ATK ALLIANT TECHSYSTEMS
THIOKOL PROPULSION

CRITICAL ITEMS LIST (CIL)

No. 10-02-01-35R/02

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1R
SUBSYSTEM:	Nozzle Subsystem 10-02	PART NAME:	Fixed Housing-to-Aft End Ring Joint, Thermal Protection System (Sealant and Fixed Housing/Aft End Ring Metal Interface) (1)
ASSEMBLY:	Nozzle and Aft Exit Cone 10-02-01		
FMEA ITEM NO.:	10-02-01-35R Rev N		
CIL REV NO.:	N (DCN-533)		
DATE:	10 Apr 2002	PART NO.:	(See Section 6.0)
SUPERSEDES PAGE:	339-1ff.	PHASE(S):	Boost (BT)
DATED:	27 Jul 2001	QUANTITY:	(See Section 6.0)
CIL ANALYST:	B. A. Frandsen	EFFECTIVITY:	(See Table 101-6)
		HAZARD REF.:	BN-03
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 10 Apr 2002

ENGINEERING: B. H. Prescott 10 Apr 2002

1.0 FAILURE CONDITION: Failure during operation (D)

2.0 FAILURE MODE: 1.0 Thermal failure

3.0 FAILURE EFFECTS: Burn-through of the primary and secondary O-rings. Burn-through of metal housing and loss of nozzle, causing thrust imbalance between SRBs, causing loss of RSRM, SRB, crew, and vehicle.

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	Failure of sealant (bond line, voids, tears, cracks)	
1.1.1	Sealing compound surfaces not properly prepared or adequately cleaned	A
1.1.2	Primer and sealing compound not properly mixed, applied, or cured	B
1.1.3	Contamination	C
1.1.4	Process environments detrimental to bond strength	D
1.1.5	Nonconforming material properties	E
1.1.6	Sealing compound degradation during storage or transportation	F
1.2	Failure of the fixed housing/aft end ring metal interface	
1.2.1	Nonconforming dimensions	G
1.2.2	Improper assembly	H
1.2.3	Corrosion	I
1.2.4	Surface defects	J
1.2.5	Improper preload	K

5.0 REDUNDANCY SCREENS:

SCREEN A: Fail—The hardware is not capable of checkout during normal ground turnaround
SCREEN B: Fail—Loss of the thermal protection system is not detectable during flight
SCREEN C: Pass—Loss of all redundant items in the thermal protection system can not be the result of a credible single failure cause

6.0 ITEM DESCRIPTION:

1. Sealant, Silicone, RTV provides thermal protection between the two nozzle assembly items at their phenolic surface interface. A gap is provided between the two phenolic surfaces for the following reasons:

   a. To allow for thermal expansion of the nozzle assembly parts during boost
   b. To allow for positive and full surface mate-up while providing for surface contour tolerances

2. Polysulfide sealing compound is used as an environmental seal in bolt bore holes (flexible bearing protector-to-aft end ring) with no thermal significance. The assembled joint is shown per Figures 1 and 2. Materials are listed in Table 1.

3. The Fixed Housing and Aft End Ring are steel components and are a part of the Nozzle Assembly, Final. They are assembled together with screws creating a metal-to-metal joint.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U51369	Washer, Special	4130 Steel		72/motor
1U52833	Aft End Ring	D6AC Steel	STW4-2709	1/motor
1U52855	Nose-Throat Assembly, Nozzle			1/motor
1U52858	Nose-Throat-Bearing-Cowl-Housing Assembly Nozzle			1/motor
1U52945	Housing, Nozzle Fixed	D6AC Steel	STW4-2709	1/motor
1U76385	Screw	Alloy Steel with Cadmium Plating	FF-S-86 NAS 1351 QQ-P-416	72/motor
1U76887	Pin, Spring	Steel, CRES 420	MS16562	A/R
1U77640	Segment, Rocket Motor, Aft			1/motor
1U79146	Nose-Throat Assembly			1/motor
1U79149	Nose-Throat-Bearing-Cowl Assy, Nozzle			1/motor
1U79153	Nose-Throat-Bearing-Cowl Assembly			1/motor
1U77660	Nozzle Assembly, Final			1/motor
1U79150	Nozzle Fixed Housing Assembly			1/motor
1U79324	Bearing Assembly, Nozzle Flexible			1/motor
	Primer (Adhesive-Sealant Silicone RTV)	A One-part Dilution of Reactive Materials in Solvent	STW4-3875	A/R
	Silicone Sealing Compound (Sealant, Silicone, RTV)	A Two-part Room Temp Vulcanizing Silicone Rubber, High-Temp Pressurization Sealing Compound and Ablative Thermal Barrier	STW5-2813	A/R

