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PRINT DATE: 01/08/90

SHUTTLE CRITICAL ITEMS LIST - ORBITER

NUMBER: 06-1B3-0561-X

SUBSYSTEM NAME: ARS - COOLING

REVISION : 2 01/08/90

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	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: COLDPLATE	V070-613010
LRU	: COLDPLATE	V070-613160
LRU	: COLDPLATE	V070-613207
LRU	: COLDPLATE	V070-613208
LRU	: COLDPLATE	V070-613210
LRU	: COLDPLATE	V070-613211
LRU	: COLDPLATE	V070-613212
LRU	: COLDPLATE	V070-613213
LRU	: COLDPLATE	V070-613214
LRU	: COLDPLATE	V070-613215
LRU	: COLDPLATE	V070-613220
LRU	: COLDPLATE	V070-613225
LRU	: COLDPLATE	V070-613229
LRU	: COLDPLATE	V070-613231
LRU	: COLDPLATE	V070-613232
LRU	: COLDPLATE	V070-613233
LRU	: COLDPLATE	V070-613234
LRU	: COLDPLATE	V070-613237
LRU	: COLDPLATE	V070-613241
LRU	: COLDPLATE	V070-613242
LRU	: COLDPLATE	V070-613243

## SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-183-0561-X

LRU	:	COLDPLATE	V070-613371
LRU	:	COLDPLATE	V070-613373
LRU	:	COLDPLATE	V070-613374
LRU	:	COLDPLATE	V070-613596
LRU	:	COLDPLATE	V070-613597
LRU	:	COLDPLATE	V070-613598

QUANTITY OF LIKE ITEMS: 51

## FUNCTION:

PROVIDES HEAT DISSIPATION OF AVIONICS BAY EQUIPMENT BY MEANS OF CONDUCTION TO THE WATER COOLANT LOOPS. FORTY-NINE COLDPLATES PER SET.

COLDPLATE P/N	QUANTITY	EQUIPMENT COOLED
V070-613207	2	RCDP'S
V070-613208	3	PWR CONT ASSY'S
V070-613210	1	GCILU
V070-613211	1	CCMSEC'S
V070-613212	1	CCUA, E/ASS, P/L DATA INTLVR
V070-613213	2	S-BAND XPDR'S, N/W S/P'S
V070-613214	2	P/L INTERR'S, P/L SIG PROC'S
V070-613215	1	MCA 3, E/A/ATC XCVR
V070-613220	1	FM XMT'S
V070-613226	3	KU BAND EA-1A & EA-2A, HUD'S
V070-613228	1	KU BAND SP
V070-613231	1	S/B PRE AMP, S/B PWR AMP
V070-613232	3	MSS PCM RCRDR, OP RCRDR'S
V070-613233	3	INVERTERS
V070-613234	2	PCM MSTR'S
V070-613237	3	INVERTERS
V070-613241	1	MTU
V070-613242	3	LOAD CONT ASSY'S
V070-613243	3	MDM & SIG COND'S
V070-613371	5	MDM'S
V070-613373	2	MASS MEM'S
V070-613374	2	RAD ALT & MDM'S
V070-613596	1	TEXT GRAPHICS
V070-613597	1	GPS 4
V070-613598	1	GPS 3

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TWO ADDITIONAL COLDPLATES PROVIDE HEAT DISSIPATION FOR MDM OF4 (FLIGHT DECK) AND FLOODLIGHT (PAYLOAD BAY); P/N'S V070-613010, V070-613180.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT.      FMXA NO 06-1B -0561 -1      REV:09/88

ASSEMBLY : WATER COOLANT LOOPS  
P/N RI : V070-61300X  
P/N VENDOR:  
QUANTITY : 81  
          : PER SUBSYSTEM

VEHICLE      102      103      104  
EFFECTIVITY:      X      X      X  
PHASE(S):      PL      LO X OO X DO X IS

CRIT. FUNC: 1  
CRIT. HW:      :

PREPARED BY:  
DES N. K. DUONG  
REL N. L. STEISSENGER  
QE D. STOICA

REDUNDANCY SCREEN  
APPROVED BY:  
DES *[Signature]*  
REL *[Signature]*  
QE *[Signature]*

A-PASS B-PASS C-PAS  
APPROVED BY (NASA):  
SSM *[Signature]*  
REL *[Signature]*  
QE *[Signature]*

ITEM:  
COLDPLATES

FUNCTION:

PROVIDES HEAT DISSIPATION OF AVIONICS BAY EQUIPMENT BY MEANS OF CONDUCTION TO THE WATER COOLANT LOOPS. FORTY-NINE COLDPLATES PER SET.

