ATK ALLIANT TECHSYSTEMS
THIOKOL PROPULSION

CRITICAL ITEMS LIST (CIL)

No. 10-05-03-06R/01

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1R
SUBSYSTEM:	Assy Hardware/Interfaces 10-05	PART NAME:	Redesigned Igniter Adapter-to-Case Joint, Thermal Barrier, Primary Seal of Outer Gasket & Leak Check Port Plug (2)
ASSEMBLY:	Ignition System-to-Case Intfc 10-05-03		
FMEA ITEM NO.:	10-05-03-06R Rev M		
CIL REV NO.:	M		
DATE:	17 Jun 2002	PART NO:	(See Section 6.0)
SUPERSEDES PAGE:	450-1ff.	PHASE(S):	Boost (BT)
DATED:	5 Oct 2001	QUANTITY:	N/A
CIL ANALYST:	D. J. McGough	EFFECTIVITY:	(See Table 101-6)
		HAZARD REF.:	BC-03
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 17 Jun 2002

ENGINEERING: P. M. McCluskey 17 Jun 2002

1.0 FAILURE CONDITION: Failure during operation (D)

2.0 FAILURE MODE: 1.0 Leakage of primary seal of gasket and leak check port

3.0 FAILURE EFFECTS: Failure of the primary seal of the gasket and leak check port would result in hot gas flow through the joint to the atmosphere causing burn-through, thrust imbalance, and loss of RSRM separation system, SRB, crew, and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	Nonconforming finish of sealing surfaces or contamination on sealing surfaces	A
1.2	Nonconforming material properties	B
1.3	Performance degradation due to aging	C
1.4	Damage to elastomers, threads, or sealing surfaces	D
1.5	Nonconforming dimensions	E
1.6	Improper installation of components	F
1.7	Nonconforming surface or subsurface defects in elastomers	G
1.8	Cracks, corrosion, or other material defects	H
1.9	Moisture and/or fungus degradation of elastomer	I
1.10	Performance degradation due to temperature effects	J

5.0 REDUNDANCY SCREENS:

SCREEN A: Fail--The leak check port seal cannot be verified during mission turnaround
SCREEN B: Fail--No provision is made for failure detection by crew
SCREEN C: Pass--The primary seal of the outer gasket and leak check port plug cannot be lost by a single credible cause

1. The primary seal and leak check port plug form part of a redundant seal system with the secondary seal. The leak check port plug will not be pressurized because it is a standby redundant to the primary seal. If the primary seal fails, the leak check port plug in addition to the secondary seal will maintain a seal. If the primary seal and the leak check port plug fail, a leak path will exist and result in loss of vehicle and crew.

6.0 ITEM DESCRIPTION:

1. Igniter Adapter-to-Case Joint, Primary Seal of Outer Gasket and Leak Check Port. Materials are listed in Table 1.

2. The outer joint closes under pressurization per TWR-61222. Therefore, this Failure Mode would require a failure of the attaching system leading to insufficient compressive load on the joint.

3. The Leak Check Port Plug is also known as the RSRM Port Plug (leak check port plug for lock/safety wire).

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U77610	Segment, Rocket Motor, Forward	Composite of Various Components		1/motor
1U76793	Case Segment, Forward, Forging	D6AC Steel	STW4-2606, STW72608	1/motor
1U51473	Case Segment, Forward	D6AC Steel	STW4-2606	1/motor
1U77450	Adapter, Igniter	D6AC Steel	STW4-2706	1/motor
1U77463	Gasket - Outer	Seal-Fluorocarbon Rubber Retainer-4130 Steel Heat Treat	MIL-R-83248, Type I, Class 1 MIL-S-18729 MIL-H-6875, Class A	1/motor
1U78676	RSRM Port plug (Leak Check Port Plug for lock/safety wire)	Corrosion-Resistive Steel	QQ-S-763, Class (316 or AMS 5648)	2/igniter
1U50228	Packing, Preformed	Fluorocarbon Rubber	STW4-3339	1/joint
1U51916	Cartridge Assembly Sealant/Adhesive	Lubricating Oil and Gelling Agent	STW5-2942	A/R

6.1 CHARACTERISTICS:

1. The primary seal (Figure 1) is an integral part of the outer gasket (Figure 4). The outer gasket crown and void areas (Figure 5). The outer gasket is located between the Forward Dome boss and the Igniter Adapter, and is held in place by 40 bolts. The primary seal contains high pressures, during ignition and boost phase, which prevent hot gasses from escaping into the atmosphere.

