



CRITICAL ITEMS LIST (CIL)

No. 10-03-02-02R/05

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1
SUBSYSTEM:	Ignition Subsystem 10-03	PART NAME:	Redesigned Barrier-Booster Assembly (1)
ASSEMBLY:	Safety and Arming Device 10-03-02	PART NO.:	(See Table A-3)
FMEA ITEM NO.:	10-03-02-02R Rev N	PHASE(S):	Boost (BT)
CIL REV NO.:	N	QUANTITY:	(See Table A-3)
DATE:	27 Jul 2001	EFFECTIVITY:	(See Table 101-6)
SUPERSEDES PAGE:	416-1ff.	HAZARD REF.:	BI-01
DATED:	31 Jul 2000		
CIL ANALYST:	D. J. McGough		
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 27 July 2001

ENGINEERING: G. A. Ricks 27 July 2001

- 1.0 FAILURE CONDITION: Failure during operation (D)
- 2.0 FAILURE MODE: 2.0 Structural failure of the Barrier-Booster Assembly
- 3.0 FAILURE EFFECTS: Structural failure of housing causes hot gas leakage or Pyrotechnic Basket ejection causing initiator damage resulting in the of loss RSRM, SRB, crew and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
2.1	Nonconforming dimensions	A
2.2	Nonconforming materials	B
2.3	Improper heat treatment (annealing)	C
2.4	Cracks and other material defects	D
2.5	Improper assembly	E
2.6	Improper proof testing	F
2.7	Fatigue	G

5.0 REDUNDANCY SCREENS:

SCREEN A: N/A
 SCREEN B: N/A
 SCREEN C: N/A

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6.0 ITEM DESCRIPTION:

1. The Barrier-Booster Housing is part of the Barrier-Booster Assembly Safety and Arming (S&A) device. Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U77648	Assembly and Closeout, RSRM, KSC	Composite of Various Components		1/motor
1U51701	Basket, Booster	304 CRES	QQ-S-763 Cond A	1/Motor
1U51702	Basket Assembly, Booster			1/Motor
1U77359	S&A Bolt	MP35N or MP159	AMS-5844 or AMS-5842	10/Motor
1U77383	Housing, Barrier-Booster	A286 CRES	AMS-5737	1/Motor
1U77385	Barrier-Booster Assembly S/A Device			1/Motor
1U77386	Barrier-Booster Assembly, S/A Device, Loaded			1/Motor
1U77472	Preload Indicating (PLI) Washer Assembly	Per Supplier Specification Cadmium Plated	Per Supplier Spec. Plating per QQ-P-416, Type II, Class 3	10/Motor
NAS1352CO8LL20	Screw, Cap-Socket Head	CRES	FF-S-86	6/Motor

6.1 CHARACTERISTICS:

1. The RSRM Safety and Arming (S&A) device meets established requirements for performance, design, development, test, manufacture, and acceptance for a two-part electromechanical safety and arming device per engineering.
2. The Space Shuttle S&A Device is designed to prevent inadvertent ignition of the SRB and facilitate desired ignition on demand. It is a two-part electromechanical assembly consisting of an Arming-Monitor Assembly and a Barrier-Booster Assembly.
3. The Arming-Monitor Assembly contains the electric drive motor, switches, reduction gears, clutch, manual safing mechanism safing pin, and visual position indicator. The Barrier-Booster Assembly contains electrical position indicator circuits, a mechanical barrier, two initiators, and a Pyrotechnic Basket Assembly.
4. The Barrier-Booster Assembly is attached to the Barrier-Booster Housing with six cap screws. The Barrier-Booster Housing Assembly is attached to the igniter with ten S&A bolts. Figure 1 shows these attachments.

7.0 FAILURE HISTORY/RELATED EXPERIENCE:

1. Current data on test failures, flight failures, unexplained failures, and other failures during RSRM ground processing activity can be found in the PRACA Database.

