

Reference1-
Impact Test Results

A DIVISION OF J. T. ADAMS Co., INC.

4520 WILLOW PARKWAY
CLEVELAND, OHIO 44125
PHONE: (216) 641-3290
FAX: (216) 641-1223
www.tensile.com



TENSILE TESTING
METALLURGICAL LABORATORY

CERTIFIED TEST REPORT

Job No.: 1812-21-1550

[Paul Okocha]
Lokring
36376 Apollo Parkway
Willoughby OH 44094

Date: 1n/2019
Cust. PO#: 29867-00
This report is amended on 1/28/2019

Description: 1 Sample(s) Round Bar 15V24 Bar 1.750" Dia.

Part#	ID#
1020237	@+500F

Material: 16V24 Heat# LOK180233
Spec: LMS 92-10C

TEST RESULTS

Part#	CharpyType	Charpy Size	Dir	Test Temp, (°F)	Item	Energy (ft-lba) (ft-lba)	LaI Exp, (Mlis)	%Shear (%)
1020237	V-Notch	Full	Long	+500	1	[REDACTED]	[REDACTED]	[REDACTED]
					2			
					3			
					Avg.			

Test Method:

ASTM E23-18, Type A, Striker Radius 8mm

"Amendment: DescripUon, Heat#, Part#



[
Michael Gaydos
Michael Gaydos,
Quality Supervisor
]

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This report represents Tensile Testing Interpretation of the results obtained from the test and is not to be construed as a Warranty or Warranty of the condition of the materials tested. Tensile Testing shall not be held liable for misinterpretation of conditions, loss, damage, injury or death arising from or attributable to delay preceding a test or subsequent to performance of a test. Unless otherwise noted, all testing reported herein was done at room temperature. All work performed in accordance with TTML QA Manual Rev D 02115/07.



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CERTIFIED TEST REPORT

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Willoughby OH 44094

Job No.: 1812-21-1550

Date: 1/7/2019
Cust. PO#: 29867-00

*This report is amended on 1/28/2019

Description: 1 Sample(s) Round Bar 15V24 Bar 1.750" Dia.

Part#	ID#
1020237	@+70F

Material: 15V24 Heat# LOK180233

Spec: LMS 92-10C

TEST RESULTS

Part#	Charpy Type	Charpy Size	Dir	Test Temp. (°F)	Item	Energy (ft-lbs) (ft-lbs)	Lat. Exp. (Mils)	% Shear (%)
1020237	V-Notch	Full	Long	+70	1	[REDACTED]	[REDACTED]	[REDACTED]
					2			
					3			
					Avg.			

Test Method:

ASTM E23-18, Type A, Striker Radius 8mm

*Amendment: Description, Heat#, Part#



[*Michael Gaydos*]
Michael Gaydos,
Quality Supervisor

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**CERTIFIED TEST REPORT****Job No.:** 1812-21-1550

[Paul Okocha]
Lokring
38376 Apollo Parkway
Willoughby OH 44094

Date: 1/7/2019
Cust. PO#: 29867-00

*This report is amended on 1/28/2019

Description: 1 Sample(s) Round Bar 15V24 Bar 1.750" Dia.

Part#	ID#
1020237	@-20F

Material: 15V24 Heat# LOK180233**Spec:** LMS 92-10C**TEST RESULTS**

Part#	Charpy Type	Charpy Size	Dir	Test Temp. (°F)	Item	Energy (ft-lbs) (ft-lbs)	Lat. Exp. (Mils)	% Shear (%)
1020237	V-Notch	Full	Long	-20	1	[REDACTED]	[REDACTED]	[REDACTED]
					2			
					3			
					Avg.			

Test Method:

ASTM E23-18, Type A, Striker Radius 8mm

*Amendment: Description, Heat#, Part#



[*Michael Gaydos*]
Michael Gaydos,
Quality Supervisor

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CERTIFIED TEST REPORT

[Paul Okocha]
Lokring
38376 Apollo Parkway
Willoughby OH 44094

Job No.: 1812-21-1550

Date: 1/7/2019
Cust. PO#: 29867-00

*This report is amended on 1/28/2019

Description: 1 Sample(s) Round Bar 15V24 Bar 1.750" Dia.

