ATK ALLIANT TECHSYSTEMS
THIOKOL PROPULSION

CRITICAL ITEMS LIST (CIL)

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

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	QUANTITY:	(See Section 6.0)
DATE:	17 Jun 2002	EFFECTIVITY:	(See Table 101-6)
SUPERSEDES PAGE:	314-1ff.	HAZARD REF.:	BN-04
DATED:	10 Apr 2002		
CIL ANALYST:	B. A. Frandsen		
APPROVED BY:		DATE:	

RELIABILITY ENGINEERING: K. G. Sanofsky 17 Jun 2002

ENGINEERING: P. M. McCluskey 17 Jun 2002

1.0 FAILURE CONDITION: Failure during operation (D)

2.0 FAILURE MODE: 1.0 Thermal failure of carbon phenolic ablative liner or glass phenolic insulator components

3.0 FAILURE EFFECTS: Burn-through of aft exit cone, break up causing loss of aft exit cone, thrust reduction causing loss of RSRM, SRB, crew, and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
1.1	Carbon phenolic or glass phenolic material not manufactured to required thickness	A
1.2	Bond line failure of the glass phenolic-to-metal housing bond or glass phenolic-to-carbon phenolic bond	
1.2.1	Bonding surfaces not properly prepared or adequately cleaned	B
1.2.2	Bonding material not properly mixed, applied, or cured	C
1.2.3	Contamination during processing	D
1.2.4	Process environments detrimental to bond strength	E
1.2.5	Nonconforming material properties	F
1.2.6	Bond lines not to required thickness	G
1.3	Structural failure	
1.3.1	Improper ply angle orientation in phenolic components	H
1.3.2	Nonconforming raw material properties	I
1.3.3	Nonconforming manufacturing processes	J
1.3.4	Nonconforming dimensions	K
1.3.5	Phenolic cracks or delaminates at cap screw holes	L

1.3.6	Ply lift of carbon-cloth phenolic	M
1.4	Improper thermal characteristics due to nonconforming raw material properties	N
1.5	Component degradation during assembly, handling, transportation, or storage	O
1.6	Temperature, humidity, vibration, and shock during boost phase	P
1.7	Porosity, voids, de-laminations, inclusions, or cracks	Q
1.8	Cap screws (shear pins) fail to hold phenolics to metal housing	
1.8.1	Caps crews improperly installed or locked	R
1.8.2	Corrosion of cap screws	S
1.8.3	Embrittlement	T
1.8.4	Damaged threads	U

5.0 REDUNDANCY SCREENS:

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

6.0 ITEM DESCRIPTION:

Nozzle aft exit cone--insulator and liner

1. The RSRM Exit Cone Assembly-Nozzle, Aft is one of a series of interconnected, modular nozzle components (Figure 1). The aft exit cone is attached to the forward exit cone assembly. Figure 2 provides a sectional view of the RSRM nozzle showing the aft exit cone. The aft exit cone consists of an aluminum shell, glass-cloth phenolic insulator, and carbon-cloth phenolic liner as indicated by Figure 3. Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U79157	Exit Cone Assembly-Nozzle, Aft			1/motor
1U79155	Exit Cone Subassembly, Aft			1/motor
	Aft Exit Cone (Test)	Product Specification	STW3-3463	A/R
1U52842	Shell, Exit Cone, Aft			1/motor
1U76065	Cap screws (Shear pins)	316 Stainless Steel	AMS-5737, NAS-1352,FF-S-86	60/motor
5U77652	Exit Cone, Aft			1/motor
	Ablative Liner	Carbon-Cloth Phenolic	STW5-3279	4175 lbs.
	Insulation	Glass-Cloth Phenolic	STW5-2651	2813 lbs.
		Phenolic Slit Tape	STW5-3621	A/R
	Resin, Phenolic Laminating	Thermosetting Phenolic	MIL-R-9299	A/R
	Adhesive, TIGA 321	Adhesive,Two-Part	STW5-9203	A/R
	Shims	Two-Part Epoxy	STW5-9203	A/R
	Shim adhesive	Cyanocrylate, Solventless	STW5-9205	A/R
	Sealant, Polysulfide	Synthetic Rubber, Polysulfide	STW5-9072	A/R
	Primer, Cyclohexane Silane	Silane Primer	STW5-9206	A/R

