SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2A-202108-X

SUBSYSTEM NAME: AFT REACTION CONTROL SYSTEM (RCS)
REVISION : 2 12/12/89

| | | PART NAME<br>VENDOR NAME | PART NUMBER<br>VENDOR NUMBER |
|---|---|---|---|
| LRU | : | OMS | MC621-0059 |
| SRU | : | FEEDLINE AND FITTINGS | 73A560001 |

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
FEEDLINE AND FITTINGS FROM TANK TO THRUSTERS, INCLUDING VALVE BODIES AND MECHANICAL FITTINGS.

QUANTITY OF LIKE ITEMS: 2
ONE SET PER PROPELLANT PER MODULE

FUNCTION:
TO PROVIDE FEED FROM THE PROPELLANT TANK TO THRUSTERS AND CROSSFEED VALVES.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2A-202108-01

REVISION# 2 12/12/89

SUBSYSTEM: AFT REACTION CONTROL SYSTEM (RCS)
LRU :OMS
ITEM NAME: FEEDLINE AND FITTINGS

CRITICALITY OF THIS FAILURE MODE:1/1

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FAILURE MODE:
STRUCTURAL FAILURE RUPTURE, EXTERNAL LEAKAGE

MISSION PHASE:
PL PRELAUNCH
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT
LS LANDING SAFING

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

CAUSE:
VIBRATION, FATIGUE, SHOCK, WELD DEF, INSTALL DAM, DYNATUBE SEAL FAILURE, MAT'L DEF (SULPHIDE STRINGER) STRESS CORROSION, ISOLATION VALVE RELIEF DEVICE FAILURE TO RELIEVE, EXCESSIVE SURGE PRESSURE, CONTAMINATION, FRETTING/GALLING.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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REDUNDANCY SCREEN A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)

B)

C)

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- FAILURE EFFECTS -

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(A) SUBSYSTEM:
SUBSYSTEM DEGRADATION - LOSS OF PROPELLANT.

(B) INTERFACING SUBSYSTEM(S):
POSSIBLE CORROSION DAMAGE IN THE POD AND/OR ADVERSE AFFECT ON TPS DUE

TO PROPELLANT LEAKAGE.

(C) MISSION:
LAUNCH DELAY OR ABORT DECISION.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE IF LEAK RESULTS IN EXCESSIVE LOSS OF PROPELLANT OR EXPLOSIVE HAZARD. OVERPRESSURIZATION OF POD MAY OCCUR. LOSS OF PROPELLANT FOR ET SEP/ENTRY. LINE RUPTURES BELOW ISO VALVE ARE NOT ISOLATABLE IN ALL INSTANCES DUE TO LIMITED TIME REQUIRED TO REACT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

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- DISPOSITION RATIONALE -

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(A) DESIGN:
THE FACTOR OF SAFETY IS 4X THE MAX OPERATING PRESSURE FOR LINES LESS THAN 1-1/2" AND 1.5X FOR LINES MORE THAN 1-1/2". THE FACTOR OF SAFETY FOR VALVE BODIES IS >1.5.

THE LINES ARE MOSTLY OF WELDED CONSTRUCTION TO REDUCE JOINTS AND LEAK PATHS. THE ANNEALED AREA FROM THE WELDING IS BACKED UP BY A SLEEVE.

THE GIMBAL AND ALIGNMENT BELLOWS AND FASTENING CLAMPS ALLOW FREEDOM OF MOVEMENT TO PRECLUDE LEAK POTENTIAL. AC MOTOR VALVES AND MANIFOLD ISO VALVES HAVE RELIEF DEVICES. MATERIALS ARE SELECTED THAT ARE COMPATIBLE WITH PROPELLANTS.

(B) TEST:
ROCKWELL PERFORMED LIMITED TUBING CERTIFICATION TESTS PER "ORBITER TUBING VERIFICATION PLAN" (SD75-SH-0205). THIS TESTING INCLUDED PRESSURE CYCLING AND FATIGUE FOR TYPICAL SHUTTLE LINES & JOINTS.

THE LINES WERE ALSO QUALIFIED AS PART OF THE VIBROACOUSTIC TESTING AT JSC AND HOT FIRE TEST AT WSTF. (24 EQUIVALENT MISSION DUTY CYCLES AT WSTF AND 131 AT JSC) OPTICAL INSPECTIONS ARE ALSO PERFORMED IN ADDITION TO X-RAY AND DYE PENETRANT. LEAKAGE TESTS ARE ALSO PERFORMED AFTER INSTALLATION INTO THE SYSTEM AND ADDITIONAL WELDS ARE ALSO SUBJECTED TO NDE.

