

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : AUXILIARY POWER (APUS) FMEA NO 04-2 -S16A -2 REV:02/16/82

ASSEMBLY : FUEL SUPPLY CRIT. FUNC: 12  
 P/N RI : ME360-0017-0008 CRIT. HDW: 2  
 P/N VENDOR: SDC P/N 975-0399-008 VEHICLE 102 103 104  
 QUANTITY : 6 EFFECTIVITY: X X X  
 : 1 FOR PRIM HTR ELEM PHASE(S): PL X LO X CO X DO X LS  
 : (S16B FOR SEC HTR ELEM)

PREPARED BY: REDUNDANCY SCREEN: A-PASS E-PASS C-PASS  
 DES R STEDMAN DES APPROVED BY: (NASA):  
 REL T R BOLTZ REL SSM  
 QE W J SMITH QE

ITEM: THERMOSTAT, FUEL SERVICING LINES (FILL AND TEST LINE).

FUNCTION:

TO PROVIDE A CLOSED ELECTRICAL CIRCUIT AT 55 DEG F AND AN OPEN CIRCUIT AT 65 DEG F (PLUS OR MINUS 5 DEG F). THE THERMOSTAT CONTROLS THE PRIMARY ELEMENTS OF THE FUEL SERVICING AND TEST LINE HEATERS. BOTH THE PRIMARY AND SECONDARY THERMOSTATS AND 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 FMEA 04-2-MR116).

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 SHUT DOWN AND HEATER IS NOT TURNED OFF. IF NOT, POSSIBLE LOSS OF CREW/VEHICLE OR 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.

SHUTTLE CRITICAL ITEMS LIST - CROBTER

SUBSYSTEM :AUXILIARY POWER (APUS) PMAA NO 04-2 -516A -2 REV:00, 28, 8

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 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 SUNSTRAND DATA CONTROL. THE SWITCH WAS QUALIFICATION TESTED.

OMRSD: APU 1/2/3 HEATER TEST BY COCKPIT COMMAND VERIFIES THERMOSTATS ON FIRST FLIGHT AND ON A CONTINGENCY BASIS THEREAFTER ANY TIME THE LEVE, 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.