SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :AFT - REACTION CONTROL FMEA NO 03-2A -201091-1 REV:04/12/88

ASSEMBLY :PRESSURIZATION
P/N RI :ME276-0032-0019/0021
P/N VENDOR:R642900-1&3
QUANTITY :24
:12 REQ'D FOR EA. POD
:6 EA PROPELLANT

CRIT. FUNC: 1R
CRIT. HDW: 3

VEHICLE EFFECTIVITY:	102	103	104
PHASE(S): PL X LO X OO X DO X LS X	X	X	X

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

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
DES	J LAZARUS	DES	SSM
REL	R P DIEHL	REL	REL
QE	W J SMITH	QE	QE

ITEM:
DISCONNECT, QUICK, TEST POINT, HELIUM SIDE, (MD201, 202, 203, 204, 207, 208, 209, 210, 211, 212, 213, 214, 301, 302, 303, 304, 307, 308, 309, 310, 311, 312, 313, 314).

FUNCTION:
TO PROVIDE ACCESS TO THE HELIUM SUPPLY SYSTEM FOR CHECKOUT OF THE HELIUM ISOLATION VALVES AND REGULATORS. COMPONENTS ARE ACCESSIBLE ONLY WITH THE POD OFF THE VEHICLE. CAP PROVIDES REDUNDANCY FOR EXTERNAL LEAKAGE.

FAILURE MODE:
LEAKAGE, POPPET FAILS OPEN CAP LEARS

CAUSE(S):
SEALS DAMAGED OR DETERIORATED, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, IMPROPER USE, INADEQUATE MAINTENANCE OF GSE HALF, INADEQUATE LINE SUPPORT, SHAFT OR BORE BENT, OVERPRESSURE OF PANEL, EXCESS TORQUE.

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

(A) LOSS OF REDUNDANCY. LOSS OF HELIUM PRESSURANT (THIRD ORDER FAILURE).

(B) NO EFFECT

(C) NO EFFECT

(D) NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECTS - POTENTIAL CREW/VEHICLE LOSS IF PROPELLANT CAN NOT BE UTILIZED OR DEPLETED DUE TO INABILITY TO REPRESSURIZE PROP TANKS AS A RESULT OF HELIUM LOSS. POSSIBLE DAMAGE TO POD STRUCTURE AND ADJACENT HARDWARE IF CAP BLOWS OFF. 1R EFFECT ASSUMES LOSS OF ALL SEALS (POPPET AND CAP) BEFORE EFFECT IS MANIFESTED. CANNOT CHECK REDUNDANT SEALS WHEN CAP IS INSTALLED. REQUIRES BOTH SEALS TO LEAK ON-ORBIT BEFORE FAILURE IS DETECTABLE.

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

(A) DESIGN
DUAL SEAL SURFACES WHEN CAP INSTALLED PRECLUDES FAILURE (EACH SEALING SURFACE INDEPENDENT OF THE OTHER).

THE DESIGN BURST PRESSURE IS 2X THE MAX OPERATING PRESSURE (10,000 PSI). A COMPLETE STRESS ANALYSIS WAS PERFORMED. THE GSE HALF HAS A 10 MICRON FILTER TO PREVENT CONTAMINATION.

(B) TEST
THE QUALIFICATION TEST PROGRAM INCLUDED NINE UNITS. HOWEVER, ALL TESTS WERE NOT PERFORMED ON ALL UNITS. THE TESTING INCLUDED RANDOM VIBRATION (POPPET OPEN AND CAP ON), ENDURANCE (400 CYCLES), THERMAL: +190 DEGREES (-100 DEGREE F CERTIFIED BY MPS), AND BURST (10,000 PSI).

THE UNIT WAS ALSO QUALIFIED AS PART OF THE POD ASSEMBLY IN THE VIBRO-ACOUSTIC TESTING AT JSC (131 EQUIVALENT MISSIONS) AND THE HOT FIRE TEST PROGRAM AT WSTF (24 EQUIVALENT MISSION DUTY CYCLES AND APPROX 7 YEARS OF PROPELLANT EXPOSURE).

THE ACCEPTANCE TESTING INCLUDES PROOF OF EACH UNIT (1.5 X THE MAX OPERATING PRESSURE 7500 PSI), FUNCTIONAL TESTS, CLEANLINESS, AND TESTING OF THE UNIT AS AN ASSEMBLY. THE UNIT IS LEAKED CHECKED WITH AND WITHOUT A CAP INSTALLED.

