FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: 02-6-E28 -X

SUBSYSTEM NAME: HYDRAULICS

REVISION: 1 07/24/96

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:HOSE AND SWIVEL ASSEMBLY TITEFLEX	MC277-0002

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
HOSE AND SWIVEL ASSEMBLY, WATER BOILER HYDRAULIC

REFERENCE DESIGNATORS:
50V58FH95
50V58FH96
50V58FH97
50V58FH98
50V58FH99
50V58FH100

QUANTITY OF LIKE ITEMS: 6
ONE IN EACH POWER SYSTEM H2O BOILER PRESSURE AND RETURN LINES

FUNCTION:
TO COMPENSATE FOR 3 DIMENSIONAL DEFLECTIONS BETWEEN PRIMARY AND SECONDARY STRUCTURE.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

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SUBSYSTEM NAME: HYDRAULICS
LRU: HOSE AND SWIVEL ASSEMBLY **CRITICALITY OF THIS**
ITEM NAME: HOSE AND SWIVEL ASSEMBLY **FAILURE MODE:** 1R2

FAILURE MODE:
RUPTURE, HOSE

MISSION PHASE: LO LIFT-OFF
DO DE-ORBIT

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

CAUSE:
DEFECTIVE MATERIAL OR MANUFACTURE

CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES
RTLS RETURN TO LAUNCH SITE

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF ONE HYDRAULIC SYSTEM.

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(B) INTERFACING SUBSYSTEM(S):
LOSS OF HYDRAULIC POWER FOR ENGINE VALVE CONTROL FOR ONE ENGINE RESULTING IN LOSS OF ONE SSME THRUST CONTROL. HOWEVER, ENGINE VALVES WILL LOCK INTO POSITION AND ENGINE WILL CONTINUE TO OPERATE. LOSS OF REDUNDANT HYDRAULIC POWER SYSTEM FOR FOUR TVC ACTUATORS. LOSS OF NOSE WHEEL STEERING AND HYDRAULIC LANDING GEAR DEPLOYMENT CAPABILITY IF SYSTEM ONE IS LOST. LOSS OF ONE OF THREE HYDRAULIC POWER SYSTEMS TO FLIGHT CONTROL SURFACES AND BRAKES. LOSS OF ONE OF THREE ET UMBILICAL RETRACT ACTUATORS FOR EACH UMBILICAL PLATE. HYDRAULIC FLUID ON TPS SCREED MAY CAUSE DEGRADED TPS BONDS.

(C) MISSION:
ABORT DECISION OR POSSIBLE EARLY MISSION TERMINATION.

(D) CREW, VEHICLE, AND ELEMENT(S):
NONE

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE WITH TWO FAILURES: THIS FAILURE PLUS LOSS OF SECOND HYDRAULIC SYSTEM. CRITICALITY 1 FOR SSME INDUCED RTLS

-DISPOSITION RATIONALE-

(A) DESIGN:
HOSE INNER CORE IS EXTRUDED TFE. REINFORCEMENT IS 304 STAINLESS STEEL WIRE BRAID. HOSE IS SINGLE PLAITS OF SMALL DIAMETER, TIERED, TENSION CONTROLLED TYPE 304 STAINLESS STEEL WIRE BRAID QUALIFIED TO MIL-H-38360. GENERAL REQUIREMENTS FOR HOSE ASSEMBLY - TFE, HIGH TEMPERATURE, HIGH PRESSURE, SYNTHETIC CARBON BASE, AIRCRAFT. HOSE END-FITTINGS ARE TITANIUM PROGRESSIVE-SWAGED WITH POSITIVE BRAIDLOCK AND CONFORM TO MIL-H-38360. SWIVEL FITTINGS ARE STAINLESS STEEL AND TITANIUM WITH ALUMINUM BRONZE SWIVEL BEARINGS. ALUMINUM BRONZE IS ISOLATED FROM THE HYDRAULIC FLUID

(B) TEST:
QUALIFICATION:
RETURN HOSE
- IMPULSE ENDURANCE CYCLING - 100,000 CYCLES 0-2,250-0 PSI AT 450 DEGREES F IN ACCORDANCE WITH FIGURE 3 MIL-H-25579, WITH A RATE OF 70 CYCLES/MIN.

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- BURST PRESSURE - 6,000 PSI AT 70 DEGREES F.

PRESSURE HOSE
- IMPULSE ENDURANCE CYCLING - 250,000 CYCLES 0-4,500-0 PSI IN ACCORDANCE WITH FIGURE 3 MIL-H-38360, WITH A RATE OF 70 CYCLES/MIN. 80 PERCENT AT 400 DEGREES F. 20 PERCENT AT 70 DEGREES F.
- BURST PRESSURE - 12,000 PSI AT 70 DEGREES F.

HOSE AND SWIVEL
- ENDURANCE CYCLING - 50,000 DEFLECTION CYCLES, 50 PERCENT AT 0 DEG F 50 PERCENT AT 275 DEGREES F, WITH A RATE OF 30 CYCLES/MIN. SIMULTANEOUSLY, IMPULSE CYCLES PER FIGURE 2 OF MIL-J-5513, GENERAL REQUIREMENTS FOR HYDRAULIC SWIVEL JOINTS.

ACCEPTANCE:
- PROOF PRESSURE - RETURN 3,000 PSI, PRESSURE 5,000 PSI.
- LEAK TEST - WITH OIL, 3,000 PSI INTERNAL PRESSURE APPLIED.
- LEAK TEST - WITH AIR UNDER WATER, 5-10 PSI INTERNAL PRESSURE APPLIED FOR NOT LESS THAN 2 MINUTES.

GROUND TURNAROUND TEST
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
INCOMING MATERIAL IS VERIFIED BY INSPECTION AND COMPANY METALLURGIST. INCOMING MATERIAL IS TESTED AND VERIFIED BY INSPECTION ON A SAMPLING BASIS, TO ENSURE CERTIFICATION IS CORRECT.

CONTAMINATION CONTROL
CLEANLINESS LEVEL 190 PER MAO110-301 IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
WELDING AND SWAGING PROCESSES ARE VERIFIED BY INSPECTION

NONDESTRUCTIVE EVALUATION
RADIOGRAPHIC INSPECTION IS PERFORMED TO ENSURE THE FOLLOWING: HOSE AND BRAID ARE PROPERLY BOTTOMED IN END FITTING; BUTT WELD TUBING IS CHECKED FOR FREEDOM FROM CRACKS, POROSITY, INCLUSIONS, OR VOIDS. RADIOGRAPH IS EXAMINED UNDER MAGNIFICATION.

ASSEMBLY/INSTALLATION
MANUFACTURING AND ASSEMBLY PROCESSES VERIFIED BY INSPECTION.

TESTING
PROOF AND LEAK TESTS PERFORMED BY TEST LAB UNDER DELEGATION OF QUALITY ASSURANCE MANAGER. SWIVELS ARE TESTED TO RATED PRESSURE, TO ENSURE THAT FITTINGS' DEFLECTION AND EXCURSION ARE WITHIN SPECIFICATION. ATP IS VERIFIED BY INSPECTION.

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HANDLING/PACKAGING
INSPECTION VERIFIES PACKAGING PRIOR TO SHIPMENT

(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.

(E) OPERATIONAL USE:
NONE. RAPID LEAK RATE WOULD DEPLETE HYDRAULIC SYSTEM BEFORE ACTION COULD BE TAKEN.

- APPROVALS -

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