

PAGE: 1

PRINT DATE: 02/24/95

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 02-1B-033 -X**

**SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS
REVISION: 1 02/24/95**

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
	: BRAKE/SKID CONTROL	
LRU	: MLG BRAKE SYSTEM HYDRO-AIRE	MC621-0055 48-043-1

PART DATA

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
PRESSURE REGULATOR**

**QUANTITY OF LIKE ITEMS: 6
3 LEFT,
3 RIGHT**

**FUNCTION:
EACH HYDRAULIC SYSTEM (3000 PSI) SUPPLY PRESSURE TO THE HYDRAULIC BRAKE
BRAKE MODULES IS LIMITED TO 2000 PSI BY A PRESSURE REGULATOR.**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – CRITICAL FAILURE MODE
NUMBER: 02-1B-033 - 02**

REVISION# 1 02/24/95

SUBSYSTEM NAME: LANDING/DECELERATION - BRAKE/SKID CONTROL SYS
LRU: MLG BRAKE SYSTEM
ITEM NAME: MLG BRAKE SYSTEM
CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS CLOSED

MISSION PHASE:
LS LANDING-SAFING

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

CAUSE:
CONTAMINATION, FAILURE OF INTERNAL PART(S).

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)
B)
SCREEN "B" FAILS BECAUSE SWITCHING VALVE WILL SELECT THE STANDBY SYSTEM.
C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT - SWITCHING VALVE WILL SELECT THE STANDBY HYDRAULIC SYSTEM.

(B) INTERFACING SUBSYSTEM(S):
SAME AS (A)

(C) MISSION:
POSSIBLE LOSS OF MISSION/CREW/VEHICLE AFTER TWO OTHER FAILURES - LOSS OF THE OTHER PRIMARY SYSTEM PRESSURE REGULATOR AND LOSS OF THE STANDBY SYSTEM PRESSURE REGULATOR ON THE SAME SIDE WHICH WOULD RESULT IN TOTAL LOSS OF BRAKING ON THAT SIDE.

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

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NUMBER: 02-1B-033 - 02

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:

THE PRESSURE REGULATOR IS DESIGNED TO OPERATE AFTER BEING SUBJECTED TO A SAWTOOTH SHOCK PULSE OF 50G PEAK MAGNITUDE FOR DURATION OF 10 TO 12 MILLISECONDS.

THE HYDRAULIC SYSTEM FILTER MODULE IS 5 MICRON ABSOLUTE AND IS SIZED TO FILTER THE BULK OF ANY CONTAMINATE(S).

(B) TEST:

QUALIFICATION TEST: ENVIRONMENTAL TESTING INCLUDES; HUMIDITY, SALT FOG, VIBRATION ACCELERATION AND 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. LANDING ACCELERATION - THE PRESSURE REGULATOR 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.

ACCEPTANCE TEST: ACCEPTANCE TESTS ARE PERFORMED ON ALL UNITS DELIVERED FOR FUNCTIONAL USE - THESE TESTS INCLUDE; COMPONENT FUNCTIONAL TESTS AND PROOF PRESSURE TESTING. ALL HYDRAULIC COMPONENTS ARE CAPABLE OF WITHSTANDING 60,000 PRESSURE IMPULSE CYCLES WHILE AT FLUID TEMPERATURE OF 200 DEG F.

OMRSD: BRAKE PEDAL/HYDRAULIC DYNAMIC INSTABILITY;
TEST CONDITIONS -

- (1) RMG/LMG WOW SIGNALS ACTIVATED (INDICATORS OFF)
 - (2) HYDRAULIC SYSTEM 1,2 & 3 SUPPLY PRESSURE AT 3000 PLUS OR MINUS 200 PSI.
 - (3) SKID CONTROL ACTIVATED (FAIL INDICATOR OFF)
- DURING THIS TEST EACH BRAKE PEDAL IS PUMPED TO 1/4, 1/2, 3/4 AND FULL STROKE WHILE IT'S ADJACENT PEDAL IS HELD IN THE FULLY DEPRESSED POSITION-THE CORRESPONDING BRAKE PRESSURES ARE VERIFIED.

FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.

(C) INSPECTION:

RECEIVING INSPECTION
INCOMING MATERIAL FOR THE REGULATOR IS VERIFIED BY RECEIVING INSPECTION.

CONTAMINATION CONTROL

ALL PARTS ARE CLEANED PRIOR TO ASSEMBLY, AND UNITS ARE ASSEMBLED AND TESTED IN A CONTROLLED ATMOSPHERE. DURING ASSEMBLY, MOISTURE DETECTION EQUIPMENT IS UTILIZED TO CONTROL THE MOISTURE CONTENT. CLEANING AND PACKAGING CONFORM TO ESTABLISHED SPECIFICATIONS AND ALL OF THE ABOVE OPERATIONS ARE VERIFIED BY INSPECTION.

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ASSEMBLY/INSTALLATION
SPECIAL PROCESS DOCUMENTS TRAVEL WITH A SPECIFIC SHOP ORDER AND ARE MONITORED BY QE DURING THEIR PROCESSING.

CRITICAL PROCESSES
HEAT TREATING AND TIG WELDING ARE VERIFIED BY INSPECTION. TIG WELD OPERATORS ARE CERTIFIED.

NONDESTRUCTIVE EVALUATION
PENETRANT INSPECTION OF SPRINGS AND UNIT STEM IS VERIFIED BY INSPECTION.

TESTING
PRIMARY AND SECONDARY SPRING PACKS ARE TESTED ON AN INSTRON TESTER, WHOSE READINGS ARE VERIFIED BY INSPECTION.

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

(D) FAILURE HISTORY:
NONE.

(E) OPERATIONAL USE:
CREW CAN COMPENSATE EITHER BY CHANGING BRAKING PROCEDURE AND/OR USE OF NWS TO MAINTAIN DIRECTIONAL CONTROL.

- APPROVALS -

PAE MANAGER : K. L. PRESTON
PRODUCT ASSURANCE ENGR : M. PHUNG
DESIGN ENGINEERING : M. T. PORTER
NASA SSMA :
NASA SUBSYSTEM MANAGER :

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