

**SSME FEA/CIL  
REDUNDANCY SCREEN**

Component Group: Propellant Valves  
 CIL Item: D600-03  
 Component: Recirculation Isolation Valve  
 Part Number: RS010161  
 Failure Mode: Valve fails to open.

Prepared: P. Lowrimore  
 Approved: T. Nguyen  
 Approval Date: 6/30/99  
 Change #: 1  
 Directive #: CCBD ME3-01-5225  
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Phase	Failure / Effect Description	Criticality Hazard Reference
P 4.1	<p>Would permit excess helium/GOX in accumulator/HPOTP supply line. Launch delay. Loss of vehicle due to helium ingestion into HPOTP during cutoff may result if RIV failure to open 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: Fail - Loss of redundant hardware items could result from a single credible event.</p>	<p>1R ME-C1A,C</p>

SSME FMEA/CIL  
DESIGN

Component Group: Propellant Valves  
CIL Item: D600-03  
Component: Recirculation Isolation Valve  
Part Number: RS010161  
Failure Mode: Valve fails to open.

Prepared: P. Lowrimore  
Approved: T. Nguyen  
Approval Date: 8/30/99  
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Design / Document Reference

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**FAILURE CAUSE: A: Stem binding or seizure.**

THE RIV STEM (1) AND THE HOUSING (2) ARE HEAT TREATED INCONEL 718. THE MATERIAL WAS SELECTED FOR ITS STRENGTH, DUCTILITY, AND WEAR RESISTANCE (3). INCONEL 718 IS CORROSION AND STRESS CORROSION RESISTANT. TEFLON BUSHINGS (1) (4) ARE INSTALLED ON THE LARGE DIAMETER OF THE STEM (1) AND IN THE HOUSING (2) AT THE STEM SMALL DIAMETER. THE TEFLON BUSHINGS RIDE ON SURFACES MACHINED FOR DYNAMIC SEALS WHICH PREVENTS BUSHING WEAR AND STEM BINDING OR SEIZURE. THE L/D OF APPROXIMATELY 1.3 PREVENTS SEIZURE CAUSED BY STEM COCKING. ALL VALVE PARTS ARE CLEANED FOR LOX SERVICE (5). THE BUSHINGS ARE NOT IN AREAS EXPOSED TO FLOW AND TRANSIENT CONTAMINATION. TEFLON BUSHINGS ARE NOT SUSCEPTIBLE TO SEIZURE BY EXPOSURE TO SMALL CONTAMINANT PARTICLES. RIV POSITION INDICATOR WILL DETECT FAILURE TO OPEN AND ENGINE START WILL BE INHIBITED TO PREVENT CRITICAL EFFECTS (6). THE RIV HAS COMPLETED DESIGN VERIFICATION SPECIFICATION TESTING (7), INCLUDING VIBRATION (8), AND ENDURANCE (9). RIV'S FROM ENGINES 0107 AND 2014 WERE DISASSEMBLED AND EXAMINED. NEITHER VALVE SHOWED DETRIMENTAL WEAR OR DAMAGE. THE VALVE FROM ENGINE 0107 HAD 98 STARTS AND 31,620 SECONDS HOT FIRE TIME. THE VALVE FROM ENGINE 2014 HAD 36 STARTS AND 11,590 STARTS (10).

(1) RS010167; (2) RS010162; (3) RSS-8582; (4) RS010173 (5) RS010161; (6) CP406R0002 PT 1 3.2.3:6.4, (7) DVS-SSME-49; (8) RSS-517-41, RSS-517-58 RSS-EQP-579; (9) RSS-517-49; (10) SSME-03-02275

**SSME FMF OIL  
INSPECTION AND TEST**

Component Group: Propellant Valves  
 CIL Item: D800-03  
 Component: Recirculation Isolation Valve  
 Part Number: RS010161  
 Failure Mode: Valve fails to open.

Prepared: P. Lowrmore  
 Approved: T. Nguyen  
 Approval Date: 6/30/99  
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Failure Causes	Significant Characteristics	Inspector(s) / Test(s)	Document Reference	
A	RIV		RS010161	
	HOUSING		RS010162	
	STEM		RS010167	
	BUSHING		RS010173	
	MATERIAL INTEGRITY	MATERIAL INTEGRITY AND HEAT TREAT ARE VERIFIED PER DRAWING REQUIREMENTS		RSC10162 RS010167
		DIAMETER AND FINISH OF THE SMALL DIAMETER OF THE STEM AND THE HOUSING BORE WHICH OPERATES ON THE LARGE END OF THE STEM ARE VERIFIED PER DRAWING REQUIREMENTS		
	ASSEMBLY TESTING	VALVE PARTS ARE VERIFIED CLEAN PER DRAWING REQUIREMENTS. VALVE ASSEMBLY IN A CONTAMINATION CONTROLLED AREA IS VERIFIED ASSEMBLY CHECKOUT AND FUNCTIONAL TESTING VERIFY VALVE OPERATION.		RSC10161 RL00142
HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING		RL00461	
	VALVE IS ACTUATED DURING FLIGHT READINESS CHECKOUT.		OMRSD V41AS0 030	
	PNEUMATIC CHECKOUT MODULE AND PRE-CRYO LOADING CONFIGURATION CHECKOUT VERIFY STEM IS NOT SEIZED.		OMRSD V41AS0.020	

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)  
 Reference: NASA letter SA21/88/308 and Rockwell letter 88RC09761.  
 Operational Use: Not Applicable.

SSME / RA/CIL  
WELD JINTS

Component Group: Propellant Valves  
 CIL Item: D600  
 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			