



ETR10-027

RELEASE DATE: 13AUG10
CS125-1420-16CRMCRP STUD
CB9120V5 CABLE TIE ANCHOR
CB9205VF STRAP FASTENER LOOP
CB200 ACRYLIC ADHESIVE
CB420 ADHESIVE
PROJECT NO. 593

**AMERICAN BUREAU OF SHIPS (ABS)
ADHESIVE BONDED FASTENER CERTIFICATION TEST**

Abstract

Three types of Click Bond fasteners bonded with two formulations of acrylic adhesive were subjected to conditioning that simulated extreme marine environments for certification to American Bureau of Shipping (ABS) requirements. The test specimens were bonded with CB200 or CB420 adhesive to 3/8 inch thick A36 low carbon steel plate and then subjected to 7 days of salt fog followed by 30 days at 165°F and 90% relative humidity. CS125-1420-16CRMCRP studs were tested to failure in tension, shear, and offset modified shear. CB9120V5 cable tie anchors and CB9205VF strap fastener loops were tested to failure in tension. The CS125-1420-16CRMCRP studs, CB9120V5 cable tie anchors, and CB9205VF strap fastener loops bonded with either adhesive retained acceptable ultimate strength after conditioning in the simulated marine environment.

**AMERICAN BUREAU OF SHIPS (ABS)
ADHESIVE BONDED FASTENER CERTIFICATION TEST**

Executive Summary

Click Bond tested three types of adhesive bonded fasteners mounted to A36 steel with CB200 or CB420 adhesive. The mounted fasteners were conditioned for 7 days in salt fog followed by 30 days at 165°F and 90% relative humidity. The test was requested by Click Bond Sales Engineering to support certification of the fasteners to American Bureau of Shipping (ABS) requirements.

The Click Bond fasteners tested were a CS125-1420-16CRMCRP stainless steel stud, a CB9120V5 composite cable tie anchor, and a CB9205VF composite strap fastener loop.

All fastener and adhesive combinations retained at least 80% of their original tensile strength after conditioning.

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1. INTRODUCTION

Test Program Requested by:

Click Bond, Inc. Sales Engineer – Keith Register

(775) 885-8000 X1924

Customer:

Click Bond Certification/Qualification Activity

Contact:

N/A

Background:

To verify that Click Bond fasteners meet or exceed the certification requirements of the American Bureau of Shipping (ABS), a test was proposed by Click Bond Sales Engineering that subjected the adhesive bonded fasteners to continuous salt fog conditioning per ASTM B117 for seven days followed by continuous exposure to 165°F and 90% relative humidity for thirty days followed by testing to failure as noted in the Test Group Definition Table.

2. SCOPE

Thirty CS125-1420-16CRMCRP studs were bonded with CB200 and thirty studs with CB420 adhesive to 3/8 inch thick low carbon steel. Fifteen from each adhesive group were retained as test controls, and the remaining fifteen were conditioned for seven days salt fog per ASTM B117 followed by conditioning for thirty days at 165°F and 90% relative humidity. Testing to failure in groups of five was performed in tension, shear and two inch offset modified shear for a total of sixty test specimens.

Ten CB9120V5 cable tie anchors were bonded with CB200 and ten cable tie anchors with CB420 adhesive to 3/8 inch thick low carbon steel. Five from each adhesive group were retained as test controls, and the remaining five were conditioned for seven days salt fog per ASTM B117 followed by conditioning for thirty days at 165°F and 90% relative humidity. Testing to failure in groups of five was performed in tension for a total of twenty test specimens.

Ten CB9205VF strap fastener loops were bonded with CB200 and ten strap fastener loops with CB420 adhesive to 3/8 inch thick low carbon steel. Five from each adhesive group were retained as test controls, and the remaining five were conditioned for seven days salt fog per ASTM B117 followed by conditioning for thirty days at 165°F and 90% relative humidity. Testing to failure in groups of five was performed in tension for a total of twenty test specimens.

3. REFERENCES

ASTM B 117-07a Standard Practice for Operating Salt Fog Apparatus

4. PRINCIPLE

The salt fog and hot/wet environmental conditioning is designed to simulated extreme conditions at sea for prolonged periods of time.

5. APPARATUS

United STM-20 Tensile/Compression Testing Machine.

- CS125-1420-16CRMCRP studs and CB9205VF strap fastener loops were tested using a 5,000 lbs F.S. load cell.
- CB9120V5 cable tie anchors were tested using a 500 lbs F.S. load cell.

Singleton SCCH22 salt fog system.

Cincinnati sub-zero ZH-81-HAC environmental chamber.

Right-angle grinder with coarse grit flexible disk.

6. TEST GROUP DEFINITION TABLE (5 EACH GROUP)

ID	Substrate	Fastener	Adhesive	Test	Conditioning	
A2TC	3/8 Inch Thick A36 Low Carbon Steel	CS125-1420-16CRMCRP Stud	CB200	Tensile	Control	
A2TA					Aged	
A2SC				Shear	Control	
A2SA					Aged	
A2MC				2" Offset Modified Shear	Control	
A2MA					Aged	
A4TC				CB420	Tensile	Control
A4TA			Aged			
A4SC			Shear		Control	
A4SA					Aged	
A4MC			2" Offset Modified Shear		Control	
A4MA					Aged	
C2TC			CB9120V5 Cable Tie Anchor		CB200	Tensile
C2TA				Aged		
C4TC		CB420		Control		
C4TA		Aged				
D2TC		CB9205VF Strap Fastener Loop	CB200	Tensile	Control	
D2TA			Aged			
D4TC			CB420		Control	
D4TA			Aged			

7. PROCEDURE

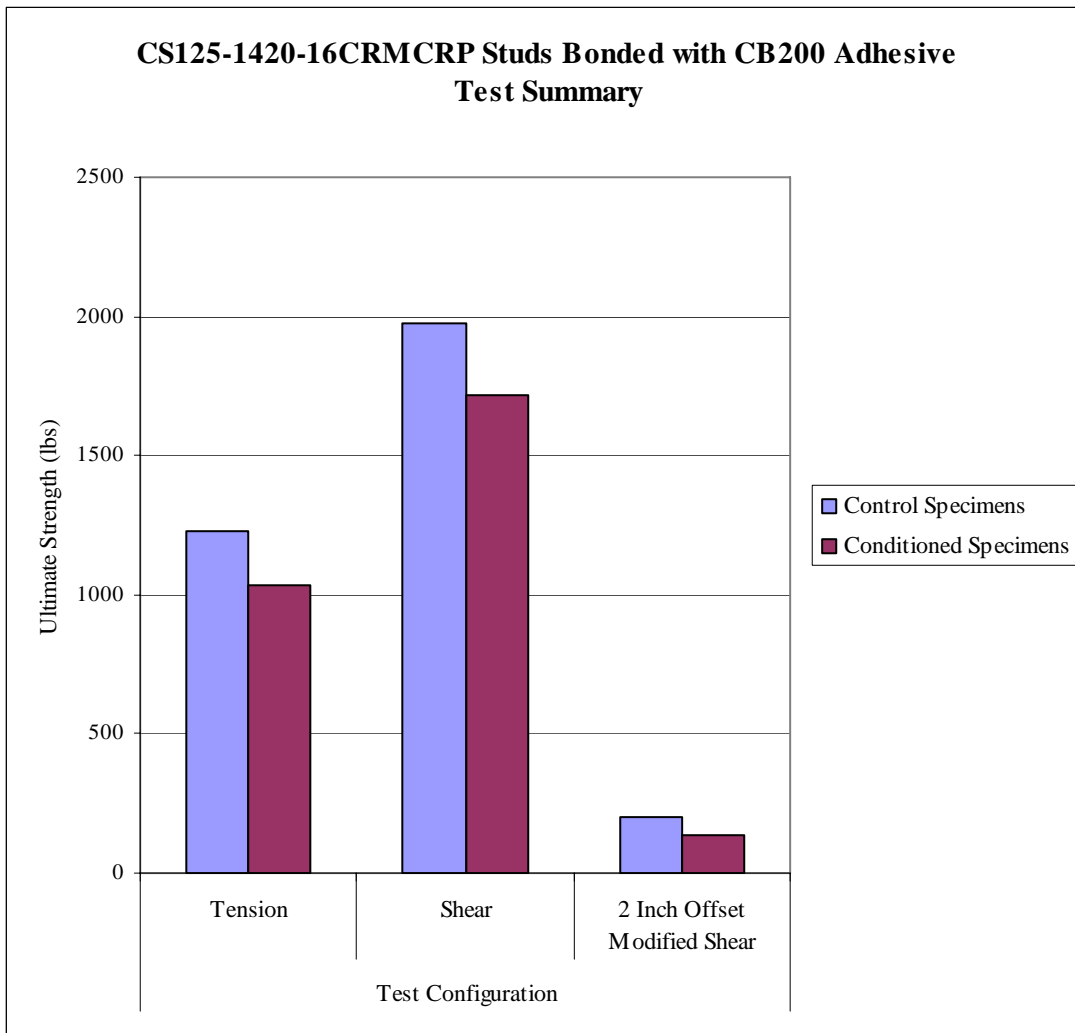
The A36 low carbon steel substrate surfaces were prepared for bonding using a flexible grinding wheel followed by a CB911 solvent wipe clean per CBPS-233. The adhesive bond areas were masked and Deft 44GN036 primer applied by spraying to the exposed steel surfaces to reduce the quantity of rust introduced into the salt fog system (App. A, Photo 1).

