CRITICAL ITEMS LIST (CIL)

No. 10-01-02-01R/03

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)
		PHASE(S):	Boost (BT)
FMEA ITEM NO.:	10-01-02-01R Rev N	QUANTITY:	(See Section 6.0)
CIL REV NO.:	N	EFFECTIVITY:	(See Table 101-6)
DATE:	27 Jul 2001	HAZARD REF.:	BC-06
SUPERSEDES PAGE:	212-1ff.		
DATED:	31 Jul 2000		
CIL ANALYST:	F. Duersch		
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 27 July 2001

ENGINEERING: T. R. Hoffman 27 July 2001

1.0 FAILURE CONDITION: Failure during operation (D)

2.0 FAILURE MODE: 1.0 Failure to operate within required thrust profile

3.0 FAILURE EFFECTS: Thrust imbalance between RSRMs from high or low chamber pressure will result in loss of RSRM; worst-case high pressure will cause case rupture with resulting debris, causing loss of SRB, crew, and vehicle.

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	Nonconformance of propellant burn rates	A
1.2	Propellant cracks, flaws, voids, or inclusions due to manufacturing and assembly processes	B
1.3	Propellant bond line separation due to manufacturing and assembly processes	C
1.4	Storage degradation (aging)	D
1.5	Improper mixing or casting of propellant materials	E
1.6	Inadvertent use of RSRM segments from different lots or evaluations of raw materials	F
1.7	Cracking of the propellant grain or bond line separation due to transportation or handling dynamic loads	G
1.8	Cracking of the propellant grain or bond line separation due to thermal-induced stresses	H
1.9	Crack propagation or propellant grain structural failure due to improper crack repair	I
1.10	Cracking of the propellant grain due to aging and humidity	J
1.11	Ballistic inadequacies	
	1.11.1 Core misalignment	K

1.12 Nonconforming raw materials L

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 formula using Polybutadiene Acrylonitrile (PBAN) and epoxy as the binder. The formula 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 engineering drawings as loaded segment assembly's forward, center (2 each), and aft.

2. Each lot of propellant raw materials is standardized per engineering to meet burn rate and mechanical property 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.

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 60^0F	0.368 psi
2.	Maximum stress	110 psi minimum
3.	Strain at maximum stress	30% minimum
4.	Autoignition temperature (copper block test)	489^0F

