

PAGE: 1

PRINT DATE: 03/02/90

S050250L
ATTACHMENT -
Page 140 of 152

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: MO-AA4-610-X

SUBSYSTEM NAME: STABILIZED PAYLOAD DEPLOYMENT SYSTEM
REVISION : 2 03/01/90

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ SRU :	THRUSTER ASSEMBLY	MC287-0047

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
THRUSTER ASSEMBLY - STABILIZED PAYLOAD DEPLOYMENT SYSTEM
THERE ARE THREE MAJOR PARTS TO THIS DEVICE: THRUSTER, WITH MOVEABLE BUT
SHEAR PIN FIXED PISTON (CFE) AND DUAL PRESSURE CARTRIDGE (CFE)/NSI (GFE)
ASSEMBLIES.

■ REFERENCE DESIGNATORS: V54X0864E
: V54X0844E
: V54X0812E
: V54X0822E
: V54X0845E
: V54X0865E
: V54X0841E
: V54X0823E

■ QUANTITY OF LIKE ITEMS: 2
ONE PER PEDESTAL

■ FUNCTION:
THIS ITEM IS A STANDBY DEVICE WHOSE PURPOSE IS TO ACTUATE THE COUPLER
(V790-544005) AND CAUSE THE PRIMARY/SECONDARY ROTARY ACTUATORS TO
DECOUPLE/COUPLE AND THUS CHANGE THE DRIVING PEDESTAL WHEN REQUIRED. THE
DEVICE OPERATES WITH PISTON MOVEMENT RESPONSE TO PYROTECHNICALLY
GENERATED GAS PRESSURE, REACTING AGAINST THE COUPLER; SEE MO-AA4-605.
THE THRUSTER IS FITTED WITH DUAL NSI/PRESSURE CARTRIDGE ASSEMBLIES TO
ACTUATE A SINGLE PISTON. WHEN THE DEVICE IS SELECTED AND FIRED BY
ELECTRIAL IMPULSE THE SEQUENCE OF EVENTS IS: NSI FIRES, PRESSURE
CARTRIDGE IGNITES, GAS PRESSURE ACCUMULATES, PISTON MOVEMENT IS
INITIATED, PISTON SHEAR PIN IS FRACTURED, PISTON MOVEMENT CONTINUES
FULL STROKE. AT THE END OF TRAVEL, GAS PRESSURE FORCES CAUSE THE PISTON
FLANGE TO DEFORM AND 'LOCK' THE PISTON IN PLACE. THE SPECIFICATION FOR
THE NSI, NASA SLB 25100052/SKB 25100066, INCLUDES A 'NO FIRE' CONDITION
OF ONE AMP AND ONE WATT THROUGH ITS BRIDGEWIRE FOR FIVE MINUTES OVER
THE TEMPERATURE RANGE -265F TO + 165F. NOTE: FOR INADVERTENT OPERATION
DUE TO A STRAY ELECTRICAL IMPULSE TO OCCUR, A SERIES OF EARLIER

PAGE: 2

PRINT DATE: 03/02/90

8050250L
ATTACHMENT -
Page 141 of 152

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: MO-AA4-610-X

FAILURES WOULD BE NECESSARY. TYPICAL OF THESE IS THE NON-CREDIBLE EVENT OF A CIRCUIT BREAKER SHORTING CLOSED FROM AN INTENTIONALLY OPEN CONDITION.

PAGE: 7

PRINT DATE: 03/02/90

S050250L
ATTACHMENT -
Page 146 of 152

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: MO-AA4-610-02

SUBSYSTEM: STABILIZED PAYLOAD DEPLOYMENT SYSTEM REVISION# 2 03/01/90

ITEM NAME: THRUSTER ASSEMBLY

CRITICALITY OF THIS
FAILURE MODE:1R2

■ FAILURE MODE:
LOSS OF OUTPUT, FAILS TO FUNCTION

MISSION PHASE:
00 ON-ORBIT

■ VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS
: 105 ENDEAVOUR

■ CAUSE:
CONTAMINATION, BINDING, JAMMING, BRIDGEWIRE OPEN CIRCUIT, NSI/PRESSURE
CARTRIDGE FAILS TO FUNCTION

■ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

■ REDUNDANCY SCREEN A) N/A
■ B) N/A
■ C) N/A

PASS/FAIL RATIONALE:

- A)
SCREEN A IS N/A BECAUSE THE ITEM IS A PYROTECHNIC DEVICE.
- B)
SCREEN B IS N/A BECAUSE THE ITEM IS A PYROTECHNIC DEVICE.
- C)
SCREEN C IS N/A BECAUSE THE ITEM IS A PYROTECHNIC DEVICE.

