

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-1CB-0774-X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION : 0 02/23/89 F

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	CLAMP, HE PNL LINE SUPPLY	NAS1716C12K
LRU :	CLAMP, HE PNL LINE SUPPLY	NAS1716C6K
LRU :	CLAMP, HE PNL LINE SUPPLY	NAS1716C8K
LRU :	ADAPTER, HE PNL LINE SUPPLY	V070-415148
LRU :	ADAPTER, HE PNL LINE SUPP	V070-415575
LRU :	ADAPTER, HE PNL LINE SUPPLY	V070-415791

ITEM:

ADAPTER CLAMP ASSEMBLY, HELIUM PANEL 3/8, 1/2, AND 3/4 INCH LINE SUPPORTS

QUANTITY OF LIKE ITEMS:

NUMEROUS, PER DRAWING CALLOUT

DESCRIPTION/FUNCTION:

ADAPTER CLAMP ASSEMBLY IS MOUNTED ON AN ISOLATION MOUNT AND USED PRIMARILY TO SUPPORT LINES TO AND FROM THE HELIUM PANEL. THE LINES ARE ALLOWED TO SLIDE IN THE AXIAL DIRECTION.

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NUMBER: 03-1CB-0774-01

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SUBSYSTEM: MAIN PROPULSION  
 LRU CLAMP, HE PNL LINE SUPPLY  
 ITEM NAME: ADAPTER, HE PNL LINE SUPPLY

CRITICALITY OF THIS  
 FAILURE MODE: 1/1

## FAILURE MODE:

FAILURE TO PREVENT THE LINE FROM SLIDING IN THE AXIAL DIRECTION OR  
 RESTRAIN THE LINE FROM MOVING IN ANY OTHER DIRECTION.

## MISSION PHASE:

PL PRELAUNCH  
 LO LIFT-OFF  
 DO DE-ORBIT

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

## CAUSE:

PIECE PART STRUCTURAL FAILURE, BINDING, IMPROPER INSTALLATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? N

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

## PASS/FAIL RATIONALE:

A)

B)

C)

## - FAILURE EFFECTS -

## (A) SUBSYSTEM:

FAILURE CAUSES RUPTURE/LEAKAGE OF HIGH/LOW PRESSURE HELIUM LINE(S).

DURING ASCENT, THE PNEUMATIC/ENGINE HELIUM SUPPLY WILL BE LOST.  
 ESCAPING HELIUM MAY OVERPRESSURIZE THE AFT COMPARTMENT.

DURING ASCENT, HELIUM SUPPLY TO ONE ENGINE WILL BE LOST. POSSIBLE  
 UNCONTAINED ENGINE SHUTDOWN IF REDUNDANT LEG CANNOT PROVIDE ENGINE  
 HELIUM REQUIREMENTS. EXCESSIVE HELIUM TANK PRESSURE DECAY (SM ALERT:  
 20 PSI/3 SECONDS; CAUTION AND WARNING: 1150 PSIA LOWER LIMIT) AND/OR  
 REGULATOR PRESSURE OUT OF LIMITS WILL BE INDICATED BY SM ALERT (BOTH  
 LEGS: 679 LOWER AND 806 UPPER) OR CAUTION AND WARNING (LEG A ONLY: 680

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LOWER LIMIT AND 810 UPPER LIMIT).

PURGE OF AFT COMPARTMENT AND LH2/LO2 SYSTEMS WOULD DEPEND SOLELY ON THE LEFT ENGINE HELIUM SYSTEM RESIDUALS, RESULTING IN INADEQUATE ABORT PURGE, INCOMPLETE PROPELLANT DUMP, AND INGESTION OF CONTAMINATION.

LOSS OF PNEUMATIC LOW PRESSURE HELIUM MAY PREVENT THE APPLICATION OF CLOSING PRESSURE TO THE LO2 PREVALVE ACTUATORS AT ENGINE SHUTDOWN RESULTING IN PUMP OVERSPEED AND CAVITATION. MAY RESULT IN THE INABILITY TO MAINTAIN ENGINE HELIUM REQUIREMENTS. POSSIBLE UNCONTAINED ENGINE SHUTDOWN. POSSIBLE FIRE/EXPLOSION HAZARD.

STORED HELIUM PRESSURE IN THE ACCUMULATOR LEG AND SUPPLEMENTAL HELIUM FROM LV10 SHOULD BE ADEQUATE TO OPERATE THE LO2 PREVALVES AT MECO. LOSS OF HELIUM MAY PREVENT OPERATION OF VALVES FOR MPS DUMP.

HELIUM WILL NOT BE AVAILABLE FOR AFT COMPARTMENT PURGE (RTLS AND TAL ABORT CRITICAL).

DURING ENTRY, VENT DOORS ARE CLOSED TO PREVENT INGESTION OF RCS AND APU GASES. LEFT ENGINE B LEG ISOLATION VALVE IS OPENED WHEN VEHICLE TRANSITIONS TO ORBITER SOFTWARE MAJOR MODE 304 (MM304). RUPTURE ON THIS LINE DURING THE TIME PERIOD THAT THE VENT DOORS ARE CLOSED MAY RESULT IN OVERPRESSURIZATION OF THE AFT COMPARTMENT. VENT DOORS ARE OPENED WHEN VEHICLE VELOCITY DROPS BELOW 2400 FT/SEC.

PRIOR TO T-9 MINUTES, EXCESSIVE HELIUM LEAKAGE WILL BE DETECTABLE USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

(B) INTERFACING SUBSYSTEM(S):  
SAME AS A.

