

SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group: Propellant Valves
CIL Item: D110-04
Component: Main Fuel Valve
Part Number: RS008258
Failure Mode: Structural failure.

Prepared: P. Lowrimore
Approved: T. Nguyen
Approval Date: 6/30/99
Change #: 1
Directive #: CCBD ME3-01-5226
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Phase	Failure / Effect Description	Criticality Hazard Reference
PSMCD 4.1	Fuel flow to combustors reduced; high pressure fuel leakage into aft compartment. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A.	1 ME-D3P,D, ME-D3S,A,M,C

**SSME / FA/CIL
DESIGN**

Component Group: Propellant Valves
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Design / Document Reference

FAILURE CAUSE: A: Fracture of housing or end cap.

THE MFV HOUSING IS MACHINED FROM A 5AL-2.5SN (ELI) TITANIUM FORGING (1). THE TITANIUM ALLOY IS CORROSION RESISTANT, AND IS RESISTANT TO STRESS CORROSION CRACKING AT THE OPERATING TEMPERATURE AND EXPOSURE CONDITIONS. 5AL-2.5SN (ELI) TITANIUM IS RESISTANT TO HYDROGEN ENVIRONMENT EMBRITTLEMENT AT THE NEAR -400 DEGREES F OPERATING ENVIRONMENT. THE VALVES SHORT EXPOSURE TO GASEOUS HYDROGEN MAKES HYDRIDE FORMATION NOT A PROBLEM (2). THE ROUGH MACHINED HOUSING IS HYDROSTATIC PRESSURIZED PER DRAWING REQUIREMENTS. THE ROUGH MACHINED HOUSING IS STRESS RELIEVED AFTER PRESSURE LOADING (3). HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE MFV CAP AND HOUSING MEET CEI REQUIREMENTS (4). MINIMUM FACTORS OF SAFETY FOR THE CAP AND HOUSING MEET CEI REQUIREMENTS (5). A SPECIALLY STRAIN GAGED HOUSING WAS HYDROSTATICALLY PRESSURIZED AND STRAINS WERE RECORDED. THE HOUSING DEMONSTRATED LOW STRAINS AT ALL STRAIN GAGE LOCATIONS (6). THE MFV HOUSING AND CAP WERE CLEARED FOR FRACTURE MECHANICS/IDE FLAW GROWTH BY CRITICAL INITIAL FLAW SIZE DETECTABILITY (7). THE VALVE COMPLETED DVS TEST REQUIREMENTS (8) INCLUDING ENDURANCE (9) AND VIBRATION (10).

(1) RS000207; (2) RSS-8576; (3) RS000201, RS000275; (4) RL00532, CP320R0003B; (5) RSS-8546, CP320R0003B; (6) SSME-82-142; (7) NASA TASK 117; (8) DVS-SSME-515; (9) RSS-515-17; (10) RSS-515-24

**SSME FMEA/CIL
INSPECTION AND TEST**

Component Group: Propellant Valves
 CIL Item: D110-04
 Component: Main Fuel Valve
 Part Number: RS008258
 Failure Mode: Structural failure.

Prepared: P. Lowimore
 Approved: T. Nguyen
 Approval Date: 8/30/99
 Change #: 1
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	HOUSING CAP ASSEMBLY		RS008201 RS008275
	MATERIAL INTEGRITY	THE MATERIAL IS VERIFIED PER DRAWING REQUIREMENTS. THREE STANDARD TEST SPECIMENS ARE TAKEN FROM THE THREE AXES OF EACH FORGING AND AT LEAST ONE SPECIMEN FROM EACH AXIS IS TESTED TO ESTABLISH CONFORMANCE WITH THE REQUIRED MECHANICAL PROPERTIES. TRACEABILITY DATA ARE RECORDED FOR EACH FORGING.	RS008207
		THE HOUSING IS PRESSURE TESTED AFTER ROUGH MACHINING.	RL00440
		THE HOUSING AND CAP ARE PROOF PRESSURE TESTED AT CRYOGENIC TEMPERATURES AFTER FINAL MACHINING.	RL00438 RL00439
		THE HOUSING AND CAP ARE PENETRANT INSPECTED AFTER FINAL MACHINING.	RA0115-116
	HEAT TREAT	STRESS RELIEF OF HOUSING AFTER ROUGH MACHINING AND PRESSURE TEST IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RA0111-024
	ASSEMBLY INTEGRITY	THE ASSEMBLED VALVE IS PROOF PRESSURE TESTED AND FUNCTIONAL CHECKOUT TESTED INCLUDING LEAK CHECKS. THE VALVE IS HELIUM SIGNATURE LEAK TESTED AND VALVE OPERATION IS VERIFIED DURING PRE-LAUNCH CHECKOUTS. (LAST TESTS)	RL00453 OMRSD S00000.950 OMRSD S00FA0.211

D-11

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
 Reference: NASA letter SA21/88/308 and Rocketdyne letter BBRC09761.
 Operational Use: Not Applicable.

SSME FACIL
WELD JOINTS

Component Group: Propellant Valves
 CIL Item: D110
 Component: Main Fuel Valve
 Part Number: RS008256

Prepared: P. Lowrimore
 Approved: T. Ngruyen
 Approval Date: 6/30/99
 Change #: 1
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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	
BELLOWS	RS008208	3,4	EBW	II	X	X		
BELLOWS	RS008208	5-8	GTAW	I				
SHAFT	RS008271	1,2	EBW	II	X	X		