

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-E08-04

REVISION#: 1 07/24/98

SUBSYSTEM NAME: HYDRAULICS

LRU: FILTER MODULE

ITEM NAME: FILTER MODULE

CRITICALITY OF THIS

FAILURE MODE: 1R2

FAILURE MODE:

CLOGGED, RETURN LINE FILTER

MISSION PHASE: LO LIFT-OFF
DO DE-ORBIT

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

CAUSE:

EXCESSIVE ACCUMULATION OF CONTAMINANTS, COLLAPSED ELEMENT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:

A)

B)

B SCREEN IS FAILED BECAUSE BYPASS VALVE WOULD MASK FILTER FAILURE.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FIRST FAILURE - NO EFFECT FILTER BYPASS VALVE WILL PROVIDE ALTERNATE RETURN PATH. SECOND FAILURE - LOSS OF HYDRAULIC SYSTEM FUNCTION.

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(B) INTERFACING SUBSYSTEM(S):

FIRST FAILURE - NO EFFECT. SECOND FAILURE (FAILURE OF FILTER BYPASS VALVE) DURING ASCENT WOULD RESULT IN BLOCKED RETURN PATH, TRAPPING MAIN PUMP PRESSURE AT SSME VALVES. POTENTIAL FOR UNCONTAINED ENGINE DAMAGE BECAUSE PNEUMATIC SHUTDOWN CAN'T OVERRIDE TRAPPED HYDRAULIC PRESSURE SECOND FAILURE DURING ENTRY WOULD RESULT IN BLOCKED RETURN PATH, INHIBITING LANDING GEAR DEPLOYMENT (SYSTEM 1 ONLY), AND CAUSING UNCOMMANDED BRAKE PRESSURE (SYSTEM 1 OR 2).

(C) MISSION:

FIRST FAILURE - NO EFFECT.

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

FIRST FAILURE - NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

POSSIBLE LOSS OF CREW/VEHICLE WITH TWO FAILURES: THIS FAILURE, PLUS LOSS OF BYPASS VALVE. LOSS OF CREW/VEHICLE DUE TO TOTAL LOSS OF ENGINE VALVE CONTROL OR DUE TO FAILURE OF LANDING GEAR DEPLOYMENT.

-DISPOSITION RATIONALE-

(A) DESIGN:

ONE OF SUPPLIERS PROPRIETARY LINE OF FILTERS. DESIGNED IN ACCORDANCE WITH REQUIREMENTS OF MIL-F-8815 (GENERAL SPECIFICATION FOR FILTER AND FILTER ELEMENTS, FLUID PRESSURE, HYDRAULIC LINE). ELEMENT SIZED FOR 100 MISSIONS AT WORST CASE SYSTEM ALLOWABLE CONTAMINATION LEVEL. THE CYLINDRICAL CONVOLUTED 6 LAYER OUTER FILTER ELEMENT CONTAINS INNER AND OUTER STAINLESS STEEL SUPPORT SCREENS. THIS COMPOSITE ELEMENT IS MOUNTED ON THE OUTSIDE OF A PERFORATED WIRE-WOUND THIN WALL STAINLESS STEEL CYLINDER RESULTING IN A RIGID ASSEMBLY CAPABLE OF WITHSTANDING A DIFFERENTIAL PRESSURE, FROM OUTSIDE TO INSIDE, OF 1.5 TIMES THE NORMAL SYSTEM PRESSURE.

(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

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- FLOW FATIGUE TEST - 35,100 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 T 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

HEAT TREATING AND DRY FILM LUBE (VITROLUBE) ARE VERIFIED BY INSPECTION

TESTING

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FLOW, DIFFERENTIAL, AND PRESSURE DROP TEST PARAMETERS ARE VERIFIED BY INSPECTION

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. THE FAILURE HISTORY DATA PROVIDED BELOW IS NO LONGER BEING KEPT UP-TO-DATE.

(AB4388-010) (1981) ON SYSTEM NUMBER 3, ON THE FCHL TEST ARTICLE ALL FILTER MODULES WERE FOUND TO CONTAIN A PURPLISH BLACK SUBSTANCE WHICH ALSO COATED THE UPSTREAM SIDE OF THE FILTER ELEMENTS. IN ALL CASES THE DELTA P INDICATORS WERE EXTENDED INDICATING HIGH DELTA P. IT WAS OBSERVED THAT THE BYPASS VALVES PERFORMED AS REQUIRED. IT WAS DETERMINED THAT THE CAUSE WAS EXCESSIVE FREON TF ENTERING THE SYSTEM DURING GENERAL CLEANUP OF THE SYSTEM EQUIPMENT. THE COMBINATION OF EXCESSIVE FREON, WATER, AND ELEVATED HYDRAULIC TEMPERATURES LEAD TO A CHEMICAL REACTION WHICH CREATED THE SOLID PRODUCT OBSERVED. USE OF FREON TF HAS BEEN DISCONTINUED FOR USE AS A CLEANUP MATERIAL.

(E) OPERATIONAL USE:

NONE

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

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