ATK ALLIANT TECHSYSTEMS
THIOKOL PROPULSION

CRITICAL ITEMS LIST (CIL)

No. 10-02-01-05R/04

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1
SUBSYSTEM:	Nozzle Subsystem 10-02	PART NAME:	Aft Exit Cone (1)
ASSEMBLY:	Nozzle and Aft Exit Cone 10-02-01	PART NO:	(See Section 6.0)
FMEA ITEM NO.:	10-02-01-05R Rev N	PHASE(S):	Boost (BT)
CIL REV NO.:	N (DCN-533)	QUANTITY:	(See Section 6.0)
DATE:	10 Apr 2002	EFFECTIVITY:	(See Table 101-6)
SUPERSEDES PAGE:	317-1ff.	HAZARD REF.:	BN-05
DATED:	27 Jul 2001		
CIL ANALYST:	B. A. Frandsen		
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: 4.0 Structural failure of actuator brackets/compliance ring or attach bolts

3.0 FAILURE EFFECTS: Structural failure of actuator bracket and compliance rings or attach bolts will cause loss of TVC, RSRM, SRB, crew and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
4.1	Nonconforming dimensions	
4.1.1	Initial manufacturing dimensions	A
4.1.2	Metal dimensions reduced by corrosion and/or refurbishment	B
4.1.3	Hardware dimensions	C
4.2	Nonconforming material	
4.2.1	Improper heat treatment	D
4.2.2	Hydrogen embrittlement of bolts	E
4.2.3	Nonconforming voids, inclusions, or other material defects	F
4.3	Improperly-installed bolts	G
4.4	Fatigue	H
4.5	Stress-corrosion cracking	I
4.6	Transportation, handling, or assembly damage	J
4.7	Improper assembly techniques	K

5.0 REDUNDANCY SCREENS:

SCREEN A: N/A
SCREEN B: N/A
SCREEN C: N/A

6.0 ITEM DESCRIPTION:

1. An actuator bracket connects each Thrust Vector Control (TVC) actuator to the nozzle. Loads from the nozzle (or, collaterally, the actuators) are transferred through the compliance ring to the actuator brackets that are fastened to the aft exit cone shell and the compliance ring by screws (Figure 1). Each clevis-type actuator bracket is joined to the actuator arm by a stud. This hardware is part of the Exit Cone Sub-Assembly Nozzle, Aft. Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U52842	Shell, Exit Cone, Aft	7075-T73 or 7075-T7351 Aluminum	STW3-3155	1/motor
1U52242	Ring, Compliance, Nozzle	7075-T7351 Aluminum Forging Alloy	STW3-2746	1/motor
1U78783	Ring, Compliance, Forging	7075-T7351 Aluminum Forging Alloy	STW3-2746	1/motor
1U75643	Bracket, Nozzle Actuator	7075-T7351 Aluminum Forging Alloy	STW3-2746	2/motor
1U75643	Actuator Bracket Bushings	316 Corrosion-Resistant Steel Cadmium Plating	QQ-S-763	2/motor
1U51916	Cartridge Assembly	Heavy-Duty Calcium Grease, Filtered and Placed in an Application Cartridge	STW7-3657	A/R
1U51937	Shims, Compliance Ring	Aluminum, 1100-H19 or 5052-H19/H39		144/motor
1U51139	Spacer, Plate	316 Corrosion-Resistant Steel Cadmium Plating		4/motor
SPS93439	Bolt, External Wrenching	MP35N Alloy, 260 KSI	AMS5844	8/motor
SPS93438	Bolt, External Wrenching	MP35N Alloy, 260 KSI	AMS5844	8/motor
1U77928	Screw, SKT HD, Flat, CSK (alternate to 1U50510) Cadmium Plated Fasteners:	Alloy, Steel Cadmium Plating	FF-S-86	92/motor
	Nut	Alloy, Steel	MS9881	24/motor
	Helical-Coil Inserts	302/304 Corrosion Resistant Steel	MS124XXX NASM124XXX	A/R
		Finishes:		
		Alodine 1200 Chemical Coating	MIL-C-5541	A/R
	Sealing Compound	Synthetic Rubber, Polysulfide	STW5-9072	A/R
	Primer, Coating	Epoxy Coating Corrosion-Resistant, Epoxy Resin	STW5-2914	A/R
	Enamel Protective Zinc Chromate Primer	Epoxy Resin	STW5-2922 TT-P-1757	A/R A/R
	Adhesives, Epoxy	Epoxy Adhesive	STW5-3292	A/R