Part#	ID#
1020237	@-40F

Material: 15V24 Heat# LOK180233

Spec: LMS 92-10C

TEST RESULTS

Part#	Charpy Type	Charpy Size	Dir	Test Temp. (°F)	Item	Energy (ft-lbs) (ft-lbs)	Lat. Exp. (Mils)	% Shear (%)
1020237	V-Notch	Full	Long	-40	1	[REDACTED]	[REDACTED]	[REDACTED]
					2			
					3			
					Avg.			

Test Method:

ASTM E23-18, Type A, Striker Radius 8mm

*Amendment: Description, Heat#, Part#



[Michael Gaydos]
Michael Gaydos,
Quality Supervisor

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CERTIFIED MILL TEST REPORT

R481734

Alton Steel Test Lab
#5 Cut Street
Alton, IL 62002-9011
(618) 463-4490 EXT 2486
(618) 463-4491 (Fax)

BILL TO		SHIP TO	
EMJ Company 2060 Enterprise Pkwy Twinsburg, OH 44087		EMJ Company 2060 Enterprise Pkwy Twinsburg, OH 44087	
Date 05/21/2018	Customer PO P856652-429	Specifications SAE 15V24 ASTM A29-16, ASTM A576-90b (12)	
ASI Ord No. 91367	Customer PT. 546272		
ASI Ord Line Item 1			

Item Description: Steel Bar, Hot Rolled, 1.7500, 20' 0" Strand Cast, RR =20.37:1

Heat Number: 188400 Yield PSI: [REDACTED] Tensile PSI: [REDACTED] % Elongation: [REDACTED] % ROA: [REDACTED] BHN: [REDACTED]

CHEMICAL ANALYSIS TEST METHODS ASTM E-415 & E-1019

Heat #	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	Nb/Cb	V	B	Ti	N	Pb	Ca
188400	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0.25	0.097	0.154	0.028	0.011	0.003	0.003	[REDACTED]	0.003	0.0016	[REDACTED]	0.0050	0.0026

JOMINY HARDENABILITY USING ASTM A-255 CALCULATED FROM CHEMICAL DE

Heat Number: 188400 SS DI
8 2.08

SPECIAL TEST RESULTS

ADDITIONAL COMMENTS

conforms to LMS 92-10

No mercury, lead, radium, or alpha containing material or equipment is used or deliberately added in the production of this steel. No weld or weld repairs were performed on this material. This Steel is 100% Electric Arc Furnace Melted and Rolled in the U.S.A. Material qualifies as NAFTA origination.

Subscribed and sworn to before me, a Notary Public, in and for the county of Madison, State of Illinois

This _____ Day of _____

My commission expires _____

(Notary Public)

Alteration or reproduction of this report, except in full, is not allowed without written approval by a representative of Alton Steel Incorporated.

I hereby certify that the above tests are correct as contained in the records of ALTON STEEL INCORPORATED

Quality Leader: Josh Levi

[Signature]

CERTIFIED TRUE COPY OF ORIGINAL MTR
ID NUMBER: Lok 180233
PART NUMBER: 1020237
P/O#: 28754 LMS [92-10]
VENDOR: EMJ
DATE: 7-10-18 PMV & QA *[Signature]*

~~Confidential Information Submitted Under 10 CFR 2.390~~

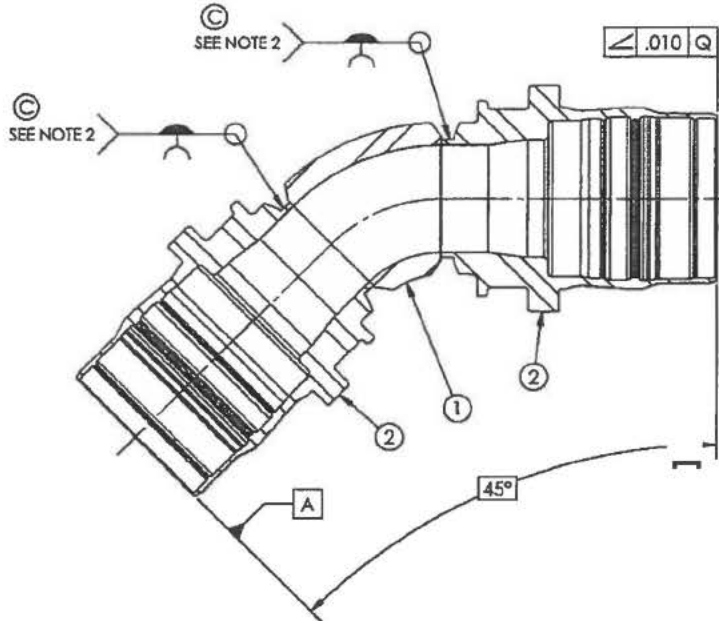
Reference 2-
Welding Procedure and Qualification Record.

