SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :P/L RETEN & DEPLOY-LATCHES FMEA NO 02-5E -T13 -1 REV:04/04/88

ASSEMBLY :ACTIVE KEEL ACTUATOR
P/N RI :V073-544560
P/N VENDOR:61328
QUANTITY :5 MAX

CRIT. FUNC: 1
CRIT. HDW: 1

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X

PHASE(S): PL LO OO X DO LS

REDUNDANCY SCREEN: A- B- C-

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ITEM:
SWITCH MECHANISM, LATCH CLOSED LIMIT SWITCH

FUNCTION:
KEEL LATCH REACTS FLIGHT LOADS ON PAYLOAD VERTICAL TRUNNION HELD BETWEEN TWO SPHERICAL HALF BEARINGS. THE SWITCH MECHANISM CONSISTS OF DUAL LIMIT SWITCHES ACTIVATED BY A COMMON CONTROL LEVER. LATCH CLOSED LIMIT SWITCH ASSEMBLY VERIFIES LATCH IS OVER-CENTER LOCKED. LIMIT SWITCH SIGNAL REMOVES POWER FROM THE MOTOR AND GIVES THE CREW AN INDICATION THAT LATCH IS CLOSED.

FAILURE MODE:
TRANSFERS PREMATURELY/INADVERTENTLY

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

EFFECTS ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A) FAILURE WILL PREVENT LATCH CLOSURE.

(B) FAILURE WILL RESULT IN PAYLOAD INADEQUATELY RESTRAINED IN PAYLOAD BAY.

(C) FAILURE WITH LATCH OPEN WILL RESULT IN POSSIBLE LOSS OF MISSION DUE TO INABILITY TO RESTRAIN PAYLOAD.

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

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ISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

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, OPEN AND CLOSED POSITIONS, WHILE UNDER LOAD. THERMAL - STABILIZED RANGE FROM -100 DEG F TO +350 DEG F. FUNCTIONAL TESTS CONDUCTED AT -100 DEG F, +70 DEG F AND +350 DEG F. LOADS/ALIGNMENT - VERIFY RETENTION OF LATCHED POSITION AT 60% 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: THE FOLLOWING IS A SUMMATION OF TESTS CONDUCTED PER CR 44-147-0017-0001 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 ACCEPTED BY ANALYSIS INCLUDE FUNGUS, OZONE, SALT SPRAY, ACCELERATION, SOLAR RADIATION (THERMAL AND NUCLEAR), METEOROIDS, SAND AND DUST, STORAGE, FACTOR OF SAFETY, RELIABILITY, MAINTAINABILITY, MATERIALS AND PROCESSES, ELECTRICAL DESIGN AND SAFETY. CERTIFICATION BY SIMILARITY INCLUDED TRUNNION FRICTION AND EXPLOSIVE ATMOSPHERE. VIBRATION - QUALIFICATION ACCEPTANCE VIBRATION TEST (QAVT) RANGE OF 20 TO 2,000 HZ WITH MAXIMUM LEVEL OF 0.067 g2/HZ AT 80 TO 350 HZ ALL AXES. FLIGHT VIBRATION LEVEL - 20 TO 2,000 HZ WITH MAXIMUM LEVEL OF 0.15 g2/HZ AT 100 TO 400 HZ ALL AXES, OPEN AND CLOSED POSITIONS. SHOCK BENCH HANDLING PER MIL STD-810C. THERMAL - STABILIZED RANGE FROM -100 DEG F TO +350 DEG F. FUNCTIONAL TESTS CONDUCTED AT -100 DEG F, +70 DEG F, +350 DEG F, THERMAL VACUUM AT 10 -6 TORR, AND HUMIDITY. LOAD TESTS - COMBINED AXIS LOADING TO 100% LIMIT LOAD. LIFE CYCLE TESTS - 1,018 CYCLES IN ADDITION TO CYCLES CONDUCTED DURING QUALIFICATION TESTING WITH VARIOUS LOAD AND MOTOR CONDITIONS. TRUNNION/BRIDGE INTERFACE FRICTION - SINGLE AND COMBINED AXIS LOADING UP TO LIMIT IN BOTH DIRECTIONS THROUGHOUT THE ENTIRE TEMPERATURE RANGE, IN COMPLIANCE WITH INTERFACE CONTROL DOCUMENT.

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
NONE.