6.1 CHARACTERISTICS:

1. Structural support of the aft exit cone consists of a partially enclosing (on the forward portion) aluminum aft exit cone shell and an aluminum nozzle compliance ring at its aft end, joined together by 180 equally spaced flat head screws. Two nozzle actuator brackets for connection of the thrust vector control actuators are attached to the compliance ring at points 90 degrees apart (at positions 45 degree and 135 degree) by eight external wrenching bolts each. Each actuator bracket is also connected directly to the outer aluminum shell of the aft exit cone by 12 studs (flat head screws through the shell from the inside) with flat washers and nuts. All fastener hardware is cadmium plated to avoid galvanic corrosion. The actuator arm is secured in the clevis-type actuator bracket by a stud with safety wired jam nuts on each end (NASA parts) and supported in bushings pressed into the tines of the actuator bracket. The compliance ring and actuator brackets are reusable parts (Figure 1).

2. Waiver RWW0533 provides flight rationale regarding detection capability of penetrant inspection of nozzle aluminum parts. Affected nozzle aluminum parts include the Aft Exit Cone, Compliance Ring, Cowl Housing, and Actuator Bracket. Various levels of penetrant inspection performed on nozzle aluminum hardware may not reliably detect critical flaw sizes. A minimum flaw of 0.100 inches was assumed for the capability of the penetrant inspection and was used in the fracture mechanics analysis per TWR-16875. Recent testing of the effects of glass beaded and grit blasted bonding surfaces suggests that these manufacturing processes impact crack detection capability. The waiver allows for the use of identified nozzle parts.

   Nozzle Aluminum Hardware, along with applicable flaw data, is provided in the table below.

COMPONENT	FRACTURE CRITICAL	MINIMUM CRITICAL INITIAL FLAW SIZE	INITIAL CRITICAL FLAW SIZE (3-SIGMA FLIGHT LOADS)	CRITICAL FLAW SCREENING TECHNIQUE	IS WAIVER REQUIRED
Compliance Ring	Yes	0.54 corner crack (bolt holes)	>1.2 inches	Penetrant (1)	Yes
Aft Exit Cone	Yes	0.67 through (joint 1)	>2.0 inch	Penetrant	Yes
Actuator Bracket	Yes	0.52 corner crack (bushing hole)	>1.2 inch	Penetrant	Yes
Nose Inlet Housing	Yes	0.36 through (joint 2 bolt holes)	N/A	Proof Test	No
Cowl Housing	Yes	0.42 through (holes)	N/A	Penetrant (only new parts)	Yes
Snubber	No	N/A	N/A	N/A	N/A

(1) Bolt holes are fail safe

Flight rationale is based on the following:

<u>New Hardware-Manufacturing Induced Flaws</u>

New nozzle aluminum parts are forged and ultrasonic inspected (longitudinal) to verify the forging is free of sub-surface flaws. This inspection is capable of detecting internal flaws of 0.130 inches diameter or larger. Etching, per aerospace industry standards (up to 0.0004 inches), is performed and immediately followed by penetrant inspection. Penetrant inspection performed on new hardware detected cracks as small as 0.080 inches long.

