SSME FMEA/CIL
INSPECTION AND TEST

Component Group: Ducts and Lines
CIL Item: K535-01
Part Number: R0019561
Component: Nitrogen Supply Line
FMEA Item: K516, K535
Failure Mode: Fails to contain GN2.

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

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	LINE FITTING FLANGE		R0019561 RS007144 R0019547
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	R0019561 RS007144 R0019547
		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.	R0019561
		WELD JOINTS ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS AFTER PROOF TEST.	RA0115-116
	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 Rocketdyne letter 88RC09761.

Operational Use: Not Applicable.

SSME FMEA/CIL
DESIGN

Component Group:	Ducts and Lines	**Prepared:**	D. Early
CIL Item:	K535-01	**Approved:**	T. Nguyen
Part Number:	R0019561	**Approval Date:**	7/25/00
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Design / Document Reference

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

THE LINE ASSEMBLY (1) IS MANUFACTURED UTILIZING 321 CRES TUBE AND INCONEL 625 BAR. 321 CRES TUBING WAS SELECTED FOR ITS STRENGTH, FABRICABILITY, GENERAL CORROSION RESISTANCE, AND STRESS CORROSION RESISTANCE (2). INCONEL 625 WAS SELECTED FOR ITS WELDABILITY, FORMABILITY, RESISTANCE TO STRESS CORROSION CRACKING, AND CORROSION RESISTANCE (2). INCONEL 625 POSSESSES THE REQUIRED STRENGTH WITHOUT REQUIRING HEAT TREAT. FLANGE AND FITTING 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 (3). MINIMUM FACTORS OF SAFETY FOR THE LINE MEET CEI REQUIREMENTS (4). HIGH AND LOW CYCLE FATIGUE LIFE MEET CEI REQUIREMENTS (5). THE LINE ASSEMBLY HAS COMPLETED PRESSURE CYCLING AND ULTIMATE PRESSURE DVS TESTING (6). THE LINE ASSEMBLY PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE THEY ARE NOT FRACTURE CRITICAL PARTS (7). TABLE K535 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) R0019561; (2) RSS-8582; (3) RA1102-006; (4) RSS-8546, CP320R0003B; (5) RL00532, CP320R0003B; (6) RSS-511-31, RSS-511-45; (7) NASA TASK 117; (8) RSS-8756

SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group:	**Ducts and Lines**
CIL Item:	**K535-01**
Part Number:	**R0019561**
Component:	**Nitrogen Supply Line**
FMEA Item:	**K516, K535**
Failure Mode:	**Fails to contain GN2.**

Prepared:	**D. Early**
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Page:	**1 of 1**

Phase	Failure / Effect Description	Criticality Hazard Reference
P 4.1	GN2 leakage into aft compartment. Engine oxidizer system purge falls below acceptable limits for inerting propellant leakage at ICD limits. Potential open air fire. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-A1P, ME-A1A

SSME I A/CIL
WELD JOINTS

Component Group: Ducts and Lines
CIL Item: K535
Part Number: R0019561
Component: Nitrogen Supply Line
FMEA Item: K516, K535

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	R0019561	1,1a,2	GTAW	I	X	X		