ATK
ALLIANT TECHSYSTEMS
THIOKOL PROPULSION

CRITICAL ITEMS LIST (CIL)

No. 10-03-04-06/03

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1
SUBSYSTEM:	Ignition Subsystem 10-03	PART NAME:	Igniter Propellant (1)
ASSEMBLY:	Igniter Assembly 10-03-04	PART NO.:	(See Table A-3)
FMEA ITEM NO.:	10-03-04-06 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:	436-1ff.	HAZARD REF.:	BI-03
DATED:	31 Jul 2000		
CIL ANALYST:	F. Duersch		
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 Ignition delay or failure to provide energy in the required time frame

3.0 FAILURE EFFECTS: Thrust imbalance between the two RSRMs or thrust imbalance between the two SRBs could cause loss of RSRM, SRB, crew, and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
2.1	Improper propellant burn rate	
2.1.1	Improper formulation	A
2.1.2	Improper mixing of materials	B
2.1.3	Improper cure	C
2.1.4	Nonconforming raw materials	D
2.1.5	Nonconforming propellant density	E
2.1.6	Contamination	F
2.2	Igniter propellant weight is out of conformance	G
2.3	Propellant cracks, flaws, or voids	H
2.4	Moisture/high humidity	
2.4.1	Moisture/high humidity during propellant processing	I
2.4.2	Moisture/high humidity intrusion after assembly of loaded Igniter Chamber-to-Igniter Adapter	J
2.5	Storage degradation	K
2.6	Improper casting of propellant	L

2.7	Improper grain configuration	M
2.8	Igniters not cast from same batch	N
2.9	Ammonium Perchlorate (AP) leaching	O

5.0 REDUNDANCY SCREENS:

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

6.0 ITEM DESCRIPTION:

1. Igniter propellant is designated TP-H1178 and is composed of bimodal ammonium perchlorate (AP) oxidizer, spherical aluminum, ferric oxide, polybutadiene acrylic acid acrylonitrile (HB) polymer binder, and Epoxy Curing Agent (ECA).

2. The igniter casting process is designed to ensure the propellant grain configuration is free of foreign materials and objects. The igniter propellant grain configuration is a 40-point star web grain design. Star peaks and valleys are rounded to reduce the likelihood of stress discontinuities (Figure 1). After casting is completed and core removed, the igniter is inspected for cracks or voids.

3. The igniter is up to 90 percent of peak output by 0.045 seconds from time zero. The flame from the igniter exhausts onto the forward star of the forward segment and thus ignites this surface initially. Ignition of the rest of the propellant surface occurs very rapidly. RSRM internal pressure increases rapidly and achieves lift off thrust in less than 0.3 seconds.

4. Igniter propellant is protected from atmospheric exposure after propellant cure by installation of an igniter environmental seal. The igniter environmental seal is a 0.1-inch thick disc of cured asbestos and silicon dioxide-filled acrylonitrile butadiene rubber (NBR). The disc is bonded over the igniter nozzle opening with an asbestos and thixotropic agent-filled epoxy sealant. The seal protects the loaded igniter propellant from degradation due to moisture or humidity. The igniter is further protected from moisture and humidity by the inner gasket, packing with retainer, initiator-nozzle port environmental seals, and Barrier-Booster seals. An igniter protective cover is required to seal the Safety and Arming (S&A) device attachment flange on the igniter adapter. The protective cover is temporary until the S&A device is installed at KSC. The cover is made of aluminum and has an O-ring seal. Materials are listed in Table 1.

