

**FATIGUE AND STATIC LOAD TESTS OF THE
PRECISION-HAYES INTERNATIONAL SURE-LOCK®0.50-IN
ANCHORAGE SYSTEM CONSISTING OF A
SURE-LOCK® F5CA SLOCK 0.5-IN. ANCHOR,
SURE-LOCK® F500SL2 0.5-IN. x 1.3 2PC WEDGES,
SURE-LOCK® F6500 SLOCK 0.5-IN OTU SPLICE CHUCK,
SURE-LOCK® F5TCA SLOCK II 0.5-in. ANCHOR,
SURE-LOCK® F500SL21.2 SLOCK 0.5-IN X 1.2 2PC. WEDGES AND
SCAW SOUTH AFRICA (Pty)LIMITED WIRE AND STRAND
0.5-IN DIAMETER, ASTM A-416 270 KSI
LOW RELAXATION SEVEN-WIRE STRAND MILL CERTIFICATE 2100824**

By

**Shannon W. Hutchison
H. Scott Norville, PH.D., P.E.**

Prepared for

**Precision-Hayes International
704B West. Simonds Road
Seagoville, TX 75159**

May 15, 2015

**Civil Engineering Testing Laboratory
Texas Tech University
Lubbock, TX 79409**

INTRODUCTION

This report documents the results of two fatigue load tests and one static load test on a 0.5-in Anchorage System furnished by PRECISION-HAYES INTERNATIONAL SURE-LOCK® of Dallas, TX. The test specimens for fatigue and static testing consisted of THE PRECISION-HAYES INTERNATIONAL SURE-LOCK® 0.50-IN ANCHORAGE SYSTEM CONSISTING OF A SURE-LOCK® F5CA SLOCK 0.5-IN. ANCHOR, SURE-LOCK® F500SL2 0.5-IN. x 1.3 2PC WEDGES, SURE-LOCK® F6500 SLOCK 0.5-IN OTU SPLICE CHUCK, SURE-LOCK® F5TCA SLOCK II 0.5-in. ANCHOR, SURE-LOCK® F500SL21.2 SLOCK 0.5-IN X 1.2 2PC. WEDGES AND SCAW SOUTH AFRICA (Pty)LIMITED WIRE AND STRAND 0.5-IN DIAMETER, ASTM A-416 270 KSI LOW RELAXATION SEVEN-WIRE STRAND MILL CERTIFICATE 2100824. The strand was certified to have a minimum ultimate tensile strength (MUTS) of 41.3 kips. Certification documents are provided in the appendices. A MUTS of 41.3 kips was used when calculating loads for the fatigue tests described in this report.

The tests were performed in the Civil Engineering Testing Laboratory, Texas Tech University in Lubbock, Texas. Fatigue testing commenced at 8:45pm on February 6, 2015 and concluded at 9:55am on February 6, 2015. Static testing commenced at 7:10pm on February 7, 2015 and concluded at 7:15pm on February 7, 2015.

The 0.5-in Anchorage System with a SURE-LOCK® F5CA SLOCK 0.5-IN. ANCHOR, SURE-LOCK® F500SL2 0.5-IN. x 1.3 2PC WEDGES, SURE-LOCK® F6500 SLOCK 0.5-IN OTU SPLICE CHUCK, SURE-LOCK® F5TCA SLOCK II 0.5-in. ANCHOR, SURE-LOCK® F500SL21.2 SLOCK 0.5-IN X 1.2 2PC. WEDGES AND SCAW SOUTH AFRICA (Pty)LIMITED WIRE AND STRAND 0.5-IN DIAMETER, ASTM A-416 270 KSI LOW RELAXATION SEVEN-WIRE STRAND MILL CERTIFICATE 2100824 remained intact and performed satisfactorily during the two fatigue load tests performed in accordance with specifications for Unbonded Single Strand Tendons, issued by the Post Tensioning Institute. During static testing, loading was increased until the strand failed by rupture. A sketch of the test assembly is shown in Figure 1.

TESTING EQUIPMENT

Fatigue and static tests were performed using a MTS Model 880 materials testing system consisting of a 55 kip capacity load frame, a servo-controlled hydraulic actuator and a computer control station. The test assembly was mounted in the testing machine as shown in Figure 2 (fatigue) and Figure 3 (static).

Load measurement was accomplished by means of a strain gage load cell conditioned to give a DV voltage output in proportion to the magnitude of the load. The load cell is conditioned and calibrated annually by MTS to agree within 0.1% of a transducer certified by the National Institute for Science and Technology (NIST). Calibration certificates are available on request.

The testing machine has the capability to output the applied cyclic load in terms of maximum/minimum, load range or mean value. The load pulse was obtained using a function generator that produces a sine wave pattern. During static load testing, a monotonic loading function was used to increase the static load from near zero to maximum tensile load. Time, position of the actuator and loading were recorded during static load testing.

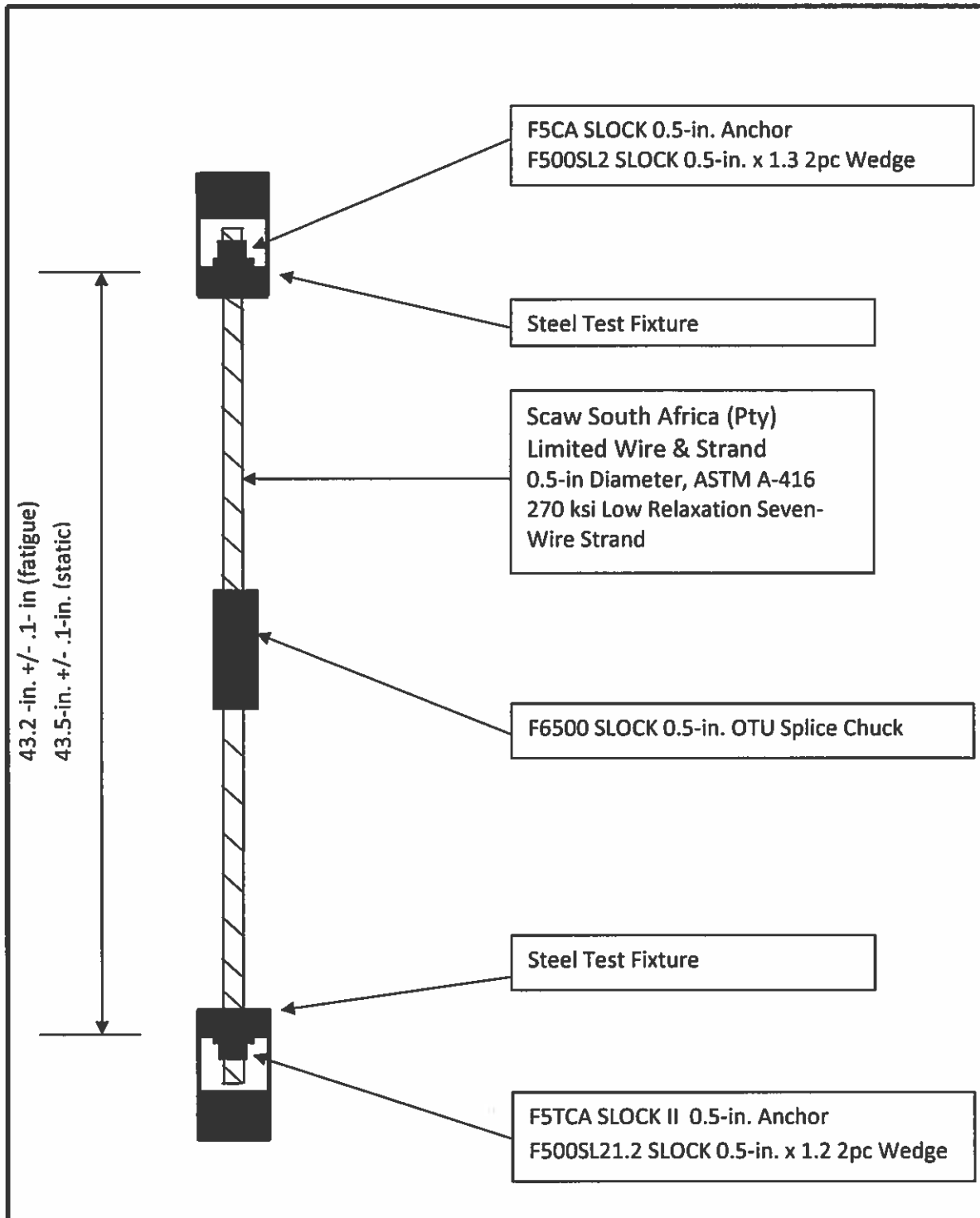


Figure 1. Test Assembly, 0.5-in Anchorage System



Figure 2. Fatigue Test Assembly Mounted in MTS

Model 880 Testing Machine



Figure 3. Static Test Assembly Mounted in MTS

Model 880 Testing Machine

TEST PROCEDURE

The same anchorage assembly and strand were used for the both fatigue tests. A new test assembly for static testing consisted of the same anchors, wedges, strand and test fixtures as used for fatigue testing.

