SSME FA/CIL
REDUNDANCY SCREEN

Component Group:	Pneumatic Controls	Prepared:	P. Lowrimore
CIL Item:	C116-01	Approved:	T. Nguyen
Component:	Fuel Preburner ASI Purge Check Valve	Approval Date:	6/2/99
Part Number:	RS008059	Change #:	2
Failure Mode:	Fails to open or restricts flow during propellant conditioning.	Directive #:	CCBD ME3-01-5213
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Phase	Failure / Effect Description	Criticality Hazard Reference
P 4.1	Reduced flow has no effect on fuel preburner conditioning as purge is accomplished through fuel preburner purge check valve. Loss of flow through this check valve reduces the purge flow below acceptable limits for inerting propellant leakage at ICD limits. Potential open air fire Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-A1P, ME-A1A

SSME FMEA/CIL
DESIGN

Component Group:	Pneumatic Controls		
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Component:	Fuel Preburner ASI Purge Check Valve	Approved:	T. Nguyen
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Design / Document Reference

FAILURE CAUSE: A: Poppet assembly jammed closed.
B: Contamination between poppet assembly and valve body, or blockage of filter.

DETAIL PARTS AND TEST FIXTURES ARE CLEANED (1) PRIOR TO ASSEMBLY (2). ASSEMBLY AND TEST ARE PERFORMED IN A CLEAN ROOM (3). LUBRICANTS ARE NOT ALLOWED FOR ASSEMBLY OR TEST (2). COMPONENT LEVEL TEST FLUIDS ARE NITROGEN AND HELIUM WHICH MEET THE HARDWARE CLEANLINESS REQUIREMENTS (1). THE COMPONENT PARTS AND SUBASSEMBLY ARE FREE OF VISIBLE FOREIGN PARTICLES AT THE TIME OF ASSEMBLY (2). AT THE ENGINE LEVEL, A 15-MICRON FILTER IN THE PNEUMATIC CONTROL ASSEMBLY (4) ENSURES THAT CONTAMINANTS LARGER THAN 15-MICRONS WILL BE REMOVED. THE FUEL PREBURNER ASI PURGE PRESSURE ACTUATED VALVE (5) INCORPORATE TEFLON POPPET GUIDES WHICH PREVENT METAL-TO-METAL RUBBING AND METAL PARTICLE GENERATION. A TEFLON SLEEVE ON THE CHECK VALVE POPPET ASSEMBLY (6) REDUCES FRICTION AND WEAR AND PREVENTS METAL-TO-METAL CONTACT, GALLING, AND PARTICLE GENERATION. A TEFLON GUIDE BETWEEN THE SPRING AND BODY (7) PREVENTS SPRING AND BODY WEAR AND PARTICLE GENERATION. THESE DESIGN FEATURES PREVENT GENERATION OF METALLIC PARTICLES IN THE IMMEDIATE AREA OF THE BODY/POPPET INTERFACE. IN THE EVENT THAT METALLIC PARTICLES FROM ANOTHER SOURCE GET INTO THE BODY/POPPET INTERFACE, THE PARTICLES BECOME IMBEDDED IN THE TEFLON SLEEVE. THIS PREVENTS GALLING BETWEEN THE BODY AND POPPET AND PREVENTS POPPET JAMMING. THE POPPET L/D RATIO (5) AS WELL AS THE CHECK VALVE SPRINGS (8) CLOSED END DESIGN MINIMIZES THE PROBABILITY OF POPPET COCKING. POSITIVE STOPS ARE PROVIDED AT EACH END OF THE POPPET TRAVEL. THE POPPET (6) AND POPPET SEAT (9) ARE MANUFACTURED FROM HAYNES 188 BAR. THIS MATERIALS MODULUS OF ELASTICITY MAKES IT RESISTANT TO DAMAGE OR DEFORMATION DUE TO EXTERNAL LOADS (10)

(1) RL10001, (2) RL00037; (3) RQ0711-600; (4) R0019450; (5) R0010984; (6) RS008214; (7) RS008217; (8) R0010733; (9) RS008220; (10) RSS-8582-6

FAILURE CAUSE: C: Housing weld or parent material failure.

THE BODY (1) AND CAP (2) ARE MADE FROM HAYNES 188. HAYNES WAS SELECTED FOR ITS STRENGTH, WELDABILITY, GENERAL CORROSION RESISTANCE, AND RESISTANCE TO STRESS CORROSION CRACKING (3). THE CAP AND BODY ARE CONNECTED BY AN ELECTRON BEAM WELD. THE WELD IS CONTROLLED BY SPECIFICATION TO ENSURE HIGH QUALITY AND PRODUCEABILITY (4).

(1) RS008220; (2) RS008213; (3) RSS-8582, (4) RA0607-094

FAILURE CAUSE: ALL CAUSES

HIGH CYCLE AND LOW CYCLE FATIGUE, AS WELL AS THE MINIMUM FACTORS OF SAFETY FOR THE CHECK VALVES, MEET CEI REQUIREMENTS (1). THE CHECK VALVE WAS CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH BY CRITICAL INITIAL FLAW SIZE DETECTABILITY (2). TABLE C116 LISTS THE CHECK VALVE FMEA/CIL WELDS. WELD NO. 2 DOES NOT HAVE ROOT SIDE ACCESS FOR INSPECTION. THIS WELD IS ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (2). THE ASSEMBLED CHECK VALVE WAS SUBJECTED TO DVS TESTING (3), INCLUDING PRESSURE TEST, PRESSURE CYCLING, VIBRATION TEST, AND ENDURANCE CYCLING (4).