~~This information is a trade secret or confidential and not subject to disclosure under any federal or state freedom of information law or regulation.~~

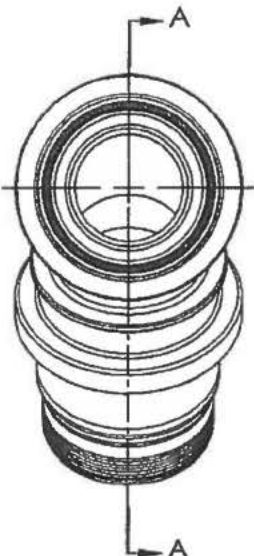
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	8062205	MAS-P12-EL45-BW	1
2	8060642	MAS-P12-HB-MACH	2

REVISIONS				
BY	REV.	DESCRIPTION	DATE	APPROVED
GSS	B	SEE ECRN: T050602B	050602	AAM
SAS	C	SEE ECRN: T140324B	140324	MJS

NOTES:



SECTION A-A



PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS
DRAWING IS THE SOLE PROPERTY OF
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REPRODUCTION IN PART OR AS A WHOLE
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OF LOCKING TECHNOLOGY, LLC IS
PROHIBITED.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN GSS	NAME GSS	DATE 010604
TOLERANCES:	FINISHED	AAM	010604
	ENG APPR.	AAM	010604
	MFG APPR.		
MATERIAL			
INTERPRET GEOMETRIC TOLERANCING PER ASME Y14.5-2009 DO NOT SCALE DRAWING			
TITLE: MAS-P12-EL45-WA		SIZE B	DWG. NO. 8060643
		REV C	
		0.56 LBS.	SHEET 1 OF 1



LOKRING MATERIAL SPECIFICATION

TITLE: LMS 92-10
15V24 MICRO ALLOYED CARBON STEEL BAR

REVISION HISTORY

<u>REV.</u>	<u>DESCRIPTION</u>	<u>DATE</u>	<u>BY</u>
C	[REDACTED]	17-Nov-03	AAM

1. Scope:

This specification is for hot rolled, [REDACTED] micro alloyed 15V24 carbon steel bar used to make LOKRING couplings. This material is intended to be machined, welded and forged.

2. Specification:

Bar shall conform to ASTM A 675 except as specified herein.

Chemistry: Material composition shall generally be as specified for ASTM A 576 grade 1524 with additions of vanadium and nitrogen. Chemistry shall be as specified below:

Carbon	0.19 – 0.26
Manganese	1.35 – 1.65
Phosphorus	0.040 Max.
Sulfur	0.050 Max.
Vanadium	0.100 Min.
Nitrogen	0.030 Max.

Addition of elements intended to enhance machinability, such as lead selenium, bismuth and tellurium are not allowed.

Surface: [REDACTED]

Straightness: bars shall be furnished with the standard straightness tolerance of [REDACTED] per ASTM A 29.

Mechanical Properties: Mechanical properties shall be as follows:

Ultimate Tensile Strength	110,000 – 130,000 PSI
Yield Strength (2% offset)	80,000 PSI, Minimum
Elongation	15%, Minimum

Grain Size: [REDACTED]

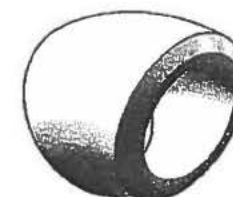
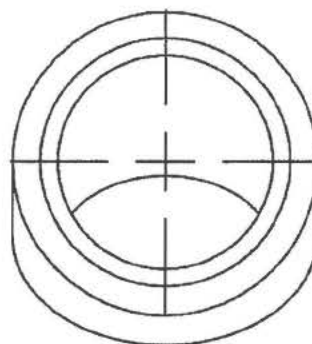
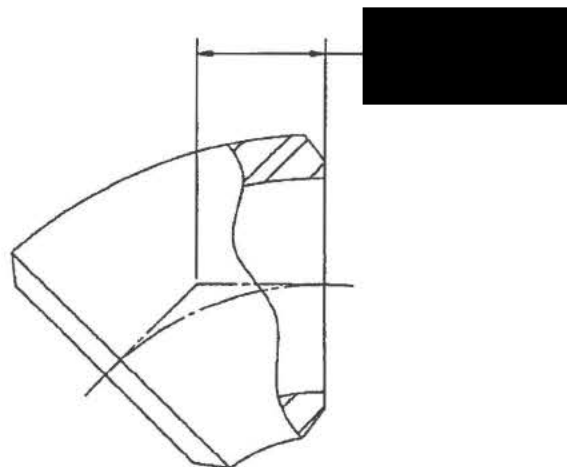
Certification: The material supplier shall provide a certification of conformance with each shipment that contains the following as a minimum:

