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PRINT DATE: 12/13/89

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2F-102106-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 :	PROP LINE FLEX ASSY	MC271-0095-0001 74724-11
LRU :	PROP LINE FLEX ASSY	MC271-0095-0002 74724-12

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EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
PROPELLANT LINE FLEX ASSEMBLY

QUANTITY OF LIKE ITEMS: 2  
ONE PER PROPELLANT

FUNCTION:  
TO PROVIDE PROPELLANT FEED FROM PROPELLANT TANK TO APPROPRIATE  
PROPELLANT FEEDLINES.

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SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2F-102106-01

REVISION# 2 12/12/89

SUBSYSTEM: FORWARD REACTION CONTROL SYSTEM (RCS)

LRU :PROP LINE FLEX ASSY

CRITICALITY OF THIS

ITEM NAME: PROP LINE FLEX ASSY

FAILURE MODE:1/1

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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, VIBRATION, FATIGUE, IMPROPER  
INSTALLATION (WELD) AND MATERIAL DEFECT

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:  
LOSS OF PROPELLANTS.

(B) INTERFACING SUBSYSTEM(S):  
POSSIBLE CORROSION DAMAGE IN THE POD AND OR ADVERSE AFFECT ON TPS.  
LEAKAGE OF PROPELLANT INTO THE POD.

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**(C) MISSION:**

MISSION DELAY OR ABORT DECISION, EARLY MISSION TERMINATION.

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

POTENTIAL 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.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

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- DISPOSITION RATIONALE -  
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**(A) DESIGN:**

MATERIAL IS SELECTED THAT IS COMPATIBLE WITH PROPELLANTS. THE MAX STEADY STATE WORKING PRESSURE IS 350 PSIG. MULTIPLE BELLWS ARE UTILIZED. A FLOW INDUCED VIBRATION ANALYSIS AND A STRESS ANALYSIS WERE CONDUCTED TO VERIFY ADEQUACY OF DESIGN. THE SAFETY FACTOR IS 2.14 FOR PROOF AND 3 FOR BURST WITH RESPECT TO THE MAXIMUM OPERATING PRESSURE OF 350 PSIA. THE SAFETY FACTOR IS 3 FOR PROOF AND 4 FOR BURST WITH RESPECT TO THE NOMINAL OPERATING PRESSURE OF 250 PSIA.

**(B) TEST:**

QUALIFICATION TESTING INCLUDED THERMAL CYCLING (+20 TO +150 DEG F), BURST (1000 PSI), PRESSURE DROP, PRESSURE SURGE CYCLES (156,000), FLEXURE CYCLES (800), VIBRATION (48 MIN EACH AXIS), AND PROPELLANT EXPOSURE.

ACCEPTANCE TEST INCLUDES PRESSURE CYCLING, VIBRATION, PROOF PRESSURE, CLEANLINESS AND DRYING.

OMRSD PERFORMS THE FOLLOWING: PROPELLANT TANK TOXIC VAPOR LEAK CHECK FIRST FLIGHT AND CONTINGENCY. AN EXTERNAL LEAKAGE VERIFICATION OF THE SYSTEM FOR THE FIRST FLIGHT AND ON A CONTINGENCY BASIS. THE PROPELLANT LOADING FOR EACH FLIGHT. PROPELLANT SAMPLING WHEN PROPELLANT TANKS ARE DRAINED. A STATIC AIR SAMPLE THE SECOND FLIGHT AND EVERY FLIGHT THEREAFTER AND ON A CONTINGENCY BASIS. A SUBSYSTEM INSPECTION THE 5TH AND EVERY 5 FLIGHTS THEREAFTER 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. CORROSION PROTECTION IS VERIFIED BY INSPECTION.

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

NONDESTRUCTIVE EVALUATION  
UNIVERSAL JOINT, OUTER RACE, AND STAND-OFF WELDS ARE PENETRANT INSPECTED PER DRAWING REQUIREMENTS. TWO OF THE UNIVERSAL JOINT WELDS, OUTER RACE WELDS, AND STAND-OFF WELDS ARE RADIOGRAPHIC INSPECTED PER DRAWING REQUIREMENTS. THE BELLOWS TUBE WELDS ARE DYE AND RADIOGRAPHICALLY INSPECTED BEFORE FORMING.

CRITICAL PROCESSES  
WELDING OF UNIVERSAL JOINT, BELLOWS TUBE WELDS, OUTER RACE, DUST SHIELD, AND STAND-OFF PER MIL-W-8611 IS VERIFIED BY INSPECTION. BELLOWS SEAM WELD PER MIL-W-6856, CLASS B ARE VERIFIED BY INSPECTION.

TESTING  
ATP IS WITNESSED AND VERIFIED BY INSPECTION. LEAK TEST OF BELLOWS PER DRAWING REQUIREMENTS IS VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY:**

CAR AB3249:

THE FLEX LINE HAS HAD RUST ON SURFACES AND WHITE SPOTS ON INTERNAL SURFACE OF THE TUBE END. FLEX LINES ON OV103 AND SUBS ARE SUBJECTED TO IMPROVED MANUFACTURING CLEANING PROCEDURES. FLEX LINES ON OV-102 WERE NOT CONSIDERED TO BE A LIKELY PROSPECT BECAUSE THEY DID NOT HAVE THE SAME HAND WELD.

**(E) OPERATIONAL USE:**

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

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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 :

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: *[Signature]* 2/22/90  
: *[Signature]* 3/16/90  
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