Fastener bonding per CBPS-206.

Tensile testing per CBPS-202 (App. A, Photos 2, 4, and 5).

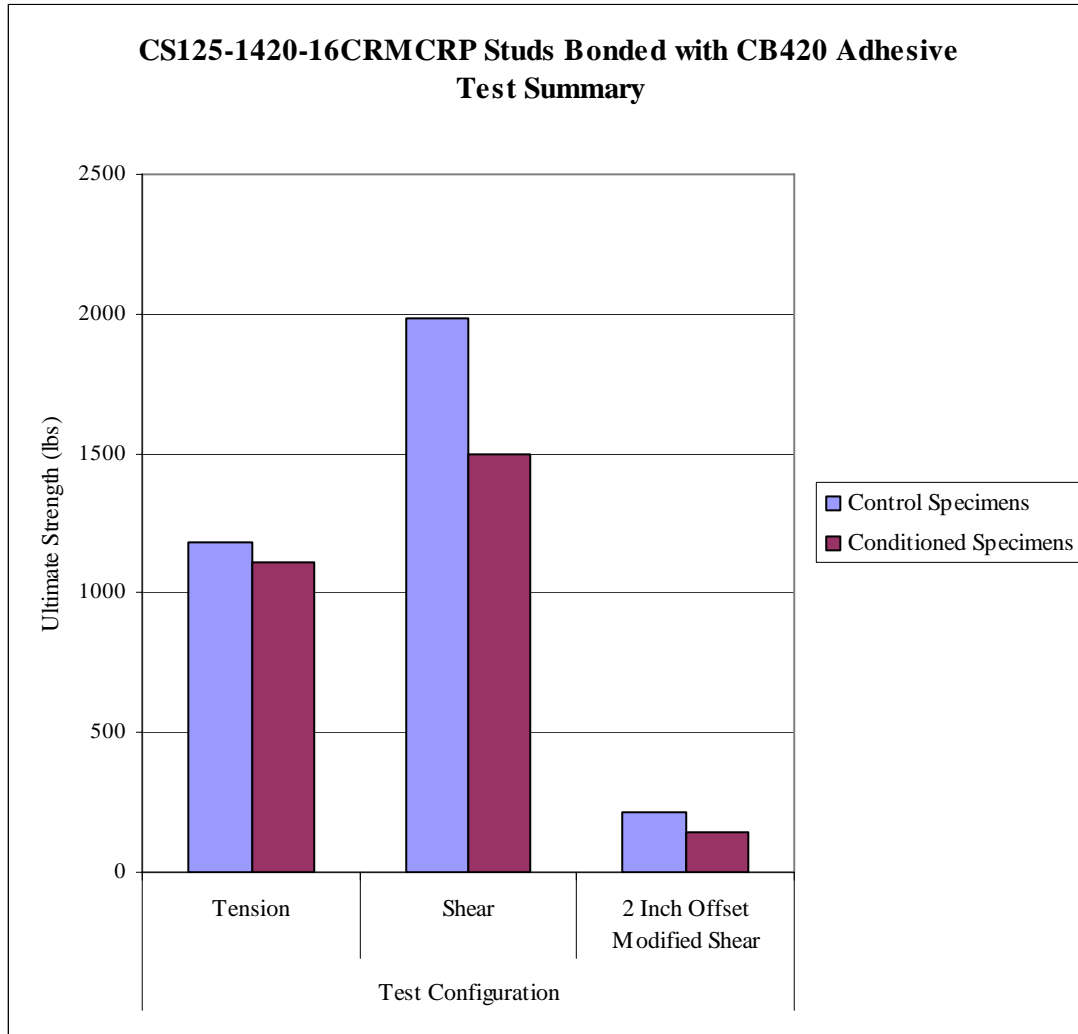
Shear testing per CBPS-201 (App. A, Photo 3).