7.0 FAILURE HISTORY/RELATED EXPERIENCE:

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

8.0 OPERATIONAL USE: N/A

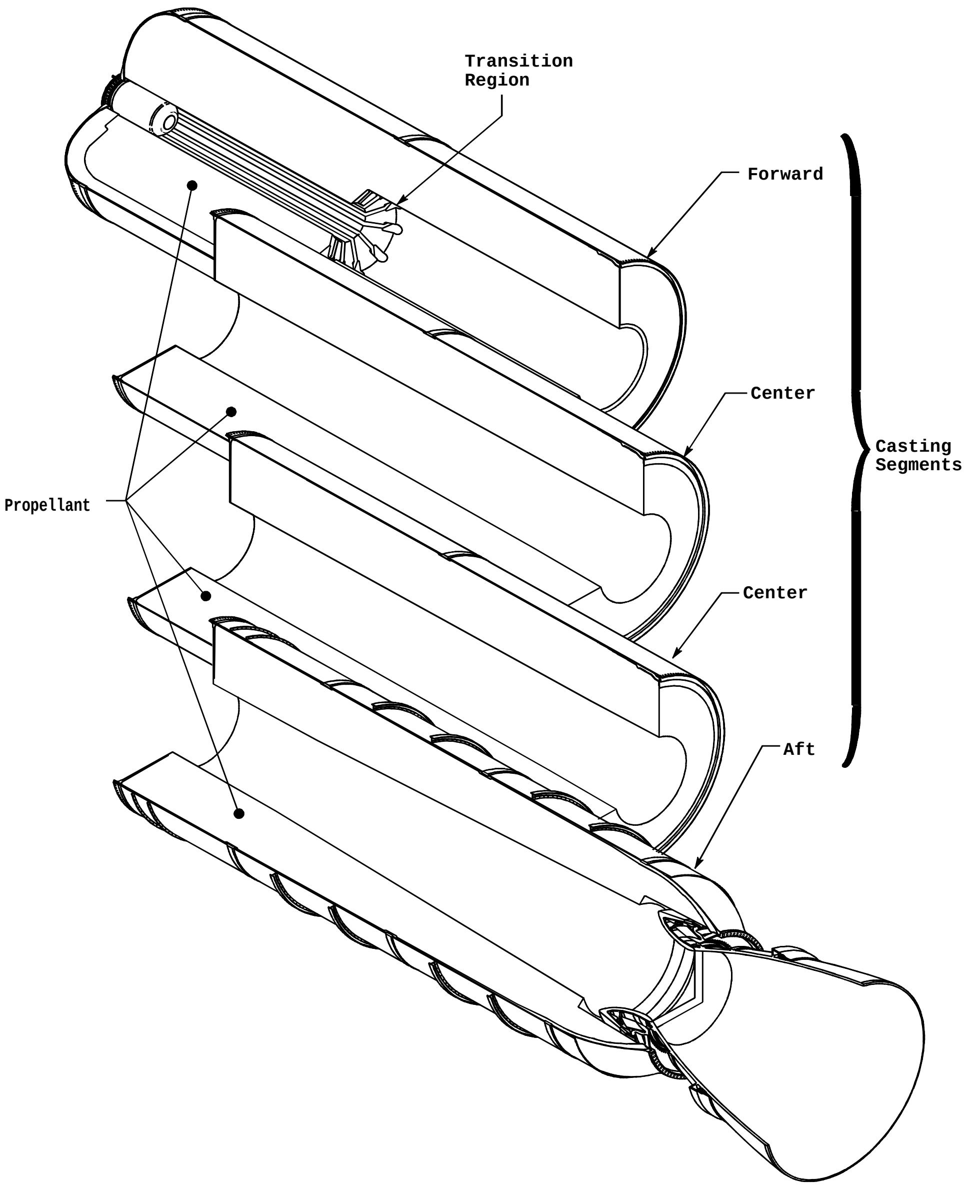

Figure 1. RSRM Propellant Configuration

A038657aDDB

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN FAILURE CAUSES		
A,D,E,F	1.	Calculation of burn rates is used to provide data for matched pairs of motor segments to minimize unbalanced thrust performance. Matched pairs are cast from the same combinations of propellant material evaluations and identified by part number and serial number to assure storage and use as matched pairs.
A,E,F	2.	An evaluation is a combination of single raw material lots and all of the propellant standardization, verification, and production batches produced by this combination of lots. Adjustments for ferric oxide, HB polymer (terpolymer) and Epoxy Curing Agent (ECA) proportions are determined per standardization processes and engineering to meet target burn rate and stress and strain values.
A	3.	Performance balancing requirements for the RSRM are verified by analyses of static test data from RSRM Development motors (DM) and Qualification Motors (QM) as reported in TWR-18764-04.
A	4.	The Burn Anomalous Rate Factor (BARF) is expected to remain constant from motor-to-motor as long as casting techniques are consistent as reported in TWR-11074. Past experience with BARF indicates it remained consistent with historical ballistics performance data per TWR-14415.
A	5.	Burn rate analyses are performed per engineering using 5-inch CP test motors cast from at least one out of every three propellant batches for each segment.
A	6.	Propellant burn rate is partially dependent upon propellant temperature. Maximum propellant mean bulk temperature differential allowed between two RSRMs during pre-launch is 1.4^{o}F.
A	7.	Qualification motors QM-1 and QM-2 were composed of matched pair segments. Resulting performance data were well within the imbalance tolerances for the ignition transient, steady state, and tail off phases per TWR-12646.
A	8.	A comparison of grain design and performance of High Performance Motor (HPM) design versus the RSRM was done to show that changes in the RSRM did not significantly affect performance per TWR-16940.
A,F	9.	Thiokol verifies that each segment meets match cast requirements of the propellant specification prior to shipment to KSC. KSC configuration management verifies for each flight that the segments are assembled in the proper order per stacking engineering specifications. Thiokol LSS further documents the as-built configuration for each flight in the KSC Processing, Configuration, and Data Report that verifies as-built segments meet match cast requirements of the Propellant, SRM, TP-H1148 material specification.
B	10	The transition region of the forward casting segment was redesigned from a slightly radiused transition to a tapered bulb transition to reduce the number of cracks caused by core and fin former removal. The redesign also increased the factors of safety for storage per TWR-14688.
B	11.	Structural analysis of the redesigned transition region per TWR-14688 was performed to verify positive margins of safety.
B,C,H	12.	Acceptance criteria for cracks, flaws, voids, tears, bond line separations, and other

