

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 02-4B-007-X

SUBSYSTEM NAME: PAYLOAD BAY DOOR MECHANISMS

REVISION : 0 12/15/88 W

		PART NAME	PART NUMBER
		VENDOR NAME	VENDOR NUMBER
LRU	:	PAYLOAD BAY DOOR C/L ACTUATOR	MC287-0040
		HOOVER ELECTRIC	15810
SRU	:	TORQUE LIMITER	41415-2
		HOOVER ELECTRIC	15810

QUANTITY OF LIKE ITEMS: 4
4 CENTERLINE LATCH
ACTUATORS

DESCRIPTION/FUNCTION:

PROTECTS ACTUATOR MOTORS/GEARS AND LATCH LINKAGE BY SLIPPING WHEN LINKAGE IS STALLED OR JAMMED. PROTECTS LINKAGE UP TO 10 DEGREES FROM ON CENTER POSITION. ACTUATOR OUTPUT TORQUE IS LIMITED TO 4,000 - 6,500 INCH-LB. ONE TORQUE LIMITER IS INCLUDED IN GEAR TRAIN OF EACH ACTUATOR.

add bulkhead actuator MC287-0039, it is also in

the 02-4B-007-X series

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SUMMARY

SUBSYSTEM NAME: PAYLOAD BAY DOOR MECHANISMS
 LRU PAYLOAD BAY DOOR C/L ACTUATOR
 LRU PART #: MC287-0040
 ITEM NAME: TORQUE LIMITER

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	RZD FLG
02-4B-007-01	SLIPS AT LESS THAN MINIMUM ALLOWABLE TORQUE*	X	1R2	
02-4B-007-02	STRUCTURAL FAILURE <i>Fails to slip at max allowable torque</i>	X	1R3	
02-4B-007-03	SLIPS AT LESS THAN MINIMUM ALLOWABLE TORQUE*	X	1R2	
02-4B-007-04	FAILS TO SLIP AT MAX ALLOWABLE TORQUE*	X	1R3	

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 02-4B-007-02

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SUBSYSTEM: PAYLOAD BAY DOOR MECHANISMS
LRU PAYLOAD BAY DOOR C/L ACTUATOR
ITEM NAME: TORQUE LIMITER

CRITICALITY OF THIS
FAILURE MODE: 1R3

FAILURE MODE:
FAILS TO SLIP AT MAXIMUM ALLOWABLE TORQUE (CENTERLINE LATCHES)

MISSION PHASE:
OO ON-ORBIT

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

CAUSE:
ADVERSE TOLERANCES/WEAR, CHANGE IN MATERIAL PROPERTIES, CONTAMINATION/
FOREIGN OBJECT/DEBRIS, DEFECTIVE PART/MATERIAL OR MANUFACTURING DEFECT,
TEMPERATURE, SPRING DEGRADATION.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? N

REDUNDANCY SCREEN A) FAIL
B) FAIL
C) PASS

PASS/FAIL RATIONALE:

A)
FAILS REDUNDANCY SCREEN "A" SINCE NO TURNAROUND TESTS ARE PERFORMED TO
VERIFY THIS FAILURE.

B)
FAILS REDUNDANCY SCREEN "B" SINCE THERE ARE NO MEANS OF VISUALLY
DETECTING TORQUE SLIPPAGE IN FLIGHT.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
POSSIBLE DAMAGE TO LATCH LINKAGE, DOOR STRUCTURE, OR ACTUATOR IF STALLED
OR JAMMED CONDITION OCCURS.

(B) INTERFACING SUBSYSTEM(S):
POSSIBLE INABILITY TO RECYCLE LATCH MECHANISM, FAILURE TO LATCH A GANG
OF FOUR LATCHES. SAFE ENTRY MAY PROCEED WITH ANY GANG OF CENTERLINE

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LATCHES DISENGAGED, REF JSC08934.

(C) MISSION:

LOSS OF MISSION IF PAYLOAD BAY DOORS CANNOT BE OPENED.

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

POSSIBLE LOSS OF CREW/VEHICLE IF MORE THAN ONE GANG OF CENTERLINE LATCHES FAIL TO LATCH.

(E) FUNCTIONAL CRITICALITY EFFECTS

 - DISPOSITION RATIONALE -

(A) DESIGN:

SPRING LOADED BALL CLUTCH WITH ALUMINUM BRONZE AND STEEL CLUTCH DISKS. NO WEAR IN NORMAL OPERATION OF ACTUATOR. TORQUE LIMITING ONLY REQUIRED IN JAMMED OR OVERLOAD CONDITION OF LINKAGE. DESIGN OF THE ACTUATION SYSTEM PERMITS PARTIAL WORKAROUND OF THIS FAILURE MADE BY EXTRAVEHICULAR ACTIVITY (EVA) CREW IF PAYLOAD DOES NOT LIMIT ACCESS.

