

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 06-3D-0501 -X

SUBSYSTEM NAME: ATCS - RADIATORS AND FLOW CONTROL
REVISION: 1 12/02/97

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: RADIATOR AND FLOW CONTROL ASSY	MC203-0002-XXXX 224-00XX-XXX
LRU	: FWD RADIATOR RH	MC203-0002-0012 224-00010-109
LRU	: MID-FWD RADIATOR RH	MC203-0002-0019 224-00015-113
LRU	: MID-AFT RADIATOR RH	MC203-0002-0022 224-00020-109
LRU	: AFT RADIATOR RH	MC203-0002-0028 224-00025-109
LRU	: FWD RADIATOR LH	MC203-0002-0032 224-00030-109
LRU	: MID-FWD RADIATOR LH	MC203-0002-0039 224-00035-113
LRU	: MID-AFT RADIATOR LH	MC203-0002-0041 224-00040-109
LRU	: AFT RADIATOR LH	MC203-0002-0048 224-00045-109

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SPACE RADIATOR PANEL ASSEMBLY.

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 8
FOUR PER LOOP;
EIGHT PER VEHICLE

FUNCTION:

PROVIDES HEAT REJECTION SURFACES FOR FREON COOLANT LOOPS WITH RADIATOR PANELS DEPLOYED. USED DURING ORBITAL OPERATIONS. FOUR PANELS ON LOOP 1 (LEFT SIDE OF VEHICLE) AND FOUR PANELS ON LOOP 2 (RIGHT SIDE OF VEHICLE).

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NORMAL ATCS ENTRY, THE RADIATORS ARE COLD SOAKED PRIOR TO DOOR CLOSURE AND ARE USED FOR THERMAL CONTROL AFTER FLASH EVAPORATOR GPC SHUTDOWN.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3D -0501 -3 REV:08/29/82

ASSEMBLY : RADIATOR & FLOW CONTROL CRIT. FUNC: 2
 P/N RI : MC203-0002-XXXX CRIT. HDW: 2
 P/N VENDOR: 224-000XX-XXX VEHICLE 102 103 104
 QUANTITY : 8 EFFECTIVITY: X X X
 : EIGHT/VEHICLE PHASE(S): PL LO OO X DO LS
 : FOUR PER LOOP

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

ITEM:
 SPACE RADIATOR PANEL ASSEMBLY.

FUNCTION:
 PROVIDES HEAT REJECTION SURFACES FOR FREON COOLANT LOOPS WITH RADIATOR PANELS DEPLOYED. USED DURING ORBITAL OPERATIONS. FOUR PANELS ON LOOP 1 (LEFT SIDE OF VEHICLE) AND FOUR PANELS ON LOOP 2 (RIGHT SIDE OF VEHICLE). NORMAL ATCS ENTRY, THE RADIATORS ARE COLD SOAKED PRIOR TO DOOR CLOSURE AND ARE USED FOR THERMAL CONTROL AFTER FLASH EVAPORATOR GPC SHUTDOWN.

NOMENCLATURE	ROCKWELL PART NUMBER	VENDOR PART NUMBER
FWD RADIATOR RH	MC203-0002-0012	224-00010-109
MID-FWD RADIATOR RH	MC203-0002-0019	224-00015-113
MID-AFT RADIATOR RH	MC203-0002-0022	224-00020-109
AFT RADIATOR RH	MC203-0002-0028	224-00025-109
FWD RADIATOR LH	MC203-0002-0032	224-00030-109
MID-FWD RADIATOR LH	MC203-0002-0039	224-00035-113
MID-AFT RADIATOR LH	MC203-0002-0041	224-00040-109
AFT RADIATOR LH	MC203-0002-0048	224-00045-109

FAILURE MODE:
 RESTRICTED FLOW OF FREON 21 IN PANEL ASSEMBLY

CAUSE(S):
 CONTAMINATION, MECHANICAL SHOCK.

EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
 (A, B) POSSIBLE LOSS OF RADIATOR FLOW IN ONE FREON LOOP FOR VEHICLE COOLING THROUGH THE RADIATORS.
 (C) POSSIBLE LOSS OF MISSION DUE TO THE LOSS RADIATOR COOLING TO SUPPORT PAYLOAD OPERATIONS, A CRITICALITY 2/2 CONDITION.
 (D) NO EFFECT.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3D -0501 -3 REV:08/29/8

(E) FUNCTIONAL CRITICALITY EFFECT - ANY TWO ADDITIONAL FAILURES (OTHER FREON COOLANT LOOP, HI-LOAD EVAPORATOR, AND AMMONIA BOILER SYSTEM) WILL CAUSE LOSS OF VEHICLE COOLING CAPABILITY AND MAY RESULT IN LOSS OF CREW/VEHICLE, A CRITICALITY LRD (PPP) CONDITION.

DISPOSITION & RATIONALE:

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

(A) DESIGN

DESIGN SAFETY FEATURE OF MULTI-PARALLEL PASSAGES. INSIDE DIAMETER OF THE TUBES ARE 0.187 AND 0.236 INCHES FOR THE FORWARD AND AFT PANELS RESPECTIVELY. TUBES ARE 6061-T6 ALUMINUM WHICH IS COMPATIBLE WITH FREON 21. RADIATOR PANELS AND INTERPANEL PLUMBING ARE DESIGNED FOR 400 MISSION LIFE. FILTRATION PROVISIONS MINIMIZE CONTAMINATION (65 MICRON FILTERS IN THE FLOW CONTROL ASSEMBLY, 25 AND 61 MICRON FILTERS IN PUMP PACKAGE).

(B) TEST

QUALIFICATION TEST - THE RADIATOR PANELS AND INTER-PANEL PLUMBING WAS LIFE TESTED FOR AN EQUIVALENT OF 400 MISSIONS (FOUR LIFETIMES). VIBRATION TESTED AT 3 G²/HZ FOR Y AND Z AXES, AND 1G²/HZ FOR X AXIS, FOR 48 MIN/AXIS. SHOCK TESTED AT +/- 20 G EACH AXIS.

ACCEPTANCE TEST - ATP VERIFIES UNRESTRICTED FLOW.

OMRSD - FCL FLOW RATES ARE CHECKED PRIOR TO EACH FLIGHT. FREON CHEMICAL ANALYSIS PER SE-S-0073 DURING SERVICING. FREON IS SERVICED THROUGH A FINAL FILTER OF 25 MICRON SIZE.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL IS VERIFIED BY INSPECTION. VISUAL INSPECTION/ID PERFORMED. PARTS PROTECTION IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

SYSTEM FLUID SAMPLES PERIODICALLY ANALYZED FOR CONTAMINATION AND VERIFIED BY INSPECTION. CONTAMINATION CONTROL PROCESSES AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION. FORMAL CONTAMINATION CONTROL PLAN IS VERIFIED BY INSPECTION. INSPECTION VERIFIES CLEANLINESS TO LEVEL 300

ASSEMBLY/INSTALLATION

MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION ON SHOP TRAVELER MIPS. MATERIAL AND EQUIPMENT CONFORMANCE TO CONTRACT REQUIREMENTS ARE VERIFIED BY INSPECTION. PROCESSING EQUIPMENT CONTROLS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES

WELDING IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

X-RAY EXAMINATION OF FUSION WELDS IS VERIFIED BY INSPECTION.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

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TESTING

FUNCTIONAL TEST IS MONITORED BY INSPECTION TO VERIFY FLOWRATE IS WITHIN SPECIFIED LIMITS.

HANDLING/PACKAGING

PROPERLY MONITORED HANDLING AND STORAGE ENVIRONMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

NO FAILURE HISTORY.

(E) OPERATIONAL USE

ON-BOARD ALARM, EVAP OUT TEMPERATURE, WILL PROVIDE INDICATION OF HARDWARE FAILURE. LOSS OF RADIATOR MAY CAUSE AN EARLY END OF MISSION. RADIATOR WILL BE BYPASSED, FREON PUMP WILL BE TURNED OFF, AND A POWERDOWN WILL BE PERFORMED. FREON PUMP WILL BE REACTIVATED FOR ENTRY.