NASA/TM-2006-214603



# Qualification Testing of Solid Rocket Booster Diagonal Strut Restraint Cable Assembly Part Number 10176–0031–102/103

T.W. Malone Marshall Space Flight Center, Marshall Space Flight Center, Alabama

September 2006

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National Aeronautics and Space Administration

Marshall Space Flight Center • MSFC, Alabama 35812

September 2006

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# LIST OF ACRONYMS AND ABBREVIATIONS

- ELV elevated temperature
- RT room temperature
- SRB solid rocket booster
- TM Technical Memorandum
- USA United Space Alliance

#### TECHNICAL MEMORANDUM

#### QUALIFICATION TESTING OF SOLID ROCKET BOOSTER DIAGONAL STRUT RESTRAINT CABLE ASSEMBLY PART NUMBER 10176–0031–102/103

#### **1. INTRODUCTION**

This Technical Memorandum (TM) presents qualification test results for solid rocket booster (SRB) diagonal strut restraint cable assembly part no. 10176–0031–102/103. During flight, this assembly is exposed to a range of temperatures. MIL–W–83420 defines the breaking strength of the cable to be 798 kg (1,760 lb) at room temperature; however, it does not define cable strength at 669 °C (1,236 °F), the maximum temperature to which the cable is exposed during the first 2 min of flight.<sup>1</sup> The cable, which is able to be built from different corrosion-resistant steel alloys, may also vary in its chemical, physical, and mechanical properties at the tested temperatures.

Analysis of the cable at the tested temperature, when using the standard knockdown factors for untested requirements given in MSFC–HDBK–505, "Structural Strength Program Requirements," produced negative margins of safety.<sup>2</sup> However, MSFC–HDBK–505 also stipulates conditions where a less conservative safety factor of 1.4 and less conservative knockdown factors are appropriate if they have been verified by testing.<sup>2</sup> SRB document 90PLN–0064 provides requirements for qualification testing the strut retainer assembly.<sup>3</sup>

#### 2. BACKGROUND

The restraint cable assembly is a steel cable with two terminal wire-rope clevis ends, pins, and cotter pins. The clevis ends and pins are picked from standard military specification hardware to interface with the external tank attachment ring and the diagonal strut assembly (figs. 1 and 2). The terminal wire-rope clevis ends are swaged onto the steel cable in accordance with MIL–T–6117.<sup>4</sup>

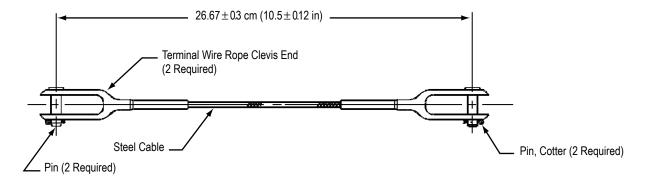


Figure 1. Strut retainer assembly.

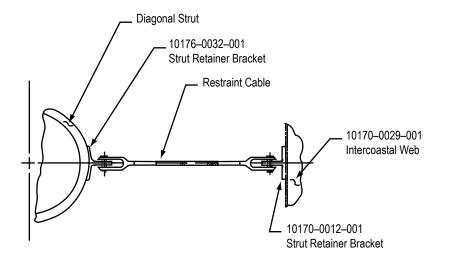


Figure 2. Strut retainer assembly installation.

This TM presents test results for three lots of MIL–W–83420, 0.317-cm (0.125- or 1/8-in) diameter, type 1 (nonjacketed) cable to loads required to restrain the diagonal strut during the first 2 min of flight and, ultimately, to failure.<sup>1</sup> The first lot consisted of available flight cable assemblies that existed in United Space Alliance (USA) stock. The other two lots were obtained from new procurements, with

documentation that the wire ropes are from two different wire lots or spools. Test results qualified the available restraint cable assemblies and all future buys of restraint cables manufactured under the same procurement specifications for flight.

#### 3. TESTING AND EVALUATION

#### 3.1 Testing

Mechanical testing was completed June 6, 2004 and was performed in accordance with ASTM–E–8 and test procedure SRB–QUAL–04–0064 for the first lot of cables.<sup>5,6</sup> Five restraint cables were each pulled to failure at room temperature and at  $671 \pm 5 \,^{\circ}C (1,240 \pm 10 \,^{\circ}F)$  in accordance with the referenced procedure, 90PLN–0064, and memorandum MP41 (04–063).<sup>3,7</sup> Testing was completed for the other two lots on August 6, 2004. Ten additional restraint cables were each pulled to failure at room temperature and at 677 °C (1,250 °F) in accordance with the referenced procedure and plan.<sup>3</sup>

Table 1 shows analysis of the test results, including the calculation of a knockdown factor using methods described in chapter 9 of MIL–HDBK–5.<sup>8</sup>

Each cable was photographed before and after testing. All tests at room temperature were videotaped, and appendix A shows still images taken from the videos.

Procedure checklists were used for each test, in accordance with SRB–QUAL–04–0064, and they are shown in appendix B of this  $TM.^6$ 

#### **3.2 Evaluation**

A value, *R*, was calculated for each pair of room temperature and elevated temperature tests. This value is the reduced ratio for the peak load tests at the elevated temperature, 677 °C (1,250 °F), and room temperature. Mean and standard deviations were then calculated for the *R* value.

ID	Test Temperature (°F)	Peak Load (Ib)	Ratio, r
	. ,	. ,	Italio, I
5369RT-1 (408899)	73	1776.7	-
5369RT-2 (408899)	72	1781.9	-
5369RT-3 (408899)	72	1797.7	-
5369RT-4 (408899)	72	1792.5	-
5369RT-5 (408899)	71	1779.8	-
104236RT-1	71	1900.3	-
104236RT-2	71	1863.3	-
104236RT-3	71	1899.4	-
104236RT-4	71	2008.5	-
104236RT-5	71	1981.6	-
071081RT-1	70	1956.8	-
071081RT-2	70	1954.4	-
071081RT-3	71	1891.5	-
071081RT-4	70	1925.6	-
071081RT-5	71	1939.8	-
Average	-	1883.32	-
5369ELV-6 (408899)	1,250	322.2	0.1813
5369ELV-7 (408899)	1,259	342.1	0.192
5369ELV-8 (408899)	1,258	323	0.1797
5369ELV-9 (408899)	1,254	330.3	0.1843
5369ELV-10 (408899)	1,254	337.8	0.1898
104236ELV-6	1,253	387.8	0.2041
104236ELV-7	1,259	370.6	0.1989
104236ELV-8	1,251	399.8	0.2105
104236ELV-9	1,250	392.7	0.1955
104236ELV-10	1,251	402.4	0.2031
071081ELV-6	1,251	374.7	0.1915
071081ELV-7	1,254	383.2	0.1961
071081ELV-8	1,252	388.8	0.2056
071081ELV-9	1,258	358	0.1859
071081ELV-10	1,240	361.3	0.1863
		sum =	2.9
	0.1936		
	0.0094		
At 6	0.1892		

Table 1. Mechanical test results.

At the working temperature of 677 °C (1,250 °F), the lower 95-percent confidence interval estimate, or reduced ratio, of the mean percentage was determined from percentage values for each lot at that temperature. If r equals percentage values, r-bar equals the average of these values, and n equals the number of such percentages, estimated standard deviation, s, and reduced ratio, R, can be determined using the equation:

$$S^{2} = \operatorname{sum}(r - r \operatorname{-bar})^{2} / (n - 1) , \qquad (1)$$

or

$$S^{2} = \left[ \operatorname{sum}(r^{2}) - (\operatorname{sum} r)^{2} / n \right] / (n-1) , \qquad (2)$$

and

$$R = r - bar - ts/n^{1/2} , \qquad (3)$$

where *t* is a 0.95 fractal of the t distribution corresponding to n-1 degrees of freedom. In this case, the *t* used was t=1.753 for alpha = 0.95 and n=30.

### 4. CONCLUSIONS

A calculated knockdown factor of 0.1892 was determined for the restraint cables. That value will be used during structural analysis of the restraint cables in the elevated temperature condition. When combined with the minimum breaking strength of 0.317-cm (0.125- or 1/8-in) diameter, type 1 composition rope according to table 1A of MIL–W–83420, this knockdown factor provides a minimum breaking strength of 151 kg (333 lb) at 677 °C (1,250 °F).<sup>1</sup>

## APPENDIX A-PHOTOGRAPHS BEFORE AND AFTER TESTING



Figure 3. 071081–RT–1 (a) before testing and (b) after testing.

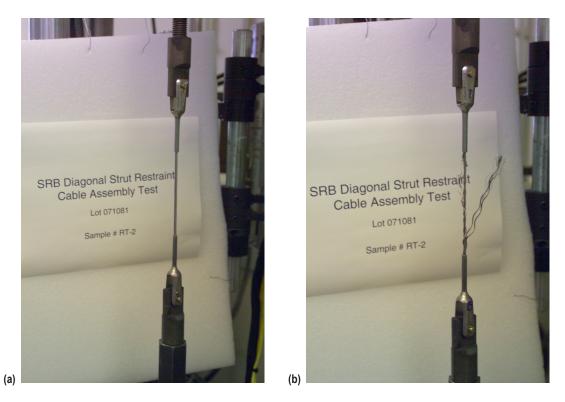


Figure 4. 071081–RT–2 (a) before testing and (b) after testing.

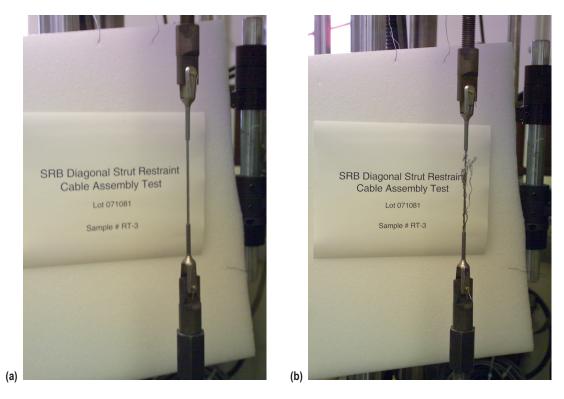


Figure 5. 071081–RT–3 (a) before testing and (b) after testing.

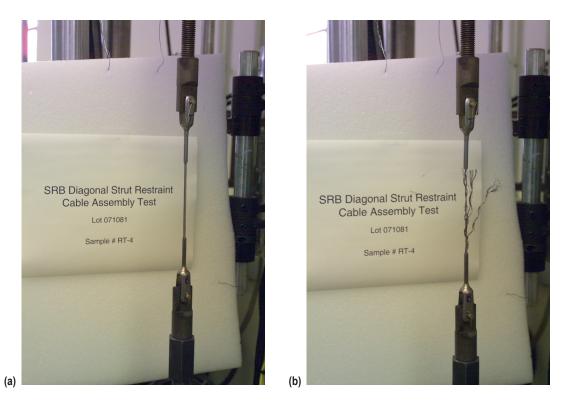


Figure 6. 071081–RT–4 (a) before testing and (b) after testing.

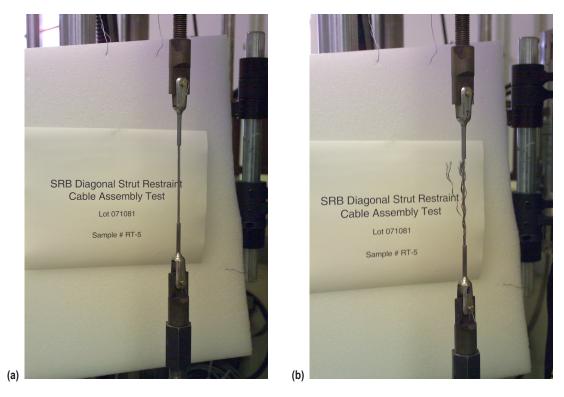


Figure 7. 071081–RT–5 (a) before testing and (b) after testing.

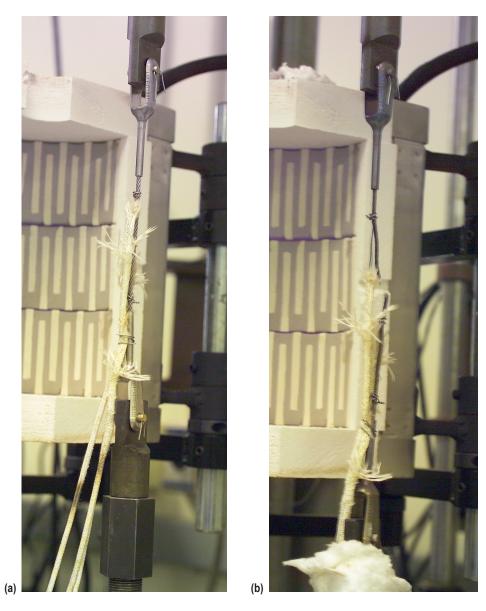


Figure 8. 071081–ELV–6 (a) before testing and (b) after testing.

