

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ELECT POWER DIST & CONT FMEA NO 05-6 -2017 -1 REV:05/03/88

| | | | | | | |
|-------------|--------------------------|--------------|-----|-----|------------|-----------|
| ASSEMBLY | : INV DIST AND CONT | | | | CRIT.FUNC: | 1R |
| P/N RI | : V070-763380-002 | | | | CRIT. HDW: | 2 |
| P/N VENDOR: | | VEHICLE | 102 | 103 | 104 | |
| QUANTITY | : 3 | EFFECTIVITY: | X | X | X | |
| | : THREE REQUIRED, ONE | PHASE(S): | PL | LO | X OO | X DO X LS |
| | : PER INVERTER ASSEMBLY. | | | | | |

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS

| | | | | | |
|--------------|----------|---------------|---------------------------|---------------------|---------------------------|
| PREPARED BY: | | APPROVED BY: | | APPROVED BY (NASA): | |
| DES R | PHILLIPS | DES <i>SM</i> | <i>R. Williams</i> | SSM | <i>M.C. Stapp 5/16/88</i> |
| REL M | HOVE | REL | <i>M. C. Stapp 5-6-88</i> | REL | <i>William D. ...</i> |
| QE J | COURSEN | QE | <i>J. J. ... 5/6/88</i> | QE | <i>...</i> |

ITEM:

AC BUS (PHASE A, PHASE B, PHASE C AND RETURN)

FUNCTION:

SUPPLIES 115/200VAC, 400HZ, 3 PHASE POWER TO LOADS FROM THE INVERTER DISTRIBUTION AND CONTROL ASSEMBLIES 1, 2, 3.
 81V76A35 AC 1 (PHASE A, PHASE B, PHASE C AND RETURN),
 82V76A36 AC 2 (PHASE A, PHASE B, PHASE C AND RETURN),
 83V76A37 AC 3 (PHASE A, PHASE B, PHASE C AND RETURN)

FAILURE MODE:

SHORT CIRCUIT/ONE PHASE, SHORT CIRCUIT TO NEUTRAL OR STRUCTURE

CAUSE(S):

PIECE PART FAILURE, CONTAMINATION, MECHANICAL SHOCK, VIBRATION, THERMAL STRESS, PROCESSING ANOMALY

EFFECT(S) ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE (E) FUNCTIONAL CRITICALITY EFFECT:

(A) THE AFFECTED BUS VOLTAGE WILL BE INTERRUPTED IF SENSOR SWITCH IS IN "AUTO". IF SENSOR SWITCH IS IN MONITOR OR OFF POSITION, INVERTER WILL NOT AUTOMATICALLY BE DISCONNECTED AND VOLTAGE ON ALL THREE PHASES MAY BE DEGRADED. CREW ACTION REQUIRED TO ISOLATE AFFECTED BUS.

(B) ASSOCIATED 3-PHASE LOADS WILL BE LOST. CAN BE RESTORED BY OPENING CIRCUIT BREAKERS TO SHORTED PHASE. HOWEVER, CABIN FAN CANNOT BE RESTARTED AND LOADS ON 3-PHASE BREAKERS ARE LOST.

(C) EARLY MISSION TERMINATION DUE TO LOSS OF REDUNDANCY FOR CLOSING PAYLOAD BAY DOORS.

(D) FIRST FAILURE - NO EFFECT.

(E) POSSIBLE LOSS OF CREW/VEHICLE WITH SECOND FAILURE (LOSS OF ANOTHER 3 PHASE AC BUS) DUE TO LOSS OF CRITICAL LOADS (CABIN FANS, PAYLOAD BAY DOOR MOTORS, ET UMBILICAL DOORS).

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DISPOSITION & RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE:

(A,B,C,D) DISPOSITION AND RATIONALE

(A) DESIGN

EACH OF THREE 3-PHASE AC BUSES IS ESTABLISHED AND CONTAINED WITHIN ONE OF THREE INVERTER DISTRIBUTION AND CONTROL ASSEMBLIES (IDCA'S). EACH AC BUS IS FORMED BY ROUTING EACH OF THREE SINGLE-PHASE INVERTER'S OUTPUT POWER THROUGH A LATCHING RELAY. POWER IS THEN CONNECTED VIA AWG 16 WIRE TO A MODULAR TERMINAL BOARD (P/N MD417-0113-0001) WITHIN THE IDCA. FROM THE MODULAR TERMINAL BOARD AWG 12 WIRING IS ROUTED TO VARIOUS ORBITER PANELS. THE AC BUS CONSISTS OF THE AWG 16 WIRING FROM THE RELAYS, THE MODULAR TERMINAL BOARD AND THE AWG 12 WIRING TO THE CIRCUIT BREAKER PANELS. THE WIRING AND MODULAR TERMINAL BOARDS ARE ALL CERTIFIED TO ORBITER REQUIREMENTS.

