SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :LANDING DECELERATION FMEA NO 02-1F -H01 -A01 REV:06/27

ASSEMBLY :NLG STRUT ACTUATOR
P/N RI :MC287-0034
P/N VENDOR:PARKER-BERTEA
QUANTITY :1
:ONE FOR NOSE LANDING
:GEAR

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

REDUNDANCY SCREEN: A-N/A B-N/A C-N/

PREPARED BY:		APPROVED BY:		APPROVED BY (NASA):	
DES	N LEVERT	DES	N. Levert	SSM	R. Baluman
REL	C NELSON	REL		REL	
QE	M SAVALA	QE	7-25-88	QE	

ITEM:
ACTUATOR, STRUT

FUNCTION:
PROVIDE HYDROMECHANICAL MEANS FOR RETRACTING THE NOSE GEAR CONTROLLING THE TIME OF GEAR EXTENSION WITHIN 10 SECONDS MAXIMUM AN SECONDS MINIMUM.

FAILURE MODE:
EXTERNAL LEAKAGE

CAUSE(S):
MATERIAL DEFECT (CYLINDER RUPTURE), DAMAGED PISTON ROD SEAL, TEMPERAT TRANSDUCER BOSS LEAK, RETRACT FLOW CONTROL VALVE LEAK, EXTEND PORT LE RETRACT PORT LEAK, CONTAMINATION

EFFECT(S) ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A) AT DOWN GEAR COMMAND - POSSIBLE JAMMED ACTUATOR. LOSS OF M NUM ONE DUE TO LOSS OF FLUID.

(B) GEAR MAY NOT EXTEND. IF GEAR DOES EXTEND, POSSIBLE EXCESS DEPLOYMENT VELOCITY RESULTING IN MINOR STRUCTURAL DAMAGE; SAFE LAND PROBABLE.

(C) NONE, COMMITTED TO LAND.

(D) POSSIBLE LOSS OF CREW AND VEHICLE IF GEAR DOES NOT DEPLOY.

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

(A) DESIGN
CYLINDER BURST FACTOR OF 2.5. FRACTURE MECHANICS APPLIED. 9-4-30 ST IS HEAT TREATED TO 240,000 PSI (PER BPS 4625, REF. MIL-HDBK-5 PROVIDING GOOD PHYSICAL PROPERTIES FOR HIGH ALLOWABLE STRESS. ALLOWA IS 174,600 PSI. THE ACTUAL CALCULATED CYLINDER HOOP STRESS IS 144,0 PSI. THE MARGIN OF SAFETY IS 0.21. CYLINDER DESIGN AVOIDS STRESS RIS AND SUDDEN CHANGES IN SECTION IN CRITICAL AREAS. FLUID DEPLETION

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SYSTEM ONE, OTHER THAN BY CYLINDER RUPTURE, WOULD TAKE APPROXIMATELY SECONDS BASED ON ORIFICE SIZE IN ACTUATOR EXTEND PORT AND RESERVC QUANTITY. 61 SECONDS WOULD BE APPROXIMATELY AT ROLL STOP.

(B) TEST
QUALIFICATION-400 FULL STROKE CYCLES WITH A RETRACT LOAD OF 13,200 POUN FOR 10 PERCENT OF THE STROKE AND 7,000 POUNDS FOR THE REMAINING PERCENT OF STROKE. IT IS ALSO TESTED AS PART OF THE LANDING GEAR TE ARTICLE (SIMULATOR).

ACCEPTANCE TEST-PROOF PRESSURE 4,500 PSI. ACTUATOR RETRACT LOAD TESTS.

