

SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group: Ducts and Lines
 CIL Item: K558-02
 Part Number: R055339
 Component: CCVA Emergency Shutdown Pneumatic Vent
 FMEA Item: K558
 Failure Mode: Fails to vent.

Prepared: D. Early
 Approved: T. Nguyen
 Approval Date: 7/25/00
 Change #: 1
 Directive #: CCBD ME3-01-5638

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Phase	Failure / Effect Description	Criticality Hazard Reference
C 4.1	<p>Trapped pressure temporarily places/locks in PAV 7 midstroke. Pneumatic shutdown pressure vents overboard delaying/preventing emergency engine shutdown. Engine shutdown would have to be accomplished by closing vehicle prevalve. Loss of vehicle.</p> <p>Redundancy Screens: HYDRAULIC SYSTEM - PNEUMATIC SYSTEM: UNLIKE REDUNDANCY</p> <p>A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Fail - Loss of a redundant hardware items is not detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.</p>	1R ME-C1A,C
C 4.2	<p>Failure to supply HPV control pressurant prevents backdoor actuation of HPV for POGO shutdown charge. Loss of pogo shutdown charge during MECO, at zero G condition and minimum NPSP will result in cavitation/overspeed of HPOTP and/or LPOTP. Failure to supply preburner shutdown purge results in a temperature spike during the cutoff transient, causing internal engine damage. Loss of vehicle.</p> <p>Redundancy Screens: ACTUATOR SYSTEM - PNEUMATIC SYSTEM: UNLIKE REDUNDANCY</p> <p>A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Fail - Loss of a redundant hardware items is not detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.</p>	1R ME-C1A,C

SSME A/CIL
DESIGN

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Design / Document Reference

FAILURE CAUSE: A: Contamination.

THE LEE JET BODY (1) AND EXPANDER PIN (1) ARE FABRICATED FROM 340 CRES WHICH EXHIBITS GOOD STRENGTH AND CORROSION RESISTANCE. THE LEE JET IS DESIGNED WITH A CONE SHAPED SCREEN TO REDUCE THE POSSIBILITIES OF BLOCKAGE DUE TO CONTAMINATION. THE LEE JET ASSEMBLY IS PRESS-FIT INTO THE VENT HOUSING (2) AND IS SECURED BY AN EXPANDER PIN (1). A PROOF LOAD (PULL) TEST IS PERFORMED TO VERIFY PROPER INSTALLATION AND A FLOW CHECK VERIFIES PASSAGE TO BE UNOBSTRUCTED. THE PNEUMATIC VENT ASSEMBLY IS PROOF PRESSURE TESTED TO VERIFY ASSEMBLY INTEGRITY. THE ENGINE LEVEL PNEUMATIC SYSTEM FLOW CHECK (3) VERIFIES PASSAGES ARE UNOBSTRUCTED. PROPER FLOW RATE ASSURES PNEUMATIC VENT ASSEMBLY INTEGRITY. THE PNEUMATIC SYSTEM IS FILTERED FROM THE HELIUM TANK BY A 15 MICRON FILTER. VENT ASSEMBLY MINIMUM FACTORS OF SAFETY EXCEED CEI REQUIREMENTS (4). VENT ASSEMBLY HIGH AND LOW FACTORS OF SAFETY EXCEED CEI REQUIREMENTS (5). THE VENT ASSEMBLY HAS COMPLETED CERTIFICATION TESTING BY HOT-FIRE TESTING (6).

(1) RE251-4303-3492; (2) R055339; (3) RL00050-04; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) ECP 1247

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INSPECTION AND TEST

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	PNEUMATIC VENT ASSEMBLY		R055339
	PNEUMATIC CLEANLINESS	LEE JET AND PNEUMATIC SYSTEM COMPONENTS ARE CLEANED TO PNEUMATIC USAGE REQUIREMENTS.	RL10001
	ASSEMBLY INTEGRITY	HOT-FIRE TESTING VERIFIES SATISFACTORY PERFORMANCE.	RL00050-04
	FLIGHT FLOW TESTING	PNEUMATIC SYSTEM IS FLOW CHECKED EVERY TEN LAUNCHES. PNEUMATIC VENT FLANGE FLOW VERIFICATION PRIOR TO EACH LAUNCH. PNEUMATIC VENT IS VISUALLY INSPECTED PRIOR TO EACH LAUNCH.	OMRSD V41BU0.073 OMRSD V41BU0.381 OMRSD V41BU0.070

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 FAILURE MODE AND EFFECTS ANALYSIS

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1 Mode No.	2 Function	3 Phase PSMCD	4 Failure Mode 5 Detection Method 6 Reaction Time	7 Effect Description 8 Effect On Engine 9 Effect On Mission/Vehicle	10 Crit.	11 Possible Causes	12 Correcting Action 13 Hazard Reference 14 CIL Reference
01	Contain helium pressure.	PCD	4.1 - Fails to contain helium. 5.1 - None. 6.1 - None.	7.1 - Helium leakage into aft compartment. Pressure is maintained by the pneumatic vent secondary orifice control. 8.1 - None. 9.1 - None.	3		12 - None. 13 - None 14 - None
01		SM	4.1 - Fails to contain helium. 5.1 - None. 6.1 - None.	7.1 - None. Function not applicable these phases. 8.1 - None. 9.1 - None.	N/A		12 - None. 13 - None 14 - None

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02	Vent trapped pneumatic pressure.	PSMD	4.1 - Fails to vent. 5.1 - None. 6.1 - None.	7.1 - None. Function not applicable these phases. 8.1 - None. 9.1 - None.	N/A		12 - None. 13 - None 14 - None
02		C	4.1 - Fails to vent. 5.1 - None. 6.1 - None.	7.1 - Trapped pressure temporarily places/locks in PAV 7 midstroke. Pneumatic shutdown pressure vents overboard delaying/preventing emergency engine shutdown. Engine shutdown would have to be accomplished by closing vehicle prevalve. 8.1 - Uncontained engine damage. 9.1 - Loss of vehicle.	1R	A - Contamination.	12 - None. 13 - ME-C1A,C 14 - K558-02
02		C	4.2 - Fails to vent. 5.2 - None. 6.2 - None.	7.2 - Failure to supply HPV control pressurant prevents backdoor actuation of HPV for POGO shutdown charge. Loss of pogo shutdown charge during MECO, at zero G condition and minimum NPSP will result in cavitation/overspeed of HPOTP and/or LPOTP. Failure to supply preburner shutdown purge results in a temperature spike during the cutoff transient, causing internal engine damage. 8.2 - Uncontained engine damage. 9.2 - Loss of vehicle.	1R	A - Contamination.	12 - None. 13 - ME-C1A,C 14 - K558-02