non-conformities are per engineering.

B,C,H	13.	Nondestructive evaluation (i.e., radiographic) of loaded segments for detection of propellant subsurface characteristics or bond line anomalies is per engineering.
C,E,G,H	14.	Propellant mix proportions and mechanical property requirements of TP-H1148 are per engineering and are suitable for use at a wide temperature range per TWR-11501. Adhesion requirements of propellant and liner systems are also per engineering.
C,G,H	15.	Similar polymeric materials are used in propellant, liner, and castable inhibitor per engineering. This ensures greater bond line strength through polymer cross-linking, reducing likelihood of bond line failure per TWR-15276 and TWR-14887.
C,D,G,J	16.	Structural analyses of propellant grain and bond lines were performed to verify positive margins of safety for storage per TWR-16961.
C,D,G,H,J	17.	Grain surface or bond line anomaly repairs, either at Thiokol or KSC, are inspected per engineering.
C,D,H,J	18.	Castable Inhibitor anomaly repair is inspected per engineering as recommended in TWR-63370.
D	19.	Storage life of the following propellant raw materials is per shop planning and engineering: a. Terpolymer (PBAN) b. Epoxy resin c. Ammonium perchlorate d. Aluminum powder e. Ferric oxide
D	20.	TP-H1148 propellant used in the RSRM is similar to propellant used in other motors which were subjected to extended periods of storage in uncontrolled environments and continued to perform satisfactorily as compared and outlined in TWR-13279.
D	21.	TWR-12182 details a study of aging effects on TP-H1148 propellant. Propellant aging behavior was estimated from elevated temperature storage tests performed on TP-H1123 propellant used in the Poseidon Program. Aging data on TP-H1148 propellant shows it has aging characteristics equal to or better than TP-H1123 propellant.
D	22.	Storage environment for RSRM segments consists of uncontrolled humidity throughout a maximum storage life of 5 years. Since this humidity environment may be more severe than experienced in other programs using this type of propellant, studies were made to address effects of long-term humidity on TP-H1148 ballistics per TWR-14118. This report is based on STS-1 through STS-10. SRM segments used for these flights were stored for 5 to 19 months. During this time, high-humidity conditions varied from an estimated 46 grains of water per pound of air to an estimated 130 grains of water per pound of air. It was concluded there is no detectable effect on ballistic performance due to prior storage in the high-humidity environment of Florida.
D,H	23.	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 are controlled per engineering.

D 24. Analyses of ballistic performance data from all TEM motors indicate propellant meets ballistic performance requirements of HPM and RSRM CEI specifications after aging for up to 6.5 years per TWR-64166.

D 25. Testing of real time aged propellant/liner/insulation (PLI) samples indicated that TP-H1148 Propellant and PLI bond properties were not affected by aging for up to five years per TWR-63837.

E 26. Propellant processing, mixing, and cure requirements are per engineering, shop planning, and described in TWR-10341. Liner cure is also completed during propellant cure per engineering.

E 27. Material weighing is per TU-STD-12.

E 28. Burn rate analyses are performed per engineering using 5-inch CP test motors cast from at least one out of every three propellant batches for each segment.

F 29. Lots consist of all materials manufactured at one time using identical processes and ingredients, and submitted for acceptance at one time. Raw material requirements are per engineering.