6.1 CHARACTERISTICS:

1. The aft exit cone assembly interfaces with the forward exit cone assembly. The aft exit cone assembly consists of an aluminum shell, carbon-cloth phenolic liner, glass-cloth phenolic over wrap, compliance ring, and actuator bracket. The aluminum shell extends along the exit cone assembly far enough for attachment and retention of the compliance ring and to provide adequate bond area for retention of the cloth phenolic liner.

2. The aluminum compliance ring is provided with an attachment for the interfacing actuators. A separation ordnance ring provides capability to jettison the aft portion of the exit cone after burnout.

3. Function of the cloth phenolic materials (Figure 3) is that of insulative and ablative liner to protect the primary components of the nozzle from an extreme heat environment.

4. Deviation RDW0653, (effectivity RSRM-84, RSRM-86 and subsequent) provides flight rationale for cowl station 0.3, forward exit cone, and aft exit cone not being able to meet the 1.4 Performance Factor. The Performance Factor is reduced for these components (see table below) where analysis shows a likelihood of violating the 1.4 requirement.

Component	Performance Factor
Aft Exit Cone forward 46 inches	1.3
Forward Exit Cone	1.1
Cowl, station 0.3 only	1.2

A statistical analysis performed from flight erosion and char data showed a likelihood of violating the 1.4 Performance Factor at station 0.3 on the cowl and the forward and aft exit cones (reference TWR-75135). Changing the design to add additional carbon cloth phenolic (CCP) thickness is a possible future corrective action.

The Performance Factor equation is based on the CCP thicknesses required to meet conservative thermal requirements that ensure flight safety. Failure to meet even a Performance Factor of 1.0 does not necessarily mean failure of the nozzle. In addition, phenolic components are rarely, if ever, built to the minimum allowed thickness. For more information, see TWR-75135, Justification for Nozzle Performance Margin of Safety Equation Change.

Significant burn time capability remains with the reduced Performance Factors. Extensive assessment of postflight nozzle erosion results has determined that flight safety is assured even with Performance Factors down to 1.0.

Station with Minimum Burn Time Remaining	Deviation Performance Factor	Virgin Material Remaining (inch)*	Burn Time Remaining (seconds)**
Cowl – 0.3	1.2	0.215	91
Forward Exit Cone – 4.6	1.1	0.118	39
Aft Exit Cone – 118.77	1.3	0.258	138

* Using DMMT, virgin CCP material remaining at the end of 123 seconds of motor burn before RVMR is reached.

** Time remaining after the nominal 123 second motor burn before heating the glass cloth phenolic/CCP or silica cloth phenolic/CCP interface to 600° F while maintaining all epoxy/metal bondlines at ambient temperature.

5. Structural analyses for nozzle bondlines using adhesives EA946 and EA913NA do not include residual stresses. For this reason, RWW0548 has been approved to waive the requirements to include residual stress in ultimate combined load structural analyses for the current nozzle structural adhesives. New analyses techniques developed for TIGA adhesive may show a negative margin of safety if same analyses were applied to EA946 and EA913NA bondlines. Extensive testing and model validation was conducted for TIGA adhesive to address residual stresses, which have not been performed on EA946 and EA913NA adhesives. Therefore, inclusion of residual stresses in the structural analyses for EA946 and EA913NA bondlines is waived.

   Flight rational includes the following: 1. Nozzles are considered fully qualified with a demonstrated reliability of 0.996. 2. The 2.0 bond safety factor is meant to cover unknown conditions such as residual stress effects. 3. Process controls have been added to include monitoring and controlling of bond loads, monitoring Coeflex-shim differentials, controls on rounding forces, controls on flange mismatch, controls on transportation temperatures, improvements in grit blast, eliminated bond surface contact with black plastic, TCA-wipe prior to grit blast rather than after, and other process changes. 4. The use of improved materials include adding silane primer (adhesion promoter), virgin grit blast media for pre-bond grit blast, and incorporate the use of fresh adhesive for nozzle structural bonds.

