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PRINT DATE: 11/10/88

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-1CB-0704-X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION : 11/10/88

CLASSIFICATION NAME PART NUMBER
LRU : SEAL, LH2/LO2 ME261-0033

QUANTITY OF LIKE ITEMS: 181

DESCRIPTION/FUNCTION:

HELIUM HIGH/LOW PRESSURE METALLIC BOSS SEAL, (K SEAL).

PROVIDES A SEAL BETWEEN TRANSDUCERS/TEST PLUGS AND BOSSES TO PREVENT EXTERNAL LEAKAGE IN THE HIGH/LOW PRESSURE HELIUM SYSTEM.

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SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-1CB-0704-01

REVISION: 11/10/88

SUBSYSTEM: MAIN PROPULSION

LRU :SEAL, LH2/LO2

ITEM NAME: SEAL, LH2/LO2

CRITICALITY OF THIS

FAILURE MODE:1 1

FAILURE MODE:
RUPTURE/LEAKAGE

MISSION PHASE:

PL PRELAUNCH
LO LIFT-OFF
DC DE-ORBIT

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

CAUSE:
FATIGUE, MATERIAL DEFECT, DAMAGED SEALING SURFACE

CRITICALITY 1/1 DURING ANY MISSION PHASE OR ABORT?

REDUNDANCY SCREEN A) N/A

B) N/A

C) N/A

A)

B)

C)

- FAILURE EFFECTS -

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(A) SUBSYSTEM:

DURING ASCENT, THE PNEUMATIC/ENGINE HELIUM SUPPLY WILL BE LOST. ESCAPING HELIUM MAY OVERPRESSURIZE THE AFT COMPARTMENT.

DURING ASCENT, HELIUM SUPPLY TO ONE ENGINE WILL BE LOST. POSSIBLE UNCONTAINED ENGINE SHUTDOWN IF REDUNDANT LEG CANNOT PROVIDE ENGINE HELIUM REQUIREMENTS. EXCESSIVE HELIUM TANK PRESSURE DECAY (SM ALERT: 20 PSI/3 SECONDS; CAUTION AND WARNING: 1150 PSIA LOWER LIMIT) AND/OR REGULATOR PRESSURE OUT OF LIMITS WILL BE INDICATED BY SM ALERT (BOTH LEGS: 679 LOWER AND 806 UPPER) OR CAUTION AND WARNING (LEG A ONLY: 680 LOWER LIMIT AND 810 UPPER LIMIT).

PURGE OF AFT COMPARTMENT AND LH2/LO2 SYSTEMS WOULD DEPEND SOLELY ON THE LEFT ENGINE HELIUM SYSTEM RESIDUALS, RESULTING IN INADEQUATE ABORT PURGE, INCOMPLETE PROPELLANT DUMP, AND INGESTION OF CONTAMINATION.

LOSS OF PNEUMATIC LOW PRESSURE HELIUM MAY PREVENT THE APPLICATION OF CLOSING PRESSURE TO THE LO2 PREVALVE ACTUATORS AT ENGINE SHUTDOWN RESULTING IN PUMP OVERSPEED AND CAVITATION. MAY RESULT IN THE INABILITY TO MAINTAIN ENGINE HELIUM REQUIREMENTS. POSSIBLE UNCONTAINED ENGINE SHUTDOWN. POSSIBLE FIRE/EXPLOSION HAZARD.

STORED HELIUM PRESSURE IN THE ACCUMULATOR LEG AND SUPPLEMENTAL HELIUM FROM LV10 SHOULD BE ADEQUATE TO OPERATE THE LO2 PREVALVES AT MECO. LOSS OF HELIUM MAY PREVENT OPERATION OF VALVES FOR MPS DUMP.

HELIUM WILL NOT BE AVAILABLE FOR AFT COMPARTMENT PURGE (RTLS AND TAL ABORT CRITICAL).

DURING ENTRY, VENT DOORS ARE CLOSED TO PREVENT INGESTION OF RCS AND APU GASES. LEFT ENGINE B LEG ISOLATION VALVE IS OPENED WHEN VEHICLE TRANSITIONS TO ORBITER SOFTWARE MAJOR MODE 304 (MM304). RUPTURE ON THIS LINE DURING THE TIME PERIOD THAT THE VENT DOORS ARE CLOSED MAY RESULT IN OVERPRESSURIZATION OF THE AFT COMPARTMENT. VENT DOORS ARE OPENED WHEN VEHICLE VELOCITY DROPS BELOW 2400 FT/SEC.

PRIOR TO T-9 MINUTES, EXCESSIVE HELIUM LEAKAGE WILL BE DETECTABLE USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
POSSIBLE LAUNCH SCRUB DUE TO LCC VIOLATION.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE.

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RATIONALE FOR CRITICALITY:

- DISPOSITION RATIONALE -

(A) DESIGN:

IN ORDER TO INCREASE THE USEFUL TEMPERATURE RANGE OF THE STANDARD BOSS FITTING, A METALIC BOSS SEAL (ME261-0033, TYPE III) WAS DEVELOPED. THE SEAL WAS FABRICATED FROM A286 CORROSION RESISTANT STEEL AND IS COATED WITH K-6 NICKEL-LEAD. THE SEAL IS DESIGNED TO BE USED IN MS33649 BOSS PORTS. THE SEAL WAS DESIGNED TO A MINIMUM FACTOR OF SAFETY OF 2.0 PROOF AND 4.0 BURST.

EXTERNAL LEAKAGE FROM THE TRANSDUCER/TEST PLUG INTERFACE CAN OCCUR FROM A DAMAGED/DEFECTIVE K-SEAL OR DAMAGE TO THE SEALING SURFACE. THE SEALING SURFACE HAS AN 8 MICRON FINISH AND IS EXAMINED PRIOR TO INSTALLATION OF THE K-SEAL. THE K-SEAL JOINT IS LEAK TESTED AFTER INSTALLATION.

