

**SSME FMEA/CIL
REDUNDANCY SCREEN**

Component Group: Propellant Valves
 CIL Item: D210-02
 Component: Fuel Bleed Valve
 Part Number: RS008056
 Failure Mode: Valve fails to close.

Prepared: P. Low/more
 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
P 4.1	Bleed flow continues, controller inhibits engine start. Launch delay. Loss of vehicle due to orbiter duct rupture may result if FBV failure to close 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-G7S

SSME FA/CIL
DESIGN

Component Group: Propellant Valves
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Design / Document Reference

FAILURE CAUSE: A: Piston seizure or binding.

THE BLEED VALVE PISTON (1) IS GUIDED BY A TEFLON SLEEVE. THE SLEEVE PREVENTS METAL-TO-METAL RUBBING BETWEEN THE PISTON AND THE HOUSING (2) AND METALLIC PARTICLE GENERATION. THE TEFLON ALSO REDUCES FRICTION. THE TEFLON IS COMPATIBLE WITH ITS EXPOSURE MEDIA, AND CAUSES NO PROBLEM WHEN IN INTIMATE CONTACT WITH METALLIC COMPONENTS (3). IN THE EVENT THAT METAL PARTICLES FROM ANOTHER SOURCE GET INTO THE PISTON-HOUSING INTERFACE, THE PARTICLES BECOME IMBEDDED IN THE TEFLON SLEEVE. THIS ALSO PREVENTS GALLING BETWEEN THE PISTON AND HOUSING AND PREVENTS BINDING OR SEIZURE. THE SURFACE FINISHES OF THE HOUSING (2) AND PISTON (1) ASSEMBLY ARE SELECTED TO PREVENT EXCESSIVE WEAR. ALL INTERNAL COMPONENTS ARE CLEANED TO PROPELLANT SERVICE REQUIREMENTS (4). THE VALVE IS ASSEMBLED IN A CONTAMINATION CONTROLLED ENVIRONMENT (5).

(1) RS009503; (2) RS009507; (3) RSS-8582; (4) RL10001; (5) RQ0711-600

FAILURE CAUSE: B: Stop screw loosens.

THE SCREWS ARE TORQUED INTO SELF-LOCKING HELI-COIL INSERTS. THE DRAWING SPECIFIES A MINIMUM RUNNING TORQUE AND THE FINAL TORQUE (1). THE VALVE IS OPEN ONLY DURING PROPELLANT CONDITIONING WHEN THERE ARE NO VIBRATION LOADS TO LOOSEN THE SCREWS. DURING ENGINE OPERATION, WHEN THE VALVE IS EXPOSED TO VIBRATION, THE VALVE IS CLOSED AND THE SCREW LOAD IS MINIMUM WHICH MINIMIZES THE CHANCE OF A SCREW LOOSENING.

(1) RS008056

FAILURE CAUSE: C: Broken spring.

THE BLEED VALVE SPRING (1) IS MADE FROM INCONEL X750. INCONEL X750 IS USED FOR ITS HIGH ELASTIC LIMIT, MODULUS OF ELASTICITY, CORROSION RESISTANCE, AND RESISTANCE TO STRESS CORROSION CRACKING (2). THE SPRING IS STRAIN RELIEVED AFTER FORMING. THE COIL HAS CLOSED ENDS WHICH ARE GROUND SQUARE AND DEBURRED (1).

(1) RS008288; (2) RSS-8582

FAILURE CAUSE: ALL CAUSES

HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE BLEED VALVE MEETS CEI REQUIREMENTS (1). THE MINIMUM FACTORS OF SAFETY FOR THE BLEED VALVE MEET CEI REQUIREMENTS (2). THE FBV WAS CLEARED FOR FRACTURE MECHANICS/INDE FLAW GROWTH, SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (3). THE BLEED VALVE HAS COMPLETED DESIGN VERIFICATION TESTING (4), INCLUDING VIBRATION (5), AND ENDURANCE TESTING (6). VALVE POSITION INDICATOR LIMITS WILL INHIBIT ENGINE START AND PREVENT CRITICAL 1 EFFECTS (7).