5. Each lot of propellant raw materials is standardized per engineering to meet burn rate and mechanical properties requirements. Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
	Propellant	TP-H1178	STW5-2833	A/R
		Terpolymer (PBAN)	STW4-2600	A/R
		Liquid Epoxy Resin	STW4-2601	A/R
		Ammonium Perchlorate with Conditioner	STW4-2602	A/R
		Ferric Oxide	STW4-2604	A/R
		Aluminum, Spherical	STW4-2832	A/R

The above materials make up TP-H1178 propellant that is used in the following parts:

1U77858	Igniter Initiator Chamber, Loaded		Various	1/motor
1U77372	Igniter Chamber, Loaded		Various	1/motor
1U76674	Forward Segment, Loaded		Various	1/motor
		Sealant, Liquid Epoxy Asbestos Float Filled	STW5-2678	A/R

6.1 CHARACTERISTICS:

1. Igniter propellant is composed of bimodal ammonium perchlorate oxidizer, spherical aluminum, ferric oxide, polybutadiene acrylic acid- acrylonitrile (HB) polymer binder, and Epoxy Curing Agent (ECA). The propellant grain configuration in the igniter is a 40-point star and web grain design. Star peaks and valleys are rounded to reduce the likelihood of stress discontinuities (Figure 1). The igniter is up to 90 percent of peak thrust output by 0.045 seconds from time zero. The flame from the igniter exhausts onto the forward star of the forward segment and thus ignites this surface initially. Ignition of the remaining propellant surface occurs very rapidly. RSRM internal pressure increases rapidly and achieves lift-off thrust in less than 0.3 seconds.

