

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-6-C09 -X

SUBSYSTEM NAME: HYDRAULICS

REVISION: 1 07/24/98

PART DATA

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

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
HOSE AND SWIVEL ASSEMBLY, EXTERNAL TANK UMBILICAL RETRACT ACTUATOR

REFERENCE DESIGNATORS: 50V58FH82
50V58FH83
50V58FH84
50V58FH85
50V58FH86
50V58FH87
50V58FH88
50V58FH89
50V58FH90
50V58FH91
50V58FH92
50V58FH93

QUANTITY OF LIKE ITEMS: 12
2 ON EACH OF 3 ACTUATORS IN EACH OF TWO UMBILICALS

FUNCTION:
TO COMPENSATE FOR 3-DIMENSIONAL OCCURRING BETWEEN THE HYDRAULIC
SYSTEM HARD LINES AND THE EXTERNAL TANK UMBILICAL DURING ASSEMBLY OR
SEPARATION

FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE

NUMBER: 02-6-C09-01

REVISION#: 1 07/24/98

SUBSYSTEM NAME: HYDRAULICS

LRU: HOSE AND SWIVEL ASSEMBLY

ITEM NAME: HOSE AND SWIVEL ASSEMBLY

CRITICALITY OF THIS
FAILURE MODE: 1R2**FAILURE MODE:**

RUPTURE, HOSE

MISSION PHASE: LO LIFT-OFF

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

CAUSE:

MATERIAL DEFECT 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)

"B" SCREEN IS PASSED SINCE FAILURE CAN ONLY OCCUR WHEN TVC ISOLATION VALVE IS OPEN (DURING ASCENT OR DURING ENTRY ENGINE RESTOW). WITH SYSTEM NOT ISOLATED, INSTRUMENTATION (RESERVOIR VOLUME) IS AVAILABLE TO DETECT FAILURE. (FAILURE IS NOT PROBABLE OR DETECTABLE DURING ON-ORBIT (ISOLATED) OPERATIONS.)

C)

- FAILURE EFFECTS -**(A) SUBSYSTEM:**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- GIL FAILURE MODE
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LOSS OF ONE ACTUATOR AT EACH UMBILICAL. LOSS OF ONE OF THREE HYDRAULIC SYSTEMS IF FAILURE OCCURS ON ASCENT WHEN TVC ISOLATION VALVE IS OPEN.

(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 FOR FOUR TVC ACTUATORS. LOSS OF ONE OF THREE HYDRAULIC POWER SYSTEMS TO FLIGHT CONTROL SURFACES AND BRAKES IF FAILURE OCCURS ON ASCENT. LOSS OF NOSE WHEEL STEERING AND HYDRAULIC LANDING GEAR DEPLOYMENT CAPABILITY IF FAILURE OCCURS IN SYSTEM ONE ON ASCENT. 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

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

NONE

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE WITH TWO FAILURES. FAILURE OF HOSE PLUS LOSS OF SECOND UNAFFECTED HYDRAULIC SYSTEM DURING ASCENT-RESULTING IN LOSS OF GIMBALLING FOR ONE ENGINE. 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.

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(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.
- BURST PRESSURE - 8,000 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 6,000 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.

NDE

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

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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.

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
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

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