Fatigue Load Test

Test 1 – Specimen 1 (Fig 2)

The anchorage assembly and strand were mounted in the testing machine as described above. A cyclic load test was the performed according to the following specifications.

Minimum Ultimate Tensile Strength of strand (MUTS): 41.3 kips
Low Load (60% MUTS): 24.8 kips
High Load (66% MUTS): 27.2 kips
Number of Cycles: 500,000
Cyclic Frequency: 10 Hz

The test was ran continuously

Test 2 - Specimen 1 (Fig 2)

The anchorage assembly and strand were mounted in the testing machine as described above. A cyclic load test was the performed according to the following specifications.

Minimum Ultimate Tensile Strength of strand (MUTS): 41.3 kips
Low Load (40% MUTS): 16.5 kips
High Load (80% MUTS): 33.0 kips
Number of Cycles: 50
Cyclic Frequency: 1 Hz

The test was ran continuously

Static Load Test

Test 3 – Specimen 2 (Fig 3)

The anchorage assembly and strand were loaded statically with the load value starting near zero and increasing until rupture of the test assembly.

TEST RESULTS

FATIGUE TEST RESULTS

Details of the test results are summarized on the Test Data Sheets.

The test assembly sustained the prescribed cyclic loads in Test No. 1 without slippage or other signs of distress.

Likewise, the test assembly sustained the prescribed cyclic loads in Test No. 2 without slippage or other signs of distress.

Thus, the 0.5-in Anchorage System successfully passed each fatigue test, meeting or exceeding the specifications of the Post Tensioning Institute.

STATIC TEST RESULTS

Details of the test results are summarized on the Test Data Sheets.

The maximum load sustained by the assembly was 41,200 lbf. A static load-strain curve for the assembly is given in appendix A-1.

FATIGUE LOAD TEST OF THE 0.5-IN ANCHORAGE SYSTEM

Test Data Sheet

Job No. CETL 02-06-01 February 6 – 7, 2015

Client: Precision-Hayes International
704B West Simonds
Seagoville, TX 75159

Test No. 1

Assembly: SURE-LOCK® F5CA SLOCK 0.5-IN. ANCHOR, SURE-LOCK® F500SL2 0.5-IN. x 1.3 2PC WEDGES, SURE-LOCK® F6500 SLOCK 0.5-IN OTU SPLICE CHUCK, SURE-LOCK® F5TCA SLOCK II 0.5-in. ANCHOR, SURE-LOCK® F500SL21.2 SLOCK 0.5-IN X 1.2 2PC. WEDGES AND SCAW SOUTH AFRICA (Pty)LIMITED WIRE AND STRAND 0.5-IN DIAMETER, ASTM A-416 270 KSI LOW RELAXATION SEVEN-WIRE STRAND MILL CERTIFICATE 2100824

Length: 43.2-in. +/- .1-in between anchors

Load: Based on Minimum Ultimate Tensile Strength (MUTS) of 41.3 kips
Low Load (60% MUTS): 24.8 kips
High Load (66% MUTS): 27.2 kips
Median Load: 26.0 kips
Amplitude: 1.24 kips

Frequency: 10 Hz

No. Cycles: 500,000

Results: The PRECISION-HAYES INTERNATIONAL SURE-LOCK® anchorage assembly was able to sustain the loads without any sign of slippage, distress or damage.

Attested: 
Shannon W. Hutchison

Date 5/15/15

FATIGUE LOAD TEST OF THE 0.5-IN ANCHORAGE SYSTEM

Test Data Sheet

Job No. CETL 02-06-01

February 6 – 7, 2015

Client: Precision-Hayes International
704B West Simonds
Seagoville, TX 75159

Fatigue Load Test

Assembly: SURE-LOCK® F5CA SLOCK 0.5-IN. ANCHOR, SURE-LOCK® F500SL2 0.5- IN. x 1.3 2PC WEDGES, SURE-LOCK® F6500 SLOCK 0.5-IN OTU SPLICE CHUCK, SURE-LOCK® F5TCA SLOCK II 0.5-in. ANCHOR, SURE-LOCK® F500SL21.2 SLOCK 0.5-IN X 1.2 2PC. WEDGES AND SCAW SOUTH AFRICA (Pty)LIMITED WIRE AND STRAND 0.5-IN DIAMETER, ASTM A-416 270 KSI LOW RELAXATION SEVEN-WIRE STRAND MILL CERTIFICATE 2100824

Length 43.2-in. +/- .1-in between anchors

Load: Based on Minimum Ultimate Tensile Strength (MUTS) of 41.3 kips
Low Load (40% MUTS): 16.5 kips
High Load (80% MUTS): 33.0 kips
Median Load: 24.8 kips
Amplitude: 8.26 kips

Frequency: 1 Hz

No. Cycles: 50

Results: The PRECISION-HAYES INTERNATIONAL SURE-LOCK® anchorage assembly was able to sustain the loads without any sign of slippage, distress or damage.

Attested: 
Shannon W. Hutchison

Date 5/15/15

STATIC LOAD TEST OF THE 0.5-IN ANCHORAGE SYSTEM

Test Data Sheet

Job No. CETL 02-06-01

February 6 – 7, 2015

Client: Precision-Hayes International
704B West Simonds
Seagoville, TX 75159

Static Load Test

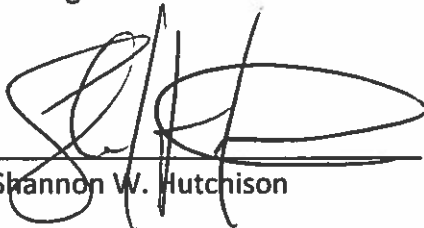
Assembly: SURE-LOCK® F5CA SLOCK 0.5-IN. ANCHOR, SURE-LOCK® F500SL2 0.5- IN. x 1.3 2PC WEDGES, SURE-LOCK® F6500 SLOCK 0.5-IN OTU SPLICE CHUCK, SURE-LOCK® F5TCA SLOCK II 0.5-in. ANCHOR, SURE-LOCK® F500SL21.2 SLOCK 0.5-IN X 1.2 2PC. WEDGES AND SCAW SOUTH AFRICA (Pty)LIMITED WIRE AND STRAND 0.5-IN DIAMETER, ASTM A-416 270 KSI LOW RELAXATION SEVEN-WIRE STRAND MILL CERTIFICATE 2100824

Length 43.5-in. +/- .1-in between anchors

Load: A new anchorage assembly was loaded from a near zero load to rupture using a monotonically increasing load function. Time, actuator position and load magnitude were recorded throughout the static load test and used to develop the load-strain curve given in the appendix. Strain was calculated as the change in length of the strand divided by the original length between the anchors.

Results: The strand ruptured at a maximum load of 41,200 lbf. Three wires ruptured on the top anchorage assembly at the point where the strand entered the wedges. The anchors remained intact with no damage observed.

Attested:


Shannon W. Hutchison

Date

5/15/15

CIVIL ENGINEERING TESTING LABORATORY
Department of Civil and Environmental Engineering
Texas Tech University
Lubbock, TX 79409

CERTIFICATION OF TEST REPORT

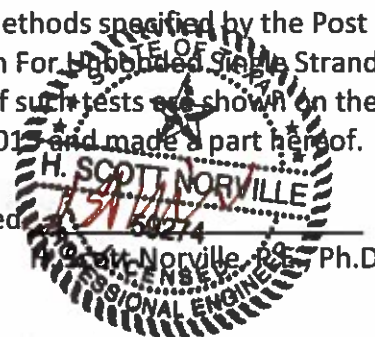
Client: Precision-Hayes International

Date: May 15, 2015

State of Texas
County of Lubbock:

H. Scott Norville, P.E., Ph.D. being duly sworn, deposes and says that he is employed by Texas Tech University; that tests of the PRECISION-HAYES INTERNATIONAL SURE-LOCK® anchorage system consisting of a SURE-LOCK® F5CA SLOCK 0.5-IN. ANCHOR, SURE-LOCK® F500SL2 0.5-IN. x 1.3 2PC WEDGES, SURE-LOCK® F6500 SLOCK 0.5-IN OTU SPLICE CHUCK, SURE-LOCK® F5TCA SLOCK II 0.5-in. ANCHOR, SURE-LOCK® F500SL21.2 SLOCK 0.5-IN X 1.2 2PC. WEDGES AND SCAW SOUTH AFRICA (Pty)LIMITED WIRE AND STRAND 0.5-IN DIAMETER, ASTM A-416 270 KSI LOW RELAXATION SEVEN-WIRE STRAND MILL CERTIFICATE 2100824 were made under his supervision; that to the best of his knowledge and belief such tests were made in accordance with the particulars relating to such tests set forth in the testing methods specified by the Post Tensioning Institute and meet all requirements of the Specification For Unbonded Single Strand Tendons (PTI M10.2-00) Sections 2.2.1.1 and 2.2.1.2. The results of such tests are shown on the attached Test Report No. CETL 02-06-01 and dated February 14, 2015 and made a part hereof.

