CRITICAL ITEMS LIST (CIL)

No. 10-03-04-03/01

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1
SUBSYSTEM:	Ignition Subsystem 10-03	PART NAME:	Igniter Nozzle Insert (1)
ASSEMBLY:	Igniter Assembly 10-03-04	PART NO.:	(See Table A-3)
FMEA ITEM NO.:	10-03-04-03 Rev M	PHASE(S):	Boost (BT)
CIL REV NO.:	M	QUANTITY:	(See Table A-3)
DATE:	31 Jul 2000	EFFECTIVITY:	(See Table 101-6)
SUPERSEDES PAGE:	429-1ff.	HAZARD REF.:	BI-01
DATED:	30 Jul 1999		
CIL ANALYST:	D. J. McGough		
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 31 Jul 2000

ENGINEERING: D. W. Sylte 31 Jul 2000

1.0 FAILURE CONDITION: Failure during operation (D)

2.0 FAILURE MODE: 1.0 Structural failure

3.0 FAILURE EFFECTS: Igniter nozzle insert failure results in delay of ignition and/or alteration of pressure/time trace. Igniter nozzle insert debris exits the RSRM and damages the nozzle assembly resulting in uncontrollable thrust imbalance between paired SRB causing loss of RSRM, SRB, crew, and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	Nonconforming dimensions	A
1.2	Nonconforming materials	B
1.3	Improper cure	C
1.4	Improper assembly of the igniter nozzle insert-to-igniter chamber joint	D
1.5	Improper ply orientation	E

5.0 REDUNDANCY SCREENS:

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

6.0 ITEM DESCRIPTION: Igniter nozzle insert (Figures 1 and 2). Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U78412	Insert, Igniter	Silica Cloth Phenolic	STW5-2652	1/Motor
1U77538	Chamber, Igniter	D6AC Steel	STW4-2706	1/Motor
	Silica Cloth		STW5-2652	A/R

6.1 CHARACTERISTICS:

1. The Igniter Nozzle Insert is a thermally-resistant structure that contributes to control of pressure rise within the igniter and provides proper distribution of igniter hot gases for RSRM ignition. A laminate billet is molded from silica-cloth patterns, pre-impregnated with phenolic resin and thermally cured. The Igniter Nozzle Insert is bonded to the Igniter Chamber with adhesive. The Igniter Nozzle Insert is machined from the cured laminate billet to engineering requirements.