(C) MISSION:  
POSSIBLE LOSS OF CREW/VEHICLE.

(D) CREW, VEHICLE, AND ELEMENT(S):  
SAME AS C.

(E) FUNCTIONAL CRITICALITY EFFECTS

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- DISPOSITION RATIONALE -  
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(A) DESIGN:  
THE ADAPTER CLAMP ASSEMBLY USES A 2024 T851 ALUMINUM ADAPTER WHICH TIES THE LINE HOLD-DOWN CLAMP TO THE VIBRATION ISOLATOR MOUNT (REFERENCE FMEA/CIL 0763-1). THE ADAPTER INCORPORATES 2 ROSAN INSERTS WHICH ENABLE THE CLAMP TO BE POSITIVELY LOCKED TO THE ADAPTER. THE 302 CRES CLAMP HAS AN INNER TEFLON LINER PROVIDING A LUBRICATED SURFACE FOR THE LINE TO SLIDE IN. THE TEFLON LINER SECURES ITSELF TO THE CLAMP BY OVERLAPPING OUTER EDGES.

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THE ADAPTER DESIGN HAS A POSITIVE MARGIN OF SAFETY AND WAS REVERIFIED DURING THE 6.0 LOADS ANALYSIS.

PIECE PART STRUCTURAL FAILURE OR BINDING COULD CAUSE LINE FATIGUE FAILURE RESULTING IN LOSS OF PNEUMATIC SYSTEM HELIUM SUPPLY INTO THE AFT COMPARTMENT.

**(B) TEST:  
ATP**

EXAMINATION OF PRODUCT  
MATERIAL AND DIMENSIONAL

**CERTIFICATION**

THE ADAPTER ASSEMBLIES WERE CERTIFIED WITH THE MAIN PROPULSION TEST ARTICLE (MPTA) WHICH INCORPORATES ALL CONFIGURATIONS UTILIZED IN THE MPS SYSTEM. MPTA EXPERIENCED NUMEROUS FULL DURATION STATIC FIRINGS OF THE MAIN ENGINE AT DIFFERENT PERFORMANCE LEVELS. THESE STATIC FIRINGS IMPARTED WORST CASE ENVIRONMENTS AT MAXIMUM OPERATING TEMPERATURES AND PRESSURES.

DURING QUALIFICATION OF THE VARIOUS LINE SEGMENTS, SPECIFIC ADAPTER CLAMP ASSEMBLIES WERE UTILIZED AND SUBJECTED TO A SERIES ENVIRONMENTAL AND DYNAMIC CONDITIONS SPECIFIED FOR THEIR LOCATION.

OMRSD  
V41BUO.010 ORBITER MPS COMPONENT VISUAL INSPECTION (EVERY FLIGHT)

**(C) INSPECTION:**  
RECEIVING INSPECTION  
INCOMING MATERIAL IS VERIFIED FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL  
CORROSION PROTECTION OF PARTS ARE VERIFIED PER SPECIFICATION. GENERAL CLEAN CONDITION IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION  
MACHINED PARTS ARE DIMENSIONALLY CHECKED AND VERIFIED TO MEET TOLERANCE REQUIREMENT. MANDATORY INSPECTION POINTS ARE INCLUDED IN ASSEMBLY PROCESS.

CRITICAL PROCESSES  
N/A

NONDESTRUCTIVE EVALUATION  
DYE PENETRANT INSPECTION ON MACHINED PARTS IS VERIFIED BY INSPECTION.

TESTING  
ATP IS VERIFIED BY INSPECTION.

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**HANDLING/PACKAGING**

HANDLING, PACKAGING, STORAGE, AND SHIPPING REQUIREMENTS ARE VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY:**

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

**(E) OPERATIONAL USE:**

ENGINE HELIUM TANK AND/OR REGULATOR PRESSURE ANOMALIES ARE INDICATED BY SM ALERT OR CAUTION AND WARNING. THE CREW ACTION IS TO FOLLOW THE NORMAL LEAK ISOLATION PROCEDURE.

PNEUMATIC ACTUATION HELIUM BOTTLE PRESSURE IS ON A DEDICATED DISPLAY IN COCKPIT. CREW ACTION IS TO FOLLOW NORMAL LEAK ISOLATION PROCEDURE. PRIOR TO MECO, ISOLATION VALVES (LV7, LV8) WILL BE REOPENED AND THE LEFT ENGINE HELIUM CROSSOVER VALVE (LV10) WILL BE OPENED.

EFFECTIVE FOR OI-8D SOFTWARE, CR 89397 "MPS PNEUMATIC SYSTEM FDA AND DISPLAY - BFS" ADDS THE PNEUMATIC TANK, REGULATOR AND ACCUMULATOR PRESSURE TO THE SM ALERT FDA SYSTEM AND ADDS THE 3 PRESSURE MEASUREMENTS TO BFS SYSTEM SUMMARY DISPLAY. THIS ALLOWS THE FLIGHT CREW TO RESPOND TO A PNEUMATIC HELIUM SYSTEM LEAK INDEPENDENT OF GROUND CONTROL.

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**- APPROVALS -**  
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RELIABILITY ENGINEERING: L. H. FINEBERG  
 DESIGN ENGINEERING : J. E. OSLUND  
 QUALITY ENGINEERING : R. WILLIAMS  
 NASA RELIABILITY :  
 NASA SUBSYSTEM MANAGER :  
 NASA QUALITY ASSURANCE :

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