

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0105 -2 REV: 05/85

ASSEMBLY : FREON THERMAL LOOP CRIT. FUNC: 1
P/N RI : MC276-0035-1205 CRIT. HDW: 1
P/N VENDOR: RR42860 VEHICLE 102 103 104
QUANTITY : 2 EFFECTIVITY: X X X
: TWO REQUIRED PHASE(S): PL LO X OO X DO X IS

REDUNDANCY SCREEN: A-PASS B-FAIL C-PAS
PREPARED BY: DES APPROVED BY: APPROVED BY (NASA):
DES O. TRAN DES *[Signature]* SSM *[Signature]*
REL D. RISING REL *[Signature]* REL *[Signature]*
QE W. SMITH QE *[Signature]* QE *[Signature]*

ITEM:
CONNECTOR, FLUID/GSE HEAT EXCHANGER.

FUNCTION:
PROVIDES CONNECTION FOR GROUND COOLING OF VEHICLE FREON. ALSO FUNCTION
AS A RELIEF VALVE DURING FLIGHT.

FAILURE MODE:
FAILS CLOSED, RELIEF VALVE.

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

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
(A) LOSS OF ONE REDUNDANT GSE LOOP RELIEF VALVE.
(B,C,D) NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECT - IF SECOND RELIEF VALVE FAILS CLOSED
OVERPRESSURIZATION WILL OCCUR IN GSE LOOP DUE TO THERMAL EXPANSION AND
RESULT IN POSSIBLE DAMAGE TO HEAT EXCHANGER AND ONE VEHICLE FREON 21
COOLANT LOOP. THIRD ASSOCIATED FAILURE (LOSS OF REDUNDANT FREON COOLANT
LOOP) WILL CAUSE LOSS OF ALL VEHICLE COOLING, RESULTING IN LOSS OF CREW
VEHICLE. REDUNDANCY SCREEN 'B' FAILS BECAUSE VEHICLE GSE LOOP HAS NO
INSTRUMENTATION TO DETECT RELIEF VALVE FAILURES.

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

(A) DESIGN
DESIGN PROOF AND BURST PRESSURE FOR THE GSE LOOP ARE 175 AND 500 PSIG.
THE INTEGRAL RELIEF VALVE, BUILT IN THE CONNECTOR, HAS A RELIEF PRESSURE
OF 77 PSIG AND A RESEAT PRESSURE OF 35 PSIG. THE HEAT EXCHANGER,
CONNECTOR, AND THE INTEGRAL RELIEF VALVE PARTS ARE MADE OF STAINLESS
STEEL AND THE SEALS IN THE RELIEF VALVE ARE TEFLON. THESE MATERIALS ARE
COMPATIBLE WITH FREON 114.

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(B) TEST

QUALIFICATION TEST - THE HEAT EXCHANGER AND CONNECTOR ARE QUALIFICATION TESTED FOR 100 MISSION LIFE. THE GSE HEAT EXCHANGER BURST PRESSURE IS 2440 PSIG. THE RELIEF VALVE WAS LIFE CYCLE TESTED FOR 1000 CYCLES, VIBRATION TESTED AT 0.1 G²/HZ FOR 52 MIN/AXIS, AND SHOCK TESTED AT +/- 20 G/AXIS.

ACCEPTANCE TEST - FUNCTIONAL TEST DURING ATP INCLUDED CHECK OF RELIEF VALVE RELIEF PRESSURE OF 77 PSIG WITH A FLOW RATE OF 165 LB/HR AND A RESEAT PRESSURE OF 35 PSIG.

OMRSD - PERIODIC VERIFICATION OF THE CRACK AND RESEAT PRESSURES OF THE RELIEF VALVE. FREON CHEMICAL ANALYSIS PER SE-S-0073 DURING SERVICING.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY INSPECTION. INSPECTION VERIFIES MATERIAL AND EQUIPMENT CONFORMS TO SPECIFICATION. VISUALLY INSPECTED FOR DAMAGE. INSPECTION VERIFIES PARTS PROTECTION.

CONTAMINATION CONTROL

SYSTEM FLUID SAMPLE ANALYZED FOR CONTAMINATION. CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION. CLEANLINESS (LEVEL 300) IS VERIFIED BY INSPECTION BEFORE AND AFTER ATP. ULTRASONIC CLEANING OF COMPONENTS IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, INSTALLATION, AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREATMENT, WELDING AND PASSIVATION ARE VERIFIED BY INSPECTION.

TESTING

FUNCTIONAL TEST IS MONITORED FOR LEAKAGE BY INSPECTION.

HANDLING/PACKAGING

PROPER HANDLING AND STORAGE ENVIRONMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

(CAR AC3643) HIGH CRACK PRESSURE FAILURES HAVE OCCURRED. THREE RELIEF VALVES CRACKED AT APPROXIMATELY 125 PSIG, INSTEAD OF 55-75 PSIG. THE RELIEF VALVES WERE TESTED AT THE VENDOR AND NO CAUSE WAS FOUND FOR THE HIGH CRACK PRESSURE. ACCEPTED AS IS BECAUSE SYSTEM PROOF PRESSURE IS 37 PSIG.

(E) OPERATIONAL USE

FIRST TWO FAILURES ARE NOT DETECTABLE IN FLIGHT - NO CREW ACTION REQUIRED.