

CRITICAL ITEMS LIST (CIL)

No. 10-01-02-01R/01

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1
SUBSYSTEM:	Case Subsystem 10-01	PART NAME:	Propellant (1)
ASSEMBLY:	Propellant, Liner, Insulation, Inhibitor 10-01-02	PART NO.:	(See Section 6.0)
FMEA ITEM NO.:	10-01-02-01R Rev M	PHASE(S):	Prelaunch (PL)
CIL REV NO.:	M	QUANTITY:	(See Section 6.0)
DATE:	31 Jul 2000	EFFECTIVITY:	(See Table 101-6)
SUPERSEDES PAGE:	210-1ff.	HAZARD REF:	FC-01
DATED:	30 Jul 1999		
CIL ANALYST:	F. Duersch		
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 31 Jul 2000

ENGINEERING: S. R. Graves 31 Jul 2000

- 1.0 FAILURE CONDITION: Premature operation (A)
- 2.0 FAILURE MODE: 1.0 Premature propellant ignition
- 3.0 FAILURE EFFECTS: Ignition of one RSRM could cause loss of RSRM, SRB, crew, and vehicle
- 4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	Static discharge to propellant system elements, causing premature ignition	A

5.0 REDUNDANCY SCREENS:

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

6.0 ITEM DESCRIPTION:

1. Propellant used in the RSRM is an 86 percent solid-loaded, aluminized formulation using PBAN and epoxy as the binder. The propellant formulation is designated as TP-H1148. A cylindrical, Center Perforated (CP) grain design is employed in each of four separately-cast segments except that the forward segment CP transitions into an eleven-point star geometry for approximately half of its length. See Figure 1. The four cast segments are identified per Thiokol drawings as Loaded segment assemblies forward, center (2 each), and aft.
2. Each lot of propellant raw materials is standardized per engineering to meet burn rate and mechanical properties requirements. Thrust balancing is achieved by matched-pair casting and segment pairs are acceptable based on calculated burn rates from 5-inch CP evaluation motor firings. Materials are listed in Table 1.

CRITICAL ITEMS LISTS (CILS)

No. 10-01-02-01R/01

DATE: 31 Jul 2000  
SUPERSEDES PAGE: 210-1ff.  
DATED: 30 Jul 1999

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
	Propellant	TP-H1148	STW5-3343	1,106,880 LB/Motor
		Terpolymer (PBAN)	STW4-2600	Per Mix Ratio
		Epoxy Resin	STW4-2601	Per Mix Ratio
		Ammonium Perchlorate	STW4-2602	Per Mix Ratio
		Aluminum Powder	STW4-2603	Per Mix Ratio
		Ferric Oxide	STW4-2604	Per Mix Ratio (nominal)

The above materials make up TP-H1148 propellant that is used in the following parts:

1U76674	Segment Assembly, Loaded, Forward	Various	1 ea/Motor
1U76675	Segment Assembly, Loaded, Center	Various	2 ea/Motor
1U77504	Segment Assembly, Loaded, Aft	Various	1 ea/Motor

6.1 CHARACTERISTICS:

- |   |                    |
|---|--------------------|
| 1. Burn rate at 625 psia and 60°F               | 0.368 psi          |
| 2. Maximum stress                               | 110 psi minimum    |
| 3. Strain at maximum stress                     | 30 percent minimum |
| 4. Autoignition temperature (copper block test) | 489°F              |

7.0 FAILURE HISTORY/RELATED EXPERIENCE:

- 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

CRITICAL ITEMS LISTS (CILS)

No. 10-01-02-01R/01

DATE:  
SUPERSEDES PAGE:  
DATED:

31 Jul 2000  
210-1ff.  
30 Jul 1999

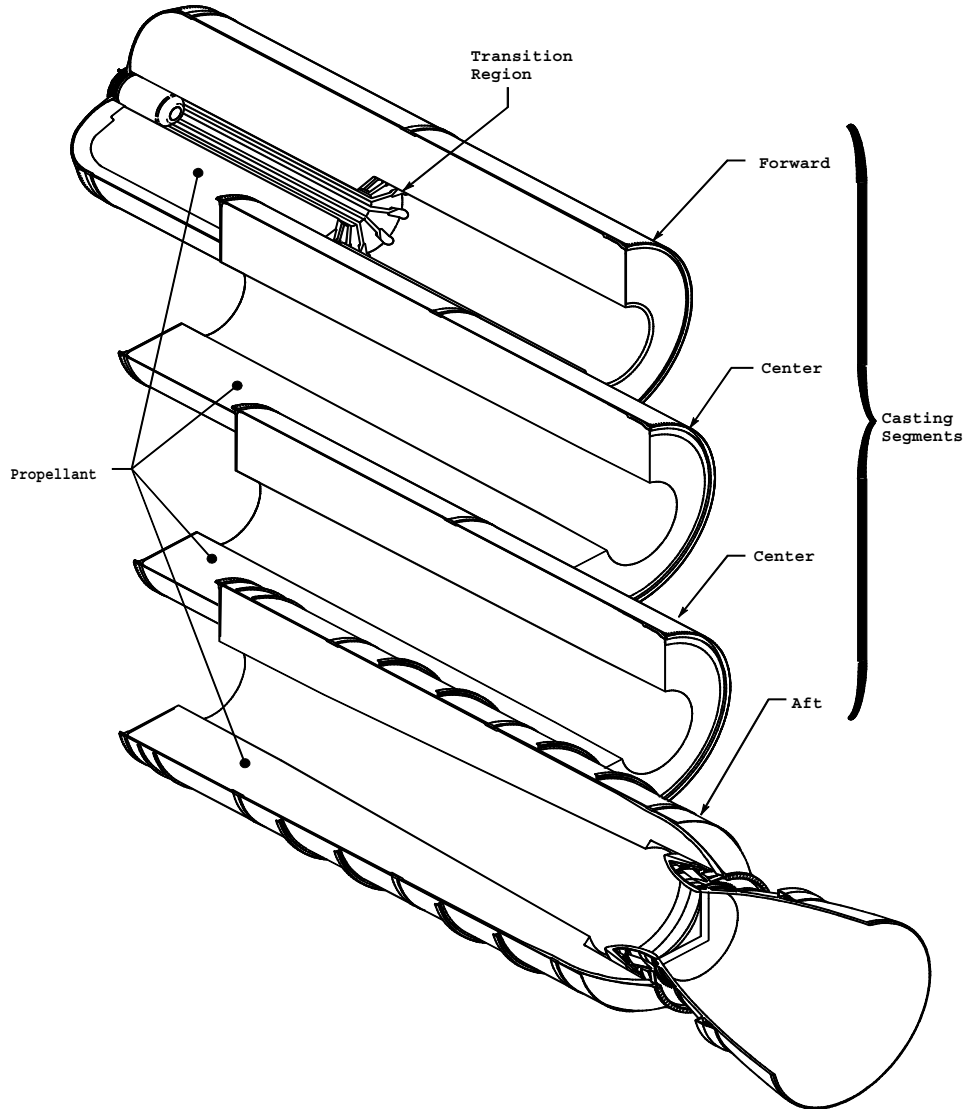


Figure 1. RSRM Propellant Configuration

A038657aDDB

CRITICAL ITEMS LISTS (CILS)

No. 10-01-02-01R/01

DATE: 31 Jul 2000  
SUPERSEDES PAGE: 210-1ff.  
DATED: 30 Jul 1999

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN FAILURE CAUSES

- |   |   |
|---|---|
| A | 1. Analyses were performed to determine the sensitivity of TP-H1148 propellant to ignition due to Electrostatic Discharge (ESD). It was determined that TP-H1148 is sensitive to ESD only as far as structural considerations (cracking) are concerned and then only at temperature extremes (-10 <sup>0</sup> F). In no case during the analyses was ignition of the propellant experienced per TWR-16512. |
| A | 2. During repair operations, protective clothing and proper grounding are provided per shop planning to preclude electrostatic buildup within the propellant grain.   |
| A | 3. During all handling operations at Thiokol, RSRM segments are grounded per shop planning to preclude ESD problems.  |
| A | 4. Case segments, when assembled, have grounding straps from case segment-to-segment to drain electrostatic energy and lightning through grounding on the mobile launch platform per engineering.   |
| A | 5. Grounding straps connected to the systems tunnel floor plates are bonded to the case to provide a path for ESD and lightning dissipation.  |

CRITICAL ITEMS LISTS (CILS)

No. 10-01-02-01R/01

DATE: 31 Jul 2000  
SUPERSEDES PAGE: 210-1ff.  
DATED: 30 Jul 1999

9.2 TEST AND INSPECTION:

FAILURE CAUSES and			
<u>DCN</u>	<u>TESTS</u>	<u>(T)</u>	<u>CIL CODE</u>
	1.	For New Segment, Rocket Motor (Forward, Forward Center, Aft Center, and Aft), verify:	
A	(T)	a. Electrical bond resistance of each ground strap	AET010,AEU010,AEW010,AGA010
	2.	KSC verifies:	
A	a.	No processing takes place on or around RSRM propellant when humidity falls below 10 percent per OMRSD, File V, Vol I, B47GEN.040	OMD030
A	b.	Acceptable electrostatic levels per OMRSD, File V, Vol I, B47GEN.110	OMD035
A	c.	Acceptable proper grounding per OMRSD, File V, Vol I, B47GEN.120	OMD036