COLDPLATE P/N	QUANTITY	EQUIPMENT COOLED
V070-613207	2	RJDF'S
V070-613208	3	PWR CONT ASSY'S
V070-613210	1	GCILS
V070-613211	1	COMSEC'S
V070-613212	1	CUJA, EVLSS, P/L DATA INTLVR
V070-613213	2	S-BAND XPNDR'S, N/W S/P'S
V070-613214	2	P/L INTERR'S, P/L SIG PROC'S
V070-613215	1	MCA 3, EVA/ATC XCVR
V070-613220	1	FM XMT'S
V070-613226	3	KU BAND EA-1A & EA-2A, HUB'S
V070-613228	1	KU BAND SP
V070-613231	1	S/B PRE AMP, S/B PWR AMP
V070-613232	3	MSS PCM RCRDR, CP RCRDR'S
V070-613233	3	INVERTERS
V070-613234	2	PCM MSTR'S
V070-613237	3	INVERTERS
V070-613241	1	MTU
V070-613242	3	LOAD CONT ASSY'S
V070-613243	3	MDM & SIG COND'S
V070-613271	5	MDM'S
V070-613273	2	MASS MEM'S
V070-613274	2	RAD ALT & MDM'S
V070-613256	1	TEXT GRAPHICS
V070-613297	1	GPS 4
V070-613298	1	GPS 1

TWO ADDITIONAL COLDPLATES PROVIDE HEAT DISSIPATION FOR MDM OF4 (FLIGHT DECK) AND FLOODLIGHT (PAYLOAD BAY); P/N'S V070-613010, V070-613290.

FAILURE MODE:  
EXTERNAL LEAKAGE

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0561 -1 REV:09/08,8

CAUSE(S):

MECHANICAL SHOCK, VIBRATION, CORROSION, MATERIAL DEFECT

EFFECT(S) ON:

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

(A) LOSS OF REDUNDANCY - LOSS OF ONE WATER COOLANT LOOP.

(B) LOSS OF COOLING IN AFFECTED WATER COOLANT LOOP. FREE WATER IN CABIN AVIONICS BAY, OR PAYLOAD BAY.

(C) POSSIBLE EARLY MISSION TERMINATION FOR LOSS OF ONE WATER COOLANT LOOP.

(D) POTENTIAL LOSS OF CREW/VEHICLE UPON SUBSEQUENT LOSS OF REDUNDANT WATER COOLANT LOOP.

DISPOSITION & RATIONALE:

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

(A) DESIGN

COLDPLATES ARE CONSTRUCTED OF TWO TYPE 347 CRES FACE SHEETS (LOOP 1 SIDE 0.012 IN THICK AND LOOP 2 SIDE 0.016 IN THICK) BRAZED TO A CORE 0.113 IN THICK. THE COLDPLATE CORE HAS PIN FINS ON BOTH SIDES AND BAFFLES TO MAKE UP FLOW PATHS FOR WCL 1 & 2. PIN FINS ARE 0.048 INCH IN DIAMETER AND 0.047 IN HIGH, AND ARE ARRANGED IN A STAGGERED EQUILATERAL TRIANGLE FORMATION WITH A PITCH DISTANCE OF 0.190 IN. THERE ARE NICKEL PLATED PADS AROUND PORTS, AND ETHYLENE PROPYLENE RUBBER (EPR) O-RING SEALS AT MANIFOLDS. THERE ARE NO MOVING PARTS. WATER COOLANT LOOPS CONTAIN 10 MICRON HIGH HOLDING CAPACITY SYSTEM FILTER AT THE PUMP PACKAGE INLET AND 61 MICRON FILTERS AT PUMP INLET AND OUTLET. COOLANT IS HIGH PURITY/LOW OXYGEN CONTENT WATER. MATERIAL COMPATIBILITY WITH WATER AND ALCOHOL BASED ON MATERIALS AND PROCESSES CERTIFICATION ANALYSIS (REF CAR 01A-22-610001-FCF-A).

