

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-6-A06 -X

SUBSYSTEM NAME: HYDRAULICS

REVISION: 1 07/24/98

PART DATA

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

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

VALVE, LATCHING, SOLENOID OPERATED, HYDRAULIC (TVC ISOLATION VALVE),
PRESSURE LINE

REFERENCE DESIGNATORS: 50V58LV34
50V58LV35
50V58LV36

QUANTITY OF LIKE ITEMS: 3
ONE IN EACH SSME/TVC SYSTEM PRESS LINE

FUNCTION:

A TWO POSITION, LATCHING TYPE, BI-STABLE VALVE WHICH CONTROLS FLUID FLOW TO THE SSME TVC ACTUATORS, UMBILICAL RETRACT ACTUATORS, AND SSME FUEL CONTROL VALVE ACTUATORS. MODE ONE ALLOWS FULL FLOW FOR OPERATION OF THE ACTUATORS DURING ASCENT OR ON ORBIT. MODE TWO PROVIDES RESTRICTED FLOW FOR THERMAL CONTROL ON ORBIT AND CONSERVATION OF APU FUEL ON DESCENTS. A SWITCH IS PROVIDED TO INDICATE WHEN VALVE IS IN FULL FLOW MODE.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-6-A06-01

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SUBSYSTEM NAME: HYDRAULICS

LRU: VALVE LATCHING

ITEM NAME: VALVE LATCHING

CRITICALITY OF THIS

FAILURE MODE: 1R2

FAILURE MODE:

FAILS TO TRANSFER FROM FULL FLOW TO RESTRICTED FLOW.

MISSION PHASE: DO DE-ORBIT

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

CAUSE:

DEFECTIVE SOLENOID, CONTAMINATION, FAILURE OF LATCHING MECHANISM, STRUCTURAL FAILURE OF THE OPENING SOLENOID VALVE PLUNGER. VIBRATION

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:
NONE

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(B) INTERFACING SUBSYSTEM(S):

EXCESSIVE USE OF APU FUEL DURING ENTRY FAILURE WOULD CAUSE APPROXIMATELY 4-7 GPM EXTRA APU FUEL DELIVERY AND A 10 HP INCREASE IN WORK AT FULL PRESSURE. POSSIBLE APU FUEL DEPLETION DURING WORST CASE ENTRY.

(C) MISSION:

NONE

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

NONE

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE WITH TWO FAILURES. APU FUEL DEPLETION FROM THIS FAILURE, PLUS ANOTHER HYDRAULIC SYSTEM LOSS.

-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 LEEJET 100 MICRON FILTER INTERNAL TO VALVE ASSISTS IN PREVENTING CONTAMINATION FROM ENTERING THE SOLENOID AND SPOOL AREA.

(B) TEST:

QUALIFICATION

- 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

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- 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 190 PER MAO110-301 IS VERIFIED BY INSPECTION.

NDE

SPOOL ASSEMBLY WELDS ARE PENETRANT AND RADIOGRAPHICALLY INSPECTED, VERIFIED BY INSPECTION.

CRITICAL PROCESSES

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.

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(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.

(23F014-010) (1985) ISOLATION VALVE RESTRICTOR/SHUTOFF VALVE PERMITTED EXCESS HYDRAULIC FLUID FLOW CAUSING UNEXPECTED HYDRAULIC LOAD FOR APU NUMBER 3 AT SHUT DOWN. CONDITION DETECTED DURING REVIEW OF POST FLIGHT DATA OF 51D (OV103-4). VALVE NEXT FLEW ON 51G (OV103-5) AND CONDITION WAS NOTED AGAIN. SUPPLIER VERIFIED CONDITION. TEARDOWN REVEALED THAT THE LOCKING MECHANISM WAS MISSING, RESULTING IN FLOW AT HIGH PRESSURE THROUGH RESTRICTOR VALVE. NO DIMENSIONAL PROBLEMS FOUND. ATP CHANGED TO REQUIRE FLOW TESTS ON ALL 6 POSITIONS OF RESTRICTOR VALVE. CORRECTIVE ACTION APPLIES TO ALL FUTURE DELIVERIES. VALVES IN FIELD HAD NO REPORTED ANOMALIES, SO NO ACTION IS REQUIRED ON THESE.

(28F008-000) (1985) ENGINE HYDRAULIC SYSTEM PRESSURE INDICATED SUPPLY PRESSURE WITH ISOLATION VALVE CLOSED. IT WAS CONCLUDED THAT THE CLOSE COMMAND ISSUED DURING FLIGHT 51J WAS TOO SHORT IN DURATION TO OBTAIN A LATCHED CLOSED CONDITION. NO HARDWARE CORRECTIVE ACTION REQUIRED. MANUAL SIGNAL DURATION WILL BE INCREASED FROM 2 TO 5 SECONDS ON FUTURE FLIGHTS.

(E) OPERATIONAL USE:

ATTEMPT TO MINIMIZE APU FUEL CONSUMPTION BY RUNNING HYDRAULIC PUMP IN LOW PRESSURE OR SHUTTING DOWN AND RESTARTING APU.

- APPROVALS -

EDITORIAL APPROVED

: BNA

TECHNICAL APPROVAL

: VIA APPROVAL FORM

J. Kemura 7-30-98

95-CIL-009_02-6