6.1 CHARACTERISTICS:

1. The fixed housing to aft-end-ring joint anchors the aft end of the flex bearing. The joint is bolted together, with silicone rubber compound filling the gap between the two nozzle assembly items, acting as a thermal barrier. The joint is not exposed to direct gas impingement and there is not a defined char line.
2. Silicone rubber sealing compound provides high-temperature flexible thermal protection between phenolic layers that face together at the joint. The function of sealant is to protect joint metal components from heat affect and the O-rings from erosion.
3. The main structure of the nozzle assembly consists of various machined steel and aluminum forgings. These parts support the bearing assembly, nozzle throat, and exit cone.
4. The metal interface of the fixed housing-to-aft end ring joint was added to the CIL as a contributor to thermal protection of the joint per TWR-66503. Metal in the joint provides a heat sink that reduces temperature of hot gases if the gases pass the RTV per TWR-66865 and TWR-66146.

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

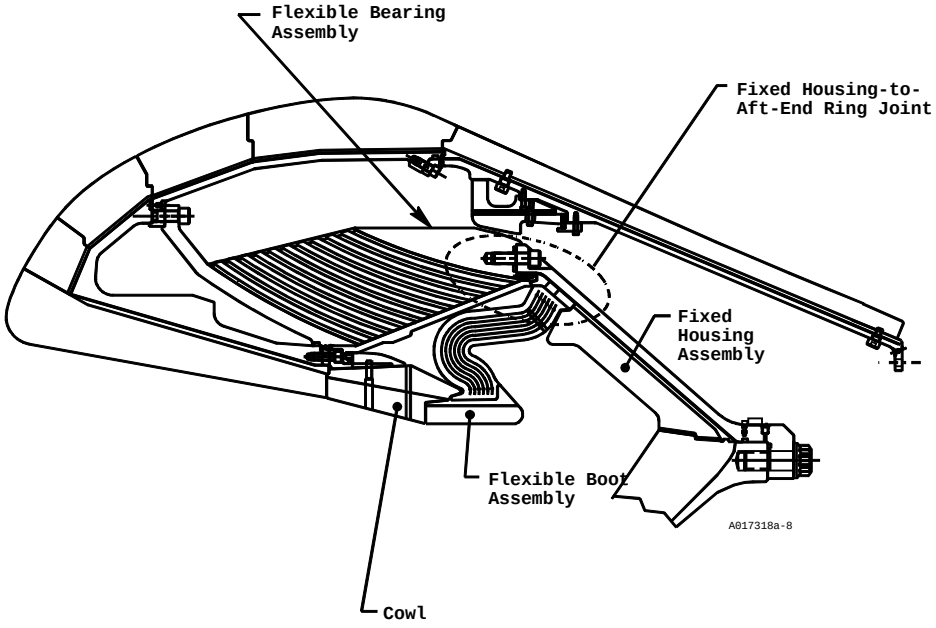

Figure 1. Fixed Housing-to-Aft End Ring Joint Location

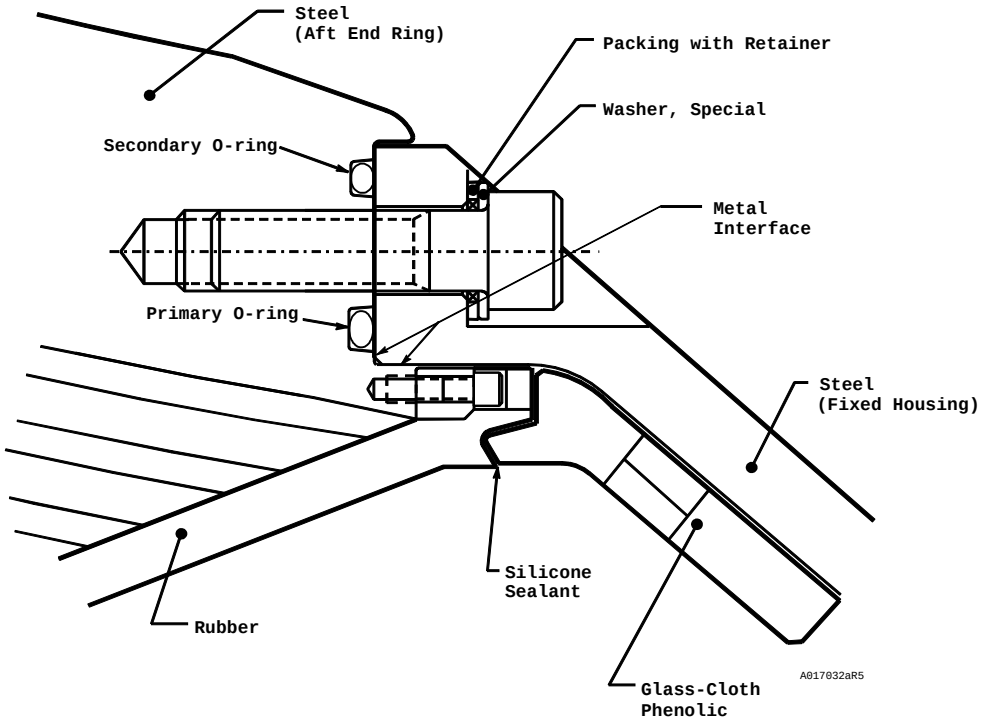

Figure 2. Fixed Housing-to-Aft End Ring Joint, Sealing Compound

9.0 RATIONALE FOR RETENTION:
9.1 DESIGN:

DCN	FAILURE CAUSES	
A,C,D	1.	Preparation and cleaning of bonding surfaces is per shop planning. Cleanliness of bonding surfaces is determined by a combination of visual inspection and visual inspection aided by black light. Surface inspection type is per shop planning. Preparation, cleaning, and inspection methods for aft exit cone bondlines are identified as process critical planning.
A,B,C,D,E,F	2.	Sealing compound and method of application were qualified through testing per TWR-18764-09.
