

SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group: Propellant Valves
 CIL Item: D220-04
 Component: Oxidizer Bleed Valve
 Part Number: RS008056
 Failure Mode: Erroneous position feedback signal.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 6/30/99
 Change #: 1
 Directive #: CCBD ME1-01-5226
 Page: 1 of 1

Phase	Failure / Effect Description	Criticality Hazard Reference
P 4.2	Erroneous signal not detected by controller results in loss of protection against failure of valve to close. Loss of vehicle due to orbiter duct rupture may result if OBV fails to close and is not detected. Redundancy Screens: SENSOR SYSTEM - VALVE SYSTEM: UNLIKE REDUNDANCY 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	1R ME-G3P.A, ME-G7S

SSME / FA/CIL
DESIGN

Component Group: Propellant Valves
CIL Item: D220-04
Component: Oxidizer Bleed Valve
Part Number: RS008058
Failure Mode: Erroneous position feedback signal.

Prepared: P. Lowrimore
Approved: T. Nguyen
Approval Date: 6/30/99
Change #: 1
Directive #: CCB0 ME3-01-5226
Page: 1 of 1

Design / Document Reference

FAILURE CAUSE: A: Damaged armature.

THE ARMATURE IS MANUFACTURED FROM HY-MU 80 ALLOY BAR (1) COLD DRAWN AND MAGNETIC ANNEALED. MATERIAL IS SELECTED FOR ITS MAGNETIC PERMABILITY AND COERCIVE FORCE. THE HY-MU 80 ARMATURE MATERIAL CANNOT ADVERSELY AFFECT THE INDICATOR FEEDBACK SIGNAL UNLESS THE ARMATURE ITSELF IS DIMENSIONALLY DEFORMED OR OTHERWISE PHYSICALLY COMPROMISED AS DETECTABLE PER REQUIRED ACCEPTANCE TEST VERIFICATION SUCH AS OUTPUT CHANGE (2). THE HOUSING PROTECTS THE ARMATURE FROM THE OUTSIDE ELEMENTS. THE MINIMUM DIAMETRICAL CLEARANCE BETWEEN ARMATURE O.D. AND THE TRANSFORMER HOUSING BORE IS CONTROLLED (2). THE ARMATURE IS DRY-FILM LUBRICATED (2). THE ARMATURE EXTENSION IS HEAT TREATED INCONEL 718 (2). THE MATERIAL WAS SELECTED FOR ITS STRENGTH, DUCTILITY, AND WELDABILITY. THE ARMATURE EXTENSION MAY ALSO BE MANUFACTURED FROM INCONEL 625 BAR (2). THIS MATERIAL WAS SELECTED FOR ITS WELDABILITY, CORROSION RESISTANCE, CRYOGENIC TOUGHNESS, RESISTANCE TO STRESS CORROSION CRACKING, AND RESISTANCE TO INDUCED FERROMAGNETISM (3). THE EXTENSION IS KNURLED FOR A TIGHT FIT ON THE ARMATURE I.D. THE ARMATURE IS RETAINED BY AN E.B. WELDED GUIDE ON THE END OF THE EXTENSION. THE LVDT ASSEMBLY IS LIFE LIMITED TO PREVENT FAILURE (4).

(1) MIL-N-14411, COMP 1; (2) RES1114; (3) RSS-8582; (4) DAR 1422

FAILURE CAUSE: B: Open or short circuit.

C: Change of internal resistance caused by moisture, corrosion, or contamination.

PARTS FOR THE CIRCUITS INVOLVED IN THIS FUNCTION HAVE BEEN SELECTED FROM THE MSFC CLASS S OR EQUIVALENT APPROVED PARTS SELECTION (1). ELECTRICAL CONNECTOR IS DESIGNED TO SEAL AGAINST MOISTURE/CONTAMINATION (2). RECEPTACLE PINS ARE NICKEL UNDERPLATED AND GOLD OVERPLATED TO PREVENT CORROSION (3). GLASS BEADS (4) FILL ALL CAVITIES AND PREVENT WIRE MOVEMENT. THE CAVITY IS EVACUATED AND BACK-FILLED WITH HELIUM. A TEFLON PLUG IS INSERTED IN THE ACCESS PASSAGEWAY AND A BALL IS RESISTANCE WELDED TO THE HOUSING ACCESS PORT. THE BALL RECESS IS POTTED (5) FLUSH WITH TOP OF FLANGE. THIS DESIGN PREVENTS MOISTURE/CONTAMINATION PROBLEMS (6). SOLDERING OF ELECTRICAL CONNECTIONS AND TERMINAL CONNECTIONS ARE CONTROLLED BY SPECIFICATION (7). PRIMARY AND SECONDARY COILS ARE DESIGNED SO THEY ARE INSULATED FROM EACH OTHER (8). THE FUEL AND OXIDIZER BLEED VALVES WITH THE POSITIONING INDICATOR ATTACHED HAS SUCCESSFULLY PASSED DESIGN VERIFICATION TESTING (9), WHICH INCLUDED PRESSURE CYCLING (10), AND VIBRATION TESTING (11).