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

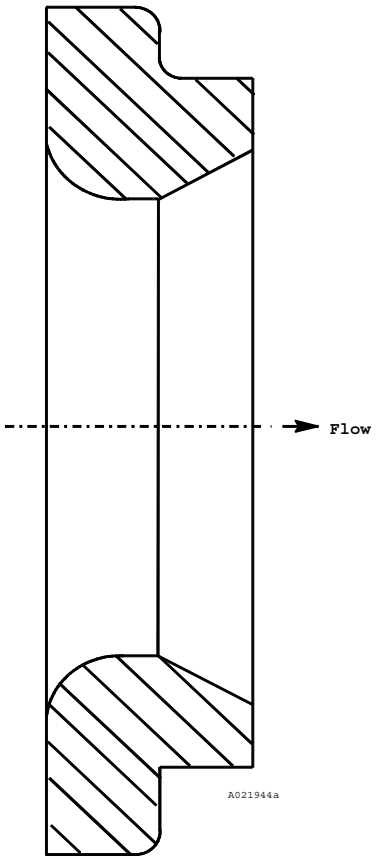

Figure 1. Igniter Nozzle Insert

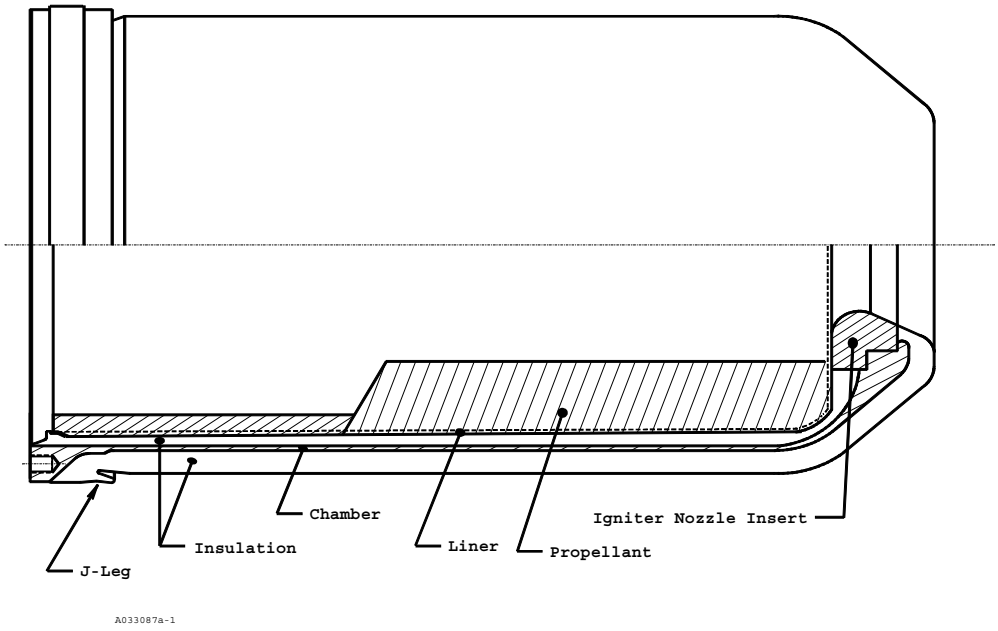

Figure 2. Loaded Chamber Assembly

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN		FAILURE CAUSES
	A	1. Igniter Insert dimensions are per engineering drawings.
	A	2. New Igniter Chamber dimensions are established by engineering drawings.
	A	3. The Igniter nozzle Insert has positive structural margins of safety with a 1.4 ultimate factor of safety per TWR-75468.
	B	4. Silica-cloth phenolic patterns are woven, silica-cloth reinforced and pre-impregnated with a phenolic resin per engineering drawings.
	B	5. Materials used in Igniter Inserts are analyzed and qualified for use by a series of live firings per TWR-18764-03.
	B	6. The integrity of the Igniter Nozzle Insert was determined by lot sample destruct tests.
	B	7. Criteria for material properties of the insert are determined by TWR-75469.
	B	8. Silica cloth phenolic patterns have cured material properties per engineering.
	C	9. The Igniter Nozzle Insert billet is cured at controlled time, temperature and pressure using strict process procedures per shop planning.
	C	10. Process environments and contamination are controlled per shop planning.
	D	11. The insert is bonded into the metal igniter chamber per engineering drawing.
	E	12. The structural integrity of the igniter insert is related to the ply orientation. The structural properties vary with ply orientation that is controlled by clocking circular plies laid up in a 90 degree ply angle to the centerline of the billet mold.
	D	13. The igniter nozzle insert-to-igniter chamber joint tolerances are controlled per engineering drawing.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS	(T)			CIL CODES
			1.	For New Silica-Cloth Phenolic verify:	
B,C		(T)	a.	Interlaminar shear strength--cured	AMN027
B		(T)	b.	Volatile content--uncured	AMN027A
B		(T)	c.	Dry resin solids--uncured	AMN027B
B		(T)	d.	Silica filler content--uncured	AMN027C
B		(T)	e.	Cloth content--uncured	AMN027D
B		(T)	f.	Resin flow--uncured	AMN027E
B,C		(T)	g.	Density--cured	AMN027F
B,C		(T)	h.	Resin content--cured	AMN027G
B,C		(T)	i.	Compressive strength--cured	AMN027H
			2.	For Retest Silica-Cloth Phenolic verify:	
B		(T)	a.	Resin flow	AMO020
B		(T)	b.	Volatile content	AMO028
			3.	For New Igniter Insert, verify:	
A			a.	Throat diameter	ACG000
A			b.	All dimensions throat inlet radius	ACG000A
B,C			c.	Solvent wipe technique to detect surface cracks, de-laminations, chips, flakes, and voids on the surface after machining	ACG001
C			d.	Acceptable contamination	ACG004
B,C		(T)	e.	Density destruct tests	ACG007
C			f.	Mold cleanliness	ACG011
C			g.	Proper cure time	ACG013
B,C,E			h.	Radiograph for discontinuities, inclusions, and voids after machining	ACG016
B,C,E		(T)	i.	Residual volatile destruct tests	ACG022
B,C,E		(T)	j.	Resin content destruct tests	ACG024
C			k.	Work area cleanliness	ACG039
C			l.	Workmanship	ACG040
C			m.	Silica-Cloth patterns preheated prior to lay up	AMT024
C			n.	Proper pressure for total cure time	AMT025
C			o.	Proper temperature for total cure time	AMT026
D,E			p.	Install correct number of Silica-Cloth patterns	AMT500
D,E			q.	Clocking of patterns in mold	DJM015
C,D,E		(T)	r.	Interlaminar test	DJM016
A			s.	Overall height of insert	DJM017
A			t.	Height of insert step	DJM018
			4.	For New Igniter Chamber, verify:	
A			a.	8.550 dimension of view "B"	AEC001
A			b.	11.100 dimension of view "B"	AEC001A
A			c.	9.250 dimension of view "B"	AEC001B
A			d.	Circular run out in view "B"	AEC001C
A,D			e.	1.20 dimension of view “B”	AEC001D
A			f.	.510 dimension of view "B"	AEC001E
A			g.	Vendor records are complete and acceptable	AEC280