

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-6-C07-IM -X**

SUBSYSTEM NAME: HYDRAULICS

REVISION: 3 07/24/98

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : VALVE, LATCHING	MC284-0469

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

VALVE, SHUTOFF, SOLENOID OPERATED LATCHING, (BRAKE ISOLATION VALVE 1 AND LANDING GEAR EXTEND ISOLATION VALVE)

REFERENCE DESIGNATORS: 50V58LV26 (BRAKE ISO 1)
50V58LV43 (EXTEND ISO)

QUANTITY OF LIKE ITEMS: 2

TWO IN HYDRAULIC POWER SYSTEM #1 LANDING GEAR DISTRIBUTION LINES (LV43 AND LV26)

FUNCTION:

ONE VALVE (LV43) ISOLATES THE LANDING GEAR HYDRAULIC CIRCUIT FROM THE HYDRAULIC POWER SYSTEM #1 WHEN POWER IS NOT REQUIRED. THE OTHER VALVE (LV26) ISOLATES THE MAIN LANDING GEAR HYDRAULIC BRAKE CIRCUIT FROM THE HYDRAULIC POWER SYSTEM #1 WHEN POWER OR THERMAL CONDITIONING FLUID FLOW IS NOT REQUIRED. A CHECK VALVE IS PROVIDED INTERNAL TO BOTH VALVES ON THE OUTLET SIDE. ON LV43 THIS CHECK VALVE IS NECESSARY FOR LANDING GEAR STOWAGE/DEPLOYMENT WITH GSE. ONE SOLENOID OPENS VALVE AND ONE SOLENOID CLOSES VALVE. HYDRAULIC PRESSURE IS REQUIRED IN CONJUNCTION WITH SOLENOID COMMAND TO CYCLE VALVE. A VALVE POSITION INDICATION SWITCH IS ALSO PROVIDED.

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SUBSYSTEM NAME: HYDRAULICS

LRU: VALVE, LATCHING

ITEM NAME: VALVE, LATCHING

CRITICALITY OF THIS
FAILURE MODE: 1R2

FAILURE MODE:

OPENS PREMATURELY OR FAILS TO CLOSE

MISSION PHASE: LO LIFT-OFF
DO DE-ORBITVEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:

FAILURE OF LATCHING MECHANISM, CONTAMINATION, VIBRATION, STRUCTURAL
FAILURE OF OPENING SOLENOID VALVE PLUNGER, DEFECTIVE SOLENOID (FAILS TO
CLOSE ONLY)

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:

A)

B)

VALVE HAS POSITION INDICATION

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF LANDING GEAR CIRCUIT ISOLATION REDUNDANCY (LV43 ONLY). LOSS OF
BRAKE CIRCUIT ISOLATION REDUNDANCY (LV26 ONLY).

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(B) INTERFACING SUBSYSTEM(S):

NO EFFECT. RESULTANT APPLIED SYSTEM 1 PRESSURE WOULD BE ISOLATED BY THE BRAKE CONTROL VALVE (LV26 ONLY), AND EXTEND AND RETRACT VALVES (LV43 ONLY) UNLESS COMMANDED TO BE OPENED.

(C) MISSION:

NO EFFECT

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

NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE DUE TO PREMATURE LANDING GEAR DEPLOY AFTER TWO FAILURES. THIS FAILURE (WITH LV43) AND FAILURE OF EXTEND VALVE 1 PREMATURELY OPENING. PREMATURE DEPLOYMENT OF LANDING GEAR CAUSES POSSIBLE LOSS OF CREW/VEHICLE DUE TO (1) ET IMPACT BY LANDING GEAR DURING ASCENT, OR (2) CONTROL PROBLEMS. STRUCTURAL DAMAGE AND AERO HEATING PROBLEMS DURING ENTRY. ALSO, POSSIBLE LOSS OF CREW/VEHICLE WITH THREE FAILURES (THIS FAILURE, PLUS LEAK DOWNSTREAM OF VALVE, PLUS LOSS OF SECOND HYDRAULIC SYSTEM). ALSO, POSSIBLE LOSS OF CREW/VEHICLE DUE TO UNCOMMANDED BRAKE PRESSURE AFTER TWO FAILURES; THIS FAILURE (WITH LV26) AND A FAILED CLOSED CHECK VALVE (CV19).

-DISPOSITION RATIONALE-

(A) DESIGN:

BI-STABLE DESIGN, LATCHED IN POSITION, REQUIRES ELECTRICAL ACTUATION OF A SOLENOID PLUS PRESSURE TO UNLATCH SPOOL AND CHANGE SPOOL POSITION. ONE OF TWO SOLENOIDS OPENS VALVE, OTHER SOLENOID CLOSES VALVE. SHOULD SOLENOID PLUNGER FAIL OR LATCH SPRING FAIL, THE "GLYD" RING SPOOL FRICTION WILL TEND TO PREVENT PREMATURE SPOOL TRANSLATION. LEE JET 100 MICRON FILTER INTERNAL TO VALVE ASSISTS IN PREVENTING CONTAMINATION FROM ENTERING THE LATCHING MECHANISM AREA.