2. The RSRM Port Plug (leak check port plug for lock/safety wire), Figure 2, is located on the Igniter Adapter flange at location 337 degrees between the primary and secondary seals of the outer gasket.

3. The O-ring (Figure 3) is a part of the leak check port plug and helps to prevent hot gasses from leaking into the atmosphere in the event the primary seal of the outer gasket fails.

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

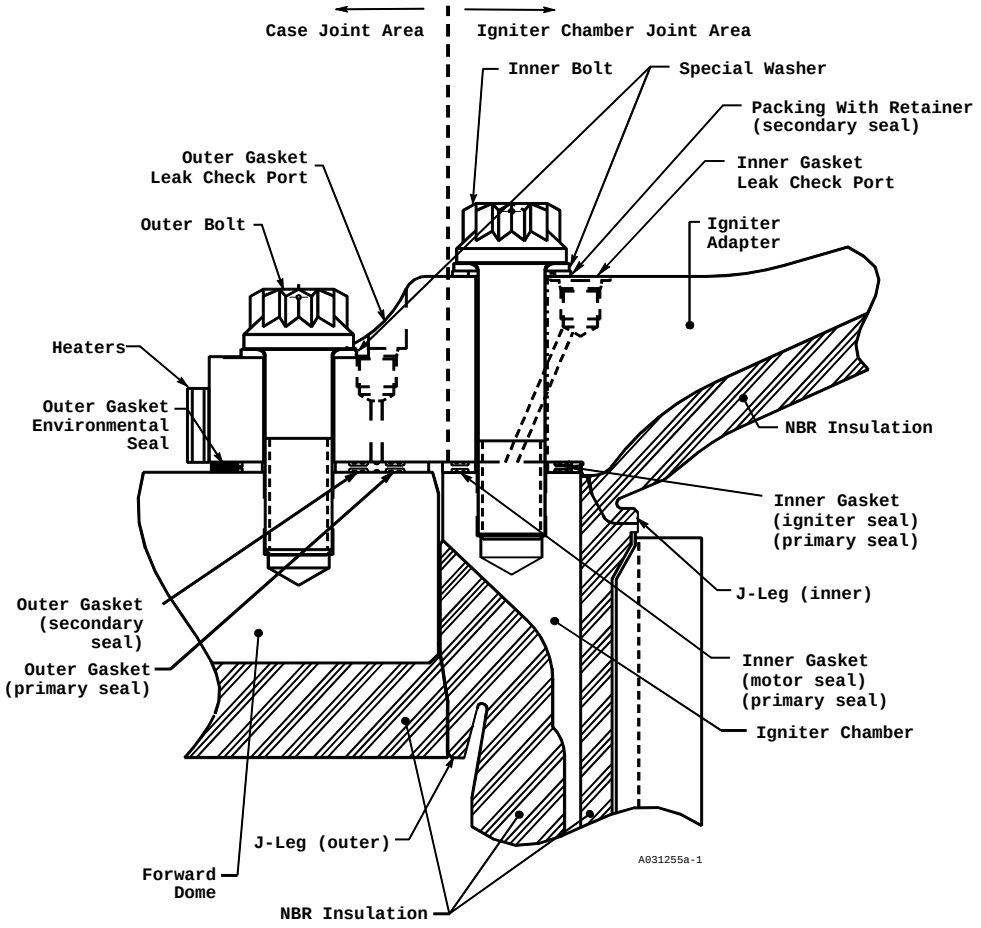


Figure 1. Igniter Adapter-to-Chamber Joint
and Igniter Adapter-to-Case Joint

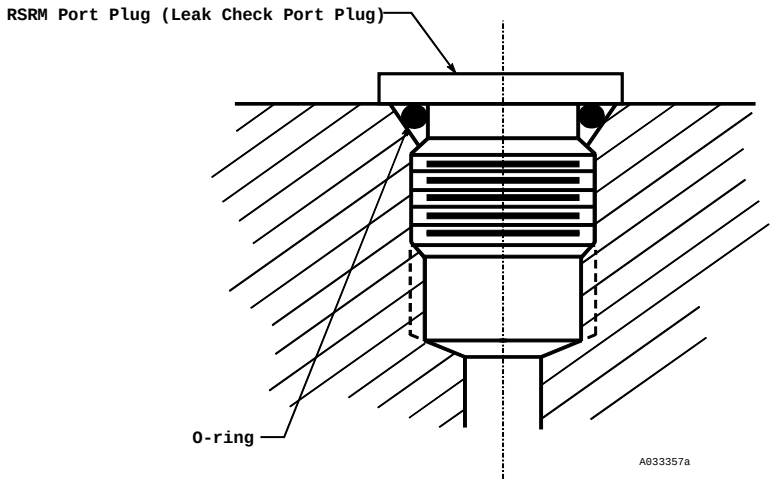


Figure 2. RSRM Port Plug

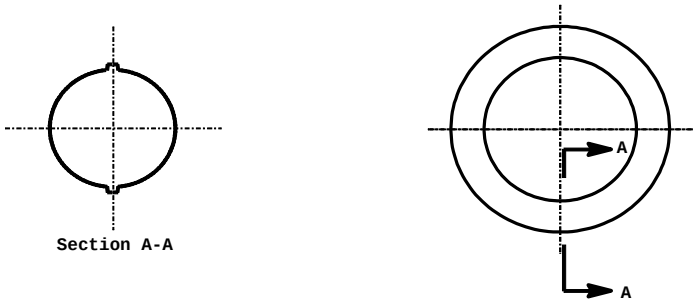


Figure 3. O-ring

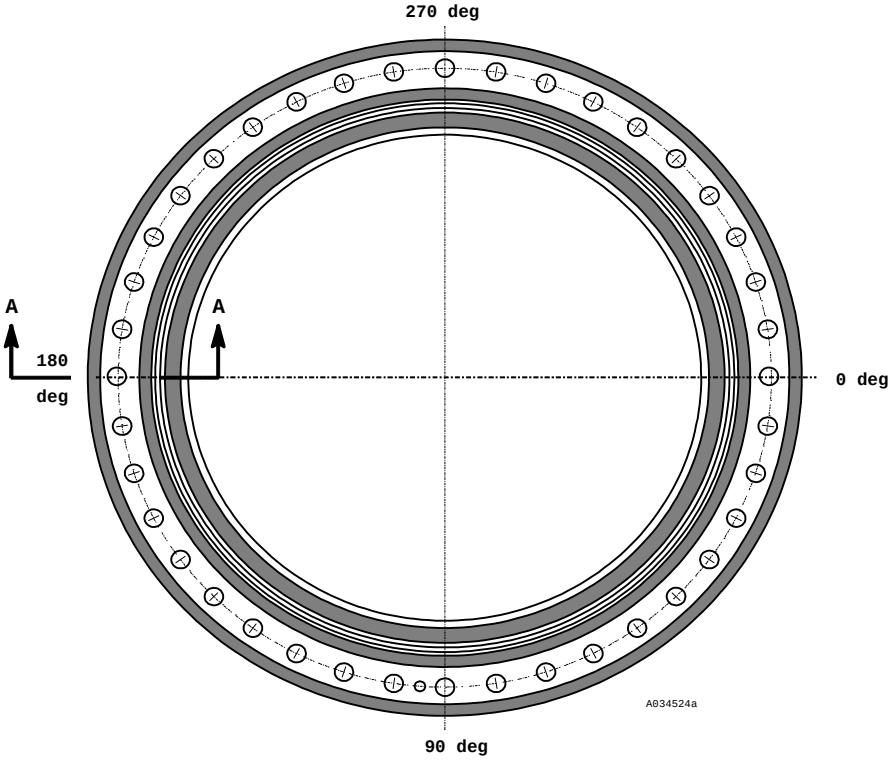
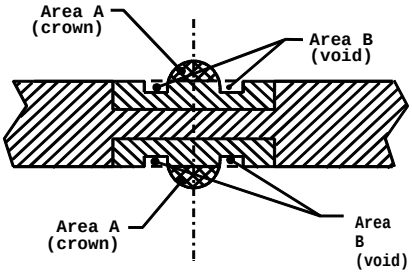
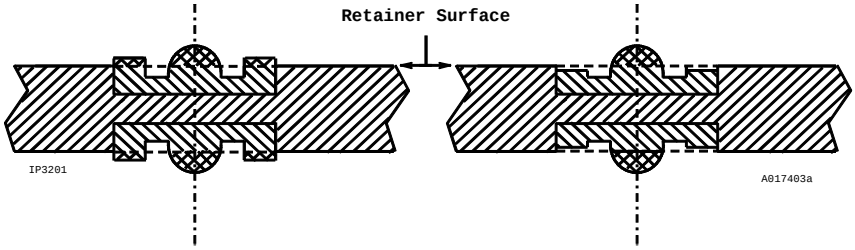


