

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 02-6-G16-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 2), SINGLE SOLENOID OPERATED 2 POSITION/3 WAY

REFERENCE DESIGNATORS: 87V58LV42

QUANTITY OF LIKE ITEMS: 1

ONE IN HYDRAULIC POWER SYSTEM #2 EXTEND SIDE OF THE NOSE LANDING GEAR CIRCUIT (LV42)

FUNCTION:

CONTROLS POWER SYSTEM TWO IN THE NOSE LANDING GEAR CIRCUIT WHEN THE L.G. SWITCHING VALVE IS IN THE STANDBY POSITION. ON "ARM AND DOWN" COMMANDS IT (LV42) DIRECTS PRESSURE TO THE NOSE LANDING GEAR UPLOCK, STRUT ACTUATORS AND NOSE WHEEL STEERING. WHEN THE VALVE IS CLOSED (DE-ENERGIZED) HYDRAULIC SUPPLY PRESSURE 2 IS ISOLATED FROM THE NOSE WHEEL STEERING SWITCHING VALVE. HYDRAULIC PRESSURE AND SOLENOID POWER REQUIRED TO OPEN VALVE. WHEN VALVE IS OPEN (ENERGIZED) SUPPLY PRESSURE 2 IS PROVIDED TO THE NOSE WHEEL STEERING SWITCHING VALVE.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-6-G15-IM-02

REVISION#: 3 07/24/98

SUBSYSTEM NAME: HYDRAULICS

LRU: VALVE, LANDING GEAR CONTROL

ITEM NAME: VALVE, LANDING GEAR CONTROL

CRITICALITY OF THIS

FAILURE MODE: 1R3

FAILURE MODE:

PREMATURE TRANSFER (FAILS OPEN)

MISSION PHASE: LO LIFT-OFF
 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) PASS
 B) FAIL
 C) PASS

PASS/FAIL RATIONALE:

A)

B)

NO VALVE POSITION INDICATION EXISTS.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

NO EFFECT. NOSE LANDING GEAR WILL NOT PREMATURELY DEPLOY SINCE THE L.G. SWITCHING VALVE SPOOL IS NORMALLY IN THE PRIMARY POSITION (BIASED TO SYSTEM 1).

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- GIL FAILURE MODE
NUMBER: 02-6-G16-1M- 02**

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT

(C) MISSION:
NO EFFECT

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE WITH THREE FAILURES: THIS FAILURE, BRAKE ISOLATION VALVE 2 FAILED OPEN, AND FAILED OPEN LANDING GEAR SWITCHING VALVE SOLENOID VALVE SEAT, RESULTING IN PREMATURE NOSE GEAR DEPLOY. THIS RESULTS IN (1) ET IMPACT BY NOSE LANDING GEAR DURING ASCENT OR (2) CONTROL PROBLEMS, STRUCTURAL DAMAGE, AND AEROHEATING PROBLEMS DURING ENTRY.

-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 AND SECOND FAILURE NONE

THIRD FAILURE RESULTING IN PREMATURE NOSE LANDING GEAR DEPLOYMENT. IF OCCURS AFTER MACH 1, CREW MAY BE ABLE TO MANAGE VEHICLE SUFFICIENTLY TO REACH THE RUNWAY.

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

: J. Kamura 7-30-98
: 95-CIL-009_02-6