   Future incorporation of TIGA 321 adhesive on RSRM-94 will eliminate the need for waiver RWW0548. Certification analyses will include residual stresses for TIGA 321 adhesive.

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

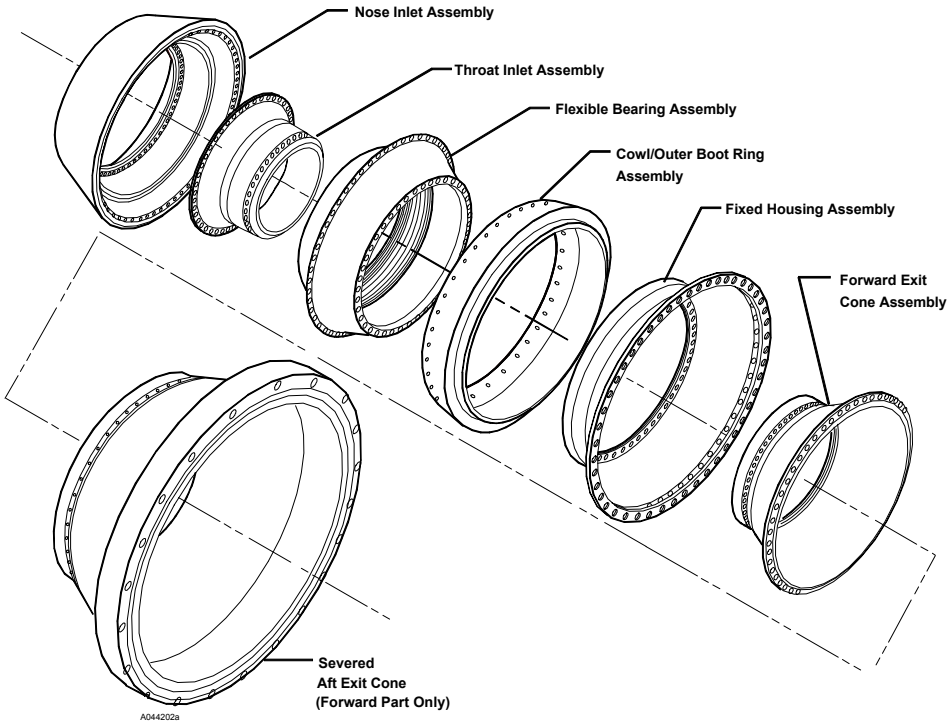

Figure 1. RSRM Nozzle Assembly Components

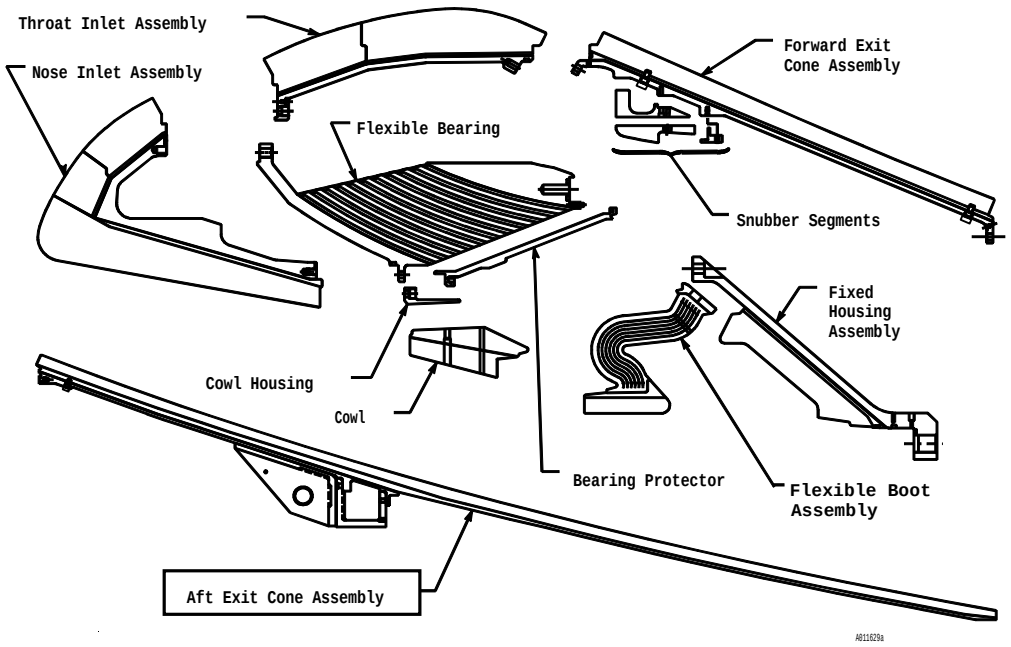

Figure 2. Exploded Section of Nozzle

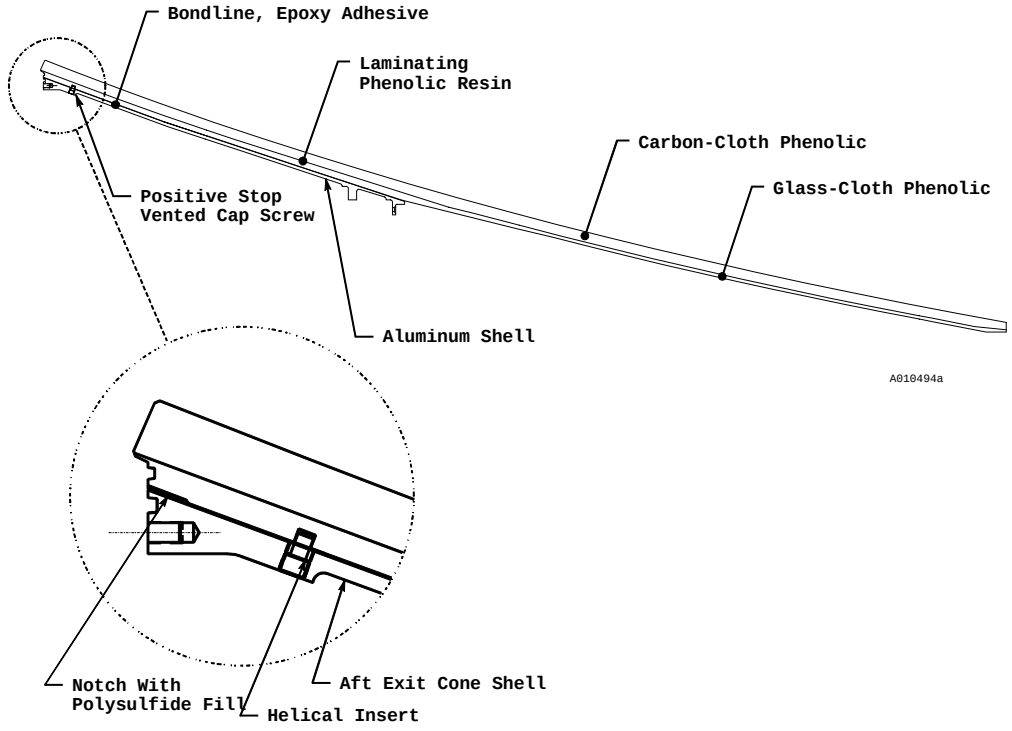

Figure 3. Aft Exit Cone Assembly

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN	FAILURE CAUSES	
A,K	1.	Thickness of the RSRM aft exit cone ablative liner was increased per TWR-17219.
A,K	2.	Thickness of carbon-cloth phenolic and glass-cloth phenolic is controlled by wrapping the phenolics on a mandrel that was designed to generate the final inside contour of the exit cone. The phenolics are machined to reference points per engineering drawings.
B,C,D,J	3.	Preparation and cleaning of bonding surfaces are per shop planning. Cleanliness of bonding surfaces is determined by a combination of visual inspection and visual inspection aided by black light. Surface inspection is per shop planning. Preparation, cleaning, and inspection methods for aft exit cone bond lines are identified as process critical planning.
A,B,C,D,E,F,G,H, I,J,K,L,M,N,P,Q,R	4.	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.
C	5.	Two-part epoxy adhesive is mixed, applied, and cured per shop planning and engineering drawings.
C	6.	Phenolic laminating resin is applied to the carbon phenolic surface and the composite structure is autoclave cured per shop planning and engineering drawings.
D	7.	Contamination control requirements and procedures are per TWR-16564.
E	8.	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.
F	9.	Material properties for epoxy adhesive are per engineering.
F	10.	Material properties for laminating phenolic resin are per government specifications for Resin, Phenolic Laminating.