Signed



H. Scott Norville, P.E., Ph.D.

STATE OF TEXAS

COUNTY OF LUBBOCK

Subscribed and sworn to before
Me this 15 day of May.

Debbie Starcher

Notary Public of Texas

Commission Expires

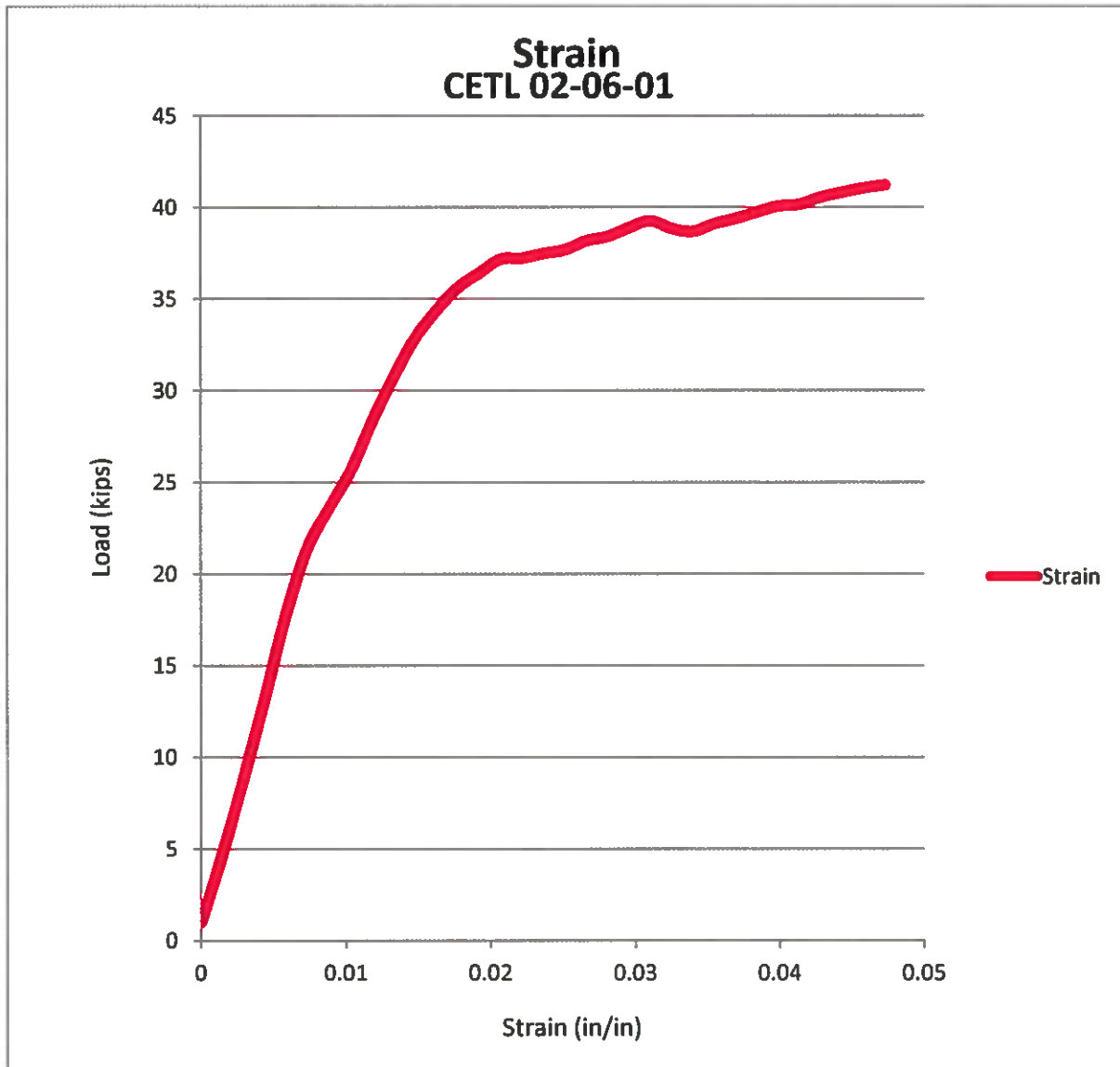
7/27/18



Notary without Bond

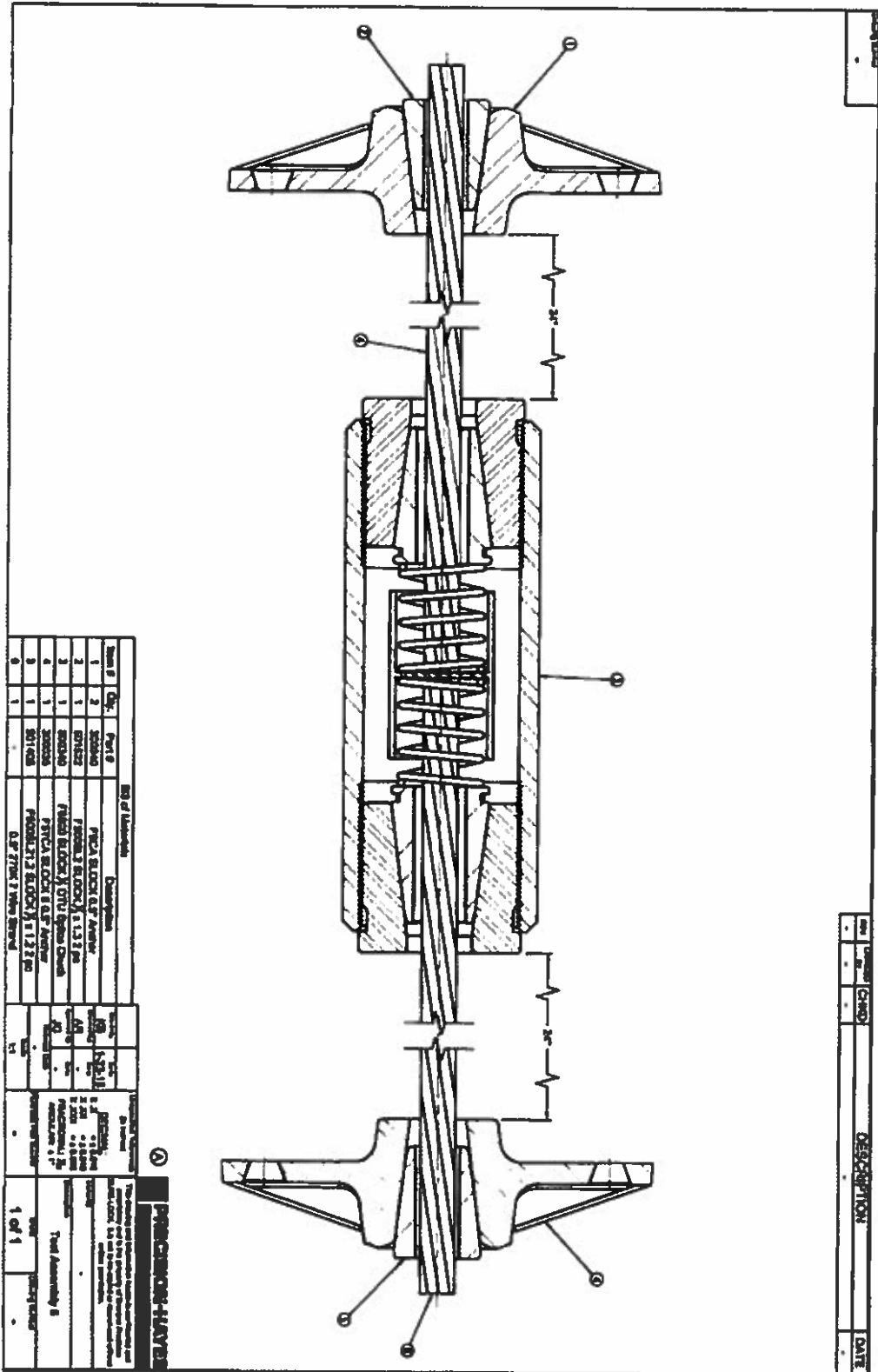
APPENDICES

1. Static Load-Strain Curve
2. Drawing – SURE-LOCK® Test Assembly
3. Drawing – SURE-LOCK® F5CA SLOCK 0.5-in. Anchor
4. Certification – SURE-LOCK® F5CA SLOCK 0.5-in. Anchor Material Certification
5. Drawing – SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Detail
6. Certification – SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Quality Certification
7. Certification – SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Heat Certification
8. Certification – SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Product Certification
9. Drawing – SURE-LOCK® F6500 SLOCK 0.5-in. OTU Splice Chuck Detail
10. Certification – SURE-LOCK® F500SL2R SLOCK 0.5-in. 2pc W/Ring Quality Certification
11. Certification – SURE-LOCK® F6500 SLOCK 0.5-in. OTU Splice Chuck Body Material Certification
12. Certification – SURE-LOCK® F6500 SLOCK 0.5-in. OTU Splice Chuck Cap Product Certification
13. Certification – SURE-LOCK® F500SL2R SLOCK 0.5-in. 2pc W/Ring Product Certification
14. Drawing – SURE-LOCK® F5TCA SLOCK II 0.5-in. Anchor Detail
15. Certification – SURE-LOCK® F5TCA SLOCK II 0.5-in. Anchor Material Certification
16. Drawing – SURE-LOCK® F500SL21.2 SLOCK 0.5-in. x 1.2 2pc Wedge Detail
17. Certification – SURE-LOCK® F500SL21.2 SLOCK 0.5-in. x 1.2 2pc Wedge Heat Certificate
18. Certification – SURE-LOCK® F500SL21.2 SLOCK 0.5-in. x 1.2 2pc Wedge Product Certificate
19. Scaw Metals Group Seven Strand Test Certificate
20. Scaw Metals Group Seven Strand Mill Certificate
21. Scaw Metals Group Seven Strand Stress-Strain Curve



**A-1. CETL 02-06-01, Load-Strain Curve
(Stain = elongation/[length between anchors])**

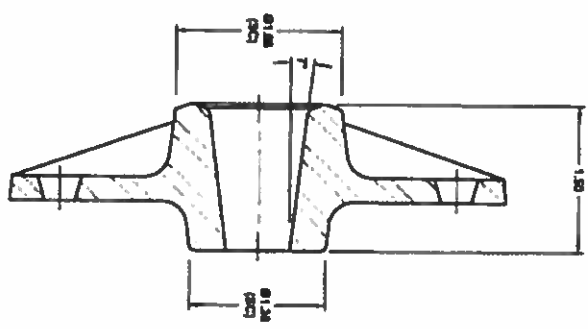
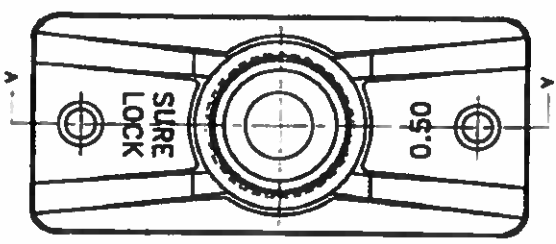
Note – The original seating load for the anchors was 20,000 lbf. The testing of the assembly until failure resulted in additional wedge seating, and therefore movement above 20,000 lbf. This additional seating of the assembly affected the linearity of the curve relative to the individual strand stress-strain curve.



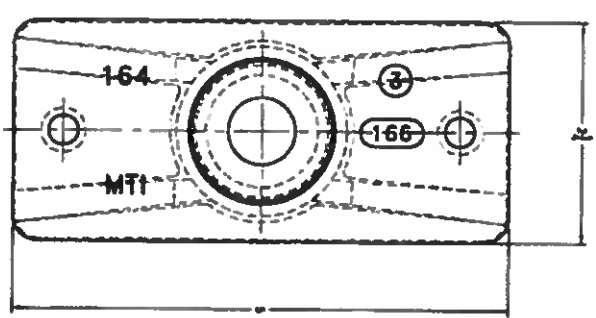
REV	DATE	DESCRIPTION

Item #	Qty.	Part #	Description	Notes	Material	Finish	Quantity	Assembly
1	2	000000	FLANGE BLOCK (L/R ANGLE)					
2	1	000000	FLANGE BLOCK (L/R ANGLE)					
3	1	000000	FLANGE BLOCK (L/R ANGLE)					
4	1	000000	FLANGE BLOCK (L/R ANGLE)					
5	1	000000	FLANGE BLOCK (L/R ANGLE)					
