

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-6-E03 -X**

SUBSYSTEM NAME: HYDRAULICS

REVISION: 1 07/24/98

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	RESERVOIR, HYDRAULIC ARKWIN	MC282-0062

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
RESERVIOR, HYDRAULIC

REFERENCE DESIGNATORS: 50V58TK4
50V58TK5
50V58TK6

QUANTITY OF LIKE ITEMS: 3
ONE IN EACH HYDRAULIC POWER SYSTEM

FUNCTION:
PROVIDE MEANS FOR THE COLLECTION, STORAGE AND DISTRIBUTION OF HYDRAULIC FLUID.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-6-E03-05

REVISION#: 1 07/24/98

SUBSYSTEM NAME: HYDRAULICS

LRU: RESERVOIR, HYDRAULIC

ITEM NAME: RESERVOIR, HYDRAULIC

CRITICALITY OF THIS

FAILURE MODE: 1R2

FAILURE MODE:

LEAKAGE, INTERNAL, HIGH PRESSURE PISTON AND PISTON ROD SEALS

MISSION PHASE: OO ON-ORBIT
DO DE-ORBITVEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:

DAMAGED/INCORRECT/INCORRECTLY INSTALLED SEAL, CONTAMINATION

CRITICALITY 1/1 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 BOOTSTRAP/RESERVOIR PRESSURE. HOWEVER, AUTOMATIC BOOTSTRAP ACCUMULATOR RECHARGE CAPABILITY IS AVAILABLE DURING MAJORITY OF ON-ORBIT PHASE (CIRC PUMP).

(B) INTERFACING SUBSYSTEM(S):

NOSE WHEEL STEERING AND HYDRAULIC LANDING GEAR DEPLOYMENT CAPABILITY WOULD BE LOST IF SYSTEM ONE IS LOST. LOSS OF 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.

-DISPOSITION RATIONALE-

(A) DESIGN:

STANDARD MIL-G-5514 (GENERAL REQUIREMENTS FOR HYDRAULIC PACKINGS AND GLAND DESIGN) SEAL DESIGN. MATERIALS, PROCESSES AND MANUFACTURING TECHNIQUES USED BY SUPPLIER FOR A-10, F-15 AND F-105 HYDRAULIC RESERVOIRS OF SIMILAR DESIGN. SMALL DIAMETER SHAFT (5/16 DIAMETER) LIMITS "O" RING ROLL LEAKAGE. FOHL TESTS HAVE SHOWN THAT RUNNING CIRC PUMPS ON UNASSOCIATED SYSTEMS PROVIDE INTERSYSTEM LEAKAGE TO BUILD UP SUFFICIENT INLET PRESSURE FOR PUMP RESTART. ALSO MAIN PUMP CAN BE STARTED UP AND RUN FOR 15 SECONDS WITH NO INLET PRESSURE WITHOUT ANY PUMP DAMAGE.

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(B) TEST:

QUALIFICATION:

- ENDURANCE CYCLING - 5000 CYCLES AT 50 PERCENT STROKE. 50,000 AT 10 PERCENT STROKE. 145,000 AT 2 PERCENT STROKE. 25 PERCENT OF EACH AT 275 DEGREES F WITH A RATE OF 1 HZ. PASS/FAIL CRITERIA: PASSAGE OF PERFORMANCE RECORD TEST.
- IMPULSE CYCLING - HIGH PRESSURE CYLINDER: 50,000 CYCLES, 3,000 - 4,500 - 3,000 PSI WITH A RATE OF 2 HZ. PASS/FAIL CRITERIA: PASSAGE OF PERFORMANCE RECORD TEST
- BURST TEST - HIGH PRESSURE CYLINDER: 7,500 PSI. LOW PRESSURE CYLINDER: 320 PSI. PASS/FAIL CRITERIA: NO EXTERNAL LEAKAGE OR RUPTURE.

ACCEPTANCE:

- EXAMINATION OF PRODUCT - WEIGHT, WORKMANSHIP, FINISH, DIMENSIONS, AND CONSTRUCTION
- PROOF PRESSURE TEST - TESTED AT 275 DEG F AND 4,500 PSIG PRESSURE. AND 160 PSIG RETURN. PASS/FAIL CRITERIA: NO EXTERNAL LEAKAGE.
- PERFORMANCE RECORD TEST:
 - RELIEF VALVE OPERATION TEST - VERIFY CRACK FULL FLOW AND RESEAT PRESSURES
 - LEAKAGE TEST - 25 FULL CYCLES, PRESSURE AS REQUIRED TO CYCLE RESERVOIR PORTS BLOCKED 3,000 PSIG TO PRESSURING CHAMBER. PASS/FAIL CRITERIA: EXTERNAL LEAKAGE PAST RESERVOIR PISTON SHALL NOT EXCEED 1 DROP PER 25 CYCLES.
 - PISTON BREAKWAY TEST - 3,000 PSIG ON HIGH PRESSURE PISTON. PASS/FAIL CRITERIA: PISTON SHALL MOVE WHEN RESERVOIR PRESSURE IS INCREASED/DECREASED WITH NO GREATER THAN 4 PSIG
- RESERVOIR CLEANLINESS TEST - CLEANLINESS LEVEL 190 PER MA0110-301

GROUND TURNAROUND TEST

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION

MATERIAL CERTIFICATION IS VERIFIED BY INSPECTION. PROCESS CERTIFICATION IS IMPOSED AND VERIFIED BY INSPECTION. THREE SEAL PODS PER LOT ARE 100 PERCENT INSPECTED AND ALL DATA IS VERIFIED BY RECEIVING INSPECTION. T-TYPE SEAL SET OUTER AND INNER DIAMETER DIMENSIONS AND THICKNESS ARE INSPECTED AND DOCUMENTED BY RECEIVING INSPECTION.

CONTAMINATION CONTROL

CONTAMINATION LEVEL OF 190, OR BETTER, PER MA0110-301 IS MAINTAINED AND VERIFIED BY INSPECTION.

CRITICAL PROCESSES

COATING PROCESS IS VERIFIED BY INSPECTION.

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ASSEMBLY/INSTALLATION

ALL SUPPLIER DRAWING CHARACTERISTICS ARE VERIFIED BY INSPECTION. SEAL INSTALLATION IS PER DRAWING/PLANNING TICKET AND VERIFIED BY INSPECTION. DATA PAK RECORDS AND ASSEMBLY PROCEDURES ARE VERIFIED BY INSPECTION.

TESTING

ATP AND POST ATP FLUID TESTS ARE 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.

(A5608-010) (1976) QUALIFICATION - DURING THE ENDURANCE TEST OF THE HYDRAULIC RESERVOIR, EXCESSIVE INTERNAL LEAKAGE OCCURRED AT THE BOOTSTRAP PISTON SEAL. THE EXCESSIVE LEAKAGE RESULTED FROM RUPTURE OF THE "O" RING WHICH WAS CAUSED BY THE SPLITTING OF THE CAP SEAL. A FLUOROCARBON OMNI-SEAL REPLACED THE CAP SEAL ON ALL UNITS. WITH THIS CORRECTIVE ACTION THE FAILURE HAS NOT BEEN REPEATED.

(E) OPERATIONAL USE:

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

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

: *J. Kimura 7-30-98*
: 95-CIL-009_02-6