Figure 4. Outer Gasket



Area A of each seal is between 45 and
95 percent of area B of each seal



Seal areas above the retainer
surface are added to Area A

Seal areas below the retainer
surface are added to B areas

Figure 5. Gasket Crown and Void Areas

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN	FAILURE CAUSES	
A	1.	Forward case segment boss sealing surface finish requirements are per engineering. a. Refurbishment of the forward case segment boss is performed per engineering.
A	2.	Igniter Adapter sealing surface finish requirements are per engineering drawings. a. Refurbishment of the Igniter Adapter is performed per engineering.
A,G	3.	Igniter outer gasket rubber seal surface quality requirements are per engineering.
A, E	4.	A small O-ring is used with the RSRM Port Plug (leak check port plug for lock/safety wire). Small O-ring surface quality is per engineering that establishes design requirements and fabrication details. The small O-ring is a one-time-use item.
A	5.	Surface finish is controlled per engineering drawings and specifications. Surface finish testing was performed on O-ring sealing surfaces for the case and nozzle. Sealing surface finish requirements in the igniter metal components are the same as the case and nozzle metal components. Results show considerable sealing margin in the current design, and more dependence on temperature than surface finish per TWR-17991.
A,B,D,E,F,G,H,J	6.	Leak check test requirements and procedures are determined per TWR-17922 and TWR-19510.
A,D,F,I	7.	Cleanliness of sealing surfaces to prevent contamination is controlled per shop planning, engineering, and TWR-16564.
A,D,F	8.	All sealing surfaces of Igniter Assembly components conform per engineering drawings and specifications.
A,B,C,D,E,F,G,H,J	9.	The outer joint closes under pressurization per TWR-61222. Therefore, this Failure Mode would require a failure of the attaching system leading to insufficient compressive load on the joint.
A,I	10.	Small O-rings are individually packaged in an opaque, waterproof, grease-proof, and heat-sealed bag per engineering.
B,J	11.	The outer gasket seal is fabricated from fluorocarbon rubber.
A,B,H	12.	RSRM Port Plug (leak check port plug for lock/safety wire) surface requirements are per engineering. The RSRM Port Plug is made from stainless steel per Aerospace Material Specifications or Federal Specifications, and is cold-worked for high strength, high toughness with reduced internal and surface stresses. The RSRM Port Plug proved to be a reliable composition for the intended use and provides a very high degree of corrosion resistance. The passivation process improves corrosion resistance properties. The RSRM Port Plug material is referenced in MSFC specifications that designate high resistance to stress-corrosion cracking. The RSRM Port Plug is one-time use only.