G	11.	Bond line thickness between carbon-cloth phenolic and glass-cloth phenolic is per shop planning.
G	12.	Bond line thickness of the glass phenolic-to-metal housing is per engineering drawings.
G	13.	Dry-fit to develop bond line shim size is done with Coe-flex per shop planning.
G	14.	Preparation methods for bond line thickness are per shop planning. Surface

inspection type and the bonding process are per process critical planning.

H 15. Carbon-cloth phenolic is tape wrapped parallel to the mandrel centerline per engineering drawings.

H 16. Glass-cloth phenolic is tape wrapped over the carbon-cloth phenolic parallel to interfacing surface per engineering drawings.

I,N 17. Material properties affecting structural and thermal integrity are controlled per Thiokol or government specifications for the following materials:

a. Carbon-Cloth Phenolic
b. Glass-Cloth Phenolic
c. Resin, Phenolic Laminating
d. Adhesive, LER, Silicone Filled

I,N 18. Intermixing of equivalent materials from different suppliers within glass phenolic or carbon phenolic components is not permitted per engineering drawings.

J,Q 19. Aft exit cone manufacturing processes for carbon phenolic ablative liner and glass phenolic insulator components are per engineering drawings and shop planning.

L 20. Sixty flat-bottom holes are drilled around the forward end of the aft exit cone assembly into the glass phenolic insulator for installation of cap screws per engineering drawings.

L 21. Cracks or delaminates in phenolic material at the cap screw holes are minimized by use of:

a. Sharp drills
b. Drill bushings
c. Drill depth stop
d. Flat-bottom drills

M 22. Manufacturing of Carbon-Cloth Phenolic is per engineering.

M 23. Packaging, storage, handling, and shipping requirements for Carbon-Cloth Phenolic are per engineering and MH&SI.

