SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTUATION MECH-RADIATORS FMEA NO 02-4G -152 -1 REV:03/07/88

ASSEMBLY :RADIATOR DEPLOYMENT CRIT. FUNC: 1
P/N RI :V070-594410 CRIT. HDW: 1
P/N VENDOR: VEHICLE 102 103 104
QUANTITY :8 EFFECTIVITY: X X X
:FOUR PER SIDE PHASE(S): PL LO OO X DO LS

REDUNDANCY SCREEN: A- B- C-

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
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ITEM:
LINKAGE ASSEMBLY

FUNCTION:
POWER DRIVE UNIT (PDU) PROVIDES THE ROTARY MOTION TO DRIVE THE ROTARY ACTUATORS AND LINKAGE ASSEMBLY TO DEPLOY OR STOW THE RADIATORS.

FAILURE MODE:
PHYSICAL BINDING/JAMMING

CAUSE(S):
ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, DEFECTIVE PART/MATERIAL DEFECT, THERMAL DISTORTION, VIBRATION

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

(A) MECHANISM FAILS TO STOW RADIATOR OR DEPLOY RADIATOR.

(B) POSSIBLE INTERFERENCE WITH PAYLOAD BAY DOOR CLOSING, IF RADIATOR CANNOT BE STOWED.

(C) IF RADIATOR CANNOT BE DEPLOYED, REDUCED COOLING CAPACITY OF FREON COOLANT LOOP WILL RESULT, POSSIBLY RESTRICTING MISSION.

(D) NO EFFECT ON CREW/VEHICLE IF RADIATOR CANNOT BE DEPLOYED. POSSIBLE LOSS OF CREW/VEHICLE IF RADIATOR CANNOT BE STOWED, RESULTING IN INTERFERENCE WITH CLOSING OF PAYLOAD BAY DOORS.

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

(A) DESIGN
MATERIALS INCONEL 718 LINKS AND BEARINGS, CHOSEN FOR HIGH STRENGTH/LOW WEAR CHARACTERISTICS. MECHANISM SIZED FOR FULL PDU OUTPUT TORQUE. POSITIVE MARGIN OF SAFETY ON ALL MECHANISM COMPONENTS. RADIATOR MECHANISM IS DESIGNED TO ALLOW FOR STALL LOADS FROM THE MAXIMUM REACH TO THE LATCH POSITION. ALL MECHANISMS DESIGNED WITH DUAL ROTATING SURFACES AND DUAL LOCKING DEVICES ON PIVOT SHAFTS. DESIGN OF THE ACTUATION SYSTEM PERMITS PARTIAL WORKAROUND OF THIS FAILURE MODE BY EXTRAVEHICULAR ACTIVITY (EVA) CREW IF PAYLOAD DOES NOT LIMIT ACCESS AND RADIATOR IS FULLY DEPLOYED.

(B) TEST
QUALIFICATION TESTS: THE TWO DIFFERENT ACTUATORS HAVE BEEN CERTIFIED PER CR-29-287-0037-0001G (REF. FMEA/CIL NO. 02-4G-153-1) AND CR-29-147-0015-0001A (REF. FMEA/CIL NO. 02-4G-182-1) RESPECTIVELY. THE RADIATOR DEPLOYMENT MECHANISM HAS BEEN CERTIFIED PER CR-29-594400-001D. QUALIFICATION TESTS OF RADIATOR DEPLOYMENT MECHANISM ON FORWARD 15 FT PAYLOAD BAY DOOR TEST ARTICLE (087) INCLUDE: ACCEPTANCE - TO CONFIRM ALL COMPONENTS HAVE BEEN ASSEMBLED AND RIGGED PER MLO308-0023; CYCLE FUNCTION - CYCLED 42 TIMES UNDER THREE DIFFERENT TEST CONDITIONS (CONTROL, NON-DISTORTED AND DISTORTED) THROUGH UNLATCH, DEPLOY, STOW AND LATCH CYCLE WITH SIMULATED ZERO GRAVITY; ORBITAL FUNCTION - CYCLED 18 TIMES UNDER THREE DIFFERENT TEST CONDITIONS (TAIL SUN, BOTTOM SUN WITH PAYLOAD BAY DOOR PANEL NO. 1 AND BOTTOM SUN WITH PAYLOAD BAY DOOR PANEL NO. 2) THROUGH UNLATCH AND LATCH CYCLE WITH PAYLOAD BAY DOOR HINGE LINE DISTORTED; ACOUSTIC - TESTED IN ACCORDANCE WITH MF0004-014C (25 HZ TO 8,000 HZ FOR 5 MINUTES); CERTIFICATION BY ANALYSIS/SIMILARITY - PRESSURE, FUNGUS, HUMIDITY, OZONE, TEMPERATURE-CYCLE, TRANS-PACKAGE, LANDING, SHOCK BASIC DESIGN, ACCELERATION, SALT SPRAY, SAND/DUST, TRANSPORTATION-VIBRATION, LIMIT LOAD, ULTIMATE LOAD AND MARGIN OF SAFETY.

ACCEPTANCE TESTS: THE RADIATOR DEPLOYMENT MECHANISMS WERE RIGGED PER CONTROLLED SPECIFICATION MLO308-0023. OPERATION OF RADIATORS DEPLOYMENT MECHANISMS WERE VERIFIED IN CHECKOUT AT KSC WHICH INCLUDED RADIATOR FUNCTIONAL CHECK.

OMRSD: GROUND TURNAROUND INCLUDES VISUAL INSPECTION OF HARDWARE TO INSURE THAT PARTS ARE NOT BROKEN OR DEFORMED AND MONITORING FUNCTIONAL TEST FOR EVIDENCE OF BINDING OR JAMMING. THESE TESTS ARE PERFORMED FIRST FLIGHT AND FOR EVERY FLIGHT WHERE THE RADIATORS WILL BE DEPLOYED.

(C) INSPECTION

RECEIVING INSPECTION
RECEIVING INSPECTION VERIFIES MATERIAL AND PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL
INSPECTION VERIFIES CONTAMINATION CONTROL AND CORROSION PROTECTION REQUIREMENTS.

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ASSEMBLY/INSTALLATION
MATERIAL ISSUED IS VERIFIED BY INSPECTION ON MANUFACTURING ORDERS. MACHINE TOLERANCES ARE PER DRAWING AND MACHINING SPECIFICATION; VERIFIED BY INSPECTION. BEARING INSTALLED PER BEARING INSTALLATION SPECIFICATION VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
DYE PENETRANT VERIFIED BY INSPECTION.

CRITICAL PROCESSES
HEAT TREAT FOR MAXIMUM TENSILE AND CRYOGENIC PROPERTIES VERIFIED BY INSPECTION.

TESTING
PROOF LOADED WITH USE OF TOOLING VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING AND PROTECTION VERIFIED BY INSPECTION.

(D) FAILURE HISTORY
THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

(E) OPERATIONAL USE
EVA WORKAROUND MAY BE POSSIBLE IF RADIATORS ARE FULLY DEPLOYED.