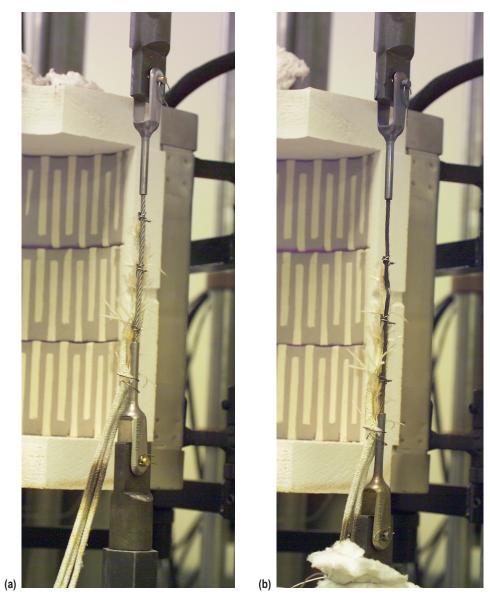


Figure 9. 071081–ELV–7 (a) before testing and (b) after testing.

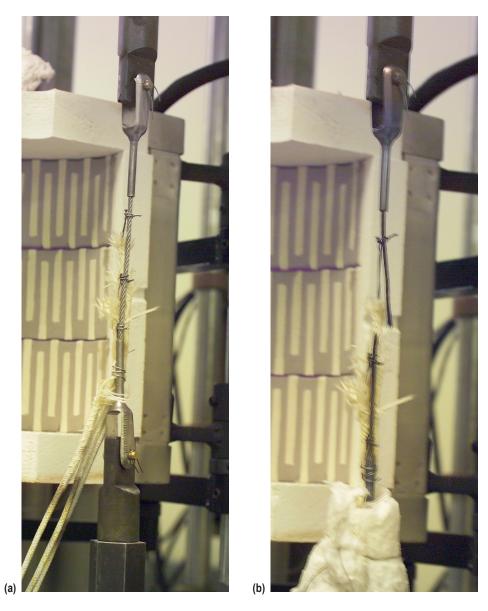


Figure 10. 071081–ELV–8 (a) before testing and (b) after testing.

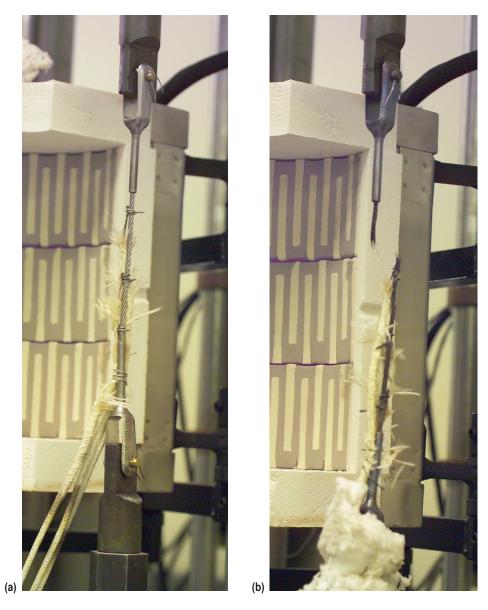


Figure 11. 071081–ELV–9 (a) before testing and (b) after testing.

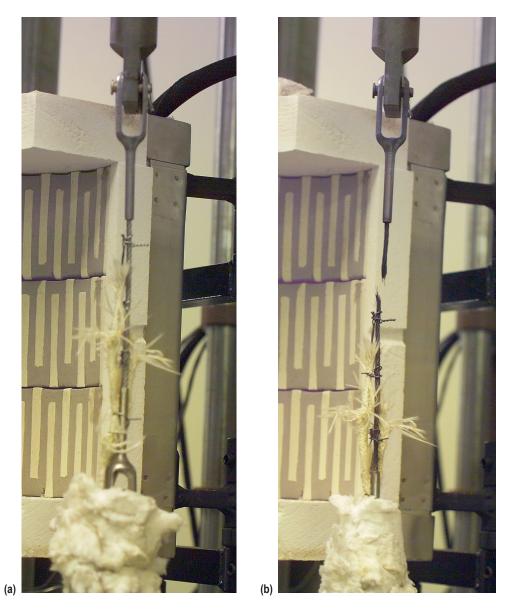


Figure 12. 071081–ELV–10 (a) before testing and (b) after testing.

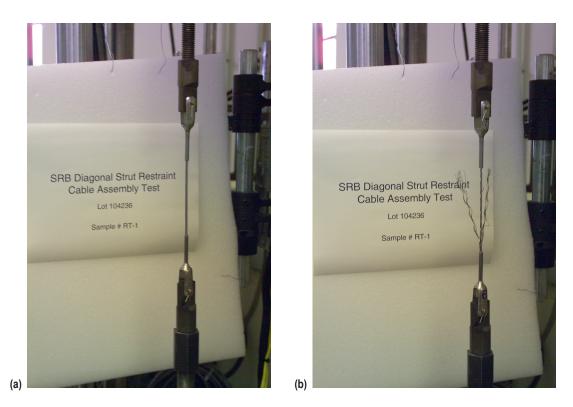


Figure 13. 104236–RT–1 (a) before testing and (b) after testing.

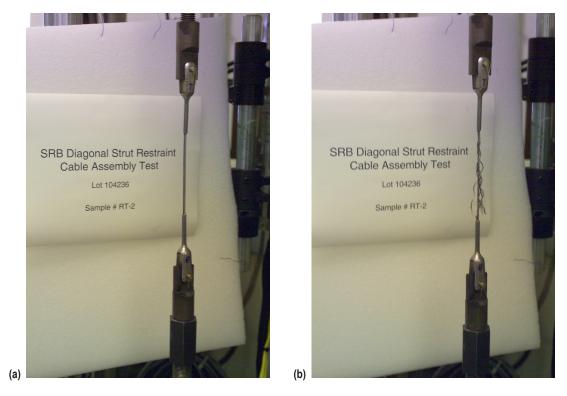


Figure 14. 104236–RT–2 (a) before testing and (b) after testing.





Figure 15. 104236–RT–3 (a) before testing and (b) after testing.

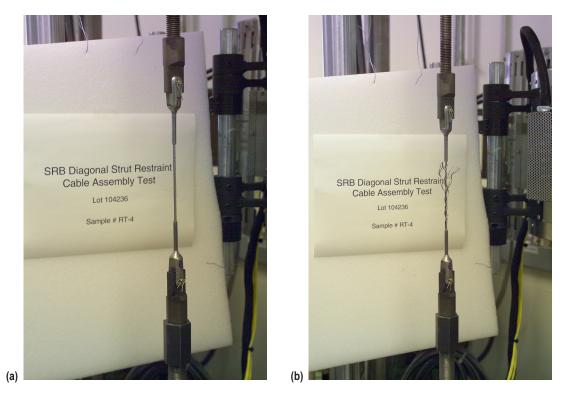


Figure 16. 104236–RT–4 (a) before testing and (b) after testing.

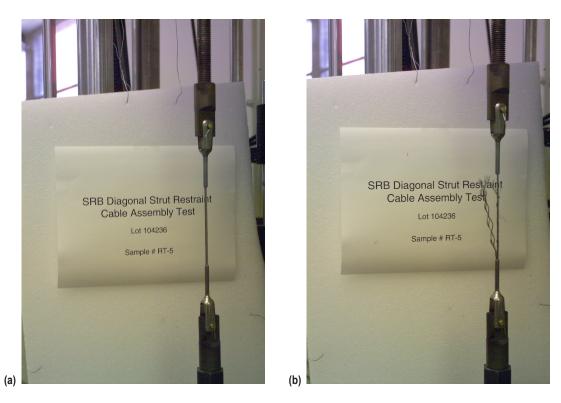


Figure 17. 104236–RT–5 (a) before testing and (b) after testing.

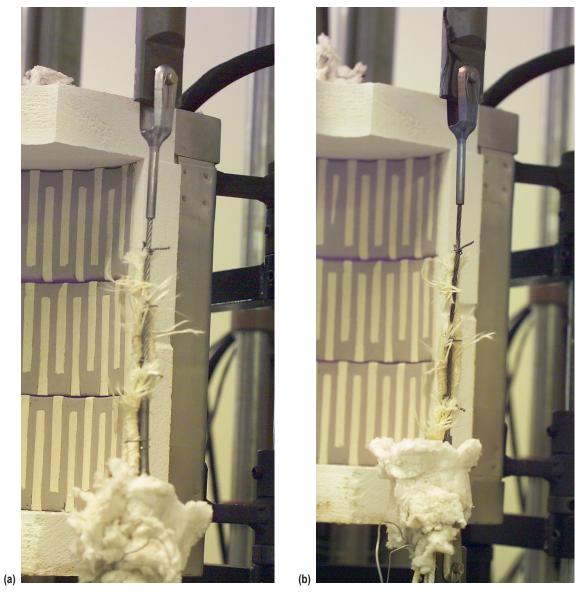


Figure 18. 104236–ELV–6 (a) before testing and (b) after testing.

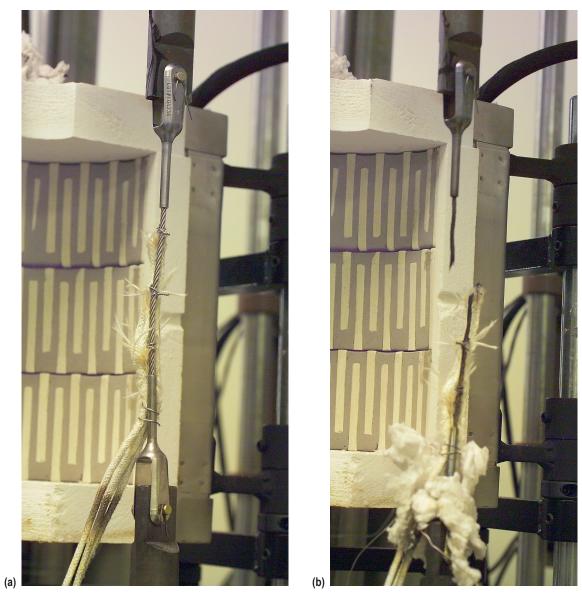


Figure 19. 104236–ELV–7 (a) before testing and (b) after testing.

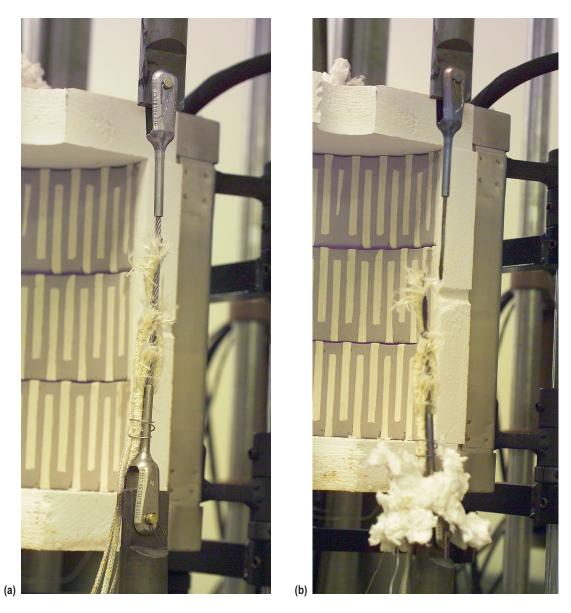


Figure 20. 104236–ELV–8 (a) before testing and (b) after testing.

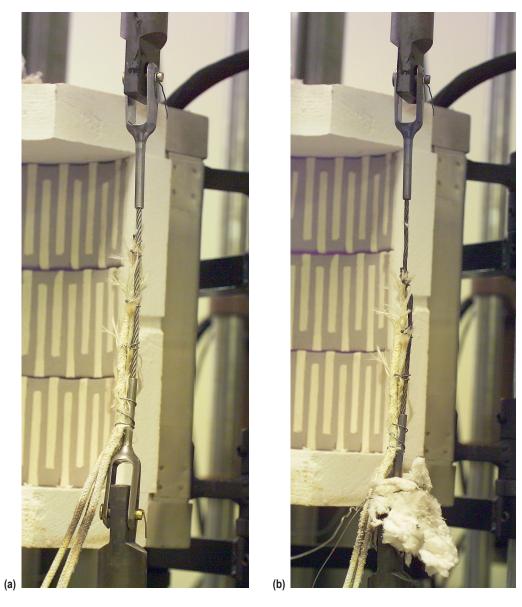


Figure 21. 104236–ELV–9 (a) before testing and (b) after testing.