A crack missed during initial and subsequent inspections could exceed or grow to critical size during flight and/or splashdown to be of concern. The flaw would need to be "smart". To create a smart crack, a flaw would need to be generated during new hardware fabrication and be located in a specific critical location (circumferential and axial). In addition, smart cracks must have a specific critical orientation (longitudinal in right plane and radial in thickness). Critical flaw sizes are relatively large (>0.5 inch). Critical flaw size is based on MEOP loads, and for 3 sigma statistical flight loads, critical flaw size is over twice as large. A smart crack flaw would have to be missed by all inspections (penetrant, visual, and ultrasonics). The probability of this occurring simultaneously is extremely low.

Refurbishment Hardware - Water Impact Induced Cracks

Nozzle aluminum parts are acceptable for reuse provided they meet the requirements of STW7-2863. Dimensional checks, ie. diameter, lengths, parallelism, etc., screens hardware that saw minor damage from water impact loads. More severe loads result in structural failure (cracks) of the parts. These cracks are easily detected during visual inspection. Aluminum parts receive penetrant inspections in addition to visual and dimensional inspection. Impact damage from debris is detected visually.

Maximum load on nozzle hardware occurs during splashdown. Splashdown loads may cause local yielding that permanently deforms the hardware. Deformed hardware will not meet refurbishment dimensional requirements (roundness, etc.). In addition, higher splashdown loads that exceed material ultimate strength will result in localized structural failure (cracks). Post flight inspection history confirms these cracks are open and readily detectable.

The compliance ring is fail safe in bolt hole areas. Critical cracks in compliance ring bolt holes can propagate to the next hole or through the ligament and not cause failure. Critical flaw size in membrane areas is a 1.28 inch surface crack with actuator stall loads and a 1.22 inch through crack with 3-sigma flight loads (load data from 6 flights, 46.4 kip). Cracks will occur in bolt holes before cracks occur in the membrane. Compliance rings will be rejected for dimensional non-conformance before stresses are high enough to cause overload cracks due to water impact loads.

Aft exit cone critical flaw size is 0.67 inches long based on CEI design loads (ie. stall load, MEOP, etc.). Critical flaw size based on 3 - sigma expected loads (load data from 6 flights, 46.4 kip), is 2.0 inches long. Aft exit cones will be out of round and scrapped due to dimensional non-conformance before loads are of the magnitude to initiate cracks.

Actuator bracket critical flaw size is 0.52 corner crack using CEI design loads and minimum part thickness. Critical flaw size, based on 3-sigma actuator loads is 1.2 through crack (load data from 6 flight, 46.4 kip). Water impact damage and other overload conditions create large flaws. Dimensions of the actuator bracket flanges would exceed refurbishment specifications before stresses are high enough to generate cracks.

The cowl housing does not receive non-destructive examination. Damage to the forward end ring and the nose inlet housing would occur and be detected prior to or in conjunction with possible damage to the cowl housing. No visible damage to cowl housing has ever been observed (other than corrosion). Due to low stress levels, critical initial flaw sizes for the cowl are large. Flight loads are well characterized and much less severe when compared to water impact loads. Cracks generated by water impact loading would be wide and visible.

The nose inlet is not included in this wavier. The nose inlet housing meets safe life requirements through valid proof test.

Demonstrated reliability (with 50% confidence level) of RSRM aluminum hardware, using flight and test motors, is as follows:

Compliance Ring	--0.9960
Aft Exit Cone	--0.9960
Actuator Bracket	--0.9980
Cowl Housing	--0.9960

Effectivity for RWW0533 is RSRM 360X046, 360X047, 360X049 and 360X053 through 360X084.

