

- 1) CIL ITEM : H150-01, H151-01, H152-01, H153-01, H154-01, H155-01
- 2) FMEA CODE : H150, H151, H152, H153, H154, H155
- 3) COMPONENT : FASCOS COAXIAL HARNESS
- 4) PART NUMBER : R0014030
- 5) SYSTEM/SUBSYSTEM : ELECTRICAL HARNESS/HXXX (FASCOS REDLINE ACTIVE)
- 6) FAILURE MODE : OPEN OR SHORT CIRCUIT IN HARNESS CABLE. LOSS OF CONNECTOR.

- 7) PREPARED : SSME RELIABILITY
- 8) APPROVED :
- 9) DATE : 04-19-96
- 10) REVISION/CHANGE : -001/0
- 11) EFFECTIVITY : -81/201,-91/211/-101/221
:-131/251,-111/231,-121/241
- 12) HAZARD REFERENCE: SEE LISTINGS BELOW
- 13) CCBD # : ME3-01-3285

PHASE	FAILURE DESCRIPTION/EFFECT	CRITICALITY
SM 4-2	<p>FAILURE OF TWO HARNESS CHANNELS OUTSIDE OF QUALIFICATION LIMITS CAUSES CHANNEL DISQUALIFICATION RESULTING IN A LOSS OF REDLINE PROTECTION. LOSS OF VEHICLE DUE TO TURBOPUMP FAILURE MAY RESULT IF EXCESSIVE VIBRATION OCCURS AND IS NOT DETECTED.</p> <p>REDUNDANCY SCREENS: TURBOPUMP SYSTEM - HARNESS SYSTEM: UNLIKE REDUNDANCY</p> <p>A: PASS. REDUNDANT HARDWARE ITEMS ARE CAPABLE OF CHECKOUT DURING NORMAL GROUND TURNAROUND. B: PASS. LOSS OF A REDUNDANT HARDWARE ITEM IS DETECTABLE DURING FLIGHT. C: PASS. LOSS OF REDUNDANT HARDWARE ITEMS COULD NOT RESULT FROM A SINGLE CREDIBLE EVENT.</p>	1R HAZARD REF: ME-D1S,M
SM 4-3	<p>FAILURE OF ONE QUALIFIED HARNESS CHANNEL WITHIN REDLINE LIMITS RESULTS IN A LOSS OF REDLINE PROTECTION. LOSS OF VEHICLE DUE TO TURBOPUMP FAILURE MAY RESULT IF EXCESSIVE VIBRATION OCCURS AND IS NOT DETECTED.</p> <p>REDUNDANCY SCREENS: TURBOPUMP SYSTEM - HARNESS SYSTEM: UNLIKE REDUNDANCY</p> <p>A: PASS. REDUNDANT HARDWARE ITEMS ARE CAPABLE OF CHECKOUT DURING NORMAL GROUND TURNAROUND. B: FAIL. LOSS OF A REDUNDANT HARDWARE ITEM IS NOT DETECTABLE DURING FLIGHT. C: PASS. LOSS OF REDUNDANT HARDWARE ITEMS COULD NOT RESULT FROM A SINGLE CREDIBLE EVENT.</p>	1R HAZARD REF: ME-D1S,M
SM 4-4	<p>FAILURE OF TWO REMAINING OR ALL QUALIFIED HARNESS CHANNELS OUTSIDE OF MONITOR REDLINE LIMITS CAUSES ERRONEOUS ENGINE SHUTDOWN. MISSION ABORT.</p> <p>REDUNDANCY SCREENS: HARNESS SYSTEM: LIKE REDUNDANCY</p> <p>A: PASS. REDUNDANT HARDWARE ITEMS ARE CAPABLE OF CHECKOUT DURING NORMAL GROUND TURNAROUND. B: FAIL. LOSS OF A REDUNDANT HARDWARE ITEM IS NOT DETECTABLE DURING FLIGHT. C: PASS. LOSS OF REDUNDANT HARDWARE ITEMS COULD NOT RESULT FROM A SINGLE CREDIBLE EVENT.</p>	1R HAZARD REF: ME-D1S,M

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DESIGN

DOCUMENT REF.

FAILURE CAUSE A: CONDUCTOR OR INSULATION DAMAGE CAUSED BY VIBRATION, FLEXURE, ROUTING, OR CLAMPING.