6	1	000000	FLANGE BLOCK (L/R ANGLE)					
7	1	000000	FLANGE BLOCK (L/R ANGLE)					
8	1	000000	FLANGE BLOCK (L/R ANGLE)					
9	1	000000	FLANGE BLOCK (L/R ANGLE)					

A-2. SURE-LOCK® Test Assembly



Section View A-A



Part No.	9400000
Rev.	1
QTY	1
DATE	12-17-17
BY	MTI
CHKD	MTI
APP'D	MTI
DESCRIPTION	Anchor (See Detail 9400000)
PROJECT	F5CA SLOCK (F) Anchor
DATE	12-17-17
1 OF 1	03000040

A-3. SURE-LOCK® F5CA SLOCK 0.5-in. Anchor

Metal Technologies

Auburn Casting Center

Date & Time Emailed: 01/12/2015 4:52 PM

Sent To: Jon Douglas , Chris Jackson

SUBJECT: Product Material Certification (Ductile Iron)

Customer Part # & Rev. Level: 910425	
Description: SureLock Anchor	MTI Part Number: 910425
Product Cast Date: 01/09/2015	15009 ZM

This is to certify that for the period the subject castings were in production, our process was in control and producing ductile iron in conformance to:

Specification #: A536G80

Grade: A536 80-55-06 BHN187

Typical Chemistry		Typical Mechanical		BHN Range
Carbon (C):	3.822	Ultimate PSI:	111,000	227 - 239
Silicon (Si):	2.567	Yield PSI:	62,000	
Manganese (Mn):	0.382	Elongation %:	7.0%	
Sulfur (S):	0.009	Matrix Structure		Radioscopy
Phosphorous (P):	0.017	Nodularity %	99	<input type="checkbox"/> Acceptable
Magnesium (Mg):	0.045	Pearlite %	79	
Copper (Cu):	0.390	Carbide %	1	

* This data parameter is not a requirement of the material specifications of this job.

Sincerely,



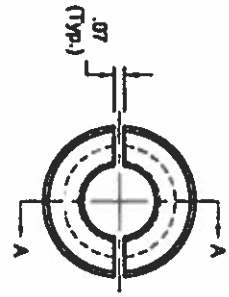
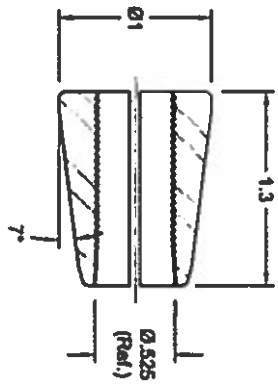
Mr. David Kesse
Metallurgist

MELTED AND MANUFACTURED IN THE USA

METAL TECHNOLOGIES - AUBURN CASTING CENTER - 1637 AUBURN DRIVE - AUBURN, IN 46706 - USA TEL: 360-573-1410

A-4. SURE-LOCK® F5CA SLOCK 0.5-in. Anchor Material Certification

Drawing Number
Q501522



Section View A-A

PROUDEN SURE-LOCK <small>This drawing and information herein is confidential and proprietary and is the property of Proudens Sure-LOCK. It is not to be copied or reproduced without permission.</small>		Description: F500SL2 SLOCK 1/2" x 1.3 Wedge 2 pc	Drawing Number: Q501522
Revision: C	Date: 6-20-11	Drawing Number: 12L14	
Drawn by: RGB	Date: 6-20-11		
Checked by: JK	Date: 6-20-11		
Released Date: 6-27-12			
Scale: 1:1			

A-5. SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Detail

Quality Certification

Precision SURE-LOCK® certifies that the products referenced herein comply with the specifications of the Post-Tensioning Institute.

S.O. #: Texas Tech Date: 1/26/2015 Quantity: 16

PO #: _____

PSL Part No.: 501522 Desc: F500SL2 SLOCK 1/2 X 1.3 2PC

Customer Part #: _____ The products referenced herein comply with the specifications of ICC-

PSL Thread Form #: ES02-0001 AC 303 as listed in ICC-ESR-2381.

