SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -MD11 -13 REV:02/28/

ASSEMBLY :FUEL SUPPLY
P/N RI :ME276-0030-0015
P/N VENDOR:J.C.CARTER P/N 60870-1
QUANTITY :2
:1 PER FUEL TANK
:

CRIT. FUNC: 1
CRIT. HDW:

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X

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

REDUNDANCY SCREEN: A-FAIL B-FAIL C-PA

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
DES	J R MUNROE	DES	SSM
REL	T R BOLTZ	REL	REL
QE	W J SMITH	QE	QE

3-16-82

ITEM:
COUPLING, FUEL FILL AND DRAIN.

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

FAILURE MODE:
EXTERNAL LEAKAGE

CAUSE(S):
SEAL FAILURES (CAP AND POPPET), 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 CREW/VEHICLE IF BOTH SEALS ARE LOST, RESULTING IN EXTERNAL LEAKAGE OF HYDRAZINE. QD CA SEALS ARE NOT CAPABLE OF CHECKOUT BECAUSE NO TEST PORT OR EQUIPMENT IS PROVIDED. NOT DETECTABLE IN-FLIGHT BECAUSE NO MEASUREMENT BETWEEN POPP AND CAP SEALS EXISTS.

SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -MD11 -13 REV:02/26/88

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 ON APOLLO CSM AND LEM RCS FUEL AND OXIDIZER SYSTEMS, EXCEPT THE BODY THICKNESS IN THE TIG WELD AREA HAS BEEN INCREASED 50% MORE ON THE SHUTTLE COUPLING ON THE END THAT CONNECTS TO GROUND HALF. THE BODY MATERIAL AND END FITTING ARE 17-4 PH WITH DYNATUBE MALE FITTING FOR ORBITER TUBING CONNECTION.

THE DISCONNECT IS CAPPED DURING FLIGHT AND HAS DUAL POPPET TEFZEL SEALS AS WELL AS TWO CONCENTRIC INDEPENDENT SEALING RIDGES ON THE TEFZEL CAP SEAL. THE DYNATUBE FITTING HAS DUAL SEALING SURFACES AND IS MADE OF 17-4 PH CRES HEAT TREATED TO 145 KSI TENSILE MINIMUM.

THE FLIGHT HALF QD AND CAP ARE A MATCHED SET. ANY VIOLATION OF THIS WOULD WOULD RAISE THE CRITICALITY TO 1/1. (SERVICE PANEL SEALS WILL RELIEVE.)

(B) TEST
THE COUPLING WAS TESTED TO BURST OF 2,100 PSIG (F.S. = 6) DURING CERTIFICATION FOR APOLLO RCS USE. SIMILAR COUPLINGS HAVE BEEN TESTED AT 295 DEG F, 270 PSIG, AND VIBRATED AT 0.7 G2/HZ. THE KYNAR WAS TESTED WITH HYDRAZINE AT 160 DEG F PER CR.

DYNATUBES 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 VIBRATE AT +/- 0.41 G TO +/- 10 G FOR 3 HR (20 MIN SWEEPS FROM 5 TO 2,000 CPS).

540 PSIG PROOF AND HELIUM LEAKAGE TESTS ARE PERFORMED AT COUPLING SUPPLIER WITH CAPS ON AND OFF. THE PROOF AND HELIUM LEAKAGE (AT OPEN POSITION) TESTS ARE REPEATED AFTER INSTALLATION IN THE ORBITER APU SYSTEM. MAXIMUM ALLOWABLE LEAKAGE IS 5 X 10-3 SCC/SEC APPLIES TO POPPET. THE DYNATUBES ARE ALIGNED AND TORQUED TO MINIMUM 360 IN-LB PER MA0102-306.

OMRSD: TOXIC VAPOR CHECKS, POST-FLIGHT SYSTEM INSPECTION, FUEL TANK SERVICING, AND QD CAP VISUAL CHECKS ARE PERFORMED EVERY FLOW.

(C) INSPECTION

RECEIVING INSPECTION
MATERIAL AND PROCESSES CERTIFICATIONS ARE VERIFIED.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 100 IS VERIFIED BY INSPECTION. PARTS PASSIVATION AND OTHER 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.

NONDESTRUCTIVE EVALUATION
LEAK TEST IS VERIFIED BY INSPECTION.

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CRITICAL PROCESSES
TIG WELDING AND HEAT TREATING ARE VERIFIED BY INSPECTION.

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

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

(D) FAILURE HISTORY
SEVEN, LEAKAGE FAILURES DOCUMENTED IN CAR AC1697, INVOLVING GN2 AND F COUPLING LEAKAGE. DR/CAR's AC1697, AC3298, AC4175, AC9478, AD0666, 03F017, AND 04F009.

CORRECTIVE ACTION IS TO PROVIDE SAMPLING AT THE GSE/VEHICLE INTERFACE THE FIRST THREE FLIGHTS TO ASSURE THAT THE GSE FILTERS ARE INTACT AND CONTAMINATION IS BEING INTRODUCED INTO THE SYSTEM.

ALSO, THE GSE FILTERS ARE BEING CHANGED TO REMOVABLE ELEMENT INSTEAD FIXED ELEMENT FILTERS TO FACILITATE BETTER CLEANING AND DRYING OF THE ASSEMBLY.

NO VEHICLE/MISSION THREATENING LEAKS HAVE BEEN EXPERIENCED.

(E) OPERATIONAL USE
IF LEAKAGE IS DETECTED BY THE GROUND CREW, THE WORST CASE (FUEL LEAKA IS ASSUMED AND THE CREW HAS OPTION TO RUN APU TO DEPLETION.