B	3.	Two-part sealing compound mix ratio is controlled per engineering and mixing instructions are per shop planning.
B	4.	Primer is prepared by the supplier per engineering.
B	5.	Primer and sealing compound application and cure for the Nose-Throat-Bearing Cowl Assembly are controlled per engineering drawings and shop planning: a. Sealing compound to-carbon-cloth phenolic is identified as a critical process planning step.
C,D,I	6.	Contamination control requirements and procedures are per TWR-16564.
C	7.	Primer is a one-component Room Temperature Vulcanization (RTV) silicone per engineering.
C	8.	Sealing compound is a two-part RTV silicone elastomer, supplied in separate sealed containers per engineering.
C,D,I	9.	The nozzle manufacturing building is a controlled environment facility with temperature and humidity controls. There is controlled access to the building through a separate room with a card reader.
E	10.	Material properties for primer and sealing compound are per engineering.
E	11.	Sealing compound consists of a silicone rubber base and a catalyst. The supplier supplies the correct amount of each component material to achieve the proper mix ratio per engineering.
F	12.	Requirements for handling RSRM components during assembly and transportation are similar to those for previous and other current programs at Thiokol. Proof testing is required for all lifting and handling equipment per TWR-13880.
F	13.	Support equipment used to test, handle, transport, and assemble or disassemble the RSRM is certified and verified per TWR-15723.
F,G,J	14.	All components are inspected for handling damage after completion. Assembly and handling operations are controlled per shop planning and IHM 29.
F	15.	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.

