

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ELECT POWER DIST & CONT FMEA NO 05-6 -2005A -3 REV:05/16/88

ASSEMBLY :MAIN DC DIST ASSY	ABORT: RTLS,TAL	CRIT.FUNC: 1R
P/N RI :VQ70-764200		CRIT. HDW: 2
P/N VENDOR:	VEHICLE 102 103 104	
QUANTITY :1	EFFECTIVITY: X X X	
:ONE	PHASE(S): PL LO X OO X DO X LS	
:		

PREPARED BY:	REDUNDANCY SCREEN: A-PASS B-PASS C-PASS
DES R PHILLIPS	APPROVED BY:
REL M HOVE	APPROVED BY (NASA):
QE J COURSEN	SSM <i>W.C. Stager 2/5/88</i>
	REL <i>D. A. ... 7/1/88</i>
	QE <i>J. ... 7-25-88</i>

ITEM:

BUS, MAIN DC - MAIN DC BUS A

FUNCTION:

DISTRIBUTES PRIMARY 28 VDC POWER FOR ASSOCIATED MAIN BUS A LOADS.  
40V76A31

FAILURE MODE:

LOSS OF OUTPUT, LOSS OF MAIN DC BUS A

CAUSE(S):

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

EFFECT(S) ON:

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

(A) LOSS OF BUS VOLTAGE.

(B) LOSS OF POWER TO AFFECTED BUS LOADS, ASSOCIATED INVERTERS AND 3-PHASE  
AC BUS SET. THE AFFECTED APT RCS AC MOTOR VALVES CANNOT BE OPERATED FOR  
OMS/RCS INTERCONNECT OR CROSSFEED. ALSO, NEITHER OF TWO SERIES HE  
BLOWDOWN VALVES CAN BE OPENED.

(C) EARLY MISSION TERMINATION - LAND AT NEXT PRIMARY LANDING SITE  
OPPORTUNITY.

(D) FIRST FAILURE - NO EFFECT. CRIT 1 FOR RTLS BECAUSE LOSS OF ANY AC  
BUS PRIOR TO OMS/RCS INTERCONNECT LEAVES RCS TANK ISOLATION VALVE OPEN  
DURING RTLS OMS PROPELLANT DUMP. SINCE DUMPING OMS PROPELLANTS THROUGH  
RCS JETS NORMALLY SUPPLIED FROM THE AFFECTED OPEN TANK ISOLATION VALVE  
WOULD RESULT IN DUMPING RCS PROPELLANTS ALONG WITH OMS PROPELLANTS, AND  
MANUALLY CLOSING THE ASSOCIATED MANIFOLD ISOLATION VALVES AFTER THE OMS  
PROPELLANT DUMP BEGINS WOULD RENDER THOSE RCS MANIFOLDS UNUSABLE FOR ET  
SEPARATION, "SMART INTERCONNECT" SOFTWARE (CR'S 59126H AND 89210B,

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EFFECT(S) ON (CONTINUED):

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

EFFECTIVITY 01-88, STS-26) PROTECTS AGAINST LOSS OF AFT RCS MANIFOLDS BY  
Deselecting the affected RCS jets for the OMS propellant dump.  
Disabling half of the aft RCS jets for OMS propellant dump reduces the  
dump capability and may result in an incomplete OMS RTLS propellant dump  
with a possible violation of landing constraints for weight and/or center  
of gravity. Also crit 1 for RTLS and TAL because helium blowdown valves  
cannot be opened. Both He supply blowdown valves must open. Failure to  
open either series valve after MECO could prevent purge of fuselage  
compartment, LH2/LO2 umbilical cavities and aft OMS pods, allowing  
accumulation of propellants with possible fire and explosion resulting in  
probable loss of crew and vehicle (REF. 05-6J-2050-1, 03-1-0233-3).

(E) POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF SECOND MAIN DC BUS OR  
FUEL CELL/MAIN BUS CONTACTOR DURING ASCENT OR ENTRY RESULTING IN  
UNDERVOLTAGE CONDITION TO CRITICAL LOADS.