	B	13. Required torque for the RSRM Port Plug (leak check port plug for lock/safety wire) is called out per engineering drawings and specifications. This value is based on results from sealability tests documented in TWR-16964.
	B	14. Small O-rings are high-temperature, low-compression set, fluid-resistant, black fluorocarbon rubber. The small O-ring is a one-time-use item.
	B	15. Grease material requirements are per engineering.
	B,C	16. Tests for sealing the Igniter gaskets with joint deflection were performed as outlined and reported in TWR-61388 and TWR-61400. Tests show that the sealing function is maintained for worst-case compression set under maximum extremes of temperature and maximum deflections.
	B	17. Criteria for nonmetallic properties are determined per TWR-17367.
	C	18. Cured fluorocarbon elastomer rubber age resistant properties have a maximum storage life of up to 20 years when packaged per engineering.
	C	19. Aging studies of O-rings after 5 years installation life were performed. Test results are applicable to all RSRM fluorocarbon seals. Fluorocarbon maintained its tracking ability and resiliency. Fluorocarbon was certified to maintain its sealing capability over 5 years per TWR-65546.
	C	20. Grease is stored at warehouse ambient condition that is any condition of temperature and relative humidity experienced by the material when stored in an enclosed warehouse, in unopened containers, or containers that were resealed after each use. Storage life under these conditions is per engineering.
	C	21. Aging studies to demonstrate characteristics of grease after 5 years installation life were performed on TEM-9. Results showed that grease provided adequate corrosion protection for D6AC steel, and that all chemical properties of grease remained intact per TWR-61408 and TWR-64397.
	C	22. Small O-rings are packaged and stored to preclude deterioration from ozone, grease, ultraviolet light, and excessive temperature.
	D,F	23. Thiokol IHM 29 describes the requirements for handling, packaging, and transportation systems for the control of internal loads, stresses, or deflections preventing damage to elastomers or sealing surfaces.
	D,F	24. Igniter installation requirements are per engineering as follows: a. Installation preparation requires cleaning of the RSRM Port Plug (leak check port plug for lock/safety wire), outer gasket, through holes of the adapter, and threaded holes in the forward dome boss before assembly. b. Application of lubricant spray to bolt threads and air drying.
585	A,D,F	25. Prior to assembly per shop planning, all heavy-duty calcium grease is removed from sealing surfaces of the Forward Case Segment, Igniter Adapter, and bolt holes using a clean, lint-free cloth dampened with approved solvent. The outer gasket is cleaned using a clean, dry, lint-free, tightly woven cloth. A piece of mylar film is used to remove excessive grease from the grooves of the igniter gasket.
	E	26. Igniter outer gasket dimensions are per engineering.
	E	27. Forward case segment dimensions are per engineering.

a. Acceptance criteria for Forward Case Segment dimensions at refurbishment are per engineering.

E 28. Igniter Adapter dimensions are per engineering drawings.

a. Refurbishment of the Igniter Adapter is per engineering.

E 29. RSRM Port Plug (leak check port plug for lock/safety wire) dimensions are per engineering. The RSRM Port Plug is a one-time use item.

E 30. A special tool (inspection aid) was developed to visually inspect the seal foot print around the entire circumference of each new outer gasket.

G 31. Testing and analysis of elastomers that established criteria for acceptable abrasions, grind marks, scratches, cuts, inhomogeneities, splices, repairs, substandard material, surface voids and inclusions, and internal voids and inclusions are documented in TWR-17991.

G 32. Small O-ring surface quality conforms per engineering that establishes design requirements and fabrication details.

H 33. The Igniter Adapter and Forward Case Segment are made of high strength D6AC steel and are heat treated per engineering. The forgings are inspected ultrasonically for cracks per engineering.

H 34. Refurbished Igniter Adapters are subject to engineering requirements and are cleaned by Spray-in-Air, thus corrosion is removed per shop planning.

H 35. Analyses and testing to qualify the Igniter Adapter are reported in TWR-10735, TWR-11559, TWR-61222, and TWR-16104.

H 36. Igniter Adapters are hydro-proof tested and magnetic-particle inspected before every use.

H 37. The Igniter Adapter is included in TWR-16872. Fracture control analysis of the modified Igniter per TWR-16104 shows that the Igniter Adapter may be used eight times for the conservative assumptions used. Planned number of uses is four.

H 38. A Material Use Agreement is required per MSFC requirements and provided for D6AC steel.

H 39. The outer gasket is alloy steel with high resistance to stress corrosion cracking.

H 40. Inherent resistance to corrosion and stress-corrosion cracking of metal parts is augmented by the use of corrosion protection as required per engineering.

