

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 02-5E-L07-XSUBSYSTEM NAME: PAYLOAD RETEN & DEPLOY - IUS DAMPER/LATCHES
REVISION : 3 01/09/91

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	LIGHTWEIGHT LONGERON LATCH	V073-544100
LRU :	MIDDLEWEIGHT LONGERON LATCH	V073-544230
LRU :	SUPER MIDDLE WT LONGERON LATCH	V073-544530
■ SRU :	SWITCH, LIMIT	MC452-D123-0003

PART DATA

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
TWO "LATCH CLOSED" LIMIT SWITCHES, S2 AND S4, ARE INSTALLED IN SWITCH MODULE AND ARE ACTUATED BY SAME LEVER.

QUANTITY OF LIKE ITEMS:
20 MAX

FUNCTION:
LIGHTWEIGHT, MIDDLEWEIGHT OR SUPER MIDDLEWEIGHT LONGERON LATCH REACTS FLIGHT LOADS ON PAYLOAD HORIZONTAL TRUNNION HELD BETWEEN TWO SPHERICAL HALF BEARINGS. THE SWITCH MECHANISM CONSISTS OF DUAL LIMIT SWITCHES ACTIVATED BY A COMMON LEVER. WHEN LATCH IS CLOSED, LATCH CLOSED LIMIT SWITCH ASSEMBLY VERIFIES LATCH IS CLOSED. LIMIT SWITCH SIGNAL REMOVES POWER FROM THE MOTORS AND GIVES THE CREW AN INDICATION THAT THE LATCH IS CLOSED.

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REVISION# 3 10/10/90 R
SUBSYSTEM: PAYLOAD RETEN & DEPLOY - IUS DAMPER/LATCHES
LRU :LIGHTWEIGHT LONGERON LATCH
ITEM NAME: SWITCH, LIMIT
CRITICALITY OF THIS FAILURE MODE:1/1

■ FAILURE MODE:
TRANSFERS PREMATURELY//INADVERTENTLY (LATCH CLOSED)

MISSION PHASE:
OO ON-ORBIT
DO DE-ORBIT

■ VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS
: 105 ENDEAVOUR

CAUSE:
ACCELERATION, CONTAMINATION/FOREIGN OBJECT/DEBRIS, DEFECTIVE PART/
MATERIAL OR MANUFACTURING DEFECT, TEMPERATURE, VIBRATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)
B)
C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
FAILURE WILL PREVENT LATCH CLOSURE.

(B) INTERFACING SUBSYSTEM(S):
FAILURE WILL RESULT IN PAYLOAD INADEQUATELY RESTRAINED IN PAYLOAD BAY.

(C) MISSION:
FAILURE WITH LATCH OPEN WILL RESULT IN POSSIBLE LOSS OF MISSION DUE TO

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INABILITY TO RESTRAIN PAYLOAD.

(D) CREW, VEHICLE, AND ELEMENT(S):

FAILURE LATE IN LATCH CYCLE (IMMEDIATELY BEFORE LINKAGE IS OVERCENTER LOCKED) MAY GO UNOBSERVED AND MAY RESULT IN LOSS OF CREW/VEHICLE DURING ENTRY DUE TO UNRESTRAINED PAYLOAD.

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

(A) DESIGN:

THE SWITCH MECHANISM CONSISTS OF DUAL LIMIT SWITCHES ACTIVATED BY A COMMON LEVER. ONLY ONE SWITCH IS REQUIRED FOR SIGNAL ACTUATION. TWO SPRINGS ARE USED TO MAINTAIN SWITCH MODULE ACTUATION ARM IN UNACTUATED POSITION.

(B) TEST:

ACCEPTANCE TESTS: THE FOLLOWING TESTS ARE PERFORMED FOR ALL FLIGHT ARTICLES AND WERE PERFORMED FOR EACH QUALIFICATION TEST ARTICLE:
VIBRATION - RANGE 20 TO 2,000 HZ MAXIMUM LEVEL OF 0.04 g²/HZ FROM 80 TO 350 HZ, ALL AXES. THERMAL - STABILIZED RANGE FROM -180 DEG F TO +255 DEG F. FUNCTIONAL TESTS CONDUCTED AT -80 DEG F, +70 DEG F, AND +255 DEG F. LOADS/ALIGNMENT - VERIFY RETENTION OF LATCHED POSITION AT 80% LIMIT LOAD, AS WELL AS SPHERICAL BEARING TORQUE RESISTANCE AND TRAVEL LIMITS. ONE UNIT TESTED TO 110% LIMIT LOAD. ELECTRICAL - VERIFY (WITHIN DESIGN LIMITS) CONTINUITY, DIELECTRIC STRENGTH, INSULATION RESISTANCE, AND SWITCH OPERATION.

