

CRITICAL ITEMS LIST (CIL)

SYSTEM: Electrical  
 SUBSYSTEM: ORB/ET to ET/SRB Harnesses  
 REV & DATE: J, 12-19-97  
 DCN & DATE:  
 ANALYSTS: J. Huggins/A. Oser

FUNCTIONAL CRIT: 1R  
 PHASE(S): b  
 HAZARD REF: E.01

FAILURE MODE: Fails Shorted

FAILURE EFFECT: b) Loss of mission and vehicle/crew due to vehicle breakup caused by loss of TVC for SRB.  
 Loss of mission and vehicle/crew due to flight instability caused by loss of rate detection system.  
 Loss of mission and vehicle/crew due to premature separation cue caused by loss of SRM chamber pressure measurements.  
 Loss of mission and vehicle/crew due to ignition of only one SRB caused by loss of ignition arm and fire commands.  
 Loss of mission and vehicle/crew due to inability to achieve SRB separation caused by loss of separation arm and fire commands.  
 Loss of mission and vehicle/crew due to loss of TVC rate detection system and/or separation function caused by loss of main bus power.

TIME TO EFFECT: Immediate

FAILURE CAUSE(S): A: Abrasion of Wire Insulation  
 B: Faulty Contact  
 C: Faulty Backshell  
 D: Faulty Ferrule  
 E: Faulty Connector  
 F: Faulty Potting

REDUNDANCY SCREENS: Screen A: PASS  
 Screen B: FAIL - Not detectable or detectable but not correctable in flight.  
 Screen C: FAIL - Failure of cable tray.

FUNCTIONAL DESCRIPTION: ET harnesses route the ORB/SRB functions defined by ICD-2-14001 between the ORB/ET and ET/ORB interfaces.

FMEA ITEM CODE(S)	PART NO.	PART NAME	QTY	EFFECTIVITY
3.12.1.2	80931003714-149	ET/SRB Harnesses	1	LWT-54 thru 88
	(303W01 J01/P41) -209		1	LWT-89 & Up
3.12.2.2	80931003714-150	ET/SRB Harnesses	1	LWT-54 thru 88
	(303W02 J02/P42) -210		1	LWT-89 & Up

REMARKS: These harnesses are grouped since the failure mode and Rationale for Retention are the same.

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FMEA ITEM CODE(S): 3.12.1.2, 3.12.2.2, 3.12.3.2, 3.12.4.2,  
3.12.5.2, 3.12.6.2, 3.12.7.2, 3.12.8.2,  
3.12.9.2, 3.12.10.2, 3.12.11.2, 3.12.12.2

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<u>FMEA ITEM CODE(S)</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY</u>	<u>EFFECTIVITY</u>
3.12.3.2	80931003714-159 (303W03 J03/P43) -219	ET/SRB Harnesses	1	LWT-54 thru 88
			1	LWT-89 & Up
3.12.4.2	80931003714-160 (303W04 J04/P44)	ET/SRB Harnesses	1	LWT-54 & Up
3.12.5.2	80931003714-169 (303W05 J05/P45)	ET/SRB Harnesses	1	LWT-54 & Up
3.12.6.2	80931003714-170 (303W06 J11/P51) -220	ET/SRB Harnesses	1	LWT-54 thru 88
			1	LWT-89 & Up
3.12.7.2	80931003714-179 (303W07 J12/P52) -229	ET/SRB Harnesses	1	LWT-54 thru 88
			1	LWT-89 & Up
3.12.8.2	80931003714-180 (303W08 J13/P53) -230	ET/SRB Harnesses	1	LWT-54 thru 88
			1	LWT-89 & Up
3.12.9.2	80931003714-189 (303W09 J14/P54)	ET/SRB Harnesses	1	LWT-54 & Up
3.12.10.2	80931003714-190 (303W10 J15/P55)	ET/SRB Harnesses	1	LWT-54 & Up
3.12.11.2	80931003714-199 (303W11 J06/P46) -239	ET/SRB Harnesses	1	LWT-54 thru 88
			1	LWT-89 & Up
3.12.12.2	80931003714-200 (303W12 J16/P56) -240	ET/SRB Harnesses	1	LWT-54 thru 88
			1	LWT-89 & Up

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RATIONALE FOR RETENTION

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DESIGN:

Engineering Process Specifications, STP6508 establishes the requirements to be met for fabrication and installation of airborne electrical interconnecting wire and cable assemblies. Harness assemblies produced as specified in STP6508 will meet the applicable requirements of MIL-W-81600 and 40M39582A.

The wire is procured from vendors that have qualification approval from Lockheed Martin. These vendors meet material specification STM E659.

For additional weight savings on SLWT, spare wires were eliminated from the harnesses.