Heat Treat Lot # (s):

270568									

Base Material

Material: 12L14		Specification: ASTM-A108							
Chemistry	C	Mn	P	S	Si	Ni	Mo	Cr	Pb
AISI Min /Max	0 / 0.15	0.85 / 1.15	0.04 / 0.09	0.28 / 0.35	-	-	-	-	0.15 / 0.35
Compliance	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	Yes

PSL Heat Treat Specification: ES01-0003

Heat Treat	Hardness: HRC	Case Depth (in.)
Minimum:	58	0.013
Compliance:	Yes	Yes

PSL Quality Assurance:

Heat Treat	Hardness: HRC	Inspected Qty
Minimum:	58	50
Compliance:	Yes	Yes


 PSL Quality Authorized Signature

1/26/2015
 Date

Precision SURE-LOCK® maintains physical documentation of the above properties. Precision SURE-LOCK® recommends that Precision SURE-LOCK® components be used only in combination with other Precision SURE-LOCK® anchorage products. Modification to the product or use with products other than Precision SURE-LOCK® brand may void warranty.

MADE IN THE USA

A-6. SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Quality Certification



CERTIFICATION

Order No.: 270568
 Date: 01/22/2015
 Page: 1 of 2

To: **PRECISION SURE-LOCK, INC.**
 704 W. SIMONDS RD. STE B
 SEAGOVILLE TX 75159

Purchase Order No.: 54401
 Material: 12L14
 Customer Spec
 79-83 HRA, .015-.025" Per PO Instructions
 I.A.W. PSL Engineering Standard ES-001
 Revision E

Quantity	Part Number / Part Name / Part Description	Container	Pounds
3,600	HT501522 F500SL2 SLOCK 1/2 x 1.3 2 PC Tub#C04	Tub 8	493
3,600	HT501522 F500SL2 SLOCK 1/2 x 1.3 2 PC Tub#106A		493
3,600	HT501522 F500SL2 SLOCK 1/2 x 1.3 2 PC Tub#17B		493
3,600	HT501522 F500SL2 SLOCK 1/2 x 1.3 2 PC Tub#51A		493
3,600	HT501522 F500SL2 SLOCK 1/2 x 1.3 2 PC Tub# 13B		493
3,600	HT501522 F500SL2 SLOCK 1/2 x 1.3 2 PC Tub# 249		493

ENERPAC
 PRECISION SURE-LOCK
 HEAT TREAT VERIFICATION

79	80	81	82	83	84	85
10	4	5	19	13	6	2

50

C. B. *[Signature]* DATE 1-22-15

Customer Requirements: 79-83 HRA, .015-.025" Per PO
 Machine #2144
 Recipe #130
 Total Parts Processed- 1/20/2015
 Reworked Parts Reprocessed- N
 Defective Parts Reprocessed, Date Reprocessed- N/A
 Quantity of Parts Inspected-60
 Inspected By- Eduardo Coria

Temp. Type	Scale	Minimum	Maximum	Insp. Type	Scale	Minimum	Maximum	Value
Customer Requirements:				Results:				
Surface	HRA	79.0	83.0	Surface Hardness	HRA	80.7	85.5	
Method: E18				Date Tested: 1/21/2015				

IMPORTANT STATEMENT:
 Test specimens and testing conforms to applicable ASTM Standards, unless otherwise specified per written customer requirement. Reported values apply to the sample(s) tested and/or inspected and are not necessarily

[Signature]
 Daryl Holsager
 Quality Representative
 Texas Heat Treating, Inc.

All Rights Reserved © 2011 USA

A-7. SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Heat Certification



ST. LOUIS GOLD DRAWN
PRODUCER OF GOLD FINISHED STEEL BARS

PRODUCT CERTIFICATION

WORK ORDER
011590


LOT NUMBER
Y100270

SALES ORDER / RLS
002906 / 004

CERT ID / REV
00021991 / 01

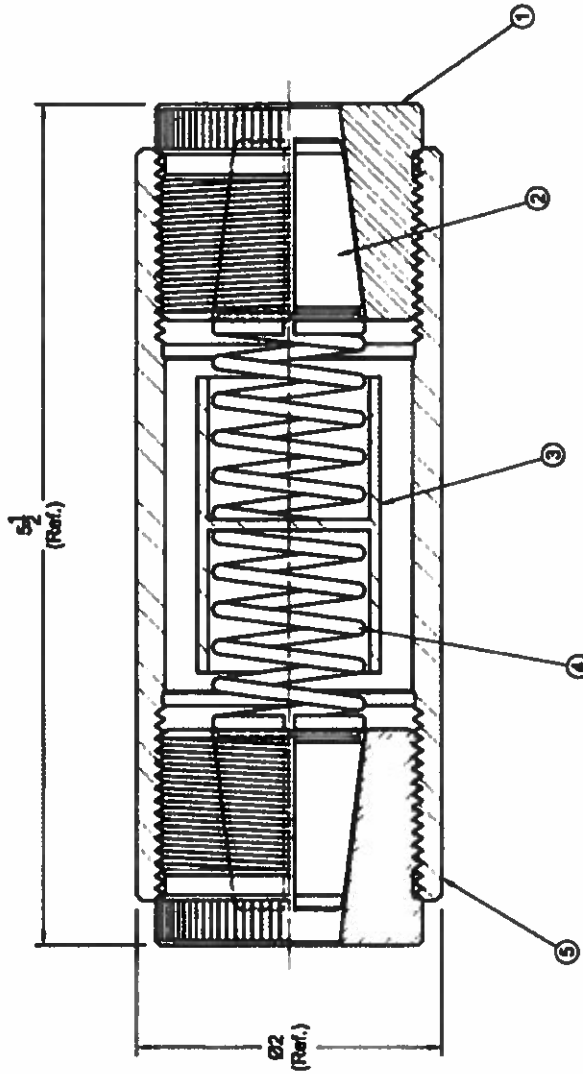
SOLD TO

Precision Sure-Lock
704 West Simonds
Seagoville, TX 75159
USA

CUSTOMER P.O. 62587	CUSTOMER PART 100120	QUANTITY 2,979 Lbs	Bundle 1	LADING NO 00009401	SHIPMENT DATE 01/06/2015					
SPECIFICATION DRD1000012L14PSL- Size Min/Max: 0.9980/1.0000" Shape: Round Form: Dead Length Grade: 12L14 Length Min/Max: 192.000/194.000" Paint Color: BLUE - BOTH ENDS										
CERTIFICATION REQUIREMENTS 1. Material produced to ASTM A-108 or applicable customer requirements. 2. Physical result tested in accordance with ASTM A-370. 3. Chemistry result as supplied by hot rolled mill.										
Chemical										
C	Mn	P	S	Si	Cu	Ni	Mo	Cr	Cb	V
0.07	1.14	0.044	0.312	0.014	0.069	0.034	0.007	0.029	0.003	0.0
Al	N	Pb	Sn	B	NCMC					
0.0024	73	0.259	0.007	0.0	.14					
Mechanical										
TEST	UNITS	Result								
Tensile Strength (PSI)	PSI	73660								
End of Certification										
I certify that the above figures are a true and correct copy of those contained in the records of this company.										
										
Date Printed: 01/06/2015		Page 1 of 1								

A-8. SURE-LOCK® F500SL2 SLOCK 0.5-in. x 1.3 2pc Wedge Product Certification

Drawing Number
Q500340



PRECISION SURE-LOCK

This drawing and information herein is confidential and proprietary and is the property of Empiris Precision SURE-LOCK. It is not to be copied or reproduced without written permission.

Revision	B
Drawn by	KB
Check by	RB
Released Date	3-6-12
Scale	1:1

Item #	Qty.	Part #	Description
1	2	520415	.5 OTU Thread Splice Chuck End
2	2	501440	F500SL2R SLOCK 1/2" 2 pc w/ Ring
3	1	300015	OTU Splice Chuck Spring Spacer
4	2	300012	1" x 2" Chuck Spring Q-81407
5	1	520405	.5 OTU Thread Splice Chuck Body

Material	As noted
Description	F6500 SLOCK X" OTU Splice Chuck
Sheet	1 of 1
Drawing Number	Q500340

A-9. SURE-LOCK® F6500 SLOCK 0.5-in. OTU Splice Chuck Detail

Quality Certification

Precision SURE-LOCK® certifies that the products referenced herein comply with the specifications of the Post-Tensioning Institute.