M 24. Tape wrap and curing of carbon-cloth phenolic is per engineering drawings and shop planning.

M 25. Bias-cut carbon phenolic is wrapped over the wrap mandrel to the ply angle required per engineering drawings. The ply angle is mandrel controlled per shop planning.

O 26. 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.

O 27. Pre-assembly mismatch causing bond line stresses was shown by analysis to be within allowable limits per TWR-16975.

O 28. Handling and lifting requirements for RSRM components are similar to those for previous and current programs as conducted by Thiokol per TWR-13880.

a. Proof loading of all lifting equipment is per TWR-10212.

O 29. The exit cone and exit cone fragment shipping kit is designed for transportation of the exit cone to the launch facility and return of the recovered exit cone fragment to Thiokol per TWA-1123. The shipping kit provides an enclosed container to protect the aft exit cone from external environments.

a. A detailed description of the shipping kit is per TWA-1189.

O 30. The primary storage configuration for the aft nozzle exit cone assembly is on the exit cone installation fixture. Exit cones in storage are grounded and under protection from the elements per TWA-1123.

O 31. Transportation and handling of aft exit cone assembly items by Thiokol is per IHM 29.

O 32. 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.

O 33. Support equipment used to test, handle, transport, and assemble or disassemble the RSRM is certified and verified per TWR-15723.

O 34. 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.

O 35. 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.

O 36. 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 environment during in-plant transportation or storage are per engineering.

P 37. Analysis is conducted by Thiokol engineering to assess dynamic, acoustic, and vibration response of RSRM nozzle operation during boost phase per TWR-16975.