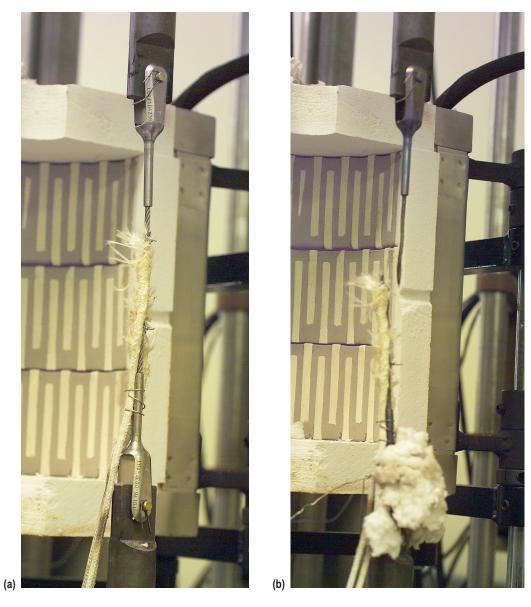


Figure 22. 104236–ELV–10 (a) before testing and (b) after testing.

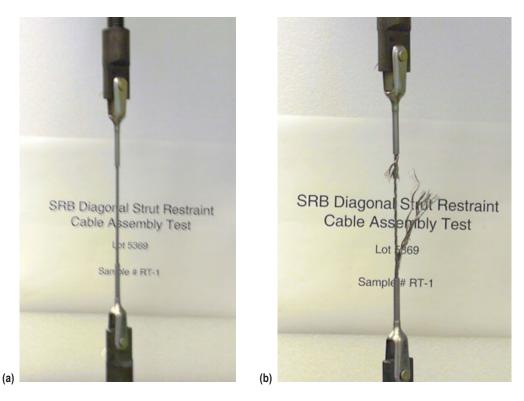


Figure 23. 5369–RT–1 (a) before testing and (b) after testing.

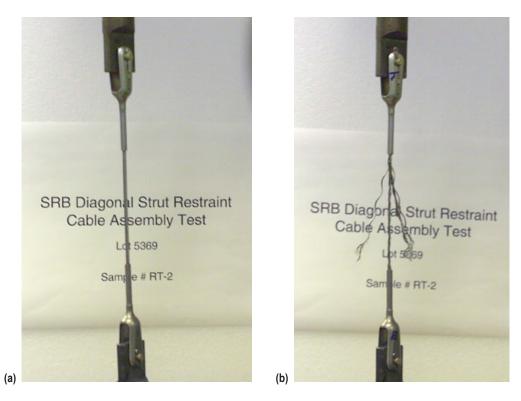


Figure 24. 5369–RT–2 (a) before testing and (b) after testing.



Figure 25. 5369–RT–3 (a) before testing and (b) after testing.

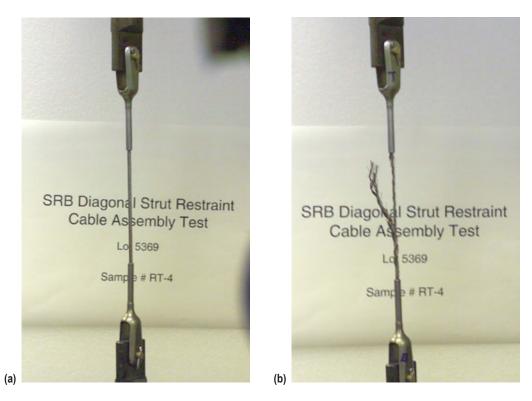


Figure 26. 5369–RT–4 (a) before testing and (b) after testing.

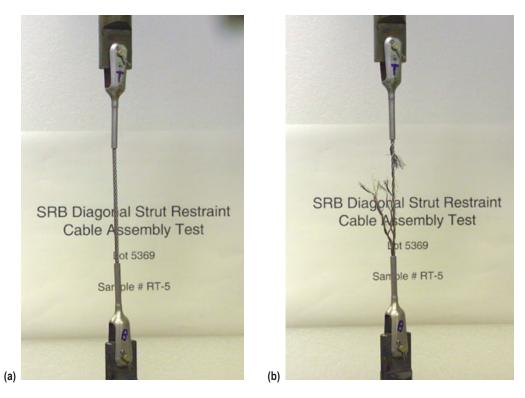


Figure 27. 5369–RT–5 (a) before testing and (b) after testing.

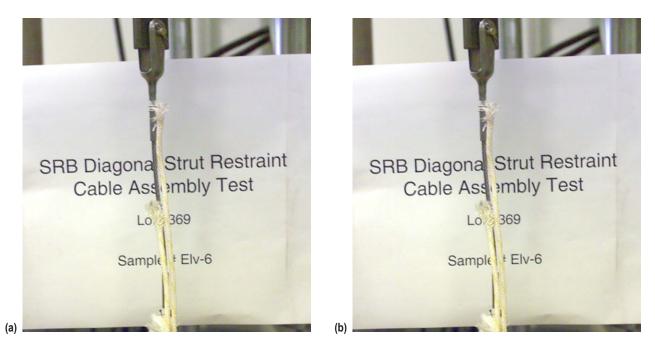


Figure 28. 5369–ELV–6 (a) before testing and (b) after testing.

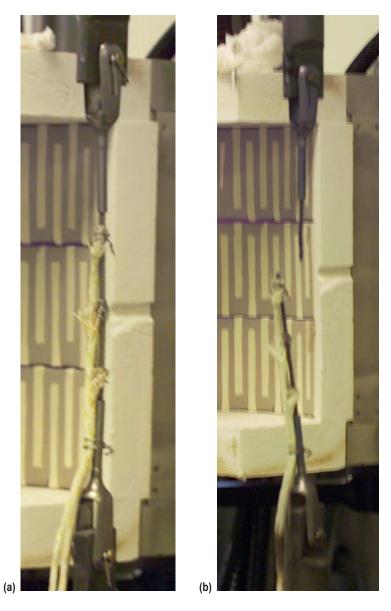


Figure 29. 5369–ELV–7 (a) before testing and (b) after testing.

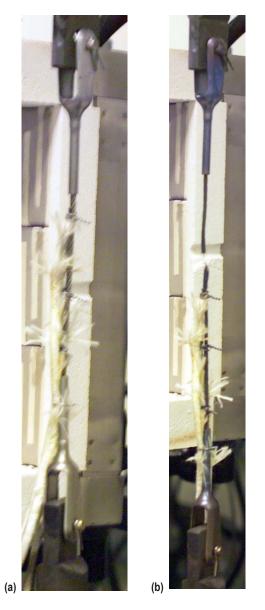


Figure 30. 5369–ELV–8 (a) before testing and (b) after testing.



Figure 31. 5369–ELV–9 (a) before testing and (b) after testing.

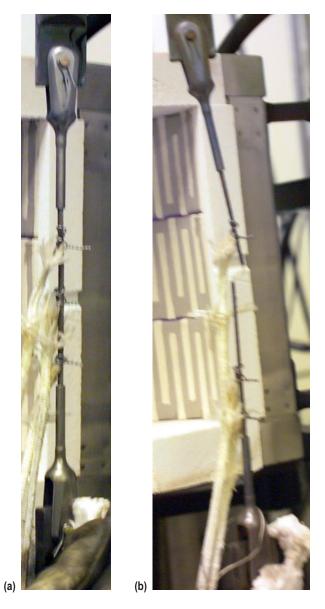


Figure 32. 5369–ELV–10 (a) before testing and (b) after testing.

## **APPENDIX B-PROCEDURE CHECKLISTS**

Achment 1 ED33 / MECHANICAL METALLURGY AND CORROSION TEAM Revision: Basic SRB Diagonal Strut Restraint Cable SRB-QUAL-04-0064 Assembly Page 6 of 9 Date: 7/26/04 QUALIFICATION TEST TEST OPERATION 6.0 Verify calibration is current for all calibrated test equipment in 6.0.1 accordance with ED33-WI-012 Mechanical Testing Calibration and 7-28-04 Verification Procedures Verify PQAR Note serial number or other identification for the Restraint Cable in 6.0.2 test: 28-04 ot 5369 Verify PQ 8-04 Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAI Apply three thermocouples, one at the top, middle and bottom of the  $\chi 6.0.4$ Restraint Cable. Verify PQAF Photograph set-up. 6.0.5 28-04 Install furnace and heat to 1250F (HT tests only). X 6.0.6 Verify PQAR Begin video. 6.0.7 7-28-04 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only). X6.0.8 Verify PQAR Document temperature of test article. 6.0.9 Witness POAR -28-04 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 42.4 165 inches per minute. Witness PQAR 7-28-04 Verify load is at approximately 45 pounds and all instrumentation is 6.0.11 functioning. Verify PQAR 6.0.12 Continue increase load until failure occurs .: Witness PQAR

SKR D	iagonal Strut Restraint Cable	SRB-QUAL-04-0064	Revision: Basic	
Q	Assembly UALIFICATION TEST	Date: 7/26/04	Page 7 of 9	A
5.0.13	Verify load and instru	mentation.		MASA 7-28-0 240
				<u>ch</u>
6.0.14	Stop video.			/NASA 7-28-0
5.0.15	Document load and lo Failure load <u>//วว6</u> Failure location:	17 N/A 4"-Top i	swage nches from cable end Ceat other Top Verify PQAR	P: N POAR A MA
.0.16	Photograph set-up.		<u>_</u>	NASA 7-28-0 302 NASA 7-28-0
.0.17	Place broken Restrair	nt Cable debris in Ziploc	bag and identify. Verify PQAR	NABA 340 240
.0.18	values, contact the fol Richard Knochelmánr Cary Cox (321) 867-1 Pat Roberts (321) 86	757 7-1757	ris Epler (321) 867-9309	
<u> </u>	IVIAFK FIII (256) 544-4	327 or Brian Pung (256	) 544-9346	7-28-00

# AHAchment #2

SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

#### 6.0 TEST OPERATION

- 6.0.1 Verify calibration is current for all calibrated test equipment in 7-28-04 accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures Verify PQAR Note serial number or other identification for the Restraint Cable in 6.0.2 28-04 test: RT-2 of 5369 Verify PQAR 6.0.3 Mount the Restraint Cable into the fixture. Verify PQAF -78-04
- X6.0.4 Apply three thermocouples, one at the top, middle and bottom of the Restraint Cable. Verify PQAR
  - 6.0.5 Photograph set-up.
- X6.0.6 Install furnace and heat to 1250F (HT tests only).
- 6.0.7 Begin video.
- X6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only). Verify PQAR

6.0.9 Document temperature of test article. 73° F

- 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. 4//./ Witness PQAR
- 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning.
- 6.0.12 Continue increase load until failure occurs .:

Verify PQAR

Verify PQAR

7-28-0

7-28-04

28-04

1	ED33 / MECH	ANICAL METALLURGY AND	CORROSION TEAM
SRB D	iagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
Q	UALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13	Verify load and instru	mentation.	Verify PQAR
6.0.14	Stop video.		-28-04 MARA 2-04
6.0.15	Document load and lo Failure load <u>/78/.</u> Failure location:	9 73/4 - T	swage nches from cable end other Verify PQAR
6.0.16	Photograph set-up.		MASA 7-28-03
6.0.17	Place broken Restrair	nt Cable debris in Ziploc	bag and identify. Verify PQAR
6.0.18	values, contact the fol Richard Knochelmann Cary Cox (321) 867-1 Pat Roberts (321) 86	757	ris Epler (321) 867-9309

		Attachment	#3
		ANICAL METALLURGY AND	
SRB D	Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
Ç	PUALIFICATION TEST	Date: 7/26/04	Page 6 of 9
6.0	TEST OPERATION		
6.0.1	<u> </u>	urrent for all calibrated to 3-WI-012 Mechanical T es	
			Verify PQAR
6.0.2	Note serial number or test:	other identification for t	the Restraint Cable in
	Lot 5360	7 RT-3	POAR
6.0.3	Mount the Restraint C	Cable into the fixture.	
€ 6.0.4	Apply three thermoco Restraint Cable.	uples, one at the top, m	iddle and bottom of the NA NASA
			Verify PQAR NA
6.0.5	Photograph set-up.		
(6.0.6	Install furnace and he	at to 1250F (HT tests or	nly). AA MAA
6.0.7	Begin video.		
6.0.8	Verify all thermocouple	es read 1250F +/- 10 de	grees (HT tests only).
6.0.9	Document temperatur	e of test article	Witness PQAR
<del>6.0</del> .10	Ramp load to approxir inches per minute.	nately 45 pounds at a lo 41,1165	(Page 1)
			Witness PQAR
6.0.11	Verify load is at approx functioning.	kimately 45 pounds and	all instrumentation is
6.0.12	Continue increase load	I until failure occurs.:	Witness PQAR