NEW DESIGNED COAXIAL HARNESS CABLES ARE MANUFACTURED UTILIZING A STRANDED CONDUCTOR OVER SOLID WIRE AND A KEVLAR OVERBRAID WITH A NEW CABLE CONNECTOR. THE NEW STRANDED SOLID CONDUCTOR WITH KEVLAR BRAID DESIGN PROVIDES ADDITIONAL COAXIAL HARNESS RELIABILITY (1). MATERIAL SELECTION OF THE WIRES, INSULATORS, CONNECTORS AND ASSEMBLY TECHNIQUES ARE CONTROLLED BY SPECIFICATION (2) TO GUARD AGAINST THE FAILURE OF THE HARNESS IN THE ENVIRONMENTS IT IS EXPOSED TO. THESE CONTROLS ARE ESTABLISHED BY SPECIFICATIONS FOR CONNECTORS AND WIRE SELECTION (3), AND ARE KEYED TO THE FUNCTION AND USAGE OF THE HARDWARE. TO PREVENT DETERIORATION OF THE CONDUCTOR OR INSULATOR, WIRES ARE OF SUCH CROSS SECTION AS TO PROVIDE AMPLE AND SAFE CURRENT CARRYING CAPACITY. THE MAXIMUM DESIGN CURRENT IN ANY WIRE IS LIMITED SO THAT "WIRE TOTAL TEMPERATURE" WILL NEVER EXCEED THE RATED WIRE TEMPERATURE (2). CABLE ROUTING IS CONTROLLED BY THE ASSEMBLY DRAWINGS (4) THAT ESTABLISH THE RETAINING CLAMPS AND RESTRAINING TIES. THE SECURING CLAMPS (5) INCORPORATE RUBBER GROMMETS THAT PREVENT PINCHING OR CUTTING OF THE INSTALLED HARNESS.

- (1) ECP 1136
- (2) RL10014
- (3) RC1336
- (4) RS007007
- (5) RE127-2018

FAILURE CAUSE B: LOOSE, WORN OR DAMAGED PIN OR PINS.

FAILURE CAUSE C: DAMAGED CONTACT OR CRIMP.

FAILURE CAUSE E: CONNECTOR SHELL FAILURE.

FAILURE CAUSE F: BROKEN LOCKING RING.

FAILURE CAUSE G: DAMAGED POTTING.

CONNECTOR SELECTION OF THE SUBASSEMBLIES IS CONTROLLED BY SPECIFICATION REQUIREMENTS (1). THE REQUIREMENTS INCORPORATE CONTROLS (2) TO GUARD AGAINST THE ENVIRONMENTS THEY ARE EXPOSED TO. THE CONNECTORS MEET CEI REQUIREMENTS FOR HIGH CYCLE FATIGUE, LOW CYCLE FATIGUE, AND MINIMUM FACTORS OF SAFETY (3). THE CONNECTOR SELECTION IS CONTROLLED PER SPECIFICATION REQUIREMENTS (4). THE CONNECTORS INCORPORATE A MALE-FEMALE DESIGN. THE CONNECTORS ARE PROTECTED FROM BACKING OFF THE THREADS BY POTTING THE CONNECTIONS (5). WIRE CRIMPING AND CONNECTOR WELDING ARE CONTROLLED BY SPECIFICATION REQUIREMENTS (4).

- (1) RL10014
- (2) R0014030
- (3) RL00532
RSS-8546
CP320R00038
- (4) RC1336
- (5) RL00477

FAILURE CAUSE D: CORROSION OR MOISTURE.

THE ELECTRICAL COMPONENTS OF THE WIRE HARNESS ARE PROTECTED FROM CORROSION BY INHERENT MATERIAL DESIGN AND PROTECTIVE EXTERNAL COVERING OF THE CABLE. THE WIRE INSULATION IS COMPOSED OF TEFLON (1). TEFLON HAS RESISTANCE TO FLUIDS AND ATMOSPHERIC VAPORS. THE CENTER CONDUCTOR IS CONSTRUCTED FROM SOLID COPPER WELD WIRE WITH A NICKEL OVERPLATE (2). THE CONNECTORS ARE POTTED IN PLACE FURTHER REDUCING THE POSSIBILITY OF CORROSION/MOISTURE (3). CONNECTORS ARE MAINTAINED IN THEIR SEALED BAGS UNTIL READY FOR ASSEMBLY. CONNECTORS ARE PROTECTED TO PREVENT DAMAGE OR CONTAMINATION RESULTING FROM CONTACT WITH EACH OTHER OR ADJACENT OBJECTS (4).