(B) TEST

ACCEPTANCE TEST - FLOW AND DELTA-P ARE VERIFIED. COLDPLATES ARE ULTRASONICALLY CLEANED, FLUSHED WITH WATER AND FREON TF, VERIFIED TO LEVEL 300 CLEANLINESS AND DRIED PRIOR TO STORAGE.

QUALIFICATION TEST - COLDPLATES CERTIFIED BY SIMILARITY TO APOLLO COLDPLATES (VIBRATION, SHOCK, AND ACCELERATION). COLDPLATES WERE SUBJECTED TO PRESSURE CYCLING, BURST PRESSURE, FLOW VS PRESSURE DROP AND THERMAL PERFORMANCE TESTS.

IN-VEHICLE TESTING - SYSTEM DECAY TEST IS PERFORMED AT 85 - 95 PSIG, 8 CC/MIN MAX LEAKAGE. PUMP OUT PRESSURE AND ACCUMULATOR QUANTITY ARE CONTINUOUSLY MONITORED WHEN THE VEHICLE IS POWERED UP AND SERVE AS AN INDICATION OF EXTERNAL LEAKAGE.

OMRSD - PUMP ACCUMULATOR QUANTITY AND OUTLET PRESSURE ARE CONTINUOUSLY MONITORED WHILE THE VEHICLE IS POWERED UP DURING EACH TURNAROUND, AND SERVE AS AN INDICATION OF EXTERNAL LEAKAGE. WATER IS SAMPLED PER SPEC SE-S-0073 DURING SERVICING.

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SUBSYSTEM : ATMOSPHERIC REVIT. PMA NO 06-1B -0561 -1 REV: 09/08/8

(C) INSPECTION

RECEIVING INSPECTION

MATERIAL ISSUED FOR FABRICATION IS VERIFIED BY INSPECTION ON MANUFACTURING ORDERS (CHECK MATERIAL FOR SCRATCHES).

CONTAMINATION CONTROL

CLEANLINESS LEVEL 300 IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MACHINE TOLERANCES AND DETAIL PARTS ARE PER DRAWING, AND ARE VERIFIED BY INSPECTION. SEALING SURFACES PROTECTION IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

COLDPLATES ARE BRAZED PER DRAWING, AND ARE VERIFIED BY INSPECTION. ELECTRO-DEPOSIT IS VERIFIED BY INSPECTION.

TESTING

PROOF PRESSURE AND LEAK CHECK ARE VERIFIED BY INSPECTION. ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

AB6112-010, 2/21/80 AT DOWNEY. FIVE COLDPLATES FAILED ATP - LEAKAGE EXCEEDED SPEC REQUIREMENT. LEAKAGE WAS BETWEEN THE ELECTRO-FORMED NICKEL PAD AND FACE SHEET AND WAS DUE TO DELAMINATION. A REVIEW WAS CONDUCTED AT THE SUPPLIER: THE BOND FAILURE OF THE NICKEL WAS FOUND TO BE CAUSED BY THE FAILURE OF THE NICKEL STRIKE SOLUTION TO CLEAN THE BONDING SURFACE PROPERLY, LEAVING CONTAMINATION ON THE FACE SHEET. ALL MARGINAL SOLUTIONS WERE REPLACED AND THE ELECTROFORMING NICKEL SPECIFICATION WAS MODIFIED TO ACCOMMODATE STRIPPING AND REPLATING.

AB9025-010, 3/17/81 AT DOWNEY. SIX PIN-HOLES WERE DETECTED IN A COLDPLATE FACESHEET DURING LEAK CHECK. FATIGUE CRACKS WERE FOUND IN THE FACESHEET OVER CORE PINS. ANALYSIS CONCLUDED THAT THE CRACKS WERE FATIGUE CRACKS CAUSED BY EXCESSIVE ULTRASONIC ENERGY DURING CLEANING. CORRECTIVE ACTION - THE CLEANING PROCESS WAS REVISED TO REDUCE THE ULTRASONIC ENERGY INPUT TO THE COLDPLATE BY SUSPENDING COLDPLATES IN THE ULTRASONIC TANK ON A PLASTIC NET AND BY REDUCING THE TIME OF EXPOSURE. THIS CORRECTIVE ACTION ALSO APPLIED TO LEAKS ON OTHER COLDPLATES: AB8977-010, 3/13/81 AND AB8972-010, 3/12/81.

(E) OPERATIONAL USE

TBS.