

SSME FMEA/CIL
INSPECTION AND TEST

Component Group: Ducts and Lines
 CIL Item: K516-01
 Part Number: RS007132
 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

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| Failure Causes | Significant Characteristics | Inspection(s) / Test(s) | Document Reference |
|----------------|--------------------------------|--|---|
| A | LINE ASSY FITTING FLANGE | | RS007132 RS007145 RS007152 |
| | MATERIAL INTEGRITY | MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS. | RS007132 RS007145 RS007152 |
| | | 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. | RS007132 |
| | 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.

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DESIGN

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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. 321 CRES TUBING WAS SELECTED BECAUSE OF 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 K516 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) RS007132; (2) RSS-8582; (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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| 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 () :A/CIL
WELD JOINTS

Component Group: Ducts and Lines
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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 | |
| LINE | RS007132 | 1,2 | GTAW | I | X | X | | |
