

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-1E-056 -X**

**SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE
REVISION: 0 03/07/88**

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: MAIN LANDING GEAR (MLG)	MC621-0051
SRU	: MLG WHEEL THERMAL RELIEF PLUG B. F. GOODRICH	49-127-1

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
MAIN LANDING GEAR THERMAL RELIEF PLUG**

REFERENCE DESIGNATORS:

**QUANTITY OF LIKE ITEMS: 12
THREE PER WHEEL**

**FUNCTION:
THREE THERMAL RELIEF DEVICES INSTALLED IN EACH WHEEL ASSEMBLY WHICH
RELIEVES THE TIRE INFLATION PRESSURE WHEN THE TIRE BEAD SEAT
TEMPERATURE IS EXCEEDED.**

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-1E-056-01

REVISION#: 1 08/03/97

SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE

LRU: MAIN LANDING GEAR (MLG)

CRITICALITY OF THIS

ITEM NAME: MLG WHEEL THERMAL RELIEF PLUG

FAILURE MODE: 1/1

FAILURE MODE:

PREMATURE OPERATION - RESULTING IN LANDING WITH A FLAT TIRE.

MISSION PHASE:

- LO LIFT-OFF
- OO ON-ORBIT
- DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

- 102 COLUMBIA
- 103 DISCOVERY
- 104 ATLANTIS
- 105 ENDEAVOUR

CAUSE:

DEGRADED QUALITY - RELIEVES PRESSURE BELOW SPECIFIED BEAD SEAT TEMPERATURE

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

- A)
- B)
- C)

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF ROLLING AND LOAD CARRYING CAPABILITY ON AFFECTED TIRE/WHEEL ASSEMBLY. LOSS OF ADJACENT TIRE/WHEEL ASSEMBLY AND LOSS OF ALL BRAKING

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CAPABILITY ON AFFECTED STRUT. PROBABLE FAILURE OF AFFECTED MLG STRUT OR ITS ATTACHMENTS.

(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
PROBABLE LOSS OF MISSION/CREW/VEHICLE DUE TO THE EXCESSIVE YAWING FORCES PRODUCED AND/OR LOSS OF 50 PERCENT OF BRAKING CAPABILITY CAUSING VEHICLE TO DEPART RUNWAY.

(D) CREW, VEHICLE, AND ELEMENT(S):
SAME AS C.

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:
EUTECTIC MATERIAL SELECTED FOR ITS STABLE THERMAL CHARACTERISTICS. HEAT SOAK BACK FROM BRAKES DOES NOT RESULT IN SIGNIFICANT TEMPERATURE RISE UNTIL AFTER ROLLOUT. DESIGN PRECLUDES LOSS OF PLUG WITHOUT ITS MELTING.

(B) TEST:
QUALIFICATION TESTS: THE PERFORMANCE OF THE THERMAL RELIEF PLUG (TRP) WAS TESTED DURING THE MAIN WHEEL AND BRAKES QUAL TESTS - BRAKE DYNAMIC TESTS, TUBELESS WHEEL TESTS (ORBIT LEAKAGE TEST), AND ROLL TESTS.

BRAKE DYNAMIC TESTS (BASELINE BRAKE):
NORMAL ENERGY STOPS - THE TRP DID NOT RELIEVE PRESSURE DURING THE BRAKE NORMAL ENERGY STOPS (36.55 MILLION FT-LBS) AS THE WHEEL BEAD SEAT TEMPERATURE DID NOT EXCEED 400 DEGREES F. THE TRP DID BLOW TWO MINUTES EIGHT SECONDS AFTER THE MAXIMUM ENERGY STOP (60.2 MILLION FT-LBS). THE WHEEL BEAD SEAT TEMPERATURE AT THE TIME THE TRP BLEW WAS APPROXIMATELY 350 DEGREES F.

ACCEPTANCE TESTS INCLUDE LOT SAMPLE TESTS, DIMENSIONAL CHECKS, FINISH, CLEANLINESS AND THAT CERTIFIED MATERIALS AND PROCESSES HAVE BEEN USED.

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GROUND TURNAROUND TEST

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD. THE OMRSD DATA PROVIDED BELOW IS NO LONGER BEING KEPT UP-TO-DATE. IF THERE IS ANY DISCREPANCY BETWEEN THE GROUND TESTING DATA PROVIDED BELOW AND THE OMRSD, THE OMRSD IS THE MORE ACCURATE SOURCE OF THE DATA.

WHEEL AND TIRE INSPECTION;

THE THERMAL RELIEF PLUGS ARE INSPECTED (PER THE ML0308-0142 SPEC.) FOR EVIDENCE OF LOOSENESS, DEFORMATION OR CORROSION.

MLG WHEEL/TIRE CERT:

VERIFIES MLG WHEEL/TIRE ASSEMBLY HAS BEEN BUILT UP AND TESTED PER THE VO70-510002 DRAWING, ML0308-0029 LANDING GEAR RIGGING SPECIFICATION AND ML0308-0142 MLG WHEEL/TIRE INSTALLATION AND INSPECTION SPECIFICATION. THIS INCLUDES TORQUING THE INFLATION VALVE CAP TO A VALUE OF 8 TO 10 IN-LBS.

FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION:

RECEIVING INSPECTION

RECEIVING INSPECTION SAMPLE INSPECTS PER MIL-STD-105 EUTECTIC MELTING POINT. RECEIVING INSPECTION LEAK TESTS THE PLUGS.

CONTAMINATION CONTROL

CORROSION CONTROL REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

WHEEL ASSEMBLED PER REQUIREMENTS AND INSPECTED FOR PROPER ASSEMBLY.

CRITICAL PROCESSES

CHEMISTRY OF FUSIBLE MATERIAL VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT SAMPLE INSPECTION PER MIL-STD-105 IS VERIFIED BY INSPECTION.

TESTING

SAMPLE INSPECTION FOR ALL PHYSICAL CHARACTERISTICS AND DIMENSIONS IS VERIFIED.

PACKAGING/HANDLING

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

NONE.

(E) OPERATIONAL USE:

FAILURE DETECTED ON ORBIT - AN ABORT DECISION IS REQUIRED TO SELECT A SUITABLE LANDING PROFILE/SITE.

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WHEEL FAILURE BEFORE NLG TOUCHDOWN - CREW WILL ATTEMPT TO USE AERO
RUDDER AND BRAKING ON THE OPPOSITE SIDE IN AN ATTEMPT TO MAINTAIN
DIRECTIONAL CONTROL.

WHEEL FAILURE AFTER NLG TOUCHDOWN - CREW WILL USE NWS, AERO RUDDER AND
DIFFERENTIAL BRAKING TO MAINTAIN DIRECTIONAL CONTROL.

- APPROVALS -

EDITORIALLY APPROVED	: BNA	: <u>J. Kypura 8/3/97</u>
EDITORIALLY APPROVED	: JSC	: <u>A. O'Leary 9-12-97</u>
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 96-CIL-011_07-1E