POAR

	ED33 / MECH	ANICAL METALLURGY AND C	ORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly		SRB-QUAL-04-0064	Revision: Basic
QT	JALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13	Verify load and instru	mentation.	Verify PQAR
5.0.14	Stop video.		
6.0.15	Document load and lo Failure load <u>1797.</u> Failure location:	$\frac{7}{34-T}$ in	wage ches from cable end her Verify PQAR
6.0.16	Photograph set-up.		
5.0.17	Place broken Restrair	nt Cable debris in Ziploc I	bag and identify. Verify PQAR
5.0.18	values, contact the fol Richard Knochelmann Cary Cox (321) 867-1 Pat Roberts (321) 86		s Epler (321) 867-9309

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Allachur	+ 11
HTTHCMMC	-ni 7
	and the second se

		Attachment	4	
		ANICAL METALLURGY AN		
SRB I	Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
(	QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9	
6.0	TEST OPERATION			
6.0.1	Verify calibration is cu accordance with ED3 Verification Procedure	3-WI-012 Mechanical	l test equipment in Testing Calibration and	M 7-28-04 NASA 7-28-04
	v enhousen i recoudi		Verify PQAF	
6.0.2	Note serial number of test: $207536$	0-	r the Restraint Cable in	MASA 7-28-04
			Verify PQAR	
6.0.3	Mount the Restraint C	Cable into the fixture.	Verify PQAR	NABA 7-28-04
X <sup>6.0.4</sup>	Apply three thermoco Restraint Cable.	uples, one at the top,	middle and bottom of the Verify PQAR	NIA (MASA 7-28-04, 340
6.0.5	Photograph set-up.			(UEA)
<b>X</b> 6.0.6	Install furnace and he	at to 1250F (HT tests	only). Verify PQAR	N/A NASA 7-28-04 N/A
6.0.7	Begin video.			POAR LIBA
X <sup>6.0.8</sup>	Verify all thermocouple	es read 1250F +/- 10	degrees (HT tests only). Verify PQAR	N/A /MASA 7-28-0 N/A
6.0.9	Document temperatur	e of test article7	<b>₩itness PQAR</b>	POAR 4
6.0.10	Ramp load to approxir inches per minute.	nately 45 pounds at a 44.2 /6 <i>s</i>	load rate not to exceed-5 Witness PQAR	POAR 4
6.0.11	Verify load is at approx functioning.	kimately 45 pounds ar	nd all instrumentation is Verify PQAR	MASA 7-28-09 220 (USA) 4
6.0.12	Continue increase load	d until failure occurs.:	Witness PQAR	(USA) 4

PQAR UBD 7-28-04

SRB Diagonal Strut Restraint Cable Assembly		SRB-QUAL-04-0064	Revision: Basic
Q	UALIFICATION TEST	Date: 7/26/04	Page 7 of 9
5.0.13	Verify load and instru	mentation.	Verify PQAR
.0.14	Stop video.		(190AR) 1984) 7-28-0
.0.15	Document load and lo Failure load <u>ノクタ2</u> Failure location:	.3	vage ches from cable end $7 - 28 - 0$

VIA

Verify PQAR

28

7-28-04

other

6.0.16 Photograph set-up.

6.0.17 Place broken Restraint Cable debris in Ziploc bag and identify. Verify PQAR

IF any anomaly or test failure occurs below the expected minimum 6.0.18 values, contact the following within 24 hours: Richard Knochelmann (321) 867-9813 or Chris Epler (321) 867-9309 Cary Cox (321) 867-1757 Pat Roberts (321) 867-1757 Mark Hill (256) 544-4327 or Brian Pung (256) 544-9346

Attachment #5

ED33 / MECHA	NICAL METALLURGY AND CORROS	ION TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures

Verify PQAR

6.0.2 Note serial number or other identification for the Restraint Cable in test:

ot 5369

Verify PQAR

7-28-04

7-28-04

7-28-04

7-28-04

7-28-04

7-28-04

1

-28-04

6.0.3 Mount the Restraint Cable into the fixture.

Verify PQAR

Verify PQAR

- $\chi$  6.0.4 Apply three thermocouples, one at the top, middle and bottom of the Restraint Cable. Verify PQAR
  - 6.0.5 Photograph set-up.
- ★6.0.6 Install furnace and heat to 1250F (HT tests only).
  - 6.0.7 Begin video.
- ★6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only). Verify PQAR

6.0.9 Document temperature of test article. 7/°F

Witness PQAR

- 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed-5 inches per minute. 4/1.5 Witness PQAR
- 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. Verify PQAR
- 6.0.12 Continue increase load until failure occurs .:

Witness PQAR

	ED33 / MECH	ANICAL METALLURGY AND CO	RROSION TEAM
SRB D	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
Q	UALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13	Verify load and instru	mentation.	Verify PQAR
6.0.14	Stop video.		
6.0.15	Document load and lo Failure load <u>/779,</u> Failure location:	<u>     NIA</u> sw	age hes from cable end er Verify PQAR
6.0.16	Photograph set-up.		MASA 7-28-04
6.0.17	Place broken Restrair	nt Cable debris in Ziploc ba	ag and identify. Verify PQAR
6.0.18	values, contact the fol Richard Knochelmann Cary Cox (321) 867-1 Pat Roberts (321) 86		Epler (321) 867-9309

		ANICAL METALLURGY AND C	
SRBI	)iagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
	UALIFICATION TEST	Date: 7/26/04	Page 6 of 9
6.0	TEST OPERATION		
6.0.1		urrent for all calibrated tes 3-WI-012 Mechanical Tes es	
6.0.2	test.	r other identification for th	e Restraint Cable in
	<u></u>	9 Elv-6	Verify PQAR
6.0.3	Mount the Restraint (	Cable into the fixture.	Verify PQAR
6.0.4	Apply three thermoco Restraint Cable.	uples, one at the top, mid	dle and bottom of the Verify PQAR
6.0.5	Photograph set-up.		
6.0.6	Install furnace and he	at to 1250F (HT tests only	y). Verify PQAR
6.0.7	Begin video.		NIA
6.0.8	Verify all thermocoupl	es read 1250F +/- 10 deg	rees (HT tests only) Verify PQAR
6.0.9.	Document temperatur	e of test article. <u>/2</u> a	Witness PQAR
6.0.10	Ramp load to approxir inches per minute.	nately 45 pounds at a loa 45.1 /bs	이 아이에는 것은 것이 같아. 것이 같아.
			Witness PQAR
6.0.11	Verify load is at approx functioning.	kimately 45 pounds and a	Il instrumentation is
			Verify PQAR
6 0 12	.Continue increase load	unfil failure occurs :	

Witness PQAR

		ANICAL METALLURGY AND	CORROSION TEAM
SRB Di	agonal Strut Restraint Cable	SRB-QUAL-04-0064	Revision: Basic
QT	Assembly UALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13	Verify load and instru	mentation.	Verify PQAR
6.0.14	Stop video.		
6.0.15	Document load and le Failure load Failure location:	534-T	swage inches from cable end other Verify PQAR
6.0.16	Photograph set-up.		
6.0.17	Place broken Restrai	nt Cable debris in Ziplo	c bag and identify. Verify PQAR
6.0.18	values, contact the fo Richard Knochelmann Cary Cox (321) 867- Pat Roberts (321) 86	1757	nris Epler (321) 867-9309
	Chamsed 2 to 0	-oad Rate f. 2 IN/mip.	rom 0.02 IN/Min.
	198,8	16s. max a	t and Informin.
	302,2 16	Sample.	Load to Breake piston out of

ED33 / MECHA	ANICAL METALLURGY AND CORROS	
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9
6.0 TEST OPERATION		
6.0.1 Verify calibration is cu	urrent for all calibrated test equ	inmont in A

Note serial number or other identification for the Restraint Cable in 6.0.2 test: 5369 Elv-7 Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAR Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. 1 1361 .480 Verify PQAR 7-7804 6.0.5 Photograph set-up.

6.0.6 Install furnace and heat to 1250F (HT tests only).

Verification Procedures

**x**6.0.7 · Begin video.

6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only). Verify PQAR

6.0.9 Document temperature of test article. <u>/259</u> Witness PQAR

- 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed-5 inches per minute. 41.5 165 Witness PQAR
- 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning.
- 6.0.12 Continue increase load until failure occurs .:

Witness PQAR

Verify PQAR

7-28-04

78-04

7-28-09

Verify PQAR

Verify PQAR

	ED33 / MECH	ANICAL METALLURGY AN	ID CORROSION TEAM
SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QT	JALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13	Verify load and instru	mentation.	Verify PQAR
6.0.14	Stop video.		NA
6.0.15	Document load and lo Failure load <u>34</u> 9. Failure location:		_swage
NOTE !	0,8 M/min Per Telecon	5"-T NA	other Verify PQAR
6.0.16	Photograph set-up.		(LIELAT) ALASA 4 ALASA 380
6.0.17	Place broken Restrair	nt Cable debris in Ziplo	bc bag and identify. Verify PQAR
	values, contact the fol	lowing within 24 hours (321) 867-9813 or C 757 7-1757	hris Epler (321) 867-9309

	ATTI	newt #8		
-		ANICAL METALLURGY AND	CORROSION TEAM	
SRB D	Piagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
Q	UALIFICATION TEST	Date: 7/26/04	Page 6 of 9	
6.0	TEST OPERATION			
6.0.1		urrent for all calibrated t 3-WI-012 Mechanical T		MA NASA 380, 7-28-04
	Venification Frocedul	55	Verify PQAR	7-28-04
6.0.2		r other identification for	the Restraint Cable in	
	test: 1 of 5:	369 Elv-8	>	POAR MASA
			Verify PQAR	
6.0.3	Mount the Restraint C	Cable into the fixture.	Verify PQAR	NASA NASA 7-28-04 7.28-04
6.0.4		uples, one at the top, m	iddle and bottom of the	MASA
	Restraint Cable.		Verify PQAR	1380 7-28-04 (1900 - 7-28-04
6.0.5	Photograph set-up.			ADAR ANSA
6.0.6	Install furnace and he	at to 1250F (HT tests o	nly). Verify PQAR	MASA 380 7-28-04
			Verny i cont	
₹6.0.7	Begin video.			NA .
6.0.8	Verify all thermocoupl	es read 1250F +/- 10 de	egrees (HT tests only). Verify PQAR	(1000 28-04 (1000 28-04 (1000 28-04
6.0.9	Document temperatur	e of test article	) 58 °F Witness PQAR	POAR HEAT A MASA - 2.804
6.0.10			bad rate not to exceed-5	100 28-04
	inches per minute.	43.1/65	Witness PQAR	(UBA) 4 Junear -04
6.0.11	Verify load is at approx functioning.	ximately 45 pounds and	all instrumentation is	M NASA 380
	g.		Verify PQAR	POAR 7-28 04
6.0.12	Continue increase load	d until failure occurs.:	Witness PQAR	AND 28 04

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ED33 / MECH	ANICAL METALLURGY AND	CORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13 Verify load and instru	imentation.	Verify PQAR
6.0.14 Stop video.		MASA AVA 7-2
6.0.15 Document load and l Failure load <u>333</u> Failure location:	.o N/A	swage nches from cable end
Note: Load Rate Big Minin Per Telecon		other Verify PQAR
6.0.16 Photograph set-up.		POAR UBAN 4 ALSSEN 72
6.0.17 Place broken Restrai	nt Cable debris in Ziploc	bag and identify. Verify PQAR
values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86	1757	ris Epler (321) 867-9309

		ANICAL METALLURGY ANI		
SRB I	Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: B	asic
	QUALIFICATION TEST	Date: 7/26/04	Page 6 of	9
			1	
6.0	TEST OPERATION			
6.0.1	Verify calibration is c	urrent for all calibrated	test equipment in	$\wedge$
		3-WI-012 Mechanical	Testing Calibration a	and $\frac{1}{380}$
	Verification Procedur	es	Verifv	PQAR PQAR 7-
6.0.2	Note serial number o test:	r other identification for	the Restraint Cable	e in
	Lot 5369	E12-9		POAR
			Verify	PQAR
6.0.3	Mount the Restraint C	Cable into the fixture.		NASA 38Q
		그는 것 같은 것 같은 것	Verify	PQAR
6.0.4	Apply three thermoco	uples, one at the top, n	niddle and bottom o	f the
	Restraint Cable.	· · · · · · · · · · · · · · · · · · ·		NASA 380 L
			Verify	PQAR POAR 7
3.0.5	Photograph set-up.	생 옷이 물건을 많았다.		NASA 380
6.0.6	Install furnace and bo	at to 1250F (HT tests o	nhy)	MASA
.0.0	motair rumace and ne	at to 12001 (111 tests 0		PQAR POAR
207	Rogin video			A A
6.0.7	Begin video.			A
6.0.8	Verify all thermocoupl	es read 1250F +/- 10 d	0	
			verity	PQAR POAR
6.0.9	Document temperatur	e of test article.	540	
		성방 이야 없었다.	Witness	PUAR
<del>.</del> 0.10		nately 45 pounds at a l	oad rate not to exce	ed-5
	inches per minute.	43.8	Witness	POAR (DAR)
	)			
.0.11	Verify load is at approx functioning.	kimately 45 pounds and	l all instrumentation	is MASA
	runcuorning.		Verify I	PQAR POAR 7-
0.40	Continue in average la	huntil failura a serve		4 POAR
.0.12	Continue increase load	a unui railure occurs.:	Witness F	PQAR
				7
		the second s		