J 41. Igniter gasket fluorocarbon elastomer resiliency and dynamic tests were performed per TWR-61388 and TWR-61400. Tests show that the sealing function is maintained for worst-case compression-set under maximum extremes of temperature and maximum deflections.

I,J 42. Outer gasket fluorocarbon elastomer material high temperature response for compression set and volume swell (in fluids) is per TWR-17367.

J 43. SRM launch constraints per TWR-15832 limit Igniter joint temperature to no lower than specified per TWR-61388 and TWR-61400.

D,E,F 44. Port plug vibration testing, documented in TWR-73485, demonstrated that a very

small amount of torque from any combination of O-ring load or thread friction is sufficient to prevent loss of port plugs during flight. In addition, port plugs on the igniter are lock/safety wired in place using the double twist method per engineering.

B,E 45. RSRM Port Plug lock/safety wire conforms to engineering requirements.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS (T)			CIL CODE
		1.	For New Segment, Rocket Motor, Forward, verify:	
A,B,D,E, F,G,H,I	(T)	a.	After assembly, the igniter-to-forward dome joint is leak tested at low and high pressures	AEG218,AEG219
A,D,F,G,H,I		b.	Igniter adapter sealing and mating surfaces are clean and free of contamination and surface defects prior to installation	AEG168
A,D,F,G,H,I		c.	Forward dome sealing surfaces, bolt holes and threads are cleaned prior to installation	AEG169,AEG127
A,D,F,G,H,I		d.	Outer gasket is free of contamination, corrosion and excess grease prior to installation	AEG113
A,D,F,G,H,I		e.	Leak check port, RSRM Port Plug (leak check port plug for lock/safety wire), and O-ring are cleaned, and port is free of surface defects, prior to RSRM Port Plug installation	AEG250,AEG250A
A,D,F,H		f.	Filtered grease is applied to the forward dome-igniter interface surface	AEG100
A,D,F,H		g.	Filtered grease is applied to the igniter adapter sealing surfaces and bolt through holes	AEG112
C		h.	Outer gasket shelf life, and package container seal prior to installation	ACT065
C		i.	RSRM Port Plug (leak check port plug for lock/safety wire) O-ring shelf life, and package container seal prior to installation	AEG119
C		j.	Shelf life of filtered grease prior to application	AEG371
D,F,H		k.	Filtered grease is applied to the leak check port, RSRM Port Plug (leak check port plug for lock/safety wire), and O-ring	ACP070
D,F		l.	RSRM Port Plugs (leak check port plug for lock/safety wire) are torqued correctly	AEG272
H		m.	Filtered grease is applied to all exposed bare metal surfaces of the igniter after installation	AEG028
D,F		n.	Outer gasket is installed correctly (oriented and indexed properly)	AEG187
G		o.	RSRM Port Plugs (leak check port plug for lock/safety wire) are lock/safety wired correctly	SER218
		2.	For New Igniter Adapter, verify:	
A,D,E,F		a.	Outer leak check spot face diameter	AAS081
A,H	(T)	b.	Proof test	AAS198A
A,H	(T)	c.	Magnetic-particle inspection after proof test is complete and acceptable	AAS313A
A,D,F		d.	Surface finish of bottom surface (Datum -C-)	AAS458,AAS466
A,D,E,F,H		e.	Supplier records are complete and acceptable	AAS550
D,E,F		f.	Outer leak check spot face depth	RAA100
E		g.	Outer leak check port	AAS228
E		h.	Outside diameter	AAS366
E		i.	Flange thickness at outer bolt circle	AAS005,AAS420
E		j.	Diameter of outer bolt through holes	AAS508,RAA104
E		k.	True position of outer bolt through holes	RAA097,RAA102
E		l.	Flatness and parallelism of bottom surface (Datum -C-)	RAA109,AAS138
H	(T)	m.	Chemical analysis	AAS029,AAS323
H	(T)	n.	Mechanical properties	AAS404,RAA044
H	(T)	o.	Metallurgical characteristics	AAS404C,RAA045
H	(T)	p.	Heat treatment	AAS175,AAS177
H		q.	Material is D6AC steel	AAS029A

H		r.	No obvious shipping or handling damage	AAS343
H	(T)	s.	Ultrasonic testing complete and acceptable	AAS541,RAA001