P 38. The aft exit cone is designed not to be adversely affected when experiencing temperature, pressure, humidity, vibration, or shock environments per TWR-15723.

P 39. Analysis of nozzle natural frequency and vibration response throughout motor burn is per TWR-16975.

Q 40. Surface and subsurface defect criteria rationale are per TWR-16340.

R,U 41. To lock the metal housing and phenolics together during installation, 60 holes equally spaced are threaded at the forward end of the aft exit cone housing. Sixty flat-bottom holes are drilled in the liner per engineering drawings. The holes are filled with adhesive and threaded cap screws are installed per the specified torque value. This seats the cap screw head to the metal housing surface and provides a positive stop per engineering drawings. A continuous bead of Sealant, Polysulfide is placed at the base of the cap screw heads per engineering drawings.

S,T	42.	Cap screw materials for the Modified Cap Screw are fabricated from 316 stainless steel per Federal Specifications for Cap Screws, Socket Head which have a high resistance to stress-corrosion cracking per Aerospace Material Specifications for Bars, Forgings and Tubing and MSFC specifications for controlling stress corrosion cracking design criteria, as well as NAS specifications for Screws. The forward exit cone housing is D6AC steel per engineering.
S,T	43.	Cap screw material (A286 steel) is a passivated high-strength CRES per AMS material specifications for Bars, Forgings and Tubing.
T	44.	Cap screws fabricated from 316 stainless steel are not subject to embrittlement per Federal Specifications for Cap Screw Socket Heads.
S,U	45.	Threaded inserts are installed with a coat of primer per Federal Specifications to prevent corrosion.
S,U	46.	Helical inserts are corrosion resistant steel (AMS 7245).
R	47.	A vent hole is provided in the cap screw to preclude build up of hydraulic pressure during installation.
B	48.	A Spray-in-Air cleaning system is used to clean metal components as part of the bonding surface preparation processing sequence.
F,H,I,J,N	49.	Two lots of carbon-cloth phenolic from the same supplier may be used to fabricate the Exit Cone, Aft.
E,O,P	50.	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.
E,O,P	51.	Structural analysis documented in TWR-16975 show that nozzle phenolic-to-metal bondlines have positive margins of safety based on a safety factor of 2.0. These analyses used standard conditions as allowed by the CEI specification.