7-280

VASA 380

SDB D:	agonal Strut Restraint Cable	ANICAL METALLURGY AI SRB-QUAL-04-0064	Revision: Basic	
SKD DI	Assembly	5100-2010-04-0004		
QT	UALIFICATION TEST	Date: 7/26/04	Page 7 of 9	
6.0.13	Verify load and instru	mentation.	Verify PQAR (	POAR 7-28-
<b>X</b> 6.0.14	Stop video.			N/A
6.0.15	Document load and lo Failure load <u>330.3</u> Failure location:		_swage	
te · I mad	Pate	614-7	_ inches from cable end	(POLD) A
.8 th/min	N Per Felecon	~N/A	_ other Verify PQAR	
6.0.16	Photograph set-up.			POAR A LAND
6.0.17	Place broken Restrai	n <u>t Cab</u> le debris in Zipl	oc bag and identify. Verify PQAR	POAR T-2
6.0.18	values, contact the fo	lowing within 24 hour 1 (321) 867-9813 or ( 1757 7-1757	Chris Epler (321) 867-9309	1 28 OUL (1)

Attachment 10

SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures Verify PQAR

7-28-04

6.0.2 Note serial number or other identification for the Restraint Cable in test:

Lot 5369 Elr-10 Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAR Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. -28-04 Verify PQAR Photograph set-up. 6.0.5 -28-04 Install furnace and heat to 1250F (HT tests only). 6.0.6 Verify PQAR 7-28.04 Begin video. X6.0.7 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only). 6.0.8 7-28-04 Verify PQAR :1254 Document temperature of test article. 6.0.9 /itness POAR NASA Ramp load to approximately 45 pounds at a load rate not to exceed 5 6.0.10 inches per minute. 43.8 Witness PQAR 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 7-28-04 Verify PQAR

Witness PQAR

ED33 / MECH	ANICAL METALLURGY AND C	
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13 Verify load and instru	imentation.	Verify PQAR
<b>X</b> 6.0.14 Stop video.		NA
6.0.15 Document load and l Failure load <u>337</u> . Failure location:	<u>8</u>	wage
4: Load Rate		ches from cable end
in/min Per Telcoon	0	Verify PQAR
6.0.16 Photograph set-up.		
6.0.17 Place broken Restrai	nt Cable debris in Ziploc	NACA
values, contact the fo Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86		is Epler (321) 867-9309

			ATTAC HALSAT	D CORROSION	TEAM		]
	SRB Dia	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064		Revision: Basic		
	QT	JALIFICATION TEST	Date: 7/26/04	1	Page 6 of 9		
	6.0	TEST OPERATION					
	6.0.1	Verify calibration is cu accordance with ED3	3-WI-012 Mechanica	l test equipn Testing Cal	nent in ibration and	M NASA 380	
		Verification Procedur	es		Verify PQAR	(INF)	8-6-04
	6.0.2	Note serial number o	r other identification fo	or the Restra	int Cable in		
		test: Lot 07	1081 RT-	1	Verify PQAR	POAR	(8-6-04
	6.0.3	Mount the Restraint (	Cable into the fixture.		Verify PQAR	M NASA 280 POAR INCA 4	18-6-04
×	<b>4</b> 6.0.4	Apply three thermoco	ouples, one at the top,	middle and	bottom of the	NA	
		Restraint Cable.			Verify PQAR	NA	
2	6.0.5	Photograph set-up.				NASA 380	-8-6-0L
1	<b>¥</b> 6.0.6	Install furnace and he	eat to 1250F (HT tests	s only).	Verify PQAR	NA	
	6.0.7	Begin video.				M NASA 380	18-6-04
	<b>K</b> 6.0.8	Verify all thermocoup	les read 1250F +/- 10	degrees (H	T tests only). Verify PQAR	NA	
	6.0.9	Document temperatu	re of test article	70°F	Witness PQAR	PQAR	8-6-04
	6.0.10	Ramp load to approxi	mately 45 pounds at	a load rate n	ot to exceed 5	MASA 380	C8-604
		inches per minute.			Witness PQAR	(UBA) A	
	6.0.11	Verify load is at appro functioning.	ximately 45 pounds a 46 <i>(65</i>	and all instru	mentation is Verify PQAR	Poar HERA	- 0 4
						E Parties 1	

- 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 46 (65 Verify PG Verify PQAR
- 6.0.12 Continue increase load until failure occurs.:

Witness PQAR

8-6-04

POAR

3-6

	ANICAL METALLURGY AND	CORROSION TEAM	
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
QUALIFICATION TEST	Date: 7/26/04	Page 7 of 9	
			M IASA 380
0.13 Verify load and instru	imentation.	Verify PQAR	AR AR SBO
			D
.0.14 Stop video.		1	A C
.0.15 Document load and l	ocation of failure:	<u>/s</u>	BQ
Failure load 195		NIGGO	
Failure location:		wage nches from cable end	_
	0 <u>A/a</u>	ther	QAR BA
		Verify PQAR	<u>*</u>
.0.16 Photograph set-up.			SAL (
.0.17 Place broken Restrai	nt Cable debris in Ziploc	bag and identify.	MAL 8
		Verify PQAR	AR L
.0.18 IF any anomaly or tes	st failure occurs below th	e expected minimum	シ
values, contact the fo	llowing within 24 hours:	회장에 지난 것이 같이 많이 많이 많이 많이 많이 많이 많이 많이 많이 했다.	
Richard Knochelman Cary Cox (321) 867-		ris Epler (321) 867-9309	
Pat Roberts (321) 86	67-1757	있는 것 같은 것이 같은 것이다. 같은 것 같은 것은 것이 같은 것이 같은 것이 같이	
Mark Hill (256) 544-4	1327 or Brian Pung (256)	544-9346	
			/
가는 것은 것을 위해 이는 것을 것을 것을 것을 수 있다. 같은 것을 것을 것을 것이 같은 것을 가지 않는 것을 것을 것을 수 있다.			
		/	(UBAR)
	· · · · · · · · · · · · · · · · · · ·	/8-6	-04

	ED33 / MECH	IANICAL METALLURGY AN	D CORROS	SION TEAM		
SRB D	iagonal Strut Restraint Cable	SRB-QUAL-04-0064		Revision: Basic		
Q	Assembly UALIFICATION TEST	Date: 7/26/04	<u> </u>	Page 6 of 9		
6.0	TEST OPERATION		,			
6.0.1	Verify calibration is c	current for all calibrated 33-WI-012 Mechanical	test equ	ipment in Calibration and	MASA	
	Verification Procedu		rooung	Canbradon and		-
				Verify PQAR		C
6.0.2	Note serial number of	or other identification fo	r the Re	straint Cable in		
	test: of of	71081 RT-2	3		POAD	
		77007 117 8	×	Verify PQAR		C
6.0.3	Mount the Restraint	Cable into the fixture.			NASA 380	
0.0.0	Would the Root and			Verify PQAR	ALON R	18
¥-6.0.4	Apply three thermoco	ouples, one at the top,	middle a	nd bottom of the	S AS	N/A
~	Restraint Cable.			여행이 집에 가지 않아 있는	380-	8
				Verify PQAR	MA	C
6.0.5	Photograph set-up.	전 영상 김 영향을 통			NASA 380	Ł
<del>X</del> 6.0.6	Install furnace and he	eat to 1250F (HT tests	only).		NA	
~				Verify PQAR	NA	8-
6.0.7	Begin video.				MASA 380	C
	Ŭ		5		11/0	1 2
¥6.0.8	Verify all thermocoup	oles read 1250F +/- 10	degrees	(H1 tests only): Verify PQAR	NA	Q
			764		- / - /	
6.0.9	Document temperatu	re of test article.	1010	Witness PQAR	(LOAR)	15
					M	C
6.0.10		imately 45 pounds at a	load rat	e not to exceed 5	MASA 380	-
	inches per minute.			Witness PQAR		4
6.0.11	Verify load is at appr	oximately 45 pounds ar	nd all ins	trumentation is	A	
0.0.11	functioning.	47.6			NASA 38Q	L
		1116		Verify PQAR	POAR	8
6.0.12	Continue increase los	ad until failure occurs.:			POAR	
0.0.12				Witness PQAR	J	Va
						4

MAS 38Q

POAR

8-6-04

ED33 / MECH	ANICAL METALLURGY AND	CORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 7 of 9
0.0.13 Verify load and instru	umentation.	Verify PQAR
6.0.14 Stop video.		ASS 3BC
6.0.15 Document load and l Failure load <u>/9s4.</u> Failure location:	<u>4</u> <u>334"-T</u> i	swage nches from cable end other Verify PQAR
6.0.16 Photograph set-up.		/NASJ 380
6.0.17 Place broken Restrai	nt Cable debris in Ziploc	bag and identify. Verify PQAR
values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86	1757	ris Epler (321) 867-9309

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ATTACHMEN+#3

ED33 / MECH	ANICAL METALLURGY AND CORROSI	ON TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures

Verify PQAR

8-6-09

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8-6-04

POAR

8-6-04

6.0.2 Note serial number or other identification for the Restraint Cable in test:

71081

6.0.3 Mount the Restraint Cable into the fixture.

Verify PQAR

Verify PQAR

Verify PQAR

★6.0.4 Apply three thermocouples, one at the top, middle and bottom of the Restraint Cable.
Verify PQAR

6.0.5 Photograph set-up.

 $\pm$  6.0.6 Install furnace and heat to 1250F (HT tests only).

6.0.12 Continue increase load until failure occurs .:

- 6.0.7 Begin video.
- ↓ 6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only). Verify PQAR

6.0.9 Document temperature of test article. Witness PQAR

- 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. Witness PQAR
- 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 47.6165
  - Verify PQAR
  - Witness PQAR

	ED33 / MECHA	NICAL METALLURGY AND	CORROSION TEAM	
SRB Di	agonal Strut Restraint Cable	SRB-QUAL-04-0064	Revision: Basic	
QT	Assembly JALIFICATION TEST	Date: 7/26/04	Page 7 of 9	
6.0.13	Verify load and instru	mentation.	Verify PQAR	
6.0.14	Stop video.		NASA 380	1- 8-10-04
6.0.15	Document load and lo Failure load <u>/871.</u> Failure location:	5 (1953.5) Second F <u>N/A</u> <u>374"-T</u> i	Peak Load swage nches from cable end other Verify PQAR	) 
6.0.16	Photograph set-up.			10 8-6-04
6.0.17	Place broken Restrair	nt Cable debris in Ziploc	bag and identify. Verify PQAR	1 (8.6-04
6.0.18	values, contact the fo Richard Knochelmann Cary Cox (321) 867- Pat Roberts (321) 86	1757	nris Epler (321) 867-9309	POAR A A A A A A A A A A A A A A A A A A

Attachment 4	
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		ANICAL METALLURGY AND	CORROSION TEAM	_
SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
QI	UALIFICATION TEST	Date: 7/26/04	Page 6 of 9	
5.0 5.0.1	TEST OPERATION	urrent for all calibrated to	est equipment in	
5.0.1	accordance with ED3 Verification Procedur	3-WI-012 Mechanical T	esting Calibration and Verify PQAR	- 8-6-
6.0.2		r other identification for	the Restraint Cable in	
	test: LoT	07/081 RT	Verify PQAR	- 18-1
5.0.3	Mount the Restraint (	Cable into the fixture.	Verify PQAR	- 2-6
5.0.4	Apply three thermoco Restraint Cable.	ouples, one at the top, m	iddle and bottom of the Verify PQAR	
6.0,5	Photograph set-up.			1 -8-
6.0.6	Install furnace and he	eat to 1250F (HT tests o	nly). Verify PQAR	8-10
6.0.7	Begin video.		NASA 38G	1-8-10
5.0.8	Verify all thermocoup	les read 1250F +/- 10 de	egrees (HT tests only). <u>N/A</u> Verify PQAR <u>N/A</u>	8-le-
6.0.9	Document temperatu	re of test article	Witness PQAR	- 28-6
3.0.10	Ramp load to approxi inches per minute.	mately 45 pounds at a l	witness PQAR	8-6-6
5.0.11	Verify load is at appro functioning.	oximately 45 pounds and 44.7 165		8-le-
5.0.12	Continue increase loa	d until failure occurs.:	Witness PQAR	8-6-

B

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8-6-04

NASA 38Q

	and the second descent of the second s	ANICAL METALLURGY AND C		
SRB Dia	gonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
QU	ALIFICATION TEST	Date: 7/26/04	Page 7 of 9	•
0.13	Verify load and instru	mentation.		MA 380 8-6
0.14	Stop video.			NASA 380 S-Le
0.15	Document load and lo Failure load <u>/935.</u> Failure location:	<u>ZNSide Top</u> sv <u>N/A</u> in	vage ches from cable end her Verify PQAR	POAR Maria
0.16	Photograph set-up.		-	NASA 390 - 8-
0.17	Place broken Restrair	nt Cable debris in Ziploc b	bag and identify. Verify PQAR	POAR 8-
	values, contact the fol Richard Knochelmanr Cary Cox (321) 867-1 Pat Roberts (321) 86		s Epler (321) 867-9309	(PQAR)

	A ment	
ED33 / MECH	ANICAL METALLURGY AND C	ORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

LH5

### 6.0 TEST OPERATION

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures

Verify PQAR

810-04

6.0.2 Note serial number or other identification for the Restraint Cable in test:

60/ 07/08/ RT-5 Verify POAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAR

- ★ 6.0.4 Apply three thermocouples, one at the top, middle and bottom of the Restraint Cable.
  Verify PQAR
  - 6.0.5 Photograph set-up.