- FAILURE EFFECTS -

- (A) SUBSYSTEM:
THRUSTER FAILS TO COUPLE BACK UP PEDESTAL DRIVE OR FAILS TO DECOUPLE
PRIMARY PEDESTAL DRIVE. PRIMARY PEDESTAL ROTARY ACTUATOR CANNOT BE
DISENGAGED. FAILURE OF THE THRUSTER/COUPLER TO FUNCTION IS ALSO FAILURE
TO RECOVER FROM AN EARLIER MALFUNCTION.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: MO-AA4-610-02

- (B) INTERFACING SUBSYSTEM(S):
LOSS OF ABILITY TO SELECTIVELY DEPLOY OR REBERTH THE PAYLOAD.
- (C) MISSION:
LOSS OF MISSION. PAYLOAD CANNOT BE DEPLOYED. THE NEED FOR THIS FUNCTION MEANS THAT PRIMARY PEDESTAL ROTARY ACTUATOR FAILURE HAS OCCURRED. IF THE PRIMARY PEDESTAL CANNOT BE DECOUPLED OR SWITCHING TO THE SECONDARY PEDESTAL CANNOT BE ACHIEVED, THE MISSION WILL BE ABORTED.
- (D) CREW, VEHICLE, AND ELEMENT(S):
POTENTIAL IMPACT ON CREW/VEHICLE DUE TO INABILITY TO DEPLOY PAYLOAD OR CLOSE PAYLOAD BAY DOORS.
- (E) FUNCTIONAL CRITICALITY EFFECTS:
THE THRUSTER IS A BACKUP COMPONENT. REDUNDANCY IS ASSURED BY A DUAL NSI INITIATOR ON EACH THRUSTER ASSEMBLY. FAILURE TO ACTIVATE THE SECONDARY PEDESTAL MAY RESULT IN AN ABORTED MISSION. FAILURE TO DISENGAGE THE PRIMARY PEDESTAL WILL RESULT IN MISSION ABORT IF EVA IS NOT ELECTED.

- DISPOSITION RATIONALE -

- (A) DESIGN:
THE THRUSTER ASSEMBLY IS MADE OF HIGH STRENGTH CORROSION RESISTANT MATERIAL FOR SPACE ENVIRONMENT USE. THE DESIGN SHOWS POSITIVE STRUCTURAL MARGIN BY ANALYSIS AND MEETS 1.4 MINIMUM FACTOR OF SAFETY.
- (B) TEST:
QUALIFICATION TESTS BY THE SUPPLIER HAVE BEEN SUCCESSFULLY COMPLETED. REFERENCE: SPACE ORDNANCE SYSTEMS REPORT QTR 9219 REV. 8, DATED MAY 30, 1989.
OMRSD: GROUND TURNAROUND - FREQUENCY OF CHECKOUT IS MISSION DEPENDENT.
PEDESTAL DRIVE TRANSFER FUNCTIONS S0790A.130
- (C) INSPECTION:
ALL DIMENSIONAL CHARACTERISTICS ARE VERIFIED BY INSPECTION. PROCESSES ARE VERIFIED BY INSPECTION EITHER AT ROCKWELL OR AT SUPPLIER FACILITIES. CLEANLINESS AND MATERIAL CERTIFICATION ARE VERIFIED BY INSPECTION.
- (D) FAILURE HISTORY:
A0585B-010.- During the tests for qualification of the MC325-0047-0003 Thruster, the attached Coupler, V790-544005-002, failed to engage mechanically when the Thruster was fired. Testing was being conducted at the Supplier's (Space Ordnance Systems) facilities and in accordance with the Supplier's document QTP 9151, paragraph 6.4.1 (MC325-0047

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: MO-AA4-510-02

paragraph 4.2.4.1.14). When operated as required by the test, Thruster actuation occurred as planned without the accompanying mechanical engagement of the Coupler. X-ray inspection to assure location of the anomaly was inconclusive. Subsequently, the Coupler was manually tested for performance independent of the Thruster. This testing revealed that the Coupler required excessive force and its linear movement was too short. Failure actually resides in the Coupler (V790-544005) and is the subject of analysis in corrective action report A05957. See also Failure Analysis MO-AA4-605. A05358 closed 890724.

■ (E) OPERATIONAL USE:
NONE.

- APPROVALS -

RELIABILITY ENGINEERING:	W. R. MARLOWE	<i>WRM</i>	<i>3-6-90</i>
DESIGN ENGINEERING	: G. CAMPBELL	<i>G.C.</i>	<i>9/25/90</i>
QUALITY ENGINEERING	: M. F. Mergen	<i>M.F.M.</i>	<i>9/25/90</i>
NASA RELIABILITY	:		
NASA SUBSYSTEM MANAGER	:		
NASA QUALITY ASSURANCE	:		