8. RESULTS



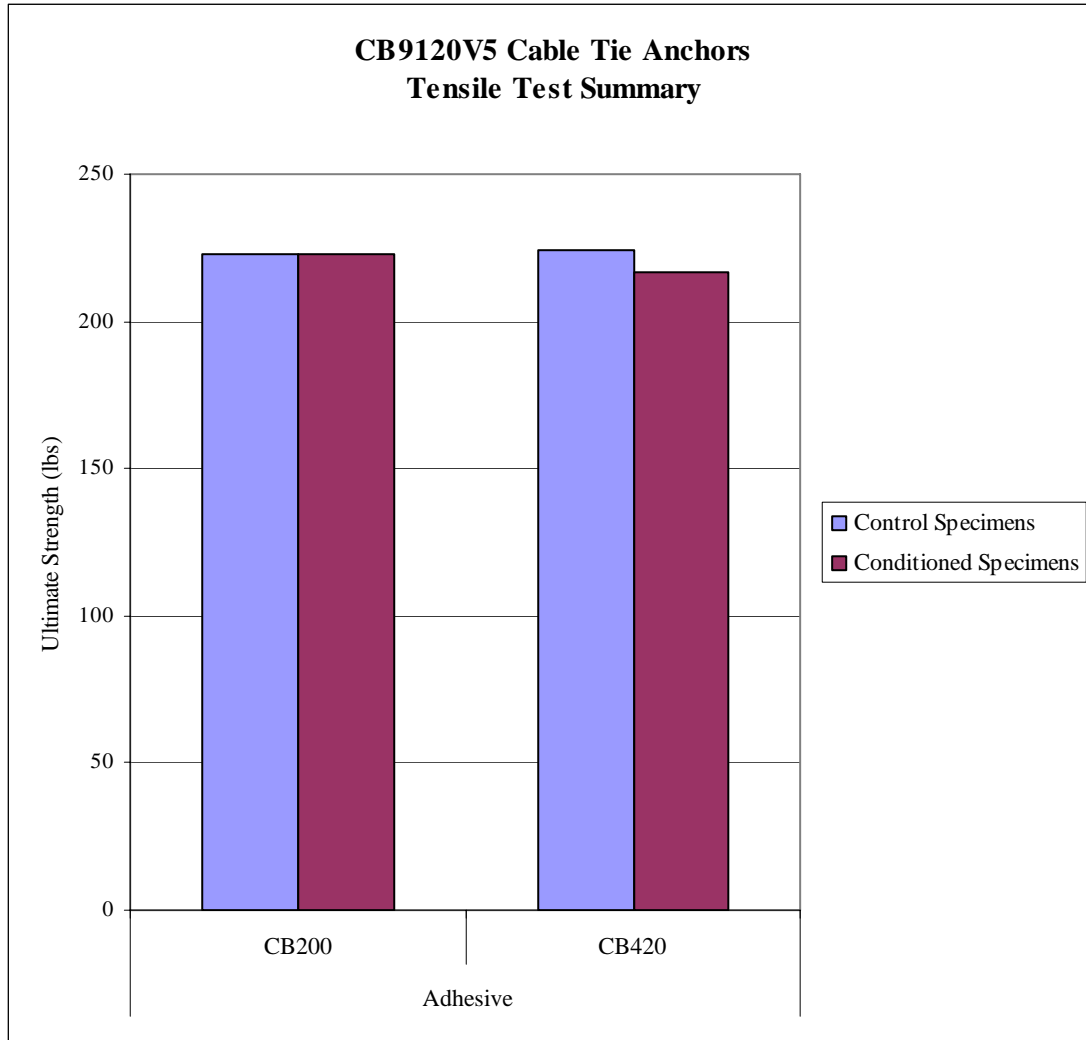
CS125-1420-16CRMCRP studs, bonded with CB200 adhesive to low carbon steel, retained 84% of the mean tensile strength, 87% of the mean shear strength, and 68% of the mean 2 inch offset modified shear strength after salt fog and hot/wet conditioning relative to the ultimate strength of the control specimens.

RESULTS (CONT.)



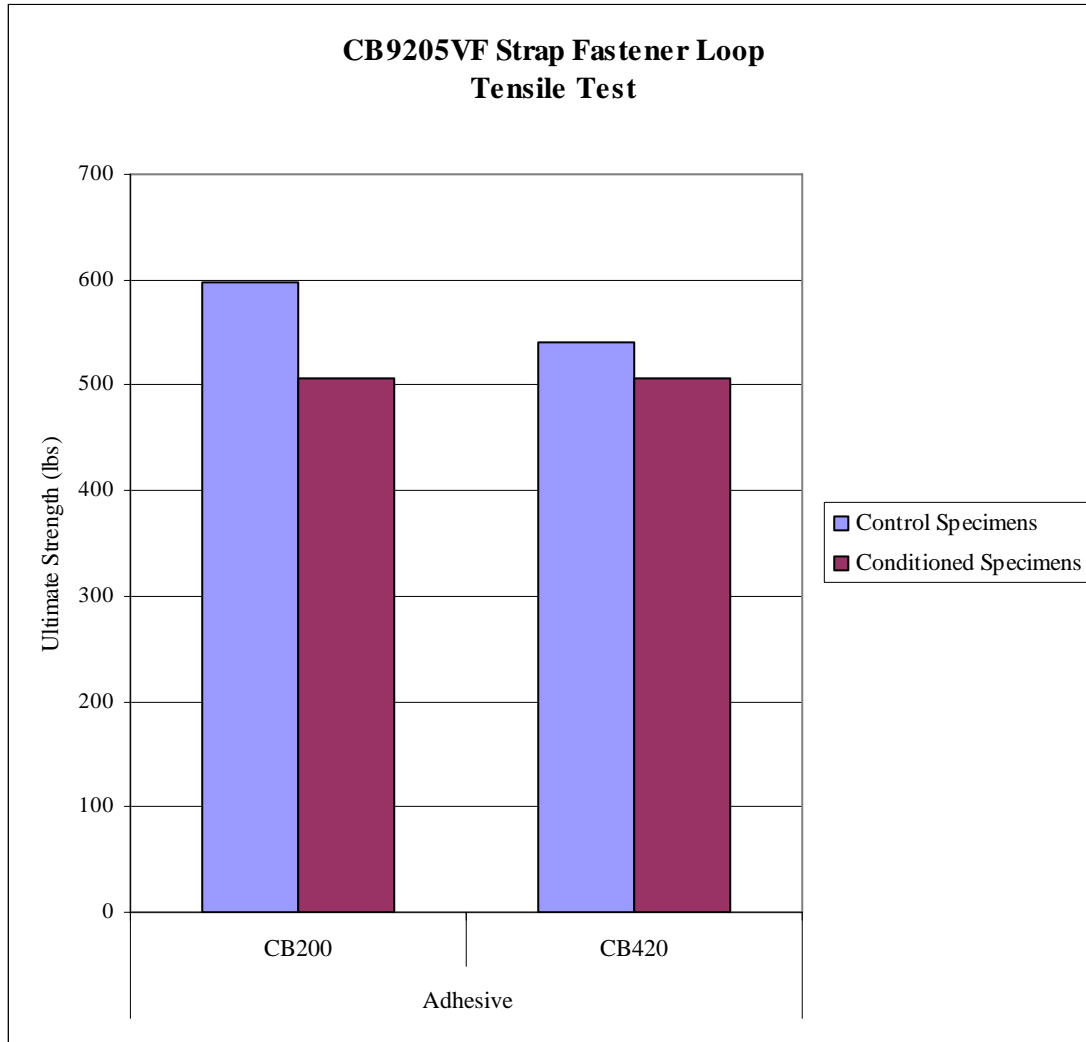
CS125-1420-16CRMCRP studs bonded with CB420 adhesive to low carbon steel retained 94% of the mean tensile strength, 75% of the mean shear strength, and 66% of the mean 2 inch offset modified shear strength after salt fog and hot/wet conditioning relative to the ultimate strength of the control specimens.

RESULTS (CONT.)



CB9120V5 cable tie anchors did not change significantly from the control group strengths after conditioning regardless of the adhesive used. CB9120V5 cable tie anchors bonded with CB200 adhesive resulted in no change in ultimate strength and CB9120V5 cable tie anchors bonded with CB420 adhesive retained 97% of the control specimen strength.

RESULTS (CONT.)



CB9205V strap fastener loops bonded with CB200 adhesive to low carbon steel retained 85% of the control mean tensile strength and CB9205V strap fastener loops bonded with CB420 adhesive to low carbon steel retained 94% of the control mean tensile strength.


9. CONCLUSIONS


CS125-1420-16CRMCRP studs, CB9120V5 cable tie anchors, and CB9205VF strap fastener loops bonded with CB200 or CB420 acrylic adhesive retain at least 80% of their original bonded strength after conditioning for 7 days in salt fog per ASTM B117 followed by 30 days at 165°F and 90% relative humidity.

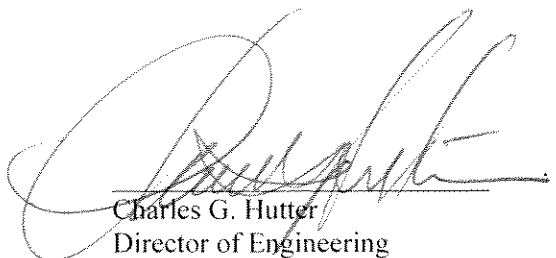
10. RECOMMENDATIONS

Click Bond recommends the CS125-1420-16CRMCRP stud, the CB9120V5 cable tie anchor, and the CB9205VF strap fastener loop be approved for shipboard applications that require certification and compliance with requirements of the American Bureau of Ships (ABS).

