SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ATMOSPHERIC REVIT. FMEA NO 06-1C -0161 -2 REV:01/08/88

[redacted]EMBLY :ATMOS MAKEUP CONTROL
[redacted]N RI :MC282-0082-0040
P/N VENDOR:BLD999050-1
QUANTITY :4
:TWO PER LOOP
:FOUR PER SUBSYSTEM

CRIT. FUNC: 1
CRIT. HDW: 1

VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

PHASE(S): PL X LO X OO X DO X LS X

REDUNDANCY SCREEN: A- B- C-

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ITEM:
TANK ASSEMBLY, NITROGEN STORAGE

FUNCTION:
STORAGE FOR SYSTEMS ONE AND TWO GASEOUS NITROGEN. EACH TANK STORES 65.5 POUNDS (MASS) OF GASEOUS NITROGEN OVER AN OPERATING RANGE OF 285 PSIG TO 3300 PSIG. TANKS PROVIDE NITROGEN FOR CABIN LEAKAGE, NORMAL USAGE, AND EMERGENCY USAGE.

FAILURE MODE:
RUPTURE

[redacted]E(S):
RUPTURE AT OPERATING PRESSURE CAN ONLY OCCUR AS A RESULT OF STRESS RUPTURE (STATIC FATIGUE) OF KEVLAR OVERWRAP.

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

(A) LOSS OF REDUNDANCY - LOSS OF ONE HALF OF NITROGEN SUPPLY PLUS THAT PORTION OF THE REMAINING HALF LOST DURING LEAK ISOLATION REACTION TIME.

(B) REDUCED SUPPLY OF NITROGEN AVAILABLE.

(C) ABORT DECISION - ONLY TWO NITROGEN TANKS CAN BE USED FOR CABIN PRESSURIZATION, CABIN LEAK AND OTHER REQUIREMENTS.

(D) DAMAGE TO SURROUNDING STRUCTURE OR SYSTEMS MAY OCCUR AS A RESULT OF CATASTROPHIC FAILURE OF TANK. POSSIBLE LOSS OF CREW OR VEHICLE DUE TO LACK OF SUFFICIENT NITROGEN TO SUPPORT CONTINGENCIES.

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

(A) DESIGN
THE TANKS ARE FILAMENT WOUND (500 KSI TENSILE STRENGTH KEVLAR-49) OVER A FORGED 6A1-4V TITANIUM LINER (0.05 INCH MINIMUM THICKNESS, 130 KSI [redacted]TIMATE STRENGTH). THE TANK IS DESIGNED TO LEAK BEFORE BURST. BURST [redacted]ESSURE IS 4950 PSI WHICH IS 1.5 TIMES THE WORKING PRESSURE OF 3300 PSI. TANK IS DESIGNED TO WITHSTAND NEGATIVE 15.23 PSID.

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(B) TEST

MANUFACTURING BUILDUP - THE LINER IS FLUORESCENT-PENETRANT INSPECTED AND RADIOGRAPHICALLY INSPECTED FOR MATERIAL AND WELD FLAWS. THE LINER IS PROOF PRESSURE TESTED AT 778 PSIG AND LEAK CHECKED AGAINST A 1 X 10 EXP -7 SCCS HELIUM REQUIREMENT.

ACCEPTANCE TEST - EXAMINATION OF PRODUCT, LEAK, PROOF, AND RADIOGRAPHIC INSPECTION OF WELDS.

QUALIFICATION TEST- 1000 PRESSURE CYCLES, BURST TEST, DESIGN SHOCK (20G SAWTOOTH PULSE FOR 11 MS IN EACH DIRECTION OF 3 ORTHOGONAL AXES, RANDOM VIBRATION AT 0.5 G**2/HZ, PROOF PRESSURE AT 1.1 TIMES OPERATING PRESSURE, LEAK 1 X 10 EXP -7 SCCS HELIUM AT 3300 PSI, AND DYNAMIC LOADS.

OMRSD - TANKS ARE DEPRESSURIZED TO LESS THAN 200 PSIA WHEN NON-OPERATING PERIOD IS IN EXCESS OF 8 WEEKS OR FOR VEHICLE STORAGE.

(C) INSPECTION

RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION. MICRO-EXAMINATION AND CHEM-ETCH INSPECTION FOR ALPHA SEGREGATION AND QUALITY TESTING PERFORMED ON FORGINGS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
INTERNAL SURFACES CLEANED TO LEVEL 100A AND DRYNESS REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
FABRICATION OF COMPONENTS AND ASSEMBLY PER DRAWING REQUIREMENTS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
WELD SCHEDULES OF VESSELS VERIFIED BY INSPECTION. MECHANICAL PROPERTIES AND CHEMICAL ANALYSIS FOR O2, N2, AND H CONTENT OF HEMISPHERES AFTER FINAL HEAT TREATMENT ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
PENETRANT AND RADIOGRAPHIC INSPECTIONS OF LINER ARE VERIFIED BY INSPECTION. X-RAY AND PROOF AND LEAK TEST OF THE VESSEL ARE VERIFIED BY INSPECTION.

TESTING
PRESSURIZATION CYCLE HISTORY LOG AND SCHEDULE ARE VERIFIED BY INSPECTION

HANDLING/PACKAGING
HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

THERE HAVE BEEN NO FAILURES APPLICABLE TO RUPTURE FAILURE MODE. THE TANKS HAVE SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM FOR THIS FAILURE MODE.

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(E) OPERATIONAL USE

1. CREW ACTION
   PERFORM LEAK ISOLATION BY CLOSING THE AFFECTED N2 SUPPLY VALVES AND APPROPRIATE SYSTEM RECONFIGURATION. DATA NOT AVAILABLE TO CREW DURING ASCENT AND ENTRY. RESPONSE WOULD BE BASED ON GROUND ADVISEMENT.

2. TRAINING
   STANDARD ECLSS TRAINING COVERS THE EFFECTS OF THE GENERIC N2 PCS LEAK; LEAK ISOLATION, SYSTEM RECONFIGURATION AND MISSION DURATION.

3. OPERATIONAL CONSIDERATION
   A. REAL TIME DATA SYSTEM ALLOWS FOR GROUND MONITORING OF THE TANK ASSEMBLY PRESSURE AND TEMPERATURE.
   B. FLIGHT DATA FILE PROCEDURES COVER THE EFFECTS OF THIS FAILURE WITH THE EXCEPTION OF SYSTEM DESTRUCTION DUE TO RUPTURE.
   C. LENGTH OF MISSION AFFECTED BY THE REMAINING QUANTITY OF N2 ON BOARD.
   D. REFERENCE LOSS/FAILURE FLIGHT RULES.