SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2F-121308-X

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

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	LINE ASSEM., FLEXIBLE	MC271-0084-0002 74714
LRU	:	LINE ASSEM., FLEXIBLE	MC271-0084-0007 76145

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
LINE ASSEMBLY, FLEXIBLE AND FITTINGS.

QUANTITY OF LIKE ITEMS: 28
ONE FUEL AND ONE OXID. PER PRIMARY THRUSTER

FUNCTION:
TO PROVIDE FLEXIBLE COUPLING BETWEEN PROPELLANT SUBSYSTEM AND FORWARD RCS PRIMARY THRUSTERS.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2F-121308-01

REVISION# 2 12/12/89

SUBSYSTEM: FORWARD REACTION CONTROL SYSTEM (RCS)
LRU :LINE ASSEM., FLEXIBLE
ITEM NAME: LINE ASSEM., FLEXIBLE

CRITICALITY OF THIS FAILURE MODE:1/1

FAILURE MODE:
EXTERNAL LEAKAGE, RUPTURE

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:
MECHANICAL SHOCK, FLOW INDUCED VIBRATION, FATIGUE, IMPROPER INSTALLATION (WELD), MATERIAL DEFECT, STRUCTURAL FAILURE, CORROSION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF PROPELLANTS TO EXTENT OF LEAK SIZE.

(B) INTERFACING SUBSYSTEM(S):
INCREASED GN&C CONTROL & USE OF ALTERNATE THRUSTERS. POSSIBLE CORROSION DAMAGE IN MODULE, LEAKAGE OF PROPELLANT INTO MODULE.

(C) MISSION:
POTENTIAL EARLY MISSION TERMINATION.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE IF LEAKAGE OCCURS BEFORE ET SEPARATION WHEN "G" LOADS ARE SUFFICIENT TO PREVENT FROM REACHING. VALVE SWITCHES TO ISOLATE THE LEAK. POSSIBLE EXPLOSIVE HAZARD OR MODULE OVERPRESSURIZATION.

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

(A) DESIGN:
THE LINES CAN BE ISOLATED AT THE MANIFOLD IN CASE OF LEAKAGE. THE DESIGN ALLOWS SUFFICIENT MOVEMENT TO PRECLUDE EXCESSIVE STRESSES DURING INSTALLATION AND OPERATION. THE DESIGN BURST PRESSURE IS 3 X THE MAX OPERATING PRESSURE OF 700 PSIG. THE DESIGN PROOF PRESSURE IS 1.5 X THE MAX OPERATING PRESSURE OF 700 PSIG.

CRES 321 (WHICH IS COMPATIBLE WITH PROPELLANTS) SINGLE PLY BELLOWS IS USED. FLOW INDUCED VIBRATION ANALYSIS AND STRESS ANALYSIS WERE CONDUCTED TO VERIFY THE ADEQUACY OF THE DESIGN. MATERIALS ARE SELECTED THAT ARE COMPATIBLE WITH PROPELLANTS.

■ (B) TEST:
THE QUALIFICATION TEST PROGRAM USED 4 UNITS. THE TESTING INCLUDED PRESSURE SURGE (156,000 CYCLES), FLEXURE (800 CYCLES), FLOW INDUCED VIBRATION, BURST (2000 PSI), VIBRATION, AND PRESSURE CYCLING.

ACCEPTANCE TESTING INCLUDES PROOF PRESSURE (1500 PSIG), EXTERNAL LEAKAGE, AND CLEANLINESS AND DRYING.

OMRSD PERFORMS THE FOLLOWING: THE MANIFOLD ISO VLV (PRI) RELIEF DEVICE C/O THE 5TH AND EVERY 5 FLIGHTS THEREAFTER AND ON A CONTINGENCY BASIS. TOXIC VAPOR LEAK CHECK OF PROPELLANT MANIFOLDS FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS. AN EXTERNAL LEAKAGE VERIFICATION OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS. THE PROPELLANT LOADING FOR EACH FLIGHT. PROPELLANT SAMPLING THE SECOND FLIGHT AND WHEN THE MANIFOLDS ARE DRAINED. MECHANICAL JOINT LEAKAGE TESTS EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. SUBSYSTEM INSPECTION EVERY FIVE FLIGHTS AND ON A CONTINGENCY BASIS. STATIC AIR SAMPLING EVERY FLIGHTS STARTING WITH THE SECOND FLIGHT AND ON A CONTINGENCY BASIS.

(C) INSPECTION:
RECEIVING INSPECTION

RAW MATERIAL IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 100 FOR MMH AND 100A FOR NTO IS VERIFIED BY INSPECTION. CORROSION PROTECTION IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
WELDS ARE PENETRANT INSPECTED PER DRAWING REQUIREMENTS. ONE PAIR OF WELDS ARE RADIOGRAPHIC INSPECTED PER DRAWING REQUIREMENTS.

CRITICAL PROCESSES
WELDING PER MIL-W-8611 IS VERIFIED BY INSPECTION.

TESTING
ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING PROCEDURES ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
CAR AB3249: (ONY INSPECTION)
TWELVE FLEXLINES THAT WERE TO BE INSTALLED IN TEST ITEM 081 WERE OBSERVED TO HAVE BROWN AND WHITE SPOTS ON THE INTERNAL SURFACE OF THE TUBE END. THE WHITE SPOTS WERE FOUND TO BE TITANIUM DIOXIDE AND THE BROWN SPOTS WERE IRON OXIDE. THE SPOTS RESULTED FROM A CLEANING TECHNIQUE OF A HAND WELD THAT WAS UNIQUE TO 081.
CORRECTIVE ACTION WAS TO CHANGE THE CLEANING PROCESS FOR OV-103 FLEX LINES. LAB TESTING CONDUCTED DURING THE FAILURE ANALYSIS INDICATED THAT THE FLEX LINES ON OV-102 WOULD NOT BE A PROBLEM BECAUSE THEY DIDN'T HAVE THE SAME HAND WELD.

SEVERAL INSTANCES OF SMALL LEAKAGES OCCURRED POST FLIGHT IN DYNATUBES. THE PROBLEM WAS SOLVED BY INCREASING THE TORQUE TO MAXIMUM ALLOWABLE. 5 CASES OF DYNATUBE LEAKAGE OCCURRED IN 6/79.

(E) OPERATIONAL USE:
IF A LEAK IS SLOW ENOUGH, IT CAN BE ISOLATED BY CLOSING A MANIFOLD ISOLATION VALVE.

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- APPROVALS -

RELIABILITY ENGINEERING:	F.E. BARCENAS	
DESIGN ENGINEERING :	B. DIPONTI	
QUALITY ENGINEERING :	M. SAVALA	1/15/90
NASA RELIABILITY :		
NASA SUBSYSTEM MANAGER :		
NASA QUALITY ASSURANCE :		1/16/90