

04/25/09

INSTRUCTIONS TO APPENDIX I

ITEM 1 - TYPE NO. CONNECTION, CIRCULAR, MINIMUMS MESSAGES-XXXXX
 ITEM 2 - TYPE NO. CONNECTION, CIRCULAR, MINIMUMS MESSAGES-XXX
 ITEM 3 - TYPE NO. CONNECTION, CIRCULAR, MINIMUMS MESSAGES-XXXX

THE FOLLOWING TABLE LISTS FAILURE MODES AND CHECKS WHICH WERE CONSIDERED IN DEVELOPING THE FAILURE MODES AND EFFECTS ANALYSIS (FMEA'S) FOR THE ITEMS LISTED ABOVE:

FAILURE MODES / FAILURE CAUSE	ITEM 1			ITEM 2			ITEM 3		
	TYPE NO. CONNECTION	TYPE NO. CONNECTION	TYPE NO. CONNECTION	TYPE NO. CONNECTION	TYPE NO. CONNECTION	TYPE NO. CONNECTION	TYPE NO. CONNECTION	TYPE NO. CONNECTION	TYPE NO. CONNECTION
MIN-20-TYPE NUMBER (MIN) (a) Piece Part Structural Failure (b) Optimization (c) Vibration (d) Mechanical Shock (e) Processing Anomaly (f) Thermal Stress	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X
MIN-20-TYPE NUMBER (GROUND) (a) Piece Part Structural Failure (b) Optimization (c) Vibration (d) Mechanical Shock (e) Processing Anomaly (f) Thermal Stress	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X
INDEPENDENT MOUNTING (a) Piece Part Structural Failure (b) Optimization (c) Vibration (d) Mechanical Shock (e) Processing Anomaly	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X

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HEAVY CRITICAL ITEM LIST - HELI COPT 1/A FUELING CONNECTORS

NO.	YRZA NO.	RESISTIVE	CIRCUIT DESCRIPTION	FAILING MODE
1.	05-7 -2000-1	EPD&C (EM&SIC)	RT TUMBLE VALVE	PIN-TO-PIN SHT (GND) INDUCTIVENT DEPARTING
2.	05-7 -2001-1	EPD&C (EM&SIC)	RT TUMBLE VALVE	
3.	05-7E2-2000-1	LAND GEAR & CTRL	HLG RETURNING PYRO FORCED ASSIST	INDUCTIVENT DEPARTING
4.	05-7E2-2001-1	LAND GEAR & CTRL	LANDING GEAR DOWN COMMAND	PIN-TO-PIN SHT (HOT)
5.	05-7E2-2002-1	LAND GEAR & CTRL	LANDING GEAR DOWN CONTROL	PIN-TO-PIN SHT (GND)
6.	05-7E2-2000-1	LAND GEAR & CTRL	BRAKE COMMAND	PIN-TO-PIN SHT (HOT)
7.	05-7I2-2000-1	REMOTE MANIP ARM	REMOTE MANIPULATOR ARM CONTROL	PIN-TO-PIN SHT (HOT)
8.	05-7I2-2001-1	REMOTE MANIP ARM	REMOTE MANIPULATOR ARM CONTROL	PIN-TO-PIN SHT (GND)
9.	05-7J -2000-1	MPS	102 RELIEF SEQUENT VALVE	PIN-TO-PIN SHT (HOT)
10.	05-7J -2001-1	MPS	102 RELIEF SEQUENT VALVE	PIN-TO-PIN SHT (HOT)
11.	05-7J -2002-1	MPS	102 OVERBOARD BLEED VALVE	PIN-TO-PIN SHT (GND)
12.	05-7J -2003-1	MPS	102 OVERBOARD BLEED VALVE	INDUCTIVENT DEPARTING
13.	05-7J -2004-1	MPS	102 AND 102 ULLAGE PRESSURE TRANSDUCER	INDUCTIVENT DEPARTING
14.	05-7J -2005-1	MPS	102 HELIUM MANIFOLD PRESSURE VALVE	INDUCTIVENT DEPARTING
15.	05-7J -2006-1	MPS	HELIUM SUPPLY BLOWDOWN VALVE	INDUCTIVENT DEPARTING
16.	05-7E2-2000-1	AFT-RCS	LEFT & RIGHT AFT RCS FUEL & OXID VALVE	PIN-TO-PIN SHT (HOT)
17.	05-7E2-2000-1	FWD-RCS	FORWARD RCS FUEL & OXID VALVE	PIN-TO-PIN SHT (HOT)
18.	05-7N -2000-1	APU	APU START/STOP CONTROL	PIN-TO-PIN SHT (HOT)
19.	05-7B -2000-1	DPS	RTU NO. 1 COMMAND PATH	INDUCTIVENT DEPARTING
20.	05-7B -2000-2	DPS	RTU NO. 1 COMMAND PATH	PIN-TO-PIN SHT (HOT)