8.0 OPERATIONAL USE: N/A

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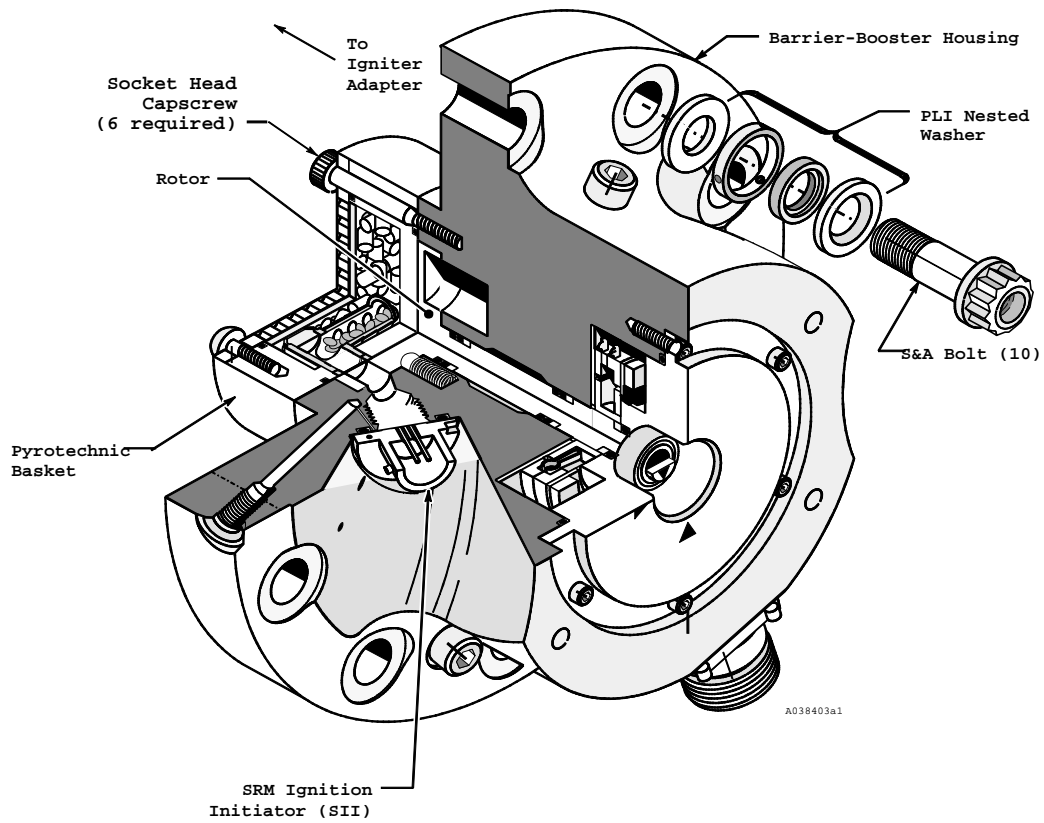


Figure 1. Barrier-Booster Assembly

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9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN FAILURE CAUSES

- | | | |
|---------|-----|---|
| | 1. | Barrier-Booster housing dimensions are per engineering drawings. |
| A | 2. | Critical interface and seal surface inspection criteria are defined by in-process inspection specifications for the Booster Basket assembly and engineering drawings. |
| A | 3. | S&A bolt threads, thread length, and other dimensions are per engineering drawings. |
| A,B,C,D | 4. | Pyrotechnic Basket Assembly screws are self-locking per engineering. |
| A | 5. | The refurbished Barrier-Booster Housing must meet dimension surface criteria per engineering drawings. |
| A | 6. | A stress analysis of the Barrier-Booster Housing to the Maximum Expected Operating Pressure (MEOP) of the ignition system at 2600 psig, including analysis of all threaded holes, is documented in TWR-61222. The design factor of safety is 2.0. |
| A | 7. | Dimensions of the preload indicating washer are per engineering drawings. |
| B,C,D | 8. | S&A bolt material is MP35N or MP159, having tensile ultimate strength and tensile yield strength as required per engineering drawings and material specifications. |
| B,C,D | 9. | The Barrier-Booster housing is CRES, Type A286. |
| B,C | 10. | The Preload Indicating (PLI) washer assembly was qualified for use on TEM-9 per TWR-17669 and FSM-3 per TWR-63347. |
| B,C,D | 11. | The Igniter Redesign Baseline Barrier-Booster is similar to the RSRM Barrier-Booster per TWR-63653. |
| D | 12. | Each S&A bolt is dye penetrant inspected after forming the head and prior to threading. |
| D | 13. | Structural analyses per TWR-61222 and TWR-17265 show a positive margin of safety for the igniter assembly and bolts. |
| E | 14. | The Barrier-Booster Housing is a part of the Barrier-Booster Assembly. The housing is assembled as part of the complete assembly. |
| E | 15. | The Pyrotechnic Basket Assembly is assembled to the loaded Barrier-Booster Assembly that becomes part of the complete S&A device. The Arming-Monitor, when assembled to the Barrier-Booster Assembly completes the S&A Assembly. |
| E | 16. | The S&A device is installed per engineering drawings to the Igniter Adapter Assembly at KSC. The outer flange of the Barrier-Booster Assembly is joined to the Igniter Adapter using the S&A bolts. |
| E | 17. | The leak check port plug in the Barrier-Booster Housing-to-Adapter joint is installed after the leak test at KSC per engineering drawings and specifications. |
| E | 18. | Pyrotechnic Basket Assembly screw torque is per engineering drawings. |