TEST DATES: May 14, 2010 to August 9, 2010

TEST PERFORMED BY: 
Daniel J. Brown 13 Aug 10
Test Engineer

REPORT WRITTEN BY: 
Daniel J. Brown 13 Aug 10
Test Engineer

APPROVED BY: 
Charles G. Hutter
Director of Engineering

APPENDIX A – PHOTOS

PHOTO 1 – TEST SPECIMENS BONDED TO MASKED AND PRIMED A36 LOW CARBON STEEL PLATE

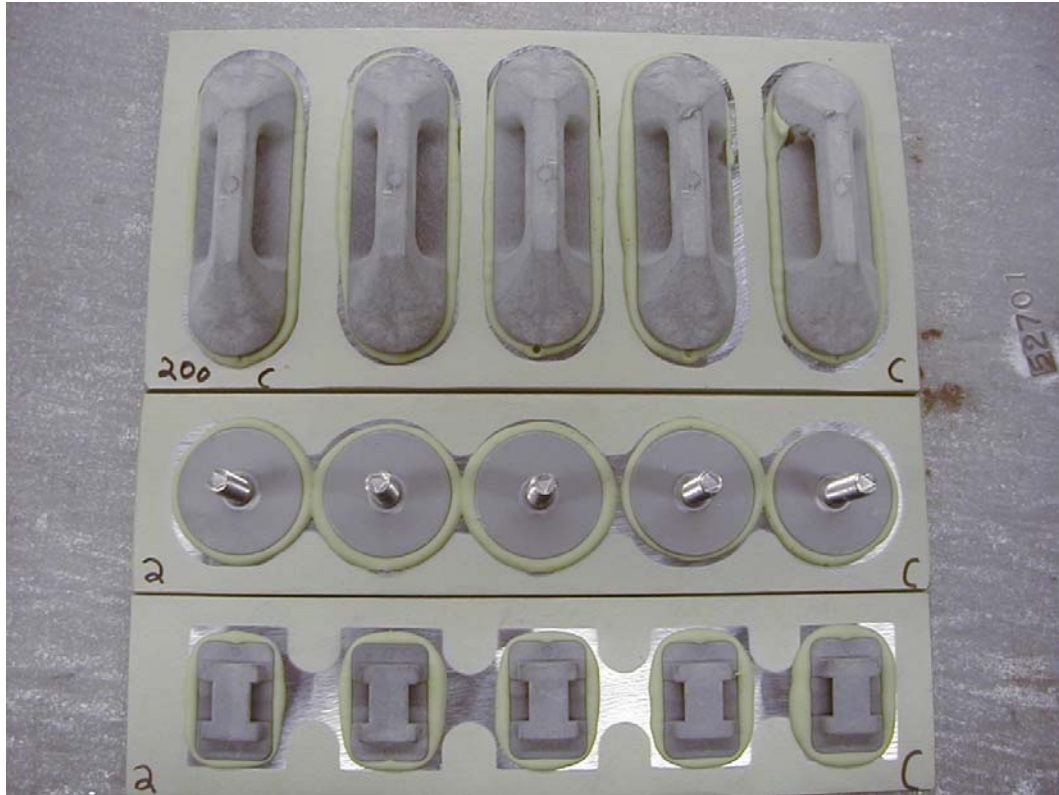
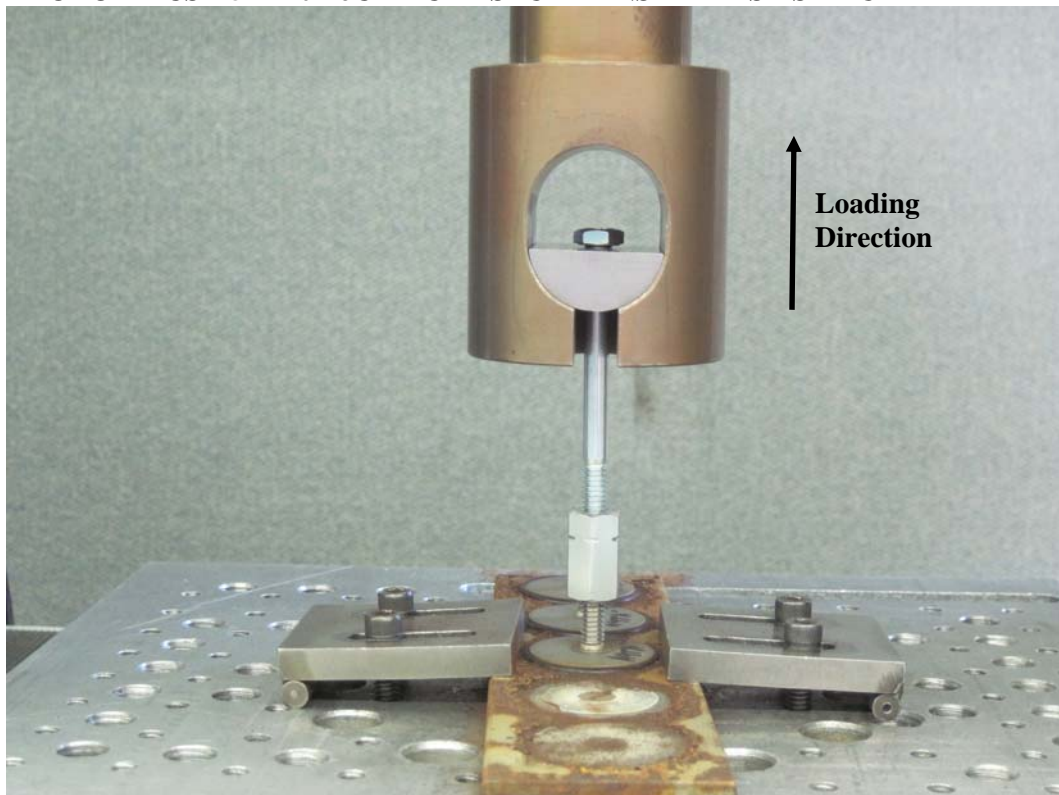


PHOTO 2 – CS125-1420-16CRMCRP STUD TENSILE TEST SET-UP



APPENDIX A – PHOTOS (CONT.)