(B) TEST:

ATP

EXAMINATION OF PRODUCT
PER ROCKWELL SPECIFICATION CONTROL DRAWING

VEHICLE ACCEPTANCE (PALMDALE ONLY)
PROOF PRESSURE
6750 PSIG (HI-PRESSURE HELIUM BOSS/SEALS)
1500 PSIG (REGULATED HELIUM BOSS/SEALS)
LEAK CHECK
4400 PSIG (HI-PRESSURE HELIUM BOSS/SEALS)
750 PSIG (REGULATED HELIUM BOSS/SEALS)

COMPATIBILITY TEST
GO2 COMPATIBILITY
60 TEST COUPONS (EACH BATCH OF SEALS).
EACH BATCH OF SEALS IDENTIFIED BY LOT TRACIBILITY REQUIREMENTS.

CERTIFICATION

THE SEALS WERE CERTIFIED BY SIMILARITY TO THE K-SEALS USED ON THE SATURN II PROGRAM.

OMRSD
V4LA20.070 MPS/SSME HELIUM SYSTEM FLANGE/THREAD JOINT LEAK CHECK (110)
V4LA20.080 ORBITER/MPS HI PRESS HELIUM SYSTEM FLIGHT DECAY (EVERY FLT)
V4LA20.100 MPS PNEUMATIC LOW PRESSURE DECAY TEST (EVERY FLT)

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V41AZO.140 ORBITER/MPS SSME HELIUM HI DELTA PRESSURE DECAY (I5)
V41AZO.150 FLIGHT PRESSURIZATION ISOLATION TEST (EVERY FLT)
V41AZO.200 PNEUMATIC ACCUMULATOR DECAY TEST (EVERY FLT)
V41AYO.300 LO2 REPRESS SYSTEM LEAK TEST (I5)
V41AYO.310 LH2 REPRESS SYSTEM LEAK CHECK (I5)
V41BCO.100 HI-PRESS 2-WAY SOLENOID VALVE LEAK TEST (EVERY FLT)
V41BGO.010 PR1-4,7-9 PNEUMATIC REGULATOR LOCKUP TEST (EVERY FLT)
V41BUO.010 ORBITER MPS COMPONENT INSPECTIONS (EVERY FLT)

(C) INSPECTION:

RECEIVING INSPECTION
PARTS ARE EXAMINED TO DETERMINE CONFORMANCE TO REQUIREMENTS WITH
RESPECT TO MATERIALS, DIMENSIONS, MARKINGS, AND WORKMANSHIP.

CONTAMINATION CONTROL

CLEANLINESS LEVEL OF 100A IS MAINTAINED AND VERIFIED.

ASSEMBLY/INSTALLATION

PRIOR TO JOINT ASSEMBLY, FLANGE SEALING SURFACES AND SEAL ARE VISUALLY
INSPECTED AND CLEANLINESS IS VERIFIED. SEALS ARE PROOF PRESSURE TESTED
AND LEAKED CHECK AFTER INSTALLATION INTO THE VEHICLE.

CRITICAL PROCESSES

K-6 NICKEL-LEAD PLATING IS VERIFIED BY INSPECTION. THE SEAL IS TESTED
FOR GO2 COMPATIBILITY PER NHB 8060.1A REQUIREMENTS.

TESTING

ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

EACH SEAL IS INDIVIDUALLY WRAPPED IN A FLOUROCARBON FILM AND THEN
PLACED IN A POLYURETHANE ENVELOPE AND HEAT SEALED. PACKAGING FOR
SHIPMENT IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

THERE HAVE BEEN NO RUPTURE FAILURES ASSOCIATED WITH THIS COMPONENT.
SEVERAL LEAKS HAVE BEEN DETECTED DURING VEHICLE LEAK CHECKS. ALL WERE
CORRECTED BY PARTS REPLACEMENT AND/OR RETORQUE.

(E) OPERATIONAL USE:

ENGINE HELIUM TANK AND/OR REGULATOR PRESSURE ANOMALIES ARE INDICATED
BY SM ALERT OR CAUTION AND WARNING. THE CREW ACTION IS TO FOLLOW THE
NORMAL LEAK ISOLATION PROCEDURE.

PNEUMATIC ACTUATION HELIUM BOTTLE PRESSURE IS ON A DEDICATED DISPLAY
IN COCKPIT. CREW ACTION IS TO FOLLOW NORMAL LEAK ISOLATION PROCEDURE.
PRIOR TO MECC, ISOLATION VALVES (LV7, LV8) WILL BE REOPENED AND THE
LEFT ENGINE HELIUM CROSSOVER VALVE (LV10) WILL BE OPENED.

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EFFECTIVE FOR OI-8D SOFTWARE, CR 89397 "MPS PNEUMATIC SYSTEM FDA AND DISPLAY - BFS" ADDS THE PNEUMATIC TANK, REGULATOR AND ACCUMULATOR PRESSURE TO THE SM ALERT FDA SYSTEM AND ADDS THE 3 PRESSURE MEASUREMENTS TO BFS SYSTEM SUMMARY DISPLAY. THIS ALLOWS THE FLIGHT CREW TO RESPOND TO A PNEUMATIC HELIUM SYSTEM LEAK INDEPENDENT OF GROUND CONTROL.

- APPROVALS -

RELIABILITY ENGINEERING: L. H. FINEBERG
DESIGN ENGINEERING : J. E. OSKUND
QUALITY ENGINEERING : R. WILLIAMS
NASA RELIABILITY :
NASA DESIGN :
NASA QUALITY ASSURANCE :

[Handwritten signatures and dates]
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