Grumman Corporation

CRITICAL ITEMS LIST

GRUMMAN

ASSY NOMENCLATURE: MANIPULATOR FOOT RESTRAINT

ASSEMBLY PART NO: SED 53400100

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: RMS 87 R 1

REVISION: A

DATE: 17 MAY 1988

FMEA REF	REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
F4		Hand Hold Assembly (HHA) (containing retainers for foot boards) QTY (1) Dwg C95-118	2/2	F4 - Tool board retainer leaf spring jammed or lock failed in closed position	END ITEM Tool board guide will not release tool board; possible interference between tool board and grapple fixture/RMS end effector interface when moving the vertical stanchion to the stowed position GFE INTERFACE None, since MFR will be jettisoned MISSION Loss of MFR; unable to accomplish subsequent mission objectives CREW / VEHICLE None	A. Design In addition to considering the launch loads discussed under cases A1 and B1, the MFR has been designed to accomodate the following conditions in the deployed configurations: - Astronaut handling loads of one hundred pounds in any direction. Inertial response loads of MFR to RMS runaway accelerations (2.6 ft/sec/sec linear accel(x, y, or z axes and 0.5 rad/sec/sec Roll acel about x axes) - RMS constrained motion load of 300 pounds ultimate, any point, any direction. - 140 pound couple by each foot to footplate assembly - 343 pound load applied to any tether/reel assembly. - The design minimizes orbital EVA thermal stresses by utilizing aluminum as the one basic structural material, coated with a low absorption thermal control coating per Grumman spec CSS-MFR-PS-001 Using the above load spectrum design safety margi 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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ASSY NOMENCLATURE: MANIPULATOR FOOT RESTRAINT

ASSEMBLY PART NO: SED 20100100

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: RMS 87.0 A

REVISION AT B

DATE: 8 JULY 1988

FMEA REF	REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
F4		Hand Held Assembly (HHA) (containing retainers for tool boards) QTY (1) Dwg C95-118	2/2	F4 - Tool board retainer leaf spring jammed or lock failed in closed position	END ITEM Tool board guide will not release tool board; possible interference between tool board and grapple fixture/RMS end effector interface when moving the vertical stanchion to the stowed position GFE INTERFACE None, since MFR will be jettisoned MISSION Loss of MFR; unable to accomplish subsequent mission objectives CREW / VEHICLE None	B. TEST HISTORY 1. Acceptance test per procedure 386 94.01 at Grumman (7/7/83) before and after all tests. ATP includes functional of all operating functions and a general visual inspection. 2. Stiffness test per procedure 386-101.01 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 Hundred pound loads. 3. Vibration and shock test per procedure 386-98.01 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 STS83-0044 at Rockwell (8/83). Loads applied in 14 steps, each composing 10% of limit load; no yield was observed at the ultimate load of 1.4 x limit 5. Thermal vacuum test at JSC (7/2/84). 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 (12/2/84) 7. Moment of inertia swing test at JSC (9/4/85) C. INSPECTION 1. NAVFRD 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 RMACA database). The MFR has been successfully utilized on five missions; STS 41, 51, 51A, 51I, and 61C. E. TURNAROUND Inspection per S2R/PIA 05801NIC M 4DEC 1987 includes a functional test of all MFR operating functions and a general visual inspection. F. OPERATIONAL USE 1. Operational Effect of Failure: MFR could not be retrieved. It possibly could not be used on a second EVA if it had to be jettisoned. 2. Crew Action - Crew could remove hardware from the tool board if possible. Otherwise, MFR would have to be jettisoned. 3. Crew Training: none 4. Mission Planning: none 5. In Flight Checkout: Operation of tool board retainer will be