(B) TEST:

QUALIFICATION TESTS: THE QUALIFICATION ACTUATOR IS CERTIFIED PER CR-29-287-0040-0001H. QUALIFICATION TESTS INCLUDE: HUMIDITY TESTS - PER MIL-STD-810B, METHOD 507 PROCEDURE IV, CYCLE ACTUATOR DURING SECOND AND FOURTH HUMIDITY CYCLE; QUAL-ACCEPTANCE VIBRATION TEST (QAVT) - 20 TO 2,000 HZ RANGE WITH MAX, OF 0.067 g²/HZ FOR 2 1/2 MINS/AXIS. ELECTRICAL CIRCUITS - MONITORED FOR CONTINUITY DURING VIBRATION AND ACTUATOR CYCLED BEFORE AND AFTER VIBRATION TEST; FLIGHT VIBRATION TESTS - 20 TO 2,000 HZ RANGE WITH MAX OF 0.75 g²/HZ FOR 51 MINS/AXIS LEVEL "A" AND 0.2 g²/HZ FOR 27 MINS/AXIS-LEVEL "B"; THERMAL VACUUM TESTS - THERMALLY CYCLED 5 TIMES BETWEEN -167 DEG F AND +250 DEG F AT A VACUUM OF 1 X 10⁻⁶ TORR; ACTUATOR CYCLED AT EACH -100 DEG F AND +250 DEG F; THERMAL CYCLING TEST - CYCLED 5 TIMES BETWEEN -167 DEG F AND +330 DEG F WITH ACTUATOR CYCLED AT EACH -100 DEG F MINIMUM HEAT DISSIPATING MODE AND +250 DEG F AT MAXIMUM HEAT DISSIPATING MODE WITH AT LEAST 60 MINUTES DWELL AT EACH TEMPERATURE EXTREME.

QUAL TESTS ALSO INCLUDE: SHOCK TEST - BASIC DESIGN SHOCK PER MIL-STD-810B METHOD 516.1 PROCEDURE I. OPERATING LIFE TEST - ACTUATOR CYCLED 1,500 TIMES AT ROOM TEMP, INCLUDES MOTOR #1 AND #2 CYCLED 250 TIMES EACH INDIVIDUALLY WITHIN 40 SECONDS/STROKE AND 1,000 TIMES WITH BOTH MOTORS DRIVING TOGETHER WITHIN 20 SECONDS/STROKE; MECHANICAL STOP TEST - 100 TIMES WITH BOTH MOTORS INTO HARD STOP IN EACH DIRECTION AT NO LOADS. POWER CONSUMPTION TEST, IRREVERSIBILITY TEST FREEPLAY TESTS WERE CONDUCTED AS DEFINED IN THIS ACCEPTANCE TESTS. CERTIFICATION BY ANALYSIS/SIMILARITY INCLUDED FUNGUS, OZONE, ACCELERATION, TRANSPORTATION-PACKAGING, SAND/DUST, SALT SPRAY, LANDING SHOCK, AND EXPLOSIVE ATMOSPHERE. THE ACTUATORS WERE SUBJECTED TO SYSTEM QUALIFICATION TESTS FOR CENTERLINE LATCH MECHANISM INSTALLATION V070-

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594360 (REF. CR-29-594360-001E).

ACCEPTANCE TESTS: INCLUDES EXAMINATION OF PRODUCT (FOR WEIGHT, WORKMANSHIP, DIMENSIONS, CONSTRUCTION, CLEANLINESS, FINISH, IDENTIFICATION MARKING; TRACEABILITY, USE OF CERTIFIED MATERIALS AND PROCESSES); ACCEPTANCE VIBRATION TESTS (AVT) - 20 TO 2,000 HZ RANGE WITH MAX OF 0.04 g²/HZ FOR 30 SECONDS/AXIS. ELECTRICAL CIRCUITS - MONITORED FOR CONTINUITY DURING VIBRATION TESTS AND ACTUATOR CYCLED BEFORE AND AFTER VIBRATION TESTS; ACCEPTANCE THERMAL TEST (ATT) - THERMALLY CYCLED FROM +70 DEG F TO +310 DEG F TO +250 DEG F TO -147 DEG F TO -100 DEG F TO +310 DEG F TO +250 DEG F TO +70 DEG F WITH CONTINUITY MONITORED THROUGHOUT, THE ACTUATOR WAS CYCLED AT EACH +250 DEG F AND -100 DEG F.