G 30. Dynamic analyses were performed on TP-H1148 propellant used in the RSRM. These analyses used test results of live propellant from mixes used in loading SRM Development Motor No. 1. A structural math model simulated dynamic response with inputs from dynamic properties determined from the live propellant analyses with positive results. The summary and results are contained in TWR-11779 and TWR-10543.

G 31. Transportation loads imposed by shipping loaded segments on railcars were studied in a test using an inert propellant loaded segment. The segment was put through a series of dynamic transportation and railcar coupling tests to verify structural integrity of the propellant grain during transportation to the launch site per TWR-11712 and TWR-12343.

G 32. Railcar transportation shock and vibration levels for segments are monitored per engineering with loads derived per analysis. Monitoring records are evaluated by Thiokol to verify that shock and vibration levels per current MSFC specifications were not exceeded.

H 33. Analysis of the effects of short exposure of RSRM segments to severe thermal environments showed no sign of structural degradation of the propellant grain per TWR-13040.

H 34. After removal from the casting pit and prior to shipment, the grain is inspected and all cracks are repaired per engineering and shop planning to prevent further crack propagation due to stresses within the grain.

H 35. RSRM segments have a stress relief flap to reduce bond line stresses during handling, storage, and thermal loading per TWR-13040 and engineering drawings.

H 36. Thermal analysis was performed for RSRM segments to verify positive thermal margins of safety per TWR-17009.

H 37. Studies of thermal storage at 32^{o}F show that a crack depth greater than 1.4 inches would propagate, but smaller than 1.4 inches would be stable per TWR-13040. Engineering prohibits propellant mean bulk temperature below 40^{o}F for storage and launch.

H	38.	Propellant, liner, and insulation bond lines have witness panels that are processed with the segments and see the same thermal environment during panel processing. These witness panels are tested by Thiokol at various times throughout the life of the segment to verify no age and thermal degradation per TWR-17123.
C,H	39.	Witness panels are cured in the autoclave with the insulated segments during the cure cycle. These panels are tested to assure bond line integrity for primer, adhesive, insulation, liner, and propellant properties was achieved at the end of the cure cycle per engineering as reported in TWR-17123, TWR-64433 and TWR-64923.
I	40.	Cracks within the star point, transition, and bore port cavity areas are acceptable provided they can be repaired per engineering.
I	41.	Once a crack is trimmed, the repair area is contoured. After contouring, smoothing is done to ensure no ridges exist per engineering.
I	42.	Surface roughness, sharp edges, or discontinuities that could propagate a crack are trimmed to exhibit smooth transitions per engineering and shop planning.
I	43.	The bore-to-fin transition region was redesigned to reduce areas of stress concentration. The transition region demonstrated the area of greatest cracking. The redesign reduced the probability of cracks occurring and improved safety factors per TWR-14688.
J	44.	Aging effects on TP-H1148 propellant capability were assessed through an accelerated aging study in which samples of propellant were stored at various temperatures and periodically tested for mechanical properties. Results of this study show that propellant stress capability increases slightly with age, and strain capability shows a slight decrease per TWR-12182.
J	45.	Studies were done analyzing aging and humidity characteristics of TP-H1148 propellant compared to UTP-3001 propellant used in the Titan III Program. It was determined that mechanical properties did not change significantly with age but exhibited a decline in 20- minute relaxation modulus upon storage at 80 percent relative humidity. TP-H1148 propellant was much less affected by storage at high humidity than UTP-3001 propellant, and stress capability decline was arrested by dry out per TWR-13279.
J	46.	A comparison of SRM propellants with similar propellants from Minuteman, Poseidon, Peacekeeper, and Pershing (with storage in some cases much longer than 5 years) was done to determine aging effects. It was determined that there were no detrimental effects on mechanical properties over a 5-year storage period per TWR-13720.
J	47.	Prior to stacking of STS-1, an inspection revealed leached AP but no cracking. STS-1 was in the Florida high humidity environment for 19 months per TWR-14118.
K	48.	To ensure proper core alignment, a mold plate (forward, center, and aft) at the bottom of the casting pit accepts the segment case and core into the tang assembly and core plug receptacles.
K	49.	Proper alignment at the top of the casting pit is ensured by the core centering ring (forward and center). Proper alignment of the aft segment is ensured by the aft casting dam.
K	50.	Core alignment requirements are per engineering drawings.