- Name of manufacturer and location of mill
- LOKRING Purchase order number
- Size and alloy designation of material
- Material chemical analysis
- Heat number
- Actual mechanical properties
 - a) Material Yield Strength (0.2% offset)
 - b) Material Ultimate Tensile Strength
 - c) Percent Elongation
 - d) Material hardness
 - e) Grain Size
- Statement that material conforms to LOKRING material specification LMS 92-10

REVISIONS				
BY	REV.	DESCRIPTION	DATE	APPROVED
GSS	A	SEE ECRN: T050309A	050309	AAM
SAS	B	SEE ECRN: T140324B	140324	MJS

NOTES:

- EXCEPT WHERE SPECIFIED DIMENSIONS SHALL BE IN ACCORDANCE WITH ASME/ANSI B16.9 LATEST EDITION.
- 3/4" NPS SCH 80.
- MATERIAL OF CONSTRUCTION SHALL BE IN ACCORDANCE WITH ASTM A234 GRADE WPB LATEST EDITION.
- PART SHALL BE PERMANENTLY MARKED (STAMPED) WITH HEAT CODE IDENTIFICATION, 1/4" MINIMUM AWAY FROM WELDED EDGES.
- DIMENSION OF [REDACTED] MAY BE SUBSTITUTED AT SUPPLIER'S OPTION.



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: [REDACTED]	DRAWN	SFP	991208		TITLE: MAS-P12-EL45-BW
	CHECKED	AJG	991208		
	ENG APPR.	AAM	991208		
	MFG APPR.				
MATERIAL SEE NOTE 3			SIZE B	DWG. NO. 8062205	REV B
INTERPRET GEOMETRIC TOLERANCING PER ASME Y14.5-2009 DO NOT SCALE DRAWING			0.10 LBS. SHEET 1 OF 1		

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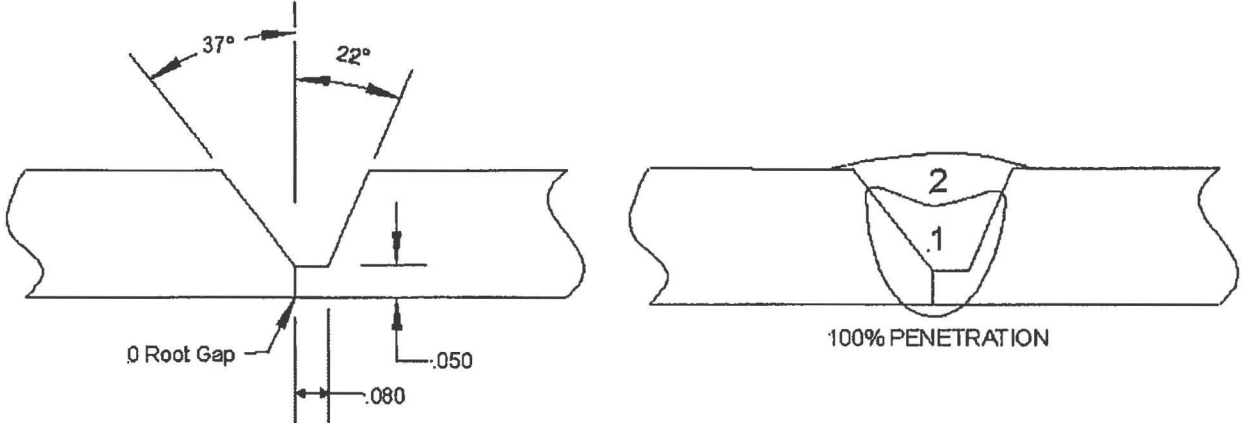
QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)

