

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : AUXILIARY POWER (APUS) EMEA NO 04-2 -HR116 -11 PERIOD 05 89

ASSEMBLY : FUEL SUPPLY  
 P/N RI : MC363-0026-0016, -0018  
 P/N VENDOR: COX P/N 2743-16, -18  
 QUANTITY : 6  
 : ONE OF EACH PER SYSTEM  
 : WITH REDUNDANT ELEMENTS

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X
PHASE(S):	PL X LO	CO X DO X LS	

CRIT. FUNC: 15  
 CRIT. HDW: 2

PREPARED BY:	S Y HWANGBO	DES	T R BOLTZ <i>TRB</i>	REL	W J SMITH	QE	
		DES		REL		QE	

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS  
 APPROVED BY: *[Signature]* APPROVED BY (MSSA):  
 SSM *[Signature]*  
 REL *[Signature]*  
 QE *[Signature]*

ITEM:  
 HEATER, FUEL SERVICING LINES (FILL AND TEST LINE). RESPECTIVE ELEMENTS OF HR116 & HR117 CONNECTED IN SERIES.

FUNCTION:  
 TO MAINTAIN LINE TEMPERATURE ABOVE 45 DEG F TO PREVENT FUEL FROM FREEZING. PRIMARY AND SECONDARY ELEMENTS ARE AUTOMATICALLY CONTROLLED BY THERMOSTATS S16A & S16B, AND MANUALLY BY PANEL SWITCHES S7 & S8, RESPECTIVELY. BOTH THE PRIMARY AND SECONDARY HEATERS ARE ACTIVATED PRIOR TO CRYO LOADING THROUGH T-0. ONLY ONE HEATER ELEMENT WILL BE ACTIVATED DURING THE REMAINDER OF THE FLIGHT.

FAILURE MODE:  
 LOSS OF OUTPUT

CAUSE(S):  
 LOSS OF POWER TO ELEMENT, ELECTRICAL SHORT OR OPEN.

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

(A) NO EFFECT ON APU OPERATION. LOSS OF REDUNDANCY IN THIS AND THE FUEL TANK, FEEDLINE, DRAIN LINE, AND WATER COOLING LINE AND TANK HEATERS.

(B) NO EFFECT

(C) LAUNCH SCRUB, IF DETECTED. NO EFFECT ON CRBIT, UNLESS ONE ELEMENT FAILS IN CONJUNCTION WITH THE ALTERNATE ELEMENT IN ONE OF THE OTHER RELATED HEATERS (2ND ORDER FAILURE).

(D) NO EFFECT UNTIL SECOND SYSTEM LOST.

(E) FUNCTIONAL CRITICALITY EFFECT - FUEL FREEZING IN LINE COULD RUPTURE LINE, CAUSING FUEL LEAKAGE INTO AFT COMPARTMENT (LOSS OF CREW/VEHICLE).

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

(A) DESIGN  
 THE HEATER CONVERTS ELECTRICAL ENERGY TO THERMAL ENERGY TO APPLY HEAT TO THE APU'S FUEL LINES.

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THE HEATER CONTAINS TWO INDEPENDENT, REDUNDANT RESISTANCE ELEMENTS AND TERMINALS. THEY ARE COVERED BY SILICON RUBBER TO PRECLUDE ANY PORTION OF THE CIRCUIT AND TERMINALS FROM SHORTING TO GROUND OR DEVELOPING HOT SPOTS.

(B) TEST

DIELECTRIC STRENGTH BETWEEN EXTERNAL SURFACE TO HEATER ELEMENT AND BETWEEN HEATER TO HEATER ELEMENT. INSULATION RESISTANCE BETWEEN EXTERNAL SURFACE TO EACH HEATER ELEMENT AND BETWEEN TWO HEATER ELEMENTS.

RESISTANCE OF EACH HEATER ELEMENT BEFORE AND AFTER INSTALLATION IS VERIFIED.

OMRSD: APU 1/2/3 HEATER TEST BY COCKPIT COMMAND PERFORMED FIRST FLOW ON A CONTINGENCY BASIS THEREAFTER ANY TIME THE HEATER OR LINES ARE DISTURBED. FLIGHT DATA IS USED TO VERIFY HEATER OPERATION EVERY FLOW AFTER THE FIRST FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION

MATERIAL AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS AND CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

INSPECTION VERIFIES CONFIGURATION OF THE HEATER TO COX DRAWING NO. 2743-18. THE LOCATION AND SPACING OF THE HEATER ELEMENTS AND LEAD WIRE CONNECTIONS AND JOINTS WITHIN THE HEATER ARE VERIFIED TO DRAWING REQUIREMENTS.

NONDESTRUCTIVE EVALUATION

INSPECTION VERIFIES HEATER ELEMENT RESISTANCE INSPECTION AND X-RAY INSPECTION PER COX DRAWING NO. 7428.

CRITICAL PROCESSES

CRIMPING OF LEAD WIRES WITH HEATER WIRING PER COX PROPRIETARY PROCESS IS VERIFIED BY INSPECTION.

TESTING

PERFORMANCE OF THE HEATER IS EVALUATED VIA ATP NO. D-7391-18, WHICH IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING OF THE HEATER PER COX DRAWING NO. 7486 IS VERIFIED BY INSPECTION.

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(D) FAILURE HISTORY

THREE OPEN CIRCUIT FAILURES WERE DETECTED DURING ATP ON THE MC363-0026 -0004/ -0005/ -0006. CAR'S A3237, A3238 AND A3239 REPORTED THAT THE HEATERS FAILED RESISTANCE TESTS DUE TO ABNORMAL ROUTING OF THE HEATER ELEMENTS. THE SUPPLIER'S MANUFACTURING OPERATION SHEET WAS CORRECTED TO CLARIFY THE TWISTING PROCEDURE. DEMONSTRATION UNITS WERE MADE TO VERIFY THAT THE CHANGED PROCEDURE WAS A SATISFACTORY ONE.

(E) OPERATIONAL USE

MANUALLY SWITCH TO ALTERNATE HEATER.