

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1C -1509 -1 REV:08/10

ASSEMBLY : EMERGENCY BREATHING SYS. CRIT. FUNC: 1R  
P/N RI : V070-613148, V070-614112, CRIT. HDW: 2  
: ME273-0126

P/N VENDOR: VEHICLE 102 103 104  
EFFECTIVITY: X X X  
QUANTITY : 1 PHASE(S): PL X LO X OO X DO X LS X  
: ONE SET PER VEHICLE

PREPARED BY: REDUNDANCY SCREEN. A-PASS B-PASS C-PASS  
DES M. PRICE *M. Price* APPROVED BY: DES *[Signature]* APPROVED BY (NASA):  
REL N. L. STEISSLINGER *N. L. SteiSSLinger* REL *[Signature]* SSM *[Signature]*  
QE S. MOR *S. Mor* QE *[Signature]* REL *[Signature]*  
QE *[Signature]*

ITEM:  
LINES & FITTINGS

FUNCTION:  
PROVIDES FOR MOVEMENT OF OXYGEN FROM N2/AUXILIARY O2 SUPPLY PANEL TO THE N2/O2 CONTROL PANEL. THIS SET OF LINES AND FITTINGS IS USED ONLY WHEN THE AUXILIARY OXYGEN TANK IS INSTALLED. THE LISTED FAILURE EFFECTS ARE FOR THE CASE WHEN THE AUX O2 TANK IS NOT INSTALLED. THE FAILURE EFFECTS FOR THE CASE OF THE TANK BEING INSTALLED WILL BE ADDRESSED IN THE MISSION KEE FMEA ON A MISSION BY MISSION BASIS.

FAILURE MODE:  
EXTERNAL LEAKAGE

CAUSE(S):  
MECHANICAL SHOCK, VIBRATION, CORROSION, POROSITY

EFFECT(S) ON:  
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) NO EFFECT.

(B,C,D) NO EFFECT

(E) FUNCTIONAL CRITICALITY EFFECT - SECOND ASSOCIATED FAILURE OF O2 EMER VALVE (1.88) INTERNAL LEAKAGE MAY RESULT IN LOSS OF CREW/VEHICLE IF LEAK RATE PROHIBITS PRESSURIZATION OF LES AND EMERGENCY BREATHING IS REQUIRED.

DISPOSITION & RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A) DESIGN

LINES ARE FABRICATED OF 21-6-9 STAINLESS STEEL WITH A THICKNESS OF 0.016 INCH. FITTINGS ARE DYNATUBES MADE OF 17-4 PH STAINLESS STEEL AND ARE BRAZED INTO THE SYSTEM. 21-6-9 STAINLESS STEEL HAS GOOD CORROSION RESISTANCE, HIGH MECHANICAL PROPERTIES, GOOD IMPACT STRENGTH, AND HIGH

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STRENGTH TO WEIGHT RATIO. 17-4 PH CONDITION A CRES IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL WHICH HAS A HIGH STRENGTH TO WEIGHT RATIO. BOTH MATERIALS ARE COMPATIBLE WITH CO<sub>2</sub>. EXTENSIVE FLIGHT EXPERIENCE STS-1 TO PRESENT PROVIDES CONFIDENCE IN DESIGN INTEGRITY. FITTING OR JOINT LEAKAGE IS LESS THAN  $1 \times 10^{-4}$  SCCS-HE. BURST FACTOR IS GREATER THAN 4 TIMES THE OPERATING PRESSURE OF 1250 PSI (5000 PSI).

(B) TEST

QUALIFICATION TEST - TESTING OF 21-6-9 STAINLESS TUBING AS FOLLOWS: PRETEST PROOF (2X OPERATING PRESSURE) AND EXTENSIVE LEAK TEST (1 X 10 EXP -6 SCCS HE MAX), BURST TEST (BURST AT GREATER THAN OR EQUAL TO 4X OPERATING PRESSURE), IMPULSE FATIGUE TEST (TWO HUNDRED THOUSAND CYCLES OF IMPULSE WAVES), FLEXURE FATIGUE TEST (TEN MILLION CYCLES OF FLEXURE), RANDOM VIBRATION, POST TEST LEAK TEST (1 X 10 EXP -6 SCCS HE MAX). DYNATUBE COUPLINGS ARE AUTHORIZED BY RI SPEC MF0004-0100 "MECHANICAL - ORBITER PROJECT PARTS LIST."

IN-VEHICLE TESTING - LINES ARE PROOF PRESSURED AT 4125 - 4325 PSIG AND LEAK TESTED AT 2900 - 3000 PSIG, 1 X 10 EXP -7 SCCS GHE MAX LEAKAGE.

OMRSD - SYSTEM LEAK TEST IS PERFORMED BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AS A CONTINGENCY FOR LRU REPLACEMENT AT 1000 - 1500 PSIG, 30 SCCM MAX SYSTEM LEAKAGE.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL

CLEANLINESS LEVEL 200A PER MA0110-301 VERIFIED BY INSPECTION PRIOR TO AND DURING OPERATIONS. 100 ML RINSE TEST VERIFIED BY INSPECTION. ELECTROPOLISHING IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

FABRICATION OF PARTS/COMPONENTS PER DRAWING VERIFIED BY INSPECTION. DIMENSIONAL INSPECTIONS ARE PERFORMED AND VERIFIED BY INSPECTION. RIGID TUBING INSTALLATION PER DRAWING, INCLUDING LUBRICANTS AND TORQUES, VERIFIED BY INSPECTION.

CRITICAL PROCESSES

BRAZING OF TUBING AND COMPONENTS VERIFIED BY INSPECTION. PARTS PASSIVATION AND ELECTRICAL BONDING APPLICATION VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

RADIOGRAPHIC INSPECTION OF INDUCTION BRAZES VERIFIED BY INSPECTION. FLUORESCENT PENETRANT INSPECTION PER MIL-I-6866 PERFORMED AND VERIFIED BY INSPECTION.

TESTING

LEAK TEST VERIFIED BY INSPECTION. PRESSURE LEAK TEST PERFORMED BY ROCKWELL AFTER SEAL MATING VERIFIED BY INSPECTION.

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HANDLING/PACKAGING  
HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURES ARE VERIFIED BY  
INSPECTION.

(D) FAILURE HISTORY

NO FAILURE HISTORY APPLICABLE TO EXTERNAL LEAKAGE FAILURE MODE. THE  
AUXILIARY O2 LINES HAVE SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE  
PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE

TBS.