F	16.	The RSRM and its component parts are protected per TWR-10299 and TWR-11325. The nozzle, which is shipped as part of the aft segment, is protected from the external environment at all times by either covers or shipping containers until assembled as part of the RSRM.
F	17.	Positive cradling or support devices and tie downs that conform to shape, size, weight, and contour of components to be transported are provided to support RSRM segments and other components. Shock mounting and other protective devices are used on trucks and dollies to move sensitive loads per TWR-13880.
F	18.	Age degradation of nozzle materials was shown to not be a concern. Full-scale testing of a six-year old nozzle showed that there was no performance degradation due to aging, TWR-63944. Tests on a 15-year old flex bearing also showed no degradation of flex bearing material properties, TWR-63806.
F	19.	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.
G	20.	Aft end ring dimensions are per engineering drawings.
G	21.	Refurbished aft end ring dimensions are per engineering drawings and specifications.
G,I,J	22.	Surfaces of the aft end ring are protected from corrosion per engineering.
G	23.	Fixed housing dimensions are per engineering drawings.
G	24.	Refurbished fixed housing dimensions are per engineering drawings and specifications.
G,I,J	25.	Surfaces of the fixed housing are protected from corrosion per engineering.
G,K	26.	Screw dimensions are per engineering drawings. This is a one-time-use item.
G	27.	Washer, Special dimensions are per engineering. This is a one-time-use item.
G	28.	Indexing/spring pin dimensions are per engineering drawings. This is a one-time-use item.
G,K	29.	Design dimensions tolerances are per TWR-15995 to assure proper operational clearances.
K	30.	The basic forging for the aft end ring and fixed housing was evaluated per requirements of a JSC Specification and found to have a grain pattern minimizing residual strain considerations per TWR-10707.
I,K	31.	Screws are cadmium plated alloy steel which are baked to relieve hydrogen embrittlement per engineering.
I,K	32.	The Indexing/spring pin is made from Corrosion-Resistant Steel (CRES) 420 per engineering.
G,I,K	33.	The design verification analysis shows that materials and geometry of the fixed housing and aft end ring are acceptable for flight per TWR-18764-09.

K	34.	The aft end ring is a heat-treated D6AC steel forging.
K	35.	The nozzle fixed housing is a heat treated D6AC steel forging.
I	36.	D6AC steel has low-to-moderate resistance to stress corrosion as rated in MSFC-STD and meets approval per Material Use Agreement.
G,H,I	37.	A light coating of filtered grease is applied to interfacing metal surfaces and holes prior to installation of socket head cap screws.
H,K	38.	The socket head cap screws joining the fixed housing to aft end ring are tightened and torqued per engineering and shop planning.
K	39.	Screws are self-locking per engineering drawings.
H,I	40.	Prior to installation, all socket head cap screws must meet cleanliness requirements per shop planning.
H,K	41.	Screw preload and sequencing is established in design verification document TWR-15995.
	42.	Assembly stresses are minimized as follows:
G,H,J,K		a. Mating surface flatness is controlled by inspection of machining operations.
H,I,J,K		b. Threads are cleaned and lubricated prior to assembly.
H,K		c. Assembly bolts are torqued in a prearranged sequence to preload values.
G,H,K	43.	An indexing pin ensures correct component positioning as the fixed housing and aft end ring are mated.
H,K	44.	Guide pins are used to aid in proper assembly of the fixed housing to the aft end ring per shop planning.
	45.	The possibility of fatigue to these parts during their service life was considered as follows:
		a. Fixed Housing:
G,I,J,K		1) TWR-16875 includes this part since its design was controlled by cyclic or repeated load condition. Fatigue analysis was performed for low cycle fatigue, high cycle fatigue, and fracture mechanics. Results of the design analysis per TWR-16975 indicate that calculated housing life substantially exceeds the service life requirement. TWR-16975 shows a positive margin of safety based on a factor of safety of 1.4 ultimate and 1.1 on yield.
		b. Aft End Ring:
G,I,J,K		1) This part is not controlled by TWR-16875 since stresses are low and the margin of safety is high. TWR-16975 shows a positive margin of safety based on a factor of safety of 1.40 ultimate and 1.1 on yield.
G,I,J,K	46.	Aft end ring internal threads at the fixed housing-to-aft end ring joint for new aft end rings are per engineering drawings. Refurbished aft end rings must satisfy thread requirements per engineering.
G,I,J,K	47.	The aft end ring is proof tested. Aft end ring threads are loaded in this test.