L 51. Raw material conformance specifications, material property requirements, means of verification, and appearance of materials for TP H1148 propellant are per engineering for the following materials:

a. Terpolymer (PBAN)
b. Epoxy resin
c. Ammonium perchlorate
d. Aluminum powder
e. Ferric oxide

C,G,H 52. Liner repair requirements for RSRM segments are per engineering (Liner repairs are not authorized for initiators or igniters).

B,G,H 53. The grain (propellant, liner, castable inhibitor and internal insulation) of the RSRM was evaluated for the Performance Enhancement (PE) Program. The grain evaluation (PLI) shows that all areas still meet required safety factors. The PLI was conservatively re-evaluated using an increased liftoff acceleration load (not part of the Performance Enhancement Program). It was concluded that structural certification was not affected per TWR-17057.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS	(T)			CIL CODE
			1.	For New Propellant, SRM, TP-H1148 verify:	
	E	(T)	a.	Aluminum plus ferric oxide content in uncured batch samples	AOV012
	E		b.	Aluminum powder dust hood clean and no loose objects during premix preparation (Applicable only for premix operations in Building M-120)	AOV013
	D,E		c.	For each premix, HB polymer, aluminum powder, iron oxide, and ECA meet bill of material requirements and are within storage life limits during propellant premix preparation	AOV014
	E		d.	Aluminum powder is properly conditioned during propellant premix preparation per shop planning (Applicable only for Premix operations in Building M-120)	AOV015
	E		e.	AP spillage weight does not exceed requirements during propellant mixing operations	AOV018
	E		f.	AP spillage does not exceed requirements during oxidizer preparation	AOV019
	A	(T)	g.	Adjusted Burn Rates of the 5 inch CPs for matched segments are within specifications	MKL023
	E		h.	Cleanliness of facility during oxidizer preparation	AOV026
	E		i.	Cleanliness of mix bowl during premix preparation	AOV027
	E		j.	Cleanliness of the mix bowl exterior and its cover, and that the lid is installed prior to shipping premix	AOV028
	E		k.	Cleanliness of mixing facility prior to mixing	AOV032
	D		l.	AP within storage life limits	AOV037
	E		m.	Desiccant requirements of AP during mixing	AOV040
	E		n.	ECA properly added and ECA addition time recorded during propellant premix preparation	AOV042
	E		o.	For each premix, HB polymer and ECA are properly conditioned during propellant premix preparations per shop planning	AOV046
	E		p.	Ground oxidizer particle size distribution in production batches	AOV048
	C,D,E,G,H		q.	HB polymer percent in uncured propellant	AOV052
	E		r.	Weight of HB polymer, aluminum powder, ECA, and iron oxide in mix bowl during propellant premix preparation	AOV055
	E		s.	Humidity and temperature during oxidizer preparation	AOV056
	E		t.	Hygrometer reading acceptable before and during grinding operations	AOV064
	A,E	(T)	u.	Liquid-Strand Burn Rate of uncured propellant	AOV067
	E		v.	AP lot number complies with material end item requirements	AOV068
	E		w.	Mill load settings are acceptable during oxidizer preparation	AOV082
	E		x.	Minimum time required for total mix cycle during mixing	AOV083
	E		y.	Minimum time requirement met between end of AP addition and end of mix	AOV084
	E		z.	Stock and lot number correct during oxidizer preparation	ALE086
	E		aa.	Oxidizer addition time requirement met during mixing	AOV090
	E		ab.	Oxidizer content in uncured propellant batch samples	AOV093
	E		ac.	Premix constituent lot numbers comply with bill of materials during mixing	AOV096
	E		ad.	Premix constituents weights comply with batch card during mixing	AOV098
	E		ae.	Propellant samples taken after propellant mixing from different locations in the mix bowl	AOV102
	E		af.	Sampling requirements met during oxidizer preparation	AOV104
	E		ag.	The scalping screen for lumpy aluminum powder or foreign material during propellant premix preparation (Applicable only for Premix operations in Building M-120)	AOV105
	E		ah.	Premix material production data sheet is properly completed	

