Grumman Corporation

CRITICAL ITEMS LIST

GRUMMAN

ASSY NOMENCLATURE: MANIPULATOR FOOT RESTRAINT

ASSEMBLY PART NO: SED 33103186

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: RMS 87 R 6
REVISION C
DATE 3 MARCH 1990

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
A1	A	Adaptive Payload Carrier (APC) Interface Mechanism QTY (1) DWG C95-101	1R/2	A1 - Relaxation or structural failure of hook spring and trigger spring	**END ITEM** Latch mechanism fails in open position if both springs fail **GFE INTERFACE** MFR loses connection to APC; MFR loose in Payload Bay(PLB) **MISSION** Impact damage to MFR; MFR unable accomplish mission objectives **CREW/VEHICLE** Potential loss of crew/vehicle due to impact from MFR	**A. Design** The APC interface mechanism has been designed to withstand launch loads including: shock(20g, 11milli-sec, sawtooth pulse, 3 axes), random vibratic as high as .2gsq/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: RED 33100150

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: FMS MFR
REVISION: C
DATE: 2 MARCH 1990

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
A1	A	Adaptive Payload Carrier (APC) Interface Mechanism QTY (1) DWG C95-101	1R/2	A1 - Relaxation or structural failure of hook spring and trigger spring	**END ITEM** Latch mechanism fails in open position if both springs fail **GFE INTERFACE** MFR loses connection to APC; MFR loose in Payload Bay (PLB) **MISSION** Impact damage to MFR; MFR unable accomplish mission objectives **CREW / VEHICLE** Potential loss of crew/vehicle due to impact from MFR	**B. TEST HISTORY** 1. Acceptance test per procedure 380-94-01 at Grumman (7/7/83) before and after all tests. ATP includes functional tests of all operating functions and a general visual inspection. 2. Stiffness test per procedure 380-101.01 at Grumman (7/7/83). Demonstrated stanchion end play less than .5 inch for a five pound load in any direction and deflection less than 3 inches lateral and 2 inches longitudinal for 1 hundred pound loads. 3. Vibration and shock test per procedure 380-98.01 at Grumman (7/7/83). Demonstrated ability to withstand design levels without structural failure with no significant resonance. Several screws required the application of loctite. 4. APC/MFR ultimate load tests per STS83-0914 at Rockwell (9/83). 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 (7/29/84). MFR was operated at ambient temperature, plus 224 F and -137 F (average lowest achievable chamber temp) at an average vacuum of .00006 torr 6. Center of gravity test at JSC (12/21/84) 7. Moment of inertia swing test at JSC (1/4/85) **C. INSPECTION** 1. NAVPRO inspects all production end items at completion of final assembly 2. Anodic hard coated aluminum parts inspected for compliance to MIL-A-8625 C by DCAS. Certificate of compliance on file at Grumman Bethpage. 3. Thermal Control Coating process is controlled by inspections, (post 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 11, 13, 51A, 51I, and 61C. **E. TURNAROUND** Inspection per 528/PIA-05001 N/C to DEC 1989 includes a functional test of all MFR operating functions and a general visual inspection **F. OPERATIONAL USE** 1. Operational effect of failure - Damage to orbiter. 2. Crew Action - None 3. Crew Training - None 4. Mission Constraints - None 5. In Flight Checkout - None