(1) RL00532, CP320R0003B; (2) RSS-8546, CP320R0003B; (3) NASA TASK 117; (4) DVS-SSME-516; (5) RSS-516-21; (6) RSS-516-17; (7) CP406R0002 PT 1 3.2.3.6.4

SSME FMEA/CIL
INSPECTION AND TEST

Component Group: Propellant Valves
 CIL Item: D210-02
 Component: Fuel Bleed Valve
 Part Number: RS008058
 Failure Mode: Valve fails to close.

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	POPPET BODY		RS008282 RS009507
	MATERIAL INTEGRITY CLEANLINESS REQUIREMENTS	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS. COMPONENTS ARE CLEANED FOR OXYGEN/FUEL SERVICE PER SPECIFICATION REQUIREMENTS	RS008282 RS009507 RL10001
B	STOP SCREW TORQUE	RUNNING AND FINAL TORQUES OF THE STOP SCREW ARE VERIFIED DURING ASSEMBLY.	RS008056
C	SPRING		RS008288
	SPRING INTEGRITY	THE SPRING MATERIAL IS VERIFIED TO MEET DRAWING REQUIREMENTS. SPRING HEAT TREAT (STRAIN RELIEF) IS VERIFIED PER DRAWING REQUIREMENTS. THE SPRING IS INSPECTED TO ASSURE NO SURFACE IMPERFECTIONS EXIST WHICH COULD AFFECT COIL LIFE AND TO VERIFY THE SPRING CHARACTERISTICS.	RA0102-012 RS008288
ALL CAUSES	ASSEMBLY INTEGRITY	SURFACE FINISH OF THE POPPET OD AND THE BODY BORE ARE INSPECTED PER DRAWING REQUIREMENTS. ASSEMBLY AND FUNCTIONAL TEST VERIFY VALVE OPERATION AND COMPONENT INTEGRITY. FBV SEAT LEAKAGE TEST EVERY START VERIFIES POPPET AND SEAT INTEGRITY. (LAST TEST)	RS008282 RS009507 RL00034 OMRSD V41BQ0.030

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRAÇA)
 Reference: NASA letter SA21/88/308 and Rocketdyne letter BRRC09761.

Operational Use: Not Applicable.

**SSME FA/CIL
WELD JOINTS**

Component Group: Propellant Valves
 CIL Item: D210
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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	
FUEL BLEED VALVE	RS008056	1	EBW	II	X	X	X	
FUEL BLEED VALVE	RS008056	2	EBW	II	X			
FUEL BLEED VALVE	RS008056	4	EBW	1A	X			

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SSME FMEA/CIL
FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

Component Group: Propellant Valves
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 Item Number: D210
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Base Line Rationale	Variance	Change Rationale	Variant Dash Number
1. D210-04 ARMATURE EXTENSION MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS (INCONEL 625, ECP 1088).	SOME ARMATURE EXTENSIONS ARE FABRICATED FROM INCONEL 718.	INCONEL 718 CAN BECOME FERROMAGNETIC AT LIQUID HYDROGEN TEMPERATURES RESULTING IN ERRONEOUS POSITION FEEDBACK SIGNAL. INCONEL 625 DOES NOT EXHIBIT THIS FERROMAGNETIC TENDENCY. USE AS IS RATIONALE: 1. ALL INCO 718 MATERIAL LOTS USED FOR FLIGHT ARMATURE EXTENSIONS HAVE BEEN SAMPLE TESTED. ARMATURE EXTENSIONS FABRICATED FROM LOTS OF INCO 718 WHICH HAVE EXHIBITED HIGH SUSCEPTABILITY TO LOW TEMPERATURE INDUCED FERROMAGNETIVITY HAVE BEEN IDENTIFIED AND ARE PROHIBITED FROM USE ON FUEL BLEED VALVES PER DAR 2251. (UCR A003781)	-021, -041, -051, -061, -071, -101