SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ELECTRICAL POWER (FCP) FMEA NO 04-1A -0137 -1 REV:04/07/88

ASSEMBLY :H2O RELIEF PANEL ASS'Y
P/N RI :V070-454765
P/N VENDOR:
QUANTITY :1
:ONE
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X

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

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS

PREPARED BY:
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ITEM: PRODUCT WATER LINES, FITTINGS, COMPONENTS
H2O RELIEF PANEL.

FUNCTION:
SUPPLIES PRODUCT WATER TO ECLSS AND TO OVERBOARD RELIEF SYSTEM.

FAILURE MODE: LEAKAGE
GROSS EXTERNAL.

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

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

(A) LOSS OF REDUNDANCY IF LEAKAGE/FREEZING IS LIMITED TO SINGLE FUEL CELL SYSTEM. IF LEAKAGE RESULTS IN FREEZING OF BOTH ECLSS SUPPLY PATH AND OVERBOARD RELIEF PATH, FUEL CELL PRODUCT WATER WILL BE AUTOMATICALLY DIVERTED TO ECLSS THROUGH THE ALTERNATE PRODUCT WATER SUPPLY LINE.

(B) FUEL CELL WATER NO LONGER DELIVERED THROUGH H2 SEPARATOR. IF SECOND FAILURE OCCURS, FUEL CELLS WILL BE LOST DUE TO FLOODING.

(C) ENTER NEXT DAILY PLANNED LANDING SITE.

(D) NO EFFECT ON CREW/VEHICLE IF PRIMARY ECLSS LINE OR EMERGENCY WATER RELIEF SYSTEM FUNCTIONS. CREW/VEHICLE WILL BE LOST IF THE WATER RELIEF PANEL AND THE ALTERNATE PRODUCT WATER SUPPLY LINE FAIL TO FUNCTION.

DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN
STAINLESS STEEL IS USED IN THE CONSTRUCTION OF COMPONENTS, LINES, AND FITTINGS FOR CORROSION RESISTANT PROPERTIES. BRAZED JOINTS ARE USED THROUGHOUT FOR FLUID CONNECTIONS.

HIGH STRENGTH FLEXURE SEAL MECHANICAL FITTINGS (DYNATUBE) EXHIBITING RELIABLE SEALING CHARACTERISTICS OVER A WIDE TORQUE RANGE ARE USED TO CONNECT TO VEHICLE PLUMBING.

COMPONENT HOUSINGS UTILIZE WELD JOINTS FOR SEALING WITH THE EXCEPTION OF A SINGLE NON-AGE SENSITIVE ETHYLENE PROPYLENE STATIC SEAL IN EACH CHECK VALVE.

OPERATION AT LOW PRESSURE (51 PSIA MAX) MINIMIZES STRESS ON LINES AND FITTINGS CAPABLE OF WORKING AT SEVERAL THOUSAND PSI. COMPONENTS ARE DESIGNED WITH A MINIMUM BURST PRESSURE SAFETY FACTOR OF TWO AND ARE DESIGNED TO OPERATE IN THE VIBRATION, SHOCK, AND THERMAL ENVIRONMENTS ASSOCIATED WITH THIS APPLICATION.

FLUID LINES TO THE PANEL ARE ENCASED IN INSULATION AND COMPONENTS AND LINES WITHIN THE PANEL ARE WRAPPED WITH GOLDIZED TAPE AND REDUNDANT HEATERS TO MAINTAIN PROPER THERMAL CONTROL FOR THE DESIGN ENVIRONMENT.

(B) TEST

CERTIFICATION REQUIREMENTS FOR THE WATER RELIEF VALVE CONSISTED OF PROOF PRESSURE, EXTERNAL LEAKAGE, CRACKING PRESSURE, FULL FLOW, RESEAT PRESSURE, INTERNAL LEAKAGE, VACUUM INTEGRITY, SALT FOG, RANDOM VIBRATION, ACCELERATION, SHOCK, THERMAL CYCLES, OPERATING LIFE TEST CYCLES, AND BURST PRESSURE.

