ATK ALLIANT TECHSYSTEMS
THIOKOL PROPULSION

CRITICAL ITEMS LIST (CIL)

No. 10-05-02-10R/01

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1R
SUBSYSTEM:	Assembly Hardware/Interfaces 10-05	PART NAME:	Case-to-Nozzle Joint, Primary O-ring, Packing With Retainer (2)
ASSEMBLY:	Case-to-Nozzle Interface 10-05-02		
FMEA ITEM NO.:	10-05-02-10R Rev M		
CIL REV NO.:	M (DCN-533)	PART NO:	(See Section 6.0)
DATE:	10 Apr 2002	PHASE(S):	Boost (BT)
SUPERSEDES PAGE:	355-1ff.	QUANTITY:	(See Section 6.0)
DATED:	31 Jul 2000	EFFECTIVITY:	(See Table 101-6)
CIL ANALYST:	R. E. L. Hamilton	HAZARD REF.:	BC-04
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 Leakage of primary O-ring and any packing with retainer

3.0 FAILURE EFFECTS: Failure of the system would result in hot gasses eroding a bolt hole creating a larger hole and allowing gas to escape resulting in loss of pressure and expulsion of the nozzle and loss of TVC, RSRM, SRB, crew, and vehicle

4.0 FAILURE CAUSES (FC):

FC N).	DESCRIPTION	FAILURE CAUSE KEY
1.1	Nonconforming O-ring splice or repair	A
1.2	O-ring gland and packing with retainer mating surfaces do not meet dimensional or surface finish requirements	B
1.3	O-ring and packing with retainer nonconforming dimensions	C
1.4	O-ring and packing with retainer improperly installed, cut, or damaged	D
1.5	Transportation, handling, or assembly damage	E
1.6	Sealing surfaces contamination or corrosion	F
1.7	Nonconforming O-ring voids, inclusions, or subsurface indications and nonconforming packing with retainer voids or inclusions	G
1.8	Age degradation of O-ring and packing with retainer	H

1.9	Moisture and/or fungus degradation of O-ring and packing with retainer	I
1.10	Nonconforming physical or mechanical properties	J
1.11	Improper preload	K

5.0 REDUNDANCY SCREENS:

SCREEN A: Pass--The primary O-ring and the packing with retainer is capable of verification.
SCREEN B: Fail--A loss of pressure that would lead to ejection of the nozzle is not discernible to the crew.
SCREEN C: Pass--The elements could not be lost due to a single credible event.

1. The primary O-ring and packing with retainer, together, form part of a redundant seal system at the nozzle-to-case joint. Packing with retainer will not be pressurized unless the primary O-ring fails. If the primary O-ring fails, the packing with retainer will be pressurized and will still maintain a seal. If the primary O-ring and any packing with retainer fail, a leak path will exist and could result in loss of crew and vehicle.

6.0 ITEM DESCRIPTION:

1. The Nozzle-to-Case Joint has a Primary O-ring and Packing With Retainer, see engineering drawings (Figures 1 and 2). Materials are listed in Table 1:

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U75150	Packing, Preformed Fluorocarbon	Black Fluorocarbon Rubber	STW4-3339	1/motor
1U75374	Packing with Retainer	4130 Alloy Steel with Fluorocarbon Rubber	MIL-S-18729 MIL-R-83248, Type I, Class 1	100/motor
1U51916	Cartridge Assembly	Heavy-Duty Calcium Grease, Filtered And Placed in an Application Cartridge	STW7-3657	A/R
1U52945	Housing, Nozzle-Fixed			1/motor
1U75167	Bolt, Machine	Alloy Steel	AMS 5844	1/motor 99/motor
1U50129	Case Segment, Aft			1/motor
1U75801	Packing, Lubricated	Black Fluorocarbon Rubber O-ring and Lubricant	STW7-2999	1/motor
	Corrosion-Preventive Compound and O-ring Lubricant	Heavy-Duty Calcium Grease	STW5-2942	A/R
1U77640	Segment Assembly, Rocket Motor, Aft			1/motor

6.1 CHARACTERISTICS:

1. The Nozzle-to-Case Joint allows the nozzle assembly to be mounted to the aft case segment. The joint is sealed with O-rings and bolted together, with each radial bolt hole (located between the primary and secondary O-ring) sealed with packing with retainer to preclude any gas flow.

2. The seals are designed so that they maintain constant contact with mating surfaces at all times. Squeeze and fill for the primary O-ring are taken into account relating to O-ring groove tolerance recovery and tracking force, case growth, and joint rotation. Packing with retainer is a static compression seal.

3. Packing with retainer and the primary O-ring are one-time-use items.

4. The assembled RSRM is a combustion chamber made up of segments and a nozzle. It is sealed with O-rings, and must contain and direct pressure generated by burning propellant.

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

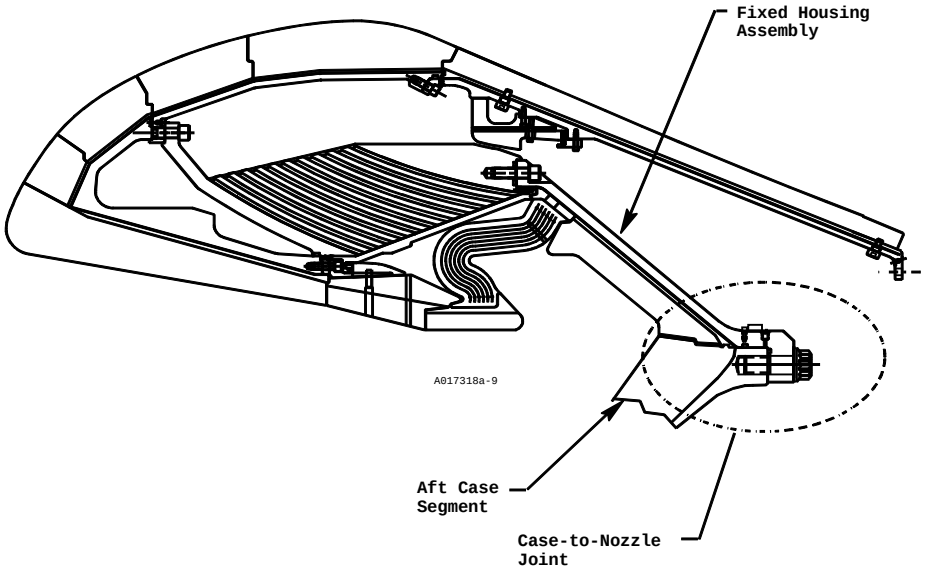

Figure 1. Case-to-Nozzle Joint Location

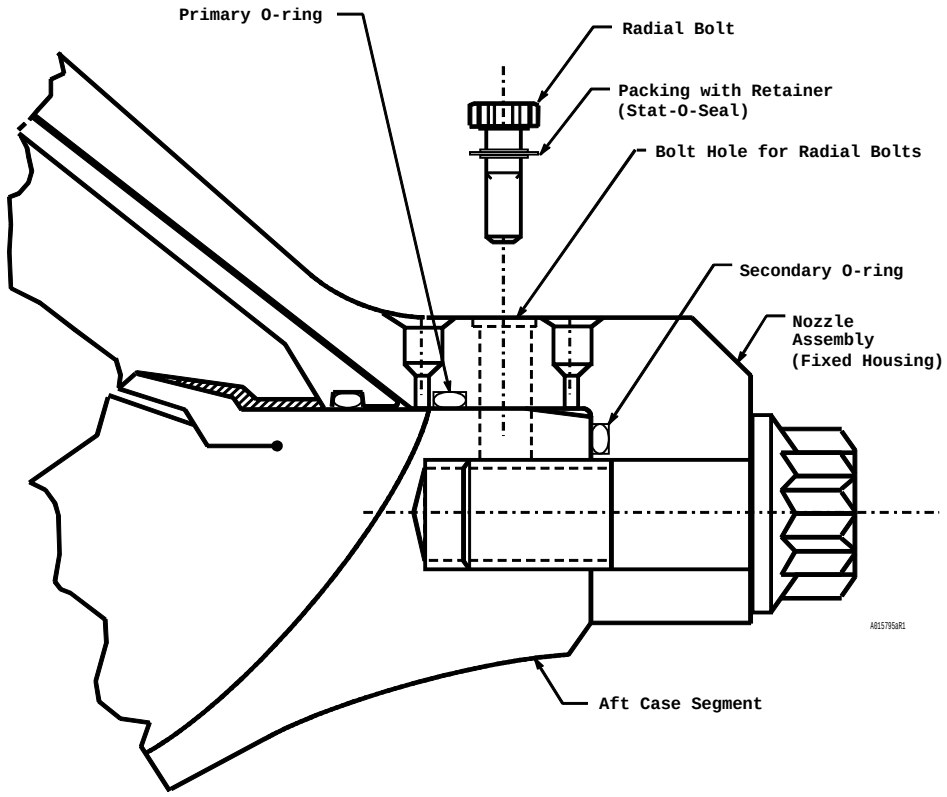

Figure 2. Case-to-Nozzle Joint, Radial Bolt, and Packing with Retainer

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN		FAILURE CAUSES
A	1.	Large O-rings conform to engineering that covers process controls for fabrication of spliced joints and repairs.
A	2.	Splice joints are cut on a specified angle and bonded together in a mold (using 100 percent of the scarf area) using an adhesive with the same physical and chemical properties as the parent stock.
A	3.	Packing with retainer has an elastomer seal that is a net molded portion with no splices.
A,G	4.	O-rings were tested to determine sizes and types of flaws that could cause sealing problems. Results are presented in TWR-17991.
B	5.	Primary O-ring gland design is established per engineering drawings, and conforms to Thiokol Design Engineering dimensions and calculations for squeeze, fill, and tracking per TWR-15771.
B	6.	Surface finish on the fixed housing packing with retainer sealing surface is established per engineering drawings.
B	7.	Bolt head sealing surface finish is established per engineering drawings.
B	8.	Packing with retainer dimensions are specified by engineering.
B	9.	Sealing surface requirements during refurbishment are established per engineering drawings.
B,H	10.	The primary O-ring and packing with retainer are one-time-use items.
C	11.	Specific criteria determining primary O-ring dimensions are found in TWR-15771.
C	12.	Both seal designs provide a constant contact between the seals and mating sealing surfaces.
C,G	13.	Packing with retainer conforms to engineering that establishes geometric dimensions and fabrication details.
C,G	14.	Large O-rings conform to engineering that establishes geometric dimensions and fabrication details.
D	15.	Large O-rings are individually packaged: a. Per engineering drawings prior to lubrication. b. Per engineering drawings after lubrication.
D	16.	Packing with retainer is individually packaged.
D	17.	Large O-ring design allows for a minimum of stretching without damage to the O-ring. Proper installation without over stretching is controlled by engineering.
D	18.	Lubricated O-rings and the packing with retainer are installed per engineering.

D	19.	Installation is with a light coat of filtered grease.
D, K	20.	Snug torque values, installation sequence, and angle of rotation for the axial and radial bolts of the Nozzle-to-Case Joint are per engineering. The bolt loading method was qualified per TWR-66211 and TWR-66738.
D	21.	Material selection (O-ring and packing with retainer elastomer) was based in part on resistance to damage per TWR-17082 and TWR-17155.
D	22.	Results of the packing with retainer installation damage tolerance test are documented per TWR-17155.
D	23.	Use of packing with retainer is qualified per TWR-17078 and TWR-17155.
D	24.	Design development testing regarding O-ring twisting and its effect on performance was performed per ETP-0153, with results documented per TWR-17991.
D	25.	Packing with retainer rubber is mechanically and adhesively bonded to the retainer. The mechanical bond is built into the design of the retainer.
E	26.	Transportation and handling of the nozzle assembly items by Thiokol is detailed per IHM 29.
E	27.	The RSRM and its component parts, when protected per TWR-10299 and TWR-11325, are capable of being handled and transported by rail or other suitable means to and from fabrication, test, operational launch, recovery or retrieval, and refurbishment sites.
E	28.	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.
E	29.	Support equipment used to test, handle, transport, and assemble or disassemble the RSRM is certified and verified per TWR-15723.
E	30.	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.
E	31.	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	32.	Corrosion-preventative compound is applied to all sealing surfaces per engineering.
F	33	Filtered grease is applied to all sealing surfaces per engineering.
F	34.	Filtered grease filtering is per engineering to control contamination.
F	35.	Removal of surface contamination or corrosion is a standard shop practice used whenever contamination or corrosion is noted.
F	36.	Contamination control requirements and procedures are described in TWR-16564.

G	37.	Acceptance criteria for packing with retainer elastomer defects are per engineering.
H	38.	Fluorocarbon rubber O-rings are suitable for periods of storage of up to 20 years (O-ring Handbook, ORD 5700, Copyright 1982, by Parker Seal Group, Lexington, KY). Environment and age are significant to useful seal life, both in storage and actual service. a. O-rings and packing with retainer are packaged and stored to preclude deterioration caused by ozone, grease, ultraviolet light, and excessive temperature.
H	39.	Large O-ring time duration of supplier storage and total shelf life prior to installation is limited per engineering.
H	40.	Packing with retainer elastomer time duration of supplier storage and total shelf life prior to installation is limited per engineering.
H	41.	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.
H	42.	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.
H	43.	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.
H	44.	Large O-rings, packing with retainer, and filtered grease are included in the aft segment life verification.
I	45.	Packing with retainer sealing material is fluorocarbon rubber.
I	46.	Seal swell is negligible unless the O-ring undergoes a long period of water immersion (O-ring Handbook, ORD 5700, Copyright 1982, by Parker Seal Group, Lexington, KY).
I	47.	Fluorocarbon rubber is a non-nutrient to fungus growth (O-ring Handbook, ORD 5700, Copyright 1982, by Parker Seal Group, Lexington, KY).
I	48.	Large O-rings are kept dry and clean prior to packaging.
I	49.	Packing with retainer is kept dry and clean prior to packaging.
J	50.	Packing with retainer material requirements are established by engineering as follows: a. Retainer is 4130 alloy steel with cadmium plating per Federal Specifications. b. Packing with retainer sealing material is high-temperature, low-compression set, fluid-resistant, fluorocarbon rubber.
I,J	51.	Large O-rings are high-temperature, low-compression set, fluid- resistant, black fluorocarbon rubber.

	J	52. Mechanical properties of the machine bolt are per engineering drawings.
	J	53. Filtered grease material requirements are per engineering.
	J	54. Temperature prior to launch is monitored for the nozzle flexible bearing and case-to-nozzle joint and is maintained to requirements as established per TWR-15832. Joint thermal analysis (o-ring resiliency testing) is documented in TWR-16818.
	K	55. Nozzle-to-case joint radial and axial bolts are refurbished per engineering.
	K	56. Structural analyses per TWR-16975 show that all metal components of the joint have a positive margin of safety based on factors of safety of 1.4 on ultimate and 1.1 on yield.
	K	57. Nozzle-to-case joint axial bolts are heat treated Inconel 718. Requirements are for tensile and yield strength.
	K	58. Radial bolt Material is heat treated MP35N alloy steel per AMS specifications.
	K	59. Aft Dome internal threads at the Case-to-Nozzle Joint must satisfy thread requirements for new and refurbished Aft Domes per engineering. Threads will have no damage or defects greater than that called out per engineering. Threads are inspected after proof testing.
	K	60. New and refurbished Aft Domes are proof tested per engineering. The Aft Dome threads are loaded in this test.
	K	61. Thread damage repair requires Discrepancy Report and Materials Review Board action per engineering. Helical inserts may be used per engineering.
	K	62. Nozzle-to-Case bolt preload controls the joint gap opening when dimensions and allowable surface defects are within limits per engineering. Thermal analysis per TWR-17016 and TWR-73594 and testing demonstrates that controlled gap opening (less then 0.004 inch) reduces the temperature of motor gas to the primary O-ring and greatly reduces gas temperature at the secondary O-ring.
	B,E	63. 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	B,E	64. 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.
	B,E	65. TWR-61410 was updated to include boundary conditions created by the Performance Enhancement (PE) Program. This report analyzed temperature conditions created from flight loads. PE temperatures are equal to current generic

temperatures for all locations for the critical time of liftoff. For a few locations at the factory joints and case acreage during flight, temperatures rise, but only slightly, and maximum case temperatures are lower than current generic certification. For flight load events, PE temperatures are not significantly different from current generic temperatures. There is no impact on previous analyses or margins of safety for case membranes, factory joints, and field joints per TWR-61410.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS (T)			CIL CODES
		1.	For New Large O-ring verify:	
A,C		a.	Diameter	AEB026,AEB027
A		b.	Splice is bonded over 100 percent of the scarf area	AEB133,AEB134
A		c.	No more than five splices	AEB167,AEB169
A		d.	Repairs	AEB265,AEB266
A		e.	Adhesive is made from fluorocarbon rubber	AEB308,AEB311
A		f.	Splice bond integrity	AEB317,AEB319
A,G	(T)	g.	Subsurface indications	AEB354
A,D,G,I		h.	Surface quality	AEB388,AEB389
A,J	(T)	i.	Tensile strength	AEB401,AEB402
A,J	(T)	j.	Ultimate elongation	AEB442,AEB443
C		k.	Correct identification	AEB087,AEB100
D,H,I		l.	Packaging is free of staples or other objects	LAA054
H,I		m.	Packaging for damage or violation	AEB179
H,I,J		n.	Material is fluorocarbon rubber	AEB151,AEB141
I		o.	Clean and dry when packaged	AEB031,AEB034
J	(T)	p.	Shore A hardness	AGM304,AGM312
J		q.	Compression set	AKW006,AKW011
		2.	For New Segment, Rocket Motor, Aft verify:	
A,B,C,D, E,F,G	(T)	a.	Joint seals leak test results	AGJ157
D		b.	Correct identification of packing with retainer	AGJ096
D		c.	Correct identification of O-ring	AGJ099
D		d.	Installation and fit of primary O-ring	AGJ123
D		e.	Radial bolt torquing sequence	AGJ210
D		f.	Radial bolt is torqued to proper specification prior to leak test	AGJ211
D,F		g.	Application of lubricant to packing with retainer and landings prior to assembly	AGJ066,AGJ067
D,F		h.	Application of lubricant to Fixed Housing aft end O-ring grooves	AGJ060
D		i.	Application of lubricant to primary O-ring	AGJ056
D,H,I		j.	Primary O-ring packaging has not been damaged or violated	AGJ195
D,E		k.	Packing with retainer sealing surface is not damaged prior to inserting radial bolt	AGJ229
D		l.	Packing with retainer is properly installed	AGJ204
D		m.	Primary O-ring is free from damage	AGJ189
D		n.	No visible damage of primary O-ring after installation into O-ring groove	AGJ188
D		o.	All O-ring installation clips are removed just prior to seating nozzle assembly with Aft Case Segment	AGJ213
E		p.	Aft end sealing surfaces on Case Segment are free from damage	LAA083
E		q.	O-ring grooves in Fixed Housing aft end are free from damage	AGJ175
E		r.	Packing with retainer landings on Fixed Housing are not damaged	AGJ233
E		s.	Radial bolt is cleaned and free from damage	AGJ082
F		t.	Aft Case Segment Boss sealing surfaces are free from contamination and corrosion	AGJ006
F,K		u.	Lubricant is applied to radial bolt	AGJ209
F		v.	O-ring grooves in Fixed Housing are free from contamination and corrosion	AGJ174
F		w.	Radial bolt is free from contamination and corrosion	LAA098
F		x.	Packing with retainer and landings are free from contamination	

			and corrosion	AGJ228,LAA077
H		y.	Shelf life of the lubricant	LAA088
H		z.	Packing with retainer shelf life	AGJ235
H		aa.	Primary O-ring storage life	AGJ222
H		ab.	Packing with retainer packaging is not damaged	LAA096
I		ac.	O-ring grooves in the Fixed Housing aft end are free from fungus and moisture	AGJ192,AGJ194
I		ad.	Radial bolt holes in the Fixed Housing aft end are free from fungus and moisture	AGJ078,AGJ079
I		ae.	Radial bolt are free from fungus and moisture prior to assembly with packing with retainer	AGJ163,AGJ164
I		af.	Packing with retainer is free from fungus and moisture prior to assembly with radial bolt	AGJ230,LAA108
I		ag.	Primary O-ring is free from fungus and moisture	LAA106,LAA107
K		ah.	Aft Segment Boss and Fixed Housing aft end holes are clean and free from debris and foreign matter prior to assembly	AGJ007
K		ai.	Aft Segment Boss and Fixed Housing Aft end holes are free from damage including scratches, pits, galls, and burrs prior to assembly	AGJ104
K		aj.	Proper location of all bolts	AGJ205
K		ak.	Axial and Radial bolts are tightened with a snug torque and angle-of-twist	AGJ238
K		al.	Axial bolts are coated with lubricant on grips and under heads	AGJ075
K		am.	Molykote spray lubricant is applied to the threads of the axial bolts and air dried before installation per the process specification	LHA047
K		an.	Molykote spray lubricant is applied to the threads of the radial bolts and air dried before installation per the process specification	LHA048

3. For New Case Segment, Aft, verify:

B		a.	Surface finish of aft boss O-ring sealing surfaces	AAJ072
K		b.	Flatness of Datum -G-	AAJ062,AAJ063
K	(T)	c.	Axial and radial threaded bolt holes are eddy-current inspected after hydroproof, and all non-conforming conditions are dispositioned	AAJ051
K		d.	Depth of threads in aft boss threaded holes	AAJ038,AAJ039
K		e.	Tap drill depth of aft boss threaded holes	AAJ036,AAJ167
K		f.	Axial and radial threaded holes with Go-No-Go gauge after hydroproof	AAJ010

4. For Refurbished Case Segment, Aft, verify:

B		a.	Surface finish of aft boss O-ring sealing surfaces	AAJ157
K		b.	Axial and radial threaded holes with Go-No-Go gauge after hydroproof	AAJ011
K	(T)	c.	Axial and radial threaded bolt holes are eddy-current inspected after hydroproof, and all non-conforming conditions are dispositioned	RAA208

5. For New Housing, Nozzle-Fixed verify:

B		a.	Diameter	ADV030,ADV049
B		b.	O-ring groove depth	ADV140
B		c.	O-ring groove width	ADV146
B		d.	Surface finish	ADV167,ADV187,ADV164,ADV186
K	(T)	e.	Ultimate tensile strength	ADV213
K	(T)	f.	Yield strength	ADV229
K		g.	Flatness	ADV039,ADV040,ADV042,ADV043

