SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION FMEA NO 03-1 -0406 -2 REV:05/03/88F

ASSEMBLY :FAIRCHILD CONTROLS
P/N RI :MC276-0004-0001 (FLT HALF)
: -0002 (GND HALF)
QUANTITY :1
:ONE
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

PHASE(S): PL LO X OO DO LS

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

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
DES	J E OSLUND	DES	SSM
REL	L H FINEBERG	REL	REL
QE	E M GUTIERREZ	QE	QE

ITEM:
DISCONNECT, LO2 BLEED, 1.5 INCH, SELF SEALING, FLIGHT AND GROUND HALF (PD13)

FUNCTION:
THE DISCONNECT PROVIDES A PATH FOR LO2 TO BLEED OVERBOARD FROM THE LO2 OVERBOARD BLEED VALVE (PV19) INTO THE GROUND VENT SYSTEM. LO2 IS BLED OVERBOARD TO MAINTAIN PROPER SSME CRYOGENIC START CONDITIONS. THE POGO ACCUMULATOR RETURN LINE IS ALSO FLUSHED PRIOR TO ENGINE START THROUGH THIS DISCONNECT. PRIOR TO LIFTOFF THE DISCONNECT IS ISOLATED FROM THE LO2 SYSTEM BY CLOSING THE LO2 OVERBOARD BLEED VALVE. THE DESIGN INCORPORATES A POPPET TO PREVENT FLOW OF LO2 OVERBOARD AFTER T-0 UMBILICAL DISENGAGEMENT AND LIFT OFF.

FAILURE MODE:
FAILS TO CLOSE/REMAIN CLOSED AT LIFTOFF AND DURING ASCENT.

CAUSE(S):
FAILS TO CLOSE: PIECE PART STRUCTURAL FAILURE, CONTAMINATION, BINDING.

FAILS TO REMAIN CLOSED: PIECE PART STRUCTURAL FAILURE.

SUBSYSTEM :MAIN PROPULSION FMEA NO 03-1 -0406 -2 REV:05

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

(A,B) LOSS OF REDUNDANCY FOR PREVENTION OF OVERBOARD LEAKAGE. POSS CONTAMINATION OF LINE DURING REENTRY. FAILS SCREEN B DUE TO LAC POSITION INDICATION INSTRUMENTATION.

PASSES C SCREEN BECAUSE CONTAMINATION CANNOT BE USED AS A COMMON C FOR THE DISCONNECT (PD13) FAILURE TO CLOSE AND THE LO2 BLEED RELIEF V (PV19) FAILURE TO RESEAT (BLEED LINE PRESSURE WILL NOT INCREASE RELIEF VALVE CRACKING PRESSURE WHEN DISCONNECT FAILS TO CLO REFERENCE FMEA/CIL 0452-10.

(C,D) NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS

1R/2, 2 SUCCESS PATHS. TIME FRAME - ASCENT

1) DISCONNECT (PD17) FAILS TO CLOSE/REMAIN CLOSED
2) LO2 BLEED SHUTOFF VALVE (PV19) FAILS TO REMAIN CLOSED

GO2/LO2 (2 PHASE FLOW FROM POGO SYSTEM) WILL DUMP OVERBOARD RESUL IN THE LOSS OF 3,000 POUNDS OF PROPELLANT, WHICH IS NOT ENO CAUSE PREMATURE SSME SHUTDOWN. FIRE/EXPLOSION HAZARD EXTERIOR VEHICLE. ALSO RESULTS IN LOSS OF HELIUM SUPPLY DURING MANI REPRESSURIZATION CAUSING LOSS OF AFT COMPARTMENT PURGE (RTLS AND ABORT CRITICAL). POSSIBLE LOSS OF CREW/VEHICLE.

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

(A) DESIGN

FLIGHT HALF - THIS FAILURE COULD BE CAUSED BY STRUCTURAL FAILURE OF POPPET SPRING OR BINDING AT THE POPPET/HOUSING INTERFACE. THE DISCON POPPET IS SPRING LOADED TO THE CLOSED POSITION WITH AN 0.070 DIAM ELGILOY TEMPERED COIL SPRING HAVING A SPRING RATE OF 10.34 LB/I SLIDING SURFACES ARE DRY FILM LUBRICATED TO PREVENT BINDING.

STRUCTURAL ANALYSIS INDICATES POSITIVE MARGINS OF SAFETY FOR CONDITIONS OF VALVE OPERATIONS. AT NO TIME DURING THE DISCONNECT'S CYCLE LIFE TEST DID THE POPPET FAIL TO CLOSE OR REMAIN CLOSED.

SYSTEM CONTAMINATION IS MINIMIZED DUE TO THE PRESENCE OF AN ET SCR PREVALVE SCREENS, A GSE DEBRIS PLATE, A GSE FILTER, AND MAINTAINI CLEANLINESS LEVEL OF 800A.

GROUND HALF - N/A.

