

ASSY NOMENCLATURE: RMS IFM D&C KIT

SYSTEM: REMOTE MANIPULATOR SYSTEM

REVISION: 8

ASSY P/N: 5E033103306-304

SUBSYSTEM: RMS IFM D&C KIT

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CRITICAL ITEMS LIST

| FMEA | | NAME, QTY & DRAWING REF DESIGNATION | CRIT/ REDUND SCREENS | FAILURE MODE AND CAUSE | FAILURE EFFECT OR END ITEM | RATIONALE FOR ACCEPTANCE |
|------|-----|-------------------------------------|--------------------------------------|--|---|---|
| REF | REV | | | | | |
| 5040 | B | DIRECT DRIVE SWITCH MS90311-271 | 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>Joint will drive in either the positive or negative direction as soon as dc power is applied to the IFM kit. Unable to change direction of joint drive.</p> <p><u>Worst Case</u> Unexpected motion. Joint runaway. Crew action required. Unannounced</p> | <p>1. <u>DESIGN</u> The toggle switch is manufactured by Cutler-Hammer to meet MIL specification requirements and is qualified to MIL-S-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-S-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-S-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 load or 1 ampere maximum at 28 ± 1-3 volts DC at temperature of 25°C using the setup criteria described in MIL-S-8834F, para 4 B 12, items a through e. <p>All screening data will be delivered with the switches</p> |

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CRITICAL ITEMS LIST

| FMEA | | NAME, QTY & DRAWING REF DESIGNATION | CRIT'Y/ REDUND SCREENS | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | RATIONALE FOR ACCEPTANCE |
|------|-----|-------------------------------------|--------------------------------------|--|--|---|
| REF | REV | | | | | |
| 5040 | B | DIRECT DRIVE SWITCH MS90311-271 | Y/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>Joint will drive in either the positive or negative direction as soon as dc power is applied to the IFM kit. Unable to change direction of joint drive.</p> <p><u>Worst Case</u> Unexpected motion. Joint runaway. Crew action required. Unannounced.</p> | <p>b. <u>QUALIFICATION/CERTIFICATION.</u></p> <p>The switch, while installed in the RMS IFM D&C kit, has been subjected to the following qualification environmental test:</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. <u>ACCEPTANCE.</u></p> <p>The switch, while installed in the RMS IFM D&C kit, has been subjected to the following acceptance environmental test:</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. <u>TURNAROUND.</u></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. <u>INSPECTION.</u></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> |

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|------|-----|-------------------------------------|--------------------------------------|--|--|---|
| REF | REV | | | | | |
| 5040 | B | DIRECT DRIVE SWITCH MS90311-271 | 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>Joint will drive in either the positive or negative direction as soon as dc power is applied to the IFM kit. Unable to change direction of joint drive.</p> <p><u>Worst Case</u> Unexpected motion. Joint runaway. Crew action required. Unannounced.</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. NTS 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> Joints will drive as soon as power is applied to the IFM kit and will be unable to change direction of joint drive.</p> <p>6. <u>CREW ACTION.</u> Remove dc power from RMS IFM D&C kit. Select backup to perform single joint operation.</p> <p>7. <u>CREW TRAINING.</u> The crew will be trained to always observe whether the arm is responding properly to commands. If it is not, the command will be removed.</p> <p>8. <u>MISSION CONSTRAINT.</u> The crew must be able to detect whether the arm is responding properly to commands via window and/or CCTV views during all arm operations.</p> |

PREPARED BY: J. P. Grisham

SUPERSEDING DATE: 10/89

APPROVED BY: R. L. Moore

DATE: 9/90

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