	G,I,J,K	48. Aft end rings are acceptable for use per engineering. Threads are visually inspected for surface contamination, damage, and surface defects. Threads will have no damage or defects greater than that called out in engineering. Threads are inspected after proof testing.
	G,I,J,K	49. Any thread damage repair requires DR/MRB action per engineering. An RSRM Material Use Agreement covers the use of helical inserts in D6AC steel. Thiokol performed tests to assure twenty-use requirements and structural capability of helical inserts in D6AC steel as documented in TWR-18555.
	G,H,J,K	50. Bolt preload holds the joint metal parts together to form a face contact interface. The joint is a closing joint upon pressurization. Any gaps within the joint metal interface are the result of flatness conditions and localized surface defects which are controlled within engineering limits. Temperature of the gas entering the joint is reduced as it comes in contact with the metal. Temperature reduction is a function of the quantity and velocity of gas entering the joint versus the surface area, path shape, and the thermal conductivity of the metal the gas contacts in the joint.
	G,H,J,K	51. TWR-66865 and TWR-66146 cover the joint during pressurization and heating within the joint due to the entrance of chamber gases by way of postulated leak paths through the joint's RTV. The maximum surface temperature of the steel housings is below the melting point, but may be above the design/reuse temperature. Features of the component metal interface surfaces ahead of the primary and secondary O-rings are controlled per engineering drawings.
	D,G,H,J,K	52. Analysis of carbon-cloth phenolic ply angle changes for the nozzle was performed. Results show that redesigned nozzle phenolic components have a reduced in-plane fiber strain and wedge-out potential per TWR-16975. New loads that were driven by the Performance Enhancement (PE) Program were addressed in TWR-73984. No significant effects on the performance of the RSRM nozzle were identified due to PE.
533	D,G,H,J,K	53. Thermal analysis per TWR-17219 shows the nozzle phenolic meets the new performance factor equation based on the remaining virgin material after boost phase is complete. This performance factor will be equal to or greater than a safety factor of 1.4 for the fixed housing assembly per TWR-74238 and TWR-75135. (Carbon phenolic-to-glass interface, bondline temperature and metal housing temperatures were all taken into consideration). The new performance factor will insure that the CEI requirements will be met which requires that the bond between carbon and glass will not exceed 600 degree F, bondline of glass-to-metal remains at ambient temperature during boost phase, and the metal will not be heat affected at splashdown.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS (T)		CIL CODE
	1.	For New Nose-Throat-Bearing-Cowl Housing Assembly, Nozzle verify:	