			during propellant premix operations. (Applicable only for Premix operations in Building M-120)	AOV107
E		ai.	Conditioning and acceptability of AP during oxidizer preparation	AOV110
B,C,D, E,G,H	(T)	aj.	Strain at maximum stress	AOV113
B,C,D, E,G,H	(T)	ak.	Maximum stress	AOV117
E		al.	Conditioning of AP tote bins during oxidizer preparation	AOV121
E		am.	Temperature requirement for end of mix is met	AOV125
E		an.	Total solids content in uncured propellant batch samples	AOV127
E		ao.	Tote bins clean and acceptable during oxidizer preparation	AOV128
E		ap.	Uniform appearance and no visible contamination in propellant batch samples	AOV129
E		aq.	Weight of unground and ground AP during oxidizer preparation	AOV135
E		ar.	Weight of unground and ground AP complies with the batch card during propellant mixing	AOV136
E		as.	Work area clean during premix preparation	AOV139

2. For New 5" CP Motor, verify:

A,E	(T)	a.	Test data for propellant standardization and burn rate	AKU000

3. For New Loaded Segment Assembly (Forward, Center, Aft) verify:

G		a.	Current certification of handling and lifting equipment per shop planning	AFF021,AFH023,MKL034
K		b.	Casting sleeve is clean, has current recycle date, and is installed per shop planning	AFJ001
K		c.	Casting dam is clean and properly installed prior to casting	AFJ005
D,H		d.	Component temperatures and exposure to ambient environments during in-plant transportation or storage are acceptable	BAA008,BAA009,BAA010
K		e.	Core alignment stud free from defects	AFJ013
K		f.	Core alignment plug is installed	AFF014
K		g.	Centering ring is clean and level per shop planning	AFH014,AFF059
C,H	(T)	h.	Results of insulation-to-liner-to-propellant bond line integrity tests with witness panel per engineering	AOX018,AOX019,AOX020
B,H,I		i.	Propellant grain surfaces are free from unacceptable anomalies per engineering	AFJ019,AFF026,AFH028
E		j.	Casting completed within specified time of ECA addition	AOV020,AOV020A,AOV020B
E		k.	Casting delay did not exceed specified limits	AOV021,AOV021A,AOV021B
C,H	(T)	l.	Results of insulation-to-liner (hand lining) bond line integrity tests with witness panel per engineering	AOX021,AOX022,AOX023
C,H	(T)	m.	Results of insulation-to-liner (first sling line mix) bond line integrity tests with witness panels per engineering	AOX024,AOX025,AOX026
C,H,	(T)	n.	Results of insulation-to-liner (second sling line mix) bond line integrity tests with witness panels	FDJ003,FDJ004,FDJ005
K		o.	Core stud O-rings are acceptable, lubricated, and properly installed per shop planning	MKL030,MKL032,AFJ037
K		p.	Case lock down pins are actuated	AFJ032,AFH052A,AFF065
K		q.	Joint adapter is clean and installed per shop planning	AFH033,AFF046
A,F		r.	Segment meets match cast requirements	MKL035,MKL036,MKL037
K		s.	No damage or discrepancy with case lockdown pins	AFJ036
K		t.	Core lock down pins are retracted prior to installing the core in the pit	AFF039,AFH045,FDJ002
K		u.	Case lock down pins are retracted	AFJ041,AFH052,AFF067
K		v.	Core lock down pins are actuated	AFJ042,AFH044
K		w.	Proper alignment of core	AFJ045

