. THESE MATERIALS WERE SELECTED FOR THEIR MACHINING CHARACTERISTICS, ELASTIC MODULUS, AND COMPATIBILITY WITH THE ADJACENT MATERIALS (9). THE SEAL SPRINGS ARE ELGILOY. THE MATERIAL IS USED FOR ITS TORSIONAL STRENGTH (9). ALL OF THE MATERIALS ARE CORROSION AND STRESS CORROSION RESISTANT (9). THE SEAL IS TEFLON (3). TEFLON IS USED FOR ITS LOW COEFFICIENT OF FRICTION AND COMPATIBILITY WITH THE ENVIRONMENT AND OTHER MATERIALS (9). ALL MATERIALS MEET THE 10 KG-METER LOX/GOX IMPACT REQUIREMENT OR HAVE A MATERIAL USAGE AGREEMENT APPROVED BY MSFC (10). HIGH CYCLE AND LOW CYCLE FATIGUE LIFE FOR THE RIV MEETS CEI REQUIREMENTS (11). THE MINIMUM FACTORS OF SAFETY FOR THE RIV MEET CEI REQUIREMENTS (12). THE RIV COMPONENTS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (13). TABLE D500 LISTS ALL THE FMEA/CIL WELDS AND IDENTIFIES THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTIBLE, AND THOSE WELDS IN WHICH THE ROOT SIDE IS NOT ACCESSIBLE FOR INSPECTION. THESE WELDS HAVE BEEN ASSESSED AS ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (14). THE RIV HAS COMPLETED DESIGN VERIFICATION SPECIFICATION TESTING (15), INCLUDING VIBRATION (16), AND ENDURANCE (17).

(1) RS010170; (2) RS010166; (3) RES1251; (4) RS010168; (5) MS16631; (6) RS010164; (7) RS010165; (8) RS010168; (9) RSS-8582; (10) RL10017; (11) RL00532, CP320R0003B; (12) RSS-8546, CP320R0003B; (13) NASA TASK 117; (14) RSS-8756; (15) DVS-SSME-49; (16) RSS-517-41, RSS-517-58, RSS-ECP-579; (17) RSS-517-49

**SSME FM 2IL
INSPECTION AND TEST**

Component Group: Propellant Valves
 CIL Item: D800-06
 Component: Recirculation Isolation Valve
 Part Number: RS010181
 Failure Mode: Piece part structural failure.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 6/30/99
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	SEAT POPPET ASSEMBLY POPPET SPRING RETAINER SEAL		RS010170 RS010166 RS010164 RS010165 RS010168 RES1251
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS. HEAT TREAT OF POPPET ASSEMBLY DETAILS AND SEAT IS VERIFIED PER DRAWING AND SPECIFICATION REQUIREMENTS.	RS010170 RS010168 RS010164 RA0611-020 RA1111-002
	RETAINER WELD INTEGRITY	PRIOR TO WELDING, THE POPPET ASSEMBLY DETAILS ARE PENETRANT INSPECTED. EB WELD SAMPLES ARE RUN PRIOR TO PRODUCTION WELDING TO VERIFY WELDER SET-UP AND SETTINGS.	RS010166 RA0115-11B RA0607-034
	ASSEMBLY INTEGRITY HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE. VALVE ASSEMBLY AND FUNCTIONAL TESTING VERIFIES PART INTEGRITY. VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING. VALVE SEAT LEAKAGE TESTS VERIFY POPPET AND SEAT INTEGRITY EVERY START (LAST TEST)	RL10011 RA0607-094 RA0115-11B RA0115-005 RA0115-127 RA1115-001 RL00442 RL00461 OMRSD V41B00.140

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA).
 Reference: NASA letter SA218B/308 and Rocketdyne letter 88RC09761.
 Operational Use: Not Applicable.

SSME / RA/CIL
WELD JINTS

Component Group: Propellant Valves
 CIL Item: 0600
 Component: Recirculation Isolation Valve
 Part Number: RS010161

Prepared: P. Lowmore
 Approved: T. Nguyen
 Approval Date: 8/30/99
 Change #: 1
 Directive #: CCBO ME3-01-5228
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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side No Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
BELLOWS	RS010163	1,2	GTAW	II	X			
BELLOWS	RS010163	5	GTAW	II	X			
BELLOWS	RS010163	6	EBW	II	X			
POPPET	RS010166	1 PLACE	EBW	II	X			
BELLOWS	RS010171	1 PLACE	EBW	II	X			