- (1) RC1336
- (2) MSFC-SPEC-250
- (3) RL00477
- (4) RL00284

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ALL CAUSES:			
FASCOS ACCELEROMETER HARNESSES ARE REDUNDANT. THE CONTROLLER SOFTWARE IS CONFIGURED TO DETECT AND RESPOND PROPERLY TO THE FASCOS INPUT. HOWEVER, THE CONTROLLER SOFTWARE IS NOT CAPABLE OR CONFIGURED TO IDENTIFY THAT A FAILURE RESULTS IN A VOTE FOR SHUTDOWN (1). THE HARNESS DESIGN IS TESTED DURING ENGINE CERTIFICATION TESTING (2).			(1) CP406R0008 (2) VCR RSS-ECP-676 VCR RSS-ECP-893
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POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
FAILURE CAUSE A:	R0014030 - COAXIAL HARNESS		R0014030
	ASSEMBLY INTEGRITY	<p>THE FOLLOWING TESTS ARE PERFORMED DURING MANUFACTURING AND ASSEMBLY ACCEPTANCE:</p> <ul style="list-style-type: none"> - EACH WIRE RUN IS VERIFIED FOR END TO END CONTINUITY - INSULATION RESISTANCE BETWEEN EACH CONDUCTOR AND SHIELD IS VERIFIED TO BE WITHIN SPECIFICATION - CAPACITANCE IS VERIFIED TO BE WITHIN SPECIFICATION. 	<p>RL00284</p> <p>RC1336</p> <p>RC1336</p> <p>RC1336</p>
	INSTALLATION INTEGRITY	<p>INSTALLATION OF THE HARNESSES IS VERIFIED PER SPECIFICATIONS DEFINING THE:</p> <ul style="list-style-type: none"> - INSPECTION OF HARNESSES PRE AND POST INSTALLATION - ROUTING REQUIREMENTS WHICH INCLUDE: <ul style="list-style-type: none"> INSTALLATION PATH, CLAMP LOCATIONS AND SIZES SEPARATION DISTANCE REQUIREMENTS FROM OBJECTS WHICH COULD CAUSE CABLE OR CONNECTOR DAMAGE MINIMUM BEND RADII - INSPECTION OF CONNECTORS PRIOR TO MATING. 	<p>RL00477</p> <p>RS007007</p> <p>RS007007</p> <p>RL00284</p> <p>RL00477</p>

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[CIL ITEM: H150-01, H151-01, H152-01, H153-01, H154-01, H155-01]		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
FAILURE CAUSES B,C,E, F,G:	RO014030 - FASCOS HARNESS		RO014030
	ASSEMBLY INTEGRITY	HARNESS/CONNECTOR ASSEMBLY PROCESSES ARE VERIFIED PER SPECIFICATIONS WHICH INCLUDE: <ul style="list-style-type: none"> - CRIMPING OF SHIELD - INSTALLATION OF HEAT SHRINKABLE, SILICON RUBBER, STRAIGHT TUBING AND MOLDED PARTS - SELECTION AND USEAGE OF PROTECTIVE CLOSURES - WELDING OF CONNECTOR CONTACT 	RL00081 RO014030 RA0116-054 RC1336
		COMPLETED ASSEMBLY IS INSPECTED FOR FRAYING AT THE CONNECTOR JUNCTION, CONTACT PIN RETENTION, MISSING PARTS, DAMAGE OR DEFECTS TO SHELL OR PINS.	RL00477
		FOLLOWING INSTALLATION, THE CONNECTORS ARE VERIFIED SECURED AND POTTED TO THE ACCELEROMETER AND FASCOS.	RL00477
FAILURE CAUSE D:	RO014030 - FASCOS HARNESS		RO014030
	CLEANLINESS OF COMPONENTS	CLEANLINESS REQUIREMENTS ARE VERIFIED PER SPECIFICATION DURING MANUFACTURING OF THE HARNESS ASSEMBLY.	RL00284
		DUST AND MOISTURE PROOF CAPS ARE VERIFIED INSTALLED ON THE CONNECTOR WHEN NOT IN USE.	RL00284
	SURFACE FINISH	THE PLATING ON THE CONDUCTOR IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RC1336
ALL CAUSES:	ASSEMBLY INTEGRITY	PRIOR TO CONNECTOR MATING, THE CONNECTOR IS INSPECTED FOR ANY CORROSION OR DAMAGE WHICH WOULD ALLOW MOISTURE TO ENTER THE CONNECTOR.	RL00477
	RO014030 - FASCOS HARNESS		RO014030
	ASSEMBLY INTEGRITY	RETEST REQUIREMENTS AFTER HARNESS REPLACEMENT OR CONNECTOR DEMATE VERIFY THAT THE PROPER CONTROLLER ELECTRICAL CHECKOUTS ARE PERFORMED TO RE-VALIDATE THE HARNESS ASSEMBLY. HARNESSSES ARE INSPECTED FOR DAMAGE, PROPER ROUTING, AND PROPER POTTING APPLICATION DURING AFT CLOSEOUT INSPECTION.	OMRSD V412AO.010 OMRSD V412AO.020 OMRSD V41BUO.070

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		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
		<p>HARNES OPERATION IS VERIFIED AFTER ANY REPAIR OR REPLACEMENT BY THE SIGNATURE RESPONSE TEST.</p> <p>ALL CONTROLLER AND FASCOS DATA FROM THE PREVIOUS FLIGHT OR HOT FIRE IS REVIEWED. ANY ANOMALOUS CONDITION NOTED REQUIRES FURTHER TESTING OR HARDWARE REPLACEMENT PRIOR TO THE NEXT FLIGHT. IN THE EVENT OF MAINTENANCE OR REPAIR, THE ABOVE CHECKOUTS ARE APPLICABLE. (LAST TEST)</p>	<p>OMRSD V41AWO.050</p> <p>MSFC PLN 1228</p>
<p>FAILURE HISTORY: COMPREHENSIVE FAILURE HISTORY DATA IS MAINTAINED IN THE PROBLEM REPORTING DATABASE (PRAMS/PRACA). REFERENCE: NASA LETTER SA21/88/308 AND ROCKETDYNE LETTER 88RC09761.</p>			

OPERATIONAL USE: NOT APPLICABLE.