

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : P/L RETEN & DEPLOY-LATCHES FMEA NO 02-5E -T07 -2 REV:04/04/88

ASSEMBLY : ACTIVE KEEL ACTUATOR	CRIT. FUNC:	1
P/N RI : V073-544560	CRIT. HDW:	1
P/N VENDOR: 61300	VEHICLE	102 103 104
QUANTITY : 5 MAX	EFFECTIVITY:	X X X
	PHASE(S):	PL LO OO X DO LS

PREPARED BY:	DES	D. S. CHEUNG	DES	<i>M. S. Campbell</i>	APPROVED BY (NASA):
REL	M. B. MOSKOWITZ	REL	<i>M.B.M.</i>	SSM	<i>[Signature]</i>
QE	W. J. SMITH	QE	<i>[Signature]</i>	QE	<i>[Signature]</i>

ITEM:
DRIVE MECHANISM

FUNCTION:
KEEL LATCH REACTS FLIGHT LOADS ON PAYLOAD VERTICAL TRUNNION HELD BETWEEN TWO SPHERICAL HALF BEARINGS. MOTORS ACT THROUGH A DIFFERENTIAL AND GEAR-BOX TO ACTUATE THE DRIVE LINKAGES, BALLSCREW AND SECONDARY FRAME. THERE IS NO TORQUE LIMITER IN THE LATCH.

FAILURE MODE:
PHYSICAL BINDING/JAMMING

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

- EFFECTS ON:
- (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
 - (A) LOSS OF ABILITY TO DRIVE THE LATCH OPEN OR CLOSED.
 - (B) INABILITY TO EITHER UNBERTH PAYLOAD (IF FAILED CLOSED) OR RESTRAIN PAYLOAD (IF FAILED OPEN OR PARTIALLY OPEN).
 - (C) POSSIBLE LOSS OF MISSION DUE TO INABILITY TO UNBERTH OR RESTRAIN PAYLOAD.
 - (D) POSSIBLE LOSS OF CREW/VEHICLE DUE TO UNRESTRAINED PAYLOAD DURING ENTRY.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

JBSYSTEM : P/L RETEN & DEPLOY-LATCHES FMEA NO 02-5E -T07 -2 REV:04/04/88

DISPOSITION & RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

1) DESIGN

LINKAGE HAS DUAL ROTATING SURFACES AT PIVOTS, BALLSCREW ASSEMBLY HAS THREAD SEALS, ICE SCRAPER, SHIELDS AT EACH END OF BALL NUT, FACTOR OF SAFETY OF ALL COMPONENTS IS 1.4 OVER LIMIT LOADS, POSITIVE MARGINS ON ALL COMPONENTS SHOWN BY ANALYSIS, REDUNDANT ELECTRIC MOTORS PROVIDED, GEARBOX IS SEALED TO EXCLUDE CONTAMINATION.

3) 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 RELEASE OPERATION (SYSTEM 1), LATCHING OPERATION (SYSTEM 1), RELEASE OPERATION (SYSTEM 2), AND LATCHING OPERATION (SYSTEM 2).

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : P/L RETEN & DEPLOY-LATCHES FMEA NO 02-5E -T07 -2 REV:04/04/88

(C) INSPECTION

RECEIVING INSPECTION

MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS AND CORROSION PROTECTION REQUIREMENTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

DIMENSIONS OF DETAIL PARTS ARE VERIFIED BY INSPECTION. FASTENER INSTALLATION VERIFIED BY INSPECTION. ASSEMBLY AND RIGGING OF LATCH IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION OF DETAIL PARTS IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

APPLICATION OF VITROLUBE IS VERIFIED BY INSPECTION. HEAT TREATING IS VERIFIED BY INSPECTION.

TESTING

ACCEPTANCE TESTING IS 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

IF THE FAILURE OCCURS WITH THE LATCH IN THE CLOSED POSITION, THE PAYLOAD MUST BE RETAINED. IF THE FAILURE OCCURS WHEN THE LATCH IS OPEN, THE PAYLOAD MUST BE DEPLOYED PRIOR TO ENTRY. CERTAIN PAYLOADS MAY NOT BE DEPLOYABLE IN A PARTIALLY UNLATCHED CONFIGURATION.