A	a.	Drying time prior to primer application of interfacing surfaces of inner boot ring-to-bearing protector	ADQ061
A	b.	Bonding/mating surfaces of the inner boot ring are solvent wiped prior to primer application	ADQ236
A	c.	All primed interfacing surfaces are free from damage (inner boot ring)	ADQ003
A	d.	All primed interfacing surfaces are free from contamination (inner boot ring)	ADQ003A
A	e.	All primed interfacing surfaces are free from damage (bearing protector)	ADQ004
A	f.	By black light that interfacing surfaces of inner boot ring-to-bearing protector are free from contamination prior to primer application	ADQ032
A	g.	All primed interfacing surfaces are free from contamination (bearing protector)	ADQ049
B	h.	Pot life of silicone sealing compound is not exceeded at time parts are seated	ADQ158
B	i.	Cure is complete and acceptable per planning requirements for silicone sealant	ADQ055
B	j.	Sealing compound (Sealant, Silicone, Two-part, RTV) is mixed per planning requirements	ADQ198
B	k.	Shelf life of primer is not exceeded at time of application	ADQ216
B	l.	Shelf life of silicone sealing compound has not been exceeded prior to start of mix	ADQ217
B	m.	Stock and lot number of primer (RTV Sealant) at time of application	ADQ253
B	n.	Stock and lot number of silicone sealing compound at time of application	ADQ255
B	o.	Bearing protector & inner boot ring are air dried per planning prior to application of sealing compound	ADQ152
B	p.	Bearing protector & inner boot ring are primed with RTV sealant prior to application of silicone sealing compound	ADQ155
B	q.	Shore A hardness (cure cup samples) achieve design value for silane primer	ADQ224
B	r.	Silicone sealing compound applied to bearing protector at assembly	ADQ227
D	s.	Temperature of bonding surfaces is within specified limits prior to sealing compound application	ADQ258
G,H,I,J	t.	Application of filtered grease to Aft End Ring O-ring grooves prior to assembly	ADQ012
G,H,I,J	u.	Application of filtered grease to Housing, Nozzle-Fixed forward end sealing surfaces prior to assembly	ADQ015
G,H,I,J	v.	O-ring grooves in Aft End Ring are free from corrosion and contamination prior to assembly	ADQ208
I,J	w.	All interfacing surfaces of Aft end ring are cleaned per planning requirements prior to installation of O-rings	ADP001
I,J	x.	Interfacing surfaces of fixed housing are cleaned prior to assembly per planning requirements	AJR000
I	y.	Filtered grease is per drawing requirements	ADQ044
H,I	z.	Filtered grease is applied to all noted holes	ADQ041
H,I	aa.	Filtered grease is applied to socket head cap screws prior to installation	ADQ043
G,I,J	ab.	Sealing surfaces on Housing, Nozzle-Fixed forward end are free from corrosion and contamination prior to assembly	ADQ202
H,K	ac.	Socket head cap screws locking device acceptable at installation	ADQ231
G,I,K	ad.	Fixed housing to aft end ring screw is free from contamination and corrosion, prior to installation	ADQ232