B,C,H	(T)	x.	Results of radiographic inspections per engineering	AFJ046,AFF058,AFH060
B,H,I		y.	Acceptable repairs of propellant grain surface anomalies per engineering	AFJ048,AFF057,AFH064
K		z.	Seal properly positioned in gap around OD of casting dam	AFJ051
K		aa.	Segment properly lined and acceptable just prior to installation of end covers and shipment to the casting pits per shop planning	AFJ052
K		ab.	Lockdown pins are free from damage	AFH053
K		ac.	Zero degree on aft mold net aligned with zero on case	AFJ061
K		ad.	Zero degree on segment and zero degree on mold plate are aligned	AFJ062,AFH082
K		ae.	Zero degree of segment and zero degree on joint adapter ring are aligned	AFF079
K		af.	Zero degrees on segment and zero degrees on casting stand are aligned	AFF080
E		ag.	Mix acceptance prior to casting for each propellant batch	AOV085,AOV085A,AOV085B
E		ah.	Mix bowl water of the correct temperature is circulating during casting per shop planning	AOV087,AOV087A,AOV087B
E		ai.	Time and date of ECA addition is recorded for each propellant mix	AOV103,AOV103A,AOV103B
E		aj.	Vacuum during casting is per shop planning	AOV131B,AOV131,AOV131A
577 E		ak.	Core was cleaned within two hours of going into the segment per shop planning	FDJ008,FDJ008A
577 E		al.	Proper lubrication of bell-to-bowl connector butterfly valve with polymer prior to installing per shop planning	FDJ006,FDJ006A,FDJ006B
577 E		am.	Mold plate is free of contamination prior to segment mating using the white glove test per shop planning	FDJ007,FDJ007A
C		an.	Propellant/Igniter Boot terminations, after propellant trimming to a smooth contour, are acceptable per engineering	AFF003
C		ao.	Igniter Boot propellant-to-liner-to-insulation bond line is free of anomalies per engineering	MKL003
C		ap.	Aft face of propellant is free of unacceptable anomalies after trimming to a smooth contour per engineering	AFH007,MKL033
C		aq.	Acceptable repair of Aft Face Inhibitor anomalies per engineering	MKL027,MKL028
C		ar.	Cured aft face inhibitor is free from separations and unbonds per engineering	AFF049,AFH056

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

D,H	a.	Component environments during in-plant transportation or storage	BAA021
B,H,I	b.	Propellant bore fin cavity area is free of cracks	AFF026A
B,H,I	c.	Any repair of cracks in the propellant bore fin cavity area	AFF057A

5. For New HB Polymer, verify:

D,L	(T)	a.	Acid number	ALC000,ALC001,ALC004
D,L	(T)	b.	Acrylonitrile content	ALC005,ALC006,ALC009
D,L	(T)	c.	Agerite stalite content	ALC010,ALC011,ALC014
D,L	(T)	d.	Cetyldimethyl benzyl ammonium chloride content	ALC015,ALC016,ALC019
D,L	(T)	e.	Chloride	ALC020,ALC021,ALC024
D,L	(T)	f.	Unbound/total acid ratio	ALC025,ALC026,ALC029
D,L	(T)	g.	Infrared spectrum	ALC030,ALC031,ALC034
D,L	(T)	h.	Iron content	ALC035,ALC036,ALC039
D,L	(T)	i.	Moisture content	ALC040,ALC041,ALC045
D,L		j.	No shipping or handling damage	ALC046
D,L	(T)	k.	Viscosity	ALC060,ALC061,ALC064

