

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: 02-6-G02-IM -X**

SUBSYSTEM NAME: HYDRAULICS

REVISION: 3 07/24/98

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	VALVE, LANDING GEAR CONTROL	MC621-0029-0005

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

VALVE, LANDING GEAR CONTROL (EXTEND VALVE 1), SINGLE SOLENOID OPERATED 2 POSITION/3 WAY

REFERENCE DESIGNATORS: 67V58LV11

QUANTITY OF LIKE ITEMS: 1

ONE IN HYDRAULIC POWER SYSTEM 1 EXTEND SIDE OF THE LANDING GEAR CIRCUIT

FUNCTION:

CONTROLS POWER SYSTEM ONE IN THE LANDING GEAR CIRCUIT. ON "ARM AND DOWN" COMMANDS IT (LV11) DIRECTS PRESSURE TO THE MAIN LANDING GEAR UPLOCK AND STRUT ACTUATORS. IT ALSO DIRECTS PRESSURE TO THE NOSE LANDING GEAR UPLOCK AND STRUT ACTUATORS WHEN THE LANDING GEAR SWITCHING VALVE IS IN THE PRIMARY POSITION. WHEN THE VALVE IS CLOSED (DE-ENERGIZED), THE LANDING GEAR CIRCUIT IS VENTED TO RETURN 1 AND ISOLATED FROM SUPPLY PRESSURE. HYDRAULIC PRESSURE AND SOLENOID POWER ARE REQUIRED TO OPEN VALVE. WHEN VALVE IS OPEN (ENERGIZED) SUPPLY PRESSURE 1 IS PROVIDED TO THE LANDING GEAR CIRCUIT.

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ITEM NAME: VALVE, LANDING GEAR CONTROL

CRITICALITY OF THIS
FAILURE MODE: 1/1

FAILURE MODE:

PREMATURE TRANSFER (FAILED OPEN)

MISSION PHASE: DO DE-ORBIT

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

CAUSE:

FRACTURED SOLENOID SPRING, FRACTURED SOLENOID VALVE PLUNGER

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

A)

B)

NO VALVE POSITION INDICATOR EXISTS. DETECTABLE BY PREMATURE GEAR DEPLOY DURING ENTRY AT A RELATIVE VELOCITY 800 FPS WHEN LANDING GEAR EXTEND ISOLATION VALVE (LV43) OPENS.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

PREMATURE GEAR DEPLOY AT 800 FPS (LDG EXTEND ISO VALVE IS OPENED AT 800 FPS)

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(B) INTERFACING SUBSYSTEM(S):

PREMATURE GEAR DEPLOY AT 800 FPS (LDG EXTEND ISO VALVE IS OPENED AT 800 FPS).

(C) MISSION:

SAME AS (A) AND (B)

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

SAME AS (A) AND (B)

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE WITH THIS FAILURE CAUSING PREMATURE DEPLOYMENT OF LANDING GEAR AT 800 FPS POSSIBLE LOSS OF CREW/VEHICLE DUE TO CONTROL PROBLEMS, ENERGY PROBLEMS, STRUCTURAL DAMAGE. THIS CASE APPLIES ONLY AFTER LDG EXTEND ISO VALVE OPENING.

-DISPOSITION RATIONALE-

(A) DESIGN:

SPRING MATERIAL IS 302 CRES AND SPRING IS COMPLETELY CONTAINED. PLUNGER IS 440C CRES. ANALYSIS ALLOWING COMPLETE LOSS OF ONE EFFECTIVE SPRING COIL INDICATES AVAILABLE PRESSURE WILL NOT OPEN VALVE (UNSEAT BALL). SUPPLIER STANDARD BALL TYPE DESIGN USED ON VARIETY OF PROPRIETARY PILOT OPERATED FLUID CONTROLS FOR AIRCRAFT INDUSTRY. OVER 50,000 PILOT VALVE UNITS BUILT. SOLENOID COIL IS HERMETICALLY SEALED, ISOLATING IT FROM THE HYDRAULIC FLUID

(B) TEST:

QUALIFICATION:

ENDURANCE CYCLING TEST - 20,000 CYCLES AT RATED FLOW AND PRESSURE. 8,000 AT 35 DEG F. 2,000 AT 0 DEG F AND 10,000 AT 275 DEG F WITH A RATE OF 6 CYCLES/MINUTE.

IMPULSE CYCLING TEST - 50,000 IMPULSE CYCLES AT 3,000-4,500-3,000 PSI AT 2 HZ

BURST PRESSURE TEST - TESTED AT 7,500 PSI.

ACCEPTANCE:

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PROOF PRESSURE TEST - TESTED AT 4 500 PSIG PRESSURE PORT ONLY. 4,500 PSIG CYLINDER AND PRESSURE PORT; 2,250 PSIG RETURN PORT ONLY. PASS/FAIL CRITERIA: NO EXTERNAL LEAKAGE OR PERMANENT DEFORMATION

GROUND TURNAROUND TEST

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION

RECEIVING INSPECTION VERIFIES MATERIAL AND PROCESS CERTIFICATIONS (RAW MATERIAL, PLATING AND COATING). PROCURED PARTS ARE VERIFIED AT RECEIVING INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS IS VERIFIED BY INSPECTION TO BE WITHIN SPECIFICATION REQUIREMENTS PER MA0110-301, LEVEL 190. CLEANLINESS OF SOLENOID IS VERIFIED BY INSPECTION TO BE WITHIN SPECIFICATION REQUIREMENTS. CLEANLINESS OF TEST FLUID USED DURING ACCEPTANCE TESTING IS VERIFIED BY INSPECTION TO BE WITHIN SPECIFICATION REQUIREMENTS.

CRITICAL PROCESSES

SURFACE TREATMENT (PASSIVATION) IS VERIFIED BY INSPECTION. HEAT TREATMENT AND SOLDERING ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

SOLENOID BUILD-UP, IN-PROCESS TESTING, AND COMPLETED SOLENOID ASSEMBLY ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS ARE VERIFIED BY INSPECTION.

TESTING

ACCEPTANCE TESTS (PROOF PRESSURE, LEAKAGE, DIELECTRIC WITHSTANDING VOLTAGE, INSULATION RESISTANCE FUNCTIONS) ARE VERIFIED BY INSPECTION

HANDLING/PACKAGING

HANDLING AND STORAGE OF COMPONENTS TO PREVENT EXTERNAL DAMAGE 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.

(AB7781-010) (1980) VALVE FAILED TO OPEN DURING USE ON FLIGHT CONTROL HYDRAULICS LABORATORY (FCHL). PILOT SECTION PLUNGER FRACTURED FROM HIGH IMPACT LOADS. COMPRESSION SPRING REMOVED AND SOLID SHIM ADDED TO MINIMIZE FORCES. ALL VALVES WERE CHANGED. (NOTE: THIS FAILURE IS INCLUDED IN THIS CIL AS THIS TYPE FAILURE COULD RESULT IN A PREMATURE TRANSFER.)

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(E) OPERATIONAL USE:

FIRST FAILURE - NONE SECOND FAILURE RESULTING IN PREMATURE GEAR DEPLOY -
NONE. IF OCCURS AFTER MACH 1, CREW MAY BE ABLE TO MANAGE VEHICLE ENERGY
SUFFICIENT TO REACH THE RUNWAY.

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

J. Korman 7-30-98
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