

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE

NUMBER: 02-6-E08 -X

SUBSYSTEM NAME: HYDRAULICS

REVISION: 1

07/24/98

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : FILTER MODULE PUROLATOR	MC621-0026

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

FILTER MODULE

REFERENCE DESIGNATORS: 50V58FL6
50V58FL7
50V58FL8

QUANTITY OF LIKE ITEMS: 3
ONE IN EACH HYDRAULIC POWER SYSTEM

FUNCTION:

PROVIDES FILTRATION CAPABILITY FOR THE HYDRAULIC POWER SUPPLY LINE, RETURN LINE AND MAIN PUMP CASE DRAIN. ALSO CONTAINS THE MAIN SYSTEM RELIEF VALVE AND PROVISIONS FOR MOUNTING THE SYSTEM SUPPLY PRESSURE TRANSDUCERS. INCORPORATES CHECK VALVE IN LINE WITH SERVICING DISCONNECT (02-6-E02) TO LIMIT FLUID LOSS AND ISOLATE SYSTEM PRESSURE DURING CONNECT/DISCONNECT PROCEDURE.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-6-E08-06

REVISION#: 1 07/24/98

SUBSYSTEM NAME: HYDRAULICS

LRU: FILTER MODULE

ITEM NAME: FILTER MODULE

CRITICALITY OF THIS

FAILURE MODE: 1R2

FAILURE MODE:

FAILS OPEN, HYDRAULIC SYSTEM MAIN RELIEF VALVE

MISSION PHASE: LO LIFT-OFF
 DO DE-ORBIT

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

CAUSE:

BROKEN SPRING, CONTAMINATION

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 DUE TO REROUTING OF FLOW TO RESERVOIR. ALSO, SUSTAINED FLOW RATE WILL INPUT EXCESSIVE HEAT INTO RESERVOIR RESULTING IN POTENTIAL SEAL DEGRADATION DUE TO HOT FLUID. (FDA WOULD ALERT THE CREW/GROUND TO THIS POTENTIAL RESERVOIR FAILURE MODE.)

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: 02-6-E08-06**

(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 IN POSITION AND ENGINE CONTINUES 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.

(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. (IF SYSTEM ONE WERE LOST WITH FIRST FAILURE, CRITICALITY 1 WOULD BE REACHED WITH THIS FAILURE PLUS LOSS OF LANDING GEAR PYRO DEPLOY) CRITICALITY 1 FOR SSME INDUCED RTLS.

-DISPOSITION RATIONALE-

(A) DESIGN:

DESIGNED IN ACCORDANCE WITH MIL-V-8813 CLASS D (GENERAL SPECIFICATION FOR VALVES, AIRCRAFT, HYDRAULIC PRESSURE RELIEF) AND SHUTTLE UNIQUE FUNCTIONAL REQUIREMENTS. LOW STRESSED SPRING FOR HIGH ENDURANCE LIMIT. HYDRAULIC SYSTEM FILTER UPSTREAM OF RELIEF VALVE IS 5 MICRON NOMINAL, 15 MICRON ABSOLUTE.

(B) TEST:

QUALIFICATION:

- ELEMENT COLLAPSE TEST - TESTED AT 275 DEG F, 2,250 PSID AND 6 GPM ACCORDING TO MIL-F-8815 PARAGRAPH 4.7.2.6

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE**NUMBER: 02-6-E08- 06**

- FLOW FATIGUE TEST - 36,100 CYCLES AT VARIOUS PRESSURE DROPS AND 275 DEG F ELEMENTS LOADED WITH A-C FINE DUST. PASS/FAIL CRITERIA: NO EVIDENCE OF DAMAGE.

ACCEPTANCE:

- EXAMINATION OF PRODUCT - WEIGHT, WORKMANSHIP, FINISH, DIMENSIONS AND CONSTRUCTION.
- CLEAN ELEMENT PRESSURE DROP TEST - TESTED AT 95 DEG F. SUPPLY AND RETURN ELEMENT 65 GPM AND CASE DRAIN 5 GPM. PASS/FAIL CRITERIA: SUPPLY ELEMENT 37 PSID MAXIMUM. RETURN ELEMENT 15 PSID MAXIMUM. CASE DRAIN 3.5 PSID MAXIMUM.
- PERFORMANCE RECORD TEST:
 - DIFFERENTIAL PRESSURE INDICATOR TEST - 60 PSIG TO 80 PSIG TO 0 PSIG, EACH SECTION BLOCKED PASS/FAIL CRITERIA INDICATOR SHALL NOT ACTUATE AT LESS THAN 60 PSIG, INDICATOR SHALL ACTUATE FULLY AND LOCK AT 80 PSIG AND INDICATOR SHALL REMAIN IN ACTUATED POSITION AT 0 PSIG.
 - CRACKING PRESSURE TEST - INCREASE INLET PRESSURE IN FREE FLOW DIRECTION TO 2 CC/MIN OR GREATER PASS/FAIL CRITERIA: VALVE SHALL OPEN AT NOT LESS THAN 2 PSIG AND NO GREATER THAN 8 PSIG.
- MODULE PRESSURE DROP TEST - 0 DEG F. 3,150 PSIG SUPPLY WITH 46 PSID, 1,500 PSIG RETURN WITH 15 PSID PASS/FAIL CRITERIA FLOW RATE SHALL BE 4 GPM MINIMUM.
- RATED FLOW TEST - 105 DEG F. 3,150 PSIG SUPPLY WITH 65 GPM, 1,500 PSIG RETURN WITH 65 GPM AND 1,500 PSIG CASE DRAIN WITH 5 GPM. PASS/FAIL CRITERIA: PRESSURE DROP SHALL NOT EXCEED 81 PSID SUPPLY, 33 PSID RETURN, AND 32 PSID CASE DRAIN.
- CLEANLINESS TEST - LEVEL 190 PER MA0110-301.

GROUND TURNAROUND TEST

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:**RECEIVING INSPECTION**

RECEIVING/SHIPPING INSPECTION VERIFIES MATERIAL CERTIFICATIONS. MATERIAL IS VERIFIED BY PHYSICAL-CHEMICAL RECORDS AT RECEIVING INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS AND CONTAMINATION LEVELS ARE VERIFIED BY INSPECTION (LEVEL 190 PER MA0110-301).

ASSEMBLY/INSTALLATION

MANUFACTURING/ASSEMBLY PROCESSES ARE VERIFIED BY INSPECTION

CRITICAL PROCESSES

RELIEF VALVE SPRING HEAT TREATMENT IS VERIFIED BY INSPECTION.

TESTING

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NUMBER: 02-6-E08-06**

RELIEF VALVE CRACKING/RESEAT PRESSURE TEST PARAMETERS ARE VERIFIED BY INSPECTION DURING ATP.

HANDLING/PACKAGING
HANDLING AND PACKAGING REQUIREMENTS ARE 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

(E) OPERATIONAL USE:

DEPRESSURIZE MAIN PUMP TO ALLOW SWITCHING VALVES TO CYCLE. SHUTDOWN APU IF REQUIRED.

- APPROVALS -

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