

PAGE: 1

PRINT DATE: 12/13/89

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2F-102108-X

SUBSYSTEM NAME: FORWARD REACTION CONTROL SYSTEM (RCS)

REVISION: : 2 12/12/89

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	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	FEEDLINE AND FITTINGS	V070-421001

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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

FUNCTION:  
TO PROVIDE FEED FROM THE PROPELLANT TANK TO THRUSTERS.

PAGE: 2

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SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2F-102108-01

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SUBSYSTEM: FORWARD REACTION CONTROL SYSTEM (RCS)

LRU :FEEDLINE AND FITTINGS

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, CONTAMINATION, FRETTING/GALLING, EXCESSIVE  
SURGE PRESSURE

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 PROP.

(B) INTERFACING SUBSYSTEM(S):

POSSIBLE CORROSION DAMAGE IN THE MODULE AND/OR ADVERSE AFFECT ON TPS

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DUE TO PROPELLANT LEAKAGE.

(C) MISSION:  
MISSION MODIFICATION MAY BE REQUIRED.

(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 REQ'D 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 1.5 X 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 PRECLUDE LEAKAGE FAILURES AT THE FTG JOINTS. THE ANNEALED AREA FROM THE WELDING IS BACKED UP BY A SLEEVE. FASTENING CLAMPS ALLOW FREEDOM OF MOVEMENT TO PRECLUDE LEAK POTENTIAL.

ALL 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 RELIEF DEVICE CHECKOUT THE FIFTH FLIGHT AND EVERY FIVE FLIGHTS THEREAFTER AND ON A CONTINGENCY BASIS. THE MANIFOLD ISOLATION VALVE (VERNIER) RELIEF DEVICE CHECKOUT ON A FIVE FLIGHT BASIS. A TOXIC VAPOR LEAK CHECK OF PROPELLANT TANKS AND PROPELLANT MANIFOLDS FIRST FLIGHT AND ON A CONTINGENCY BASIS. AN EXTERNAL LEAKAGE VERIFICATION OF THE

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SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS WHENEVER A LRU IS REPLACED. A SUBSYSTEM INSPECTION EVERY 5TH FLIGHT. AN EXTERNAL MECHANICAL JOINT LEAK CHECK THE FIFTH FLIGHT AND EVERY 5TH FLIGHT THEREAFTER. PROPELLANT LOADING EVERY MISSION. FLANGE LEAK CHECKS EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. PROPELLANT SAMPLING THE SECOND FLIGHT AND ON A CONTINGENCY BASIS. STATIC AIR SAMPLING EVERY FLIGHT AND ON A CONTINGENCY BASIS.

(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 INSPECTION PER MT0501-507.

CRITICAL PROCESSES  
INSPECTION VERIFIES WELDING PER MA0107-313. INSPECTION VERIFIES TUBING AND FITTINGS ARE INSTALLED PER MA0102-306.

TESTING  
ATP IS WITNESSED AND VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:  
CAR AC141B:  
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.





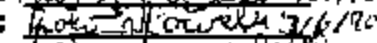
CAR'S AB4724, AB6494, AB5888, AB5890, AC1139, AC1146:  
THERE HAVE BEEN SEVERAL INSTANCES OF SMALL LEAKAGES THAT HAVE OCCURRED IN DYNATUBES (POST FLIGHT). THESE LEAKS ARE ALWAYS SMALL AND ARE CAUSED BY RELAXED TORQUE (LOW END OF ALLOWANCE) ON THE DYNATUBE FITTING DUE TO CYCLING OF TEMPERATURE OR VIBRATION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

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2F-102108-01

(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 NOTICEABLE LEAK RATES ON ORBIT DUMP ONBOARD PROPELLANT. IF LEAK RATE DOES NOT SUPPORT NOMINAL ET SEPARATION, A CONTINGENCY AFT SEPARATION WILL BE PERFORMED.

- APPROVALS -

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