9.2 TEST AND INSPECTION:

DCN	FAILURE CAUSES and TESTS (T)			CIL CODES
		1.	For New Exit Cone, Aft verify:	
A,H,K,M		a.	Proper mandrel is used	AGL001
A,K		b.	Outside diameter of glass phenolic	AGL007
A,K		c.	Outside diameter profile of glass phenolic	AGL008,AGL075
A,K		d.	Final surface profile of the carbon phenolic	AGL108
B		e.	Dry time of solvent wipe on carbon phenolic prior to resin application	AIB015
B		f.	Solvent wipe of carbon phenolic bonding surface prior to resin application	AIB033
B		g.	Carbon phenolic surface is free from grease, oil and foreign material prior to resin application	AIB016
C,G		h.	A thin uniform coating of resin is applied to carbon surface	AIB044
C,E,J,M		i.	Autoclave cure of phenolic is acceptable	AGL019,AIB008
D,J,Q	(T)	j.	Radiographic examination is acceptable	AGL118A
G,J		k.	Acceptable completion of tape wrap per planning requirements	AGL078
J,M		l.	Acceptable completion of tape wrap per planning requirements	AGL184
I,M		m.	Environmental history of phenolic materials (carbon cloth)	AGL104
I		n.	Environmental history of phenolic materials (glass cloth and phenolic resin)	AIB027,AJG003
I,N		o.	Only one phenolic supplier's cloth material is used	AGL105,AGL106
I,N		p.	Only one phenolic resin supplier's material is used	AIB028
J		q.	Alcohol wipe on phenolic	AIB002,AIB003
M		r.	Carbon-cloth phenolic shelf life has not exceeded expiration date	AOD159A
		2.	For New Aft Exit Cone (Test) verify:	
J,M	(T)	a.	Compressive strength (carbon)	AGL034
J	(T)	b.	Compressive strength (glass)	AGL043
J,M	(T)	c.	Residual volatiles (carbon)	AGL138
J	(T)	d.	Residual volatiles (glass)	AGL140
J,M	(T)	e.	Resin content (carbon)	AGL148
J	(T)	f.	Resin content (glass)	AGL150
J,M	(T)	g.	Specific gravity (carbon)	AGL173
J	(T)	h.	Specific gravity (glass)	AGL174
		3.	For New Exit Cone, Subassembly-Nozzle, Aft verify:	
K		a.	Overall length of assembly	AGL109
B,D		b.	Bonding surfaces free of contamination (Black light)	AGL022,AGL023
B		c.	Solvent wipe dry time	AGL067A
B		d.	Solvent dry wipe	AGL073
B		e.	Solvent wipe down	AGL167
B,C,E		f.	Proper cure of primer	NCC014
B,C,D		g.	Primer application	NCC015
C		h.	Adhesive (LER, Silicon filled) is mixed per planning requirements	AGL004
C		i.	Metal shell is seated	AGL094
C,F,I,R	(T)	j.	Cure-cup hardness test	AGL051
C		k.	Layer of adhesive applied to bonding surface	AGL200
B,C,D,E,F, I,J,N,R	(T)	l.	Witness panel results for adhesive integrity	NCC011
D,J,Q	(T)	m.	Radiographic examination is acceptable	AGL118
E		n.	Temperature of shell bonding surface	AIB041
D		o.	Metal bonding surface grit blast-to-primer application time limits	AGL080
E,J		p.	Bonding cure	AGL059

G		q.	Correct shim location	AGL049
G		r.	Bond gap thickness	AGL102
G		s.	Correct shim size	AGL048
I		t.	Adhesive environmental history	ANM021
J		u.	Grit blast of metal is acceptable	AGL081
L		v.	Holes are drilled per engineering	AGL028
O		w.	Component temperatures and exposure to ambient environments	BAA026
Q		x.	Alcohol wipe test	AGL010
R,S		y.	Threads coated with grease	AGL013

585 4. For New Approved Solvent, verify:

B,D		a.	Certificate of Conformance is complete and acceptable	AJJ007A

5. For New Adhesive, LER, Silicone Filled verify:

F,I		a.	Pot life	ANM025
F,I	(T)	b.	Tensile Adhesion Strength	ANM045

6. For New Adhesive, Modified Epoxy (Grey) verify:

F,I,N	(T)	a.	Average molecular weight (epoxy paste)	ANL002
F,I,N	(T)	b.	Epoxide equivalent, epoxy resin	ANL029,ANL027
F,I		c.	Pot life	ANL074,ANL075
F,I,N	(T)	d.	Titratable nitrogen, curing agent	ANL159,ANL160
F,I	(T)	e.	Viscosity, epoxy resin	ANL176,ANL178
F,I,N	(T)	f.	Ingredient percentages	ANL045,ANL060
F,I	(T)	g.	Steel-to-steel tensile adhesion	ANL094
F,I,N		h.	Visual examination (workmanship)	ANL117

7. For New Silicon Dioxide, verify:

F,I,N	(T)	a.	Bulk density	ALP002,ALP008
F,I,N	(T)	b.	Moisture	ALP058,ALP064
F,I	(T)	c.	pH	ALP097,ALP101
F,I,N	(T)	d.	Loss on ignition	ALP040

8. For New Resin, Phenolic Laminating verify:

F,I,N	(T)	a.	Specific gravity	AJG006
F,I,N		b.	Data pack is complete and acceptable	AJG022
F,I	(T)	c.	Viscosity	AJG037

