

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -L2A -1L REV:02/26/88

ASSEMBLY :LUBE OIL COOLING ABORT
P/N RI :ME271-0079-41XX RTLS, AOA, ATO, TAL CRIT. FUNC: 1R
P/N VENDOR:TITFLEX P/N 106056-41XX VEHICLE 102 CRIT. HDW: 2
QUANTITY :12 EFFECTIVITY: X X X
:2 PER APU INTERFACE AND PHASE(S): PL X LO X CO X DO X LS X
:2 PER WATER BOILER INT.

PREPARED BY: DES M HAMMEL DES APPROVED BY: REDUNDANCY SCREEN: A-PASS B-PASS C-PASS
REL T R BOLTZ REL APPROVED BY (NASA): SSM Walt Smit
QE W J SMITH QE [Signature] REL [Signature] QE [Signature]

ITEM:
FLEX HOSE, LUBE OIL COOLING LOOP

FUNCTION:
TO PROVIDE LUBE OIL TO AND FROM APU COOLING LOOPS AND TO PROVIDE FOR DEFLECTION AT THE APU INTERFACE CAUSED BY BULKHEAD VIBRATION AND APU OVERHANG; TO ELIMINATE PRELOADS INDUCED BY LARGE TOLERANCES ON THE APU AND THE WATER BOILER INTERFACE LOCATIONS.

FAILURE MODE:
LEAKAGE (GROSS EXTERNAL).

CAUSE(S):
RUPTURE, CRACKS, FITTING FAILURES, APU DETONATION.

EFFECT(S) ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE
(A) POSSIBLE LOSS OF ONE APU SYSTEM BEFORE MISSION COMPLETION. GRADUAL DECREASE IN FLOW TO BEARINGS, INCREASED BEARING TEMPERATURE. OVERTEMPERATURE INDICATION TO PMS. POSSIBLE SHUTDOWN.
(B) POSSIBLE LOSS OF SHAFT POWER TO ONE HYDRAULIC PUMP AND LUBE OIL IN AFT FUSELAGE.
(C)ABORT DECISION IS REQUIRED, IF FAILURE OCCURS PRIOR TO ENTRY COMMITMENT.
(D) NO EFFECT UNLESS LUBE OIL IS IGNITED (IGNITION TEMPERATURE IS 760 DEG F) OR UNTIL SECOND SYSTEM LOST. CRITICALITY 1 FOR SSME INDUCED RTLS, ATO, AOA, OR TAL DUE TO THE POSSIBLE ADDITIONAL LOSS OF ASSOCIATED APU/HYD AND MAIN ENGINE.
(E) FUNCTIONAL CRITICAL EFFECT - POSSIBLE LOSS OF CREW/VEHICLE IF EXPOSED OIL IS IGNITED, CAUSING LOSS OF ADJACENT AND REDUNDANT HARDWARE.

DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE
(A) DESIGN
MATURE HARDWARE USED ON MILITARY AIRCRAFT AND SPACE PROGRAMS.

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SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -L2A -11 REV:02/86

HOSE INNER CORE IS EXTRUDED TPE. REINFORCEMENT IS 304 SS WIRE BRAID.
HOSE IS SINGLE BRAID, QUALIFIED TO MIL-H-25579.

HOSE-END FITTINGS ARE SS PROGRESSIVE-SWAGED WITH POSITIVE BRAID LOCK AND CONFORM TO MIL-H-25579. ONE HOSE END IS 21-6-9 STRAIGHT TUBE AND THE OTHER END IS 17-4PH DUAL-SEAL FITTING. THEY ARE HEAT TREATED TO 145 KSI TENSILE.

(B) TEST

HOSE ASSEMBLY QUALIFICATION IMPULSE ENDURANCE CYCLING - 100,000 CYCLES, 0-1875-0 PSI AT 400F IN ACCORDANCE WITH FIG 3 MIL-H-25579. RATE 70 CYCLES/MIN BURST PRESSURE - 10 SIZE, 7,000 PSI AT 70F, 5,500 PSI AT 450 DEG F. SUPPLIER ACCEPTANCE - PROOF PRESSURE 3,000.

INTEGRATED SUBSYSTEM TEST WAS USED FOR CERTIFICATION.

CMRSD: POSTFLIGHT SYSTEM INSPECTION AND PRESSURE DECAY LEAK TESTS ON LUBE SYSTEM ARE PERFORMED EVERY FLOW.

(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTION AND CHEMICAL ANALYSIS PERFORMED ON ALL RAW MATERIALS. RECEIVING INSPECTION VERIFIES INCOMING RAW STOCK IS NOT RELEASED TO THE SHOP FOR USE UNTIL A SAMPLE OF THE MATERIAL HAS BEEN CERTIFIED AS ACCEPTABLE BY THE COMPANY METALLURGIST.

CONTAMINATION CONTROL

CLEANLINESS TO LEVEL 100 IS VERIFIED BY INSPECTION. CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, ASSEMBLY AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION. DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. HOSE END FITTINGS ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

RADIOGRAPHIC INSPECTION OF SWAGED FITTINGS TO ASSURE THE HOSE AND BRAID ARE PROPERLY BOTTOMED IN THE END FITTING IS VERIFIED. RADIOGRAPHIC INSPECTION OF BUTT WELDED TUBING IS VERIFIED. EACH WELD RADIOGRAPH IS INSPECTED UNDER MAGNIFICATION TO ASSURE THE WELDS ARE FREE OF CRACKS, POROSITY, INCLUSIONS OR VOIDS.

CRITICAL PROCESSES

BUTT WELDING AND SWAGING ARE VERIFIED BY INSPECTION.

TESTING

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. PROOF PRESSURE AND LEAK TEST OF EACH HOSE ASSEMBLY IS PERFORMED BY INSPECTION

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE, AND SHIPPING PROCEDURES ARE VERIFIED.

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(D) FAILURE HISTORY

NO FAILURE HISTORY ON LUBE OIL HOSE; SEE FAILURE (A85521) ON HYDRAZINE HOSE (DYNATUBE LEAK).

(E) OPERATIONAL USE

SHUT DOWN APU BASED ON SYSTEM TEMPERATURES AND FLIGHT PHASE. ALSO, IF APU SHUTS DOWN, REMAINING APUS GO TO HIGH SPEED AND AUTOMATIC SHUTDOWN IS INHIBITED TO PRECLUDE INADVERTENT SHUTDOWNS.

IF ENTRY, PERFORM HOT RESTART IF REQUIRED TO GAIN SECOND APU.