Grumman Corporation

# CRITICAL ITEMS LIST

GRUMMAN

ASSY NOMENCLATURE: [illegible]

ASSEMBLY PART NO: [illegible]

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: [illegible]

REVISION: A

DATE: [illegible]

| FMEA REF | FMEA REV | NAME, QTY & DRAWING REF DESIGNATION | CRIT | FAILURE MODE AND CAUSE | FAILURE EFFECT | RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|---|
| G1 | A | Foot Platform Assembly (FPA)<br><br>QTY (1)<br><br>Dwg C95-123 | 2/2 | G1 - Latch fails to engage in notch in platform indexing mechanism due to structural failure of latch or latch spring as a result of defective material, contamination or galling | END ITEM<br>Foot platform will rotate freely<br><br>GFE INTERFACE<br>N/A<br><br>MISSION<br>Astronaut cannot stabilize large payload; limited use of MFR<br><br>CREW / VEHICLE<br>None | A. Design<br>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:<br>- Astronaut handling loads of one hundred pounds in any direction.<br>Inertial response loads of MFR to RMS runaway accelerations (2.6 ft/sec/sec linear accelt.y, or z axes and 0.5 rad/sec/sec Roll acct about x axes)<br>- RMS constrained motion load of 300 pounds ultimate, any point, any direction.<br>- 140 pound couple by each foot to footplate assembly<br>- 343 pound load applied to any tether/reel assembly.<br>- 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<br>Using the above load spectrum design safety margi of 1.14 for deformation and 1.40 for failure have been achieved.<br>All springs are corrosion resistant and will be cycled a small fraction of nominal cyclic life in the 20 mission life of the MFR.<br>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 \|<br>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: MFR 2016-0150

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: FMS-91-R-6

REVISION AT: B

DATE: 8 JULY 1998

| FMEA REF | FMEA REV | NAME, QTY & DRAWING REF DESIGNATION | CRIT | FAILURE MODE AND CAUSE | FAILURE EFFECT | RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|---|
| G1 | A | Foot Platform Assembly (FPA)<br><br>QTY (1)<br><br>Dwg C95-123 | 2/2 | G1 - Latch fails to engage in notch in platform indexing mechanism due to structural failure of latch or latch spring as a result of defective material, contamination or galling | END ITEM<br>Foot platform will rotate freely<br><br>SSE INTERFACE<br>N/A<br><br>MISSION<br>Astronaut cannot stabilize large payload, limited use of MFR<br><br>CREW / VEHICLE<br>None | B. TEST HISTORY<br>1. Acceptance test per procedure 380-9404 at Grumman (7/7/93) before and after all tests. ATP includes functional tests of all operating functions and a general visual inspection.<br>2. Stiffness test per procedure 380-10104 at Grumman (7/7/93). Demonstrated stanchion end play less than 5 inch for five pound load in any direction and deflection less than 3 inches lateral and 2 inches longitudinal for 1 hundred pound loads.<br>3. Vibration and shock test per procedure 380-9801 at Grumman (7/7/93). Demonstrated ability to withstand design levels without structural failure with no significant resonance. Several screws required the application of loctite.<br>4. APC/MFR ultimate load tests per STS83 0044 at Rockwell (9/95). Loads applied in 10 steps, each comprising 10% of final load no yield was observed at the ultimate load of 1.4 x limit.<br>5. Thermal vacuum test at JSC (7/29/96). MFR was operated at ambient temperature, plus 224 f and -137 f (average lowest achievable chamber temp) at an average vacuum of .00006 torr.<br>6. Center of gravity test at JSC (10/21/96)<br>7. Moment of inertia swing test at JSC (9/4/96)<br><br>C. INSPECTION<br>1. MAYPRO inspects all production end items at completion of final assembly.<br>2. Anodic hard coated aluminum parts inspected for compliance to MIL-A-8625 C by DCAS. Certificate of compliance on file at Grumman Bethpage.<br>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 absorptio<br><br>D. FAILURE HISTORY<br>None (per PRACA database). The MFR has been successfully utilized on five missions, STS 16, 19, 54A, 54, and 61C.<br><br>E. TURNAROUND<br>Inspection per S28NNA 05001 R/C 10 DEC 1997 includes a functional test of all MFR operating functions and a general visual inspection.<br><br>F. OPERATIONAL USE<br>1. Operational Effect: Ability to stabilize large payloads restricted length of EVA may be extended.<br>2. Crew Action: Attempt to tie foot restraint platform position w/ tethers or other available hardware.<br>3. Crew Training: Trained in the use of available generic tools.<br>4. Mission Constraints: Subsequent MFR activities may be limited based upon crew assessment of payload characteristics.<br>5. Inflight Checkout: operation of the foot platform assembly will be checked out at time of use. |