

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : SEPARATION MECHANISMS-PYRO FMEA NO P2-3A -U4 -1 REV:10/09/87

ASSEMBLY : UMBILICAL PLATE SEPARATION

P/N RI : SKD26100099-201

P/N VENDOR:

QUANTITY : 6

: THREE PER SIDE

CRIT. FUNC: 1

CRIT. HDW: 1

VEHICLE 102 103 104

EFFECTIVITY: X X X

PHASE(S): PL LO X OO DO LS

REDUNDANCY SCREEN: A- B- C-

APPROVED BY: 10/11/87 APPROVED BY (NASA):

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ITEM:

UMBILICAL NUT-FRANGIBLE

FUNCTION:

IN CONJUNCTION WITH BOLTS, STRUCTURALLY TIES TOGETHER THE ORBITER/EXTERNAL TANK (ET) UMBILICAL PLATES AT THE LH2 AND LO2 VALVE SEPARATION PLANE. NUT FRACTURES UPON RECEIVING A SHOCK OUTPUT FROM EITHER OR BOTH DETONATORS.

FAILURE MODE:

FAILS TO FRACTURE UPON RECEIVING SHOCK OUTPUT FROM DUAL DETONATORS

CAUSE(S):

INADEQUATE SHOCK OUTPUT FROM BOTH DETONATORS/NASA STANDARD INITIATORS (NSI'S), IMPROPER MACHINING, OVER-STRENGTH MATERIAL

EFFECT(S) ON:

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

(A,B,C,D) LOSS OF FUNCTION, POSSIBLE LOSS OF CREW/VEHICLE IF ORBITER/ET UMBILICAL PLATES FAIL TO SEPARATE.

DISPOSITION & RATIONALE:

(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

1) DESIGN

DESIGN CAPABILITY TO FRACTURE 120% WEB THICKNESS WITH SINGLE DETONATOR CHARGE. NUT IS INCONEL 718 FOR CORROSION PROTECTION (ULTIMATE TENSILE 180-200 KSI).

2) TEST

COMPONENT QUALIFICATION TESTS: SALT FOG, VIBRATION AT -410 DEG F, DYE PENETRANT, FIRINGS AT -200 DEG F AND -410 DEG F (AT LIMIT LOAD AND UNLOADED), AMBIENT TEMPERATURE FIRINGS WITH ZERO LOAD, AND MARGIN DEMONSTRATION FIRINGS. FOUR SAMPLES WERE SUBJECTED TO ULTIMATE LOAD - NO STRUCTURAL FAILURES ALLOWED. MARGIN DEMONSTRATION REQUIRES A SINGLE DETONATOR TO FRACTURE NUT WITH 120% WEB THICKNESS. CERTIFICATION REQUIREMENTS (CR) 45-114-0018-0003; SKD26100099.

SYSTEM QUALIFICATION TESTS: 8 SYSTEM LEVEL TESTS OF ORBITER/ET UMBILICAL SEPARATION SYSTEM AT CRYOGENIC TEMPERATURE UNDER PRELOAD. CR-45-565330.

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ACCEPTANCE TESTS: 100% HARDNESS, 100% LOT PROOF TESTED TO LIMIT LOAD WITH NO THREAD OR WEB DEFORMATION, 100% DYE PENETRANT, ULTIMATE LOAD (RANDOM SAMPLE), LOT SAMPLE FIRINGS (NUTS PREVIOUSLY SUBJECTED TO LIMIT LOADS ARE ACCEPTANCE FIRED WITH ONE DETONATOR) - FAILURE TO FRACTURE IS CAUSE FOR LOT REJECTION. MATERIAL INTEGRITY VERIFIED BY TENSILE TEST COUPONS. CR-45-114-0018-0003, ATF 8277; SKD26100099.

OMRSD: TURNAROUND TESTS INCLUDE - UMBILICAL ATTACH NUT/STUD FIT, THREAD CHECK, AND VERIFICATION OF ALL PARTS SEPARATION SYSTEM IN DEBRIS CONTAINERS. NEW HARDWARE REPLACED EVERY FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL IS VERIFIED BY INSPECTION TO ASSURE SPECIFIC SHUTTLE REQUIREMENTS ARE SATISFIED.

CONTAMINATION CONTROL

CONTAMINATION CONTROL AND CORROSION PROTECTION PROCESSES VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

SELECTED MANUFACTURING/ASSEMBLY STEPS ARE IDENTIFIED BY NASA AND QUALITY ASSURANCE AND VERIFIED BY GOVERNMENT INSPECTION MANDATORY INSPECTION POINTS (MIPS).

NONDESTRUCTIVE EVALUATION

100% DIMENSIONAL INSPECTION OF WEB THICKNESS. 100% DYE PENETRANT.

CRITICAL PROCESSES

ALL MANUFACTURING PROCESSES SUCH AS WELDING, PLATING, HEAT TREATING, PASSIVATION AND ANODIZING ARE VERIFIED BY INSPECTION.

TESTING

DESTRUCTIVE LOT ACCEPTANCE TESTING BY SAMPLE SIZE VERSUS LOT SIZE.

STORAGE

STORAGE ENVIRONMENTS ARE MONITORED AND VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

NONE.

(E) OPERATIONAL USE

NONE.