PRINT DATE: 12/18/96

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-1B-023 -X

SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS
REVISION: 0 03/14/88

PART DATA

	PART NAME **VENDOR NAME**	**PART NUMBER** **VENDOR NUMBER**
	: BRAKE/SKID CONTROL	
LRU	: MLG BRAKE SYSTEM HYDRO-AIRE	MC621-0055 33-01727

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SWITCHING VALVE

QUANTITY OF LIKE ITEMS: 4
LEFT SIDE - TWO
RIGHT SIDE - TWO

FUNCTION:
PROVIDES A COMMON PRESSURE OUTLET AND SELECTS HYDRAULIC POWER SOURCE TO PROVIDE MODULE WITH OPERATING PRESSURE.

PRINT DATE: 12/20/96

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE
NUMBER: 02-1B-023- 02

REVISION#: 1 12/20/96

SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS
LRU: MLG BRAKE SYSTEM
ITEM NAME: SWITCHING VALVE

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:
GROSS EXTERNAL LEAKAGE

MISSION PHASE: DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:
MATERIAL DEFECT, COMPLETE SEAL FAILURE DOWNSTREAM OF SWITCHING VALVE.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF HALF BRAKE PRESSURE COMMAND TO TWO BRAKES ON ONE STRUT.

(B) INTERFACING SUBSYSTEM(S):
POSSIBLE LOSS OF TWO HYDRAULIC SYSTEMS.

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(C) MISSION:
POSSIBLE LOSS OF MISSION/CREW/VEHICLE IF ADDITIONAL FAILURE RESULTS IN LOSS OF ALL HYDRAULIC SYSTEMS.

(D) CREW, VEHICLE, AND ELEMENT(S):
SAME AS (C)

(E) FUNCTIONAL CRITICALITY EFFECTS:

DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 1/1

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

-DISPOSITION RATIONALE-

(A) DESIGN:
THE BRAKE/SKID CONTROL MODULE IS DESIGNED TO BE A HIGH RESPONSE ELECTRO - HYDRAULIC PRESSURE CONTROL VALVE. IT IS DESIGNED AND FABRICATED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF MIL-H-5440, MIL-H-8775, AND MIL-V-5529. THE SWITCHING VALVE IS AN INTEGRAL PART OF THE BRAKE/SKID CONTROL MODULE, ALL OF IT'S SEALS ARE STATIC AND ARE DESIGNED TO PRECLUDE GROSS LEAKAGE. THE MODULE IS DESIGNED TO A BURST FACTOR OF SAFETY OF 5.0 AND WAS ORIGINALLY DESIGNED FOR A 3000 PSI SYSTEM - IT NOW OPERATES AT 1500 PSI. DESIGN MINIMUM FACTOR OF SAFETY IS 1.4.

(B) TEST:
QUALIFICATION TEST: IMPULSE PRESSURE TESTING - PEAK PRESSURE 4500 PSI, FREQUENCY - 1 TO 3 HZ, MINIMUM PRESSURE 1500 PSI, TOTAL CYCLES-60,000, TEMPERATURE 200 DEG F FLUID, 275 DEG F AMBIENT. BURST PRESSURE TEST - 7500 PSIG FOR 3 TO 5 MINUTES - FLUID AND AMBIENT TEMPERATURE 275 DEG F. ENVIRONMENT TESTING INCLUDE; HUMIDITY, SALT FOG, VIBRATION ACCELERATION & SHOCK - TEST SPECIMEN ARE SUBJECTED TO FUNCTIONAL TESTS BEFORE AND AFTER EACH ENVIRONMENT TEST. EQUIPMENT NORMALLY OPERATING DURING EXPOSURE TO THESE ENVIRONMENTS ARE ALSO FUNCTIONALLY MONITORED DURING QUALIFICATION TESTING. THE BRAKE/SKID CONTROL SYSTEM IS SUBJECTED TO 10G UPWARD/7.5G DOWNWARD LANDING ACCELERATION IN THE VERTICAL AXIS AND 0.8 AFT/2G FORWARD IN THE LONGITUDINAL AXIS. THIS LANDING ACCELERATION IS MAINTAINED FOR A MINIMUM OF 5 MINUTES. HIGH TEMPERATURE TESTING IS PERFORMED ON ALL EQUIPMENT PER METHOD 501, PROCEDURE I, OF MIL-STD-810, TEST TEMP IS 275 DEGREES F. LOW TEMP TESTING IS CONDUCTED AT MINUS 80 DEGREES F AND MINUS 65 DEGREES F.

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ACCEPTANCE TESTS ARE PERFORMED ON ALL UNITS DELIVERED FOR FUNCTIONAL USE THESE TESTS INCLUDE; COMPONENT FUNCTIONAL TESTS & PROOF PRESSURE TESTING. DURING ACCEPTANCE TESTING EACH UNIT IS SUBJECTED TO PROOF PRESSURE OF 4500 PSIG FOR 2 MINUTES. PASS CRITERIA IS NO EVIDENCE OF EXTERNAL LEAKAGE, DISTORTION, OR PERMANENT DEFORMATION.

OMRSD: HYDRAULIC SYSTEM INSPECTION REQUIREMENTS; THIS INSPECTION CHECKS ALL ACCESSIBLE COMPONENTS IN THE SYSTEM FOR EVIDENCE OF DAMAGE OR LEAKAGE.

HYDRAULIC SWITCHING/CONTROL VALVES: THIS TEST CHECKS THE OPERATION OF THE SWITCHING VALVES BY SELECTING HYDRAULIC SYSTEMS, DEPRESSING THE BRAKE PEDALS AND VERIFYING THE BRAKE PRESSURE TO THE CORRESPONDING BRAKES.

FREQUENCY: ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION. RECEIVING INSPECTION VERIFIES FUNCTIONAL CHARACTERISTICS.

CONTAMINATION CONTROL
CONTAMINATION CONTROL AND CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
VALVE VISUALLY AND DIMENSIONALLY VERIFIED DURING FABRICATION. SEALS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
EDM AND GRINDING ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
INSPECTION VERIFIES X-RAY, PENETRANT, AND MAGNETIC PARTICLE INSPECTION OF VARIOUS PARTS.

TESTING
ACCEPTANCE TESTING INCLUDING PROOF PRESSURE FOR EXTERNAL LEAKS IS VERIFIED BY INSPECTION.

PACKAGING/HANDLING
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
NONE.

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(E) OPERATIONAL USE:
AFTER LEAK DETECTION CREW WILL CLOSE LANDING GEAR HYDRAULIC ISOLATION VALVE(S) WHICH WILL ISOLATE LEAK.

- APPROVALS -

EDITORIALLY APPROVED	: RI	: Robert Stell Jr 12/20/96
EDITORIALLY APPROVED	: JSC	: Tom Searcy 7-16-97
TECHNICAL APPROVAL	: VIA JSC	:96-CIL-011