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

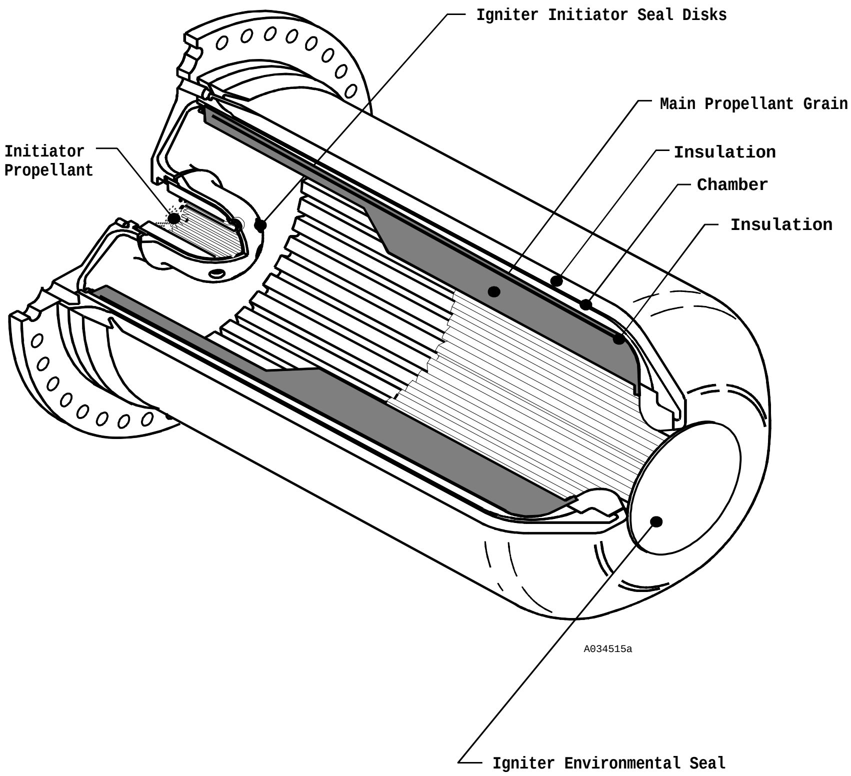

Figure 1. Igniter and Initiator Propellant Grain Configuration

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN	FAILURE CAUSES	
A,B,C,E,F	1.	Propellant mix proportions and mechanical property requirements of Igniter/Initiator Propellant (TP-H1178) are per engineering.
A,B,C,E,F	2.	Fine adjustment for percent of ground AP, (HB) polymer, and ECA proportions are determined by standardization per engineering to meet burn rate requirements and propellant mechanical properties. Average burn rate of 5-inch CP motors is used to adjust percent ground oxidizer content that adjusts the burn rate. Liquid Strand Burn Rate (LSBR) of standardization batches is used to determine the target burn rate of production propellant batches. Tests on loaf samples are processed to determine propellant mechanical properties. Propellant standardization is the process of determining the percentages of raw materials that will produce desired propellant physical and ballistic properties of production batches per engineering.
A,B,C,E,F,G	3.	Raw material weighing is per engineering drawings and specifications.
A,B,C,E,F	4.	Propellant processing, mixing, and cure requirements are per engineering and shop planning.
A,B,C,E,F	5.	Contamination control requirements and procedures are defined per TWR-16564. During propellant processing, temperature, moisture, humidity, and contamination are controlled per engineering drawings and shop planning.
A,B,C,E,F	6.	The loaded Igniter Chamber was redesigned. Performance was analyzed and compared to target and historical values. It was concluded that all performance requirements were met per TWR-61801.
A,B,C,D,E,F	7.	Design Engineering reviews, analyzes, and publishes results of 5-inch CP and Lot Acceptance Tests (LAT) per engineering.
A,B,C,E,F, G,I,J,M,O	8.	The redesigned Baseline Igniter changed the propellant because of the insulation change. Core configuration and nozzle throat diameter was not changed. The slight drop in propellant weight will only cause a slight drop in performance that will not cause any change in main motor ignition per TWR-61801.
D	9.	Raw material conformance specifications, materials property requirements, and means of verification for TP-H1178 propellant are established per engineering for the following materials: a. Terpolymer (HB) b. Epoxy resin c. Ammonium Perchlorate d. Aluminum, spherical e. Ferric Oxide, Type I
G	10.	Final weight of igniter propellant is per engineering drawings and shop planning.
H	11.	Structural analysis of igniter propellant grain was performed to verify acceptable factors of safety and that the grain meets design requirements for thermal, pressure, transportation and handling, and dynamic loading per TWR-17195.
H	12.	Igniter acceptance criteria for cracks, voids, inclusions, bond separations, and

foreign objects are per engineering. The igniter propellant grain receives radiographic and visual inspections for defects and contamination per engineering.

H — 13. Igniter loaded chambers are radiographically inspected perpendicular to the centerline in 12 views, 30 degrees apart to determine propellant subsurface characteristics per TWR-11345.

H — 14. The Igniter Assembly is shipped installed in the forward segment. Railcar transportation shock and vibration levels for the forward segment are monitored per engineering and igniter propellant loads are derived per analysis. Monitoring records are evaluated by Thiokol to verify shock and vibration levels defined per MSFC specifications were not exceeded.

I,J,O — 15. The igniter is protected at the aft end by an environmental seal disc of cured asbestos and silicon dioxide-filled NBR. The disc is bonded over the igniter nozzle opening with an adhesive. The seal protects the loaded igniter from propellant degradation due to exposure to moisture and humidity. The initiator and igniter are further protected from moisture and humidity at the forward end by the inner gasket, packing with retainer, initiator nozzle port environmental seals, and Barrier-Booster seals per engineering drawings.

I,J,O — 16. The igniter environmental seal is cured NBR which conforms to material properties per engineering. The seal is bonded to the igniter with an asbestos float-filled liquid epoxy resin sealant that contains a polyamide curing agent and a thixotropic agent (micro-fine silicon dioxide). The environmental seal protects loaded igniter and initiator propellant from degradation due to exposure to moisture and humidity per engineering drawings. An igniter protective cover is required to seal the S&A attachment flange on the igniter adapter. The protective cover is temporary until the S&A device is installed at KSC. The cover is made of aluminum and has an O-ring seal per engineering drawings.

I,J,O — 17. Delta qualification temperature and humidity testing of loaded igniter assemblies with environmental seals in place showed no propellant performance degradation per TWR-12310 and TWR-12323.

I,J,O — 18. Moisture, high humidity, and temperature conditions are maintained within limits during AP storage and during propellant mixing operations per engineering drawings and shop planning.

I,J,O — 19. Sealant raw material specifications are defined per engineering for the following materials:

a. Asbestos pulp floats
b. Liquid epoxy resin
c. Polyamide curing agent
d. Microfine silicon dioxide

I,J,O — 20. All sealing surfaces of Igniter Assembly components conform to engineering drawings and specifications or they are reworked to conformity per Standard Repair.