H,K		ae.	Fixed housing to aft end ring screw torquing sequence	ADQ233
H,K		af.	Amount of torque used on each fixed housing to aft end ring screw	ADQ262
H,K		ag.	Washer, Special, is installed with radius side toward head of fixed housing to aft end ring screw	ADQ241
G,J		ah.	Seal surface defects (handling damage) are reworked	ADQ069
G,J		ai.	Sealing surfaces of fixed housing for gouges prior to assembly	ADQ203
G,J		aj.	Sealing surfaces of fixed housing for pitting prior to assembly	ADQ204
G,J		ak.	Sealing surfaces of fixed housing for scratches prior to assembly	ADQ205
J		al.	O-ring grooves in Aft End Ring are free from damage prior to assembly	ADQ206
G,J		am.	Sealing surfaces on Housing, Nozzle-Fixed forward end are free from damage prior to assembly	ADQ207
G,J		an.	O-ring grooves in aft end ring are free from gouges prior to assembly	ADQ210
G,J		ao.	O-ring grooves in aft end ring are free from pitting prior to assembly	ADQ212
G,J		ap.	O-ring grooves in aft end ring are free from scratches prior to assembly	ADQ214

2. For New Nose-Throat-Bearing-Cowl Assembly verify:

B		a.	Application of silicone sealing compound to joint per shop planning	ADN016A
B		b.	Tape pressure dam is installed per planning requirements	ADN017A
B		c.	Cured sealing compound is blended to adjacent contour	ADN032A
B		d.	Phenolic surfaces are cleaned per planning requirements prior to taping backfill dam	ADN035A
B		e.	Loading of silicone sealing compound into cartridges per shop planning requirements	ADN113A
B		f.	Joint sealing compound is free of cracks, inclusions, separations, uncured material, and voids	ADQ086A
B		g.	Points A to B and C to D, (cowl & nose cap) primer is dried per planning prior to application of sealing compound (Sealant, Silicone)	ADQ153A
B		h.	Points A to B and C to D, (cowl & nose cap) are primed with Adhesive-Sealant, Silicone RTV prior to application of sealing compound (Sealant, Silicone)	ADQ156A
B		i.	Pot life of sealing compound has not exceeded at time of application	ADQ158A
B		j.	Sealing compound cure per shop planning	ADQ193A
B		k.	Sealing compound (Sealant, Silicone, Two-part, RTV) is mixed per planning requirements	ADQ198A
B		l.	Shelf life of primer has not been exceeded at time of application for backfill material	ADQ216A
B		m.	Shelf life of silicone sealing compound has not been exceeded at time of application	ADQ217A
B		n.	Shore A hardness (cure cup samples) achieve design values for backfill material	ADQ224A
B		o.	Stock and lot number of primer (RTV Sealant) at time of application for backfill joint	ADQ243A
B		p.	Stock and lot number of silicone sealing compound at time of application	ADQ255A
G,J,K		q.	Finalization of parts with defects from shipping/handling damage during processing	ADP033

3. For New Adhesive-Sealant Silicone RTV verify:

C		a.	Containers for shipping and handling damage	ADQ220
C		b.	Contains no foreign matter	AIY002
C		c.	Material is homogeneous	AIY004
E		d.	Primer color	AIY001
E	(T)	e.	Specific gravity	AIY007
E	(T)	f.	Total solids content	AIY015

4. For New Sealant, Silicone, RTV verify:

C		a.	Shipping and handling damage	ADQ223
C		b.	Workmanship is uniform in appearance, quality and color	ANF045
E	(T)	c.	Elongation	ANF000,ANF002,ANF004
E	(T)	d.	Flow	ANF011,ANF013
E	(T)	e.	Shore A hardness	ANF021,ANF023,SAA042
E	(T)	f.	Specific gravity	ANF029,ANF031,SAA043
E	(T)	g.	Tensile strength	ANF037,ANF039,ANF040

5. For New Nose-Throat Assembly, Nozzle verify:

E	(T)	a.	Shore A hardness (cure cup samples) for each mix batch of silicone sealing compound	ADN112

6. For New Segment Assembly, Rocket Motor, verify:

F		a.	Nozzle assembly for handling damage and protective cover is cleaned and in place	AGJ167

7. For New Housing, Nozzle-Fixed verify:

G		a.	Thickness	ADV034,ADV034A,ADV035,ADV035A ADV204,ADV205,ADV207,ADV208
G,K		b.	Flatness	ADV039,ADV040,ADV042,ADV043
G		c.	Diameter	ADV048,ADV049,ADV053,ADV054,ADV055,ADV057
G		d.	Height	ADV069,ADV070
G,H,I,J		e.	Corrosion protection is per specification	ADV090
G		f.	Profile	ADV154,ADV155
G		g.	True position	ADV210A,ADV211,ADV212,ADV212A
G,I,J,K	(T)	h.	Hydroproof test	ADV097
G	(T)	i.	Elongation	ADV063
K	(T)	j.	Fracture toughness (K_{IC})	ADV073
G	(T)	k.	Reduction in area	ADV171
G	(T)	l.	Ultimate tensile strength	ADV213
G	(T)	m.	Yield strength	ADV229
G	(T)	n.	Ultrasonic	ADV222
K		o.	Heat treat	ADV085
K	(T)	p.	Material	ADV195