9. For New Carbon-Cloth Phenolic verify:

I,N	(T)	a.	Cloth content--uncured	AOD017
I,M	(T)	b.	Compressive strength--cured	AOD027
I,M,N	(T)	c.	Density--cured	AOD058
I,N	(T)	d.	Dry resin solids--uncured	AOD067
I,M	(T)	e.	Inter-laminar shear--cured	AOD075
I,M,N	(T)	f.	Resin content--cured	AOD112
I,M,N	(T)	g.	Resin flow--uncured	AOD140
I,N	(T)	h.	Sodium content--uncured	AOD164
I,N		i.	Supplier data pack is acceptable and complete	AOD206
I,M,N	(T)	j.	Volatile content--uncured	AOD222
I,N	(T)	k.	Carbon filler content--uncured	AOF000

10. For Retest Carbon-Cloth Phenolic verify:

I,M,N	(T)	a.	Resin flow	AOD131
I,M,N	(T)	b.	Volatile content	AOD236

11. For New Glass-Cloth Phenolic verify:

I,N	(T)	a.	Cloth content--uncured	AMN007
I	(T)	b.	Compressive strength--cured	AMN014
I,N	(T)	c.	Density--cured	AMN038
I,N	(T)	d.	Dry resin solids--uncured	AMN048
I	(T)	e.	Inter-laminar shear strength--cured	AMN057
I,N	(T)	f.	Resin content--cured	AMN088
I,N	(T)	g.	Resin flow--uncured	AMN121
I,N	(T)	h.	Volatile content--uncured	AMN195
I,N		i.	Supplier data pack is complete and acceptable	AMN172

12. For Retest Glass-Cloth Phenolic verify:

I,N	(T)	a.	Resin flow	AMN103
I,N	(T)	b.	Volatile content	AMN178

13. For Retest Phenolic Slit Tape verify:

I,N	(T)	a.	Resin flow	AMN103A
I,M,N	(T)	b.	Resin flow	AOD131A
I,N	(T)	c.	Volatile content	AMN178A
I,M,N	(T)	d.	Volatile content	AOD236A

14. For New Exit Cone Assembly--Nozzle, Aft verify:

O		a.	Handling of aft exit cone	AGK011
O		b.	Component temperatures and exposure to ambient environments during in-plant transportation or storage	BAA031

15. For New Screw, Cap, Socket Head--Modified verify:

R,U		a.	Shank length (lot sample)	AGI001A
R,U		b.	"A" dimension (lot sample)	AGI001B
R,U		c.	Shank diameter (lot sample)	AGI001C
R,U		d.	Discontinuity limits are met (head and body, socket, threads) (lot sample)	AGI004A,AGI004B,AGI004C
R,U		e.	Threads are acceptable (lot sample)	AGI007

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

R,S		a.	Sealant is acceptable	AGL164
R,S		b.	Sealant is applied to cap screw heads	AGL165
R,S		c.	Cap screws are installed with adhesive	AGL206
R		d.	Adhesive is tested per specification	NCC016
R,U		e.	Cap screws are installed per drawing requirements	NCC017
R,S		f.	Adhesive is applied to the threads of the housing	NCC018
R,S		g.	Adhesive (LER, Silicon filled) is mixed per planning requirements	AGL004A
R,S		h.	Sealant compound (Sealant, Polysulfide) is mixed per planning requirements	AGL209A

	17.	For Refurbished Aft Exit Cone, Shell, verify:	
R,U	a.	Proper installation of helical coils	ADK209
R,U	b.	Presence of all helicoil inserts	ADK209A
R,S	c.	Application of primer to insert threads	ADK146
	18.	For New Aft Exit Cone, Shell, verify:	
R,U	a.	Presence of all helicoil inserts	ADK143
R,S	b.	Application of primer to insert threads	ADK103
	19.	For Nozzle Assembly, Structural Bond line Requirements verify:	
B,C,D,E,F, I,J,N,R (T)	a.	Phenolic-to-adhesive interface checks meet specification requirements	PPC001
	20.	KSC verifies:	
O	a.	Aft exit cone for damage (absence or penetration of ablative carbon material) prior to assembly per OMRSD File V, Vol I, B47NZ0.041	OMD049
O	b.	Aft exit cone aft lip composites for absence of cracks and surface defects per OMRSD File V, Vol I, B47NZ0.081	OMD052