

SSME FMEA/CIL
INSPECTION AND TEST

Component Group: Ducts and Lines
 CIL Item: K509-01
 Part Number: RS007103
 Component: MCC Dome Purge Line
 FMEA Item: K509, K530, K562
 Failure Mode: Fails to contain GN2.

Prepared: D. Early
 Approved: T. Nguyen
 Approval Date: 7/25/00
 Change #: 2
 Directive #: CCBD ME3-01-5638

Page: 1 of 1

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference	
A	LINE ASSY		RS007103	
	BODY, CHECK VALVE		RS008220	
	CAP, CHECK VALVE		RS008213	
	ELBOW		RS007237	
	FLANGE		RS007159	
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.		RS007103 RS008220 RS008213 RS007237 RS007159
		FLANGE AND ELBOW 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
	DIMENSIONAL INTEGRITY	THE PHYSICAL CHARACTERISTICS OF THE ORIFICE ARE VERIFIED TO DRAWING REQUIREMENTS.		RS007103
	ASSEMBLY INTEGRITY	THE ASSEMBLY IS PROOF PRESSURE TESTED PER DRAWING REQUIREMENTS.		RS007103
FLIGHT FLOW TESTING	THE EXTERNAL SURFACE IS VISUALLY INSPECTED PRIOR TO EACH LAUNCH. (LAST TEST)		OMRSD V41BU0.030	

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
 Reference: NASA letter SA21/88/308 and Rockedyne letter 88RC09761.

Operational Use: Not Applicable.

**SSME EA/CIL
DESIGN**

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Page: 1 of 1

Design / Document Reference

FAILURE CAUSE: A: Parent material failure or weld failure.

THE LINE ASSEMBLY (1) IS MANUFACTURED UTILIZING INCONEL 625 TUBE AND BAR FOR FLANGE AND ELBOW. THE CHECK VALVE BODY AND CAP UTILIZE HAYNES 188 BAR. INCONEL 625 WAS SELECTED FOR ITS WELDABILITY, FORMABILITY, RESISTANCE TO STRESS CORROSION CRACKING, AND CORROSION RESISTANCE (2). INCONEL 625 POSSESSES THE REQUIRED STRENGTH WITHOUT REQUIRED HEAT TREAT. HAYNES 188 WAS SELECTED FOR ITS LOW CYCLE FATIGUE LIFE, WELDABILITY, AND CORROSION RESISTANCE (2). ALL MATERIALS USED IN THE LINE FABRICATION ARE LOX COMPATIBLE (2). FLANGE SECTIONS AND ELBOW 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 (3). MINIMUM FACTORS OF SAFETY FOR THE LINE MEET CEI REQUIREMENTS (4). HIGH AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (5). THIS LINE ASSEMBLY WAS VERIFIED TO SATISFY PRESSURE CYCLING AND ULTIMATE PRESSURE DVs BY SIMILARITY (6). THE LINE ASSEMBLY PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (7). TABLE K509 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 (8).

(1) RS007103; (2) RSS-8582, RSS-8575; (3) RA1102-006; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) RSS-511-43; (7) NASA TASK 117; (8) RSS-8756

SSME FMEA/CIL
REDUNDANCY SCREEN

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Page: 1 of 1

Phase	Failure / Effect Description	Criticality Hazard Reference
P 4.1	GN2 leakage into aft compartment. Leakage causes loss of flow to downstream system reducing purge flow below acceptable limits for inerting propellant leakage at ICD limits. Potential open air fire. Loss of vehicle.	1 ME-A1P

Redundancy Screens: SINGLE POINT FAILURE: N/A

SSME, A/CIL
WELD JOINTS

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 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	
LINE	RS007103	1,1a,2,3	GTAW	I	X	X	X	
VALVE HOUSING	RS008059	1	EB	II	X			