3. For Refurbished Igniter Adapter, verify:

A,H	(T)	a.	Hydroproof successful	AAN008
A,D,F,H		b.	Sealing and mating surfaces for surface defects and surface finish	AAS107
A,H	(T)	c.	Magnetic-particle after hydroproof test	AAS301
D,E,F,H		d.	Threaded holes conform to gauging requirements after hydroproof testing	AAS491
E,H		e.	Flatness and parallelism of sealing and mating surfaces	AAS136
E		f.	Flange thickness	AAS061A

4. For New Case Segment, Forward, verify:

A		a.	Surface finish of Datum -G-	ACD170
A		b.	No scratches, dings, gouges, or raised metal on Datum -G-	ACD150
A		c.	Surface defects and repair	FAA151
A,E		d.	Surface finish of boss sealing surface	ACD171
A,H	(T)	e.	Hydroproof test	ACD074
A,H	(T)	f.	Magnetic-particle inspection after hydroproof test	ACD121
E		g.	Threaded bolt holes for thread for igniter outer bolts	ACD183,ACD186
E		h.	Flatness of Datum -G-	ACD054,ACD059
E		i.	Threaded bolt holes for tap drill depth	ACD035,ACD175

5. For Refurbished Case Segment, Forward, verify:

A		a.	Mounting surface does not exceed specified surface finish forward case segment boss	ACD142
A,E		b.	Surface defects and repair	FAA170
A,H	(T)	c.	Hydroproof test	ACD073
A,H	(T)	d.	Magnetic-particle inspection after hydroproof test	ACD096
E		e.	Damage or surface defects not deeper than specified all threaded holes	ACD033
E		f.	Correct thread size of bolt holes	ACD031

6. For New Case Segment, Forward, Forging, verify:

H	(T)	a.	Ultrasonic test	ACD195,ACD199

7. For New Igniter Outer Gasket, verify:

A,E,G,H		a.	Primary and secondary seals for unbonds	CCC134,CCC143
A,E,G,H		b.	Primary and secondary seals for flash	CCC135,CCC144
A,E,G,H		c.	Primary and secondary seals for unacceptable flat spots on the crown	ACT152,CCC148
A,E,G,H		d.	Primary and secondary seals for abrasions	CCC138,CCC150
A,E,G,H		e.	Primary and secondary seals for flow marks	CCC139,CCC151
A,E,G,H		f.	Primary and secondary seals had the foot-print inspection performed	CCC140,CCC152
A,E,G,H		g.	Primary and secondary seals had the compression inspection performed	CCC141,CCC153
A,E,G,H		h.	Primary and secondary seals had the finger inspection performed	CCC142,CCC154
A,E,G,H		i.	Primary and secondary seals for inclusions, cuts, voids, foreign material or other irregularities	ACT004,ACT129
A,E,G,H		j.	Primary and secondary seals for undispersed materials	CCC136,CCC155
A,H	(T)	k.	Magnetic-particle testing	ACT023,ACT112
A,B,C,E,G,H		l.	Supplier records are complete and acceptable	ACT031

B,C,I,J		m.	Seal material is fluorocarbon rubber	ACT037
C		n.	Time between cure date and supplier shipping date	CCC159
C		o.	Each gasket is packaged and sealed in an individual bag	ACT168
E		p.	Primary and secondary seals for crown height	ACT177A
E		q.	Groove depth	ACT107
E		r.	Groove full radius	ACT108
E		s.	Diameter of index pin through hole	ACT083
E		t.	Diameter of bolt through holes	ACT084
E		u.	True position of bolt through holes	ACT084A
E		v.	Outside diameter of gasket	ACT082
E		w.	Metal retainer thickness	ACT192
H		x.	Voids, circumferential scratches and radial scratches in metal retainer do not exceed acceptable conditions	CCC121,CCC125
H		y.	Absence of corrosion on the metal retainer	CCC124,CCC128
H		z.	No shipping/handling damage	RAA119