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

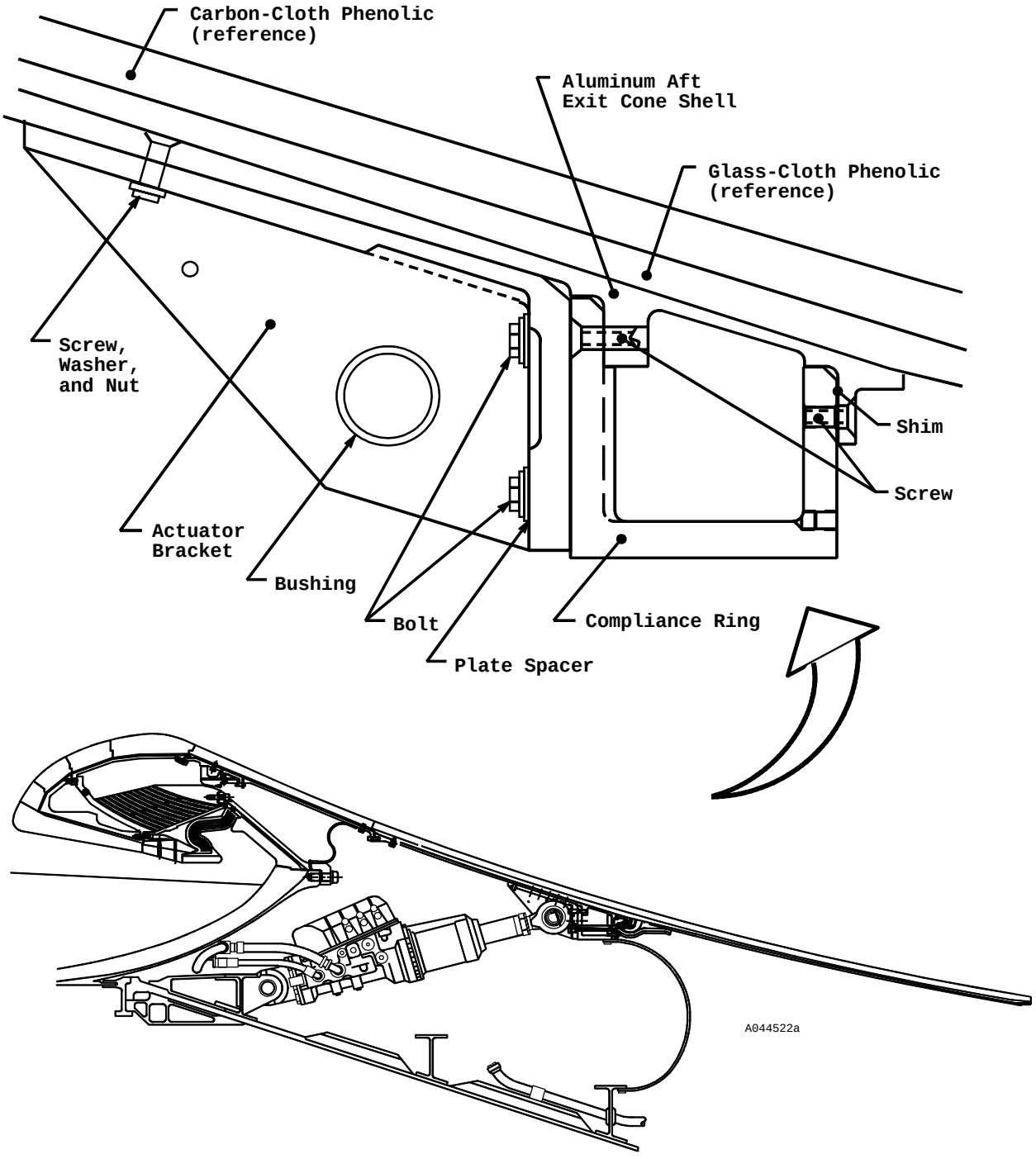

Figure 1. Compliance Ring and Actuator Bracket Assembly

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN FAILURE CAUSES

A,B,C,D,
E,G,H,I

1. Structural analysis per TWR-16975 verifies that the nozzle compliance ring, nozzle actuator brackets, aft exit cone shell, and associated connections have positive margins of safety based on factors of safety of 1.4 on ultimate and 1.1 on yield, for more than the planned four uses. In a test to failure of the actuator connection, the actuator bracket failed at a measured load in excess of that for the calculated positive margin of safety per TWR-14671.