K — 21. Data obtained from igniters that were aged up to 64 months prior to testing indicated no detectable performance change from aging per TWR-13003 and TWR-14726.

K — 22. Propellant raw materials have storage life from date of manufacture when stored at warehouse-ambient conditions in unopened containers or containers that were resealed after each use. The storage life expiration date of an individual lot of material may be extended provided the material satisfactorily passes retest requirements. Contamination control requirements and procedures are described in TWR-16564. During propellant processing, temperature, moisture, humidity, and contamination are controlled per engineering drawings and shop planning for the following materials:

a. Terpolymer (HB)
b. Epoxy Resin
c. Ammonium Perchlorate
d. Aluminum, Spherical
e. Ferric Oxide, Type I

K 23. Burn rate difference seen on igniters in the aging study per TWR-13003 are within the typical burn rate variation seen within the same propellant mix. The final conclusion is that if an igniter burn rate aging affect exists it is significantly smaller than the normal propellant mix burn rate variation. Data obtained from aged 5-inch CP motors for 75 months showed a possible burn rate decrease with age. Burn rate decrease is small in comparison with normal igniter mix burn rate variation between igniters. A slight decrease in burn rate was insignificant when compared to the normal igniter burn rate variation from a propellant mix. Mechanical property test data indicated no significant change from aging up to 260 weeks (5 years).

K 24. Thermal analyses were performed for RSRM components during in-plant transportation and storage to determine acceptable temperature and ambient environment exposure limits per TWR-50083. Component temperatures and exposure to ambient environments during in-plant transportation or storage is controlled per engineering.

K 25. Mechanical properties data from an aging test of TP-H1178 Propellant indicate allowable stresses, strains, and elastic modulus are not affected by aging per TWR-19292.

K 26. The Flight Igniter is included in RSRM Forward Segment life verification.

L,N 27. Performance balancing between igniters is achieved through the use of lot casting. Igniter Assemblies are cast in one production run from the same propellant mix per engineering.

L,N 28. Propellant grain in each loaded Igniter Chamber is traceable to and identified with a specific mix of propellant per engineering.

L,N 29. Igniter propellant grain casting is controlled per engineering drawings and shop planning.

M 30. Igniter propellant grain configuration is controlled by configuring and positioning the igniter core assembly per engineering drawings and shop planning.

M 31. The core is manually positioned into the loaded chamber and the assembly placed under the core seating arrangement. The seating mechanism is attached and the hydraulically controlled fixture is actuated remotely to seat the core per shop planning.

M 32. After the core is fully seated, a straight edge and standard measuring instruments are used to measure the distance from the top of the casting sleeve to the top of the core to ensure proper core alignment per shop planning.

M 33. Propellant grain configuration and tolerances are per the loaded igniter chamber drawing.

M — 34. For a safety factor of 2.0 and propellant grain temperature of less than 77°F., the core popping margin of safety is positive per TWR-11269.

F,I,J,K,O — 35. A Shore A hardness test is performed on a cure-cup sample at the time of hardware application on each batch of sealant to assure proper cure per shop planning.

F,H,L,M — 36. Propellant surfaces after trimming are per engineering drawings.