8. For Refurbished Igniter Outer Gasket, verify:

A,E,G,H		a.	Primary and secondary seals for unbonds	CCC134A,CCC143A
A,E,G,H		b.	Primary and secondary seals for flash	CCC135A,CCC144A
A,E,G,H		c.	Primary and secondary seals for unacceptable flat spots on the crown	ACT152A,CCC148A
A,E,G,H		d.	Primary and secondary seals for abrasions	CCC138A,CCC150A
A,E,G,H		e.	Primary and secondary seals for flow marks	CCC139A,CCC151A
A,E,G,H		f.	Primary and secondary seals had the foot-print inspection performed	CCC140A,CCC152A
A,E,G,H		g.	Primary and secondary seals had the compression inspection performed	CCC141A,CCC153A
A,E,G,H		h.	Primary and secondary seals had the finger inspection performed	CCC142A,CCC154A
A,E,G,H		i.	Primary and secondary seals for inclusions, cuts, voids, foreign material or other irregularities	ACT004A,ACT129A
A,E,G,H		j.	Primary and secondary seals for undispersed materials	CCC136A,CCC155A
A,B,C,E,G,H		k.	Supplier records are complete and acceptable	ACT031A
B,C,I,J		l.	Seal material is fluorocarbon rubber	ACT037A
C		m.	Time between cure date and supplier shipping date	CCC159A
C		n.	Each gasket is packaged and sealed in an individual bag	ACT168A
E		o.	Primary and secondary seals for crown height	ACT177B
H		p.	Voids, circumferential scratches and radial scratches in metal retainer do not exceed acceptable conditions	CCC121A,CCC125A
H		q.	Absence of corrosion on the metal retainer	CCC124A,CCC128A
H		r.	No shipping/handling damage	RAA119A

9. For RSRM Port Plug (leak check port plug for lock/safety wire) verify:

A,H		a.	No shipping or handling damage to packaging	AAB090
A		b.	O-ring groove surface finish	AAB043
A		c.	O-ring groove sealing surface blemishes	LAA264
B	(T)	d.	Tensile strength	AAB081
B	(T)	e.	Yield strength	AAB091
B,H		f.	Plug material	AAB053
E		g.	O-ring groove width dimension	AAB047
E		h.	O-ring groove diameter dimension	AAB036
E		i.	Plug length	AAB018
E		j.	Correct thread form	AAB082
E		k.	Thread surface blemishes	LAA268

10. For New Small O-ring verify:

A,C,D,F,G		a.	Surface quality	AAQ234,AAQ233
B		b.	Material is fluorocarbon rubber	AAQ157,AAQ117
B	(T)	c.	Shore A hardness	LAA001,LAA006,LAA011,LAA016
B	(T)	d.	Tensile strength	LAA002,LAA007,LAA012,LAA017
B	(T)	e.	Ultimate elongation	LAA003,LAA008,LAA013,LAA018
B	(T)	f.	Compression-set	LAA004,LAA009,LAA014,LAA019
B	(T)	g.	Tear strength	LAA005,LAA010,LAA015,LAA020
C		h.	Time from cure date to shipment	AAQ251
C		i.	Individually packaged and sealed in opaque bags; material is per engineering	AAQ211
E		j.	Inside diameter "A"	AAQ002,AAQ003
E		k.	Cross-sectional dimension "W"	AAQ004,AAQ062
E		l.	Flash dimensions	AAQ111,AAQ112

11. For New Grease verify:

B	(T)	a.	Penetration	LAA037
B	(T)	b.	Dropping point	ANO042
B	(T)	c.	Zinc concentration	LAA038

12. For New Filtered Grease verify:

B	(T)	a.	Contamination	ANO064

13. For New Lock/Safety Wire verify:

B		a.	Certificate of Conformance complete and acceptable	AJV000
E		b.	Diameter	AJV005

14. KSC verifies:

J		a.	Igniter heaters are activated and that temperatures are in compliance with NASA Launch Commit Criteria (NSTS-16007) per OMRSD File II, Vol. I, S00FA0.620	OMD012
F		b.	Lock/safety wire on the igniter adapter inner and outer bolt circles, the OPTs, and the RSRM Port Plugs (leak check port plug for lock/safety wire) to be unbroken prior to forward skirt closeout per OMRSD File V, Vol. I, B47IG0.040	OMD045