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PRINT DATE: 10/18/94

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE  
NUMBER: 02-5E-MK05-X**

**SUBSYSTEM NAME: P/L RETENTION & DEPLOY - LATCHES**

**REVISION: 3 10/18/94**

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	<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
ASSEMBLY :	MIDDLEWEIGHT KEEL LATCH	V073-544430
LRU :	SWITCH MECHANISM, LATCH CLOSED	V073-544370

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**PART DATA**

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
SWITCH MECHANISM, LATCH CLOSED LIMIT SWITCH**

**QUANTITY OF LIKE ITEMS: 5  
5 MAX  
ONE PER LATCH**

**FUNCTION:  
MIDDLEWEIGHT KEEL LATCH REACTS FLIGHT LOADS ON PAYLOAD VERTICAL  
TRUNNION HELD BETWEEN TWO SPHERICAL HALF BEARINGS. LATCH CLOSED LIMIT  
SWITCH ASSEMBLY VERIFIES LATCH IS OVER-CENTER LOCKED. LIMIT SWITCH  
SIGNAL REMOVES POWER FROM THE MOTORS AND GIVES THE CREW AN INDICATION  
THAT THE LATCH IS CLOSED.**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE  
NUMBER: 02-5E-MK05-01**

REVISION# 3 10/18/94

**SUBSYSTEM NAME: P/L RETENTION & DEPLOY - LATCHES**

**LRU: MIDDLEWEIGHT KEEL LATCH**

**CRITICALITY OF THIS  
FAILURE MODE: 1/1**

**ITEM NAME: SWITCH MECHANISM, LATCH CLOSED**

**FAILURE MODE:**

TRANSFERS PREMATURELY/INADVERTENTLY

**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 INABILITY TO RESTRAIN PAYLOAD.

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

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

**(E) FUNCTIONAL CRITICALITY EFFECTS:**  
NONE

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**-DISPOSITION RATIONALE-**

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**(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 G<sup>2</sup>/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, AMBIENT 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. ELECTRICAL - VERIFY (WITHIN DESIGN LIMITS) CONTINUITY, DIELECTRIC STRENGTH, INSULATION RESISTANCE, AND SWITCH OPERATION.

QUALIFICATION TESTS: QUALIFICATION IS BY SIMILARITY TO LIGHTWEIGHT KEEL LATCH (V073-544300). FIRST UNIT TESTED TO 100% LIMIT LOAD.

OMRSD: ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(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

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE  
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FLASH, LOST PARTS, AND ASSEMBLY ANOMALIES. ALL LIMIT SWITCHES ARE PIND TESTED.

**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:**  
FAILURE HISTORY IS TRACKED IN THE PRACA SYSTEM.

**(E) OPERATIONAL USE:**  
IF THE LATCH FAILS IN THE CLOSED POSITION, UNBERTH, DEPLOY, AND/OR JETTISON OF THE ASSOCIATED PAYLOAD MAY BE ATTEMPTED USING RMS OPERATIONS, BACKAWAY MANUEVERS, AND/OR EVA PROCEDURES TO PRECLUDE RETURN OF AN UNSECURED PAYLOAD.

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- APPROVALS -

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EDITORIALLY APPROVED : RI  
EDITORIALLY APPROVED : JSC  
TECHNICAL APPROVAL : VIA CR

*9mb*  
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:S6027DAP