8. For Refurbished Housing, Nozzle Fixed verify:

G		a.	Thickness	ADV036
G		b.	Diameter	ADV050,ADV058
G		c.	Height	ADV071
G		d.	Straightness	ADV152
G		e.	Roundness	ADV176,ADV180,ADV182
G,K		f.	Flatness	ADV197
G,I,J,K	(T)	g.	Hydroproof test	ADV092
G,I,J,K	(T)	h.	Magnetic-particle	ADV110

9. For New Aft End Ring verify:

G,K		a.	Correct thread	ADE004,ADE004A
G,I		b.	Corrosion protection is per specification	ADE005
G,H,K		c.	Tap drill hole depth	ADE008,ADE008A,ADE074,ADE074A
G,H,K		d.	Depth of threads	ADE010,ADE010A,ADE011,ADE011A
G		e.	Diameter dimension	ADE012,ADE014,ADE901,ADE903

G,K		f.	Flatness	ADE023,ADE024
G		g.	Run out of diameter	ADE063,ADE064,ADE902,ADE904
G		h.	Hole perpendicularity	ADE071
G		i.	True position	ADE077,ADE077A,ADE078,ADE078A
K	(T)	j.	Elongation	ADE076B
K	(T)	k.	Reduction of area	ADE076C
K	(T)	l.	Ultimate strength	ADE076
K	(T)	m.	Yield strength	ADE076A
I,J,K	(T)	n.	Ultrasonic	ADE080
I,J,K	(T)	o.	Magnetic-particle	ADE040
K		p.	Heat treat	ADE029
K	(T)	q.	Chemical composition	ADE069

10. For Refurbished Aft End Ring verify:

G,I,J		a.	Corrosion protection	ADE005A
G		b.	Diameter dimension	ADE013,ADJ017
G,K		c.	Thread size	ADE073
G		d.	Diameter roundness	ADJ016,ADJ018
I,J,K	(T)	e.	Magnetic-particle	ADE037
G,K		f.	No unacceptable damaged threads	ADE003

11. For the New Nozzle Fixed Housing Assembly verify:

G,I,J		a.	Part is clean and free from damage, foreign material and corrosion prior to paint per engineering	ADS026
G,I,J		b.	O-ring and packing with retainer sealing surfaces are finalized	ADR092

12. For New Washer, Special verify:

G		a.	Inside diameter	ACA018
G		b.	Outside diameter	ACA033
G		c.	Radius on inside diameter	ACA019
G		d.	Thickness	ACA043
K	(T)	e.	Heat treat tensile strength by hardness check	CIC009

13. For New Pin Spring, Tubular, Slotted verify:

G		a.	Diameter	ADV062A
I		b.	Material is CRES 420	AJR001

14. For New Pin, Spring verify:

G		a.	Length	ADV062

15. For New Nozzle Assembly, Final verify:

H,I,K		a.	Sealing compound (polysulfide sealant) application at base of fastener heads	ADR211

16. For New Screw, verify:

I,K	(T)	a.	Material (chemical and physical properties)	LAA029
K	(T)	b.	Breaking strength	LAA030
I,K		c.	Cadmium plating	LAA031
I,K	(T)	d.	Magnetic-particle inspection	LAA032
K	(T)	e.	Stress durability testing	LAA033
I,K		f.	Stress relieved	LAA034

I,K	g.	Embrittlement relieved	LAA035
K	h.	Locking element	LAA036
G	i.	By lot sample, dimensions	AHA000, AHA001

17. For New Segment Assembly, Rocket Motor, verify:

J	a.	O-ring grooves for damage prior to installation of O-ring	AGJ175
J	b.	Primary O-ring sealing surface damage does not exceed requirements	AGJ044