OMRSD PERFORMS THE FOLLOWING: A DECAY CHECK OF THE LOW PRESSURE HELIUM SYSTEM EVERY FLIGHT. AN EXTERNAL LEAKAGE VERIFICATION OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS THEREAFTER. A TEST POINT COUPLING LEAK CHECK EVERY FIVE FLIGHTS AND WHENEVER THE COUPLING IS USED AN INSPECTION OF THE CAP SEALS THE FIRST FLIGHT AND WHENEVER THE QD IS USED DURING TURNAROUND. HELIUM SYSTEM SAMPLE EVERY THIRD FLIGHT AND ON CONTINGENCY BASIS. CANNOT CHECK REDUNDANT SEALS WHEN CAP IS ASSEMBLED. LOADED PROPELLANT MEET THE REQUIREMENTS OF SE-S-0073

(C) INSPECTION

RECEIVING INSPECTION
RAW MATERIAL IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 100 FOR MMH AND 100A FOR N2O4 IS VERIFIED BY INSPECTION. CORROSION PROTECTION IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
EXAMINATION OF LIP SEALS UNDER 14X TO 30X MAGNIFICATION IS VERIFIED BY INSPECTION.

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CRITICAL PROCESSES
WELDING IS VERIFIED BY INSPECTION.

TESTING
SEAL SURFACE IS FREE OF CONTAMINATES PRIOR TO ENGAGEMENT WITH THE MATING HALF AND ENGAGING TORQUE ARE VERIFIED BY INSPECTION. ATP IS WITNESSED AND VERIFIED BY INSPECTION. SAMPLE WELDS ARE SECTIONED AND CHECKED FOR WELD PENETRATION ON A PLAN OF 1 SAMPLE PER 20 WELDS.

HANDLING/PACKAGING
HANDLING, PACKAGING, AND STORAGE ENVIRONMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY
CARS A10762 (WSTF), AD0162 (KSC), AC0519 (SUP), AC8608 (SUP): SEVERAL CONTAMINATION INDUCED LEAKAGE FAILURES HAVE OCCURRED. LEAKAGE WAS RELATIVELY MINOR. OMRSD SCREENS FOR LEAKAGE AFTER EACH USAGE AND PRIOR TO INSTALLATION OF CAP.

CAR AC9143:
FOUR HIGH PRESSURE QD'S WERE REMOVED FROM OV102 BECAUSE OF LEAKAGE. ANALYSIS IDENTIFIED THE CAUSE TO BE DUE TO DISTORTED SEALS (CAR STILL OPEN, POSSIBLE KYNAR SEAL MMH COMPATIBILITY PROBLEM) CORRECTIVE ACTION CONCERNING THE POSSIBLE MATERIAL (KYNAR) INCOMPATIBILITY IS PENDING COMPLETION OF THE FAILURE ANALYSIS. ALL HIGH PRESSURE QD'S WILL BE VERIFIED TO BE NOT LEAKING BEFORE FLIGHT STS-26.

CAR AC9986:
THREE QD'S WERE REMOVED FROM OV102 BECAUSE OF LEAKAGE. ONE COUPLING LEAK WAS DUE TO METALLIC CONTAMINATION, MOST PROBABLY CAUSED BY USE OF FREON IN CLEANING PROCEDURES. ONE LEAKED BECAUSE OF A LARGE PIECE OF ALUMINUM TAPE AND THE OTHER LEAKED BECAUSE OF SMALL METALLIC PARTICLES EMBEDDED IN THE POPPET SEAL. CORRECTIVE ACTION FOR CONTAMINATION CONTROL WAS IMPLEMENTED AT KSC BY ADHERING TO THE OMRSD PARAGRAPHS SPECIFICALLY DETAILED TO PREVENT METALLIC NITRATE AND PARTICLE CONTAMINATION. ONLY IPA IS USED IN CLEANING MMH COMPONENTS.

CAR 5360 (DOWNEY):
AFTER 375 ENDURANCE CYCLES LEAKAGE WAS EXCESSIVE. THE CAUSE WAS CONTAMINANT EMBEDDED IN THE POPPET SEAL. IT WAS CONCLUDED THAT THE PARTICLES WERE INTRODUCED WHILE, OR PRIOR TO, BEING INSTALLED IN THE TEST SET-UP. THERE WAS NO VISIBLE THREAD DAMAGE. CORRECTIVE ACTION - PROCEDURES FOR CONNECTING, DISCONNECTING, AND MAINTAINING CLEANLINESS; I.E. PURGING, DRYING, FILTER INSTALLATION, ENGAGEMENT/DISENGAGEMENT PROCEDURES, CLEANING AND LUBRICATION OF THREADS ARE TO BE IN ACCORDANCE WITH SPECIFICATION MLO310-032 TO PRECLUDE CONTAMINATION.

(E) OPERATIONAL USE
REQUIRES MULTI-SEAL FAILURE BEFORE ACTION IS REQUIRED. CLOSE THE HELIUM ISOLATION VALVE AND PERFORM STAGE PRESSURIZATION OF THE PROPELLANT SYSTEM.