

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : P/L RETEN & DEPLOY-LATCHES FMEA NO 02-5E -K04 -1 REV:04/04/88

ASSEMBLY : LIGHTWEIGHT KEEL LATCH	CRIT. FUNC:	1
P/N RI : V073-544300	CRIT. HDW:	1
P/N VENDOR:	VEHICLE	102 103 104
QUANTITY : 5 MAX	EFFECTIVITY:	X X X
	PHASE(S):	PL LO X OO X DO X LS

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

ITEM:

LATCH/TRUNNION AND BRIDGE INTERFACES

FUNCTION:

THE KEEL LATCH CAN BE MOUNTED IN A PRIMARY (FIXED) CONFIGURATION OR A SECONDARY CONFIGURATION WHERE IT IS FREE TO SLIDE (WITHIN LIMITS) ALONG THE BRIDGE TO ALLOW DYNAMIC REACTION OF PAYLOAD/ORBITER STRUCTURE DURING LAUNCH AND ENTRY. DESIGN ALSO INCLUDES SPHERICAL BEARINGS WITHIN THE LATCH TO ALLOW LIMITED ROTATION AND SLIDING OF THE PAYLOAD TRUNNION IN THE LATCH TO FURTHER RELIEVE LAUNCH AND ENTRY LOADS.

FAILURE MODE:

PHYSICAL BINDING/JAMMING

CAUSE(S):

ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, LOSS OF LUBRICANT

EFFECTS ON:

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

(A) FAILURE WILL RESULT IN LOSS OF ABILITY FOR PAYLOAD/ORBITER TO FLEX AND RELIEVE LAUNCH AND ENTRY LOADS.

(B) FAILURE WILL CAUSE PAYLOAD/ORBITER TO BE SUBJECTED TO EXCESSIVE LOADS DURING ASCENT AND ENTRY.

(C) FAILURE OF LATCH TO SLIDE ON BRIDGE MAY PRECLUDE BERTHING OF PAYLOAD OR CLOSING OF LATCH AND RESULT IN LOSS OF MISSION.

(D) FAILURE MAY CAUSE LOSS OF CREW/VEHICLE FROM EXCESSIVE LOADS DURING ASCENT OR ENTRY.

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DISPOSITION & RATIONALE:

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

(A) DESIGN

THE PAYLOAD SUPPORT POINTS ARE SELECTED TO MINIMIZE POINT TORSIONAL, BENDING AND RADIAL LOAD IMPARTED TO THE PAYLOADS. TRUNNION FRICTION LOADS ARE MINIMIZED TO $Cf = 0.10$ TO 0.25 , BRIDGE FRICTION $Cf = 0.10$ TO 0.12 DEPENDING UPON ENVIRONMENT AND LOAD. MATERIAL, FINISHES AND LUBRICANT ARE SELECTED TO PROVIDE MINIMUM COEFFICIENT OF FRICTION. TRUNNION INTERFACE USE SPHERICAL BEARING AND FIBRILOID LINER. BRIDGE INTERFACE USES DRY LUBE FINISH.

(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 $0.04 g^2/HZ$ FROM 80 TO 350 HZ, ALL AXES. THERMAL - STABILIZED RANGE FROM -180 DEG F TO +235 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: THE FOLLOWING IS A SUMMATION OF TESTS CONDUCTED PER CR 44-544300-001 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 ACCEPTED BY ANALYSIS INCLUDE FUNGUS, OZONE, SALT SPRAY, ACCELERATION, SOLAR RADIATION (THERMAL AND NUCLEAR), METEORIDS, SAND AND DUST, STORAGE, SAFETY FACTOR, RELIABILITY, MAINTAINABILITY, MATERIALS AND PROCESSES, ELECTRICAL DESIGN AND SAFETY. CERTIFICATION BY SIMILARITY INCLUDED VACUUM, HUMIDITY, TRUNNION FRICTION AND EXPLOSIVE ATMOSPHERE. VIBRATION - QUALIFICATION ACCEPTANCE VIBRATION TEST (QAVT) RANGE OF 20 TO 2,000 HZ WITH MAXIMUM LEVEL OF $0.067 g^2/HZ$ AT 80 TO 350 HZ, FOR ALL AXES. FLIGHT VIBRATION LEVEL - 20 TO 2,000 HZ WITH MAXIMUM LEVEL OF $0.01 g^2/HZ$ AT 100 TO 300 HZ, FOR ALL AXES. SHOCK BENCH HANDLING TEST IN ACCORDANCE WITH MIL-STD-810C METHOD 516.2 PROCEDURE V. THERMAL - STABILIZED RANGE FROM -100 DEG F TO +275 DEG F. FUNCTIONAL TESTS CONDUCTED AT -100 DEG F, AMBIENT, AND +275 DEG F AT 10^{-6} TORR, HUMIDITY. LOAD TESTS - BY ANALYSIS OR COMBINED AXIS LOADING TO 140% LIMIT LOAD. LIFE CYCLE TESTS - 1,062 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 LOADING IN BOTH DIRECTIONS THROUGHOUT THE ENTIRE TEMPERATURE RANGE, AS SPECIFIED IN THE INTERFACE CONTROL DOCUMENT.

OMRSD: GROUND TURNAROUND INCLUDES PAYLOAD RETENTION LATCH BEARING INSPECTION.

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(C) INSPECTION

RECEIVING INSPECTION

MATERIAL AND PROCESS CERTIFICATIONS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS REQUIREMENTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MACHINING AND DIMENSIONS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION VERIFIED BY INSPECTION.

CRITICAL PROCESSES

CHROME PLATING AND ADHESIVE BONDING OF FIBRILOID LINER TO TRUNNION INTERFACE VERIFIED BY INSPECTION. APPLICATION OF LEO140-005 DRY FILM LUBE TO BRIDGE INTERFACE VERIFIED BY INSPECTION. HEAT TREATING VERIFIED BY INSPECTION.

TESTING

ATP IS VERIFIED PER PROCEDURE.

HANDLING/PACKAGING

PARTS PACKAGED AND PROTECTED PER APPLICABLE PACKAGING SPECIFICATIONS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

CAR NO. AD0458 : DURING QUALIFICATION TESTING OF THE LIGHTWEIGHT KEEL LATCH, THE DRY FILM LUBE SHOWED SIGNS OF WEAR IN THE RAIL AREA; DRY FILM LUBE SUPPLIER DID NOT ALLOW FOR THE ASSEMBLY TO ATTAIN REQUIRED TEMPERATURE AND AS A RESULT, THE DRY FILM LUBE DID NOT CURE; MCR 11772 AUTHORIZED MEK WIPE TEST ON ALL LATCHES AND BRIDGES SUSPECTED OF NOT BEING CURED.

(E) OPERATIONAL USE

NONE.