QUALIFICATION TESTS: THE FOLLOWING IS A SUMMARY OF TESTS CONDUCTED PER CR 44-544230-001 TO INCLUDE BOTH NATURAL AND INDUCED ENVIRONMENTAL EFFECTS TO THE LATCH ASSEMBLY AND THE LATCH-TO-BRIDGE/TRUNNION FRICTION/LOAD INTERFACE. FUNCTIONAL TESTS WERE CONDUCTED DURING AND FOLLOWING EACH PHASE OF TESTING TO DETERMINE EFFECTS. ENVIRONMENTS AND REQUIREMENTS ACCEPTED BY ANALYSIS INCLUDE FUNGUS, OZONE, SALT SPRAY, ACCELERATION, SOLAR RADIATION (THERMAL AND NUCLEAR), METEORIODS, SAND AND DUST, STORAGE, FACTOR OF SAFETY, RELIABILITY, MAINTAINABILITY, MATERIALS AND PROCESSES, ELECTRICAL DESIGN AND SAFETY. CERTIFICATION BY SIMILARITY INCLUDED VACUUM, RANDOM VIBRATION, HANDLING SHOCK, THERMAL CYCLING, FULL OPERATING LIFE, QUALIFICATION ACCEPTANCE VIBRATION TEST (QAVT), QUALIFICATION ACCEPTANCE THERMAL TEST (QATT), TRUNNION/BRIDGE FRICTION, MECHANICAL STOPS, AND EXPLOSIVE ATMOSPHERE.

OMRSD: GROUND TURNAROUND INCLUDES LATCHING OPERATION (SYSTEM 1) AND LATCHING OPERATION (SYSTEM 2).

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(C) INSPECTION:

RECEIVING INSPECTION

TEST RECORDS AND REPORTS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES. RECEIVING INSPECTION PERFORMS VISUAL AND DIMENSIONAL EXAMINATION OF ALL INCOMING PARTS.

CONTAMINATION CONTROL

CORROSION PROTECTION REQUIREMENTS VERIFIED BY INSPECTION. QUALITY CONTROL VERIFIES PROPER MAINTENANCE AND OPERATION OF THE ENVIRONMENTALLY CONTROLLED MANUFACTURING AREA. ULTRASONIC CLEANING VERIFIED BY INSPECTION. CONTAMINATION CONTROL PROCEDURES INCLUDING USE OF COVERED TOTE PANS IS VERIFIED.

ASSEMBLY/INSTALLATION

DETAILED INSPECTION PERFORMED ON ALL PARTS PRIOR TO NEXT ASSEMBLY. ASSEMBLY OPERATIONS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

X-RAY INSPECTION UNDER MINIMUM 7X MAGNIFICATION FOR EVIDENCE OF WELD FLASH, LOOSE PARTS, AND ASSEMBLY ANOMALIES.

CRITICAL PROCESSES

CRITICAL PROCESSES INCLUDING WELDING, BRAZING, AND PASSIVATION ARE MONITORED AND VERIFIED BY INSPECTION.

TESTING

ATP IS VERIFIED PER PROCEDURE.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

(E) OPERATIONAL USE:

CREW CAN PERFORM EXTRAVEHICULAR ACTIVITY (EVA) PROCEDURES FOR MANUAL LATCH OPEN/CLOSE.

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- APPROVALS -

RELIABILITY ENGINEERING: D. M. MAYNE
DESIGN ENGINEERING : D. S. CHEUNG
QUALITY ENGINEERING : O. J. BUTTNER
NASA RELIABILITY :
NASA SUBSYSTEM MANAGER :
NASA QUALITY ASSURANCE :

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