PHOTO 3 – CS125-1420-16CRMCRP STUD SHEAR TEST SET-UP

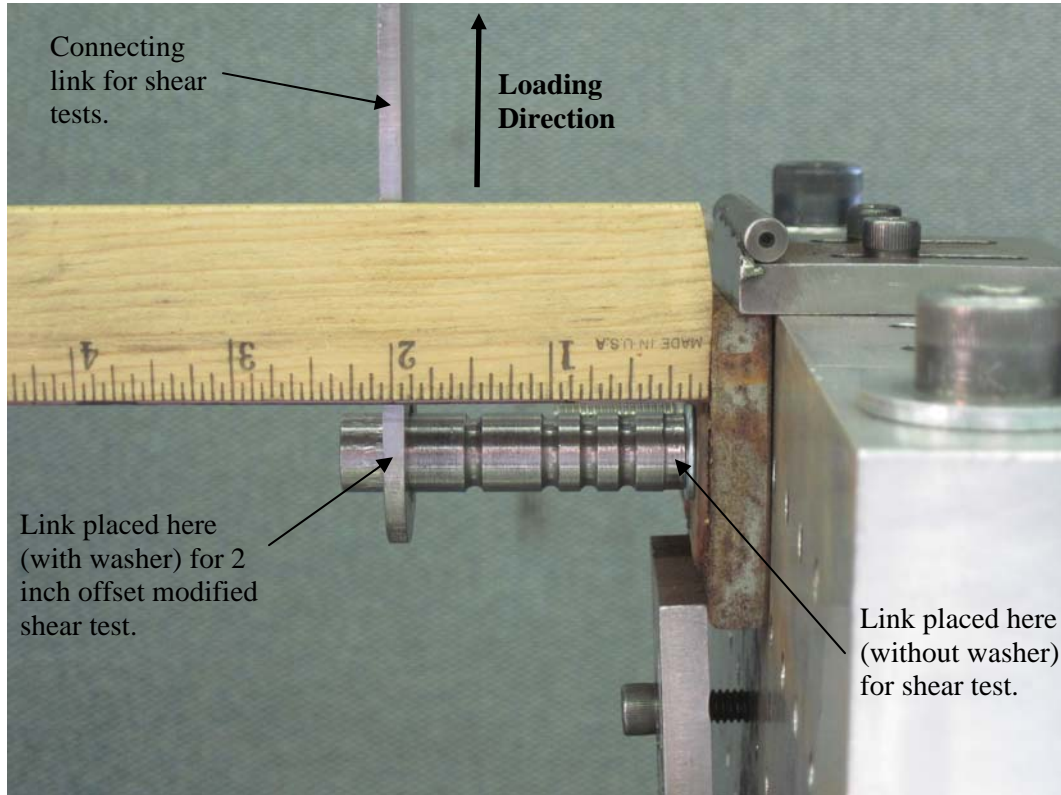
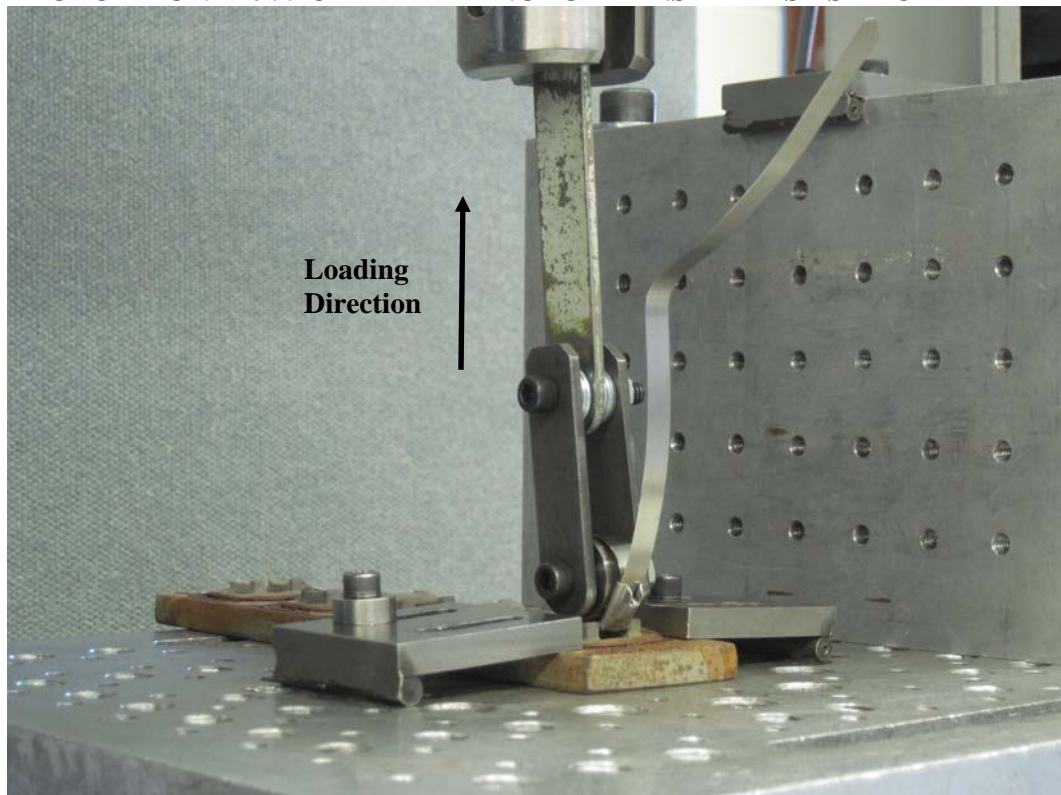
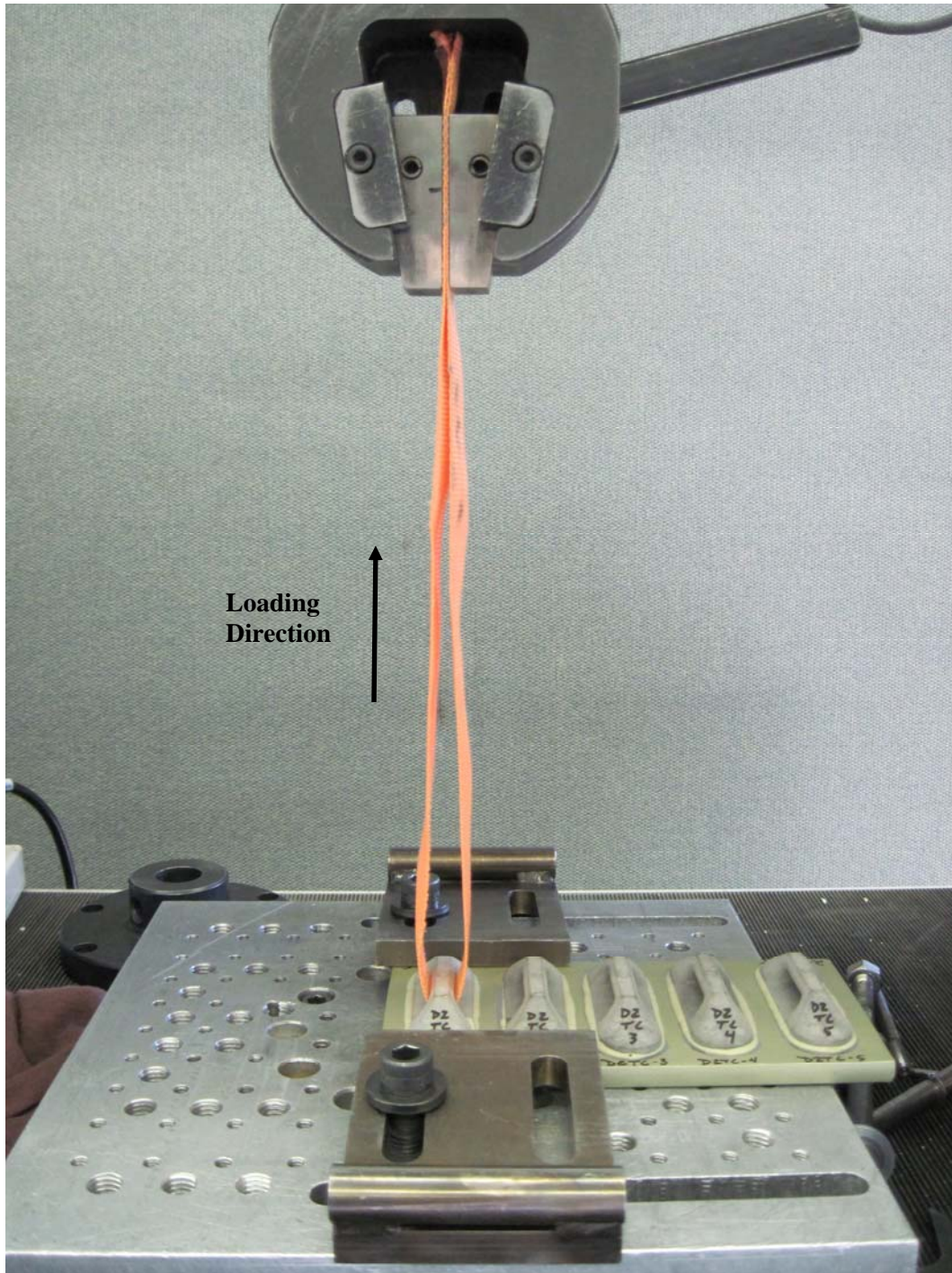