OMRSD-HYDRAULIC SYSTEM INSPECTION, PERFORMED PRIOR TO EACH MISSION. NC LANDING GEAR WHEEL WELL ZONAL INTERNAL DETAIL INSPECTION, PERFORMED PRI TO EACH MISSION; VISUAL INSPECTION FOR EVIDENCE OF LEAKAGE OR DAMAG POST LANDING HYDRAULIC RESERVOIR EFFLUENT SAMPLES, PERFORMED AFTER EVE FLIGHT; VERIFY THAT RESULTS OF FLUID SAMPLE CONTAMINATION ME SPECIFICATION. GENERAL REQUIREMENT 5.2, VERIFY ALL HYDRAULIC FLUID US TO SERVICE VEHICLE IS PER MIL-H-83282.

(C) INSPECTION

RECEIVING INSPECTION
CERTIFICATION RECORDS AND CERTIFIED TEST REPORTS ARE MAINTAIN CERTIFYING MATERIAL AND PHYSICAL PROPERTIES.

CONTAMINATION CONTROL
SUPPLIER TEST STAND FLUID PARTICLE COUNT CHECKED TWICE A DAY, WH APPLICABLE. FLUID CONTAMINATION PARTICLE COUNT CONDUCTED PRIOR TO ATP

CRITICAL PROCESSES
CYLINDER INSPECTED PRIOR TO HEAT TREAT AND FOUR TENSILE TEST SPECIME ARE INCLUDED. CYLINDER IS NORMALIZED AND TEMPERED, CHECKED TO ROCKWE HARDNESS 40. CADMIUM PLATING IS VERIFIED BY INSPECTION. SHOT PEENI (TO KEEP CHROME PLATING MICROCRACKS FROM REDUCING PARENT MATERIAL FATIG PROPERTIES) AND CHROME PLATING OF OUTPUT PISTON ROD ARE VERIFIED INSPECTION.

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

ASSEMBLY/INSTALLATION
INSPECTION OF DIMENSIONS AT FINAL INSPECTION. QUALITY CONTROL WITNESS SEAL AND BACKUP RING INSTALLATION. O-RING GROOVES AND SEAL FAC INSPECTED FOR PROPER FINISH. ALL SEALS ARE INSPECTED PRIOR INSTALLATION. TORQUES ARE WITNESSED AND VERIFIED BY INSPECTIO ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION.

TESTING
ATP IS WITNESSED BY RI SOURCE INSPECTION.

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

(D) FAILURE HISTORY
(A5137-010) DURING ACCEPTANCE TESTING, WHILE PERFORMING THE HIGH PRESSU EXTERNAL LEAKAGE TEST, LEAKAGE WAS DETECTED AT THE RETRACT PORT. TH LEAKAGE WAS A RESULT OF DEBRIS FROM A PREVIOUS FAILURE WHICH HAD NOT BE COMPLETELY FLUSHED FROM THE MANIFOLD ASSEMBLY. THE CLEANING METHO AFTER THE CONTAMINATION PROBLEM WERE REVISED TO INCLUDE REMOVAL OF A LEE PLUGS, ULTRASONIC CLEANING AND REASSEMBLY.

(A5573-010) DURING ACCEPTANCE TESTING, WHILE PERFORMING THE LOW PRESSU LEAK TEST, LEAKAGE WAS DETECTED AT A G-T STATIC SEAL BETWEEN THE ROD E GLAND AND THE CYLINDER. THE CAUSE WAS THE SEAL'S BACKUP RING HAD SHEAR DURING ASSEMBLY OF THE ACTUATOR AND A PORTION OF THE RING WAS LAYING OV THE ELASTOMERIC SEAL PREVENTING EFFECTIVE SEALING. THIS WAS DUE TO IMPROPERLY ASSEMBLED SEAL. THE SEAL AND BACKUP RINGS WERE REPLACED A THE UNIT SUCCESSFULLY PASSED SUBSEQUENT LEAK TESTS. THE SUPPLI ASSEMBLY PROCEDURES AND TOOLS WERE REVIEWED AND APPROVED. THE SUPPLI WAS DIRECTED TO UTILIZE SOLID (UNCUT) BACKUP RINGS OF NYLON MATERIAL ON IN THE FABRICATION OF THE ORBITER ACTUATOR.

(E) OPERATIONAL USE
NONE