Grumman Corporation

CRITICAL ITEMS LIST

GRUMMAN

ASSY NOMENCLATURE: MANIPULATOR FOOT RESTRAINT

ASSEMBLY PART NO: SED 33109480

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: RMS-87-R-8

REVISION: A

DATE: 17 MAY 1988

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
81		Vertical Stanchion Stow Latch QTY (1) Dwg C95-122	1/1	81 - Relaxation or structural failure of trigger spring; structural failure of hook (P/N C95-122-13) or trigger (P/N C95-122-11) due to defective material.	END ITEM Vertical stanchion may move unrestrained to deployed position. SEE INTERFACE APC latch may fail due to overload MISSION MFR may sustain damage; MFR may be unable to accomplish mission objectives. CREW / VEHICLE Potential loss of crew/vehicle due to impact by MFR	A. Design The APC interface mechanism has been designed to withstand launch loads including: shock(20g, 11milli-sec, sawtooth pulse, 3 axes), random vibration as high as .2g sq/hz, and lift-off and landing static loads 8.4g's 3.0 g's, and 6.4g's in the z, y ,and x axes respectively. Dynamic magnification of 2 has been included and all static loads are assumed simultaneous (worst case) and are combined with the worst case 3.3sigma random response load to each axes. An astronaut handling load of one hundred pounds in any direction at any point was also considered. Using the above load spectrum design safety margins of 1.14 for deformation and 1.40 for failure have been achieved. All springs are corrosion resistant and will be cycled a small fraction of nominal cyclic life in the 20 mission life of the MFR. Fatigue life based upon random response loads with appropriate stress concentration factors has been established using a scatter factor of 4.0 (e.g., 80 mission fatigue life based upon S-N curves). All materials are per table 1 and 2 of MSFC-SPEC-522A to reduce stress corrosion, and are certified for traceability/quality.

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CRITICAL ITEMS LIST

GRUMMAN

ASSY NOMENCLATURE: MANIPULATOR FOOT RESTRAINT

ASSEMBLY PART NO: SED 39100108

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: RMS-87-FR-8

REVISION: A

DATE: 6 JULY 1988

FMEA REF	REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
B1		Vertical Stanchion Stow Latch QTY (1) Dwg C95-122	1/1	B1 - Relaxation or structural failure of trigger spring; structural failure of hook (P/N C95-122-13) or trigger (P/N C95-122-11) due to defective material.	END ITEM Vertical stanchion may move unrestrained to deployed position. GFE INTERFACE APC latch may fail due to overload MISSION MFR may sustain damage; MFR may be unable to accomplish mission objectives. CREW/VEHICLE Potential loss of crew/vehicle due to impact by MFR	B. TEST HISTORY 1. Acceptance test per procedure 380 94 01 at Grumman (77H03) before and after all tests. ATP includes functional tests of all operating functions and a general visual inspection. 2. Stiffness test per procedure 380-100 01 at Grumman (77D03). Demonstrated stanchion end playless than .5 inch for a five pound load in any direction and deflection less than 3 inches lateral and 2 inches longitudinal for Hundred pound loads. 3. Vibration and shock test per procedure 380-99.01 at Grumman (77F03). Demonstrated ability to withstand design levels without structural failure with no significant resonance. Several screws required the application of loctite. 4. APCs/MFR ultimate load tests per STS83-0914 at Rockwell (3Q83). Loads applied in 14 steps, each comprising 10% of limit load no yield was observed at the ultimate load of 1.4 x limit. 5. Thermal vacuum test at JSC (2/29/84). MFR was operated at ambient temperature, plus 224 F and -137 F (average lowest achievable chamber temp) at an average vaccum of .00006 torr. 6. Center of gravity test at JSC (6/2/84) 7. Moment of inertia swing test at JSC (7/4/85) C. INSPECTION 1. MAVPRO inspects all production end items at completion of final assembly 2. Anodic hard coated aluminum parts inspected for compliance to MIL-A-8625C by DCAS. Certificate of compliance on file at Grumman Bethpage. 3. Thermal Control Coating process is controlled by inspectors, (paint prime, cure, post coating and cure), and sample testing for coating thickness, coating adhesion, and emittance/solar absorption. D. FAILURE HISTORY None (per PRACA database) The MFR has been successfully utilized on five missions, STS 1B, 13, 51A, 51I, and 61C. E. TURNAROUND Inspection per 5289PIA-05601NC 10 DEC 1987 includes a functional test of all MFR operating functions and a general visual inspection. F. OPERATIONAL USE 1. Operational Effect of Failure - Vertical stanchion would become unstowed and possibly break off or overload the APC latches. Probable damage to the orbiter, MFR, and payload. 2. Crew Action - None 3. Crew Training - None 4. Mission Constraint s- None 5. In flight Checkout - Crew will visually verify latch closed at end of stow operation

TC