SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group:	**Propellant Valves**	**Prepared:**	P. Lowrimore
CIL Item:	**D300-02**	**Approved:**	T. Nguyen
Component:	**Anti-flood Valve**	**Approval Date:**	6/10/99
Part Number:	**RS007083**	**Change #:**	1
Failure Mode:	**Valve fails to open.**	**Directive #:**	CCBD ME3-01-5225
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Phase	Failure / Effect Description	Criticality Hazard Reference
S 4 1	No LOX flow to heat exchanger. Failure detected by controller. Controller initiates engine shutdown. Mission scrub. Loss of vehicle due to heat exchanger failure may result if AFV failure to open is not detected. Redundancy Screens: VALVE SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY. 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.	1R ME-B3S

SSME CIL/FA/CIL DESIGN

Component Group:	Propellant Valves	Prepared:	P. Lowrimore
CIL Item:	0300-02	Approved:	T. Nguyen
Component:	Anti-flood Valve	Approval Date:	6/30/99
Part Number:	RS007083	Change #:	1
Failure Mode:	Valve fails to open.	Directive #:	CCBD ME3-01-5226
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Design / Document Reference

FAILURE CAUSE: A: Piston housing galled.
B: Piston seizure or binding.

THE ANTI-FLOOD VALVE HOUSING (1) AND PISTON (2) ARE MADE FROM HEAT TREATED INCONEL 718. INCONEL 718 WAS SELECTED FOR ITS STRENGTH, CRYOGENIC DUCTILITY, CORROSION RESISTANCE AND RESISTANCE TO STRESS-CORROSION CRACKING (3). A TFE TEFLON GUIDE (4) AND THE TFE TEFLON PISTON SEAL (5) SUPPORT THE PISTON WITHIN THE HOUSING BORE AND PREVENT METAL-TO-METAL RUBBING OR GALLING. GRAPHITE-FILLED TFE TEFLON IS USED FOR ITS COMBINATION OF LOW COEFFICIENT OF FRICTION AND RESISTANCE TO COLD FLOW (3). THE PISTON AND SEAL SURFACE FINISHES ARE SELECTED FOR DYNAMIC SEALING AND TO PREVENT EXCESSIVE WEAR DURING OPERATION. THE AFV IS HELD CLOSED BY SPRING PRESSURE. AS SYSTEM PRESSURE BUILDS SUFFICIENTLY TO OVERCOME THE SPRING CLOSING PRESSURE, THE VALVE IS FORCED OPEN. FOR PISTON GALLING OR SEIZURE TO PREVENT THE VALVE OPENING, SPRING PRESSURE MUST CLOSE THE VALVE, BUT THE HIGHER OPENING PRESSURE CANNOT OPEN IT.

(1) R0019121; (2) R0019123; (3) RSS-8582; (4) R0019125; (5) RES1255

FAILURE CAUSE: C: Contamination between piston stop and piston.

ANTI-FLOOD VALVE PARTS ARE CLEANED PRIOR TO ASSEMBLY (1). ASSEMBLY, INSPECTION, AND FUNCTIONAL TEST OPERATIONS ARE PERFORMED IN A CONTAMINATION CONTROLLED AREA (2). TEST FLUIDS ARE CONTROLLED TO ASSURE CLEANLINESS.

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(1) RL10011, RL00460; (2) RQ0711-600, RL00460

FAILURE CAUSE: D: Blocked inlet filter.

THE INLET FILTER (1) INCORPORATES A CONE DESIGN TO PROVIDE A LARGE SURFACE AREA AND REDUCE BLOCKAGE POTENTIAL. THE FILTER IS DESIGNED TO HOLD .275 GRAMS OF CONTAMINATION BEFORE FLOW IS REDUCED. THE FLOW RATE THROUGH THE FILTER MUST BE ACCEPTABLE WITH 25% OF THE FILTER BLOCKED OFF (2). THE LOX SUPPLY TO THE AFV IS FILTERED TO 800-MICRONS (3). ALL UPSTREAM COMPONENTS ARE CLEANED TO LOX SERVICE OR BETTER REQUIREMENTS (4).