S.O. #: **N/A** Date: **1/16/2015** Quantity: **3,600**
 PO #: **N/A**
 PSL Part No.: **501440** Desc: **F500SL2R SLOCK 1/2 2 PC W/RING**
 Customer Part #: **SAM E**
 PSL Thread Form #: **ES02-0001**

Heat Treat Lot # (s): **61683**

--	--	--	--	--	--

Base Material

Material: 12L14		Specification: ASTM- A108							
Chemistry	C	Mn	P	S	Si	Ni	Mo	Cr	Pb
AISI Min /Max	0 / 0.15	0.85 / 1.18	0.04 / 0.09	0.28 / 0.35	-	-	-	-	0.15 / 0.35
Compliance	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	Yes

PSL Heat Treat Specification: ES01-0003

Heat Treat	Hardness: HRC	Case Depth (in.)
Minimum:	58	0.013
Compliance:	Yes	Yes

PSL Quality Assurance:

Heat Treat	Hardness: HRC	Inspected Qty
Minimum:	58	50
Compliance:	Yes	Yes

NORBERTO JIMENEZ
 PSL Quality Authorized Signature

1/16/2015
 Date

Precision SURE-LOCK® maintains physical documentation of the above properties. Precision SURE-LOCK® recommends that Precision SURE-LOCK® components be used only in combination with other Precision SURE-LOCK® anchorage products. Modification to the product or use with products other than Precision SURE-LOCK® brand may void warranty.

MADE IN THE USA



3756 FARM ROAD 250
P. O. BOX 0146
LONE STAR TX 75668

Material Test Report

Customer Order No: 54147 Scot Order No: 657593.01

PRECISION HAYES INTERNATIONAL PO BOX 3241 MILWAUKEE WI 53201-3241	Material Supplier: 640.00 Part Number: Scot Rec. No: 10121545
---	---

Heat Number: 4111291	Grade: St52.3	Dimensions: 2.000" OD 1.617" ID
Scot Spec: MS-1545	ASTM Spec: A513	Other Spec:
Description: ERW * DOM * Stress Relieve Annealed * Low Carbon, High Manganese Mechanical Tubing		

Chemical Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	V
	0.16	1.40	0.013	0.004	0.19	0.04	0.03	0.05	0.01	0.003	0.027	0.002
	Ca	N										
	0.0034	0.006										

Mechanical Test Results				
Yield Strength:(PSI)	Tensile Strength:(PSI)	Elongation:(%) in 2" G.L.	ROA:(%)	Hardness
89200	103700	18.6		99(HRB)

Temp	Energy ()				Shear Area (%)			
	1	2	3	Avg	1	2	3	Avg

Eddy Current

The reported analysis and test results are certified to be the same as furnished to us by our supplier. All records and test reports covering the above materials are on file at Scot Industries and may be examined by your personnel or by any agent authorized by you.

Scott Matney
Quality Assurance

12/02/14

A-11. SURE-LOCK® F6500 SLOCK 0.5-in. OTU Splice Chuck Body Material Certification



ST. LOUIS GOLD DRAWN
PRODUCER OF GOLD FINISHED STEEL BARS

PRODUCT CERTIFICATION

WORK ORDER
009881

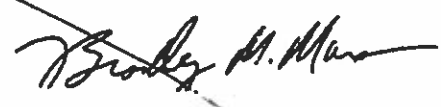
LOT NUMBER
M1410118

SALES ORDER / RL:
002290 / 02

CERT ID / REV
00019604 / 0

SOLD TO

Precision Sure-Lock
704 West Simonds
Seagoville, TX 75159
USA

CUSTOMER P.O. 51879	CUSTOMER PART 100145	QUANTITY 2,848 Lbs	Bundle 1	LADING NO 00008633	SHIPMENT DATE 11/05/2014					
SPECIFICATION URD175001045-PSL- Size Min/Max: 1.7480/1.7500" Shape: Round Form: Uniform Length Grade: 1045RV1 Length Min/Max: 180.000/204.000" Paint Color: PURPLE - BOTH ENDS										
CERTIFICATION REQUIREMENTS										
Material is 100% Melt, Rolled and Cold Drawn in USA										
Chemical										
C 0.47	Mn 0.79	P 0.014	S 0.02	Si 0.21	Cu 0.15	Ni 0.06	Mo 0.02	Cr 0.11	Cb 0.003	V 0.02
Al 0.0	N 78	Pb 0.0	Sn 0.008	B 0.0004	NCMC .34					
Mechanical										
TEST	UNITS	Result								
Yield Strength (PSI)	PSI	91690								
End of Certification										
I certify that the above figures are a true and correct copy of those contained in the records of this company.										
										
