CRITICAL ITEMS LIST (CIL)

No. 10-02-05-01/01

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1
SUBSYSTEM:	Nozzle Subsystem 10-02	PART NAME:	Separation Ring Assembly (Liner-Shaped Charge) (1)
ASSEMBLY:	Separation Ring Assembly 10-02-05		
FMEA ITEM NO.:	10-02-05-01 Rev N	PART NO:	(See Section 6.0)
CIL REV NO.:	N	PHASE(S):	Boost (BT)
DATE:	27 Jul 2001	QUANTITY:	(See Section 6.0)
SUPERSEDES PAGE:	349-1ff.	EFFECTIVITY:	(See Table 101-6)
DATED:	31 Jul 2000	HAZARD REF.:	BN-01
CIL ANALYST:	R. E. L. Hamilton		
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 27 Jul 2001

ENGINEERING: G. A. Ricks 27 Jul 2001

1.0 FAILURE CONDITION: Premature operation (A)

2.0 FAILURE MODE: 1.0 Premature operation

3.0 FAILURE EFFECTS: Loss of aft portion of Aft Exit Cone causing thrust imbalance between SRBs, and loss of RSRM, SRB, crew, and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	High temperature	
1.1.1	Loss of blast shield or cork Thermal Protection System (TPS)	A
1.2	Shock/vibration	B
1.3	Increased sensitivity due to contamination during assembly, handling, transportation, storage, and installation	C

5.0 REDUNDANCY SCREENS:

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

6.0 DESCRIPTION:

1. Separation Ring Assembly (Linear-Shaped Charge) is part of the Exit Cone Assembly--Nozzle, Aft (Figure 1). Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U77653	Exit Cone Assembly--Nozzle, Aft			1/motor
1U52700	Ring Segment, Nozzle Severance			4/motor
	Adhesive, Epoxy, Aramid-Filled	Epoxy Resin with Aramid Pulp, Silicon Dioxide	STW5-9066	A/R
	Epoxy Resin Adhesive, Non-Asbestos, Structural Bonding	Epoxy Resin And Amine Curing Agent	STW4-3218	A/R

6.1 CHARACTERISTICS:

1. The Linear-Shaped Charge (LSC) is located on the aft exit cone just aft of the compliance ring. Each motor uses four LSC ring segments, one of which has a NSD mounted near its center whereby the severance charge is initiated. The LSC is composed of an outer shell made up of copper and an inner core made of cyclonite (RDX). The LSC is held in place using a silicone rubber retainer, loop clamp, and adhesive. The function of the LSC is to sever a portion of the aft exit cone following completion of the boost phase and prior to SRB water impact.