(B) TEST

ATP

DISCONNECT DISENGAGED

ORBITER HALF

AMBIENT PROOF (520 PSIG)

AMBIENT HOUSING LEAKAGE (400 PSIG)

AMBIENT CLOSURE DEVICE LEAKAGE (20 & 400 PSIG)

GROUND HALF

AMBIENT PROOF (200 PSIG)

AMBIENT HOUSING LEAKAGE (100 PSIG)

AMBIENT CLOSURE DEVICE LEAKAGE (100 PSIG)

DISCONNECT ENGAGED (WITH RADIAL AND ANGULAR MISALIGNMENT AT MINIMUM AND MAXIMUM BELLOWS COMPRESSION)

PROOF PRESSURE (200 PSIG)

AMBIENT EXTERNAL LEAKAGE (25 & 100 PSIG)

CRYO (-255 DEG F) EXTERNAL LEAKAGE (100 PSIG)

ENGAGE - DISENGAGE CYCLE

CERTIFICATION

DURING ALL MATED TESTS THE ORBITER HALF IS RIGIDLY MOUNTED AND THE GROUND HALF IS MOUNTED WITH RADIAL AND ANGULAR MISALIGNMENT.

CRYO LEAKAGE (-400 DEG F)
MATED: 100 PSIG
ORBITER HALF: 25 AND 100 PSIG
GROUND HALF: 25 AND 100 PSIG

AMBIENT LEAKAGE
MATED: 25 AND 100 PSIG
ORBITER HALF: 20 AND 400 PSIG
GROUND HALF: 25 AND 100 PSIG

AMBIENT EXTERNAL BODY LEAKAGE
ORBITER HALF: 400 PSIG
GROUND HALF: 100 PSIG

LIFE CYCLES
2000 CYCLES (10 SERIES):
199 CYCLES AT AMBIENT TEMPERATURE
ONE CYCLE AT CRYO TEMPERATURE (-255 DEG F)

VIBRATION
TRANSIENT SINUSOIDAL VIBRATION
ORBITER HALF: 5 TO 35 HZ AT ZERO PSIG AND AMBIENT TEMPERATURE

RANDOM VIBRATION IN EACH OF TWO AXES AT +280 DEG F
MATED: 40 PSIG, 9 MINUTES
ORBITER HALF: 80 PSIG, 52 MINUTES
GROUND HALF: 0 PSIG, 9 MINUTES

THERMAL CYCLE TEST: 3 CYCLES (+70 TO -280 TO +70 TO +350 DEG F)

SALT FOG, BENCH HANDLING SHOCK AND DESIGN SHOCK PER MIL-STD-810,
AND DUST TEST

FLOW CAPACITY TEST (8 TO 18.5 LBS/SEC)

BURST TEST
MATED: 400 PSIG
ORBITER HALF: 600 PSIG
GROUND HALF: 400 PSIG

OMRSD
V41AY0.130 LO2 PROPELLANT SYSTEM DECAY TEST (EVERY FLIGHT)
V41BB0.060 PD13 LO2 BLEED DISCONNECT SEAT LEAK CHECK (EVERY FLIGHT)
V41BV0.040 PD13 LO2 BLEED DISCONNECT INSPECTION (EVERY FLIGHT)

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIALS, INCLUDING CHEMICAL AND MECHANICAL REQUIREMENTS, ARE VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION. INSPECTION VERIFIES CERTIFICATION OF ULTRASONIC INSPECTION OF BODY HOUSING FORGING.

CONTAMINATION CONTROL

CLEANING PROCEDURES AND CONTAMINATION CONTROL REQUIREMENTS ARE VERIFIED. CLEANLINESS TO LEVEL 800A (FLIGHT HALF) AND 400A (GROUND HALF) FOR THE DISCONNECT ASSEMBLY IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

ALL PARTS ARE PROTECTED FROM DAMAGE AND CONTAMINATION. ALL CRITICAL DIMENSIONS AND FINISHES ARE VERIFIED BY INSPECTION. SEALING SURFACE OF THE POPPET IS INSPECTED USING 10X MAGNIFICATION. DRAWING TORQUE REQUIREMENTS ARE VERIFIED. SEALS ARE VISUALLY EXAMINED, PRIOR TO INSTALLATION, FOR DAMAGE AND CLEANLINESS USING 10X MAGNIFICATION. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE ASSEMBLY PROCEDURE. LOG OF CLEAN ROOM AND TOOL CALIBRATION IS REQUIRED AND VERIFIED. ALL SPRINGS ARE LOAD TESTED AND VERIFIED BY INSPECTION.

CRITICAL PROCESS

HEAT TREATMENT, PARTS PASSIVATION, AND ANODIZING ARE VERIFIED. CHEMICAL FILM PROTECTANT AND DRY FILM LUBRICANT ARE VERIFIED.

NONDESTRUCTIVE EVALUATION

BODY HOUSING IS FLUORESCENT PENETRANT INSPECTED. WELDS ARE VISUALLY EXAMINED AND VERIFIED BY X-RAY AND DYE PENETRANT. BELLOWS ASSEMBLY IS PROOF PRESS TESTED AND LEAK CHECKED.

TESTING

ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING FOR SHIPPING IS VERIFIED BY INSPECTION.

SUBSYSTEM :MAIN PROPULSION FMEA NO 03-1 -0406 -2 REV:05

(D) FAILURE HISTORY
INTERNAL LEAKAGE WAS DETECTED DURING ATP AT THE SUPPLIER. AN ERRO MACHINING OF THE POPPET SEAL WAS DETERMINED TO BE THE CAUSE OF LEAKAGE (REF CAR AC8591). 100% INSPECTION IS NOW REQUIRED ON CRITICAL DIMENSIONS.

(E) OPERATIONAL USE
NO CREW ACTION CAN BE TAKEN.