

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : LANDING DECELERATION FMEA NO 02-1F -H03 -1 REV:06/27/
ASSEMBLY : NLG UPLOCK ACTUATOR CRIT. FUNC: 1
P/N RI : MC287-0035 CRIT. HDW:
P/N VENDOR: PARKER-BERTEA VEHICLE 102 103 104
QUANTITY : 1 EFFECTIVITY: X X X
: ONE IN NOSE WHEEL WELL PHASE(S): PL LO OO DO X LS
:

REDUNDANCY SCREEN: A-PASS B-PASS C-PA
PREPARED BY: APPROVED BY: APPROVED BY (NASA):
DES N LEVERT DES *N. Levert* SSM *R. Balajunas*
REL C NELSON REL *C. Nelson* REL *R. Balajunas*
QE M SAVALA QE *M. Savala 7-25-88* QE *R. Balajunas No 72-2*

ITEM:
ACTUATOR, UPLOCK

FUNCTION:
PROVIDES CAPABILITY FOR ACTUATING THE MECHANICAL LOCK RETAINING THE G
AND DOOR IN THE FULL UP AND CLOSED POSITION.

FAILURE MODE:
EXTERNAL LEAKAGE

CAUSE(S):
MATERIAL DEFECT (CYLINDER RUPTURE), DAMAGED PISTON ROD SE
CONTAMINATION, FLOW REGULATOR LEAK, EXTEND PORT LEAK, RETRACT PORT LEAK

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
(A) AT DOWN GEAR COMMAND - LOSS OF HYDRAULIC SYSTEM NUMBER C
PYROTECHNIC ACTUATOR FOR UNLOCKING GEAR.
(B) NO HYDRAULIC POWER TO UNLOCK GEAR. LOSS OF NOSE WHEEL STEERING
REDUNDANCY TO BRAKES, HOWEVER, DIFFERENTIAL BRAKING IS AVAILABLE
STEERING.
(C,D) NONE. ADEQUATE FLIGHT CONTROL. FULL GEAR DEPLOYMENT.
(E) FUNCTIONAL CRITICALITY EFFECTS-POTENTIAL LOSS OF CREW/VEHICLE V
TWO FAILURES: LOSS OF HYDRAULIC UPLOCK ACTUATOR FUNCTION AND FAILURE
PYROTECHNIC DEPLOYMENT.

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

(A) DESIGN
CYLINDER-BURST FACTOR OF 2.5. 2024-T851 ALUMINUM ALLOY PROVIDES OPTI
MIX OF STRENGTH/WEIGHT FOR ACTUATOR. ALLOWABLE STRESS IS 56,760 PSI
275 DEGREES F. ACTUAL CALCULATED CYLINDER HOOP STRESS (BURST) IS 50,
PSI. MARGIN OF SAFETY IS 0.12. CYLINDER DESIGN USES VERY GRAI
MATERIAL THICKNESS TRANSITIONS AND GENEROUS RADII TO AVOID STE

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CONCENTRATION EFFECTS. GLAND-MINIMUM MARGIN OF SAFETY EQUALS 0.24 SEAL GROOVE. ASSUMES CONSERVATIVE NOTCH FACTOR OF 3 AND MINIMUM MATERIAL THICKNESS. FATIGUE ANALYSIS 200,000 CYCLES, REQUIREMENT IS 6,000 CYCLE

(B) TEST

QUALIFICATION-THE NOSE UPLOCK ACTUATORS ARE QUALIFIED BY SIMILARITY TO THE MAIN GEAR UPLOCK ACTUATORS. ENDURANCE CYCLING TOTALS 6,000 CYCLE 1,500 CYCLES AT EACH FLUID TEMPERATURE, -20 DEGREES F, 75 DEGREES F, 1 DEGREE F AND 275 DEGREES F. CYCLE RATE 100 CYCLES PER HOUR MAXIMUM RETRACT TIME IS 0.5 SECONDS WITH A DELTA PRESSURE OF 2,430 PSI AND OPPOSING LOAD OF 2,000 LBS. BURST PRESSURE IS 7,500 PSI. ALSO TESTED PART OF THE LANDING GEAR TEST ARTICLE (SIMULATOR).

ACCEPTANCE-PROOF PRESSURE, 4,500 PSI. LEAKAGE CHECK 1 DROP PER 25 CYCLES AT OPERATING CONDITIONS. STATIC TEST AT 3,000 AND 50 PSI.

OMRSD-HYDRAULIC SYSTEM INSPECTION, PERFORMED PRIOR TO EACH MISSION; NO LANDING GEAR WELL ZONAL INTERNAL DETAIL INSPECTION, PERFORMED PRIOR TO EACH MISSION; VISUAL INSPECTION FOR EVIDENCE OF LEAKAGE OR DAMAGE. PC LANDING HYDRAULIC RESERVOIR EFFLUENT SAMPLES, PERFORMED AFTER EVERY FLIGHT; VERIFY THAT RESULTS OF FLUID SAMPLE CONTAMINATION MEET SPECIFICATION. GENERAL REQUIREMENT 5.2, VERIFY ALL HYDRAULIC FLUID USED TO SERVICE VEHICLE IS PER MIL-H-83282.

(C) INSPECTION

RECEIVING INSPECTION

RECORDS AND TEST REPORTS CERTIFYING MATERIAL AND PHYSICAL PROPERTIES ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CONTAMINATION CONTROL PLAN IS IMPLEMENTED AND VERIFIED BY INSPECTING STRICT COMPLIANCE WITH MACHINING SPECIFICATION AND CORROSION CONTROL PLAN REQUIRED AND COPIES OF THESE SPECIFICATIONS ARE INCLUDED IN EACH PLANNING PACKAGE AND VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREAT AND CADMIUM PLATING PROCESSES ARE VERIFIED BY INSPECTING SHOT PEENING (TO KEEP CHROME PLATING MICROCRACKS FROM REDUCING PARENT MATERIAL FATIGUE PROPERTIES) AND CHROME PLATING OF OUTPUT PISTON ROD ARE VERIFIED BY INSPECTION.

NDE

PENETRANT INSPECTION OF CYLINDER IS VERIFIED BY INSPECTION. PENETRANT MAGNETIC PARTICLE INSPECTION OF DETAIL PARTS, DEPENDING ON THE ALLOY, IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

COMPONENT/PIECE PARTS ARE VERIFIED UNDAMAGED PRIOR TO CLEANING AND PACKAGING. QUALITY CONTROL WITNESSES TORQUING OF RESTRICTOR IN MANIFOLD. QUALITY ASSURANCE WITNESSES SEAL AND BACKUP RING INSTALLATION AND ALL TORQUES. MIPS ARE IMPOSED FOR IN-PROCESS ACCEPTANCE TEST WITNESSING, DATA PACK REVIEW, HARDWARE SHIPMENTS AND ALL FAILURE MODE ASSEMBLY OPERATIONS VERIFIED BY INSPECTION.

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TESTING

ATP IS WITNESSED BY RI SOURCE INSPECTION.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

THERE IS NO HISTORY OF FAILURE FOR THIS FAILURE MODE.

(E) OPERATIONAL USE

DIFFERENTIAL BRAKING FOR STEERING IF SYSTEM ONE IS LOST. PYROTECH ACTUATOR WILL DEPLOY/UNLOCK GEAR. HYDRAULIC SYSTEM ONE ISOLATION VA CAN BE CLOSED AFTER DETECTION OF LEAK FOR SYSTEM ISOLATION.