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- E 19. Installation of the S&A device is performed at KSC per engineering drawings and specifications.
- F 20. New and refurbished Barrier-Booster Assemblies are accepted per engineering.
- G 21. Fatigue failure of the Barrier-Booster housing is not considered to be a possibility.
- a. The material is A286 CRES.
 - b. Each Barrier-Booster is designed to be reusable 19 times. Thus a Barrier-Booster will see 40 pressure cycles in its lifetime (20 flights plus 20 acceptable tests). Stress analysis of the barrier booster is at a MEOP of 2600 psi that includes analysis of all threaded holes per TWR-61222. The design factor of safety is 2.0.
- G 22. S&A fasteners are not reused, reducing the probability of failure due to fatigue or the propagation of flaws in the fasteners.
- B,C,D,G 23. S&A bolt material is MP35N or MP159 per engineering drawings. Limits on grain size are specified, and forgings must have substantially uniform macrostructure and grain flow.

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9.2 TEST AND INSPECTION:

FAILURE CAUSES and			
<u>DCN</u>	<u>TESTS</u>	<u>(T)</u>	<u>CIL CODES</u>
		1.	For New Barrier-Booster Housing, verify:
A		a.	Spot face diameter per Military Specification (4 places) ACY130
A		b.	Thickness of flange ACY140
A		c.	Minimum full thread length, all threaded holes in Barrier-Booster Housing ACY081
A		d.	Initiator hole spot face diameter ACY062
A		e.	Initiator hole thread configuration per Military Specification ACY063
A		f.	Through-hole diameter of Military Specification port (2 places) ACY151
A		g.	Leak check ports per Military Specification ACY068
B,C	(T)	h.	Material is A286 CRES ACY027
		2.	For New Barrier-Booster Assembly, verify:
D,E,F	(T)	a.	High-pressure leak tests on unloaded Barrier-Booster Assembly rotor shaft O-rings, rotor in "ARM" position ACZ090
D,E,F	(T)	b.	High-pressure leak tests on unloaded Barrier-Booster Assembly rotor shaft O-rings, rotor in "SAFE" position ACZ092
E		c.	Certificate of Conformance ACZ055
		3.	For Refurbished Barrier-Booster Assembly, verify:
A		a.	Thread depth of Military Specification port (2 places) ACY146
A		b.	Thickness of flange ACY139
A		c.	Minimum full thread length, all threaded holes in Barrier-Booster Housing ACY082
E		d.	Certificate of Conformance ACZ054A
D,E,F	(T)	e.	High-pressure leak tests on unloaded Barrier-Booster Assembly rotor shaft O-rings, rotor in "ARM" position ACZ090A
D,E,F	(T)	f.	High-pressure leak tests on unloaded Barrier-Booster Assembly rotor shaft O-rings, rotor in "SAFE" position ACZ092A
		4.	For New Bolt, S&A Device, verify:
A,B,C,D		a.	Supplier Certificate of Conformance is complete and acceptable RAA060
A		b.	Bolt length RAA063
A		c.	Grip length RAA064
A		d.	Grip diameter RAA065
A		e.	Fillet radius RAA066
A,D		f.	Threads per engineering RAA067
A		g.	Perpendicularity of bolt axis-to-bolt shoulder RAA068
A		h.	Head diameter RAA069
A		i.	Dimension "F" RAA070
B,C,D	(T)	j.	Material - tensile ultimate strength, tensile yield strength, and alloy RAA058
D		k.	No surface discontinuities detected by dye penetrant inspection RAA059
D		l.	No shipping or handling damage RAA093
		5.	For New Pyrotechnic Basket Assembly screw, verify:
A		a.	Length (lot-sample) DAA034
A		b.	Threads (lot-sample) DAA035
A		c.	Diameter (lot-sample) DAA037
A		d.	Certificate of Conformance complete and acceptable DAA041
B,C	(T)	e.	Material is A286 CRES and heat treatment DAA038

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| D | (T) | f. Screw is free of material defects | |
| | | 6. For New Preload Indicating Washer Assembly verify: | |
| A,E | | a. Lot acceptance test is complete and acceptable | RAA122 |
| A | | b. Countersink angle | RAA123 |
| A | | c. Thickness of outer center ring | RAA124 |
| A | | d. Thickness of crush ring | RAA125 |
| A,E | | e. Thickness of unloaded, washer assembly | AJX015 |
| B,C,D | | f. Supplier Certificate of Conformance is complete and acceptable | AJX001 |
| D | | g. No shipping or handling damage | AJX013 |
| | | 7. For New Barrier-Booster Assembly, Loaded, verify: | |
| E | | a. Proper torque applied to Pyrotechnic Basket Assembly screws | ADA181 |
| | | 8. KSC verifies: | |
| E | | a. Bolts fastening the igniter S&A device to the Igniter Adapter are torqued in an established pattern to the specified torque per OMRSD File V, Vol I, B47GEN.130. | OMD039 |