FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-6-G13-IM -X

SUBSYSTEM NAME: HYDRAULICS

REVISION: 2 03/31/92

PART DATA

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

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SERIES RETRACT VALVES, LANDING GEAR CONTROL (RETRACT 1 AND 2), SINGLE SOLENOID OPERATED 2 POSITION/3 WAY.

REFERENCE DESIGNATORS: 67V58LV25
67V58LV41

QUANTITY OF LIKE ITEMS: 2
TWO IN HYDRAULIC POWER SYSTEM #1 RETRACT SIDE (LV25 AND LV41) OF THE LANDING GEAR CIRCUIT

FUNCTION:
BOTH RETRACT (LV25 AND LV41) VALVES CONTROL THE RETRACT SIDE OF THE LANDING GEAR CIRCUIT OF POWER SYSTEM #1. GSE CONTROL POWER IS REQUIRED FOR STOWING/RETRACTING THE LANDING GEAR (NO INFLIGHT CAPABILITY) IN ADDITION, LV25 PROVIDES A RETURN PATH FOR THE LANDING GEAR CIRCUIT, AND LV41 PROVIDES A REDUNDANT RETURN PATH IF LV25 FAILS OPEN. WHEN THE VALVE IS CLOSED (DE-ENERGIZED), FLOW IS VENTED FROM THE RETRACT LINE TO RETURN DURING EXTENSION, AND SYSTEM 1 PRESSURE IS ISOLATED FROM THE RETRACT SIDE. HYDRAULIC PRESSURE AND SOLENOID POWER ARE REQUIRED TO OPEN VALVE. WHEN VALVE IS OPEN (ENERGIZED) BY GSE COMMANDS (GROUND OPERATION ONLY) HYDRAULIC SYSTEM 1 PRESSURE IS DIRECTED TO RETRACT SIDE FOR GEAR RETRACTION.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE
NUMBER: 02-6-G13-IM- 02

REVISION#: 3 07/24/98

SUBSYSTEM NAME: HYDRAULICS
LRU: VALVE, LANDING GEAR CONTROL **CRITICALITY OF THIS**
ITEM NAME: VALVE, LANDING GEAR CONTROL **FAILURE MODE:** 1R3

FAILURE MODE:
PREMATURE TRANSFER (FAILS OPEN)

MISSION PHASE: DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
103	DISCOVERY
104	ATLANTIS
105	ENDEAVOUR

CAUSE:
FRACTURED SOLENOID SPRING, FRACTURED PIN

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)

B)
NO INSTRUMENTATION AVAILABLE DURING FLIGHT TO INDICATE VALVE POSITION. PRESSURE SWITCH (V51X0074W) INDICATION AVAILABLE DURING GROUND OPERATION ONLY

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF REDUNDANT FLOW PATH TO RETURN LINE.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 02-6-G13-IM- 02

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT. REDUNDANT L.G. RETRACT VALVE (LV25 OR LV41) IN THE CLOSED POSITION PRECLUDES PRESSURE APPLICATION TO THE NOSE AND MAIN LANDING GEAR RETRACT CIRCUITS TO ASSURE GEAR EXTENSION.

(C) MISSION:
NO EFFECT

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE DUE TO INABILITY TO UNLOCK AND EXTEND LANDING GEARS AFTER THREE FAILURES: THIS FAILURE, PREMATURE TRANSFER OF THE REDUNDANT LANDING GEAR RETRACT VALVE TO THE OPEN POSITION (RESULTING IN LOSS OF HYDRAULIC DEPLOY CAPABILITY), AND FAILURE OF PYROTECHNIC BACKUP TO RELEASE MAIN GEAR.

-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.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 02-6-G13-IM- 02

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

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
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FORCES. ALL VALVES WERE CHANGED. (NOTE. THIS FAILURE IS INCLUDED IN THIS CIL AS THIS TYPE FAILURE COULD RESULT IN A PREMATURE TRANSFER.)

(E) OPERATIONAL USE:
NONE

- APPROVALS -

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