C,E,F,H — 37. As a result of the RSRM Performance Enhancement (PE) Program, load factors for ignition system PLI (Propellant, Liner, and Insulation) components were updated. Structural responses to both the original and PE loads cases were analytically compared. For all conditions, there were insignificant changes in induced stresses and therefore none of the ignition system PLI structural safety factors were changed as a result of the RSRM PE program per TWR-73983.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS (T)			CIL CODE
		1.	For New Propellant, SRM, Igniter, verify:	
	A,B,C,E,F	a.	Acceptability of AP during oxidizer preparation	AOW008
	A,B,C,E,F	b.	Cleanliness and acceptability of facility during oxidizer preparation prior to grinding	AOW009
	A,B,C,E,F	c.	Cleanliness and acceptability of tote bins during oxidizer preparation prior to grinding	AOW016
	A,B,C,E,F	d.	Actual temperature of heated water during propellant processing	AOW024
	A,B,C,E,F	e.	All containers are free from moisture, contamination, and foreign objects during premix preparation	AOW028
	A,B,C,E,F	f.	All equipment is free from moisture, contamination, and foreign objects during premix preparation	AOW030
	A,B,C,D,E,F	g.	Aluminum plus Ferric Oxide production batches, uncured propellant	AOW052
	A,B,C,E,F	h.	Aluminum powder properly conditioned during premix preparation	AOW065
	A,B,C,E,F	i.	AP conditioning during oxidizer preparation	AOW067
	A,B,C,E,F	j.	AP conditioning requirement met during propellant processing	AOW068
	A,B,C,E,F	k.	AP spillage weight is within allowable limits during propellant mixing operations	AOW077
	A,B,C,E,F	l.	AP stock and lot numbers comply with batch card during propellant processing	AOW080
	A,B,C,E,F	m.	Cleanliness of mixing facility prior to mixing	AOW092
	A,B,C,E,F	n.	ECA properly conditioned during premix preparation	AOW128
	A,B,C,E,F	o.	End of mix temperature requirement met during propellant processing	AOW130
	A,B,C,D,E,F	p.	Ground oxidizer particle size distribution production batches	AOW134
	A,B,C,E,F	q.	Ground oxidizer particle size distribution sampling requirements met during oxidizer preparation	AOW140
	A,B,C,E,F	r.	HB polymer properly conditioned during premix preparation	AOW145
	A,B,C, D,E,F (T)	s.	LSBR production batches, uncured propellant	AOW154
	A,B,C,E,F	t.	Mill load setting acceptable during oxidizer preparation	AOW167
	A,B,C,E,F	u.	No lumps in propellant during propellant processing, after mixing	AOW169
	A,B,C,D,E,F	v.	Oxidizer content production batches, uncured propellant	AOW172
	A,B,C,D,E,F	w.	Percent HB polymer production batches, uncured propellant	AOW182
	A,B,C,E,F	x.	Premix constituent weights comply with batch card during propellant processing	AOW190
	A,B,C,E,F	y.	Premix constituents lot numbers comply with shop planning during premix preparation	AOW191
	A,B,C,E,F	z.	Premix constituents stock and lot numbers comply with batch card	AOW193
	A,B,C,E,F	aa.	Propellant samples taken after propellant mixing from different locations in the mix bowl	AOW207
	A,B,C,E,F	ab.	Sieve analysis test during oxidizer preparation	AOW210
	A,B,C,E,F	ac.	Stock and lot number of AP during oxidizer preparation	AOW216
	A,B,C, D,E,F (T)	ad.	Strain at maximum stress production batches	AOW218
	A,B,C, D,E,F (T)	ae.	Maximum stress production batches	AOW228
	A,B,C,E,F	af.	Total oxidizer mixing time requirement during propellant processing	AOW238
	A,B,C,D,E,F	ag.	Total solids production batches, uncured propellant	AOW243
	A,B,C,E,F	ah.	Weight of spherical aluminum in bowl meets requirements during premix preparation	AOW258
	A,B,C,E,F	ai.	Weight of AP spillage does not exceed maximum allowable limits during oxidizer preparation	AOW262
	A,B,C,E,F	aj.	Weight of ECA meets weight requirements during premix preparation	AOW263

A,B,C,E,F	ak.	Weight of ground AP during oxidizer preparation	AOW265
A,B,C,E,F	al.	Weight of ground AP complies with batch card during propellant processing	AOW267
A,B,C,E,F	am.	Weight of HB polymer in bowl during premix preparation	AOW268
A,B,C,E,F	an.	Weight of iron oxide in mix bowl meets weight requirements during propellant premix preparation	AOW274
A,B,C,E,F	ao.	Weight of unground AP during oxidizer preparation	AOW275
A,B,C,E,F	ap.	Weight of unground AP complies with batch card during propellant processing	AOW277
A,B,C,E,F	aq.	Total AP weight (ground plus un-ground) meets allowable limits during oxidizer preparation	AOW279
I,J,O	ar.	Environmental conditions met during AP preparation	AEE001

