

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : P/L RETEN & DEPLOY-MPM PYRO FMEA NO P2-5A-J02-2 REV:08/12/88

ASSEMBLY : MPM SHOULDER MECHANISM			CRIT. FUNC: 1
P/N RI : SKD26100105-301			CRIT. HDW: 1
QUANTITY : 1	VEHICLE	102	103 104
	EFFECTIVITY:	X	X X
	PHASE(S):	PL LO	OO X DO LS

PREPARED BY:		REDUNDANCY SCREEN:	A-	B-	C-
DES R. H. YEE	APPROVED BY:		APPROVED BY (NASA): 9-17-		
REL M. B. MOSKOWITZ	DES <i>R. H. Yee for A.C. Ortega</i>		SSM <i>W.H. Thomas</i>		
QE E. M. GUTIERREZ	REL <i>M.B. Moskowitz</i>		REL <i>W.H. Thomas</i>		
	QE ENG <i>J. Ortega P-23-88</i>		QE <i>W.H. Thomas</i>		

ITEM:  
PRESSURE CARTRIDGE, MANIPULATOR POSITIONING MECHANISM (MPM) SHOULDER, TYPE I GUILLOTINE

FUNCTION:  
PROVIDES PRESSURE OUTPUT FROM EITHER OR BOTH (REDUNDANT) PRESSURE CARTRIDGES TO OPERATE THE GUILLOTINE ASSEMBLY WHICH SEVERS THE ELECTRICAL UMBILICAL AT THE MANIPULATOR POSITIONING MECHANISM (MPM) SHOULDER, IF THE REMOTE MANIPULATOR SYSTEM (RMS) CANNOT BE STOWED.

FAILURE MODE:  
INADVERTENT OPERATION

CAUSE(S):  
ERRONEOUS SIGNAL, THERMAL ENVIRONMENT, SHOCK/VIBRATION

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

(A,B) MANIPULATOR ARM DISABLED; UMBILICAL INADVERTENTLY CUT.

(C) LOSS OF MISSION; RMS CANNOT BE USED. JETTISON OF ARM IS REQUIRED IF IT IS DEPLOYED.

(D) POSSIBLE DAMAGE TO ORBITER IF CONTROL OF RMS IS LOST WHILE DEPLOYED AND ARM CONTACTS VEHICLE. POSSIBLE LOSS OF CREW/VEHICLE DURING RE-ENTRY ALSO, LOSS OF CREW/VEHICLE IF TWO AC MECHANICAL BUSES BECOME DISABLED BECAUSE OF GUILLOTINE FIRING WITHOUT PROPER DEADFACING OF ELECTRICAL CIRCUITS.

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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 OF WIRES FOR PROTECTION AGAINST ELECTROMAGNETIC INTERFERENCE (EMI) AND RADIO FREQUENCY INTERFERENCE (RFI). 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 POTASSIUM PERCHLORATE HIGH-TEMPERATURE FOR PROTECTION AGAINST EXCESSIVE THERMAL ENVIRONMENT (AUTOIGNITION AT APPROXIMATELY +500 DEG F).

(B) TEST

QUALIFICATION TESTS: 8 FOOT DROP, SHOCK, RANDOM VIBRATION, THERMAL CYCLING FROM -130 DEG F TO +270 DEG F, HIGH TEMPERATURE FIRINGS AT +160 DEG F, AUTO-IGNITION TEST VERIFIED NO-FIRE WHEN EXPOSED TO +370 DEG F FOR 1 HOUR (MAXIMUM EXPECTED FLIGHT TEMPERATURE IS +270 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) 44-325-0024, OEA 2889-10-3 AND 44-325-0025, OEA 2956-10/A NSI: SOS INC TR6068 HSTC TR2-323.

DESIGN VERIFICATION TEST: NSI AND WIRING WAS TESTED FOR CLOSE PROXIMITY RFI SUSCEPTIBILITY PRIOR TO APOLLO-SOYUZ TEST PROJECT (ASTP); REF JSC REPORT #EMC-R-PH-002, 2/7.

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 PER SEC HELIUM), AND WEIGHT (PYRO CHARGE AND ALL OTHER CARTRIDGE PARTS WERE WEIGHED PRE- AND POST-ASSEMBLY; TOTALS MUST BE WITHIN SPECIFIED TOLERANCES). (CR) 44-325-0024 AND 44-325-0025; ATP 2956-7/8 AND 2889-7-400 (OEA, INC).

OMRSD: GROUND TURNAROUND INCLUDES PYRO INITIATOR CONTROLLER (PIC) RESISTANCE TEST (POST-HOOKUP), PIC GO/NO-GO RESISTANCE TEST (PRE-HOOKUP), POWER-OFF STRAY VOLTAGE CHECK, POWER-ON STRAY VOLTAGE CHECK, NSI ELECTRICAL VERIFICATION, AND MPM JETTISON VERIFICATION.

(C) INSPECTION

RECEIVING INSPECTION

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

CONTAMINATION CONTROL

CONTAMINATION CONTROL AND CORROSION PROTECTION PROCESSES ARE VERIFIED BY INSPECTION.

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**ASSEMBLY/INSTALLATION**

VISUAL INSPECTION, IDENTIFICATION PERFORMED, AND PARTS PROTECTION ARE VERIFIED BY INSPECTION. SELECTED MANUFACTURING/ASSEMBLY STEPS ARE IDENTIFIED BY NASA QUALITY ASSURANCE AND VERIFIED BY GOVERNMENT INSPECTION AS MANDATORY INSPECTION POINTS (MIPS).

**NONDESTRUCTIVE EVALUATION**

PARTS ARE X-RAYED AND N-RAYED TO VERIFY CORRECT ASSEMBLY AND PRESENCE OF ALL DETAIL PARTS AND EXPLOSIVES. X-RAYS AND N-RAYS ARE REVIEWED BY VENDOR, DCAS, NASA QUALITY, AND ENGINEERING.

**CRITICAL PROCESS**

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

**TESTING**

ATP IS VERIFIED PER PROCEDURE.

**HANDLING/PACKAGING**

HANDLING, PACKAGING AND STORAGE ENVIRONMENTS ARE 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**

IF FAILURE OCCURS WHILE RMS IS DEPLOYED CAPABILITY STILL EXISTS TO JETTISON ARM.