PHOTO 4 – CB9120V5 CABLE TIE ANCHOR TENSILE TEST SET-UP



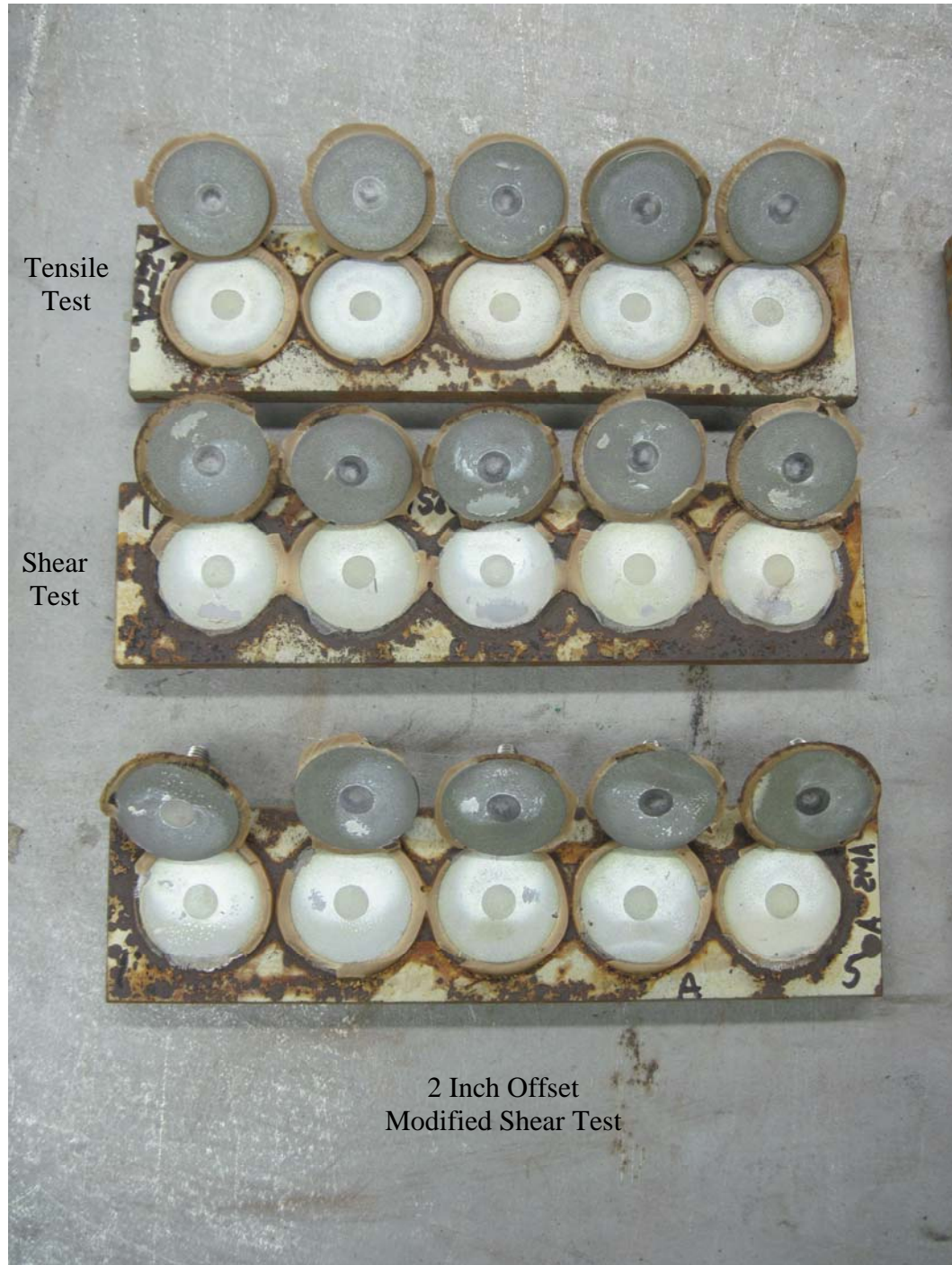
APPENDIX A – PHOTOS (CONT.)

PHOTO 5 – CB9205VF STRAP FASTENER LOOP TENSILE TEST SET-UP



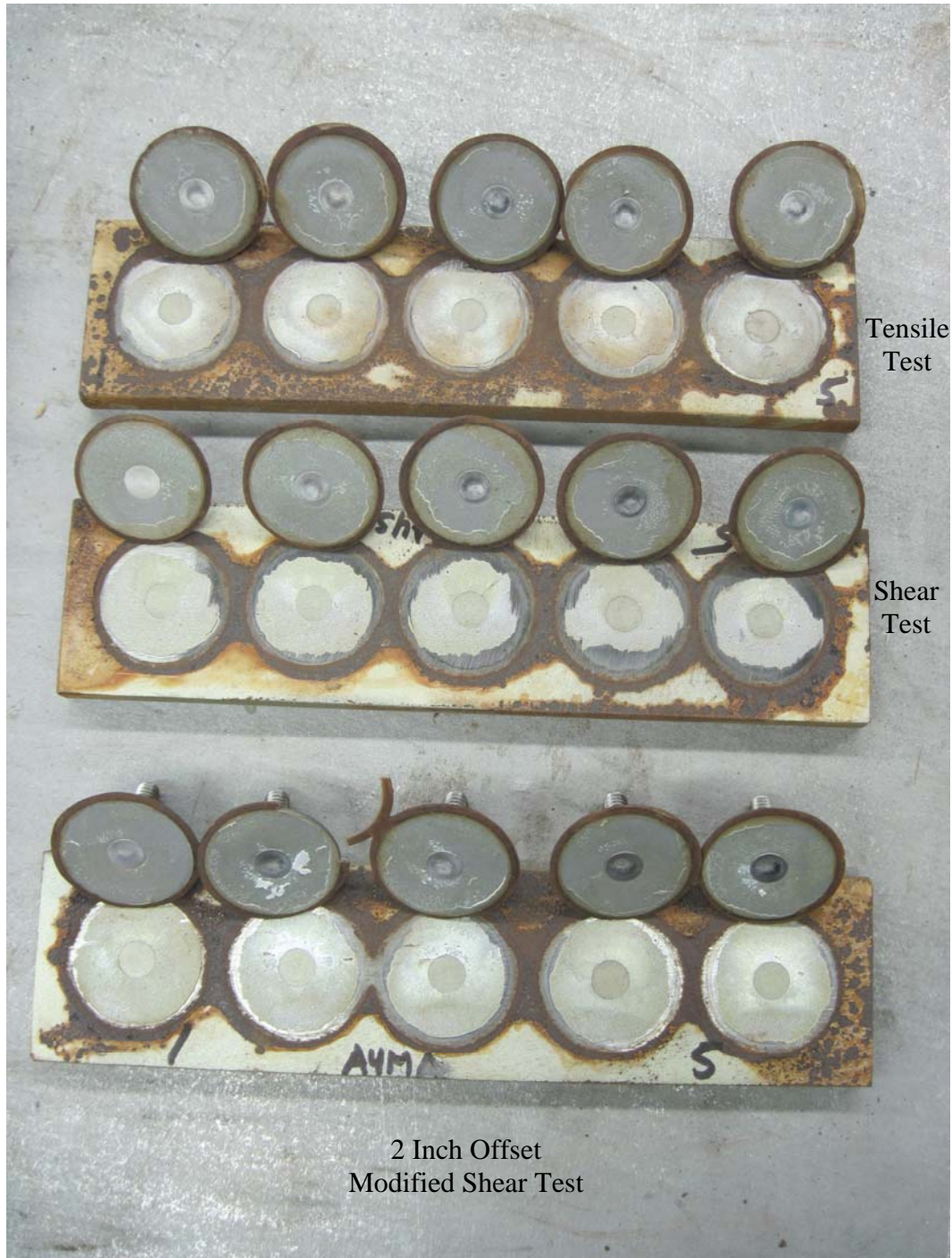
APPENDIX A – PHOTOS (CONT.)