2. For New Chamber Assembly Igniter, Loaded verify:

H,L,N	a.	Proper cure of cast propellant per engineering	ANG000
G	b.	Correct weighing system is used, is free of damage, was calibrated, and is within calibration period per engineering	MAA003
M	c.	Recycle date on igniter core is not expired	MAA006
A,B,C,E,F	d.	Cleanliness of tooling and equipment prior to propellant casting	AED007
A,B,C,E,F,M	e.	Cleanliness of liner immediately prior to casting igniter	AEE007
M	f.	Core popping temperature of propellant is within acceptable range	MAA009
K	g.	Component temperatures and exposure to ambient environments during in-plant transportation or storage are per the transportation and handling specification	BAA014
M	h.	Igniter core acceptable, core teflon is per the engineering drawing, and flange bushing, preformed packing, and double lip wiper ring are installed in the bottom of the core	AEE016
A,B,C,E,F	i.	Cleanliness of tooling prior to tooling dry-fit	AEE021
G	j.	Weight of igniter propellant added is within allowed limits	AEE023B
L,N,M	k.	Measurements are within specified limits when core is seated after casting	AEE024
F,H,L,M	l.	Propellant grain surfaces are visually inspected for surface defects after trimming per engineering	AEE032
E,F,H,L,M (T)	m.	Radiographic inspection data are acceptable per engineering	AEE035
F,H,L	n.	Propellant surfaces after trimming are per the engineering drawing	MKL044
L,N	o.	Temperature of circulating mix bowl water is acceptable prior to and during casting	AEE046
L,N	p.	Vacuum casting of propellant	AEE049
A,B,C,E,F	q.	Igniter properly packaged following propellant loading	AEF132

3. For New 5-inch CP, Igniter Propellant, verify:

A,B,C,D,E, F,H,I,J,L, M,N,O (T)	a.	5-inch CP motor test data for propellant standardization and burn rate per engineering	AOW000

4. For New Igniter Assembly verify:

I,J,O	a.	Adhesive radius for environmental seal bonding	MAA000
I,J,O	b.	Sealant within pot life at time of application	AMU001A
I,J,O	c.	Area where seal disc will be bonded is cleaned	MAA002
I,J,O	d.	Protective cover installed over S&A port prior to shipping of Igniter Assembly	AHJ003
I,J,O (T)	e.	Igniter LAT for proper propellant burn time and pressure per the igniter specification	AKU003A
I,J,K,O	f.	Component temperatures and exposure to ambient environments	

			during in-plant transportation or storage are per the temperature exposure limit specification	BAA015
I,J,O		g.	No evidence of AP leaching on igniter propellant	AEF018
I,J,K,O		h.	Proper installation of igniter environmental seal	AEE020
A,B,C,D,E, F,H,L,M,N	(T)	i.	Initiator LAT for proper propellant burn time and pressure per the igniter specification	AKU021
I,J,O		j.	Area where seal disc will be bonded is allowed to dry	AEF041
I,J,K,O		k.	Each loaded Igniter Chamber Assembly for workmanship prior to final assembly	AEF193
I,J,O		l.	Proper adhesive squeeze out after visually aligning igniter environmental seal	AEF195
I,J,O		m.	Igniter Chamber sealing and mating surfaces and threaded holes are clean and free of contamination and surface defects prior to installation per the igniter process finalization and installation preparation specifications	AEF224
I,J,O	(T)	n.	Shore A hardness on cure-cup sample on each batch of sealant prior to installation of igniter into adapter per the process specification	AEF249

