

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : AUXILIARY POWER (APUS) FMEA NO 04-2 -TFL1 -13 REV: 02/26/85

ASSEMBLY : FUEL SUPPLY CRIT. FUNC: 12
 P/N RI : ME276-0032-0025 CRIT. HDW: 2
 P/N VENDOR: LEAR SIEG P/N RR42950-25 VEHICLE 102 103 104
 QUANTITY : 3 EFFECTIVITY: X X X
 : 1 PER FUEL FEEDLINE PHASE(S): PL X LO X OO X DO X LS X

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

ITEM: COUPLING, FUEL FEED LINE TEST PORT.

FUNCTION:
 (1) TO PROVIDE INTERFACE BETWEEN GROUND SERVICING EQUIPMENT AND FUEL FEEDLINE FOR GROUND CHECKOUT OPERATIONS. (2) TO MAINTAIN PROPER SEAL AFTER SERVICING AND CHECKOUT.

FAILURE MODE:
 EXTERNAL LEAKAGE

CAUSE(S):
 SEAL FAILURES, PIECE-PART FAILURES, CORROSION, CONTAMINATION.

- EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
- (A) LOSS OF REDUNDANT SEALS THEN POSSIBLE LOSS OF ONE APU SYSTEM BEFORE MISSION COMPLETION.
 - (B) LOSS OF REDUNDANT SEALS THEN POSSIBLE LOSS OF SHAFT POWER TO ONE HYDRAULIC PUMP AND POSSIBLE DAMAGE TO EQUIPMENT DUE TO RAW FUEL IN AFT COMPARTMENT.
 - (C) ABORT DECISION IS REQUIRED, IF FAILURE OCCURS PRIOR TO ENTRY COMMITMENT.
 - (D) NO EFFECT UNLESS FUEL IS IGNITED OR SECOND SYSTEM LOST.
 - (E) FUNCTIONAL CRITICAL EFFECT - POSSIBLE LOSS OF VEHICLE IF BOTH SEALS ARE LOST, RESULTING IN EXTERNAL LEAKAGE. QD CAP SEALS ARE NOT CAPABLE OF CHECKOUT BECAUSE NO TEST PORT OR EQUIPMENT IS PROVIDED. NOT DETECTABLE IN-FLIGHT BECAUSE NO MEASUREMENT BETWEEN POPPET AND CAP SEALS EXISTS.

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SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -TP11 -13 REV:02/26/85

DISPOSITION & RATIONALE:

(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN

THE COUPLING IS BASICALLY THE SAME DESIGN AS USED IN APOLLO CSM RCS FUEL AND OXIDIZER SYSTEMS. THE PORTION OF THE BODY THAT MATES WITH THE GROUND HALF IS MADE OF 17-7 PH CRES.

THE PRIMARY AND SECONDARY POPPET SEALS ARE TEFLON (TFE), AND SECONDARY CAP SEAL IS TFE. THE PRIMARY CAP SEAL HAS BEEN CHANGED FROM KYNAR TO TEFLON FEP.

THE PORTION OF THE BODY THAT MATES WITH THE ORBITER TUBING IS 17-7 PH (HEAT TREAT TO 150 KSI TENSILE). DYNATUBE MALE FITTING.

(B) TEST

THE COUPLING WAS TESTED TO BURST OF PRESSURE 16,550 PSIG DURING CERTIFICATION FOR APOLLO USE. ANALYSIS OF THE ORBITER COUPLING INDICATES BURST WILL OCCUR AT APPROXIMATELY 12,000 PSIG.

DYNATUBE FITTINGS WERE QUALIFIED BY RESISTOFLEX FOR 200,000 IMPULSE CYCLES UP TO 4,500 PSIG AT 400 DEG F TO -65 DEG F 12,000 PSI BURST PLUS SINE VIBRATION AT +/- 0.41 G TO +/- 10 G FOR 3 HR (20 MIN SWEEPS FOR 2 TO 2,000 CPS).

COUPLING ACCEPTANCE TESTED TO 825 PSIG (PROOF AND LEAKAGE) WITH CAPS ON AND OFF AT THE SUPPLIER. PROOF OF 7,500 PSIG (OPERATING PRESSURE) AND LEAKAGE TESTS AT OPERATING PRESSURE ARE CONDUCTED ON THE COUPLING AND DYNATUBE AFTER INSTALLATION. MAXIMUM ALLOWABLE LEAKAGE IS 1×10^{-4} SCC/SEC. THE DYNATUBE FITTINGS ARE ALIGNED AND TORQUED TO A MINIMUM OF 180 IN-LB PER MA0102-306.

OMRSD: TOXIC VAPOR CHECKS AT THIS SPECIFIC LOCATION ARE PERFORMED EVERY FLOW.

(C) INSPECTION

RECEIVING INSPECTION

MATERIAL AND PROCESSES CERTIFICATIONS ARE VERIFIED. PARTS PASSIVATION IS VERIFIED BY INSPECTION.

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. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

LIP SEALS INSPECTED UNDER MAGNIFICATION IS VERIFIED

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CRITICAL PROCESSES

WELDING PER SPECIFICATION REQUIREMENTS IS VERIFIED BY INSPECTION. SAMPLE WELDS ARE SECTIONED AND CHECKED FOR WELD PENETRATION ON A PLAN OF ONE SAMPLE PER 20 WELDS.

TESTING

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING

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

(D) FAILURE HISTORY

STS-9 CAR 09F023: APU FIRE QD WELD FAILED DUE TO HIGH PRESSURE AND INSUFFICIENT WELD PENETRATION. CORRECTIVE ACTION WAS TO PROOF ALL QD's AT 7,500 PSI.

(E) OPERATIONAL USE

CLOSE ISOLATION VALVES (IF DETECTED).