(B) TEST

QUALIFICATION/CERTIFICATION

CERTIFICATION AT THE NEXT ASSEMBLY:

CERTIFICATION AT THE NEXT ASSEMBLY LEVEL WITHIN THE INVERTER DISTRIBUTION AND CONTROL ASSEMBLY INCLUDES:

| TEST | CAUSE CONTROL | | | | | |
|---|---------------|---|---|---|---|---|
| | a | b | c | d | e | f |
| THERMAL CYCLING (7.5 CYCLES, 20 TO 140 °F, STABILIZE 2 HOURS AT TEMPERATURE EXTREMES) | X | | | | X | X |
| BENCH/HANDLING SHOCK (16 DROPS TOTAL) | X | | | X | X | |
| RANDOM VIBRATION - OPERATIONAL CONFIGURATION QAVT - 0.067 g ² /HZ, 5 MINUTES/AXIS AND QVT - 0.03 g ² /HZ, 48 MINUTES/AXIS | X | | X | | X | |
| VISUAL EXAMINATION | X | | | | X | |

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(B) TEST (CONTINUED)

ACCEPTANCE AND SCREENING

ACCEPTANCE TEST AT THE NEXT ASSEMBLY (INVERTER DISTRIBUTION AND CONTROL ASSEMBLY):

| TEST | CAUSE CONTROL | | | | | |
|-------------------------------------|---------------|---|---|---|---|---|
| | a | b | c | d | e | f |
| VISUAL EXAMINATION | | | | | X | |
| INSULATION RESISTANCE | | | | | X | |
| VIBRATION (0.04 G ² /HZ) | | | X | | | |
| FUNCTIONAL CONTINUITY | X | X | | | X | X |

GROUND TURNAROUND TEST

PERFORM MANUAL AC BUS 1 (2, 3) ACTIVATION/DEACTIVATION WITH FREQUENCY AND PHASE ANGLE VERIFICATION. MONITOR THE POWER "ON/OFF" SWITCH STIMULI COMMANDS, "ON/OFF" EVENT DISCRETE INDICATORS, SWITCH SCAN DISCRETE, AND PHASE A, B AND C VOLTAGES. TEST IS PERFORMED FOR ALL FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION (FAILURE CAUSE e)

RECEIVING INSPECTION PERFORMS VISUAL AND DIMENSIONAL EXAMINATIONS OF ALL INCOMING PARTS. TEST REPORTS AND RECORDS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES.

CONTAMINATION CONTROL (FAILURE CAUSE b)

A GOOD HOUSEKEEPING AREA IS VERIFIED FOR ASSEMBLY. THE CONTACT SURFACES OF ALL ELECTRICAL TERMINATIONS ARE VERIFIED TO BE FREE OF ALL FOREIGN MATTER. ASSEMBLIES ARE VERIFIED TO BE FREE OF CHIPS, LOOSE HARDWARE, OIL, GREASE, OR OTHER FOREIGN MATTER, AND QUALITY CONTROL (QC) INSPECTION IS PERFORMED PRIOR TO FINAL CLOSE OUT OF THE UNITS.

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(C) INSPECTION (CONTINUED)

ASSEMBLY/INSTALLATION (FAILURE CAUSE a,b,e)

ASSEMBLY PROCESSES ARE MONITORED AND CONTROLLED BY ML0303-0029 WHICH ESTABLISHES THE REQUIRED TECHNIQUES FOR ALL PHASES OF BOX COMPONENT AND HARNESS FABRICATION. DETAILED INSPECTION IS PERFORMED ON PARTS PRIOR TO THE NEXT ASSEMBLY OPERATION. WIRE AND CABLE PREPARATION AND PROPER HARNESS FABRICATION ARE VERIFIED. TORQUE VALUES APPLIED AND TORQUE TOOL NUMBERS ARE RECORDED IN THE MANUFACTURING OPERATION RECORDS.

CRITICAL PROCESSES (FAILURE CAUSE b,e)

ALL CRITICAL PROCESSES AND CERTIFICATIONS ARE MONITORED AND VERIFIED BY INSPECTION. THE CRITICAL PROCESSES ARE SOLDERING, CRIMPING, CONFORMAL COATING, POTTING AND ELECTRICAL BONDING.

TESTING

THE ACCEPTANCE TEST PROCEDURE IS OBSERVED AND VERIFIED BY QC, INCLUDING PRE-TEST, FUNCTIONAL AND VIBRATION.

HANDLING/PACKAGING (FAILURE CAUSE c,d)

PARTS PACKAGED AND PROTECTED ARE VERIFIED BY INSPECTION TO APPLICABLE REQUIREMENTS.

(D) FAILURE HISTORY

THERE HAVE BEEN NO FAILURES OF AN AC BUS IN THE SHUTTLE ORBITER PROGRAM.

(E) OPERATIONAL USE

SENSOR SWITCH IN "AUTO" FOR ON-ORBIT OPERATIONS. FLIGHT CREW REQUIRED TO ISOLATE SHORTED AC PHASE BUS AND RECONFIGURE LOADS.