ACCEPTANCE TESTS ALSO INCLUDE: POWER CONSUMPTION TEST - SINGLE MOTOR STROKE WITHIN 60 SECONDS, DUAL MOTOR STROKE WITHIN 30 SECONDS; INSULATION RESISTANCE TEST AND INITIAL DIELECTRIC STRENGTH TEST - PER MF0004-002; CYCLE TEST - SINGLE MOTOR, 20 CYCLES EACH AT 30 SEC/STROKE, DUAL MOTOR 80 CYCLES AT 80 SEC/STROKE; FREEPLAY TEST - MAXIMUM OF 0.1 DEGREES WITH 10 INCH-LB REVERSING TORQUE IN EACH DIRECTION; STALL/MAXIMUM TORQUE TEST - MAXIMUM OUTPUT NOT TO EXCEED 6,500 INCH-LB OR BE LESS THAN 4,000 INCH-LB. IRREVERSIBILITY TEST - ACTUATOR IS IRREVERSIBLE TO A LOAD OF 4,000 INCH-LB MINIMUM UNDER STATIC CONDITIONS. TRAVEL LIMIT TESTS - ACTUATOR STOPPED BY LIMIT SWITCHES AND BY HARD STOPS WITH SWITCHES DEENERGIZED.

OMRSD: NONE. ACTUATOR CANNOT BE CHECKED FOR THIS FAILURE MODE DURING SYSTEM FUNCTIONAL CHECK. MAINTENANCE SAMPLING PERIODICALLY VERIFIES TORQUE LIMITED PERFORMANCE.

(C) INSPECTION:

RECEIVING INSPECTION

CERTIFICATION OF COMPLIANCE, TEST COUPONS, PHYSICAL AND CHEMICAL RECORDS ARE MAINTAINED IN THE MASTER FILE. RECEIVING INSPECTION PERFORMS VISUAL AND DIMENSIONAL EXAMINATION OF ALL INCOMING PARTS. QUALITY CONTROL MAINTAINS SURVEILLANCE OF RAW MATERIAL, LIMITED LIFE MATERIALS, CHEMICAL AND METALLURGICAL TESTS AND REPORTS. SPRINGS ARE MANUFACTURED AND CHECKED BY HOOVER SUPPLIERS. CERTIFICATION IS ON FILE.

CONTAMINATION CONTROL

POLYETHYLENE SHEETING, USED TO BAG AND SEAL PARTS AFTER CLEANING, IS VERIFIED BY INSPECTION. A CLASS 100,000 CLEAN FACILITY IS USED FOR ASSEMBLY AND VERIFIED BY INSPECTION. ALL METAL PARTS ARE VERIFIED BY INSPECTION TO BE CLEANED. FINAL INSPECTION INCLUDES CHECKS FOR CONTAMINATION USING BORESCOPES, 5X AND 10X MAGNIFICATION DEVICES, AND FILTRATION METHODS.

ASSEMBLY/INSTALLATION

INSPECTION VERIFIES AND RECORDS DIMENSIONS OF ALL DETAIL PARTS.

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NONDESTRUCTIVE EVALUATION
ALL DETAIL PARTS TO HOOVER DRAWINGS ARE MAGNETIC PARTICLE INSPECTED PER MIL-I-6868 OR FLUORESCENT PENETRANT INSPECTED PER MIL-I-6866, DEPENDING ON ALLOY.

CRITICAL PROCESSES
HEAT TREATING IS VERIFIED BY INSPECTION.

TESTING
ACCEPTANCE TESTING IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
CAR NO. AB8625 : DURING ENGINEERING EVALUATION TESTS PRIOR TO STS-1, OUTPUT TORQUE OF PAYLOAD BAY DOOR CENTERLINE LATCH ACTUATOR REACHED 10,000 INCH-LB WITHOUT TORQUE LIMITER SLIP, AND HOUSING FRACTURED (STALL/MAXIMUM OUTPUT TORQUE SHOULD BE 4,000-6,500 INCH-LB); FAILURE CAUSED BY ADHESION OF CLUTCH DISKS AT LOW TEMPERATURE DUE TO PRESENCE OF BRAYCO GREASE; A REDESIGNED TORQUE LIMITER WAS INCORPERATED IN PAYLOAD BAY DOOR CENTERLINE LATCH ACTUATORS AND ACTUATOR PERFORMANCE WITH THE NEW TORQUE LIMITER WAS VERIFIED IN A DELTA QUALIFICATION TEST (REF. MCR 7571).

(E) OPERATIONAL USE:
LATCH TOOLS ARE AVAILABLE FOR EVA WORKAROUND EXCEPT IN THE CASE OF CERTIAN PAYLOADS WHICH LIMIT ACCESS.

- APPROVALS -

RELIABILITY ENGINEERING:	M. B. MOSKOWITZ	:	<i>MBM</i>
DESIGN ENGINEERING	: M. A. ALLEN	:	<i>M.A. Allen</i>
QUALITY ENGINEERING	: W. J. SMITH	:	<i>W.J. Smith</i>
NASA RELIABILITY	:	:	<i>[Signature]</i>
NASA SUBSYSTEM MANAGER	:	:	<i>[Signature]</i>
NASA QUALITY ASSURANCE	:	:	<i>[Signature]</i>