L			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	ALC065A
		6.		For Retest HB Polymer verify:	
D	(T)		a.	Viscosity	ALC050
D	(T)		b.	Acid number	ALC050A
D	(T)		c.	Moisture content	ALC050B
D	(T)		d.	Iron content	ALC050C
D	(T)		e.	Infrared spectrum	ALC050D
		7.		For New Liquid Epoxy Resin verify:	
D,L	(T)		a.	Hydrolyzable chlorine percent	ALD006,ALD009,ALD015
D,L	(T)		b.	Infrared spectrum	ALD030
D,L	(T)		c.	Moisture percent	ALD035,ALD038,ALD042
D,L			d.	No shipping or handling damage	ALD052
D,L	(T)		e.	Specific gravity	ALD061,ALD063,ALD068
L			f.	Workmanship is uniform in appearance and free from visible contamination	ALD075
D,L	(T)		g.	Viscosity	ALD082,ALD085,ALD091
D,L	(T)		h.	Weight per epoxy	ALD098,ALD101,ALD107
		8.		For Retest Liquid Epoxy Resin verify:	
D	(T)		a.	Hydrolyzable chlorine percent	ALD011
D	(T)		b.	Viscosity	ALD083
D	(T)		c.	Weight per epoxy	ALD103
D	(T)		d.	Moisture	ALD989
		9.		For New Ammonium Perchlorate, verify:	
D,L	(T)		a.	Acid insolubles	ALE001,ALE002,ALE006
D,L	(T)		b.	Bromate	ALE007,ALE008,ALE011
D,L	(T)		c.	Bulk density	ALE012,ALE013,ALE016
D,L	(T)		d.	Chlorate	ALE017,ALE018,ALE020
D,L	(T)		e.	Chloride	ALE022,ALE023,ALE026
D,L	(T)		f.	External moisture content	ALE028,ALE029,ALE032
D,L	(T)		g.	Internal moisture content	ALE033,ALE034,ALE037
D,L	(T)		h.	Iron	ALE038,ALE039,ALE042
D,L			i.	No shipping or handling damage	ALE044
D,L	(T)		j.	Particle size distribution	ALE045,ALE046,ALE050
D,L	(T)		k.	Assay, as ammonium perchlorate	ALE052,ALE055,ALE056
D,L	(T)		l.	pH	ALE058,ALE059,ALE062
D,L	(T)		m.	Phosphate	ALE063,ALE064,ALE067
D,L	(T)		n.	Photomicrographic analysis	ALE068,ALE069,ALE072
D,L	(T)		o.	Sulfated ash	ALE091,ALE092,ALE095
D,L	(T)		p.	Total moisture content	ALE097,ALE100,ALE101
L			q.	Workmanship is uniform in appearance and free from unacceptable contamination	ALE105
		10.		For Retest Ammonium Perchlorate, verify:	
D	(T)		a.	Total moisture	ALE078
D	(T)		b.	Internal moisture content	ALE078A
D	(T)		c.	External moisture content	ALE078B
D	(T)		d.	Particle size	ALE078C

11. For New Aluminum Powder verify:

D,L	(T)	a.	Free active aluminum content	ALF001,ALF004,ALF005
D,L	(T)	b.	Iron content	ALF006,ALF007,ALF010
D,L		c.	No shipping or handling damage	ALF011
D,L	(T)	d.	Particle size distribution	ALF012,ALF013,ALF016
L		e.	Workmanship is uniform in appearance and free from visible contamination	ALF024
D,L	(T)	f.	Volatile matter content	ALF025,ALF026,ALF029

12. For Retest Aluminum Powder verify:

D	(T)	a.	Particle size distribution	ALF020
D	(T)	b.	Free active aluminum	ALF020A
D	(T)	c.	Volatile matter	ALF020B

13. For New Ferric Oxide, verify:

D,L	(T)	a.	Calcination loss	ALG000
D,L	(T)	b.	Iron content	ALG010
D,L		c.	No shipping or handling damage	ALG019
D,L	(T)	d.	Specific surface area	ALG031
D,L		e.	Workmanship is uniform in appearance and free from visible contamination	ALG040
D,L	(T)	f.	Volatile loss	ALG049

14. For Retest Ferric Oxide, verify:

D	(T)	a.	Iron content	ALG008
D	(T)	b.	Specific surface	ALG009A
D	(T)	c.	Volatile loss	ALG009B

15. KSC verifies:

A		a.	Predicted PMBT is between the limits per OMRSD, File II, Vol I, S00FA0.600	OMD010
D		b.	AP leaching is removed from each segment per OMRSD, File V, Vol I, B47GEN.030	OMD029
B,C,D,G,H,I,J		c.	Each segment (Fwd, Fwd Center, Aft Center) is free of unacceptable propellant grain surface defects per OMRSD, File V, Vol I, B47SG0.012	OMD073
B,C,D,G,H,I,J		d.	Each (aft) segment is free of unacceptable propellant grain surface defects per OMRSD, File V, Vol I, B47SG0.013	OMD074
C		e.	Forward and aft face propellant inhibitors and acrylonitrile butadiene rubber (NBR) inhibitor, liner, and propellant are free of defects per OMRSD, File V, Vol I, B47SG0.041	OMD077