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06/02/89

APPENDIX K. ITEM 1 - TYPE NB CONNECTOR
NBXGEXX-XXXXXX

DISPOSITION & RATIONALE

(A) DESIGN, (B) TEST, (C) INSPECTION, (D) FAILURE HISTORY:

(A) DESIGN

MINIATURE, CIRCULAR, ELECTRICAL CONNECTORS DESIGNED TO BE ENVIRONMENTALLY SEALED WITH EACH CONTACT INDIVIDUALLY SEALED TO PREVENT MOISTURE ENTRY AND EXCLUSION AFTER MATING. CONTACTS ARE INDIVIDUALLY REMOVABLE TO FACILITATE REPAIR AND REWORK. SOCKET CONTACTS ARE SHROUDED TO PREVENT DAMAGE DUE TO ELECTRICAL PROBING AND SELF ALIGN WITH PIN CONTACT TO ASSIST MATING AND PREVENT BENT PIN CONTACTS. CONNECTOR COUPLING IS ACHIEVED BY A 1/3 TURN BAYONET COUPLING MECHANISM WITH A TACTILE DETENT WHEN FULLY MATED AND CAN BE INSPECTED THRU THREE INSPECTION HOLES.

DESIGNED, TESTED, AND INSPECTED TO MEET THE REQUIREMENTS OF THE SPACE SHUTTLE PROGRAM BY GEORGE C. MARSHALL SPACE FLIGHT CENTER SPECIFICATION 40M39569.

(B) TEST

QUALIFICATION/CERTIFICATION

CERTIFICATION TESTING AND ANALYSIS ARE COMPLETED AND APPROVED. TESTS INCLUDED THE FOLLOWING:

TEST	CAUSE CONTROL					
	a	b	c	d	e	f
PERFORMANCE	X	X			X	
THERMAL CYCLING (-250°F TO 392°F)						X
DURABILITY (250 CYCLES MATE/DEMATE)	X					
VIBRATION (1.0 G ² /HZ)	X		X			
PHYSICAL SHOCK (75 G)	X		X			
TEMPERATURE LIFE (392°F FOR 1000 HRS)	X					X
INSERT RETENTION (75 PSI)	X				X	
MOISTURE RESISTANCE (100% HUMIDITY)		X				
VACUUM (1x10 ⁻⁸ MM OF MERCURY)	X					
CORROSION (5% SALT FOG, 48 HOURS)		X				
OZONE (0.01% FOR 2 HOURS)	X	X				
CONNECTOR MATING AND UNMATING FORCES	X				X	
CONTACT RETENTION	X				X	

APPENDIX K, ITEM 1 - CONT'D

QUALIFICATION/CERTIFICATION, CONT'D

TEST	CAUSE CONTROL					
	a	b	c	d	e	f
DIELECTRIC WITHSTANDING VOLTAGE (1500 VAC AT 2 MILLIAMPERES)	X	X	X	X	X	
INSULATION RESISTANCE (5000 MEGOHMS)	X	X	X	X	X	
CONTACT RESISTANCE (LESS THAN 65 MILLIOHMS)	X	X	X		X	
EXPLOSIVE ATMOSPHERE (2 GAS MIXTURES WILL NOT INITIATE EXPLOSION)	X	X			X	
SHELL CONDUCTIVITY (LESS THAN 50 MILLIOHMS)	X	X	X		X	

ACCEPTANCE AND SCREENING

ALL CONNECTORS ARE SUBJECTED TO A 100% ACCEPTANCE PRIOR TO DELIVERY AND INCLUDE THE FOLLOWING:

TEST	CAUSE CONTROL				
	a	b	c	d	e
DIELECTRIC WITHSTANDING VOLTAGE (1500 VAC)	X	X	X	X	X
INSULATION RESISTANCE (5000 MEGOHMS AT 500 VDC)	X	X	X	X	X
CONTACT ENGAGING AND SEPARATING FORCES (VARIES BY SIZE)	X	X			X
EXAMINATION OF PRODUCT (DIMENSIONAL/VISUAL)	X	X			X
INSERT BOND INTEGRITY (VERIFIES ADHESIVES)	X	X			X
SHELL CONDUCTIVITY (LESS THAN 50 MILLIOHMS)	X	X			X

APPENDIX K, ITEM 1 - CONT'D

ACCEPTANCE TEST AT NEXT ASSEMBLY:

TEST	CAUSE CONTROL				
	a	b	c	d	e
EXAMINATION (VISUAL)	X	X			X
DIELECTRIC WITHSTANDING VOLTAGE (1500 VAC)*	X	X			X
CONTINUITY (VERIFIES CIRCUIT PATH)	X	X			X

* NOTE: PIGTAILED COMPONENTS AND MINOR HARNESS REWORK MAY NOT BE SUBJECT TO THIS TEST.

