

CRITICAL ITEMS LIST

ASSY NOMENCLATURE: RMS IFM D&C KIT

SYSTEM: REMOTE MANIPULATOR SYSTEM

REVISION: B

ASSY P/N: SED33103304-304

SUBSYSTEM: RMS IFM D&C KIT

PAGE 24 OF 47

| FMEA | | NAME, QTY & DRAWING REF DESIGNATION | CRIT'Y/ REQ'D SCREMS | FAILURE MODE AND CAUSE | FAILURE EFFECT OR END ITEM | RATIONALE FOR ACCEPTANCE |
|------|-----|--|--------------------------------------|--|---|---|
| REF | REV | | | | | |
| 6060 | B | RIGIDIZE/ DERIGIDIZE SWITCH (S2) M590310-271 | I/I A - N/A B - N/A C - N/A | <p>Mode: Fails closed, premature close</p> <p>Cause: • structural failure • contamination • mechanical shock • vibration</p> | <p>Will have rigidize or derigidize command to end effector as soon as dc power is applied to the RMS IFM D&C Kit. Cannot change command to end effector.</p> <p><u>Worst Case</u> Unexpected payload motion. Uncommanded derigidization. Crew action required.</p> | <p>1. <u>DESIGN</u> The toggle switch is manufactured by Cutler-Hammer to meet MIL specification requirements and is qualified to MIL-5-8834. The toggle switch is a double pole, positive break, miniature, sealed, solder lug toggle switch.</p> <p>2. <u>TEST</u></p> <p>a. <u>MANUFACTURING.</u> The part is screened and qualified to the requirements of MIL-5-8834. Tests and inspections done on a sample from each lot are: sealing, examination of product, switching characteristics, dielectric withstanding voltage (DWV), contact voltage drop, marking permanency, solderability, mechanical endurance, electrical overload, endurance (electrical), life (20,000 cycles at rated current and rated load), low level, dry circuit and intermediate current, switching and temperature rise, overload, inductive load, resistive load, shock, and salt spray. Tests performed on a sample of devices for qualification are: examination of product, marking permanency, solderability, resistance to soldering heat, switching characteristics, strength of terminals, strength of toggle actuating lever, pivot and lever stop, strength of mounting bushing, mechanical endurance, contact voltage drop, electrical overload, endurance, low level dry circuit and intermediate current switching, and temperature rise, resistive load, inductive load, lamp load, intermediate current, life, low level temperature rise, overvoltage contact voltage drop, short circuit closure (overload capability demonstration test), vibration, shock, salt spray moisture resistance, toggle ice, sand and dust, thermal shock, DWV, sealing, explosion, flammability, and examination of product.</p> <p>All (100%) of the switches purchased for the RMS IFM D&C Kit are subjected to the following tests and inspections:</p> <ol style="list-style-type: none"> 1. Sealing, examination of product, switching characteristics dielectric withstanding voltage, and voltage drop (reference MIL-5-8834F, Table III, Group A). 2. Radiographic inspected for particle contamination. 3. "Run-in" of 250 cycles with nominally equal on-off times with a contact load of 1/10 the rated or 1 ampere maximum at 28 ± 3 volts DC at temperature of 25°C using the setup criteria described in MIL-5-8834F, para 4 B.12, items a through e. <p>All screening data will be delivered with the switches.</p> |