5. For New HB Polymer, verify:

D	(T)	a.	Acid number	ALC000,ALC001,ALC004
D	(T)	b.	Acrylonitrile content	ALC005,ALC006,ALC009
D	(T)	c.	Agerite stalite content	ALC010,ALC011,ALC014
D	(T)	d.	Cetyldimethyl benzyl ammonium chloride content	ALC015,ALC016,ALC019
D	(T)	e.	Chloride	ALC020,ALC021,ALC024
D	(T)	f.	Unbound/total acid ratio	ALC025,ALC026,ALC029
D	(T)	g.	Infrared spectrum	ALC030,ALC031,ALC034
D	(T)	h.	Iron content	ALC035,ALC036,ALC039
D	(T)	i.	Moisture content	ALC040,ALC041,ALC045
D		j.	No shipping or handling damage	ALC046
D	(T)	k.	Viscosity	ALC060,ALC061,ALC064
D		l.	Workmanship shall be such that the HB polymer is a viscous liquid, light to dark amber/brown in color, which may contain small visible particulates	ALC065B

6. For Retest HB Polymer verify:

K	(T)	a.	Viscosity	ALC050
K	(T)	b.	Acid number	ALC050A
K	(T)	c.	Moisture content	ALC050B
K	(T)	d.	Iron content	ALC050C
K	(T)	e.	Infrared spectrum	ALC050D

7. For New Floats, Asbestos verify:

I,J,O	(T)	a.	Calcination loss	ALI002
I,J,O	(T)	b.	Fiber size distribution	ALI011
I,J,O	(T)	c.	pH (aqueous extract)	ALI023
I,J,O	(T)	d.	Volatile matter	ALI051
I,J,O	(T)	e.	Wet volume	ALI053

8. For New Liquid Epoxy Resin verify:

D,I,J,O	(T)	a.	Hydrolyzable chlorine percent	ALD006,ALD009,ALD015
D,I,J,O	(T)	b.	Infrared spectrum	ALD030
D,I,J,O	(T)	c.	Moisture percent	ALD035,ALD038,ALD042

D			d.	No shipping or handling damage	ALD052
D,I,J,O	(T)		e.	Specific gravity	ALD061,ALD063,ALD068
D,I,J,O	(T)		f.	Viscosity	ALD082,ALD085,ALD091
D,I,J,O	(T)		g.	Weight per epoxy	ALD098,ALD101,ALD107
		9.	For Retest Liquid Epoxy Resin verify:		
K	(T)		a.	Moisture	ALD989
K	(T)		b.	Hydrolyzable chlorine percent	ALD011
K	(T)		c.	Viscosity	ALD083
K	(T)		d.	Weight per epoxy	ALD103
		10.	For New Ammonium Perchlorate, verify:		
D	(T)		a.	Acid insolubles	ALE001,ALE002,ALE006
D	(T)		b.	Bromate	ALE007,ALE008,ALE011
D	(T)		c.	Bulk density	ALE012,ALE013,ALE016
D	(T)		d.	Chlorate	ALE017,ALE018,ALE020
D	(T)		e.	Chloride	ALE022,ALE023,ALE026
D	(T)		f.	External moisture content	ALE028,ALE029,ALE032
D	(T)		g.	Internal moisture content	ALE033,ALE034,ALE037
D	(T)		h.	Iron	ALE038,ALE039,ALE042
D			i.	No shipping or handling damage	ALE044
D	(T)		j.	Particle size distribution	ALE045,ALE046,ALE050
D	(T)		k.	Assay, as ammonium perchlorate	ALE052,ALE055,ALE056
D	(T)		l.	pH	ALE058,ALE059,ALE062
D	(T)		m.	Phosphate	ALE063,ALE064,ALE067
D	(T)		n.	Photomicrographic analysis	ALE068,ALE069,ALE072
D	(T)		o.	Sulfated ash	ALE091,ALE092,ALE095
D	(T)		p.	Total moisture content	ALE097,ALE100,ALE101
D			q.	Workmanship is uniform in appearance and free from unacceptable contamination	ALE105
		11.	For Retest Ammonium Perchlorate, verify:		
K	(T)		a.	Total moisture	ALE078
K	(T)		b.	Internal moisture content	ALE078A
K	(T)		c.	External moisture content	ALE078B
K	(T)		d.	Particle size	ALE078C
		12.	For New Aluminum, Spherical, verify:		
D	(T)		a.	Active aluminum	ALU000,ALU001,ALU004
D	(T)		b.	Iron content	ALU010,ALU011,ALU014
D			c.	No shipping or handling damage	ALF011
D	(T)		d.	Magnesium content	ALU015,ALU016,ALU019
D	(T)		e.	Particle size distribution	ALU020,ALU021,ALU024
D	(T)		f.	Volatile matter	ALU036,ALU037,ALU040
		13.	For Retest Aluminum, Spherical, verify:		
K	(T)		a.	Active aluminum for life extension	MAA007
K	(T)		b.	Volatile matter for life extension	MAA008
		14.	For New Ferric Oxide, verify:		
D	(T)		a.	Calcination loss	ALG000,ALG001
D,K	(T)		b.	Iron content	ALG008,ALG010,ALG012