(1) 286-5008; (2) RC286-5008; (3) ICD 131M15000; (4) RL10001

FAILURE CAUSE: ALL CAUSES

FAILURE OF THE AFV TO OPEN WILL BE DETECTED BY THE POSITION INDICATOR AND CAUSE SHUTDOWN PRIOR TO LAUNCH (1). THE HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE ANTI-FLOOD VALVE MEETS CEI REQUIREMENTS (2). THE MINIMUM FACTORS OF SAFETY FOR THE AFV MEETS CEI REQUIREMENTS (3). THE AFV WAS CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (4). THE ANTI-FLOOD VALVE SUCCESSFULLY COMPLETED DVS TESTING REQUIREMENTS (5), INCLUDING VIBRATION (6), AND ENDURANCE (7).

(1) CP405R0002 PT 1 3.2.3.5.2; (2) RL00532, CP320R0003B; (3) RSS-8546, CP320R0003B; (4) NASA TASK 117; (5) DVS-SSME-508. (6) RSS-508-33, RSS-508-34; (7) RSS-508-32

SSME FMEA/CIL
INSPECTION AND TEST

Component Group: Propellant Valves
CIL Item: D300-02
Component: Anti-flood Valve
Part Number: RS007063
Failure Mode: Valve fails to open.

Prepared: P. Lovrimore
Approved: T. Nguyen
Approval Date: 6/30/99
Change #: 1
Directive #: CCBD ME3-01-5226

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A, B	GUIDE SEAL AFV HOUSING AFV PISTON		R0019125 RES1255 R0019121 R0019123
	MATERIAL INTEGRITY	PISTON AND HOUSING MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS	R0019121 R0019123
		PISTON GUIDE AND SEAL INTERFACE SURFACES ARE INSPECTED PER DRAWING REQUIREMENTS.	R0019125 RES1255
	GUIDE AND SEAL INTEGRITY	GUIDE AND SEAL MATERIAL IS INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS INCLUDING LOX COMPATIBILITY TESTING.	RES1255 R0019125 RB0130-086
C, D	HOUSING PISTON SEAL GUIDE		R0019121 R0019123 RES1255 R0019125
	COMPONENT CLEANLINESS	COMPONENTS ARE VERIFIED TO BE CLEAN PRIOR TO ASSEMBLY.	RL10001
		ASSEMBLY IS VERIFIED TO BE IN A CONTAMINATION CONTROLLED ENVIRONMENT.	RQ0711-600
	FILTER 100 MICRON RATING		286-5008-001
	FILTER CAPABILITY	FILTERS ARE TESTED AND INSPECTED FOR FLOW, DIRT CAPACITY, CLEANLINESS, AND BUBBLE POINT PER SPECIFICATION REQUIREMENTS.	RC286-5008
		THE FILTER IS CHANGED PRIOR TO EACH FLIGHT.	OMRSD V41BU0.220

Component Group: Propellant Valves
CIL Item: D300-02
Component: Anti-flood Valve
Part Number: RS007083
Failure Mode: Valve fails to open.

Prepared: P. Lowrim
Approved: T. Nguyen
Approval Date: 6/30/99
Change #: 1
Directive #: CCBD ME3-01-5228

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
C, D	FILTER CAPABILITY	THE OXIDIZER SUPPLY IS FILTERED TO 800-MICRONS BY EXTERNAL TANK FILTERING. THE OXIDIZER CLEANLINESS IS CONTROLLED BY VEHICLE REQUIREMENTS.	ICD 13M15000
		UPSTREAM COMPONENTS ARE VERIFIED TO BE CLEAN TO OXYGEN SERVICE REQUIREMENTS.	RL10001
ALL CAUSES	FUNCTIONAL INTEGRITY	FUNCTIONAL AND ASSEMBLY TESTING VERIFIES PROPER VALVE OPERATION.	RL00460
	HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING.	RL00461
		THE VALVE OPERATION IS VERIFIED BY VALVE CRACKING, FULL OPEN, AND RESEAT PRESSURE TESTS PRIOR TO EACH FLIGHT. (LAST TEST)	OMRSD V41BR0.030

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
Reference: NASA letter SA21/88/308 and Rocketdyne letter 88RC09761.

Operational Use: Not Applicable.

SSME / EA/CIL
WELD JOINTS

Component Group: Propellant Valves
CIL Item: D300
Component: Anti-flood Valve
Part Number: RS007083

Prepared: P. Lowrimore
Approved: T. Nguyen
Approval Date: 6/30/89
Change #: 1
Directive #: CCBD ME3-01-5226
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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable HCF	Critical Initial Flaw Size Not Detectable LCF	Comments
ANTI-FLOOD VALVE	RS007083	5	EBW	II	X			
ANTI-FLOOD VALVE	RS007083	6	EBW	II	X			