Date Printed: 11/05/2014		Page 1 of 1								

A-12. SURE-LOCK® F6500 SLOCK 0.5-in. OTU Splice Chuck Cap Product Certification



ST. LOUIS COLD DRAWN
PRODUCER OF COLD FINISHED STEEL BARS

PRODUCT CERTIFICATION

WORK ORDER
010018


LOT NUMBER
Y100662

SALES ORDER / RLS
002906 / 012

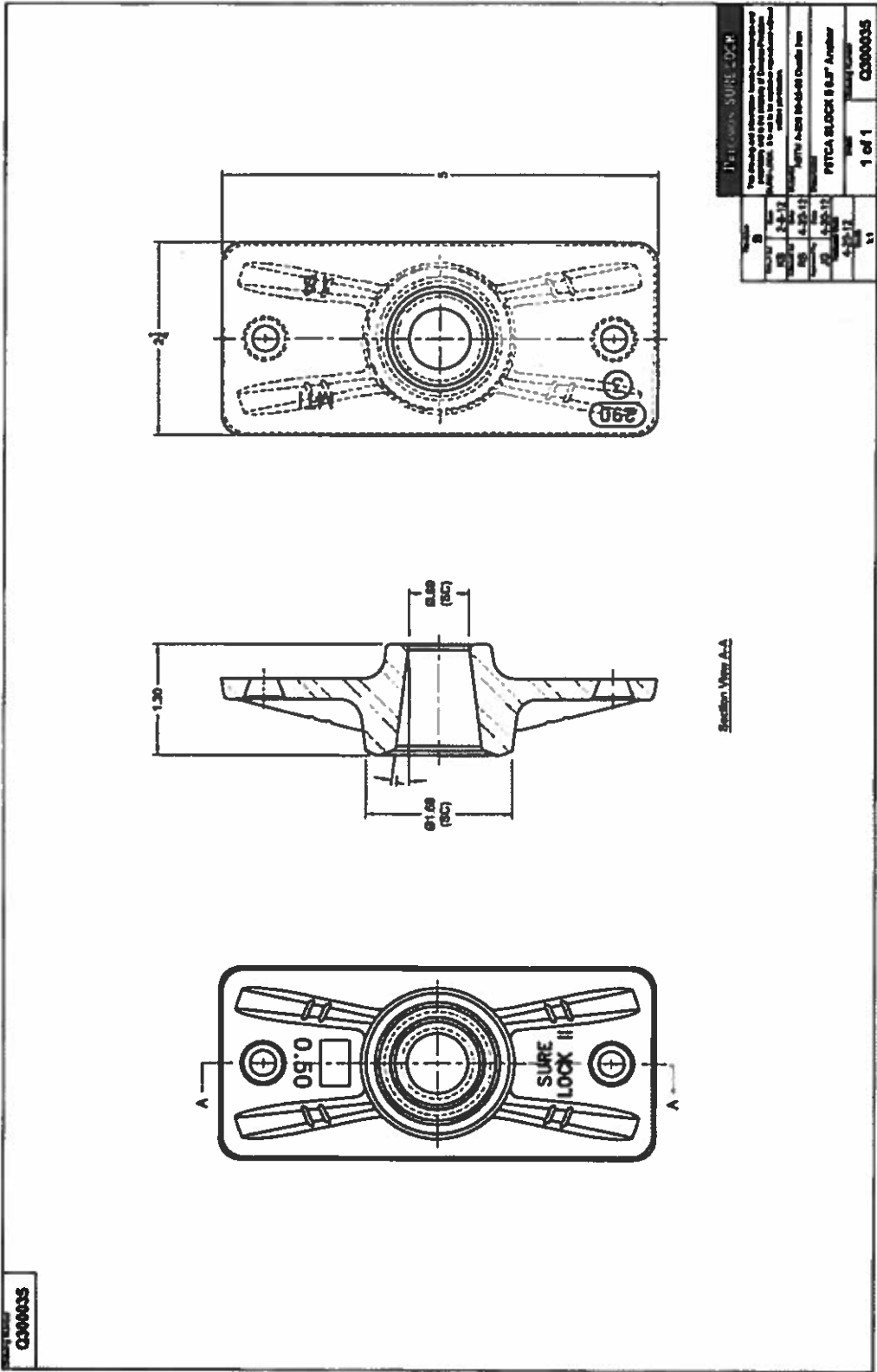
CERT ID / REV
00019388 / 01

SOLD TO

Precision Sure-Lock
704 West Simonds
Seagoville, TX 75169
USA

CUSTOMER P.O. 62587	CUSTOMER PART 100120	QUANTITY 24,484 Lbs	Bundle 6	LADING NO 00008668	SHIPMENT DATE 10/31/2014					
SPECIFICATION DRD1000012L14PSL- Size Min/Max: 0.9980/1.0000" Shape: Round Form: Dead Length Grade: 12L14 Length Min/Max: 192,000/194,000" Paint Color: BLUE - BOTH ENDS										
CERTIFICATION REQUIREMENTS										
1. Material produced to ASTM A-108 or applicable customer requirements. 2. Physical result tested in accordance with ASTM A-370. 3. Chemistry result as supplied by hot rolled mill.										
Chemical										
C	Mn	P	S	Si	Cu	Ni	Mo	Cr	Cb	V
0.061	1.15	0.045	0.308	0.02	0.072	0.038	0.012	0.027	0.0	0.002
Al	N	Pb	Sn	B	NCMC					
0.0027	89	0.252	0.006	0.0	.15					
Mechanical										
TEST	UNITS	Result								
Tensile Strength (PSI)	PSI	74010								
End of Certification										
I certify that the above figures are a true and correct copy of those contained in the records of this company.										
										
Date Printed: 10/31/2014	Page 1 of 1									

A-13. SURE-LOCK® F500SL2R SLOCK 0.5-in. 2pc W/Ring Product Certification



A-14. SURE-LOCK® F5TCA SLOCK II 0.5-in. Anchor Detail

NORTHERN FOUNDRY
 555 WEST 25TH
 HIBBING, MN 55746

Pg 1 of 1

Material Certifications

Part Number: 300035

Date Code: 340-14

Associated MetalCast, Inc

PO Box 7695

Ship to: 133 Airport Rd

Oxford

AL 36203

Bill of Lading:

601044

Specification:

ASTM 358 (80-85-06)

BHN Range:

187 - 255

THIS IS TO CERTIFY THAT THE LISTED DATA ARE OUR LAB RESULTS FOR REPRESENTATIVE SAMPLES FROM THE ABOVE DESCRIBED LOT AS TESTED IN ACCORDANCE WITH ASTM PROCEDURES. TEST RESULTS RELATE TO THE ITEMS TESTED. THIS CERTIFICATION MAY NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF THE NORTHERN FOUNDRY LABORATORY. ALL CASTING MELTED, MOLDED PRODUCED AT NORTHERN FOUNDRY HIBBING MINNESOTA USA.

Chemistry

%Si	2.58
%Mn	.32
%Cr	.05
%Ni	.02
%P	.011
%S	.007
%Cu	.37
%Al	.008
%Mg	.038
%Sn	.004
BAIRD OPERATING	MANUAL

%C	3.85
HOLDING FURNACE CARBON	

Physical Properties

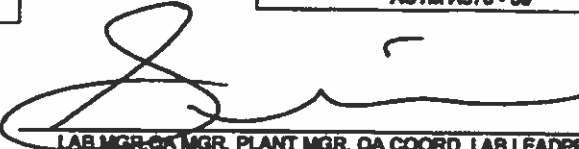
Tensile Strength (PSI)	90,300
Yield Strength (PSI)	81,000
Elongation (%)	10
ASTM E8 - 08	

Microstructure

Nodularity	99/100
Ferrite (%)	40
Pearlite (%)	60
Carbides (%)	0
ASTM A247 - 08	

Casting BHN	187-197
ASTM A370 - 09	

12-7-14
 DATE

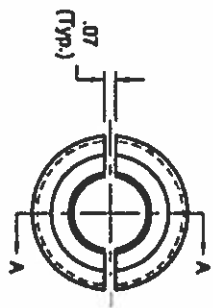
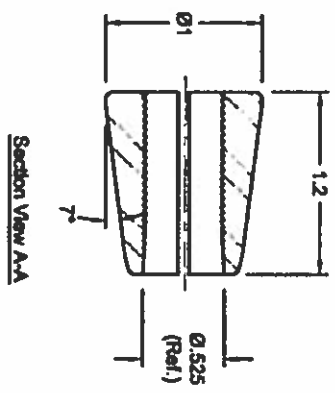

 LAB MGR, QA MGR, PLANT MGR, QA COORD, LAB LEADPERSON

IF YOU RECEIVE THIS CERTIFICATION BY FACSIMILE IN ERROR PLEASE DEEM IT CONFIDENTIAL, NOTIFY THE SENDER AND DESTROY.

QD188-2

A-15. SURE-LOCK® F5TCA SLOCK II 0.5-in. Anchor Material Certification

Drawing Number
Q501405



Revision		Description	
Rev	Date	By	Date
C	6-20-12	KB	6-20-12
R	6-20-12	RJB	6-20-12
JK	6-20-12	JK	6-20-12
1:1		1 of 1	

PRECISION SURE-LOCK

This drawing and information herein is confidential and proprietary and is the property of Eberhard Proxision SURE-LOCK. It is not to be copied or reproduced without permission.

12L14
 F500SL21.2 SLOCK
 1/2" x 1.2 pc
 Drawing Number
Q501405

A-16. SURE-LOCK® F500SL21.2 SLOCK 0.5-in. x 1.2 2pc Wedge Detail



Hayes Specialty Machining Test Certificate # HA2115-017

Part ID #: T000261

Description: WEDGE, 0.500, OTU, 2PC, 1.2, NO RING, NO GROOVE,
0001404 *

Lot Quantity Certifying: 10.0000 EA 10 SETS OF PARTS

Hardness Testing Per:

Hayes Specialty Machining Heat Treating Specifications

Sample Tested:

Piece # 1 RA: 85.0	Piece # 6 RA: 85.0
Piece # 2 RA: 85.0	Piece # 7 RA: 85.0
Piece # 3 RA: 85.0	Piece # 8 RA: 85.0
Piece # 4 RA: 85.0	Piece # 9 RA: 85.0
Piece # 5 RA: 85.0	Piece # 10 RA: 85.0

Raw Material Certification #: Y102388

(Copy of Certificate Attached)

Heat Treat Certification #: HA2115-017

Quality Assurance

1/15/2015

Date:

14030 Florence Rd • Sugar Land, Texas 77478
Phone: 281.340.6965 • Fax: 281.565.8116
Email: sales@hayspecialty.com

A-17. SURE-LOCK® F500SL21.2 SLOCK 0.5-in. x 1.2 2pc Wedge Heat Certificate



ST. LOUIS COLD DRAWN
PRODUCER OF COLD FINISHED STEEL BARS

PRODUCT CERTIFICATION

WORK ORDER
011206

LOT NUMBER
Y102368

SALES ORDER / RLS
003679 / 003

CERT ID / REV
00021224 / 01

T 000261

SOLD TO

Hayes Specialty Machine, LTD.
209 West Hamilton
Trenton, TX 75490
USA

CUSTOMER P.O. PRODUCTION ORDER	CUSTOMER PART DRD1000012L14HAYS	QUANTITY 11,993 Lbs	Bunde 3	LADING NO 00009111	SHIPMENT DATE 12/08/2014					
SPECIFICATION Size Min/Max: 0.9880/1.0000" Shape: Round Form: Dead Length Grade: 12L14 Length Min/Max: 168.000/170.000" Paint Color: NONE										
CERTIFICATION REQUIREMENTS										
Chemical										
C	Mn	P	S	Si	Cu	Ni	Mo	Cr	Cb	V
0.07	1.15	0.044	0.305	0.015	0.141	0.068	0.017	0.045	0.0	0.003
Al	N	Pb	Sn	B	NCMC					
0.003	86	0.25	0.009	0.0	.27					
End of Certification										
<p><i>REC'D 12-16-14</i></p> <p>I certify that the above figures are a true and correct copy of those contained in the records of this company.</p> <p><i>Bradley M. Mann</i></p>										
Date Printed: 12/08/2014					Page 1 of 1					

A-18. SURE-LOCK® F500SL21.2 SLOCK 0.5-in. x 1.2 2pc Wedge Product Certificate



Scaw South Africa (Pty) Limited
 Wire & Strand
 67 Koppies Street
 Lechleria East
 Compton, 481
 South Africa
 P O Box 62, Compton
 Graham, 1491, South Africa
 Tel: +27 11 976 2800
 Fax: +27 11 976 2200
 Website: www.scaw.co.za