 $\frac{1}{2}$  6.0.6 Install furnace and heat to 1250F (HT tests only).

Verify PQAR

- 6.0.7 Begin video.
- ★6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): Verify PQAR
  - 6.0.9 Document temperature of test article. 7/° F Witness PQAF
  - 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. Witness PQAR
  - 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 47.9 1/bs Verify PQAR
  - 6.0.12 Continue increase load until failure occurs .:

Witness PQAR

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	ED33 / MECH	ANICAL METALLURGY AND (	CORROSION TEAM	
SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
QT	JALIFICATION TEST	Date: 7/26/04	Page 7 of 9	A
6.0.13	Verify load and instru	mentation.	Verify PQAR	xxxx 380 380 8-6-04
6.0.14	Stop video.		-4	NASA 8-6-04
6.0.15	Document load and lo Failure load <u>/ 939.</u> Failure location:	8 INSIDE TOP S N/A ir	wage nches from cable end ther Verify PQAR	× -04
6.0.16	Photograph set-up.			NASA 18-6-09
6.0.17	Place broken Restrai	nt Cable debris in Ziploc	bag and identify. Verify PQAR	NASA 380 44R) &-6-04
6.0.18	values, contact the fo Richard Knochelmani Cary Cox (321) 867- Pat Roberts (321) 86	1757	ris Epler (321) 867-9309	QAR MASA 380 8-10-04

ATTA	chnesri #6	
ED33 / MECHA SRB Diagonal Strut Restraint Cable	NICAL METALLURGY AND COF SRB-QUAL-04-0064	Revision: Basic
Assembly QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

Verify calibration is current for all calibrated test equipment in 6.0.1 accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures 8-6-04 Verify PQAR Note serial number or other identification for the Restraint Cable in 6.0.2 test: ot 07/081 Elu- 6 Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 8-6-04 Verify PQA Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. 8-6-Verify PQAR 28-6-04 Photograph set-up. 6.0.5 Install furnace and heat to 1250F (HT tests only). 8-6-04 6.0.6 Verify PQAR Begin video. \$6.0.7. Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): 6.0.8 8-6-04 Verify PQAR Document temperature of test article. 1251 ° F 6.0.9 Witness PQAR Ramp load to approximately 45 pounds at a load rate not to exceed 5 6.0.10 inches per minute. POAR Witness PQAR 6-04 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 46.2 165 8-6-04 Verify PQAR 6.0.12 Continue increase load until failure occurs .: 186-04 Witness PQAR

8-6-04

ED33 / MECHANICAL METALLURGY AND CORROSION TEAM Revision: Basic SRB-QUAL-04-0064 SRB Diagonal Strut Restraint Cable Assembly Page 7 of 9 Date: 7/26/04 OUALIFICATION TEST 6.0.13 Verify load and instrumentation. Verify PQAF 8-6-04  $\chi$  6.0.14 Stop video. 6.0.15 Document load and location of failure: Failure load 374.7 swage Failure location: inches from cable end other Verify PQAR 6.0.16 Photograph set-up. 6.0.17 Place broken Restraint Cable debris in Ziploc bag and identify. Verify PQAR 6.0.18 IF any anomaly or test failure occurs below the expected minimum values, contact the following within 24 hours: Richard Knochelmann (321) 867-9813 or Chris Epler (321) 867-9309 Cary Cox (321) 867-1757 Pat Roberts (321) 867-1757 Mark Hill (256) 544-4327 or Brian Pung (256) 544-9346 8-6

Attachment

ED33 / MECH	ANICAL METALLURGY AND CO	ORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures

Verify PQAR

Verify PQAR

Verify PQAR

Verify PQAR

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POAR

6.0.2 Note serial number or other identification for the Restraint Cable in test:

071081 Elv-7

- 6.0.3 Mount the Restraint Cable into the fixture.
- 6.0.4 Apply three thermocouples, one at the top, middle and bottom of the Restraint Cable.
- 6.0.5 Photograph set-up.
- 6.0.6 Install furnace and heat to 1250F (HT tests only).
- ★6.0.7 Begin video.
  - 6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): Verify PQAR

6.0.9 Document temperature of test article. 1954

- 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. Witness PQAR
- 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. *#3.0 /65* Verify PQAR
- 6.0.12 Continue increase load until failure occurs .:

Witness PQAR

	ED33 / MECH	ANICAL METALLURGY AND C	ORROSION TEAM
SRB Di	Diagonal Strut Restraint Cable SRB-QUAL-04-0064 Assembly		Revision: Basic
QT	JALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13	Verify load and instru	mentation.	Verify PQAR
<b>¥</b> 6.0.14	Stop video.		N/A 8-6-04
6.0.15	Document load and le Failure load <u>383.</u> Failure location:	$\frac{\lambda}{6.0^{-}T}$ in	vage ches from cable end her
		<i>t</i>	Verify PQAR
6.0.16	Photograph set-up.		Masa 380 - 8-6-
6.0.17	Place broken Restrai	nt Cable debris in Ziploc I	bag and identify. Verify PQAR
6.0.18	values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86		s Epler (321) 867-9309

Hachment 7 ED33 / MECHANICAL METALLURGY AND CORROSION TEAM

SRB Diagonal Strut Restraint Cable	SRB-QUAL-04-0064	Revision: Basic		
Assembly QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9		

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures Verify PQAR

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Verify PQAR

Verify PQ

Verify PQA

Witness PQAR

6.0.2 Note serial number or other identification for the Restraint Cable in test:  $L_0T_07/881$  E/v-8

Mount the Restraint Cable into the fixture. 6.0.3

- 6.0.4 Apply three thermocouples, one at the top, middle and bottom of the Restraint Cable.
- 6.0.5 Photograph set-up.

6.0.6 Install furnace and heat to 1250F (HT tests only).

- ¥6.0.7 Begin video.
  - 6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): Verify PQAR

6.0.9 Document temperature of test article. /2.53 °F Witness PQAR

6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. Witness PQAR

- 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 46 16 5 Verify PQAR
- 6.0.12 Continue increase load until failure occurs .:

	ED33/MECH	ANICAL METALLURGY AND CO	RROSION TEAM	
SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
QT	JALIFICATION TEST	Date: 7/26/04	Page 7 of 9	A
6.0.13	Verify load and instru	imentation.	Verify PQAR	NASA 380 8-6-04
<b>6</b> .0.14	Stop video.		4	V/A
6.0.15	Document load and I Failure load <u>388, 9</u> Failure location:	8 165 NA SW	age hes from cable end ler Verify PQAR	(8-6-2
6.0.16	Photograph set-up.			M MASA M M
6.0.17	Place broken Restrai	nt Cable debris in Ziploc b	ag and identify. Z	1048 200 200 200 200 200 200 200 20
6.0.18	values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86		s Epler (321) 867-9309	POAR MASS 1953 8-6-04

	ment the 1	
ED33 / MECH SRB Diagonal Strut Restraint Cable Assembly	ANICAL METALLURGY AND CC SRB-QUAL-04-0064	REVISION TEAM Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

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# 6.0 TEST OPERATION

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures

Verify PQAR

6.0.2 Note serial number or other identification for the Restraint Cable in test:

07/081 E12-9

6.0.3 Mount the Restraint Cable into the fixture.

Verify PQAR

Verify PQAR

Verify POAR

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L8-6-04

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- 6.0.4 Apply three thermocouples, one at the top, middle and bottom of the Restraint Cable. Verify PQA
- 6.0.5 Photograph set-up.
- 6.0.6 Install furnace and heat to 1250F (HT tests only).
- ₩6.0.7 Begin video.
  - 6.0.8 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): Verify PQAR
  - 6.0.9 Document temperature of test article. 1958 \*/= Witness PQAR
  - 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. Witness PQAR
  - 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 44165 Verify PQAR
  - 6.0.12 Continue increase load until failure occurs .:

Witness PQAR

8-6-0

ED33 / MECHANICAL METALLURGY AND CORROSION TEAM Revision: Basic SRB-QUAL-04-0064 SRB Diagonal Strut Restraint Cable Assembly Page 7 of 9 Date: 7/26/04 **OUALIFICATION TEST** 6.0.13 Verify load and instrumentation. 86-04 Verify PQAF ¥6.0.14 Stop video. 6.0.15 Document load and location of failure: Failure load 358.0 Failure location: swage inches from cable end other Verify PQAR 6.0.16 Photograph set-up. 6.0.17 Place broken Restraint Cable debris in Ziploc bag and identify. Verify PQAR 6.0.18 IF any anomaly or test failure occurs below the expected minimum values, contact the following within 24 hours: Richard Knochelmann (321) 867-9813 or Chris Epler (321) 867-9309 Cary Cox (321) 867-1757 Pat Roberts (321) 867-1757 Mark Hill (256) 544-4327 or Brian Pung (256) 544-9346 8

MACHMENT # 10 ED33 / MECHANICAL METALLURGY AND CORROSION TEAM Revision: Basic SRB-OUAL-04-0064 SRB Diagonal Strut Restraint Cable Assembly Page 6 of 9 Date: 7/26/04 QUALIFICATION TEST TEST OPERATION 6.0 Verify calibration is current for all calibrated test equipment in 6.0.1 accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures 2-6-04 Verify PQAR Note serial number or other identification for the Restraint Cable in 6.0.2 test: 07/081 Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAR Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. Verify PQAR Photograph set-up. 6.0.5 Install furnace and heat to 1250F (HT tests only). 6.0.6 Verify PQA NA ¥6.0.7 Begin video. Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): 6.0.8 8-6-04 Verify PQAR Document temperature of test article. 12 40 -1. 6.0.9 Witness PQAR (I 8-6-04 Ramp load to approximately 45 pounds at a load rate not to exceed 5 6.0.10 inches per minute. 8-6-04 PQAR Witness PQAR Verify load is at approximately 45 pounds and all instrumentation is 6.0.11 functioning. 43.5165 8-6-04 Verify PQAR 6.0.12 Continue increase load until failure occurs .: Witness PQAR