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 MAIN DC BUSES IS ESTABLISHED AND CONTAINED WITHIN ONE OF  
THREE MAIN DISTRIBUTION AND CONTROL ASSEMBLIES (MDCA'S). SUB-BUSES TO THE  
MAIN DC BUS CONTAINED IN OTHER ASSEMBLIES ARE ALL FUSED IN THE MDCA AND ARE  
NOT CONSIDERED A PART OF THE MAIN DC BUS FOR THIS CIL. EACH MAIN DC BUS  
CONSISTS PHYSICALLY OF SEVERAL SHORT LENGTHS OF SILVER-BEARING, HIGH-  
CONDUCTIVITY COPPER BAR STOCK (QQC576, TYPE 110) APPROXIMATELY 0.125 X.750  
INCHES IN CROSS SECTION JOINED TOGETHER AT VARIOUS POINTS BY TERMINAL STUDS  
ON THE MOTOR-DRIVEN POWER CONTACTORS, INSULATED STAND-OFF MOUNTING HARDWARE  
OR BY A SHORT LENGTH OF AWG 1/0 COPPER WIRE WITH HIGH-CURRENT CRIMP LUGS ON  
EACH END. THE BUS ALSO INCLUDES TWO LENGTHS OF AWG 1/0 COPPER WIRE WHICH  
CONDUCT FUEL CELL POWER TO THE MOTOR-DRIVEN POWER CONTACTORS.

THE PHYSICAL CONSTRUCTION FOR THE MAIN DC BUS MAKES IT EXTREMELY RUGGED AND  
VIRTUALLY IMMUNE TO FAILURE FROM VIBRATING OPEN OR BEING SHORTED TO GROUND  
(STRUCTURE). THE BUS IS FURTHER PROTECTED FROM BEING SHORTED TO GROUND  
THROUGH THE APPLICATION OF A SILICONE RUBBER RTV CONFORMAL COATING TO ALL  
EXPOSED SURFACES AFTER ASSEMBLY.

(B) TEST

QUALIFICATION/CERTIFICATION

CERTIFICATION AT THE NEXT ASSEMBLY:

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(B) TEST (CONTINUED)

**CERTIFICATION TESTS AT THE NEXT ASSEMBLY LEVEL WITHIN THE MAIN DISTRIBUTION AND CONTROL ASSEMBLY INCLUDE:**

TEST	CAUSE CONTROL					
	a	b	c	d	e	f
<b>CAUSES</b> a Piece part failure b Contamination c Vibration d Mechanical shock e Processing anomaly f Thermal stress						
QUALIFICATION ACCEPTANCE VIBRATION (QAVT AT 0.67 g <sup>2</sup> /HZ, 5 MIN/AXIS)	X		X			
RANDOM VIBRATION (FLIGHT AT 0.023 g <sup>2</sup> /HZ, 84 MIN/AXIS)	X		X			
THERMAL CYCLING (1 X 10 <sup>-6</sup> TORR, 6 CYCLES -45 TO 165 °F, 3 HOURS MIN AT EACH TEMPERATURE EXTREME)	X					X
DESIGN SHOCK (20G PEAK, 11 mSEC, 3 DROPS/AXIS, 18 TOTAL)	X			X		
THERMAL VACUUM (1 X 10 <sup>-6</sup> TORR, 200 °F, 7 HOURS)	X					X

**ACCEPTANCE AND SCREENING**

**ACCEPTANCE TEST AT THE NEXT ASSEMBLY (MAIN DC DISTRIBUTION AND CONTROL ASSEMBLY):**

TEST	CAUSE CONTROL					
	a	b	c	d	e	f
<b>CAUSES</b> a Piece part failure b Contamination c Vibration d Mechanical shock e Processing anomaly f Thermal stress						
INSULATION RESISTANCE (100 MEGOHMS AT 500 VDC)	X	X			X	
DIELECTRIC WITHSTANDING VOLTAGE (500 VDC, 2 mA LEAKAGE CURRENT)	X	X			X	
VIBRATION (AVT, 0.04 g <sup>2</sup> /HZ, 1 MINUTE/AXIS)	X		X		X	
VISUAL EXAMINATION	X				X	
FUNCTIONAL	X				X	

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(B) TEST (CONTINUED)

GROUND TURNAROUND TEST

VERIFY ACTIVATION OF ORBITER MAIN DC BUS A FROM THE MAIN BUS A GROUND SUPPLY. COMMAND THE ORBITER MAIN DC BUS A "ON", AND MONITOR THE STIMULI COMMANDS, DISCRETE EVENTS, AND BUS VOLTAGE. TEST IS PERFORMED FOR ALL FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION (FAILURE CAUSE a)

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.

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.

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(D) FAILURE HISTORY

THERE HAVE BEEN NO FAILURES OF A MAIN DC BUS IN THE SHUTTLE ORBITER PROGRAM.

(E) OPERATIONAL USE

FOR FUEL CELL ELECTRICAL SOURCE LOSS, POWER CAN BE RESTORED WITH A MAIN BUS TIE TO ANOTHER MAIN BUS. PRESENT FLIGHT RULES DO NOT PERMIT BUS TIEING TO A DEAD BUS UNTIL AFTER SRB SEPARATION. ONBOARD PROCEDURES MANAGE POWER FOR LOSS OF ONE FUEL CELL/MAIN DC BUS.