SUPERSEDING DATE 10/89 IFM D&C - 24 PROVED BY: R. E. Moore

DATE: 9/80

S040274
 ATTACHMENT
 Page 69 of 93

CRITICAL ITEMS LIST

ASSY NOMENCLATURE RMS IFM D&C KIT

SYSTEM: REMOTE MANIPULATOR SYSTEM

REVISION: B

ASSY P/N: SED33103306-304

SUBSYSTEM: RMS IFM D&C KIT

PAGE 25 OF 47

| FMEA | | NAME, QTY & DRAWING REF DESIGNATION | CRITV/ REDUND SCREENS | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | RATIONALE FOR ACCEPTANCE |
|------|-----|--|--------------------------------------|--|---|---|
| REF | REV | | | | | |
| 6060 | B | RIGIDIZE/ DERIGIDIZE SWITCH (S2) M590310-271 | 1/1 A - N/A B - N/A C - N/A | <p>Mode: Fails closed, premature close</p> <p>Cause: • structural failure • contamination • mechanical shock • vibration</p> | <p>Will have rigidize or derigidize command to end effector as soon as dc power is applied to the RMS IFM D&C Kit. Cannot change command to end effector.</p> <p><u>Worst Case</u> Unrespected payload motion Uncommanded derigidization. Crew action required.</p> | <p>b. QUALIFICATION/CERTIFICATION</p> <p>The switch, while installed in the RMS IFM D&C kit, has been subjected to the following qualification environmental tests:</p> <p>Vibration: X, Y, and Z axes - duration 15 min./axis Spectrum: 20 to 80 Hz +3 db/Oct. 80 to 350 Hz 0.067 g²/Hz 350 to 2000 Hz -3 db/Oct.</p> <p>Shock: 20 g sawtooth pulse, 11 ms duration, 3 axes (6 directions).</p> <p>c. ACCEPTANCE</p> <p>The switch, while installed in the RMS IFM D&C kit, has been subjected to the following acceptance environmental tests:</p> <p>Vibration: X, Y, and Z axes - duration 3 min./axis Spectrum: 20 to 80 Hz +3 db/Oct. 80 to 350 Hz 0.04 g²/Hz 350 to 2000 Hz -3 db/Oct.</p> <p>Shock: 20 g sawtooth pulse, 11 ms duration, 3 axes (6 directions)</p> <p>d. TURNAROUND</p> <p>The RMS IFM D&C kit is visually inspected for damage between missions and will be functionally tested before every mission to assure readiness for use</p> <p>3. INSPECTION</p> <p>a. The part is inspected to the requirements of MIL-5-8834, which includes visual inspections, and screening tests as described in paragraph B. The device manufacturer is not required to prepare and maintain a product assurance program. Government source inspection is required.</p> <p>b. Receiving inspection verifies: (1) that the switches received are as identified in the procurement documents, (2) that no physical damage has occurred to the switches during shipment, (3) that the receiving documents provide adequate traceability information, and (4) acceptance test data identify acceptable parts</p> <p>c. Parts are inspected throughout manufacture and assembly as appropriate to the manufacturing stage completed. These inspections include: (1) component mounting to the front panel of the kit, (2) soldering of contacts to switch connector, (3) wire routing, (4) stress relief of wires, etc.</p> |

50402074
ATTACHMENT
Page 70 of 93

ASSY NOMENCLATURE: RMS IFM D&C KIT

SYSTEM: REMOTE MANIPULATOR SYSTEM

REVISION: 8

ASSY P/N: SED33903306-304

SUBSYSTEM: RMS IFM D&C KIT

PAGE 26 OF 47

CRITICAL ITEMS LIST

| FMEA | | NAME, QTY & DRAWING REF DESIGNATION | CRITY/ REQD/ND SCREENS | FAILURE MODE AND CAUSE | FAILURE EFFECT OR END ITEM | RATIONALE FOR ACCEPTANCE |
|------|-----|--|--------------------------------------|--|--|--|
| REF | REV | | | | | |
| 6060 | 8 | RIGIDIZE/ DERIGIDIZE SWITCH (S2) MS90316-271 | 1/1 A - N/A B - N/A C - N/A | <p>Mode: fails closed, premature close</p> <p>Cause: • structural failure • contamination • mechanical shock • vibration</p> | <p>Will have rigidize or derigidize command to end effector as soon as dc power is applied to the RMS IFM D&C Kit. Cannot change command to end effector.</p> <p><u>Worst Case</u> Unexpected payload motion, Uncommanded derigidize. Crew action required</p> | <p>d. A test readiness review, which includes verification of test personnel, test documents, test equipment calibration/validation status, and hardware configuration, is convened by the Quality Assurance and Engineering Division in conjunction with the Engineering Directorate and Reliability and Maintainability Division.</p> <p>e. Acceptance Test Procedure (ATP) is observed and verified per procedure.</p> <p>4. <u>FAILURE HISTORY.</u> There have been no failures associated with this failure mode on the RMS IFM D&C kit program. NSTS Program part failure history indicates no reported failures for this device. A review of GIDEP prior military part failure history reveals that no uncorrected generic issues exist.</p> <p>5. <u>OPERATIONAL EFFECTS.</u> If constant rigidize, cannot capture a payload. Release captured payload without derigidizing EE. If derigidization occurs, the EE carriage could be completed extended. If this occurs while the arm is being driven, the payload might take an unexpected trajectory.</p> <p>6. <u>CREW ACTION.</u> Stop arm operations if uncommanded derigidization occurs. Release payload and maneuver the arm away from it payload. Maneuver the Orbiter away from the payload</p> <p>7. <u>CREW TRAINING.</u> The crew to be trained to be prepared to maneuver the Orbiter away from a free payload at any time during arm operations.</p> <p>8. <u>MISSION CONSTRAINT.</u> The operator must be able to detect that the arm/payload is responding properly to commands via window and/or CCTV views during all arm operations. When a payload is captured, an Orbiter pilot will always be available to perform a collision avoidance maneuver should this be necessary.</p> |

PREPARED BY: J. P. Grisham

SUPERSEDING DATE 1989

APPROVED BY R. L. Moore

DATE: 8/20

IFM D&C - 26

SO4027M
 ATTACHMENT
 page 71 of 93