(C) INSPECTION

SUPPLIER INSPECTION (FAILURE CAUSE a,b,e)

ALL RAW MATERIALS INSPECTED AND RECORDED UPON RECEIPT. CRITICAL PROCESSES (MOLDING, BONDING, PLATING) WITNESSED AND TESTED BY INSPECTION PERSONNEL.

CONTAMINATION CONTROL (FAILURE CAUSE b)

CONTAMINATION CONTROL PROCESSES AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION. CONNECTOR IS CLEANED AS REQUIRED DURING AND AFTER ASSEMBLY.

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

ALL RAW MATERIALS ARE INSPECTED UPON RECEIPT. ALL MOLDING, MACHINING, AND ASSEMBLY PROCESSES ARE INSPECTED DURING AND AFTER COMPLETION OF THE ASSEMBLY CYCLE WHICH INCLUDES SHOP TRAVELERS AND MANDATORY INSPECTION POINTS (MIP'S).

CRITICAL PROCESSES (FAILURE CAUSE a,e)

ALL BONDING, PLATING AND MOLDING OPERATIONS ARE VERIFIED BY DETAILED INSPECTION INSTRUCTIONS.

TESTING (FAILURE CAUSE a,b,e)

100% OF ALL PARTS DELIVERED ARE TESTED AND WITNESSED BY INSPECTION PERSONNEL.

APPENDIX K, ITEM 1 - CONT'D

HANDLING/PACKAGING (FAILURE CAUSE a,b)

PARTS ARE PACKAGED AND PROTECTED TO MILITARY LEVELS AND ARE VERIFIED BY QC TO APPLICABLE LEVELS.

(D) FAILURE HISTORY

FAILURE HISTORY INDICATES NO GENERIC FAILURE MODES EXIST (APOLLO, MILITARY, COMMERCIAL).

NUMEROUS PROBLEMS HAVE BEEN REPORTED RELATED TO MISHANDLING AND ABUSE (WORKMANSHIP) BUT NOT RELATED TO DESIGN.

IN-FLIGHT FAILURE HISTORY:

INADVERTENT DEMATE: 1
PIN-TO-PIN SHORT (HOT): 0
PIN-TO-PIN SHORT (GND): 0

VEHICLE GROUND PROCESSING FAILURE HISTORY:

INADVERTENT DEMATE: 0
PIN-TO-PIN SHORT (HOT): 1
PIN-TO-PIN SHORT (GND): 0

INADVERTENT DEMATE FAILURE:

REFERENCE: CAR 24F009
DURING STS-51B THE ET DOOR DRIVE MOTOR B FAILED TO OPERATE. POST-FLIGHT TROUBLESHOOTING ISOLATED THE FAILURE TO A DEMATED ELECTRICAL CONNECTOR. THE CONNECTOR WAS ANALYZED AND NO ELECTRICAL OR MECHANICAL DAMAGE WAS FOUND. THE MOST PROBABLE CAUSE OF THIS FAILURE IS TECHNICIAN ERROR DURING GROUND PROCESSING RESULTING IN AN IMPROPERLY MATED CONNECTOR. THE VIBRATION OF LAUNCH THEN CAUSED THE IMPROPERLY MATED CONNECTOR TO INADVERTENTLY DEMATE.

PIN-TO-PIN SHORT FAILURE:

REFERENCE: CAR KB0038
DURING TROUBLESHOOTING OF IPR 26RV-0433 ON OV-103 A SHORT CONDITION WAS FOUND BETWEEN PIN A (AC POWER) AND PIN P (28 VOLT DC POWER) OF THE ELECTRICAL CONNECTOR. THE CONNECTOR WAS REMOVED FROM THE VEHICLE AND SENT TO DOWNEY LABORATORY AND TEST FOR FAILURE ANALYSIS. THE FAILURE ANALYSIS REVEALED A SMALL VOID OR CRACK IN THE PHENOLIC RESIN BETWEEN THE SHORTED PINS. SIGNS OF ARCING WERE VISIBLE AT THE EDGES OF THE VOID/CRACK, AND AT THE BASE OF BOTH PINS. THIS VOID/CRACK WAS BELIEVED TO HAVE BEEN A

APPENDIX K, ITEM 1 - CONT'D

PIN-TO-PIN SHORT FAILURE (CONT'D)

MANUFACTURING FLAW THAT ESCAPED INSPECTION AND TEST CONTROLS. THE CONNECTOR WAS ORIGINALLY PART OF THE PIGTAILS ON THE CENTERLINE LATCH MOTOR; THEREFORE, IT WAS NOT SUBJECTED TO THE DIELECTRIC WITHSTANDING VOLTAGE TEST AFTER INSTALLATION IN THE VEHICLE (SEE (*) UNDER (B) TEST, ACCEPTANCE TEST AT NEXT ASSEMBLY).

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APPROVED BY:

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