TEST CERTIFICATE No. 2100824
 RELATING TO MILL CERTIFICATE No. 2100824 Page 2 of 10

PRODUCT SPECIFICATION	
Specification:	ASTM A416, 270k
Diameter and Grade:	0.5 inch
Min. Ultimate strength and Type:	12.7 mm, 1860 [270] low relaxation strand to ASTM A416
Min. Breaking Load:	41300 lbf
Min % Elongation on 24 inch:	3.5
Min Force at 1% Ext:	37170 lbf

NOMINAL PHYSICAL PROPERTIES	
Steel Area:	0.153 inch ²
Lay Length:	7.0 inch
Mass:	0.521 lbs/ft

PACKING LIST

Coil Number	Constriction at break	Approximate Length (ft)	Nett Mass (lbs)	Gross Mass (lbs)
JCC-EA-PL39-8A	For all strands - ductile wire breaks visible to the naked eye	11809	8072	8118
JCC-EA-PL39-8B		12395	8485	8488
JCC-EA-PL39-8C		12387	8451	8485
JCC-EA-PL39-6D		12396	8455	8488
JCC-EA-PL3A-4A		12167	8338	8380
JCC-EA-PL3A-4B		12370	8442	8488
JCC-EA-PL3A-4C		12367	8451	8495
JCC-EA-PL3A-4D		12367	8461	8495
Total		88148	61112	61483

All strands were subjected to a continuous thermal mechanical treatment. See attached - load extension diagrams for full test results.

Date: 22 November 2011

Certified correct:

Standard	Y10	Y10	Y10	Y10	Y10	Y10	Y10	Y10	Y10
ASTM A416	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9

SCAW METALS GROUP
 67 Koppies Street
 Lechleria East
 Compton, 481
 South Africa

SCAW METALS GROUP

Scaw South Africa (Pty) Limited
 Wire & Strand
 99 Steynen Court
 Inyanga East
 Grahamstown, 4891
 South Africa

P.O. Box 82, Geyser
 Country, 1491, South Africa
 Tel: +27 11 270 2000
 Fax: +27 11 970 2100
 Website: www.scaw.co.za

MILL CERTIFICATE No: 2100824
OF CHEMICAL ANALYSIS AND INSPECTION Page 1 of 10

CUSTOMER DETAILS	
Customer:	CRP
Customer Order No.:	46830
Our Works Order:	SMG 450611

PRODUCT DESCRIPTION	
Product:	7 Wire PC Strand
Specification:	ASTM A416, 270k
Diameter and Grade:	0.5 Inch
Designation:	12.7 mm, Grade 1860 (270) low relaxation strand to ASTM A416-LHL

SHIPMENT DETAIL		
Quantity Despatched:	No. of Coils	8
	Gross lbs	51485
	Net lbs	51112
Container No.:	NODU 272303-9	
Seal No.:	0001841	
Date Despatched:	21 November 2011	
Address:	7200 Greenleaf ave, suite #330 WHITTIER CA 90602, USA HOUSTON	
Cast/Heat No.:	Refer to Load - extension diagrams attached	

Date: 22 November 2011

Verified:

G. WARD
 Technical Manager

Element	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
Carbon	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Manganese	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Phosphorus	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Sulfur	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Chromium	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Nickel	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Copper	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Aluminum	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Silicon	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Iron	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975	99.975



SCAW METALS GROUP
 Scaw South Africa (Pty) Limited
 Wire and Strand
 40 Dundas Street
 Industrial Estate, Germiston
 Gauteng, 1401
 South Africa
 P.O. Box 22, Germiston
 Gauteng, 1402, South Africa
 Tel: +27 11 874 3388
 Fax: +27 11 874 2700
 Website: www.scaw.co.za

Test No 42004
 ASTM A416 Z70K, :: 3884
 PSI Pack Number: JCC-EA-PL3A-4D

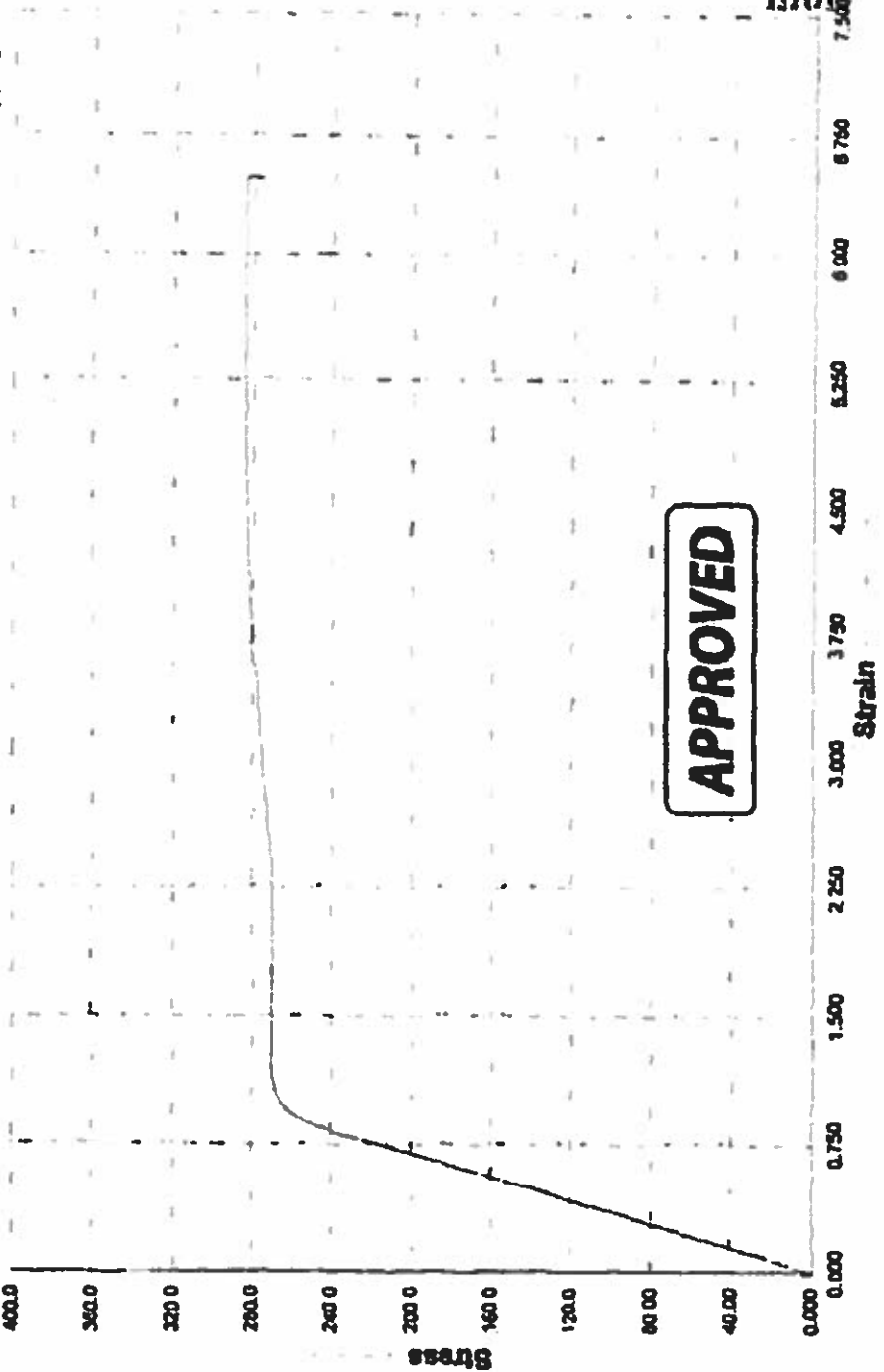
2011-08-17

UCPHANT/1
 MEASURE/2

REPORTING	
No.	
Rev.	
App'd	
By	
For	
By	
DATE	
COMPLIANCE LEVEL	
CONFORMS TO	

THIS REPORT IS THE PROPERTY OF SCAW METALS GROUP. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF SCAW METALS GROUP.

tsan



Stress (MPa)	Strain	Stress (ksi)	Strain
0.000	0.000	0.000	0.000
40.00	0.750	5.775	1.042
80.00	1.500	11.550	2.083
120.00	2.250	17.325	3.125
160.00	3.000	23.100	4.167
200.00	3.750	28.875	5.208
240.00	4.500	34.650	6.250
280.00	5.250	40.425	7.292
320.00	6.000	46.200	8.333
360.00	6.750	51.975	9.375
400.00	7.500	57.750	10.417

A-21. Scaw Metals Group Seven Strand Stress-Strain