PRINT DATE: 01/09/90

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2A-201090-X

SUBSYSTEM NAME: AFT REACTION CONTROL SYSTEM (RCS)

REVISION : 2 01/09/90

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	DISCONNECT, QUICK, TEST	ME276-0032-0005 RR42670-5
LRU	:	DISCONNECT, QUICK, TEST	ME276-0032-0007 RR42670-7

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
DISCONNECT, QUICK, TEST POINT PROPELLANT SIDE (MD230, 231, 232, 233, 234, 235, 330, 331, 332, 333, 334, 335).

QUANTITY OF LIKE ITEMS: 12
6 POD

FUNCTION:
TO PROVIDE ACCESS FOR CHECKOUT OF THE PROPELLANT TANK ACQUISITION SYSTEM.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2A-201090-01

REVISION# 2 01/09/90

SUBSYSTEM: AFT REACTION CONTROL SYSTEM (RCS)
LRU :DISCONNECT, QUICK, TEST CRITICALITY OF THIS
ITEM NAME: DISCONNECT, QUICK, TEST FAILURE MODE:1R3

FAILURE MODE:
EXTERNAL LEAKAGE, POPPET FAILS OPEN

MISSION PHASE:
PL PRELAUNCH
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT
LS LANDING SAFING

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS

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

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) FAIL
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF REDUNDANCY.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT

(C) MISSION:
NO EFFECT

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECTS:
POTENTIAL CREW/VEHICLE LOSS - LOSS OF RCS ENTRY AND ET SEP PROPELLANT. LOSS OF HELIUM MAY ALSO OCCUR ON-ORBIT DUE TO ZERO GRAVITATIONAL EFFECTS. POSSIBLE LOSS OF VEHICLE CONTROL DURING ET SEP AND ENTRY. POSSIBLE DAMAGE TO STRUCTURE/TPS IF LEAKAGE OCCURS OR STRUCTURE AND ADJACENT HARDWARE IF CAP BLOWS OFF. LEAKAGE OF PROPELLANT VAPORS INTO POD. 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.

- DISPOSITION RATIONALE -

(A) DESIGN:
EACH UNIT IS PROOF PRESSURIZED TO 2 X MAX OPERATING PRESSURE (700 PSI). THE BURST PRESSURE DURING QUAL TESTING WAS 4 X MAX OPERATING PRESSURE (1400 PSI). A COMPLETE STRESS ANALYSIS WAS PERFORMED. GROUND HALF COUPLINGS AND LINES ARE SUPPORTED TO LIMIT STRESS ON COUPLINGS TO PREVENT DAMAGE TO SEALS AND WELD JOINTS. DUAL SEALING SURFACES WHEN THE CAP IS INSTALLED MINIMIZES LEAKAGE POTENTIAL.

THE GSE HALF COUPLING HAS A 10 MICRON FILTER TO PREVENT CONTAMINATION.

(B) TEST:
NINE UNITS WERE USED IN THE QUALIFICATION TEST PROGRAM. HOWEVER, ALL TESTS WERE NOT PERFORMED ON ALL UNITS. THE PRIMARY QUALIFICATION METHOD WAS BY SIMILARITY TO APOLLO COUPLINGS.

TESTING ADDRESSED SPECIFIC CONCERNS RANDOM VIBRATION (POPPET OPEN AND CAP ON), ENDURANCE (400 CYCLES), THERMAL (+150 DEG F, -100 DEG F CERTIFIED BY MPS), PROPELLANT COMPATIBILITY AND BURST. THE UNIT WAS ALSO QUALIFIED AS PART OF THE POD ASSEMBLY IN THE VIBRO-ACOUSTIC TEST AT JSC (131 EQUIVALENT MISSIONS) AND THE HOT FIRE TEST AT WSTF (24 EQUIVALENT MISSION DUTY CYCLES AND APPROX 7 YEARS OF PROPELLANT EXPOSURE).

THE ACCEPTANCE TEST FOR EACH UNIT INCLUDED PROOF AND FUNCTIONAL, CLEANLINESS AND DRYING, TESTING OF THE CAP AT THE ASSEMBLY LEVEL, AND LEAKAGE CHECKS WITH AND WITHOUT THE CAP INSTALLED.

OMRSD PERFORMS THE FOLLOWING: LEAK CHECKS ON THE QD COUPLING EVERY FIVE FLIGHTS. ANY COUPLINGS USED DURING GROUND TESTING SHALL ALSO BE LEAK CHECKED. A TOXIC VAPOR LEAK CHECK OF THE PROPELLANT TANK THE FIRST FLIGHT AND ON A CONTINGENCY BASIS. AN EXTERNAL LEAKAGE VERIFICATION OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS. STATIC AIR SAMPLE FOR MOD/POD THE SECOND FLIGHT AND EVERY FLIGHT THEREAFTER AND ON A CONTINGENCY BASIS. A PROPELLANT SAMPLE THE SECOND FLIGHT AND WHEN TANKS OR MANIFOLDS ARE DRAINED. AN INSPECTION OF THE CAP SEALS THE FIRST FLIGHT AND WHENEVER THE QD IS USED DURING TURNAROUND. 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 N204 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.

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 ML0310-032 TO PRECLUDE CONTAMINATION.

(E) OPERATIONAL USE:
REQUIRES MULTI-SEAL FAILURE BEFORE ACTION IS REQUIRED. IF FAILURE OCCURS PRIOR TO ET SEP USE CROSSFEED.

FOR NOTICEABLE LEAK RATES ON-ORBIT, DUMP ONBOARD PROPELLANT. USE CROSSFEED FOR ENTRY. THIS MAY NOT BE SUFFICIENT PROPELLANT FOR NOMINAL ENTRY. IF LEAK OCCURS DURING ENTRY USE FAILED SYSTEM DOWN TO ZERO PVT. SWITCH TO X-FEED FOR REMAINDER OF ENTRY.

- APPROVALS -

RELIABILITY ENGINEERING	F.E. BARCENAS	
DESIGN ENGINEERING	B. DIPONTI	
QUALITY ENGINEERING	M. SAVALA	
NASA RELIABILITY		
NASA SUBSYSTEM MANAGER		
NASA QUALITY ASSURANCE		