

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE  
NUMBER: 02-6-E23 -X**

**SUBSYSTEM NAME: HYDRAULICS**

**REVISION: 07/24/98**

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**PART DATA**

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	<b>PART NAME</b>	<b>PART NUMBER</b>
	<b>VENDOR NAME</b>	<b>VENDOR NUMBER</b>
LRU	VALVE, PRIORITY PNEUDRAULICS	MC284-0417

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
VALVE, PRIORITY

**REFERENCE DESIGNATORS:** 50V58PV13  
50V58PV14  
50V58PV15

**QUANTITY OF LIKE ITEMS:** 3  
ONE IN EACH HYDRAULIC POWER SYSTEM ACCUM/RESERVOIR LINE

**FUNCTION:**

CONTROL, WITHIN LIMITS, THE ACCUMULATOR/RESERVOIR BOOST OIL PRESSURE TO ASSURE A POSITIVE HEAD AT THE MAIN PUMP INLET AT APU START UP. ALSO PROVIDES THERMAL RELIEF FOR ACCUMULATOR/RESERVOIR CIRCUIT DURING QUIESCENT PERIODS.

**FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE**

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SUBSYSTEM NAME: HYDRAULICS

LRU: VALVE PRIORITY

ITEM NAME: VALVE, PRIORITY

CRITICALITY OF THIS

FAILURE MODE: 1R2

**FAILURE MODE:**

LEAKAGE, INTERNAL (ACCUMULATOR TO SYSTEM THROUGH CHECK VALVE)

MISSION PHASE: OO ON-ORBIT  
DO DE-ORBIT

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

CAUSE:  
DEFECTIVE SEAL, CONTAMINATION

CRITICALITY 1/H DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS  
B) PASS  
C) PASS

**PASS/FAIL RATIONALE:**

A)

B)

C)

**- FAILURE EFFECTS -**

**(A) SUBSYSTEM:**

LOSS OF BOOTSTRAP PRESSURE WITH CORRESPONDING LOSS OF RESERVOIR PRESSURE (LOSS OF MAIN PUMP RESTART CAPABILITY) RESULTING IN LOSS OF ONE HYDRAULIC SYSTEM. IF FAILURE OCCURS DURING MAIN PUMP ASCENT/ENTRY OPERATIONS, MAIN PUMP STILL WOULD BE USED TO COMPLETE FLIGHT PHASE; BUT

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CAPABILITY TO RESTART MAIN PUMP WOULD BE DOUBTFUL DUE TO LOSS OF BOOTS TRAP/RESERVOIR PRESSURE. HOWEVER, AUTOMATIC RECHARGE CAPABILITY IS AVAILABLE DURING MAJORITY OF ON ORBIT PHASE.

**(B) INTERFACING SUBSYSTEM(S):**

NOSE WHEEL STEERING AND HYDRAULIC LANDING GEAR DEPLOYMENT CAPABILITY WOULD BE LOST IF SYSTEM ONE WAS LOST. LOSS OF ONE OF THREE HYDRAULIC POWER SYSTEMS TO FLIGHT CONTROL SURFACES AND BRAKES.

**(C) MISSION:**

ASCENT/ENTRY - NO EFFECT FOR FIRST FAILURE. MAIN PUMP OPERATION WOULD MAINTAIN BOOTSTRAP PRESSURE. ORBIT - ABORT DECISION (POSSIBLE EARLY MISSION TERMINATION), OR COMMIT TO CONTINUOUS CIRCULATION PUMP OPERATION TO MAINTAIN PRESSURE IF POSSIBLE.

**(D) CREW, VEHICLE, AND ELEMENT(S):**

NO EFFECT FOR FIRST FAILURE - ADEQUATE FLIGHT CONTROL CAPABILITY.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

POSSIBLE LOSS OF CREW/VEHICLE WITH TWO FAILURES: THIS FAILURE, PLUS LOSS OF SECOND HYDRAULIC SYSTEM. FAILURE IS NOT CRITICALITY 1 FOR SSME INDUCED ABORT SINCE SYSTEM WILL NOT BE LOST UNTIL PUMP START UP FOR ENTRY IS REQUIRED.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**

VALVE IS DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF MIL-H-8775 (GENERAL SPECIFICATION FOR HYDRAULIC COMPONENTS, AIRCRAFT AND MISSILE). HYDRAULIC SYSTEM FILTER BETWEEN THE MAIN PUMP AND THE PRIORITY VALVE IS 5 MICRON NOMINAL, 15 MICRON ABSOLUTE. 15 MICRON NOMINAL INTERNAL FILTRATION EXISTS IN THE UNLOADER VALVE BETWEEN THE CIRCULATION PUMP AND THE PRIORITY VALVE.

