

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : LANDING/DECELERATION-LGC FMEA NO 02-1A -003 -1 REV:09/19/8

ASSEMBLY : MAIN LANDING GEAR (MLG) CRIT. FUNC:  
P/N RI : MC621-0011 CRIT. HDW:  
P/N VENDOR: 1170300 MENASCO VEHICLE 102 103 104  
QUANTITY : 4 EFFECTIVITY: X X X  
: UPPER-TWO (LH/RH) PHASE(S): PL LO OO DO LS  
: LOWER-TWO (LH/RH)

PREPARED BY: REDUNDANCY SCREEN: A- B- C-  
DES R. A. GORDON APPROVED BY: APPROVED BY (NASAT):  
REL J. S. MULLEN REL *R. Gordon 9/2/88* SSM *Charles L. Taylor*  
QE W. J. SMITH QE *W. J. Smith* REL *W. J. Smith 9/27*  
QE *W. J. Smith* QE *W. J. Smith*

ITEM:  
MAIN LANDING GEAR DRAG BRACE.

FUNCTION:  
MLG UPPER AND LOWER MOUNTED DRAG BRACES INCORPORATES THE GEAR DOWNLOCK THE DOWNLOCKS AND DRAG BRACES ARE OPERATED BY THE MAIN LANDING GEAR ACTUATOR AT AN ATTACHMENT POINT ON THE UPPER LOCK LINK. THE DOWNLOCK ASSY INCORPORATES A SPRING BUNGEE WITH SUFFICIENT FORCE TO HOLD THE DOWNLOCK MECHANISM SECURELY LOCKED.

FAILURE MODE:  
STRUCTURAL FAILURE

CAUSE(S):  
OVERLOAD, DEFECTIVE PART/MATERIAL.

EFFECT(S) ON:  
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE  
(A) LOSS OF LOAD CARRYING CAPABILITY.  
(B) DAMAGE TO VEHICLE STRUCTURE.  
(C,D) PROBABLE LOSS OF MISSION/CREW/VEHICLE IF MAIN GEAR COLLAPSES.

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

(A) DESIGN  
DESIGNED TO FATIGUE LOAD SPECTRUM FOR LANDING, TAXI, AND GROUND HANDLING CONDITIONS. DESIGNED TO LANDING IMPACT LOADS (SPIN-UP AND SPRING BACK INCLUDING CROSSWIND DRIFT CONDITIONS) USING A MINIMUM FACTOR OF SAFETY 1.0 TO YIELD STRENGTH OF MATERIAL IN ACCORDANCE WITH ESTABLISHED CRITERIA FOR COMMERCIAL AND MILITARY AIRCRAFT. DESIGNED TO A MINIMUM FACTOR OF SAFETY OF 1.4 FOR TAXI AND GROUND HANDLING LOADS FOR 32K AND 65K PAYLOAD CONFIGURATIONS. MATERIAL PROCESSES-BARE PARTS ARE NOT EXPOSED TO CORROSIVE ACID ENVIRONMENT IN PLATING SHOP MORE THAN 30 DAYS AND PARTS ARE SHOT

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PEENED AFTER MACHINE OPERATIONS TO PREVENT STRESS CORROSION ON 300 M MATERIALS.

**(B) TEST**

QUALIFICATION TESTS: CERTIFICATION INCLUDES ULTIMATE STRENGTH TEST, SHOCK STRUT DROP TESTS, STATIC LOADS TEST, DYNAMIC TESTS AND 400 DEPLOYMENT CYCLES.

THE DRAG BRACE WAS CERTIFIED AS AN INTEGRAL PART OF THE MLG MECHANISM INSTALLATION (LANDING GEAR OPERATION) - 32 CYCLES OF THE LANDING GEAR DURING ALT, 15 DEVELOPMENT CYCLES AND 353 QUALIFICATION LIFE CYCLES FOR TOTAL OF 400 CYCLES. (THE LANDING GEAR WAS CYCLED FROM UP AND LOCKED TO DOWN AND LOCKED EACH TIME).

**ENVIRONMENT:**

HIGH TEMP TESTS; 3 CYCLES AT 140 DEG F

COLD TEMP TESTS; 3 CYCLES AT -35 DEG F TO -40 DEG F

FATIGUE LOAD SPECTRUM TESTS WERE CONDUCTED FOR LANDING, LANDING ROLLOUT, BRAKING AND TURNING LOAD CONDITIONS - THE STRUT WAS SUBJECTED TO CYCLIC APPLICATION OF VERTICAL, FORE/AFT AND SIDE LOADS IN EACH CONDITION.

THE DRAG BRACE ASSEMBLY WAS ALSO TESTED AS AN INTEGRAL PART OF THE MLG SHOCK STRUT ASSEMBLY DURING DROP TESTS - ELEVEN DROP TESTS WERE PERFORMED TO SATISFY THE DESIGN REQUIREMENTS FOR THE SHOCK STRUT ASSEMBLY.

MAXIMUM VERTICAL LOAD WAS 179,817 LBS.

MAXIMUM SINK SPEED WAS 11.69 FPS.

ACCEPTANCE TESTS: ACCEPTANCE INCLUDES VERIFICATION THAT CERTIFIED MATERIALS AND PROCESSES WERE USED. ACCEPTANCE TESTS ALSO VERIFY DIMENSIONS, WEIGHTS AND FINISHES.

OMRSD: MLG ZONAL DETAIL VISUAL INSPECTION; THE LOWER DRAG BRACE ASSY, UPPER DRAG BRACE ASSY AND TRUNNION PINS ARE INSPECTED FOR CONDITION AND SECURITY.

FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

**(C) INSPECTION**

**RECEIVING INSPECTION**

INSPECTION VERIFIES ALL RAW MATERIALS TO COMPLY WITH MATERIAL REQUIREMENTS THROUGH PERIODIC COUPON ANALYSIS.

**CONTAMINATION CONTROL**

ALL CLEANLINESS LEVELS VERIFIED BY INSPECTION. CORROSION CONTROL REQUIREMENTS VERIFIED.

**ASSEMBLY/INSTALLATION**

ALL MATERIAL PROCESSES VERIFIED BY MIP'S PRIOR TO NEXT MANUFACTURING OPERATIONS. TORQUE VALUES SPECIFIED ON DRAWINGS ARE VERIFIED AT THE TIME OF ACCOMPLISHMENT. INSTALLATION OF COTTER PIN AND LOCK WIRE VERIFIED AT ASSEMBLY LEVEL. DIMENSIONS AND SURFACE FINISHES VERIFIED.

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**CRITICAL PROCESSES**

INSPECTION VERIFIES HEAT TREATMENT AND SHOT PEENING PER MIL-S-13165.  
CD-TI PLATING VERIFIED BY INSPECTION.

**NONDESTRUCTIVE EVALUATION**

MATERIAL SURFACE DEFECTS ARE DETECTED BY FLUORESCENT PENETRANT  
INSPECTION.

**TESTING**

ATP IS VERIFIED BY INSPECTION.

**PACKAGING/HANDLING**

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY**

A FAILURE OCCURRED DUE TO LACK OF MATERIAL PLATING PROCESS CONTROL WHICH  
RESULTED IN STRUCTURAL FAILURE DUE TO BRITTLINESS. PRIME MANUFACTURER  
INITIATED NEW PROCESS CONTROLS. PARTS WERE REPROCESSED BY STRIPPING,  
INSPECTION, REPLATING AND CERTIFICATION - THIS WAS A "NON-FLIGHT" FAILURE  
PRIOR TO STS-1.

**(E) OPERATIONAL USE**

NONE.