K	(T)	c.	Specific surface	ALG009A
D,K	(T)	d.	Volatile loss	ALG009B,ALG049,ALG050
D		e.	No shipping or handling damage	ALG019
D	(T)	f.	Specific surface area	ALG031,ALG032
D		g.	Workmanship is uniform in appearance and free from visible contamination	ALG040

15. For New Curing Agent, Polyamide Liquid Resin, verify:

I,J,O	(T)	a.	Amine value	ALQ001,AMQ006
I,J,O	(T)	b.	Ash content	AMQ015
I,J,O	(T)	c.	Color	ALQ026,AMQ028
I,J,O	(T)	d.	Specific gravity	AMQ033
I,J,O	(T)	e.	Viscosity	ALQ049,AMQ050

16. For New Silicon Dioxide, verify:

I,J,O	(T)	a.	Bulk density	ALP002,ALP008
I,J,O	(T)	b.	Loss on ignition	ALP040
I,J,O	(T)	c.	Moisture	ALP058,ALP064
I,J,O	(T)	d.	pH	ALP097,ALP101

17. For New NBR, verify:

I,J,O	(T)	a.	Elongation (calendered only)	ALH010,ALH062,ALH065
I,J,O	(T)	b.	Mooney viscosity (extrusions only)	ALH041,ALH046,ALH170
I,J,O	(T)	c.	Scorch characteristics (extrusions only)	ALH081,ALH086,ALH171
I,J,O	(T)	d.	Shore A hardness (calendered only)	ALH098,ALH102,ALH109
I,J,O	(T)	e.	Specific gravity (calendered only)	ALH118,ALH121,ALH126
I,J,O	(T)	f.	Tensile strength (calendered only)	ALH147,ALH149,ALH154
I,J,O		g.	Material workmanship including uniform appearance and free from contamination	ALH168

18. For Retest NBR, verify:

I,J,O	(T)	a.	Mooney viscosity	ALH049
I,J,O	(T)	b.	Scorch characteristics	ALH087

19. For New Chamber Assembly-Igniter, Insulation verify:

I,J,O		a.	Insulation cure time, temperature, and pressure is acceptable	AED008
I,J,O		b.	Component temperature and exposure to ambient environments during in-plant transportation or storage are per engineering	BAA013

20. For New Disc, Seal Igniter verify:

I,J,O		a.	Dimensions of igniter seal after fabrication	ACN000

21. For New Barrier-Booster Assembly, Loaded, verify:

I,J,O	(T)	a.	Barrier-Booster rotor shaft and SII seals leak tested at low pressure with rotor in "SAFE" position per specification	ADA024

22. For New Segment, Rocket Motor, Forward, verify:

I,J,K,O		a.	Component environments during in-plant transportation or storage	BAA021
I,J,O	(T)	b.	Installed transducer bolt assemblies were leak tested at low and high pressures	AEG195,AEG196

23. KSC verifies:

	K		a.	Life requirements for the expected launch schedule are met per OMRSD, File II, Vol III, C00CA0.030	OMD019
595	I,J,O	(T)	b.	Integrity of the S&A device and S&A gasket installation by high- and low-pressure leak test per OMRSD File V, Vol I, B47SA0.110	OMD072
	I,J,K,O		c.	Igniter seal disk is free from punctures, debonds, or cracks, and that the disk is still sealed and intact and has no visible penetrations, debonds, or cracks per OMRSD, File V, Vol I, B47SG0.020	OMD075