2. Dimensions and associated thickness are per engineering drawings for the following components:

A,B,C

a. New parts as follows:

1) Aft exit cone shell
2) Nozzle compliance ring
3) Nozzle actuator bracket
4) Actuator bracket bushing
5) Shim, compliance ring
6) External wrenching bolt, no. 10-26
7) External wrenching bolt, no. 10-14
8) Plate spacer
9) Washer
10) Nut
11) Screw, no. 10
12) Screw, no. 11
13) Screw, no. 12

A,B,C

b. Refurbished parts per refurbishment specifications and drawings as follows:

1) Aft exit cone shell
2) Nozzle compliance ring
3) Nozzle actuator bracket

A,B,C

3. Shims are used to assemble the nozzle compliance ring to the aft exit cone shell to insure matching dimensions per engineering drawings.

A,B,C,I

4. A corrosion-resistant chemical conversion coating is applied to all aluminum structural parts. The nozzle actuator bracket, nozzle compliance ring, and aft exit cone shell are primer coated and top coat painted.

5. The following steps are used for corrosion protection:

A,B,C,I a. The bushings in the nozzle actuator bracket are cadmium plated and installed with filtered grease.

A,B,C,I b. Waterproof sealant is applied at all interfaces between parts and around screw heads per engineering drawings.

A,B,C,I c. All aluminum surfaces are painted in a three-step process to provide maximum protection against scuffing and corrosion.

A,B,C,I d. Threaded holes or fastener threads are coated with filtered grease at assembly per engineering drawing.

A,B,C,I e. All unused holes are filled with epoxy adhesive.

A,B,C f. All screws contacting aluminum are cadmium plated.

A,B,C,I g. Threaded inserts are installed with a coat of zinc chromate primer.

A,B,C 6. Helical-coil inserts are 302/304 corrosion resistant steel having composition and properties per Aerospace Material Specifications and are installed per refurbishment specifications. This material is inherently resistant to corrosion, therefore, is included in Table I of MSFC-SPEC-522, and is not subject to a material use agreement.

A,B,C 7. To prevent galvanic corrosion, helical-coil inserts are coated with corrosion inhibiting zinc chromate primer and installed while wet.

8. Parts are composed of high-strength aluminum forging alloy and heat treated per engineering drawings as follows:

D,E,F,I a. Nozzle compliance ring, with T7351 heat treat
D,E,F,I b. Nozzle actuator bracket, with T7351 heat treat
D,E,F,I c. Aft exit cone shell, with T73 or T7351 heat treat

D,E,F 9. Temperature analysis in the area of the compliance ring was found to be in close agreement with measurements in static firings. Maximum nozzle compliance ring temperature predicted for flight was well below the design limit of 232^{o}F per TWR-14199.

D,E,F 10. The external wrenching bolts holding the nozzle actuator brackets to the nozzle compliance ring are made of MP35N, which is resistant to corrosion. Other fastener hardware, holding the nozzle compliance ring and the nozzle actuator brackets to the aft exit cone shell, is cadmium plated to avoid galvanic corrosion per Cadmium Fastener specifications.

D,E,F 11. Analysis of Development Motor (DM) and Qualification Motor (QM) static firing data verifies the design meets performance requirements per TWR-18764-11.

D,E,F 12. As part of the post-flight inspection plan, char and erosion of the nozzle insulation is inspected and analyzed. If char and erosion of the insulation are determined to be such that the supporting aluminum housing was exposed to high temperature, the suspect housing is analyzed. For Qualification and Production Verification motors these char and eroding data are per TWR-16473. For flight motors these data are per TWR-50051.

G,K 13. Procedures for assembly of the nozzle compliance ring and nozzle actuator brackets are per engineering drawings and shop planning.

G,K 14. Bolt preload and sequencing is per TWR-15995 and engineering drawings.

G,K 15. A light coating of filtered grease is applied to screws, nuts, external wrenching bolts, and helical-coil inserts prior to installation per engineering drawings.