(See QW-200.2, Section IX, ASME Boiler & Pressure Vessel Code)

Page 1 of 2

Record Actual Conditions to Weld Test Coupon

Company Name		LOKRING TECHNOLOGY					
Procedure Qualification Record No.		LOK CS002		Revision	A	Date	9/8/2014
Welding Process(es)		GTAW-P			Type(s)	MACHINE	



BASE METAL (QW-403)				POST WELD HEAT TREATMENT (QW-407)			
Material Specification		ASTM A 106 (LOK090107)		Temperature		No PWHT Permitted	
Type or Grade		ASTM A106 Grade B		Time		None	
P-No.		1	To P-No.	1	Other		
Material Specification				GAS (QW-408)			
Type or Grade		ASTM A 576 Grade 1524		Type	Gas(es)	Mix in %	Flow Rate
P-No.		Unassigned	To P-No.	Unassigned	Shielding	ARGON	100%
Thickness of Coupon		.147"		Trailing	ARGON	100%	0 CFH
Diameter of Coupon		.840"		Backing	ARGON	100%	15 CFH
Other		NONE		ELECTRICAL CHARACTERISTICS (QW-409)			
FILLER METALS (QW-404)				Current	DC Pulsed	Amperage	160
SFA SPECIFICATION No.		A5.18		Polarity	EN	Voltage	9.8
AWS Classification		ER70 (Solid Wire)		Pulse	PPS	%Peak	% Background amps
Filler Metal F No(s).		F6			4	28%	65%
Weld Metal A No.		A1					
Filler Metal Size		0.0625		Electrode Size	1/8"	Electrode Type	1.5% Lanthanated
Other		Autogenous welding not permitted		Torch Type	Hot Wire Voltage	Torch offset	Electrode angle
Weld Metal Thickness		.062" - .240"		500 amp water cooled		Top Dead Center	0°
POSITION (QW-406)				TECHNIQUE (QW-410)			
Test Position		1G ROTATED		Travel Speed		3 RPM	
Other		NONE		Stringer or Weave		STRINGER	
PREHEAT (QW-406)				Torch Oscillation			
Preheat Temperature (Minimum)		~70° F		Multiple or single pass		MULTIPLE	
Interpass Temperature (Minimum)		N/A		Multiple or Single Electrode		SINGLE	
Other		Ref. WI-WELD-001 Section 5.1 & 9.0		Other		Two pass weld performed continuously in one operation.	
Additional Requirements:							
Equipment: Gentec Weld Lathe, w/Miller Maxstar 350 weld machine				Rev A - PQR reflects use of unassigned material			

FORM QW-483 (Back)							
Tensile Test (QW-150)					PQR No. <u>LOK CS002</u>		
Page 2 of 2							
Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress	Type of Failure and Location	
6302A		0.147	0.3191	25,700	80,539	Ductile Weld	
6302B		0.147	0.3191	25,900	81,166	Ductile Weld	
Guided-Bend Tests (QW-160)							
Type and Figure No.				Results			
Root Bend 1				Acceptable			
Face Bend 2				Acceptable			
Root Bend 3				Acceptable			
Face Bend 4				Acceptable			
Toughness Tests (QW-170)							
Specimen No.	Notch Location	Specimen Size	Test Temp	Impact Values			Drop Weight Break (Y/N)
				ft-lb or J	% Shear	Mils (In.) or mm	
Comments <u>Visual Results Acceptable</u>							
Fillet-Weld Test (QW-180)							
Results-Satisfactory: Yes <input type="checkbox"/> No <input type="checkbox"/> Penetration into parent Metal: Yes <input type="checkbox"/> No <input type="checkbox"/>							
Macro - Results _____							
Other Test							
Type Test _____							
Deposit Analysis _____							
Other _____							
Welder's Name <u>Jason Boling</u> Clock No. <u>310</u> Stamp No. <u>L4</u>							
Test Conducted By <u>Mark Demchak (Total Quality Testing Inc.)</u> Laboratory Test No. <u>1412-6302-1</u>							
We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.							
Organization <u>Lokring Technology LLC.</u>							
Date <u>12/16/2014</u> Certified by <u>[George Hodson]</u>							
(Detail of record of test are illustrated only and may be modified to conform to the type and number of tests required by the Code.)							