OMRSD PERFORMS THE FOLLOWING: THE MANIFOLD ISOLATION VALVE (PRI) RELIEF DEVICE CHECKOUT EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. THE MANIFOLD ISOLATION VALVE (VERN) RELIEF DEVICE CHECKOUT EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. TOXIC VAPOR LEAK CHECKS ON PROPELLANT TANK AND PROPELLANT MANIFOLDS THE FIRST FLIGHT AND ON CONTINGENCY BASIS. A STATIC AIR SAMPLE THE SECOND FLIGHT AND EVERY FLIGHT THEREAFTER AND ON CONTINGENCY. AN EXTERNAL LEAKAGE VERIFICATION

OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS WHENEVER A LRU IS REPLACED. MECHANICAL JOINT LEAKAGE TESTS EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. FLANGE LEAK TESTS EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. SUBSYSTEM INSPECTIONS EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. PROPELLANT SAMPLING THE SECOND FLIGHT AND ON A CONTINGENCY BASIS. STATIC AIR SAMPLING THE SECOND FLIGHT AND EVERY FLIGHT THEREAFTER AND ON A CONTINGENCY BASIS. PROPELLANT LOADING EVERY FLIGHT.

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIAL IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 200 FOR MMH AND 200A FOR NTO IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
FABRICATION PER APPLICABLE DRAWINGS AND SPECIFICATIONS, TUBING INSTALLATION, AND MOUNTING CLAMPS AND ATTACHING HARDWARE ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
WELDS ARE VERIFIED BY RADIOGRAPHIC AND DYE PENETRANT INSPECTION.

CRITICAL PROCESSES
WELDING IS VERIFIED BY INSPECTION.

TESTING
ATP IS WITNESSED AND VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
CAR AC1418:
AFTER STS-2 OV-102 HAD A LINE FAILURE DUE TO A BAD WELD DUE TO KRYTOX CONTAMINATION THIS WAS A SPECIAL MR ACTION AND CONSIDERED AN ISOLATED INCIDENT CORRECTIVE ACTION WAS TO MAKE PERSONNEL MORE AWARE OF SPECIAL MR ACTION CERTIFICATION.

CAR'S AB4724, AB6494, AB5888, AB5890, AC1139, AC1146:
THERE HAVE BEEN SEVERAL INSTANCES OF SMALL LEAKAGES THAT HAVE OCCURRED IN DYNATUBES (POST FLIGHT). THESE LEAKS ARE ALWAYS SMALL AND ARE CAUSED BY RELAXED TORQUE (LOW END OF ALLOWANCES) ON THE DYNATUBE FITTING DUE TO CYCLING OF TEMPERATURE OR VIBRATION LOADS. PROBLEM SOLVED BY BACKING OFF THE DYNATUBE FITTING AND RETORQUING TO MAX ALLOWED. IF THIS FAILED THE SEALING SURFACE WAS POLISHED AND RETORQUED. THE ALIGNMENT WAS ALSO CHECKED AND CORRECTED IF REQUIRED. THIS PROCEDURE HAS BEEN EXCEPTIONALLY SUCCESSFUL.

(E) OPERATIONAL USE:
IF A LEAK OCCURS DOWNSTREAM OF TANK OR MANIFOLD ISOLATION VALVE AND IS SLOW ENOUGH, IT CAN BE ISOLATED BY CLOSING THE VALVE.

FOR LEAKS ABOVE THE TANK ISOLATION VALVES OCCURRING PRIOR TO ET SEP, USE CROSSFEED AND IF ON ORBIT, DUMP PROPELLANT OVERBOARD AND USE CROSSFEED. THIS WOULD NOT BE SUFFICIENT FOR NOMINAL ENTRY.

IF THE LEAK OCCURS DURING ENTRY USE THE FAILED SYSTEM DOWN TO ZERO PVT AND THEN SWITCH TO CROSSFEED FOR REMAINDER OF ENTRY.

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- APPROVALS -

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|---|---|---|---|
| RELIABILITY ENGINEERING | : | F.E. BARCENAS | : |
| DESIGN ENGINEERING | : | B. DIPONTI | : |
| QUALITY ENGINEERING | : | M. SAVALA | : |
| NASA RELIABILITY | : | | : |
| NASA SUBSYSTEM MANAGER | : | | : |
| NASA QUALITY ASSURANCE | : | | : |