(B) TEST:

QUALIFICATION:

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ENDURANCE CYCLING - 10,000 CYCLES AT 0 DEGREES F. 5,000 CYCLES AT 35 DEGREES F AND 5,000 CYCLES AT 95 DEGREES F AT SYSTEM OPERATING PRESSURE. PASS/FAIL CRITERIA: MUST PASS PERFORMANCE RECORD TEST.

IMPULSE TEST - 3,000-4,500-3,000 PSI. 120/MINUTE MAXIMUM APPLIED TO INLET. 45,000 CYCLES WITH VALVE IN CLOSED MODE WITH OUTLET OPEN. 5,000 CYCLES WITH VALVE IN OPEN MODE WITH OUTLET BLOCKED. 1,500 - 2,250 - 1,500 PSI, APPLIED AT THE SPOOL DRAIN PORT. 50,000 CYCLES. PASS/FAIL CRITERIA: MUST PASS PERFORMANCE RECORD TEST.

RANDOM VIBRATION - 5 MINUTES PER AXIS AT 20-50 HZ + 6 DB/OCT, 50-2000 HZ 0.01 G2/HZ PASS/FAIL CRITERIA. SUCCESSFUL PASSAGE OF PERFORMANCE RECORD TEST PLUS NO DAMAGE TO VALVE

PERFORMANCE RECORD TEST - ELECTRICAL POWER TEST, LOW VOLTAGE TEST, POSITION INDICATOR TEST, RESPONSE TIME TEST, VALVE OPERATION TEST, AND A LEAKAGE TEST.

ACCEPTANCE:
EXAMINATION OF PRODUCT - WEIGHT, WORKMANSHIP, FINISH, DIMENSIONS, AND CONSTRUCTION.

INSULATION RESISTANCE TEST - CONNECT SPECIFIED PINS TOGETHER AND APPLY 500 VDC BETWEEN PINS. PASS/FAIL CRITERIA: RESISTANCE SHALL BE GREATER THAN 100 MEGOHMS (PER MIL-STD-202, METHOD 302).

PROOF TEST - 4,500 PSI.

PERFORMANCE RECORD TEST - ELECTRICAL POWER TEST, LOW VOLTAGE TEST, POSITION INDICATOR TEST, RESPONSE TIME TEST, VALVE OPERATION TEST, AND A LEAKAGE TEST.

VALVE CLEANLINESS TEST - LEVEL 190 PER MAO110-301.

GROUND TURNAROUND TEST
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
RECEIVING INSPECTION VERIFIES MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL
CLEANLINESS LEVEL OF 190 PER MAO110-301 IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
SPOOL ASSEMBLY WELDS ARE PENETRANT AND RADIOGRAPHICALLY EXAMINED, VERIFIED BY INSPECTION.

CRITICAL PROCESSES

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PASSIVATION IS VERIFIED BY INSPECTION. SOLDERING IS VERIFIED BY INSPECTION
WELDING OF SPOOL ASSEMBLIES IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

PARTS ARE PROTECTED FROM DAMAGE AND CONTAMINATION BY PRODUCTION PROCEDURES DURING MANUFACTURING THROUGH ASSEMBLY. INSPECTION VERIFIES THAT CONTRACTUAL AND TRACEABILITY REQUIREMENTS ARE IMPOSED ON ALL ELECTRICAL PARTS. MACHINING AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. SOLENOID FABRICATION IS VERIFIED BY INSPECTION. INSPECTION VERIFIES THAT ALL O-RINGS/SINGLE BACK UP RINGS ARE PROPERLY IN PLACE AND NO INSTALLATION DAMAGE OCCURS PRIOR TO ASSEMBLING INTO MATING PART.

TESTING

ATP IS VERIFIED BY RI INSPECTION.

HANDLING/PACKAGING

HANDLING/PACKAGING OF COMPONENTS IS 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.

(AB7718-010) (1980) DURING HIGH TEMPERATURE/HIGH PRESSURE TESTING OF THE HYDRAULIC SYSTEM ON THE FLIGHT CONTROL HYDRAULICS LABORATORY. THE VALVE FAILED TO CLOSE. THE FAILURE WAS CAUSED BY A METAL CHIP FOUND IN THE SPOOL/SLEEVE. A MANDATORY INSPECTION POINT WAS IMPLEMENTED ON THE SPOOL/SLEEVE TO ELIMINATE THIS PROBLEM.

(E) OPERATIONAL USE:

ATTEMPT TO CLOSE VALVE, NO ACTION IS AVAILABLE IF VALVE IS FAILED OPEN.

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

· BNA
· VIA APPROVAL FORM

J. Kemura 7-30-98
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