

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO 03-1 -0608 -1 REV:07/14/88B

ASSEMBLY :ROCKWELL INTL
P/N RI :VO70-415135-001
P/N VENDOR:
QUANTITY :1
:ONE
:

VEHICLE
EFFECTIVITY:
PHASE(S): PL LO X OO DO LS

CRIT. FUNC: 1R
CRIT. HDW: 2
102 103 104
X X X

PREPARED BY:
DES J E OSLUND
REL L H FINEBERG
QE R WILLIAMS

REDUNDANCY SCREEN: A-PASS B-FAIL C-PASS
APPROVED BY:
DES [Signature]
REL [Signature] FOR LASCOE REL [Signature]
QE [Signature] QE [Signature]

ITEM:

ORIFICE, REPRESSURIZATION, LH2 RECIRCULATION MANIFOLD, 0.060 DIAMETER (RP10).

FUNCTION:

RESTRICTS THE FLOW RATE OF HELIUM INTO THE LH2 RECIRCULATION MANIFOLD. THIS PRECLUDES EXCESSIVE RECIRCULATION MANIFOLD PRESSURE WHICH WOULD RESTRICT THE FLOW OF HYDROGEN FROM THE ENGINES THROUGH THE TOPPING VALVE DURING THE DUMP.

FAILURE MODE:

CLOGGED ORIFICE DURING LH2 DUMP OPERATION.

CAUSE(S):

CONTAMINATION.

EFFECT(S) ON:

(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A,B) NO EFFECT. LOSS OF REDUNDANCY ONLY. RECIRCULATION RELIEF VALVE (RV7) WILL REVIEVE INTO THE MANIFOLD PREVENTING LINE RUPTURE.

(C,D) NO EFFECT.

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(E) FUNCTIONAL CRITICALITY EFFECTS

1R/2,2 SUCCESS PATHS. TIME FRAME-POST DUMP

1) ORIFICE (RP10) PLUGS

2) RECIRC RELIEF (RV7) FAILS TO RELIEVE.

LARGE AMOUNT OF RESIDUALS REMAIN IN THE RECIRC SYSTEM DUE TO A BAD LH2 DUMP (POOR MANIFOLD REPRESS).

RESULTS IN RECIRC LINE RUPTURE AND FIRE/EXPLOSIVE HAZARD.

POSSIBLE LOSS OF CRITICAL ADJACENT FUNCTIONS DUE TO

CRYO EXPOSURE. POSSIBLE LOSS OF CREW/VEHICLE.

DISPOSITION & RATIONALE:

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

(A) DESIGN

THE LH2 DUMP PRESSURIZATION ORIFICE IS A LINE MOUNTED FITTING MADE FROM 304L CRES. THE ORIFICE IS BRAZED INTO THE PNEUMATICS PANEL AT EACH END USING A 304L CRES UNION AND A BRAZE ALLOY PREFORM (81.5 AU, 16.5 CU, 2 NI). IT IS DESIGNED TO A MINIMUM FACTOR OF SAFETY 2.0 PROOF AND 4.0 BURST (55 PSIG MAXIMUM OPERATING PRESSURE).

CLOGGING DUE TO CONTAMINATION IS MINIMIZED BY A 25 MICRON FILTER (FL5) LOCATED UPSTREAM OF THE ORIFICE. THE COMPONENTS AND THE TUBING BETWEEN THE FILTER AND THE ORIFICE ARE CLEANED TO LEVEL 100A.

(B) TEST

ATP

EXAMINATION OF PRODUCT
DIMENSION AND MATERIAL

THE ORIFICE WAS PROOF PRESSURE TESTED TO 66 PSIG AND LEAK CHECKED TO 30 PSIG AFTER INSTALLATION INTO THE VEHICLE.

CERTIFICATION

THE ORIFICE WAS 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.

VERIFICATION

QUALIFICATION TESTING OF A COMPLETED ORIFICE WAS NOT PERFORMED, BUT THE ORIFICE WAS VERIFIED BY ANALYSIS. FOR OV103 REFER TO REPORT STS85-0254 (STRUCTURAL ANALYSIS FOR 6.0 LOADS, DATED APRIL 1988), VOLUME 10 (THRUST STRUCTURE, MPS, AND SECONDARY STRUCTURE). THE ORIFICE DESIGN FOR OV102 AND OV104 IS IDENTICAL TO OV103.

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OMRSD

V41B20.030 HELIUM REPRESS FLOW PATH TO LH2 RECIRCULATION MANIFOLD (I7)

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIALS ARE VERIFIED FOR MATERIALS AND PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL

MATERIAL CLEANLINESS IS MAINTAINED AND VERIFIED TO LEVEL 100A. INSPECTION EXAMINES CORROSION PROTECTION PER REQUIREMENT.

ASSEMBLY/INSTALLATION

ALL MATERIALS ARE VISUALLY EXAMINED FOR DEFECTS UNDER 10X MAGNIFICATION DURING MANUFACTURING. PART SURFACES MACHINED TO 63 RMS ARE VERIFIED BY INSPECTION. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE ASSEMBLY PROCEDURE.

CRITICAL PROCESS

ELECTROPOLISHING OF PART SURFACE IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PARTS ARE INSPECTED BY DYE PENETRANT IN ACCORDANCE WITH SPECIFICATION.

TESTING

ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING FOR SHIPPING IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

THERE HAS BEEN NO FAILURE HISTORY FOR THIS FAILURE MODE. LEAKS IN TUBE FITTINGS, BRAZE JOINTS, AND SEALS HAVE BEEN DETECTED DURING VEHICLE LEAK CHECKS. ALL WERE CORRECTED BY PARTS REPLACEMENT, REPAIR, OR RETORQUING.

(E) OPERATIONAL USE

ADDITIONAL VACUUM INERTINGS MAY BE REQUIRED: