ATK ALLIANT TECHSYSTEMS
THIOKOL PROPULSION

CRITICAL ITEMS LIST (CIL)

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

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1R
SUBSYSTEM:	Assy Hardware/Interface Subsystem 10-05	PART NAME:	Case-to-Nozzle Joint, Thermal Protection System (Polysulfide, Wiper O-ring, Aft Dome/Fixed Housing Metal Interface) (1)
ASSEMBLY:	Case-to-Nozzle Interface 10-05-02		
FMEA ITEM NO.:	10-05-02-02R Rev N		
CIL REV NO.:	N (DCN-533)	PART NO:	(See Section 6.0)
DATE:	10 Apr 2002	PHASE(S):	Boost (BT)
SUPERSEDES PAGE:	352-1ff.	QUANTITY:	(See Section 6.0)
DATED:	27 Jul 2001	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 Thermal failure

3.0 FAILURE EFFECTS: Failure of the thermal protection system could cause joint seal failure. Loss of the primary and secondary seals would result in loss of TVC and ejection of the nozzle and loss of RSRM, SRB, crew, and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	Failure of the ambient cured adhesive (Bondline, voids, tears, cracks)	
1.1.1	Nonconforming mixing, application, and cure	A
1.1.2	Bonding surfaces not adequately prepared or cleaned	B
1.1.3	Contamination of adhesive	C
1.1.4	Nonconforming adhesive properties	D
1.1.5	Nonconforming dimensions of joint interfaces	E
1.1.6	Degradation of bondline due to improper assembly	F
1.1.7	Transportation, handling, and storage	G
1.2	Failure of the wiper O-ring	
1.2.1	O-ring gland does not meet dimensional and surface finish requirements	H
1.2.2	Nonconforming dimensions of aft dome NBR mating surface	I
1.2.3	Nonconforming O-ring dimensions, or improper O-ring splice joint	J
1.2.4	O-ring voids, inclusions, or subsurface indications	K
1.2.5	O-ring cut, damaged, or improperly installed	L

	1.2.6	Damage to mating surface during transportation and handling	M
	1.2.7	Mating surface contamination	N
	1.2.8	Aging degradation of O-ring, Degraded resiliency and mechanical properties	O
	1.2.9	Nonconforming material properties	P
	1.2.10	NBR Compression set	Q
	1.2.11	Moisture and/or fungus degradation of O-ring	W
1.3		Failure of the aft dome/fixed housing metal interface (gap opening during pressurization)	
	1.3.1	Nonconforming dimensions	R
	1.3.2	Improper assembly	S
	1.3.3	Corrosion	T
	1.3.4	Surface defects	U
	1.3.5	Improper preload	V

5.0 REDUNDANCY SCREENS:

SCREEN A: Fail -The thermal protection system 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 cannot be the result of a credible single failure cause

6.0 ITEM DESCRIPTION:

1. Nozzle-to-Case Joint, Insulation (Figures 1 and 2). Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U79150	Housing Assembly, Nozzle Fixed			1/motor
1U79154	Nozzle Assembly, Final			1/motor
1U77640	Segment, Rocket Motor, Aft			1/motor
1U77504	Segment Assembly-Loaded, Aft			1/motor
1U76794	Case Segment, Aft, Forging	D6AC Steel	STW4-2606 STW7-2608	1
1U76673	Aft Dome, Insulated			1/motor
1U76034	Bolt, Case/Nozzle	Inconel 718	AMS 5662 QQ-P-416	100/motor
1U75801	Packing, Lubricated	Fluorocarbon Rubber	STW7-2999	1/motor
1U75167	Bolt, Machine	MP35N Alloy	AMS 5844 QQ-P-416	99/motor 01/motor
1U75150	Packing, Preformed (large O-ring) Fluorocarbon Rubber		STW4-3339	1/motor
1U52945	Housing, Nozzle-Fixed			1/motor
1U51916	Cartridge Assembly	Heavy-Duty Calcium Grease, Filtered and Placed in an Application Cartridge	STW7-3657	A/R
1U50129	Dome, Aft Steel, Alloy, High	D6AC Steel	STW4-2606	1/motor
	Polysulfide Adhesive		STW4-9209	A/R
	Corrosion-Preventive Compound And O-ring Lubricant	Heavy-Duty Calcium Grease	STW5-2942	A/R
	Fastener, Cadmium Plated		STW3-1533	A/R
8U50800	Shipping Kit-Segment			A/R
	Helical-Coil Inserts	302/304 Corrosion-Resistant Steel	NASM33537	A/R
	IFF Polysulfide Adhesive		STW4-9211	A/R

6.1 CHARACTERISTICS:

1. The Nozzle-to-Case Joint is formed by mating the Nozzle Fixed Housing and the Aft Dome. A polysulfide adhesive is used to join the insulation (both NBR and EPDM) to the phenolics on the Nozzle Fixed Housing. Refer to CIL 10-02-01-06R/01 for installation of phenolics, and CIL 10-01-02-03/01 and 10-01-02-03/02 for insulation layup for the Aft Dome.

2. Adhesive is applied to the Aft Dome insulation surface of the joint. An interference fit polysulfide adhesive feature was added to the nozzle-to-case joint to help prevent gas paths with RSRM 360X080 and subs.

3. A large fluorocarbon O-ring, designated as the wiper O-ring, is incorporated to prevent the polysulfide adhesive from extruding into the Primary O-ring groove during joint assembly. The wiper O-ring also functions as part of the thermal protection system by preventing gas flow to the primary seals in the event of a polysulfide gas path. The wiper O-ring groove is machined in the glass-cloth phenolic mating surface of the fixed housing assembly. The wiper O-ring mating surface on the opposite side of the interface is cured NBR rubber that is vulcanized to the aft dome. The wiper is a unique O-ring in the RSRM in that it is not a "sealing O-ring".

4. Formula changes to the polysulfide were made beginning with RSRM-30, due to material obsolescence. Assembly location of the nozzle-to-case joint was moved from the large motor casting pits to the new final assembly facility (M-397) during the same time frame.

5. Several instances of gas paths in the polysulfide adhesive to the wiper O-ring were documented during the RSRM program, with two instances of dual gas paths. A UUEC team performed thermal analysis per TWR-73574 that looked at the scenario of gas past both the wiper and primary O-ring and determined that the tight gaps (less than 0.004 inch) between the aft dome and fixed housing along with the limited volume could not result in thermal failure of the secondary seals. This scenario requires dual gas paths and circumferential flow between wiper and primary O-rings to occur.

6. Thermal analysis and testing of the Nozzle Fixed Housing/Aft Dome metal interface demonstrated that geometric tolerances of the mating parts, after bolt loading, provide a restriction that reduces the motor gas temperature at the primary O-ring. A substantial drop in temperature is noted due to metal part interface upstream of the secondary O-ring. The thermal analysis per TWR-17016 considers a worst case gap opening during motor pressurization.

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

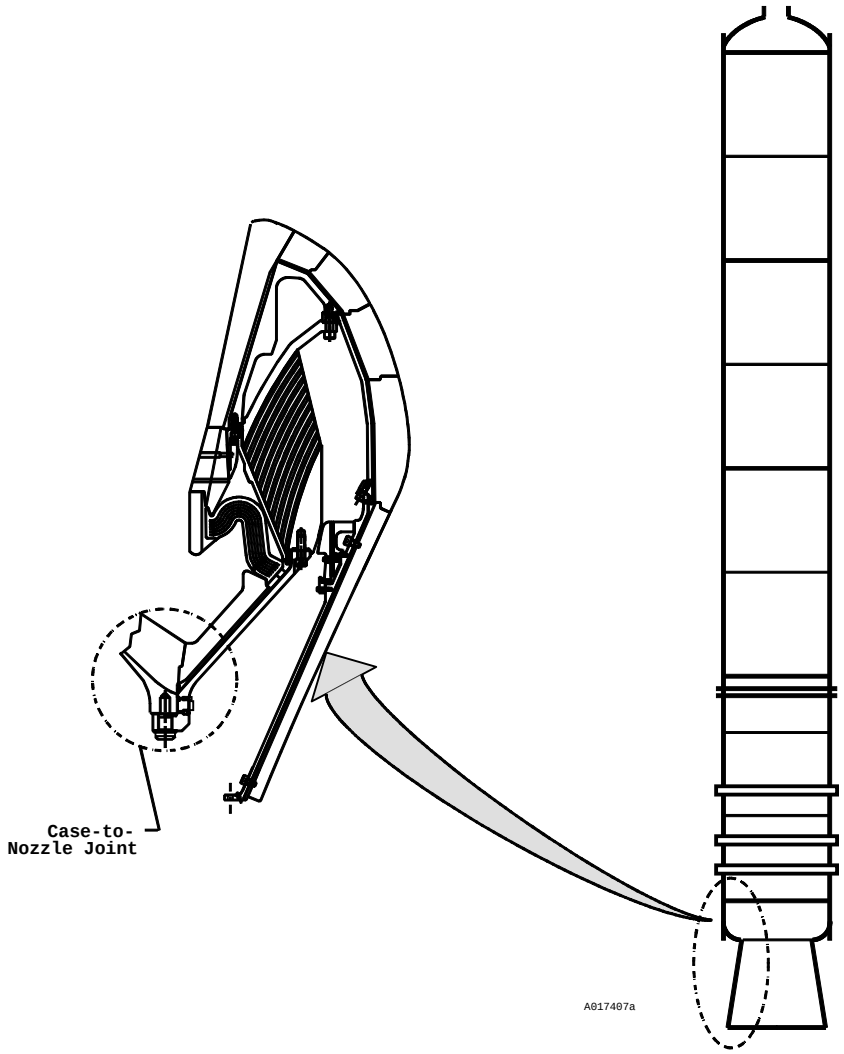

Figure 1. Case-to-Nozzle Joint, Insulation Location

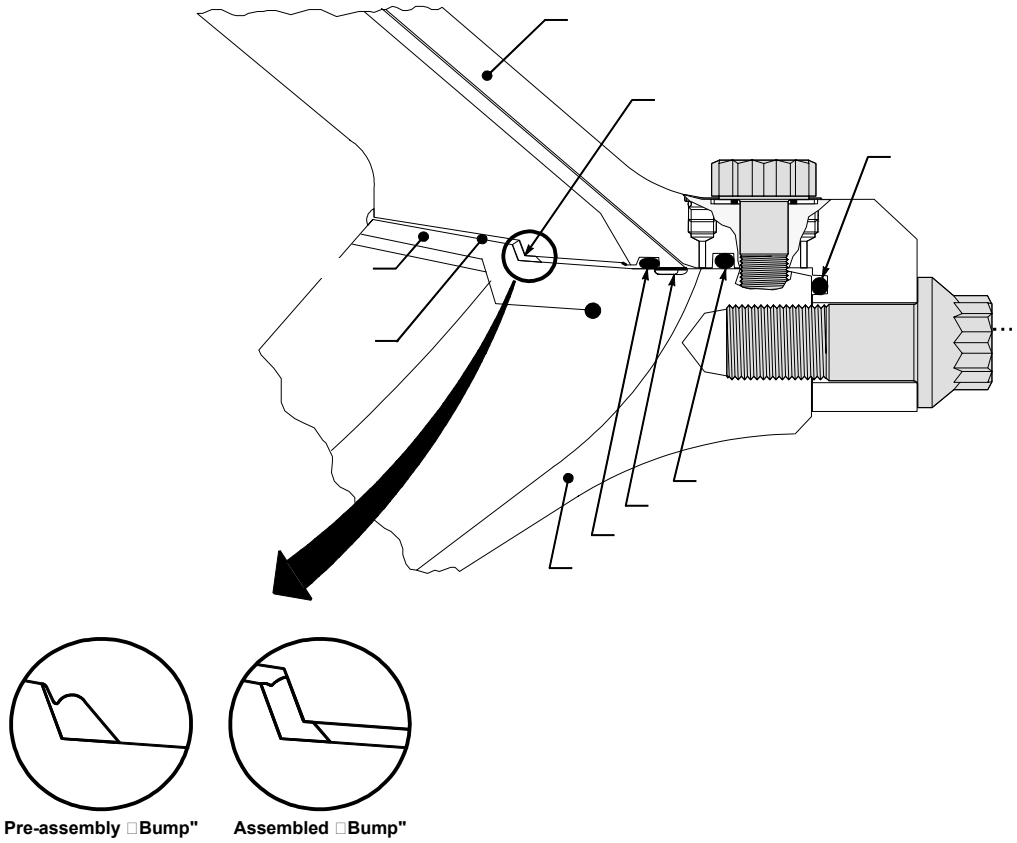

Figure 2. Case-to-Nozzle Joint, Bump Configuration

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN		FAILURE CAUSES
A	1.	Mixing, application, and cure of Polysulfide adhesive is controlled by process standards per engineering.
A,B,C,F	2.	Joint adhesive, its sealing capability, and method of application were qualified by testing as reported in TWR-18764-02.
A,D	3.	For Polysulfide adhesive, mechanical property characterization and qualification are documented in TWR-19168, TWR-61119, and TWR-61603.
B	4.	Preparation and cleaning of bonding surfaces are controlled per engineering.
B,C,N	5.	Contamination control requirements and procedures are described in TWR-16564.
D	6.	Adhesive properties conform to and are qualification tested per engineering.
D	7.	Adhesive was selected per TWR-10192.
D,E	8.	Polysulfide adhesive, adhesive interface, application and assembly processes are qualified and demonstrated by qualification motors as reported in TWR-18764-02.
D,E	9.	Engineering drawings specify dimensional requirements for the fixed housing side of the interface.
E	10.	Engineering drawings control the insulation configuration and specify dimensional requirements for the Aft Dome side of the interface which also includes the stress-relief flap and baffle.
F,L,S	11.	Assembly of the nozzle to the case is controlled per engineering.
G,M	12.	Analyses were performed by Thiokol engineering to assess vibration and shock load response of the RSRM aft segment and nozzle during transportation and handling to assembly and launch sites per TWR-16975.
G	13.	Handling and lifting requirements for RSRM components are similar to those for previous and current programs conducted by Thiokol per TWR-13880.
G,M	14.	Transportation and handling of RSRM assembly items by Thiokol is per IHM 29.
G,M	15.	The RSRM and its component parts are protected per engineering. The nozzle and aft segment, which are shipped as one assembled unit, are protected from the external environment at all times by either covers or shipping containers until assembled as part of the RSRM.
G,M	16.	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.
G,M	17.	Support equipment used to test, handle, transport, and assemble or disassemble the RSRM is certified and verified per TWR-15723.
G,M	18.	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.

G,O 19. 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 per TWR-63944. Tests on a fifteen-year-old flex bearing also showed no degradation of flex bearing material properties per TWR-63806.

G 20. 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.

H 21. Wiper O-ring gland design is per engineering drawings and specifications.

I 22. Engineering drawings control the insulation configuration and specify dimensional requirements for the Aft Dome side of the interface which also includes the area of wiper O-ring contact.

J 23. Criteria for wiper O-ring dimensions and squeeze requirements are per TWR-15771. Engineering drawings and specifications control hardware configuration to ensure design requirements are met.

J,Q 24. Wiper O-ring design provides a constant contact between the O-ring and mating surfaces.

J,K 25. Large O-rings are controlled per engineering that establishes geometric dimensions and fabrication details.

J 26. Large O-rings conform to engineering that covers process controls for fabrication of spliced joints and repairs.

J 27. Splice joints are cut on an 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.

L 28. Large O-rings are individually packaged per engineering.

L 29. large O-ring design allows for a minimum of stretching without damage to the O-ring Proper installation without overstretching is controlled per engineering.

L 30. Material selection for O-rings was based in part on resistance to damage as documented in TWR-17082.

L 31. Design development testing of O-ring twisting and its effect on performance was performed per ETP-0153, with the results documented in TWR-17991.

N 32. Filtered grease is applied to the wiper O-ring.

N 33. Filtered grease filtering is per engineering to control contamination.

N 34. Removal of surface contamination or corrosion is a standard shop practice to be used whenever contamination or corrosion is noted.

O	35.	Fluorocarbon rubber O-rings are suitable for periods of storage 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.
O	36.	O-rings are packaged and stored to preclude deterioration caused by ozone, grease, ultraviolet light, and excessive temperature.
O	37.	Large O-ring time duration of supplier storage and total shelf life prior to installation is limited per engineering.
O	38.	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.
O	39.	The wiper O-ring is a one-time-use item.
O	40.	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.
T	41.	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.
P,W	42.	Large O-rings are high-temperature, low-compression set, fluid-resistant, black fluorocarbon rubber.
P	43.	Filtered grease is per engineering drawings. Filtered grease conforms to material requirements determined by Thiokol per engineering.
H,I,N,Q	44.	The Wiper O-ring was not qualified as a motor pressure seal that must meet tracking criteria or high pressure leak test verification requirements. However, the wiper demonstrated ability to protect the primary seal in 16 of 16 motor chamber exposures with one potential blowby. Structural analysis of the NBR per TWR-73687 indicates that for at least one time slice (at 0.6 seconds) NBR moves to seal at the wiper O-ring location during motor pressurization.
Q	45.	Cured NBR properties are per engineering.
R,S,U,V	46.	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, 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.
R,U	47.	Aft Case Segment dimensions are per engineering.
R	48.	Nozzle fixed housing dimensions are per engineering drawings.
R	49.	Nozzle-to-Case Joint axial bolt dimensions are per engineering drawings. These bolts are reused.
R	50.	Radial bolt dimensions are per engineering drawings. These bolts are reused.

R,T,U	51.	Refurbished nozzle fixed housing requirements and dimensions are per engineering drawings and specifications.
R,T,U	52.	Refurbished Aft Case Segment requirements and dimensions are per engineering drawings and specifications.
S,V	53.	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.
T	54.	Corrosion preventive compound is filtered to control contamination.
S	55.	Guide pins are used to aid in assembly of the Nozzle-to-Case Joint per shop planning.
T	56.	All metal surfaces of the nozzle fixed housing are protected from corrosion per engineering.
T	57.	Aft case segment surfaces are inspected for contamination and cleaned as necessary. a. During processing, Thiokol takes steps to protect case segment exposed bare metal surfaces to minimize corrosion. Superficial discoloration is allowed as long as it does not interfere with inspection of the hardware. Corrosion is removed prior to hardware assembly per engineering. b. Filtered grease is applied to mating surfaces prior to assembly.
T	58.	Radial bolts, per engineering drawings, are made from MP35N per AMS specifications which has excellent corrosion resistance.
T	59.	Nozzle-to-Case Joint axial bolts are made from Inconel 718 which has excellent corrosion resistance.
R,T,V	60.	Nozzle-to-Case Joint radial and axial bolts are refurbished per engineering.
V	61.	Structural analyses documented in TWR-16975 show that 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.
V	62.	The Nozzle-to-Case Joint axial bolt is heat treated Inconel 718 per tensile and yield strength requirements.
V	63.	Radial bolt Material is heat treated MP35N alloy steel per AMS specifications.
V	64.	Aft Dome internal threads at the Case-to-Nozzle Joint must satisfy thread requirements for new and refurbished Aft Domes per engineering. The threads will have no damage or defects greater than called out in the specification. Threads are inspected after proof testing.
V	65.	New and refurbished Aft Domes are proof tested per engineering. Aft Dome threads are loaded in this test.
V	66.	Thread damage repair requires a Discrepancy Report and Materials Review Board action per engineering. Helical inserts may be used per engineering.
W	67.	O-ring 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).

	W	68. Fluorocarbon rubber is a non-nutrient to fungus growth (O-ring Handbook, ORD 5700, Copyright 1982, by Parker Seal Group, Lexington, KY).
	W	69. Large O-rings are kept dry and clean prior to packaging.
	B	70. A Spray-in-Air cleaning system is used to clean metal components as part of the bonding surface preparation processing sequence.
	E,G,H,M,R, S,T,U,V	71. 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	E,G,H,M,R S,T,U,V	72. 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.
	A,B,C,D,E	73. An interference fit bump feature was added to the Nozzle-to-Case joint thermal protection system. The feature underwent sub-scale and full-scale testing on FSM-7. Thermal and structural analysis was performed and showed no degradation to the joint pheonlic or insulation as documented in TWR-73415, 75255, and TWR-75475.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS (T)			CIL CODES
		1.	For New Segment Assembly, Rocket Motor, verify:	
A		a.	Adhesive is mixed per specifications	AEV010
A		b.	Proper application of adhesive	AGJ198
A		c.	Adhesive is cured to temperature and time requirements	BAA002
A,D	(T)	d.	Adhesive is cured and Shore A hardness obtained	AMH015
A,C		e.	Absolute humidity meets requirements during application of polysulfide adhesive	BAA007
B		f.	Bonding surfaces are cleaned prior to adhesive application	AGJ084
B		g.	Bonding surfaces are prepared to take adhesive	AGJ085
C		h.	Adhesive is free of contamination during processing	AMH000
B		i.	Bonding surfaces are lightly abraded to remove all glossy finish	AGJ086
B		j.	Bonding surfaces of case and nozzle are smooth	AGJ087
B		k.	Sealing surfaces of case and nozzle are properly conditioned	AGJ217
B		l.	No internal combustion engines are operated in area during adhesive application to the Aft Dome or assembly	AGJ197
F		m.	Alignment guide pins are installed prior to mating	AGJ033
F		n.	Nozzle-to-Aft Dome is in alignment prior to mating	AGJ170
F		o.	Hardware is seated within pot life of adhesive	AGJ121
F,S		p.	Axial bolts are torqued to proper specification prior to leak test	AGJ077
F,S		q.	Radial Bolt, Machine, is torqued to proper specification prior to leak test	AGJ211
F,S		r.	Axial bolts are torqued in proper sequence prior to leak test	AGJ076
F,S		s.	Radial bolts are torqued in proper sequence prior to leak test	AGJ210
F		t.	Air flow out of primary vent port is obtained during final mating	AGJ028
F		u.	Aft Dome sealing surfaces are free from damage	AGJ004
F		v.	Aft Boss sealing surfaces on Aft Case Segment are free from contamination and corrosion	AGJ006
F		w.	Component environments during in-plant transportation or storage	BAA030
H,I,J,K,L, M,N,O,P	(T)	x.	Joint seals are leak tested in accordance with the leak test specification	AGJ157
L		y.	Correct identification of O-ring at time of installation	AGJ099
L,M		z.	The primary, secondary, and wiper O-rings are unpackaged, processed, and installed one at a time	AGJ181
L		aa.	Application of lubricant to wiper O-ring prior to assembly	LHA202
K		ab.	Wiper O-ring is free from contamination prior to installation	LHA203
L,M		ac.	Wiper O-ring is free from damage prior to installation	LHA205
L,M		ad.	Wiper O-ring packaging has not been damaged or violated prior to installation	LHA206
L,M		ae.	Condition of wiper O-ring after installation into O-ring groove	LHA207
L,W		af.	Wiper O-ring is free from moisture prior to installation	LHA208
L,W		ag.	Wiper O-ring is free from fungus prior to installation	LHA209
L,M		ah.	No visible damage to wiper O-ring after installation into O-ring groove	LHA210
L,M		ai.	Radial filler plugs are positioned correctly prior to nozzle installation	LHA211
M		aj.	Aft end sealing surfaces, on Case Segment, are free from damage	LAA083
S,T,V		ak.	Aft Segment Boss and Fixed Housing aft end holes are clean and free from debris and foreign matter prior to assembly	AGJ007
S,V		al.	Aft Segment Boss and Fixed Housing Aft end holes are free from damage including scratches, pits, galls, and burrs prior to assembly	AGJ104
T		am.	Sealant is applied around bolt heads	AGJ215
T		an.	Sealant is applied around joint seam	AGJ216
S		ao.	Fixed Housing surface by blacklight inspection for proper grease	

			application	AGJ120
S,V		ap.	Proper location of all bolts	AGJ205
S,V		aq.	Axial and Radial bolts are tightened with a snug torque and angle-of-twist	AGJ238
S,V		ar.	Axial bolts are coated with lubricant on grips and under heads	AGJ075
S,V		as.	Radial bolts are coated with lubricant on grips and under heads	AGJ209
S,V		at.	Molykote spray lubricant is applied to the threads of the axial bolts and air dried before installation per the process specification	LHA047
S,V		au.	Molykote spray lubricant is applied to the threads of the radial bolts and air dried before installation per the process specification	LHA048
O		av.	Wiper O-ring storage life is not expired	LHA200
H,I,J,L		aw.	Installation and fit of wiper O-ring per engineering	LHA201
A		ax.	Adhesive (IFF) is mixed per planning requirements	AMH013B
A		ay.	Absolute humidity during application of the IFF adhesive	BAA007B
A		az.	No internal combustion engines are operated within 300 ft. of Aft Dome during IFF adhesive application or assembly	AGJ197B
A		ba.	Bonding surfaces are clean prior to IFF adhesive	AGJ084B
A		bb.	Bonding surfaces are prepared to take IFF adhesive	AGJ085B
A		bc.	Bonding surfaces where the IFF adhesive will be applied are lightly abraded to remove all glossy finish	AGJ086B
A		bd.	Proper application of IFF adhesive	AGJ198B
A		be.	Prior to adhesive application, surfaces of case are properly conditioned	AGJ217B
A,C		bf.	IFF adhesive is free of contamination during processing	AMH000B
A	(T)	bg.	Shore A hardness after cure of IFF adhesive	AMH015B
A		bh.	IFF adhesive shore “A” hardness	BAA002B
A,E		bi.	Dimensions of the IFF adhesive meet engineering	BUM001
A,E		bj.	Wet polysulfide thickness	BUM002

2. For New Adhesive, Polysulfide verify:

D	(T)	a.	Peel strength	AMH006,AMH007
D	(T)	b.	Application life	AMH001,AMH010
D	(T)	c.	Tensile adhesion	AMH016,AMH017
D	(T)	d.	Specific gravity	AMH020,AMH021
D	(T)	e.	Hardness	AMH025,AMH026
D	(T)	f.	Nonvolatile content	SAA001,SAA003
D	(T)	g.	Flow	SAA002,SAA004

3. For Retest Adhesive, Polysulfide verify:

D	(T)	a.	Peel strength	BAA006
D	(T)	b.	Application life	BAA003
D	(T)	c.	Tensile adhesion	SAA005
D	(T)	d.	Specific gravity	BAA004
D	(T)	e.	Hardness	BAA005
D	(T)	f.	Nonvolatile content	SAA006
D	(T)	g.	Flow	SAA007

4. For New Housing Assembly, Nozzle Fixed, verify:

E		a.	Line profile is within tolerance	ADS073
G		b.	Component temperatures and exposure to ambient environments during in-plant transportation or storage are per engineering	BAA035
H		c.	Wiper O-ring groove location	LEM010
H		d.	Wiper O-ring groove width	LEM011

H		e.	Wiper O-ring groove depth	LEM012
H		f.	Wiper O-ring groove surface finish	LEM014
H,N		g.	Wiper O-ring groove for contamination or defects per the sealing surface specification	LEM013
		5.	For New Insulated Aft Dome verify:	
E,I		a.	Correct mold ring with current recycle is used	BAA001
E,I		b.	5U NBR insulation layup is complete and acceptable	AFK145C
E,I		c.	No unacceptable surface defects in cured NBR	AFK078C
E,I		d.	All tools and in-process materials are accounted for after insulation layup	AFK206A
G,P,Q		e.	Environmental history for insulation	AMX019B,AMX019D
G,P,Q		f.	Storage life is acceptable for insulation	AMX019AM,AMX019AP
E		g.	Insulation thickness using template	AFK214AB
		6.	For Shipping Kit-Segment verify:	
G		a.	Transportation EDR data is acceptable	RAA232
		7.	For New Loaded Aft Segment Assembly verify:	
G		a.	Component temperatures and exposure to ambient environments during in-plant transportation or storage are acceptable	BAA010
		8.	For New Nozzle Assembly, Final verify:	
G		a.	Component temperatures and exposure to ambient environments during in-plant transportation or storage	BAA028
		9.	For New Large O-ring verify:	
J		a.	Diameter	AEB026,AEB027
J		b.	Splice is bonded over 100 percent of the scarf area	AEB133,AEB134
J		c.	No more than five splices	AEB167,AEB169
J		d.	Repairs	AEB265,AEB266
J		e.	Adhesive physical and chemical properties	AEB311
J		f.	Splice bond integrity	AEB317,AEB319
J,K		g.	Subsurface indications	AEB354
J,K,L,W		h.	Surface quality	AEB388,AEB389
J,P	(T)	i.	Tensile strength	AEB401,AEB402
J,P	(T)	j.	Ultimate elongation	AEB442,AEB443
J		k.	Correct identification	AEB087,AEB100
L,O,W		l.	Packaging for damage or violation	AEB179
O,P		m.	Material is fluorocarbon rubber	AEB141,AEB151
O,W		n.	Packaging is free of staples or other objects	LAA054
P	(T)	o.	Shore A hardness	AGM304,AGM312
P	(T)	p.	Compression set	AKW006,AKW011
W		q.	Clean and dry when packaged	AEB031
		10.	For New O-ring Lubricated verify:	
W		a.	O-ring packaging is not damaged or violated	LAA103
		11.	For New Filtered Grease verify:	
N,O,P,V,W		a.	Grease is received from storage unopened or resealed	ACP015
N,O,P		b.	Shelf life of the grease, prior to filtering	AMB018L

N,O,P,W		c.	Contamination	ANO064
N,O,P,W		d.	Grease conforms to specification	LAA044
N,O,P,W		e.	Cartridge conforms to drawing	LAA046
N,O,P,V,W		f.	Filtered grease is capped and sealed after filling	LAA047
N,O,P,V,W		g.	Filtered grease is sent to storage capped and sealed (recapped and resealed)	LAA063

12. For New Grease verify:

P,W	(T)	a.	Penetration	LAA037
P	(T)	b.	Dropping point	AN0042
P	(T)	c.	Zinc concentration	LAA038
N,O,W		d.	Preservation, packaging and packing	ANO015
O,W		e.	Type	ANO050
O		f.	No shipping or handling damage	ANO058

13. For New Housing, Nozzle-Fixed verify:

T,V	(T)	a.	Ultimate tensile strength	ADV213
T,V	(T)	b.	Yield strength	ADV229
R		c.	Corrosion protection is per specification	ADV090
R,V		d.	Flatness	ADV039,ADV040,ADV042,ADV043
R		e.	Diameter	ADV048,ADV049,ADV053,ADV054,ADV055,ADV057
R		f.	Height	ADV069,ADV070
R,T		g.	Profile	ADV154,ADV155
R		h.	Run out	ADV178,ADV179
R		i.	True position	ADV210A,ADV211,ADV212,ADV212A
R		j.	Cross-sectional wall thickness (Aft End)	ADV034A

14. For Refurbished Housing, Nozzle Fixed verify:

T,U		a.	Surfaces cleaned	ADV029
R		b.	Thickness	ADV033
R		c.	Diameter	ADV050,ADV058
R		d.	Height	ADV071
R,U		e.	Straightness	ADV152
R		f.	Roundness	ADV176,ADV180,ADV182
R,U		g.	Flatness	ADV197

15. For New Case Segment, Aft, verify:

R		a.	Flange thickness at Datum -G-	AAJ060,AAJ061
R		b.	True position of aft boss threaded holes	AAJ169,AAJ170
R,V		c.	Depth of threads in aft boss threaded holes	AAJ038,AAJ039
R,V		d.	Tap drill depth of aft boss threaded holes	AAJ036,AAJ167
R,V		e.	Flatness of Datum -G-	AAJ062,AAJ063
R		f.	Diameter of Datum -A-	AAJ040,AAJ041
R		g.	Diameter of Datum -F-	AAJ043,AAJ044
R		h.	Run out of Datum -F-	RAA207
V	(T)	i.	Axial and radial threaded bolt holes are eddy-current inspected after hydroproof, and all non-conforming conditions are dispositioned	AAJ051
V		j.	Axial and radial threaded holes with Go-No-Go gauge after hydroproof	AAJ010

16. For Refurbished Case Segment, Aft, verify:

T,U		a.	Surfaces are cleaned to remove foreign material and corrosion	AAJ030
R,V		b.	Axial and radial threaded holes with Go-No-Go gauge after hydroproof	AAJ011

R		c.	Diameter of inner boss	AAJ042
V	(T)	d.	Axial and radial threaded bolt holes are eddy-current inspected after hydroproof, and all non-conforming conditions are dispositioned	RAA208

17. For New Bolt, Case/Nozzle verify:

R		a.	Diameter of bolt shank	AGE008,AGE009
R		b.	Length dimension	AGE012,AGE013
R		c.	Length of grip	AGE015,AGE016
R		d.	Threads	AGE018,AGE019
R		e.	Circular runout of bolt bearing surface	AGE026,AGE027
R		f.	Fillet roll radius area	AGE032,AGE033
S,V	(T)	g.	Chemical composition	AGE003
S,V		h.	Mechanical properties after heat treat	AGE010
S,V		i.	Material is Inconel 718	AGE020

18. For Refurbished Bolt, Case/Nozzle verify:

V		a.	Threads	AGE017
R,V		b.	Surface defects	AGE006
R,V		c.	Part is acceptable	AGE034

19. For New Bolt, Machine verify:

V	(T)	a.	Ultimate tensile strength	AEI040
S,V	(T)	b.	Material and chemical composition	AEI018
R		c.	"L" dimension	AEI010,AEI011
R		d.	"B" diameter	AEI006,AEI007
R,V		e.	Threads	AEI016,AEI017
R		f.	Run out between Datum-A-and-Datum-B	AEI031,AEI032
R		g.	Circular run out of bolt bearing surface	AEI024,AEI025
R		h.	"R" radius	AEI027,AEI028

20. For Refurbished Bolt, Machine verify:

V		a.	Threads	AEI015
R,V		b.	Surface defects	AEI004A
R,V		c.	Part is acceptable	AEI501

21. For New NBR verify:

P,Q	(T)	a.	Mooney viscosity	ALH041,ALH046
P,Q	(T)	b.	Elongation	ALH062,ALH065
P,Q	(T)	c.	Shore A hardness	ALH098,ALH109
P,Q	(T)	d.	Specific gravity	ALH121,ALH126
P,Q	(T)	e.	Tensile strength	ALH149,ALH154

22. For Retest NBR, verify:

P,Q	(T)	a.	Mooney viscosity	ALH049

23. For New IFF Adhesive, Polysulfide verifies:

D	(T)	a.	Peel strength	AMH006A,AMH007A
D	(T)	b.	Application life	AMH001A,AMH010A
D	(T)	c.	Tensile adhesion	AMH016A,AMH017A
D	(T)	d.	Specific gravity	AMH020A,AMH021A

D	(T)	e.	Hardness	AMH025A,AMH026A
D	(T)	f.	Nonvolatile content	SAA001A,SAA003A
D	(T)	g.	Flow	SAA002A,SAA004A
D		h.	Visual examination	BMP002

24. For Retest IFF Adhesive, Polysulfide verifies:

D	(T)	a.	Peel strength	BAA006A
D	(T)	b.	Application life	BAA003A
D	(T)	c.	Tensile adhesion	SAA005A
D	(T)	d.	Specific gravity	BAA004A
D	(T)	e.	Hardness	BAA005A
D	(T)	f.	Nonvolatile content	SAA006A
D	(T)	g.	Flow	SAA007A

25. KSC verifies:

G,M		a.	Segments and nozzle components are free of damage per OMRSD File V, Vol I, B47SG0.061	OMD079