(1) RL00032, CP320R0003B, RSS-8540; (2) RSS-8756; (3) DVS-SSME-508; (4) RSS-508-34

SSME FM CIL
INSPECTION AND TEST

Component Group: Pneumatic Controls
CIL Item: C116-01
Component: Fuel Preburner ASI Purge Check Valve
Part Number: RS008059
Failure Mode: Fails to open or restricts flow during propellant conditioning.

Prepared: P. Lowrimore
Approved: T. Nguyen
Approval Date: 6/2/99
Change #: 2
Directive #: CCBD ME3-01-6213
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A, B	FUEL PREBURNER ASI PURGE CHECK VALVE BODY POPPET ASSEMBLY		RS008059 RS008220 RS008214
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS008214 RS008220
	CLEANLINESS REQUIREMENTS	COMPONENTS ARE CLEANED TO OXYGEN/FUEL SERVICE PER DRAWING AND SPECIFICATION REQUIREMENTS	RS008059 RS008214 RS008220 RL10001
	ASSEMBLY INTEGRITY	DURING MANUFACTURE OF THE CHECK VALVE, THE SPRING DEFLECTION AND POPPET FUNCTION ARE VERIFIED BY THE POPPET FULL STROKE DEFLECTION TEST.	RL00037
		SURFACE FINISH OF POPPET AND HOUSING BORE ARE INSPECTED PER DRAWING REQUIREMENTS.	RS008214 RS008220
		TEFLON GUIDE/POPPET CLEARANCE IS DIMENSIONALLY INSPECTED AND VERIFIED BY INTERFERENCE TEST PER DRAWING AND SPECIFICATION REQUIREMENTS.	RS008059 RL00037
		CRITICAL DEBUR OF POPPET IS INSPECTED PER DRAWING REQUIREMENTS.	RS008214
C	FUEL PREBURNER ASI PURGE CHECK VALVE BODY CAP		RS008059 RS008220 RS009213
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS008220 RS009213
	WELD INTEGRITY	ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE.	RL10011 RA0607-094 RA0115-116

Component Group: Pneumatic Controls
CIL Item: C116-01
Component: Fuel Preburner ASI Purge Check Valve
Part Number: RS008059
Failure Mode: Fails to open or restricts flow during propellant conditioning.

Prepared: P. Lowrimore
Approved: T. Nguyen
Approval Date: 8/2/99
Change #: 2
Directive #: CCBD ME3-01-5213
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
C	UNVERIFIABLE ROOT WELDS RS008059 CLASS II - 2	UNVERIFIABLE ROOT WELDS ARE INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS, AS APPLICABLE	RA0115-006 RA0115-127
ALL CAUSES	ACCEPTANCE TESTING	THE FOLLOWING TESTS ARE PERFORMED DURING MANUFACTURE AND VALVE ACCEPTANCE:	
		- THE CHECK VALVE IS PROOF PRESSURE TESTED WITH PRESSURE APPLIED TO THE INLET AND OUTLET.	RL00037 R101208
		- SEAT AND SEAL LEAKAGE IS VERIFIED TO BE WITHIN SPECIFICATION.	RL00037 RL01208
		- THE INTERNAL FLOW PATH IS VERIFIED.	RL00037 RL01208
		- WORKMANSHIP AND CONTAMINATION SCREENING AT FINAL VALVE ASSEMBLY.	RL01208
	PRE-FLIGHT CHECKOUT	VALVE ASSEMBLY IS LEAK CHECKED EVERY FLIGHT AND AFTER MAINTAINENCE OR REPLACEMENT.	OMRSD V41BQ0.036
		VALVE ASSEMBLY IS LEAK CHECKED AFTER EACH FLIGHT BY THE FOLLOWING OMRSD REQUIREMENTS:	
		- FLIGHT READINESS TESTS AND VALVE CYCLE VERIFICATION. - PERFORM PNEUMATIC SYSTEM CHECKOUT. - PRE-CRYO LOADING. (LAST TEST)	OMRSD S00FA0.211 OMRSD V41AS0.020 OMRSD S00FA0.213

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
Reference NASA letter SA21/86/308 and Rocketdyne letter 86RC09761.
Operational Use: Not Applicable.

SSME EA/CIL
WELD JOINTS

Component Group: Pneumatic Controls
CIL Item: C116
Component: Fuel Preburner ASI Purge Check Valve
Part Number: RS008059

Prepared: P. Lowdmore
Approved: T. Nguyen
Approval Date: 5/2/99
Change #: 1
Directive #: CCBD ME3-01-5213

Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable HCF	LCF	Comments
CHECK VALVE	RS008059	2	EBW	II	X	X	X	ASSEMBLY OF RS007103