PHOTO 6 – CS125-1420-16CRMCRP STUDS BONDED WITH CB200 ADHESIVE AFTER ENVIRONMENTAL CONDITIONING AND TESTING



APPENDIX A – PHOTOS (CONT.)

PHOTO 7 – CS125-1420-16CRMCRP STUDS BONDED WITH CB420 ADHESIVE AFTER ENVIRONMENTAL CONDITIONING AND TESTING



APPENDIX A – PHOTOS (CONT.)

PHOTO 8 – CB9120V5 CABLE TIE ANCHORS BONDED WITH CB200 OR CB420 ADHESIVE AFTER CONDITIONING AND TESTING



CB420
Adhesive

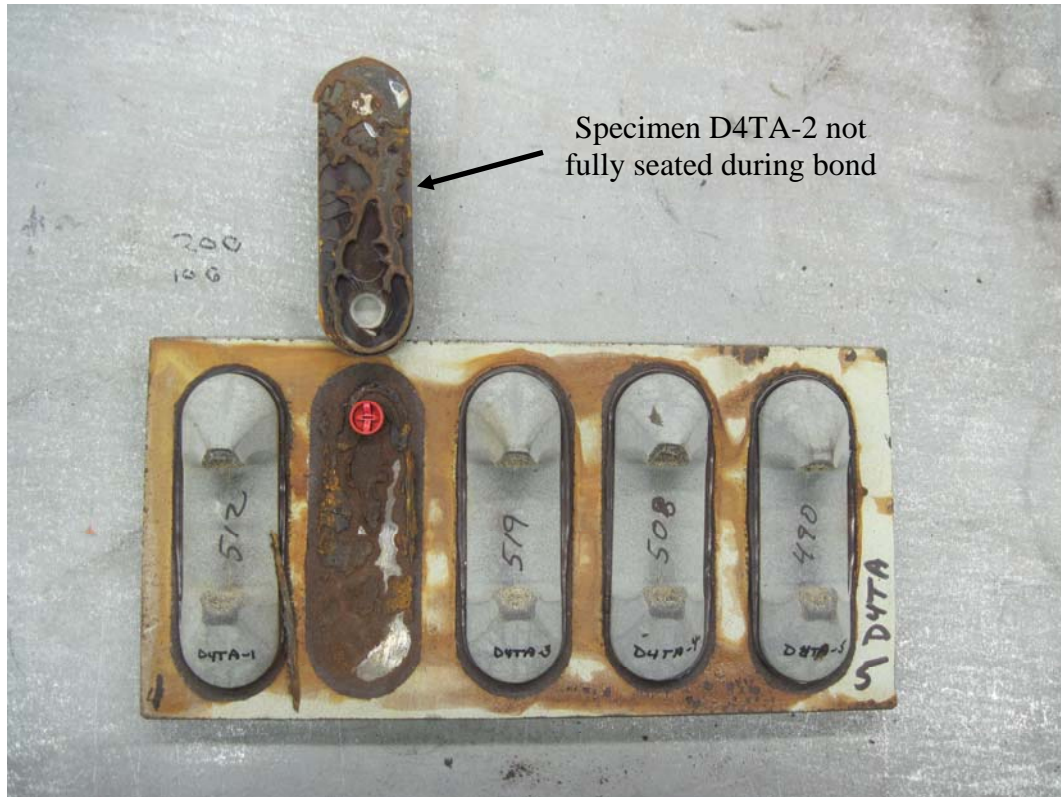
CB200
Adhesive

PHOTO 9 – CB9205VF STRAP FASTENER LOOPS BONDED WITH CB200 ADHESIVE AFTER ENVIRONMENTAL CONDITIONING AND TESTING



APPENDIX A – PHOTOS (CONT.)

PHOTO 10 – CB9205VF STRAP FASTENER LOOPS BONDED WITH CB420 ADHESIVE AFTER ENVIRONMENTAL CONDITIONING AND TESTING



APPENDIX B – DATA

CS125-1420-16CRMCRP STUDS BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION

ID	Fmax (lbs)	Failure Mode
A2TC-1	1309.2	100% adhesive to base
A2TC-2	1303.4	90% adhesive to base/10% adhesive to substrate
A2TC-3	1119.3	100% adhesive to base
A2TC-4	1265.2	80% adhesive to base/20% adhesive to substrate
A2TC-5	1163.1	90% adhesive to base/10% adhesive to substrate
Mean	1232	
St. Dev.	86.0	

CS125-1420-16CRMCRP STUDS BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE TO FAILURE IN SHEAR

ID	Fmax (lbs)	Failure Mode
A2SC-1	2009.0	20% adhesive to base/80% adhesive to substrate
A2SC-2	2192.1	70% adhesive to base/30% adhesive to substrate
A2SC-3	1992.1	70% adhesive to base/30% adhesive to substrate
A2SC-4	1733.9	70% adhesive to base/30% adhesive to substrate
A2SC-5	1957.9	70% adhesive to base/30% adhesive to substrate
Mean	1977	
St. Dev.	163.5	

CS125-1420-16CRMCRP STUDS WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE TO FAILURE IN 2 INCH OFFSET MODIFIED SHEAR

ID	Fmax (lbs)	Failure Mode
A2MC-1	187.6	10% adhesive to base/90% adhesive to substrate
A2MC-2	206.7	25% adhesive to base/75% adhesive to substrate
A2MC-3	203.0	10% adhesive to base/90% adhesive to substrate
A2MC-4	180.4	10% adhesive to base/90% adhesive to substrate
A2MC-5	226.8	40% adhesive to base/60% adhesive to substrate
Mean	201	
St. Dev.	18.1	

APPENDIX B (CONT.)

CS125-1420-16CRMCRP STUDS BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
A2TA-1	936.0	100% base primer cohesive failure
A2TA-2	980.1	100% base primer cohesive failure
A2TA-3	1147.6	100% base primer cohesive failure
A2TA-4	1068.6	100% base primer cohesive failure
A2TA-5	1025.8	100% base primer cohesive failure
Mean	1032	
St. Dev.	81.6	

CS125-1420-16CRMCRP STUDS BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN SHEAR AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
A2SA-1	1697.5	10% adhesive to substrate/90% base primer cohesive failure
A2SA-2	1515.2	100% base primer cohesive failure
A2SA-3	1712.8	10% adhesive to substrate/90% base primer cohesive failure
A2SA-4	1821.0	5% adhesive to substrate/95% base primer cohesive failure
A2SA-5	1851.4	10% adhesive to substrate/90% base primer cohesive failure
Mean	1720	
St. Dev.	132.3	

CS125-1420-16CRMCRP STUDS BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN 2 INCH OFFSET MODIFIED SHEAR AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
A2MA-1	150.7	100% base primer cohesive failure
A2MA-2	138.1	100% base primer cohesive failure
A2MA-3	144.3	100% base primer cohesive failure
A2MA-4	133.3	100% base primer cohesive failure
A2MA-5	117.1	100% base primer cohesive failure
Mean	137	
St. Dev.	12.8	

APPENDIX B (CONT.)