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

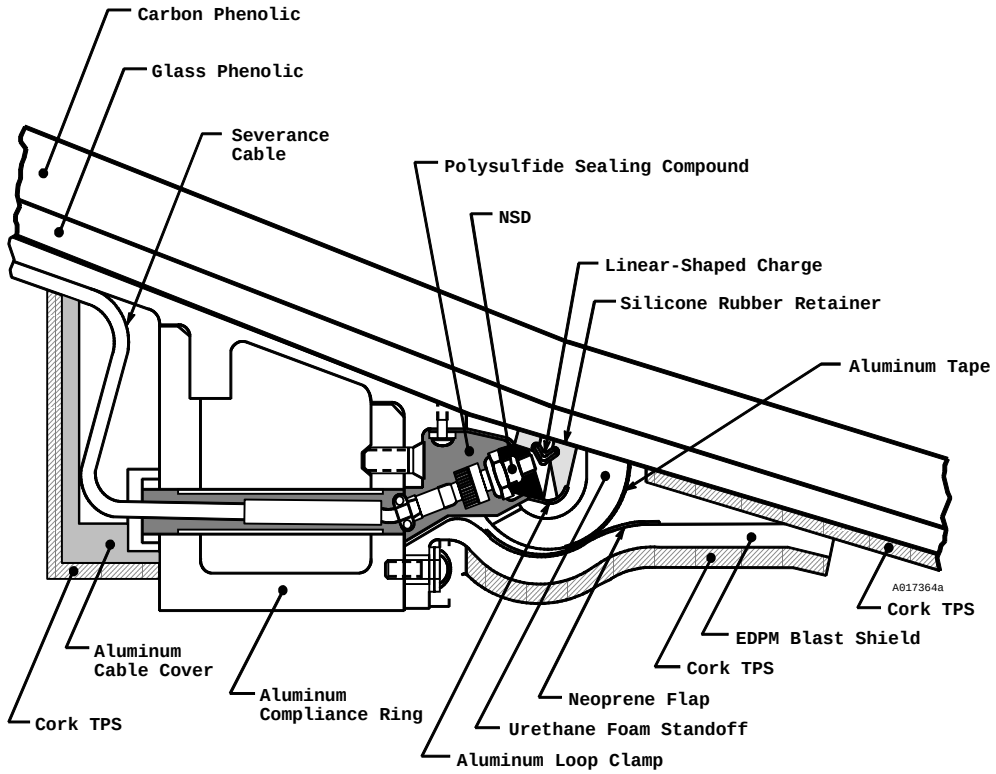

Figure 1. Linear-Shaped Charge

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN	FAILURE CAUSES	
A	1.	The Linear Shaped Charge (LSC) is designed to withstand a temperature of 350°F for three minutes and was tested for verification per TWR-12116.
A	2.	The LSC is installed within layers of insulation to insure that the LSC has a positive thermal margin of safety per TWR-17221 and TWR-12835.
A	3.	A blast shield is installed over the LSC per engineering drawings. The blast shield not only acts to shield the aft skirt but also aids when dealing with high temperatures per TWR-17221.
A	4.	The blast shield is bolted to the compliance ring per engineering drawings.
A	5.	Cork insulation is bonded to the blast shield with sealant per engineering drawings.
B	6.	The LSC is designed to withstand shock and vibration. A compressive load on the end seals with superimposed transportation, vehicle dynamics, and flight random vibrations per engineering do not constitute any safety hazard per TWR-13230.
B	7.	Testing was conducted using ring segment specimens per engineering, including exposure to transportation, acoustic, and flight vibration environments per TWR-13230.
B	8.	The shipping container is designed and constructed to meet the requirements of Tariff 6-D, Code of Federal Regulations 49, or Air Force Manual 71-4, depending upon the mode of transportation per engineering.
C	9.	The supplier maintains traceability of all changes to the current baseline, parts, materials, and processes as described per engineering.
C	10.	Hermetically sealed end devices prevent the entry of contamination per engineering.
C	11.	The severance ring segment is designed to have a designated useful life per engineering.
C	12.	The nozzle assembly is shipped in the aft segment. Railcar transportation shock and vibration levels are monitored per engineering and applicable loads are derived by analysis. Monitoring records are evaluated by Thiokol to verify shock and vibration levels per MSFC Specification SE-019-049-2H were not exceeded. TWR-16975 documents compliance of the nozzle with environments per MSFC Specifications.
C	13.	Analysis is conducted by Thiokol engineering to assess vibration and shock load response of the RSRM nozzle during transportation and handling to assembly and launch sites per TWR-16975.
	14.	For lot acceptance the following tests are performed on the LSC per engineering:
A	a.	High-temperature test
B	b.	Vehicle dynamics
B	c.	Acoustic environment
B	d.	Compressive load capability

B	e.	Flight random vibration
B	f.	Transportation vibration
B	g.	Parachute deployment shock
C	h.	Leak test
C	i.	Destructive lot test
C	j.	Packaged test samples
C	k.	X-ray and N-ray examination

A 15. Sealant is a temperature-resistant, Aramid-filled epoxy based adhesive that was qualified for use per TWR-66628.

A,B 16. The LSC is designed to withstand shock and vibration from vehicle dynamics and flight random vibrations. These flight conditions, along with worst case generic/Performance Enhancement Aero/Plume Heating environments, were analyzed. The LSC and components that interface with it have positive margins of safety and meet CEI requirements per TWR-66825-1.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS (T)			CIL CODES
		1.	For New Ring Segment Nozzle Severance verify:	
	A B C (T)	a.	Lot acceptance test data is acceptable	ADD008
	C (T)	b.	No leakage exist per requirements	ADD006
	C	c.	LSC conformance to drawing	ADD009
	C	d.	No shipping or handling damage exists	ADD015
		2.	For New Exit Cone Assembly--Nozzle, Aft verify:	
	A	a.	A complete uniform covering of insulation cork	AGH009D
	A	b.	All foam standoffs are installed over the LSC and detonator	AGH009B
	A	c.	Four LSC ring segments are installed on the aft exit cone and are acceptable	AGH015
	A	d.	Flap and blast shield are installed correctly	AGH009C
	A	e.	Blast shield screws are torqued as required	AGH001
	A	f.	Blast shield is bonded to aft exit cone assembly using adhesive	AGH004
	A	g.	Cork insulation is bonded to the blast shield using sealant	AGH008
		3.	For New Adhesive, Epoxy. Aramid-filled, verify:	
	A	a.	Tensile adhesion for each raw material lot combination	LHA301
		4.	KSC verifies:	
595	A	a.	Cork over the blast shield is in place per OMRSD File V, Vol I, B47NZ0.020	OMD047