CERTIFICATION REQUIREMENTS FOR THE WATER CHECK VALVE CONSISTED OF RANDOM VIBRATION, HIGH TEMPERATURE, AND PRESSURE DROP. INTEGRITY OF THE PRESSURIZED TUBING AND SECONDARY SUPPORT BRACKETRY WAS DEMONSTRATED DURING ACOUSTICALLY INDUCED RANDOM VIBRATION CERTIFICATION TESTING.

THE PANEL MET THE REQUIREMENT OF 100 MISSION CYCLES WITH NO FAILURES. LEAK CHECKS, HEATER RESISTANCE CHECKS, PROOF AND BURST PRESSURE TESTS WERE PERFORMED AFTER THE ACOUSTIC TEST WITH NO DISCREPANCIES.

A THERMAL VACUUM TEST DEMONSTRATED THE WATER RELIEF SYSTEM FUNCTION FOR 24 HOURS OF CONTINUOUS WATER VENTING. WATER FLOW RATES CORRESPONDED TO THE RANGE OF FUEL CELL POWER LEVELS INCLUDING SIMULATION OF AN INTERNALLY LEAKING RELIEF VALVE. THE TEST ALSO CONSISTED OF HEATER RESISTANCE AND POWER DISSIPATION CHECKS, THERMAL SWITCH CHECKS, THERMOCOUPLE OPERATION RESULTS, AND RELIEF VALVE CRACK AND RESEAT CHECKS.

THE WATER PANEL MANUFACTURING CHECKOUT CONSISTED OF PLUMBING LEAK CHECKS, CHECK VALVE BACK PRESSURE LEAKAGE AND CRACKING PRESSURE, RELIEF VALVE CRACK AND RESEAT CHECKS, HEATER RESISTANCE CHECKS, INSULATION RESISTANCE MEASUREMENTS, AND THERMAL SWITCH CHECKS.

OMRSD: WATER SYSTEM INTEGRITY INCLUDING EXTERNAL LEAKAGE IS VERIFIED DURING EACH VEHICLE TURNAROUND.

(C) INSPECTION

RECEIVING INSPECTION

TEST REPORTS AND RECORDS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES. VISUAL AND DIMENSIONAL EXAMINATION IS PERFORMED ON INCOMING PARTS.

CONTAMINATION CONTROL

CLEANLINESS IS MAINTAINED AND VERIFIED PER APPLICABLE REQUIREMENTS, AS

OBSERVED BY QC.

ASSEMBLY/INSTALLATION
DETAILED INSPECTION IS PERFORMED ON ALL PARTS PRIOR TO NEXT ASSEMBLY. CORROSION PROTECTION AND PROTECTION OF SEALING SURFACES ARE VERIFIED BY INSPECTION TO APPLICABLE REQUIREMENTS.

NONDESTRUCTIVE EVALUATION
RADIOGRAPHIC INSPECTION OF BRAZE JOINTS IS PERFORMED BY QC FOR EVIDENCE OF LEAK PATHS, TUBE ENGAGEMENTS, AND AREA OF VOIDS.

CRITICAL PROCESSES
ALL CRITICAL PROCESSES AND CERTIFICATIONS ARE MONITORED AND VERIFIED BY INSPECTION. CRITICAL PROCESSES ARE BRAZING, CLEANING, AND CORROSION PROTECTION.

TESTING
PROOF PRESSURE AND LEAK TESTS ARE OBSERVED AND VERIFIED BY QC PRIOR TO COMPONENT INSTALLATION. ATP IS OBSERVED AND VERIFIED BY QC.

HANDLING/PACKAGING
IN-PROCESS OPERATIONS ARE VERIFIED BY QC TO PROTECT PARTS AND PRECLUDE MISHANDLING. PARTS PACKAGING IS VERIFIED BY INSPECTION TO APPLICABLE REQUIREMENTS.

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

(E) OPERATIONAL USE
NO CREW ACTION AFTER FIRST FAILURE.