

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -S14A -2 REV:02/25/88

ASSEMBLY :FUEL SUPPLY  
P/N RI :ME360-0017-0006 CRIT. FUNC: 1R  
P/N VENDOR:SDC P/N 975-0399-006 CRIT. HW: 2  
QUANTITY :12 VEHICLE 102 103 104  
:2 FOR PRIM. HTR ELEM EFFECTIVITY: X X X  
:(2 FOR SEC HTR ELEM) PHASE(S): PL X LO X CO X DO X IS

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

ITEM:  
THERMOSTAT, FUEL FEEDLINE.

3-16 88

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). THERMOSTATS S14A AND S19A CONTROL THE PRIMARY ELEMENTS OF THE FEEDLINE 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-KR14 AND KR15).

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 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 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.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : AUXILIARY POWER (APUS) FMEA NO 04-2 -S14A -C 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.