G,K 16. The external wrenching bolts and nuts used in the assembly of the nozzle compliance ring and nozzle actuator brackets to the aft exit cone shell are tightened and torqued in a predetermined pattern per engineering drawings and shop planning. Torque values are per engineering drawings.

G,K 17. Sealant is applied to all interfacing surfaces, around nuts, screw heads, and external wrenching bolt heads per engineering drawings.

H,I 18. Nozzle actuator brackets, nozzle compliance ring, and aft exit cone shell are made of 7075 aluminum forgings and heat treated to T73 or T7351 per engineering specifications and drawings.

H 19. Basic forgings for the nozzle compliance ring, nozzle actuator brackets, and the aft exit cone were analyzed per JSC Specification SE-R-0006 and were found to be free of re-entrant or sharply-folded lines, and that the principal grain flows are oriented parallel to principal stresses, per the following reports:

a.	Aft exit cone shell	TWR-10725 and TWR-10725, Amendment 1
b.	Nozzle actuator bracket	TWR-10723 and TWR-10723, Amendment 1
c.	Nozzle compliance ring	TWR-10721

H,I 20. The nozzle actuator bracket, nozzle compliance ring, and aft exit cone shell are refurbished for reuse per engineering.

H,I 21. The nozzle actuator bracket, nozzle compliance ring, and aft exit cone shell are included in the Fracture Control Program that addresses effects of vibration and dynamic loading. Useful life of these parts, based on maximum predicted loading and the largest undetected crack, exceeds life expectancy per TWR-16875.

I 22. Parts made of 7075-T73 aluminum which were shown not to be susceptible to stress-corrosion cracking and are included in material use agreements are:

Part	Use Agreement Number
Nozzle actuator bracket	SRM-MUA-082
Aft exit cone shell	SRM-MUA-082
Nozzle compliance ring	SRM-MUA-082

I 23. Material specifications for forging, aluminum alloy and forging, mandrel prescribe a testing procedure to assure resistance to stress corrosion cracking for 7075 aluminum alloy with T73-series heat treat.

I 24. Assembly stresses are minimized as follows:

a. Mating surface flatness is per inspection of machining operations and re-verified during refurbishing.
b. Threads are cleaned and lubricated prior to assembly per engineering drawings.
c. Dry fitting and use of shims for installation of the nozzle compliance ring per shop planning assure stresses will not be induced.
d. Attachment screws are tightened and torqued in a pattern per shop planning.

J 25. Transportation and handling of the aft exit cone assembly by Thiokol are per Thiokol IHM 29.

J 26. Requirements for handling RSRM components during assembly, storage, and transportation are similar to those for previous and other current programs at Thiokol. These requirements dictate RSRM case segments must be handled by or near a joint to avoid damage per TWR-13880. All lifting hooks and slings are fitted with safety hooks per TWR-15723.

J 27. Instrumentation for monitoring temperature is provided by a multi-day recording clock for recording of in-transit environments. Humidity is per NASA Report TMX-64757.

J 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.