CS125-1420-16CRMCRP STUDS BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION

ID	Fmax (lbs)	Failure Mode
A4TC-1	1226.2	90% adhesive to base/10% adhesive to substrate
A4TC-2	1258.9	90% adhesive to base/10% adhesive to substrate
A4TC-3	1193.6	90% adhesive to base/10% adhesive to substrate
A4TC-4	1191.0	90% adhesive to base/10% adhesive to substrate
A4TC-5	1053.5	90% adhesive to base/10% adhesive to substrate
Mean	1185	
St. Dev.	78.4	

CS125-1420-16CRMCRP STUDS BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN SHEAR

ID	Fmax (lbs)	Failure Mode
A4SC-1	2031.3	90% adhesive to base/10% adhesive to substrate
A4SC-2	1879.3	90% adhesive to base/10% adhesive to substrate
A4SC-3	1790.0	90% adhesive to base/10% adhesive to substrate
A4SC-4	2118.5	90% adhesive to base/10% adhesive to substrate
A4SC-5	2108.9	90% adhesive to base/10% adhesive to substrate
Mean	1986	
St. Dev.	145.4	

CS125-1420-16CRMCRP STUDS BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN 2 INCH OFFSET MODIFIED SHEAR

ID	Fmax (lbs)	Failure Mode
A4MC-1	199.8	50% adhesive to base/50% adhesive to substrate
A4MC-2	242.2	70% adhesive to base/30% adhesive to substrate
A4MC-3	209.1	90% adhesive to base/10% adhesive to substrate
A4MC-4	217.5	90% adhesive to base/10% adhesive to substrate
A4MC-5	220.7	90% adhesive to base/10% adhesive to substrate
Mean	218	
St. Dev.	15.8	

APPENDIX B (CONT.)

CS125-1420-16CRMCRP STUDS BONDED WITH CB420 TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
A4TA-1	994.8	30% adhesive to substrate/70% base primer cohesive failure
A4TA-2	1208.8	30% adhesive to substrate/70% base primer cohesive failure
A4TA-3	985.9	30% adhesive to substrate/70% base primer cohesive failure
A4TA-4	1181.4	30% adhesive to substrate/70% base primer cohesive failure
A4TA-5	1185.3	30% adhesive to substrate/70% base primer cohesive failure
Mean	1111	
St. Dev.	110.9	

CS125-1420-16CRMCRP STUDS BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN SHEAR AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
A4SA-1	1406.9	30% adhesive to substrate/70% base primer cohesive failure
A4SA-2	1534.1	30% adhesive to substrate/70% base primer cohesive failure
A4SA-3	1613.5	30% adhesive to substrate/70% base primer cohesive failure
A4SA-4	1416.3	30% adhesive to substrate/70% base primer cohesive failure
A4SA-5	1512.4	30% adhesive to substrate/70% base primer cohesive failure
Mean	1497	
St. Dev.	86.3	

CS125-1420-16CRMCRP STUDS BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN 2 INCH OFFSET MODIFIED SHEAR AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
A4MA-1	121.2	20% adhesive to substrate/80% base primer cohesive failure
A4MA-2	158.6	20% adhesive to substrate/80% base primer cohesive failure
A4MA-3	145.4	20% adhesive to substrate/80% base primer cohesive failure
A4MA-4	134.2	20% adhesive to substrate/80% base primer cohesive failure
A4MA-5	161.8	20% adhesive to substrate/80% base primer cohesive failure
Mean	144	
St. Dev.	16.9	

APPENDIX B (CONT.)

CB9120V5 CABLE TIE ANCHORS BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION

ID	Fmax (lbs)	Failure Mode
C2TC-1	206.4	100% mechanical-saddle break
C2TC-2	225.6	100% mechanical-saddle break
C2TC-3	239.2	100% mechanical-saddle break
C2TC-4	223.9	100% mechanical-saddle break
C2TC-5	219.5	100% mechanical-saddle break
Mean	223	
St. Dev.	11.8	

CB9120V5 CABLE TIE ANCHORS BONDED WITH CB200 TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
C2TA-1	213.9	100% mechanical-saddle break
C2TA-2	230.9	100% mechanical-saddle break
C2TA-3	224.4	100% mechanical-saddle break
C2TA-4	220.4	100% mechanical-saddle break
C2TA-5	223.0	100% mechanical-saddle break
Mean	223	
St. Dev.	6.2	

CB9120V5 CABLE TIE ANCHORS BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION

ID	Fmax (lbs)	Failure Mode
C4TC-1	221.1	100% mechanical-saddle break
C4TC-2	222.0	100% mechanical-saddle break
C4TC-3	234.4	100% mechanical-saddle break
C4TC-4	219.0	100% mechanical-saddle break
C4TC-5	224.6	100% mechanical-saddle break
Mean	224	
St. Dev.	6.0	

APPENDIX B (CONT.)

CB9120V5 CABLE TIE ANCHORS BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
C4TA-1	215.0	100% adhesive to substrate
C4TA-2	210.3	100% adhesive to substrate
C4TA-3	224.6	100% adhesive to substrate
C4TA-4	205.3	100% adhesive to substrate
C4TA-5	228.9	100% adhesive to substrate
Mean	217	
St. Dev.	9.8	

CB9205VF STRAP FASTENER LOOP BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION

ID	Fmax (lbs)	Failure Mode
D2TC-1	615.6	100% mechanical-saddle break
D2TC-2	610.8	100% mechanical-saddle break
D2TC-3	579.6	100% mechanical-saddle break
D2TC-4	594.3	100% mechanical-saddle break
D2TC-5	587.3	100% mechanical-saddle break
Mean	598	
St. Dev.	15.3	

CB9205VF STRAP FASTENER LOOP BONDED WITH CB200 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
D2TA-1	484.5	100% mechanical-saddle break
D2TA-2	501.5	100% mechanical-saddle break
D2TA-3	520.1	100% mechanical-saddle break
D2TA-4	512.0	100% mechanical-saddle break
D2TC-5	515.6	100% mechanical-saddle break
Mean	507	
St. Dev.	14.2	

APPENDIX B (CONT.)

CB9205VF STRAP FASTENER LOOP BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION

ID	Fmax (lbs)	Failure Mode
D4TC-1	515.8	100% mechanical-saddle break
D4TC-2	588.8	100% mechanical-saddle break
D4TC-3	506.5	100% mechanical-saddle break
D4TC-4	572.0	100% mechanical-saddle break
D4TC-5	516.6	100% mechanical-saddle break
Mean	540	
St. Dev.	37.6	

CB9205VF STRAP FASTENER LOOP BONDED WITH CB420 ADHESIVE TO LOW CARBON STEEL AND TESTED TO FAILURE IN TENSION AFTER CONDITIONING FOR 7 DAYS SALT FOG FOLLOWED BY 30 DAYS AT 165°F/90%RH

ID	Fmax (lbs)	Failure Mode
D4TA-1	512.0	100% mechanical-saddle break
D4TA-2	ND	No data – the part was improperly bonded
D4TA-3	519.2	100% mechanical-saddle break
D4TA-4	508.5	100% mechanical-saddle break
D4TA-5	489.7	100% mechanical-saddle break
Mean	507	
St. Dev.	12.6	