		6.	For Refurbished Housing, Nozzle Fixed verify:	
B		a.	Surface finish	ADV192
		7.	For New Bolt, Machine verify:	
B		a.	Grip surface finish	AEI033
B		b.	Surface of washer pad, underside of bolt head	AEI034
J,K		c.	Ultimate tensile strength	AEI040,LAA109
J		d.	Dye penetrant inspection	LAA116
J		e.	Ultrasonic inspection of raw material stock	LAA117
K	(T)	f.	Material and chemical composition	AEI018
K		g.	Threads	AEI016,AEI017
		8.	For Refurbished Bolt, Machine verify:	
B		a.	Surface of washer pad, underside of bolt head	AEI035
K		b.	Threads	AEI015
K		c.	Surface defects	AEI004A
K		d.	Part is acceptable	AEI501
		9.	For New Packing With Retainer verify:	
C		a.	Correct identification when packaged	AFC010,AFC009
C		b.	Diameter "A"	AFC014
C		c.	Seal thickness dimension "D"	AFC063
C		d.	Retainer thickness dimension "E"	AFC052
C		e.	Diameter "C"	AFC015
D		f.	Rubber is adhesively bonded to each retainer	LAA042
D,H,I		g.	Each packing with retainer is packaged in the correct material	AFC046
D,G,I		h.	Surface quality	AFC068
I,J		i.	Seal material is fluorocarbon rubber	AFC028,AFC026
I		j.	Seals are clean and dry when packaged	AFC056
J		k.	Retainer is chrome molybdenum steel	AEX001A
J		l.	Heat treat tensile strength	AEX001
J		m.	Cadmium plating	AFC003
J	(T)	n.	Shore A hardness of rubber	AJF013,LAA021,AJF012,LAA025
J	(T)	o.	Tensile strength of rubber	AJF015,LAA022,AJF014,LAA026
J	(T)	p.	Percent elongation of rubber	AJF017,LAA023,AJF016,LAA027
J	(T)	q.	Compression-set of rubber	AJF002,LAA024,AJF001,LAA028
		10.	For New O-ring, Lubricated verify:	
D		a.	O-ring packaging was not damaged or violated	LAA103
D		b.	O-ring is cleaned and lubricated per drawing requirements	LAA104
D		c.	O-ring is packaged per drawing requirements	LAA105
H		d.	O-ring shelf life has not expired prior to lubrication	LAA097
		11.	For New Filtered Grease verify:	
F,H,I,J,K		a.	Grease is received from storage unopened or resealed	ACP015
F,H,I,J		b.	Shelf life of the grease, prior to filtering	AMB018L
F,H,I,J		c.	Contamination	ANO064
F,H,I,J		d.	Grease conforms to specification	LAA044
F,H,I,J		e.	Cartridge conforms to drawing	LAA046
F,H,I,J,K		f.	Filtered grease is capped and sealed after filling	LAA047
F,H,I,J,K		g.	Filtered grease is sent to storage capped and sealed (recapped and resealed)	LAA063

		12.	For New Grease verify:	
F,J	(T)	a.	Penetration	LAA037
F,J	(T)	b.	Dropping point	ANO042
F,J	(T)	c.	Zinc concentration	LAA038
		13.	For New Bolt, Case/Nozzle verify:	
K	(T)	a.	Chemical composition	AGE003
K	(T)	b.	Mechanical properties after heat treat	AGE010
K		c.	Material is Inconel 718	AGE020
		14.	For Refurbished Bolt, Case/Nozzle verify:	
K		a.	Threads	AGE017
K		b.	Surface defects	AGE006
K		c.	Part is acceptable	AGE034
		15.	KSC verifies:	
H		a.	Life requirements for the expected launch schedule are met per OMRSD, File II, Vol III, C00CA0.030.	OMD019
J		b.	Temperature at the case-to-nozzle joint is acceptable prior to launch and is in compliance with Launch Commit Criteria (NSTS-16007) per OMRSD File II, Vol I, S00FA0.777.	OMD014