8-6-04

	ED33 / MECH	ANICAL METALLURGY AND (	CORROSION TEAM	
SRB Diagonal Strut Restraint Cable Assembly QUALIFICATION TEST		SRB-QUAL-04-0064	Revision: Basic	
		Date: 7/26/04	Page 7 of 9	
.0.13	Verify load and instru	mentation.	Verify PQAR	MASA BAC GAR BA
.0.14	Stop video.		1	N/A C
.0.15	Document load and l Failure load <u>361.</u> Failure location:	<u>3</u> 165 N/A s <u>4/5"-T</u> ir	wage nches from cable end ther	POAR
		~	Verify PQAR	A CE
.0.16	Photograph set-up.		<u> </u>	MASA NASA 380
.0.17	Place broken Restrai	nt Cable debris in Ziploc	bag and identify. Verify PQAR	
.0.18	values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86		ris Epler (321) 867-9309	PQAR LISTA 4

	aT	Tachment	#1			
SRB Di	agonal Strut Restraint Cable	NICAL METALLURGY ANI SRB-QUAL-04-0064	CORROSION TEA Revis	AM ion: Basic		
Q	Assembly UALIFICATION TEST	Date: 7/26/04	Page	6 of 9		
6.0	TEST OPERATION					
6.0.1	Verify calibration is cu accordance with ED3 Verification Procedure	urrent for all calibrated 3-WI-012 Mechanical <sup>-</sup> es	Festing Calibra	ition and	M NASA 380	8-6-04
				Verify PQAR	(USA)	$\mathcal{L}$
6.0.2	toot.	other identification for	the Restraint	Cable in		
	107 100	1236 R7-1	Y	Verify PQAR		08-6-04
6.0.3	Mount the Restraint C	Cable into the fixture.	١	Verify PQAR	MASA 3800 POAR UBC	2-6-04
<b>≵</b> 6.0.4	Apply three thermoco Restraint Cable.	uples, one at the top, r		tom of the Verify PQAR	N/A N/A	8-6-04
6.0.5	Photograph set-up.				MASA 38Q	18604
<b>*</b> 6.0.6	Install furnace and he	at to 1250F (HT tests o	only). \	√erify PQAR	N/A NA	8-6-04
6.0.7	Begin video.				NASA 380	\$6-04
<b>¥</b> 6.0.8	Verify all thermocoup	es read 1250F +/- 10 c	legrees (HT te \	sts only): /erify PQAR	N/A N/A	8-6-04
6.0.9	Document temperatur	e of test article7	v 76 Wit	ness PQAR	POAR UBAA 4	8-6-09
6.0.10	Ramp load to approxininches per minute.	mately 45 pounds at a	load rate not to	o exceed-5	POAR MASA	8-10-04
	nones per minute.		Wit	ness PQAR	(USA)	8-10-04
6.0.11	Verify load is at appro functioning.	ximately 45 pounds an <i>47,8165</i>		ntation is /erify PQAR	POAR LISIO	18-6-04
6.0.12	Continue increase loa	d until failure occurs.:	Wit	ness PQAR	4 POAR LUESCI	136-04

POAR LISAS

8-6-04

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	TU 22/ NATE (11	ANICAL METALLURGY AND	CORROSION TEAM	
SRB Di	agonal Strut Restraint Cable	SRB-QUAL-04-0064	Revision: Basic	
QT	Assembly JALIFICATION TEST	Date: 7/26/04	Page 7 of 9	<u></u>
6.0.13	Verify load and instru	umentation.	Verify PQAR	850 8-6-04
6.0.14	Stop video.			15A - 8-6-04
6.0.15	Document load and l Failure load <u>1900.</u> Failure location:	<u>Inside To P</u> <u>N/A</u>	swage nches from cable end other Verify PQAR	04R 4 1/8-6-64
6.0.16	Photograph set-up.		/NAS 301 /N	MASA
6.0.17	Place broken Restra	int Cable debris in Ziploo	/ 3	BU V
6.0.18	values, contact the for Richard Knochelmar Cary Cox (321) 867 Pat Roberts (321) 8	-1757	nris Epler (321) 867-9309	PQAR MASA 4 28Q

ATTACHMENT #2

	ED33 / MECH	ANICAL METALLURGY AND	CORROSION TEAM	
SRB Diagonal Strut Restraint Cable Assembly QUALIFICATION TEST		SRB-QUAL-04-0064	Revision: Basic	
		Date: 7/26/04	Page 6 of 9	
6.0	TEST OPERATION			
6.0.1	accordance with ED3	urrent for all calibrated t 3-WI-012 Mechanical T	est equipment in esting Calibration and	M NASA 38Q
	Verification Procedur	es	Verify PQAR	9-6-0
6.0.2		r other identification for	the Restraint Cable in	
	test: LoT 10	4236 RT-	2 Verify PQAR	POAR 4. 8-6.
6.0.3	Mount the Restraint (	Cable into the fixture.	Verify PQAR	Marsa -6
46.0.4	Apply three thermoco Restraint Cable.	ouples, one at the top, n	hiddle and bottom of the Verify PQAR	N/A -8-6-
6.0.5	Photograph set-up.			MASA 82-G
<b>4</b> 6.0.6	Install furnace and he	eat to 1250F (HT tests c	nly). Verify PQAR	N/A «
6.0.7	Begin video.			ANASA -6
<b>4</b> 6.0.8	Verify all thermocoup	les read 1250F +/- 10 d	egrees (HT tests only): Verify PQAR	Na. NA
6.0.9	Document temperatu	re of test article	Witness PQAR	POAR S-6-
6.0.10	Ramp load to approx inches per minute.	imately 45 pounds at a	oad rate not to exceed-5 Witness PQAR	MASA 380 POAR
6.0.11	Verify load is at appro functioning.	47. 4 /15		AMASA 380 POAR 8-6-01
6.0.12	Continue increase loa	ad until failure occurs.:	Witness PQAR	A POAR S-6-

8-6-04 POAR

NASA 38Q

ED33 / MECI	IANICAL METALLURGY AND CO	ORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 7 of 9
		MASA
.0.13 Verify load and instr	umentation.	
.0.15 Verny foud and mou		Verify PQAR
		4
5.0.14 Stop video.		NASA
		<u></u>
0.15 Document load and	location of failure: Third	DEI
Failure load 1863.		Peak Load
Failure location:	PU/A SV	vage
화가 같은 것은 것을 많이 같아?	*	ches from cable end
		her Verify PQAR
		Verily POAR
	동일간에 공격한 강경을 넣었다.	NASA 38Q
.0.16 Photograph set-up.	김 옷을 내 흔들었는 것 같아요.	M
.0.17 Place broken Restra	int Cable debris in Ziploc I	bag and identify. $\sqrt{\frac{380}{380}}$
.U.IT Flace Dioken Result		Verify PQAR
.0.18 IF any anomaly or te	est failure occurs below the	expected minimum
values. contact the f	ollowing within 24 hours:	것 이 속 옷 많다. 그렇게 걸음한 것 같아.
Richard Knochelmar	nn (321) 867-9813 or Chri	s Epler (321) 867-9309
Cary Cox (321) 867		말 그렇게 다섯 만에 잘 하거나 했다.
Pat Roberts (321) 8		
Mark Hill (256) 544-	4327 or Brian Pung (256).	544-9345
	영상 입지 그 바람을 벗으려요?	, 김 영영의 이번에 가슴을 물었는다. 그
		POA
	1	
방송 이 성송 방송 방송 것이다.	성 영화 관계가 많은 것이 없다.	8-6-04

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			iment 3		
I			NICAL METALLURGY AND	CORROSION TEAM	
	SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic	
	QT	JALIFICATION TEST	Date: 7/26/04	Page 6 of 9	
L	6.0 -	TEST OPERATION			
	6.0.1	Verify calibration is cu accordance with ED3 Verification Procedure	urrent for all calibrated t 3-WI-012 Mechanical T	est equipment in Testing Calibration and	1
		vermeation roccourt		Verify PQAR	\$-6-04
	6.0.2	Note serial number of	other identification for	the Restraint Cable in	
		test: LoT 10	04236 RT-	3	8-10-00
P	6.0.3	Mount the Restraint C	Cable into the fixture.	Verify PQAR	-0-8-6-0
2	6.0.4	Apply three thermoco Restraint Cable.	uples, one at the top, n	hiddle and bottom of the $\frac{N}{1}$	A 8-6-04
	6.0.5	Photograph set-up.			A- 8-6-00
			at to 10505 (UT tooto o	nha) II	4
ť	6.0.6	Install furnace and ne	at to 1250F (HT tests o	Verify PQAR	\$-6-04
	6.0.7	Begin video.		ZNAS 38C	1 860
4	6.0.8	Verify all thermocoupl	es read 1250F +/- 10 d	egrees (HT tests only): Verify PQAR	A
	6.0.9	Document temperatur	e of test article	Witness PQAR	2560
	6.0.10		mately 45 pounds at a t	oad rate not to exceed 5	1 - 8-6-04
		inches per minute.		Witness PQAR	<u>s</u>
	6.0.11	Verify load is at appro functioning.	ximately 45 pounds and 47.4		7
				Verify PQAR	F 8-0-04
	6.0.12	Continue increase loa	d until failure occurs.:	Witness PQAR	24R 4) - 8-6-01

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> NASA 38Q

8-10-04

ED33 / MECHANICAL METALLURGY AND CORROSION TEAM Revision: Basic SRB-QUAL-04-0064 SRB Diagonal Strut Restraint Cable Assembly Page 7 of 9 Date: 7/26/04 OUALIFICATION TEST 380 6.0.13 Verify load and instrumentation. Verify PQAR 6.0.14 Stop video. 6.0.15 Document load and location of failure: Failure load 1899.4 swage Failure location: inches from cable end other Verify PQAR 6.0.16 Photograph set-up. 6.0.17 Place broken Restraint Cable debris in Ziploc bag and identify. Verify PQAR 6.0.18 IF any anomaly or test failure occurs below the expected minimum values, contact the following within 24 hours: Richard Knochelmann (321) 867-9813 or Chris Epler (321) 867-9309 Cary Cox (321) 867-1757 Pat Roberts (321) 867-1757 Mark Hill (256) 544-4327 or Brian Pung (256) 544-9346 8-6-

Attachment # 4 ED33 / MECHANICAL METALLURGY AND CORROSION TEAM Revision: Basic SRB-QUAL-04-0064 SRB Diagonal Strut Restraint Cable Assembly Page 6 of 9 Date: 7/26/04 **OUALIFICATION TEST** TEST OPERATION 6.0 Verify calibration is current for all calibrated test equipment in 6.0.1 accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures 8-6-09 Verify PQAR Note serial number or other identification for the Restraint Cable in 6.0.2 test: INT 104236 Verify PQAR 8-6-04 Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAR Apply three thermocouples, one at the top, middle and bottom of the ¥6.0.4 Restraint Cable. Verify PQAR Photograph set-up. 6.0.5 Install furnace and heat to 1250F (HT tests only). \$6.0.6 Verify PQAR 8-6-04 Begin video. 6.0.7 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): \$6.0.8 · Verify PQAR Document temperature of test article. 6.0.9 litness POAR Ramp load to approximately 45 pounds at a load rate not to exceed 5 6.0.10 inches per minute. PQAR UBA Witness PQAR Verify load is at approximately 45 pounds and all instrumentation is 6.0.11 48.6165 functioning. Verify PQAR 6.0.12 Continue increase load until failure occurs .: Witness PQAR

8-10-0

ED33 / MECH	ANICAL METALLURGY AND	CORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 7 of 9
.0.13 Verify load and instru	imentation.	Verify PQAR
.0.14 Stop video.		
.0.15 Document load and l Failure load <u> </u>	.5 35-7	swage nches from cable end other
.0.16 Photograph set-up.		Verify PQAR
.0.17 Place broken Restrai	nt Cable debris in Ziploc	bag and identify.
values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86	1757	ris Epler (321) 867-9309

	Attac	chment # 5				
	ED33 / MECH	ANICAL METALLURGY	AND CORROSIC	DN TEAM Revision: Basic		
SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064				
QT	JALIFICATION TEST	Date: 7/26/04		Page 6 of 9		
6.0	TEST OPERATION					
6.0.1	Verify calibration is c accordance with ED3	33-WI-012 Mechanie	ted test equip cal Testing C	oment in alibration and	MASA 380	
	Verification Procedur	es		Verify PQAR	POAR 8	2-6-04
6.0.2	Note serial number c	or other identification	n for the Rest	raint Cable in		
	test: LoT	104236	RT-5	Verify PQAR	POAR LISA	1
				voniy i do a c	MASA	8-6-04
6.0.3	Mount the Restraint	Cable into the fixture	e.	Verify PQAR	ROAR USA	8-6-04
<b>∦</b> 6.0.4	Apply three thermoco	ouples, one at the to	op, middle an	d bottom of the	11/2	
71	Restraint Cable.		•	Verify PQAR	NA	
6.0.5	Photograph set-up.				MASA 38Q	8-6-04
<b>¥</b> 6.0.6	Install furnace and he	eat to 1250F (HT te	sts only).	Verify PQAR	MA	
					MASA	· J-6-00
6.0.7	Begin video.				<u> 380</u>	
<b>¥</b> 6.0.8	Verify all thermocoup	bles read 1250F +/-	10 degrees (	HT tests only): Verify PQAR	MA	
6.0.9	Document temperatu	re of test article.	71 °	Witness PQAR	POAR	- 8-6-04
	Ramp load to approx	in the AS monday	nt n knod rote	not to exceed 5	MASA 380	
6.0.10	inches per minute.	imately 45 pounds a		Witness PQAR	POAR	8-6-04
	Verify load is at appre	ovimately 15 pound	s and all instr	4	A	
6.0.11	functioning.	48.1 165		Verify PQAR	NASA 38Q	8604
				v chi y i co ti t	POAR LEAS	
6.0.12	Continue increase loa	ad until failure occu	rs.:	Witness PQAR	POAR	\$604
					4	

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8-10-04

NAS 38C

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	ED33 / MECH	ANICAL METALLURGY AND	CORROSION TEAM
SRB Diagonal Strut Restraint Cable Assembly QUALIFICATION TEST		SRB-QUAL-04-0064	Revision: Basic
		Date: 7/26/04	Page 7 of 9
5.0.13	Verify load and instru	mentation.	Verify PQAR 8
5.0.14	Stop video.		ANABA 30G
0.15	Document load and le Failure load <u>/98/.6</u> Failure location:	165 N/A	swage nches from cable end other Verify PQAR
.0.16	Photograph set-up.		MASA 380 L
.0.17	Place broken Restrai	nt Cable debris in Ziploc	bag and identify. Verify PQAR
.0.18	values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86	1757	ris Epler (321) 867-9309

7171466	iment le	
ED33 / MECH	ANICAL METALLURGY AND CORROS	
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

H1

# 6.0 TEST OPERATION

. 1.