	J	29. Transportation and handling of the aft exit cone assembly at KSC are controlled per TWR-13880.
	J	30. The aft exit cone and aft exit cone fragment shipping kit is designed for transportation of the aft exit cone assembly to the launch facility and return of the recovered aft exit cone fragment to Thiokol per TWA-1123. It is a closed container and protects the aft exit cone assembly from the external environment.
	J	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.
	H,I,J	32. 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	H,I,J	33. 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 aft exit cone 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 Ring Compliance, Nozzle verify:		
A,B,C	a.	Application of Alodine coating		ACX000
A,B,C	b.	Flatness		ACX002,ACX003
A,B,C	c.	Countersink diameter		ACX005,ACX005B,ACX005C ACX006,ACX006B,ACX006C
A,B,C	d.	True position	ACX008,ACX008A,ACX008B,ACX008C,ACX008D,ACX008E ACX008F,ACX009,ACX009A,ACX009B,ACX009C ACX009D,ACX009E,ACX009F,ACX030,ACX031	
A,B,C	e.	Thread for helical coil insert		ACX011,ACX011A,ACX011B ACX012,ACX012A,ACX012B
A,B,C	f.	Diameter	ACX014,ACX014A,ACX014B,ACX014C,ACX015 ACX015A,ACX015B,ACX015C,ACX023,ACX024	
A,B,C	g.	Complete coverage of epoxy primer		ACX021
A,B,C	h.	Run out		ACX027,ACX028
A,B,C	i.	Wall thickness	ACX051,ACX052,ACX072,ACX073 ACX074,ACX076,ACX077	
A,B,C	j.	Thickness of epoxy primer		ACX064
A,B,C	k.	Thickness of top coat paint		ACX065
A,B,C	l.	Complete coverage of top coat paint		ACX022
D,E,F,H,I	m.	Dye penetrant		ACX033
	2.	For Refurbished Ring Compliance, Nozzle verify:		
A,B,C,I	a.	Flatness		ACX001
A,B,C	b.	Bolt hole thread		ACX010
A,B,C	c.	Diameter		ACX013
A,B,C,I	d.	Roundness		ACX025,ACX026,ACX029
A,B,C	e.	Aluminum tapped threads cleaned		ACX059
A,B,C,I	f.	Wall thickness		ACX072
D,E,F,I	g.	Paint for no heat affected areas		CIC010
H,I	h.	Dye penetrant		ACX035
	3.	For New Nozzle Actuator Bracket, verify:		
A,B,C	a.	Thickness of wall attached to compliance ring		AFP072,AFP073
A,B,C	b.	Thickness of clevis sides at base		AFP016,AFP017
A,B,C	c.	Thickness of clevis sides at top (at connection)		AFP019,AFP020
A,B,C	d.	Thickness of base, attached to nozzle shell		AFP002,AFP003
A,B,C	e.	Width between gussets (clevis sides)		AFP078,AFP079
A,B,C	f.	Width between bushing		AFP074,AFP075
A,B,C	g.	Hole diameter of clevis pin (stud)		AFP045,AFP046
A,B,C	h.	Flatness of face-to-compliance ring		AFP040,AFP041
A,B,C	i.	Profile on face-to-aft exit cone		AFP080,AFP081
A,B,C	j.	.560 -.550 diameter through holes		AFP008A,AFP009A
A,B,C	k.	.664 -.655 diameter through holes		AFP008,AFP009
A,B,C	l.	True position of .560 -.550 diameter through holes		AFP005A,AFP006A
A,B,C	m.	True position of .664 -.655 diameter through holes		AFP005,AFP006
A,B,C	n.	Application of conversion coating		AFP000
A,B,C	o.	Complete coverage of epoxy primer		AFP021
A,B,C	p.	Complete coverage of top coat paint		AFP022
A,B,C	q.	Thickness of epoxy primer		AFP062
A,B,C	r.	Thickness of top coat paint		AFP063

D,E,F,H,I	(T)	s.	Chemical composition of aluminum forging material	AFP010
D,E,F,H,I	(T)	t.	Elongation	AFP061B
D,E,F,H,I	(T)	u.	Ultimate strength	AFP061
D,E,F,H,I	(T)	v.	Yield strength	AFP061A
D,E,F,H,I	(T)	w.	Ultrasonic test	AFP069
D,E,F,H,I		x.	Dye penetrant	AFP024
D,E,F,H,I	(T)	y.	Lot tests--actuator bracket bushing material per QQ-S-763	AKN000
D,E,F,H,I	(T)	z.	Test results for electrical conductivity	AFP054
H,I		aa.	Heat treat condition of aluminum forging material	AFP042

