

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : AUXILIARY POWER (APUS) FMEA NO 04-2 -S112A -2 REV: 02/25/83

ASSEMBLY : AUXILIARY POWER UNIT  
P/N RI : ME360-0017-0008 CRIT. FUNC: 10  
P/N VENDOR: SDC P/N 975-0399-008 CRIT. HDW: 10  
QUANTITY : 6 VEHICLE 102 103 104  
EFFECTIVITY: X X X  
PHASE(S): PL X LO X OO X DO X LS  
: 1 FOR PRIM HTR ELEM  
: (S112B FOR SEC HTR ELEM)

PREPARED BY: REDUNDANCY SCREEN: A-PASS B-PASS C-PAS  
DES R STEDMAN DES APPROVED BY: *[Signature]* APPROVED BY (NASA):  
REL T R BOLTZ REL *[Signature]* SSM *[Signature]*  
QE W J SMITH QE *[Signature]* REL *[Signature]*

ITEM:  
THERMOSTAT, FUEL PUMP SEAL CAVITY DRAIN.

FUNCTION:  
TO PROVIDE A CLOSED ELECTRICAL CIRCUIT AT 55 DEG F AND AN OPEN CIRCUIT  
65 DEG F (PLUS OR MINUS 5 DEG F). THE THERMOSTAT CONTROLS THE PRIMARY  
ELEMENT OF THE FUEL PUMP SEAL CAVITY DRAIN HEATER. BOTH THE PRIMARY AND  
SECONDARY HEATERS ARE ACTIVATED PRIOR TO CRYO LOADING THROUGH LAUNCH.  
HEATERS ARE OFF FOR ASCENT AND ONLY ONE HEATER ELEMENT WILL BE ACTIVATED  
DURING THE REMAINDER OF THE FLIGHT. (REFERENCE 04-2-HR111 & HR112).

FAILURE MODE:  
FAILS TO OPEN (FAILS CLOSED).

CAUSE(S):  
SHORT, WELDED CONTACTS.

EFFECT(S) ON:  
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE  
(A) NO EFFECT WHEN APU IS RUNNING AND FUEL IS FLOWING.  
(B,C) IF HEATER PANEL SWITCH FAILS AND CREW UNABLE TO TURN HEATER OFF,  
POSSIBLE DECOMPOSITION OF HYDRAZINE COULD OCCUR RESULTING IN LOSS OF  
MISSION.  
(D,E) NO EFFECT UNLESS APU IS SHUTDOWN AND HEATER IS NOT TURNED OFF.  
IF NOT, POSSIBLE LOSS OF VEHICLE AND APU.

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

(A) DESIGN  
THE ELECTRICAL SYSTEM IS DESIGNED WITH (3) DRIVERS THROUGH (RPC) TO TURN  
ON THE HEATER. A (3) POLE SWITCH WHICH HAS (1) POLE TO EACH DRIVER  
ENERGIZES THE CIRCUIT. ANY TWO DRIVERS WILL ENERGIZE A HEATER; ONE  
DRIVER FAILING ON WILL NOT DELIVER POWER TO THE HEATER.

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SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -S111A -2 REV:02/26/88

SWITCH IS DESIGNED TO MEET THE REQUIREMENTS OF MIL-S-24236. IT IS ALL WELDED CONSTRUCTION, VIBRATION, AND CORROSION RESISTANT, SIMPLE, SNAP-ACTING THERMAL SWITCH, HERMETICALLY SEALED WITH DRY NITROGEN. IT IS RATED AT 5 AMPS AND WILL ONLY CARRY MILLIAMPS.

(B) TEST

PART ACCEPTANCE TEST INCLUDES CONTACT RESISTANCE, SEAL TEST, CREEP, AND 250 CYCLE RUN-IN.

IT IS QUALIFIED BY SIMILARITY TO LIKE MIL-S-24236 SWITCHES BUILT BY SUNDSTRAND DATA CONTROL. THE SWITCH WAS QUALIFICATION TESTED.

OMRSD: APU 1/2/3 HEATER TEST BY COCKPIT COMMAND VERIFIES THERMOSTATS FOR FIRST FLIGHT AND ON A CONTINGENCY BASIS THEREAFTER ANY TIME THE LINE, INSULATION, OR HEATER IS DISTURBED. THERMOSTATS ARE VERIFIED OPERATIONAL EVERY FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIALS ARE CERTIFIED AND VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS REQUIREMENTS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING OPERATIONS ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PARTICLE IMPACT NOISE DETECTION (PIND) IS VERIFIED BY INSPECTION. FLUOROCARBON LEAK CHECK IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

WELDING PER SPECIFICATION REQUIREMENTS IS VERIFIED BY INSPECTION.

TESTING

TEST EQUIPMENT CALIBRATION AND CERTIFICATION ARE VERIFIED BY INSPECTION. BURN-IN CYCLING IS VERIFIED BY INSPECTION. ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE, AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY

CAR 24F011: THERMOSTAT FAILED CLOSED. NO CORRECTIVE ACTION AS OF NOW. THE PROBLEM WAS THOUGHT AT FIRST TO BE CAUSED BY "SLOW CREEP," BUT THE POSSIBILITY THAT THE FAILURE MAY HAVE BEEN CAUSED BY EXCESSIVE VIBRATION IS BEING ADDRESSED. CORRECTIVE ACTION WILL BE DECIDED FOLLOWING INVESTIGATION. HOWEVER, NO FAILURES OF THIS TYPE HAVE OCCURRED ON VEHICLE LINES. THESE THERMOSTATS ARE NOT LOCATED ON THE APU AS IN CAR 24F011. CONSEQUENTLY THE VIBRATION ENVIRONMENT IS MUCH MORE BENIGN.

(E) OPERATIONAL USE

MANUALLY SWITCH TO ALTERNATE HEATER.