**(B) TEST:**

QUALIFICATION:

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- THERMAL CYCLE TEST - 70 TO 275 TO -65 TO 275 TO 70 DEG F. 5 CYCLES 6 HOURS EACH. PASS/FAIL CRITERIA: SUBSEQUENT PASSAGE OF PERFORMANCE RECORD TEST.
- ENDURANCE CYCLING TEST - 50,000 CYCLES AT RATED FLOW AND PRESSURE 13,000 AT 275 DEG F AND 37,000 AT 225 DEG F. 2,200 - 3,100 - 2,200 PSIG. PASS/FAIL CRITERIA: VALVE SHALL NOT CHATTER OR SHOW SIGNS OF INSTABILITY.
- BURST PRESSURE - 275 DEG F, 7,500 PSIG TO SYSTEM AND ACCUMULATOR PORTS WITH DRAIN PORT OPEN, 320 PSIG APPLIED TO DRAIN PORT WITH SYSTEM AND ACCUMULATOR PORTS OPEN. PASS/FAIL CRITERIA: NO RUPTURE OR LEAKAGE

**ACCEPTANCE:**

- EXAMINATION OF PRODUCT - WEIGHT, WORKMANSHIP, FINISH, DIMENSIONS AND CONSTRUCTION.
- PROOF PRESSURE TEST - 4,500 PSIG AT ACCUMULATOR AND SYSTEM PORTS, WITH DRAIN PORT OPEN, 160 PSIG AT DRAIN PORT WITH ACCUMULATOR AND SYSTEM PORTS OPEN. PASS/FAIL CRITERIA: NO LEAKAGE, DEFORMATION OR PERMANENT SET.
- PERFORMANCE RECORD TEST:
  - CRACKING PRESSURE - 75 PSIG AT DRAIN PORT WITH SYSTEM PORT OPEN TO ATMOSPHERE. PASS/FAIL CRITERIA: 3,000 PSID MAXIMUM BETWEEN THE ACCUMULATOR PORT AND DRAIN PORT
  - RESEAT PRESSURE - 75 PSIG INCREASING TO FULL FLOW THEN DECREASING TO 2,600 PSID MINIMUM BETWEEN THE ACCUMULATOR PORT AND DRAIN PORT. PASS/FAIL CRITERIA: LEAKAGE SHALL BE 1 CC/MIN MAXIMUM.
  - LEAKAGE - AT 2,600 PSID. DECREASE INLET PRESSURE TO 2,300 PSID MINIMUM BETWEEN THE ACCUMULATOR PORT AND DRAIN PORT FOR 5 MINUTES. PASS/FAIL CRITERIA: LEAKAGE SHALL BE 1 CC/HR MAXIMUM.
- CLEANLINESS TEST - LEVEL 190 PER MAO110-301.

**GROUND TURNAROUND TEST**

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**

**RECEIVING INSPECTION**

VALVE SEALS AND GROOVES ARE SAMPLE INSPECTED DURING RECEIVING INSPECTION. RAW MATERIAL CERTIFICATIONS ARE VERIFIED BY INSPECTION.

**CONTAMINATION CONTROL**

CLEANLINESS LEVEL 190 PER MAO110-301 IS VERIFIED BY INSPECTION. TEST FLUIDS ARE SAMPLED BEFORE AND AFTER ATP. VALVE IS FLUSHED UNTIL CONTAMINATION CHECKS ARE ACCEPTABLE.

**ASSEMBLY/INSTALLATION**

VALVE SEALS ARE DETAIL INSPECTED AT FINAL ASSEMBLY. VALVE SEALS AND GROOVES ARE VISUALLY INSPECTED DURING ASSEMBLY. DETAIL DIMENSIONAL INSPECTION CONDUCTED ON FIRST ARTICLE.

**CRITICAL PROCESSES**

PASSIVATION AND ANODIZATION ARE VERIFIED BY INSPECTION.

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**TESTING**

INTERNAL LEAKAGE AT RESEAT PRESSURE IS CHECKED DURING ACCEPTANCE TEST. DURING QUALITY TEST, THE VALVE IS SUBJECTED TO INTERNAL LEAK TESTS AT BOTH HIGH AND LOW TEMPERATURES THROUGH THE CHECK VALVE AND DRAIN PORTS. EXTERNAL LEAKAGE IS CHECKED AT PROOF PRESSURE TEST. CHECK VALVE CRACK AND RESEAT PRESSURE CHECKED DURING ACCEPTANCE TEST. ATP IS VERIFIED BY INSPECTION.

**HANDLING/PACKAGING**

HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION

**(D) FAILURE HISTORY:**

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATA BASE. THE FAILURE HISTORY DATA PROVIDED BELOW IS NO LONGER BEING KEPT UP-TO-DATE.

(A3939-010) (1976) DURING ACCEPTANCE TESTING, WHILE PERFORMING THE RESEAT TEST, LEAKAGE WAS DETECTED. A SMALL BURR WAS DETECTED ON THE NOSE OF THE VALVE POPPET ON THE SURFACE THAT MATES WITH THE VALVE SEAT WHICH MAKES THE FLUID SEAL. THE BURR WAS REMOVED AND THE VALVE PASSED ALL TESTS. DIRECTION WAS GIVEN FOR CLOSER VISUAL INSPECTION DURING PROCESSING.

**(E) OPERATIONAL USE:**

RUN CIRCULATION PUMP TO ATTEMPT TO MAINTAIN BOOTSTRAP PRESSURE FOR MAIN PUMP START UP FOR ENTRY.

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**- APPROVALS -**

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EDITORIALLY APPROVED  
TECHNICAL APPROVAL

: BNA  
: VIA APPROVAL FORM

: J. Kemura 7-30-98  
: 95-CIL-009\_02-6