- A: Electrical wires, cables, and bundles are routed to avoid abrasion, cutting or piercing of the insulation by contact with rough surfaces or sharp edges along the mounting surfaces. Sufficient slack is provided for installed harnesses to avoid strain on the conductors within the harnesses, termination points and associated connectors.
- B: The connector is designed with alignment tolerances to ensure proper insertion. Pins have rounded tips and the insert is designed with a tapered entry to guide the male contact for a firm mating and to preclude bent pins.
- C: The backshells are designed to the same standards as the connector to ensure proper cable support and handling characteristics.
- D: Ferrules are designed to fit tightly over wire or bundle with inner formation ring of a harder material. The outer crimp ring is a soft material. When installed on wire or bundle, the shield/ferrule termination is a snug fit. This termination is insulated and supported by shrinkable tubing.
- E: The connector is designed with a positive locking mechanism which ensures a positive lock for the coupling ring when the plug is fully mated with the receptacle and provides an audible sound when the coupling ring is seated in the positive lock position.
- F: The connectors on the SRB end of the harnesses are moisture proofed using a two part elastomer urethane compound (PR 1590). This potting is specified in MMMA procedure STP6510 for this application. STP6510 controls the mixing and application of the potting compound. PR 1590 meets the Engineering requirements for resistivity, moisture resistance, temperature and mechanical properties. This has been proven on several Aero - Space programs.

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RATIONALE FOR RETENTION

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DESIGN: (cont)

Redundancy Description

Four ET harnesses provide independent redundant TVC control functions from the Orbiter to each SRB: 303W01, 303W02, 303W03 and 303W11 for the LH SRB; 303W06, 303W07, 303W08 and 303W12 for the RH SRB. Two of four of these harnesses are required for proper system operation. Loss of any three harnesses results in the failure effect described above for loss of TVC.

Three ET harnesses provide independent redundant rate detection measurements and SRM chamber pressure measurements from each SRB to the Orbiter: 303W01, 303W02 and 303W03 for the LH SRB; 303W06, 303W07 and 303W12 for the RH SRB. Loss of one or two of these harnesses has no effect since redundancy is provided by the other harness(es). Loss of all three harnesses results in the failure effect described above for loss of the rate detection system and/or loss of SRM chamber pressure measurements.

Two ET harnesses provide independent redundant SRB ignition and separation arm and fire commands from E659 and E741 and Government Specifications 40M39569 and 40M39582 to the Orbiter to each SRB: 303W01 and 303W02 for the LH SRB; 303W06 and 303W07 for the RH SRB. Loss of one of these harnesses has no effect since redundancy is provided by the other harness. Loss of both harnesses results in the failure effect described above for loss of ignition and/or separation arm and fire commands.

Two ET harnesses provide independent redundant electrical power sources from the Orbiter to the OI A and B busses in each SRB: 303W04 and 303W05 for the LH SRB; 303W09 and 303W10 for the RH SRB. Loss of one of these harnesses has no effect since redundancy is provided by the other harness. Loss of both harnesses results in the failure effect described above for loss of main bus power.

TEST:

The harness and harness components are certified. Reference HCS MMC-ET-TM08-L-E051.

Vendor:

Piece parts for the electrical system are procured and tested to approved Lockheed Martin Drawing Specifications E659, E741 and Government Specification 40M39569.

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TEST: (cont)

MAF:

- A-E: Perform Dielectric Withstanding Voltage Test (STP6508 and TM04k).
- A-E: Perform Isolation Resistance Test (TM04k).
- A-E: Perform Crimp Tool Certification Test (STP6503 for ferrules and STP6504 for sockets and pins).
- F: Perform hardness test of potting sample (STP6510).

Launch Site:

- A-E: Perform Orbiter to SRBs functional test (OMRSD File II).

INSPECTION:

Vendor:

Surveillance by Lockheed Martin Procurement Quality is performed to ensure compliance with specifications.

MAF Quality Inspection:

- A: Inspect wire for freedom of nicks, scrapes, cuts, breaks, abrasion or other physical damage prior to assembly (STP6508).
- A: Inspect the installed harness per the installation requirements (STP6508).
- B: Inspect connector, pins, or sockets for freedom of damage, are not broken, bent, misaligned or corroded, and connector is free of foreign material (STP6501).
- C: Inspect for freedom of damage of connector, backshell, attaching hardware and grommet (STP6501).
- D: Inspect for proper crimp configuration and freedom of physical damage (STP6503 for ferrules and STP6504 for pins and sockets).
- D: Verify certification of crimping tool (STP6503 for ferrules and STP6504 for pins and sockets).

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INSPECTION: (cont)

- F: Inspect potting of connector (STP6510).
- F: Verify hardness sample (STP6510).

MAF Quality Inspection:

- A-E: Witness Dielectric Withstanding Voltage Test (STP6508 and TM04k).
- A-E: Witness Isolation Resistance Test (TM04k).

Launch Site:

- A-E: Witness Orbiter to SRBs functional tests (OMRSD File II).

FAILURE HISTORY:

Current data on test failures, unexplained anomalies and other failures experienced during ground processing activity can be found in the PRACA data base.