4. For Refurbished Nozzle Actuator Bracket, verify:

A,B,C	a.	0.62 dimension wall thickness	AFP001
A,B,C	b.	Bolt through hole diameter	AFP007
A,B,C	c.	0.90 dimension wall thickness	AFP015
A,B,C	d.	A-to-B dimension straightness	AFP036
A,B,C	e.	C-to-D dimension flatness	AFP039
A,B,C	f.	2.6000 dimension width between gussets	AFP077
A,B,C	g.	2.5075 dimension bushing face-to-face	AFP076
A,B,C	h.	2.001 dimension hole diameter	AFP044
H,I	i.	Dye penetrant	AFP082

5. For New Exit Cone, Subassembly-Nozzle, Aft verify:

G	a.	Threaded inserts are properly replaced	AGL095
G	b.	Absence of damage to fasteners	AGL000
A,B,C,G,I	c.	Screw threads are cleaned	AGL162
A,B,C,G,I	d.	Threaded holes are cleaned	AGL201
A,B,C,G,I	e.	Threads coated with filtered grease	AGL013
G	f.	Tapped threads are cleaned	AGL189
G	g.	Threaded inserts are replaced using primer	AGL092
G	h.	Threaded inserts are not damaged	AGL203
G,I	i.	Fasteners are torqued in pattern	AGL161
G,I	j.	Torque values	AGL207
I	k.	Shell and liner are properly aligned	AGL111

6. For New Exit Cone Sub-Assembly, Aft Insulated verify:

A,B,C	a.	Sealing compound is applied to actuator bracket and compliance ring screw heads	AGL209
A,B,C	b.	Sealing compound is applied to interfacing surfaces	AGL210
A,B,C	c.	Coating of counter bores with filtered grease	AGL032
A,B,C	d.	Sealant compound (Sealant, Polysulfide) is mixed per planning requirements	AGL209A

7. For New External Wrenching Bolt verify:

D,E,F	(T)	a.	Bolt material	AJM000

8. For New Screw verify:

D,E,F	(T)	a.	Cadmium plated	AAV000
D,E,F	(T)	b.	Hydrogen embrittlement relief	AAV001
D,E,F	(T)	c.	Mechanical properties	AAV002

9. For New Nut verify:

D,E,F	(T)	a.	Certificate of Conformance--mechanical properties	BHU115

D,E,F	(T)		b. Parts are plated in accordance with specification requirements per AMS2400	AGK000
		10.	For New Insert, Helical Coil, verify:	
D,E,F	(T)		a. Material is corrosion resistant steel	RHB001
		11.	For New Grease verify:	
D,E,F	(T)		a. Penetration	LAA037
D,E,F	(T)		b. Dropping point	ANO042
D,E,F	(T)		c. Zinc concentration	LAA038
		12.	For New External Wrenching Bolt verify:	
D,E,F	(T)		a. Bolt material	NCC013
		13.	For New Filtered Grease verify:	
A,B,C			a. Grease is received from storage unopened or resealed	ACP015
A,B,C			b. The shelf life of the grease, prior to filtering	AMB018L
A,B,C	(T)		c. Contamination	ANO064
A,B,C			d. The grease conforms to specification	LAA044
A,B,C			e. The cartridge conforms to drawing	LAA046
A,B,C			f. The filtered grease is capped and sealed after filling	LAA047
A,B,C			g. The filtered grease is sent to storage capped and sealed (recapped and resealed)	LAA063
		14.	KSC verifies:	
A,B,C			a. Nozzle aft exit cone for damage or contamination to metal components, cork insulation, and painted surfaces prior to assembly per OMRSD File V, Vol I, B47NZ0.020	OMD046
		15.	For New Forging, Ring Compliance, Nozzle verify:	
D,E,F,H,I	(T)		a. Chemical composition	ACX016
D,E,F,H,I	(T)		b. Electrical conductivity	ACX056
D,E,F,H,I	(T)		c. Ultimate strength	ACX063
D,E,F,H,I	(T)		d. Yield strength	ACX063A
D,E,F,H,I	(T)		e. Elongation	ACX063B
D,E,F,H,I	(T)		f. Ultrasonic test	ACX071
H,I	(T)		g. Heat treat condition	ACX044