SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :AFT - REACTION CONTROL FMEA NO 03-2A -201095-3 REV:04/10/88

ASSEMBLY :PRESSURIZATION
P/N RI :MC284-0481-0001/-0002
P/N VENDOR:RS010500-001/-011
QUANTITY :4
:2 PER POD
:1 PER HELIUM SUPPLY

	CRIT. FUNC:	1
	CRIT. HDW:	1
VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

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

REDUNDANCY SCREEN: A- B- C-

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

ITEM:
VALVE, QUAD, CHECK, HELIUM CV201, 202, 301, 302.

FUNCTION:
EACH CHECK VALVE QUAD WITH 4 POPPETS IN SERIES - PARALLEL ARRANGEMENT PROVIDES PARALLEL REDUNDANCY FOR HELIUM PRESSURIZATION AND SERIES REDUNDANCY TO LIMIT BACK FLOW OF PROPELLANT VAPORS FROM THE PROPELLANT TANKS TO THE REGULATOR. A 304L 25 MICRON FILTER IS UTILIZED AT THE INLET. VALVE UTILIZES CUTTER SEAL DESIGN CONCEPT (TWO SEALING SURFACES PER POPPET)

FAILURE MODE:
PLUGGED SCREEN

CAUSE(S):
CONTAMINATION

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

(A,B) LOSS OF HELIUM PRESSURIZATION.

(C) POSSIBLE MISSION MODIFICATION OR EARLY MISSION TERMINATION.

(D) POSSIBLE CREW VEHICLE LOSS. FAILURE OF CHECK VALVE SCREEN WOULD POSSIBLY RESULT IN INABILITY TO BURN OR DEPLETE ALL RCS PROPELLANT IN ADDITION TO MIXTURE RATIO PROBLEMS WITH RESULTANT THRUSTER FIRING PROBLEMS. POSSIBLE LOSS OF CONTROL DURING MATED COAST/EXTERNAL TANK SEPARATION/ENTRY.

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

(A) DESIGN
SERIES-PARALLEL REDUNDANT POPPETS PROVIDE REDUNDANCY FOR THE CLOSED FAILURE MODE. SERIES REDUNDANCY LIMITS THE BACK FLOW OF PROPELLANT VAPORS ULLAGE PRESSURE IS CONSIDERED A LEVEL OF REDUNDANCY FOR NOMINAL E SEPARATION.

TO LIMIT THE POTENTIAL FOR POPPET SHAFT BINDING OR GENERATION OF CONTAM, THE GUIDE PINS UTILIZE SAPPHIRE, A WEAR RESISTANT SURFACE.

A 25-MICRON INLET FILTER WILL ALSO REDUCE THE POTENTIAL FOR A CLOSED FAILURE BY LIMITING THE POTENTIAL FOR CONTAMINATION TO CAUSE BINDING OF MOVING PARTS.

(B) TEST

THE QUALIFICATION TEST PROGRAM UTILIZED FOUR UNITS. INCLUDED IN THE TESTING WAS RANDOM VIBRATION, SHOCK, SURGE PRESSURE (3800 CYCLES), LIFE CYCLES (100,000 CYCLES). THERMAL (-180 TO +150 DEG F), POPPET FLOW STABILITY, BURST (740 PSI) AND PROPELLANT COMPATIBILITY.

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

ACCEPTANCE TESTING INCLUDES PROOF PRESSURE, EXTERNAL LEAKAGE, FLOW TESTS CRACKING/RESEAT PRESS., PRESSURE DROP, FILTER BUBBLE POINT, INT. LEAKAG AND CLEANLINESS.

OMRSD PERFORMS THE FOLLOWING: REG LEAK AND FUNCTIONAL TESTS FOR EACH FLIGHT. A LEAK AND FUNCTIONAL CHECK OF THE CHECK VALVE (EACH POPPET) THE FIRST FLIGHT, FIFTH FLIGHT AND EVERY FIVE FLIGHTS THEREAFTER AND ON CONTINGENCY BASIS. A LEAK AND FUNCTIONAL CHECK ON THE CHECK VALVE (ETA UNIT) THE SECOND FLIGHT AND EACH FLIGHT THEREAFTER. MOISTURE VERIFICATION AFTER THE FIRST FLIGHT AND ON A CONTINGENCY BASIS THEREAFTER. SYSTEM HELIUM SAMPLING BEFORE THE THIRD FLIGHT AND EVERY THIRD FLIGHT THEREAFTER. HELIUM SYSTEM ACTIVATION FOR EACH FLIGHT. REGULATOR RESPONSE TESTS EVERY FLIGHT AND ON A CONTINGENCY BASIS. REGULATOR RESPONSE TEST FOR LOW PRESSURE ON A CONTINGENCY BASIS. HELIUM SYSTEM OFF LOADING THE SECOND FLIGHT AND EVERY FLIGHT THEREAFTER. A HELIUM SYSTEM SAMPLE EVERY THIRD FLIGHT AND ON A CONTINGENCY BASIS.

(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
WELDS ARE PENETRANT OR MAGNETIC PARTICLE INSPECTED.

CRITICAL PROCESSES
WELDING PER RA0107-027 IS VERIFIED BY INSPECTION AND VISUALLY INSPECTED.

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TESTING
AIP IS WITNESSED AND VERIFIED BY INSPECTION.

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

(D) FAILURE HISTORY
NONE

(E). OPERATIONAL USE
PROPOSED SOFTWARE FOR OI-8A WILL AUTOMATICALLY CROSSFEED FOR LOW PROPELLANT TANK PRESSURE DURING ET SEP.

A CONTINGENCY PROCEDURE WOULD BE TO CLOSE THE HE ISO VALVE AND USE THE SYSTEM IN BLOWDOWN FOR ENTRY UNTIL MINIMUM ENGINE PRESSURE IS REACHED. AT THIS POINT, FEED THE FAILED RCS SYSTEM FROM THE OTHER POD IN CROSSFEED. ENOUGH PROPELLANT MAY BE LEFT TO PROVIDE A NOMINAL ENTRY.

DURING MOST MISSION PHASES CROSSFEED PLUS BLOWDOWN OF FAILED SYSTEM WOULD BE ACCEPTABLE FOR A NOMINAL ENTRY.