(1) 85M03928; (2) RES1232; (3) MSFC-SPEC-250; (4) MIL-G-9954, SIZE 12; (5) MSFC-SPEC-222; (6) 2-6149-2; (7) MSFC-SPEC-278; (8) 4-6149; (9) DVS-SSME-516; (10) RSS-516-17; (11) RSS-516-20

**SSME FMEA/CIL
INSPECTION AND TEST**

Component Group: Propellant Valves
 CIL Item: D220-04
 Component: Oxidizer Bleed Valve
 Part Number: RS000056
 Failure Mode: Erroneous position feedback signal.

Prepared: P. Lowrimore
 Approved: T. Nguyen
 Approval Date: 6/30/99
 Change #: 1
 Directive #: CCBD ME3-01-5226
 Page: 1 of 2

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	POSITION INDICATOR		RES1114
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	
		ARMATURE DRY-FILM LUBRICATION IS INSPECTED PER SPECIFICATION AND DRAWING REQUIREMENTS.	RB0140-017 RES1114
		DIAMETRICAL CLEARANCE BETWEEN ARMATURE AND TRANSFORMER BORE IS INSPECTED PER DRAWING REQUIREMENTS.	RES1114
B, C	POSITION INDICATOR		RES1114
	PLATING INTEGRITY	THE PLATING IS VERIFIED PER SPECIFICATION REQUIREMENTS.	
	SOLDERING INTEGRITY	ELECTRICAL SOLDERING IS INSPECTED PER SPECIFICATION REQUIREMENTS.	
	ASSEMBLY CLEANLINESS	CLEANLINESS IS VERIFIED DURING ASSEMBLY AND TESTING PER SPECIFICATION REQUIREMENTS.	RL10001 RES1114
	ASSEMBLY INTEGRITY	EACH TRANSDUCER IS EXAMINED FOR QUALITY OF WORKMANSHIP PER SPECIFICATION REQUIREMENTS	RES1114
		THE FOLLOWING TESTS ARE PERFORMED DURING MANUFACTURING AND ACCEPTANCE TESTING: - INSULATION RESISTANCE BETWEEN COILS AND CASE. - DIELECTRIC WITHSTANDING VOLTAGE TEST TO VERIFY CURRENT LEAKAGE IS WITHIN SPECIFICATION REQUIREMENTS. - STROKE DEFLECTION TESTS TO VERIFY PROPER DISPLACEMENT, OUTPUT VOLTAGE, AND PHASING. - SCALE FACTOR AND LINEARITY TEST. - LOW TEMPERATURE FUNCTIONAL TEST. - HELIUM BACK FILL AND LEAK TEST.	
	WELD INTEGRITY	ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS.	RL10011 RA0607-094

D - 129

Component Group: Propellant Valves
 CIL Item: D220-04
 Component: Oxidizer Bleed Valve
 Part Number: R3008058
 Failure Mode: Erroneous position feedback signal.

Prepared: P. Lowrip
 Approved: T. Nguyen
 Approval Date: 6/30/99
 Change #: 1
 Directive #: CCBD ME3-01-5226
 Page: 2 of 2

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
ALL CAUSES	PRE-FLIGHT CHECKOUT	POSITION INDICATOR OPERATION IS VERIFIED DURING EACH FLIGHT FLOW BY THE FOLLOWING TESTS: (LAST TEST) - FLIGHT READINESS TEST. - CONTROLLER POWER UP. - SENSOR CHECKOUT. - PNEUMATIC CHECKOUT MODULE LOAD AND EXECUTE. - PRE-CRYO LOADING CONFIGURATION VERIFICATION.	OMRSD 500FA0.211 OMRSD 500FA0.213 OMRSD 500FA0.213 OMRSD 500FA0.213 OMRSD 500FA0.213

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
 Reference: NASA letter SA21/88/308 and Rockwell letter 88RC09761.
 Operational Use: Not Applicable.

**SSME FTA/CIL
WELD JOINTS**

Component Group: Propellant Valves
 CIL Item: D220
 Component: Oxidizer Bleed Valve
 Part Number: RS008058

Prepared: P. Lowrmore
 Approved: T. Nguyen
 Approval Date: 6/30/99
 Change #: 1
 Directive #: CCBD MEJ-01-5225
 Page: 1 of 1

Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
OXIDIZER BLEED VALVE	RS008058	1	EBW	II	X	X	X	
OXIDIZER BLEED VALVE	RS008058	2	EBW	II	X			
OXIDIZER BLEED VALVE	RS008058	4	EBW	1A	X			
BELLOWS	RS008285	3,4	GTAW	II	X	X		

SSME FMEA/CIL
FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

Component Group: Propellant Valves
 Item Name: Oxidizer Bleed Valve
 Item Number: D220
 Part Number: RS008058

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

Page: 1 of 1

Base Line Rationale	Variance	Change Rationale	Variant Dash Number
1. D220-04 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 TENDENCY. USE AS IS RATIONALE: 1. ENGINEERING ANALYSIS HAS DETERMINED THAT ALL ARMATURE EXTENSIONS FABRICATED FROM INCO 718 WILL NOT EXPERIENCE LOW ENOUGH TEMPERATURES ON OXIDIZER BLEED VALVES TO INDUCE FERROMAGNETIVITY AND ARE THEREFORE ACCEPTABLE FOR USE. (ECP 1088)	-02f, -04f, -05f, -06f, -07f, -10f