

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : LANDING/DECELERATION-PYRO FMEA NO P2-1A-035-2 REV: 12/02/87

ASSEMBLY : MAIN LANDING GEAR		CRIT. FUNC:	1	
P/N RI : SKD26100102-301		CRIT. HDW:	1	
P/N VENDOR:	VEHICLE	102	103	104
QUANTITY : 2	EFFECTIVITY:	X	X	X
: ONE PER LANDING GEAR	PHASE(S):	PL	LO X	OO X DO X LS

PREPARED BY:		REDUNDANCY SCREEN:	A-	B-	C-
DES R. H. YEE	APPROVED BY:	12/4/87	APPROVED BY (NASA): 1-7-88		
REL M. B. MOSKOWITZ	DES <i>[Signature]</i>	SSM	<i>[Signature]</i>		
QE E. M. GUTIERREZ	REL <i>[Signature]</i>	REL	12-16-87		
	QE <i>[Signature]</i>	QE	1-7-88		

ITEM:
PYRO-PRESSURE CARTRIDGE, UPLOCK THRUSTER, MAIN LANDING GEAR

FUNCTION:
SINGLE CARTRIDGE/DUAL INITIATOR DELIVERS A PRESSURE OUTPUT TO ACTIVATE THE MAIN LANDING GEAR PYRO UPLOCK RELEASE THRUSTER AS AN EMERGENCY BACKUP TO THE PRIMARY HYDRAULIC SYSTEM. PYRO UPLOCK FUNCTIONS AUTOMATICALLY 1 SECOND AFTER GEAR DOWN COMMAND IF PROXIMITY SWITCH DOES NOT SENSE MOVEMENT.

FAILURE MODE:
INADVERTENT OPERATION

CAUSE(S):
EXCESSIVE TEMPERATURE, ERRONEOUS SIGNAL TO NASA STANDARD INITIATOR (NSI), SHOCK/VIBRATION

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

(A) MAIN LANDING GEAR EXTENDED PREMATURELY.

(B,C,D) LOSS OF CREW/VEHICLE DURING RE-ENTRY.

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

(A) DESIGN
PRESSURE CARTRIDGE FIRING CIRCUITRY CONSISTS OF TWISTED SHIELDED PAIRS FOR ELECTROMAGNETIC INTERFERENCE (EMI) AND RADIO FREQUENCY INTERFERENCE (RFI) PROTECTION. NSI MEETS EMI COMPATIBILITY PER MC999-0002 AND RFI PER AFETRM 127-1. PYRO INITIATOR CONTROLLER (PIC) IS TWO FAILURE TOLERANT FOR PROTECTION AGAINST AN ERRONEOUS OUTPUT. EXPLOSIVE MIX IS BKNO3 AND KCLO4 FOR HIGH TEMPERATURE PROTECTION (APPROXIMATELY 500 DEG F).

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(B) TEST

QUALIFICATION TESTS: SHOCK, RANDOM VIBRATION, THERMAL CYCLING FROM -80 DEG F TO +350 DEG F, HIGH TEMPERATURE FIRINGS AT +350 DEG F, AUTO-IGNITION TEST VERIFIED NO-FIRE WHEN EXPOSED TO +425 DEG F FOR 1 HOUR (MAXIMUM EXPECTED FLIGHT TEMPERATURE IS +350 DEG F). NSI HAS BEEN QUALIFIED TO A NO-FIRE CONDITION WHEN SUBJECTED TO 1 WATT/1 AMP FOR 5 MINUTES. REF. CERTIFICATION REQUIREMENTS (CR) 26-325-0019-0001; NSI: SOS INC. TR6068, HSTC TR2-123.

DESIGN VERIFICATION TESTS: NSI AND WIRING WAS TESTED FOR CLOSE PROXIMITY RFI SUSCEPTIBILITY PRIOR TO APOLLO-SOYUZ TEST PROJECT (ASTP). JSC REPORT #EMC-R-PH-002, 2/74.

ACCEPTANCE TESTS: 100% INTERNAL PROOF PRESSURE TENSILE TEST (3 COUPONS FROM SAME HEAT TREAT), EXAMINATION OF PRODUCT (WEIGHT, WORKMANSHIP, FINISH, DIMENSIONS, CONSTRUCTION, CERTIFIED MATERIALS AND PROCESSES), BRIDGEWIRE RESISTANCE AND 50 VOLT INSULATION RESISTANCE TEST FOR NSI, NEUTRON AND X-RAY (PRESENCE OF EXPLOSIVE MIX, NO FOREIGN MATERIAL, AND PROPER ASSEMBLY), LEAKAGE (0.000001 CC/SEC HELIUM), AND WEIGHT (PYRO CHARGE AND ALL OTHER CARTRIDGE PARTS WEIGHED PRE- AND POST-ASSEMBLY; TOTALS MUST BE WITHIN SPECIFIED TOLERANCE). CR-26-325-0019-0001, ATP 1001-301, SKD26100102.

CMRSD: GROUND TURNAROUND INCLUDES PYRO INITIATOR CONTROLLER (PIC) RESISTANCE TEST (POST-HOOKUP) (V55AMO.110), PIC GO/NO-GO RESISTANCE TEST (PRE-HOOKUP) (V55AAO.020 AND V55AAO.030), POWER-OFF STRAY VOLTAGE CHECK (V55AMC.010), POWER-ON STRAY VOLTAGE CHECK (V55AAO.040), NSI ELECTRICAL VERIFICATION (V55ANO.010), AND PYRO FIRING TEST (LANDING GEAR) (V55ADO.000).

(C) INSPECTION

RECEIVING INSPECTION

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

CONTAMINATION CONTROL

CONTAMINATION CONTROL AND CORROSION PROTECTION PROCESSES VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

PARTS ARE X-RAYED AND N-RAYED TO VERIFY CORRECT ASSEMBLY AND PRESENCE OF ALL DETAIL PARTS AND EXPLOSIVES. VISUAL INSPECTION, IDENTIFICATION PERFORMED, AND PARTS PROTECTION VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

X-RAYS AND N-RAYS ARE REVIEWED BY VENDOR, DCAS, NASA QUALITY, AND ENGINEERING.

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CRITICAL PROCESSES

SELECTED MANUFACTURING/ASSEMBLY STEPS ARE IDENTIFIED BY NASA QUALITY ASSURANCE AND VERIFIED BY GOVERNMENT INSPECTION AS MANDATORY INSPECTION POINTS (MIPS). ALL MANUFACTURING PROCESSES, SUCH AS WELDING, PLATING, HEAT TREATING, PASSIVATION, AND ANODIZING ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

STORAGE ENVIRONMENT VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

NO FAILURE HISTORY-OF PREMATURE FIRINGS INCLUDING SATURN AND APOLLO.

(E) OPERATIONAL USE

NONE.