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures Verify PQAR

8-6-04

8-6-0

Note serial number or other identification for the Restraint Cable in 6.0.2 test: 104236 = 2/2-6 Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAR Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. Verify PQARUEA 8-6-0 6.0.5 Photograph set-up. Install furnace and heat to 1250F (HT tests only). 6.0.6 Verify PQAR Begin video. ¥6.0.7. Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): 6.0.8 Verify PQAR 1253 Document temperature of test article. 6.0.9 Witness POAR Ramp load to approximately 45 pounds at a load rate not to exceed 5 6.0.10 inches per minute. Witness PQAR -04 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 447 Verify PQAR 6-04 8 6.0.12 Continue increase load until failure occurs .: -6.0 Witness POAR

<b></b>	FD33/MECH	ANICAL METALLURGY A	ND CORROSI	ON TEAM	
SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064		Revision: Basic	
QT	JALIFICATION TEST	Date: 7/26/04		Page 7 of 9	
6.0.13	Verify load and instru	mentation.		Verify PQAR	NASA 3300 8-6-04
£6.0.14	Stop video.				ON/A
6.0.15	Document load and k Failure load <u>387</u> Failure location:	bcation of failure: $.8/b_{s}$ $\frac{N/A}{5.0^{\circ}-T}$ $\frac{N/A}{N/A}$	_ swage _ inches fr _ other	om cable end Verify PQAR	POAR <u>4</u> <u>4</u> <u>6</u> <u>6</u> <u>6</u> <u>6</u> <u>6</u> <u>6</u> <u>6</u> <u>6</u> <u>6</u> <u>6</u>
6.0.16	Photograph set-up.				100 cg-6-04
6.0.17	Place broken Restrair	nt Cable debris in Zip	loc bag and	d identify. Verify PQAR	POAR B-6-04
6.0.18	IF any anomaly or tes values, contact the fo Richard Knochelmann Cary Cox (321) 867- Pat Roberts (321) 86 Mark Hill (256) 544-4	llowing within 24 hou n (321) 867-9813 or 1757 7-1757	rs: Chris Epler	(321) 867-9309	POAR MASA 380. 8-6-04

ATTachment #

ED33 / MECHANICAL METALLURGY AND CORROSION TEAM					
SRB Diagonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064	Revision: Basic			
QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9			

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures

Verify PQAR



6.0.2 Note serial number or other identification for the Restraint Cable in test:  $L_07/04336$  E/v-7

Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAF Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. Verify PQAR 6.0.5 Photograph set-up. Install furnace and heat to 1250F (HT tests only). 6.0.6 8-6 Verify PQAR ¥6.0.7 Begin video. Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): 6.0.8 Verify PQAR 8-6-04 Document temperature of test article. 1259 1-6.0.9 Witness POAR 18-1 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. UBA Witness PQAR Verify load is at approximately 45 pounds and all instrumentation is 6.0.11 functioning. 44.9 Verify PQAR

6.0.12 Continue increase load until failure occurs .:

Witness PQAR

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1	ED33 / MECH	ANICAL METALLURGY A	AND CORROSIC	)N TEAM	
SRB Di	agonal Strut Restraint Cable Assembly	SRB-QUAL-04-0064		Revision: Basic	
QT	JALIFICATION TEST	Date: 7/26/04		Page 7 of 9	•
6.0.13	Verify load and instru	umentation.		Verify PQAR	MASA 380 1048 1048 1048 1048 1040 1040 1040 10
<b>¥</b> 6.0.14	Stop video.				MA
6.0.15	Document load and l Failure load <u>370</u> . Failure location:		swage inches fro other	om cable end Verify PQAR	(ISAR) A B-6-04
6.0.16	Photograph set-up.				MASA CB-6-04
6.0.17	Place broken Restra	int Cable debris in Zi	ploc bag and	d identify. Verify PQAR	380
6.0.18	IF any anomaly or te values, contact the fo Richard Knochelman Cary Cox. (321) 867-	bllowing within 24 ho n (321) 867-9813 oi 1757	urs:		

Pat Roberts (321) 867-1757 Mark Hill (256) 544-4327 or Brian Pung (256) 544-9346

Attachment # ED33 / MECHANICAL METALLURGY AND CORROSION TEAM Revision: Basic SRB-QUAL-04-0064 SRB Diagonal Strut Restraint Cable Assembly Page 6 of 9 Date: 7/26/04 **OUALIFICATION TEST** TEST OPERATION 6.0 Verify calibration is current for all calibrated test equipment in 6.0.1 accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures Verify PQAR Note serial number or other identification for the Restraint Cable in 6.0.2 test: OT 104236 E12-8 Verify POAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQA Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. Verify PQAR 8-6-04 Photograph set-up. 6.0.5 Install furnace and heat to 1250F (HT tests only). 6.0.6 Verify PQAR 8-6 \$6.0.7 Begin video. Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): 6.0.8 Verify PQAR 8-6-04 1251 Document temperature of test article. 6.0.9 Witness PQAR Ramp load to approximately 45 pounds at a load rate not to exceed 5 6.0.10 inches per minute. Witness PQAR 8 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 44.1 Verify PQAR 6.0,12 Continue increase load until failure occurs .: 8-6 Witness PQAR

8-10-04

		ANICAL METALLURGY AND (	CUKKUSIUN IBAMI	
SRB Diagonal Strut Restraint Cable Assembly		SRB-QUAL-04-0064	Revision: Basic	
QT	JALIFICATION TEST	Date: 7/26/04	Page 7 of 9	
6.0.13	Verify load and instru	umentation.	Verify PQAR	6
¥6.0.14	Stop video.		N/A	
6.0.15	Document load and I Failure load <u>399</u> Failure location:	.8 165 N/A 5 55 - 7 ii	wage nches from cable end other Verify PQAR	do
6.0.16	Photograph set-up.		MASA 380 CE	3-0
6.0:17	Place broken Restra	int Cable debris in Ziploc	bag and identify.	-6
6.0.18	values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 86	-1757	ris Epler (321) 867-9309	1

Attachment

ED33 / MECH	ANICAL METALLURGY AND CORRO	DSION TEAM
SRB Diagonal Strut Restraint Cable	SRB-QÜAL-04-0064	Revision: Basic
Assembly QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9

Verify calibration is current for all calibrated test equipment in 6.0.1 accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures Verify PQAR 8-6-04 Note serial number or other identification for the Restraint Cable in 6.0.2 test: 104236 Ely-9 Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAR Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. Verify PQAR 8-10-04 6.0.5 Photograph set-up. Install furnace and heat to 1250F (HT tests only). 6.0.6 Verify PQAR 8-¥6.0.7 Begin video. Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): 6.0.8 Verify PQAR Document temperature of test article. 1250°F 6.0.9 Witness POAR 186 Ramp load to approximately 45 pounds at a load rate not to exceed 5 6.0.10 inches per minute. Witness PQAR 8-6 6.0.11 Verify load is at approximately 45 pounds and all instrumentation is functioning. 43.7 Verify PQAR 6.0.12 Continue increase load until failure occurs .: Uan 8-6-00 Witness PQAR

	ED33 / MECH	ANICAL METALLURGY AND C	ORROSION TEAM
SRB Di	SRB Diagonal Strut Restraint Cable SRB-QUAL-04-0064 Assembly		Revision: Basic
QU	JALIFICATION TEST	Date: 7/26/04	Page 7 of 9
6.0.13	Verify load and instru	mentation.	Verify PQAR
¥6.0.14	Stop video.		NA
6.0.15	Document load and k Failure load <u>392.7</u> Failure location:	$\frac{165}{5^{3}4^{\prime\prime}-T}$ in	wage ches from cable end her Verify PQAR
6.0.16	Photograph set-up.		MASA 330 B-6-04
6.0.17	Place broken Restrair	nt Cable debris in Ziploc	bag and identify. Verify PQAR
6.0.18	values, contact the fo Richard Knochelmant Cary Cox (321) 867- Pat Roberts (321) 86		s Epler (321) 867-9309

Attachment#10

ED33 / MECHANICAL METALLURGY AND CORROSION TEAM				
SRB Diagonal Strut Restraint Cable	SRB-QUAL-04-0064	Revision: Basic		
Assembly QUALIFICATION TEST	Date: 7/26/04	Page 6 of 9		

6.0.1 Verify calibration is current for all calibrated test equipment in accordance with ED33-WI-012 Mechanical Testing Calibration and Verification Procedures Verify PQAR



6.0.2 Note serial number or other identification for the Restraint Cable in .

test: 184236 5/1-10 Verify PQAR Mount the Restraint Cable into the fixture. 6.0.3 Verify PQAF Apply three thermocouples, one at the top, middle and bottom of the 6.0.4 Restraint Cable. Verify PQAR 6.0.5 Photograph set-up. Install furnace and heat to 1250F (HT tests only). 6.0.6 Verify PQAR Begin video. £6.0.7 Verify all thermocouples read 1250F +/- 10 degrees (HT tests only): 6.0.8 Verify PQAR 1251°F Document temperature of test article. \_ 6.0.9 Witness POAR 6.0.10 Ramp load to approximately 45 pounds at a load rate not to exceed 5 inches per minute. POAR Witness PQAR Verify load is at approximately 45 pounds and all instrumentation is 6.0.11 42.7. 165 functioning. Verify PQAR ( POAR UBA 6.0.12 Continue increase load until failure occurs .: Witness POAR

	TO TALL SO CHE	ANICAL METALLURGY AN	TD CORROSIO	N TEAM	
SRB Diz	SRB Diagonal Struf Restraint Cable SRB-QUAL-04-0064		Revision: Basic		
QT	Assembly JALIFICATION TEST	Date: 7/26/04		Page 7 of 9	<u>A</u>
6.0.13	Verify load and instru	imentation.		Verify PQAR	NASA 8-6-04
<b>★</b> 6.0.14	Stop video.				MA
6.0.15	Document load and I Failure load <u>イクラ.</u> Failure location:	ocation of failure: $\frac{4}{5}$ $\frac{165}{5}$ $\frac{\sqrt{A}}{54}$	_ swage inches fro	om cable end	
		N/A	_ other	Verify PQAR	(1) 4 (1) (4) (1) (2) (2) (2) (2) (2) (2) (2) (2
6.0.16	Photograph set-up.				NASA 3800 186-04
6.0.17	Place broken Restra	int Cable debris in Zip	loc bag and	identify. Verify PQAR	(NASA 380 (DEG) 8-6-04
6.0.18	values, contact the for Richard Knochelman Cary Cox (321) 867- Pat Roberts (321) 80	67-1757	rs: Chris Epler	(321) 867-9309	(POAR)
	Mark Hill (256) 544-	4327 or Brian Pung (2	56) 544-93	46 8-6-	MASA -04 -04

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			ocket booster diagonal strut mbly is exposed to a range				
		0 0	s 798 kg (1,760 lb) at room				
-	-	-	which the cable is exposed				
during the first 2 min of fli							
-	-		inical properties at tempera-				
			temperature using standard				
			ervative safety factor of 1.4				
			÷				
	and knockdown factors verified by testing. Test results allowed a calculated knockdown factor of 0.189 to be determined for the restraint cables, which provides a minimum breaking strength of 151 kg (333 1						
at 677 °C (1,250 °F) when combined with the minimum breaking strength of 0.317-cm (0.125- or 1/8-in)							
diameter, type 1 composition	n rope.						
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