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- 02

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SUBSYSTEM NAME: HYDRAULICS
LRU: VALVE, LATCHING
ITEM NAME: VALVE, LATCHING

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:
INADVERTENT TRANSFER FROM FULL OPEN TO RESTRICTED FLOW MODE

MISSION PHASE: LO LIFT-OFF

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

CAUSE:
STRUCTURAL FAILURE OF CLOSING SOLENOID VALVE PLUNGER, FAILURE OF LATCHING MECHANISM, CONTAMINATION, VIBRATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES
RTLS RETURN TO LAUNCH SITE

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF HYDRAULIC POWER TO TVC/SSME HYDRAULIC SYSTEM.

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(B) INTERFACING SUBSYSTEM(S):
LOSS OF HYDRAULIC POWER FOR ENGINE VALVE CONTROL FOR ONE ENGINE RESULTING IN LOSS OF ONE SSME THRUST CONTROL; HOWEVER, ENGINE VALVES WILL LOCK INTO POSITION AND ENGINE WILL CONTINUE TO OPERATE. LOSS OF REDUNDANT HYDRAULIC POWER SYSTEM FOR FOUR TVC ACTUATORS. LOSS OF ONE OF THREE ET UMBILICAL RETRACT ACTUATORS FOR EACH UMBILICAL PLATE

(C) MISSION:
ABORT DECISION

(D) CREW, VEHICLE, AND ELEMENT(S):
NONE

(E) FUNCTIONAL CRITICALITY EFFECTS:
FUNCTIONAL CRITICALITY EFFECTS-POSSIBLE LOSS OF CREW/VEHICLE WITH TWO FAILURES: THIS FAILURE, PLUS LOSS OF ANOTHER HYDRAULIC SYSTEM DURING MAX Q THROTTLE DOWN. THIS WOULD RESULT IN TWO ENGINES LOCKED UP AT LOW THRUST LEVEL, PLUS LOSS OF GIMBALLING FOR ONE ENGINE (REQUIRES ENGINE SHUTDOWN) (CRITICALITY 1), ALSO RESULTS IN LOSS OF TWO ET UMBILICAL RETRACT ACTUATORS PER PLATE (CRITICALITY 1). CRITICALITY 1 FOR SSME INDUCED RTLS

-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.
- 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

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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 + 3 DB/OCT 50-2000 HZ 0.01 G?/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 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 TRACEABLILITY 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.

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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.

(E) OPERATIONAL USE:
NONE (VALVE SWITCH IS INACCESSIBLE).

- APPROVALS -

EDITORIALLY APPROVED	: BNA	: J. Kimura 7-30-98
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 95-CIL-009_02-6