SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group:	**Ducts and Lines**	**Prepared:**	**D. Early**
CIL Item:	**K540-01**	**Approved:**	**T. Nguyen**
Part Number:	**R0019585**	**Approval Date:**	**7/25/00**
Component:	**MCC Drying Purge Line**	**Change #:**	**1**
FMEA Item:	**K540**	**Directive #:**	**CCBD ME3-01-5638**
Failure Mode:	**Fails to contain hydrogen.**		
		Page:	**1 of 1**

Phase	Failure / Effect Description	Criticality Hazard Reference
SM 4.1	Fuel leakage outside of aft compartment causing off-nominal mixture ratio operation and propellant consumption. Mission abort. Redundancy Screens: SINGLE POINT FAILURE: N/A	1R ME-G4M
SMC 4.2	Hydrogen leakage into aft compartment. Aft compartment overpressurized. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-D3S,A,M,C

SSME FMEA/CIL DESIGN

Component Group:	**Ducts and Lines**	**Prepared:**	**D. Early**
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Design / Document Reference

FAILURE CAUSE: **A: Parent material failure or weld failure of line.**
B: Parent material failure of plate.

THE LINE ASSEMBLY (1) AND PLATE (2) ARE MANUFACTURED UTILIZING INCONEL 625 TUBE AND BAR. INCONEL 625 WAS SELECTED FOR ITS WELDABILITY, FORMABILITY, RESISTANCE TO STRESS CORROSION CRACKING, AND CORROSION RESISTANCE (3). INCONEL 625 IS NOT SIGNIFICANTLY EFFECTED BY HYDROGEN IN THIS ENVIRONMENT (3). INCONEL 625 POSSESSES THE REQUIRED STRENGTH WITHOUT REQUIRING HEAT TREAT. A STIFFENER IS INCORPORATED ACROSS THE PLATE TO PREVENT FLANGE DISTORTION UNDER PRESSURE. THE STIFFENER INCORPORATES RADII TO PREVENT STRESS RISERS. FLANGE AND ADAPTER SECTIONS INCORPORATE RADIUS JOINTS TO REDUCE STRESS CONCENTRATIONS. OFFSET LIMIT REQUIREMENTS ARE ESTABLISHED TO REDUCE STRESS CONCENTRATIONS AND IMPROVE WELD GEOMETRY. TUBING STOCK IS DRAWN TO MAINTAIN SURFACE REGULARITY. INSTALLATION IS CONTROLLED FOR ANGULARITY AND OFFSET PER SPECIFICATION REQUIREMENTS (4). MINIMUM FACTORS OF SAFETY FOR THE LINE MEET CEI REQUIREMENTS (5). HIGH AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (6). THE LINE ASSEMBLY HAS COMPLETED PRESSURE CYCLING AND ULTIMATE PRESSURE DVS TESTING (7). THE PLATE WAS DVS TESTED DURING ENGINE DVS TESTING (8). THE LINE ASSEMBLY PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (9). TABLE K540 LISTS ALL THE FMEA/CIL WELDS AND IDENTIFIES THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE, AND THOSE WELDS IN WHICH THE ROOT SIDE IS NOT ACCESSIBLE FOR INSPECTION. THESE WELDS HAVE BEEN ASSESSED AS ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (10).

(1) R0019585; (2) R0011086; (3) RSS-8582; (4) RA1102-006; (5) RSS-8546, CP320R0003B; (6) RL00532, CP320R0003B; (7) RSS-511-31, RSS-511-45; (8) DVS-SSME-101; (9) NASA TASK 117; (10) RSS-8756

SSME FMEA/CIL
INSPECTION AND TEST

Component Group:	**Ducts and Lines**	**Prepared:**	**D. Early**
CIL Item:	**K540-01**	**Approved:**	**T. Nguyen**
Part Number:	**R0019585**	**Approval Date:**	**7/25/00**
Component:	**MCC Drying Purge Line**	**Change #:**	**1**
FMEA Item:	**K540**	**Directive #:**	**CCBD ME3-01-5638**
Failure Mode:	**Fails to contain hydrogen.**		
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A, B	LINE FLANGE ADAPTER PLATE		R0019585 RS007159 R0011250 R0011086
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	R0019585 RS007159 R0011250 R0011086
		THE DETAILS ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116
	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 RA0115-006 RA1115-001 RA0115-127
	ASSEMBLY INTEGRITY	THE ASSEMBLY IS PROOF PRESSURE TESTED PER DRAWING REQUIREMENTS.	R0019585
		THE PLATE STIFFENER RADII ARE INSPECTED PER DRAWING REQUIREMENTS.	R0011086
	FLIGHT FLOW TESTING	THE EXTERNAL SURFACE IS VISUALLY INSPECTED PRIOR TO EACH LAUNCH.	OMRSD V41BU0.030
		THE PLATE AND SEAL ARE LEAK CHECKED EACH FLIGHT.	OMRSD V41GEN.565
		A HELIUM SIGNATURE LEAK TEST IS PERFORMED PRIOR TO EACH LAUNCH. (LAST TEST)	OMRSD S00000.950

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: FAILURE MODE CAN BE DETECTED IN REALTIME BY THE FLIGHT CONTROL TEAM WHO WILL EVALUATE EFFECTS UPON VEHICLE PERFORMANCE AND ABORT CAPABILITY. BASED ON THIS EVALUATION THE APPROPRIATE ABORT MODE OR SYSTEM CONFIGURATION WILL BE SELECTED. FAILURE DETECTION CUES AND ASSOCIATED SSME PERFORMANCE DATA HAVE BEEN COORDINATED BETWEEN THE ENGINEERING AND FLIGHT OPERATIONS ORGANIZATIONS WITH THE RESPONSES DOCUMENTED IN MISSION FLIGHT RULES.

SSME FMEA/CIL
WELD JOINTS

Component Group: Ducts and Lines
CIL Item: K540
Part Number: R0019585
Component: MCC Drying Purge Line
FMEA Item: K540

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

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
LINE	R0019585	1-5	GTAW	I	X	X	X	