SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :LANDING/DECELERATION-LGC FMEA NO 02-1A -001 -1 REV:09/19/8

ASSEMBLY :MAIN LANDING GEAR (MLG)
P/N RI :MC621-0011
P/N VENDOR:1170100 MENASCO
QUANTITY :2
:ONE LEFT HAND
:ONE RIGHT HAND

CRIT. FUNC: 1
CRIT. HDW: 1

VEHICLE EFFECTIVITY:	102	103	104
PHASE(S): PL LO OO DO LS	X	X	X

REDUNDANCY SCREEN: A- B- C-

PREPARED BY:		APPROVED BY:		APPROVED BY (NASA):	
DES	R. A. GORDON	DES	RAGordon 9/2/88	SSM	
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ITEM:
MAIN LANDING GEAR SHOCK STRUT INNER AND OUTER CYLINDER AND LOAD CARRYIN MEMBERS

FUNCTION:
MLG LOAD CARRYING STRUT/DAMPER - A PASSAGE OF HYDRAULIC FLUID THROUGH A ORIFICE ABSORBS THE ENERGY OF IMPACT AND WHERE DRY NITROGEN IS USED AS THE ELASTIC MEDIUM TO RESTORE THE UNSPRUNG PARTS TO THEIR EXTENDED POSITION.

FAILURE MODE:
STRUCTURAL FAILURE

CAUSE(S):
PIECE-PART STRUCTURAL FAILURE, OVERLOAD, FATIGUE

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 STRUT FAILS ON LANDING OR DURING ROLLOUT.

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

(A) DESIGN
UNDER WORST CASE LOADING (FLAT STRUT DUE TO GN_2 LEAKAGE) THE STRUT IS CAPABLE OF WITHSTANDING ONE LANDING AT A DESIGN WEIGHT OF 207,000 POUND AND SINK SPEED OF 9.6 FEET PER SECOND WITH CORRESPONDING LANDING ROLLOU AND BRAKING CONDITIONS, WITH NO YIELDING OF THE STRUCTURAL MEMBERS.

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DESIGNED TO FATIGUE LOAD SPECTRUM FOR LANDING, TAXI, AND GROUND HANDLIN CONDITIONS. DESIGNED TO LANDING IMPACT LOADS (SPIN UP AND SPRING BACK INCLUDING CROSSWIND CONDITIONS) USING A MINIMUM FACTOR OF SAFETY OF 1.0 TO YIELD STRENGTH OF MATERIAL IN ACCORDANCE WITH ESTABLISHED CRITERIA F COMMERCIAL AND MILITARY AIRCRAFT. DESIGNED TO A MINIMUM FACTOR OF SAFE OF 1.4 FOR TAXI AND GROUND HANDLING LOADS. MATERIAL PROCESSES - BARE PARTS ARE NOT EXPOSED TO CORROSIVE ACID ENVIRONMENT IN PLATING SHOP MOR THAN 30 DAYS AND PARTS ARE SHOT PEENED AFTER MACHINE OPERATIONS TO PREVENT STRESS CORROSION ON 300M MATERIALS.

(B) TEST

QUALIFICATION TESTS: CERTIFICATION INCLUDED STATIC LOAD TEST, DYNAMIC TESTS, PERFORMANCE TESTS, DROP TESTS, ENVIRONMENTAL TESTS AND FATIGUE LOAD SPECTRUM TESTS.

THE STATIC TEST PROGRAM APPLIED DESIGN AND ULTIMATE LOADS IN THE LANDIN TAXI AND GROUND HANDLING CONDITIONS.

LANDING CONDITION - VERTICAL LOADS WERE APPLIED AT THE CENTER OF THE AX AND WHEEL (PARALLEL TO THE STRUT CENTERLINE) AND RANGED FROM 103.1 KIPS TO 135.7 KIPS. THESE VERTICAL LOADS WERE COMBINED WITH FORWARD OR AFT LOADS AND SIDE LOADS THAT VARIED FROM APPROXIMATELY 83 KIPS TO 106 KIPS AND ZERO TO 32 KIPS RESPECTIVELY.

THE FORWARD/AFT LOADS WERE ALSO APPLIED AT THE CENTER OF THE AXLE AND WHEEL PERPENDICULAR TO THE STRUT CENTERLINE. SIDE LOADS WERE APPLIED A THE GROUND CONTACT POINT.

DESIGN MINIMUM FACTOR OF SAFETY WAS 1.0 TO YIELD STRENGTH.

TAXI CONDITION - THE STRUT WAS LOADED TO SIMULATE 2 POINT BRAKING, 3 POINT BRAKING, UNSYMMETRICAL BRAKING, TAXI BUMP AND LEFT/RIGHT TURN CONDITIONS WITH 32K/65K PAYLOADS AND 187 KIPS/227 KIPS VEHICLE WEIGHTS. VERTICAL LOADS RANGED FROM 42.2 KIPS TO 204.5 KIPS, FORE/AFT LOADS RANG FROM ZERO TO 90.8 KIPS AND SIDE LOADS RANGED FROM ZERO TO 88.4 KIPS.

DESIGN MINIMUM FACTOR OF SAFETY WAS 1.35 TO ULTIMATE STRENGTH.

GROUND HANDLING: THE STRUT WAS LOADED TO SIMULATE JACKING LOADS FOR 65 PAYLOAD AND 227 KIPS VEHICLE WEIGHT. APPLIED VERTICAL LOAD WAS 138 KIP FORE/AFT LOADS AND SIDE LOADS RANGED FROM ZERO TO 40.8 KIPS.

DESIGN MINIMUM FACTOR OF SAFETY WAS 1.5 TO ULTIMATE STRENGTH.

SHOCK STRUT ASSEMBLY 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.

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.

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 (LEFT AND RIGHT GEARS); CHECK THE EXTERNAL SURFACES OF THE SHOCK STRUT FOR DAMAGED PAINT OR CORROSIO INSPECTS MAIN PISTON (EXPOSED AREA) CHROME PLATE SURFACE WITH PISTON

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EXTENDED (ORBITER ON JACKS) FOR DAMAGE AND INSPECTS THE SHOCK STRUT ASSEMBLY AT THE UPPER TRUNNION PIN AND UPPER TRUNNION LUG ATTACH POINT FOR CONDITION AND SECURITY.
AN EXTERNAL VISUAL SURVEILLANCE INSPECTION OF THE LANDING GEARS FOR OBVIOUS EVIDENCE OF STRUCTURAL FAILURE OR DEFORMATION IS ALSO PERFORMI

FREQUENCY - ALL VEHICLES AT EACH GROUND TURNAROUND.

(C) INSPECTION

RECEIVING INSPECTION
MATERIALS AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS AND CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY SH TRAVELER MIPS. SURFACE FINISHES AND DIMENSIONS VERIFIED BY INSPECTION

CRITICAL PROCESSES
HEAT TREATMENT, SHOT PEENING AND CHROME & CD-TI PLATING ARE VERIFIED B INSPECTION.

NONDESTRUCTIVE EVALUATION
INTERNAL MATERIAL DEFECTS ARE DETECTED BY ULTRASONIC INSPECTION. MATER SURFACE DEFECTS ARE DETECTED BY MAGNETIC PARTICLE, NITAL ETCH AND FLUORESCENT PENETRANT INSPECTION.

TESTING
ATP IS VERIFIED BY INSPECTION.

PACKAGING/HANDLING
PROPERLY MONITORED HANDLING AND STORAGE ENVIRONMENT VERIFIED.

(D) FAILURE HISTORY
NONE.

(E) OPERATIONAL USE
NONE.