Total Quality Testing, Inc.

Lokring Technology LLC
38376 Apollo Pkwy.
Willoughby, OH 44094

Page 1 of 1
P.O. No.: 19693-00
TQT File No.: 1412-6302-1
Reported: 12-5-14
Revised: 12-16-14

Sample Description: ASME: Boiler & PVC, Section IX
WPS: LOK CS002
MATERIAL: ASTM A106 Gr. B to Lokring LMS 92-10
.840" DIA, X .147" WALL

TENSILE RESULTS:

<u>Sample ID</u>	<u>Thick</u>	<u>DIA</u>	<u>Area</u> (sq. in.)	<u>Load (lbs)</u>	<u>Ultimate Tensile</u>	<u>TYPE</u>
6302A	.147	.838	.3191	25,700	80,539	Ductile Weld
6302B	.147	.838	.3191	25,900	81,166	Ductile Weld

Bond Test Results:

Root Bend 1	Acceptable	No Defects
Face Bend 2	Acceptable	No Defects
Root Bend 3	Acceptable	No Defects
Face Bend 4	Acceptable	No Defects

Visual Results: Acceptable

By: [Mark Demchak] Date: 12-16-14
Mark Demchak
SNT-TC-1A NAS 410/LEVEL III
CWI #92060761



CERTIFICATE OF TEST

Page 01 of 02

Certification Date
1-AUG-2014

CUSTOMER ORDER NUMBER
✓ 10715-00

EARLE M. JORGENSEN COMPANY

Invoice Number
S956610

CUSTOMER PART NUMBER
✓ 1050400 LMS 92-10

2060 ENTERPRISE PRWY.
TWINSBURG OH 44087

SOLD TO: LOKRING TECHNOLOGY CORP 38376 APOLLO PARKWAY
WILLOUGHBY OH 44094

SHIP TO: LOKRING TECHNOLOGY CORP
38376 APOLLO PARKWAY
WILLOUGHBY OH 44094

Description: 15V24 HR LMS 92-10 REV C
✓ 1-3/4 RD S/C 0'2.55" (2.55") Line Total: 347.905 LB
✓ HEAT: 132895 ITEM: 546272

Specifications:
LMS 92-10 ASTM A29 12 ASTM A576 12

CHEMICAL ANALYSIS

CU	NI	CR
0.20	0.076	0.133
MO	BN	AL
0.023	0.011	0.001
NB	Y	B
0.002	0.0003	0.0012
CA		
0.0015		

RCPT: R304850
✓ VENDOR: ALTON STEEL INC (SEQ) ✓ COUNTRY OF ORIGIN:

MECHANICAL PROPERTIES

DESCRIPTION	YLD STR PSI	ULT TEN PSI	%ELONG IN 02 IN	%RED IN AREA	HARDNESS BHN
[REDACTED]					

IDEAL DIAMETER : 1.84 IN GRAIN SIZE : 8

RAW MAT'L MTR
ID NUMBER LOK 190277
PART NUMBER 1050400
P/O NUMBER 18715 LMS92-10
VENDOR EMS
DATE 8/1/14 QA JRC

The above data were transcribed from the manufacturer's Certificate of Test after verification for completeness and specification requirements of the information on the certificate. All test results remain the subject of examination.

We hereby certify that the material covered by this report will meet the applicable requirements described herein, including any specification forming a part of the description.

The willful recording of false, fictitious, or fraudulent statements in connection with test results may be punishable as a felony under federal statutes.

Material did not come in contact with mercury while in our possession.

JIM ROHN

MANAGER, QUALITY ASSURANCE

CERTIFICATE OF TEST



Page 02 of 02

Certification Date
1-AUG-2014

CUSTOMER ORDER NUMBER
✓ 10715-00

EARLE M. JORGENSEN COMPANY

Invoice Number
S956610

CUSTOMER PART NUMBER
✓ 1050400 LMS 92-10

2060 ENTERPRISE PKWY.
TWINSBURG OH 44087

SOLD TO: LOKRING TECHNOLOGY CORP
38376 APOLLO PARKWAY
WILLOUGHBY OH 44094

SHIP TO: LOKRING TECHNOLOGY CORP
38376 APOLLO PARKWAY
WILLOUGHBY OH 44094

Description: 15V24 HR LMS 92-10 REV C
-3/4 RD B/C 0'2.55" (2.55")
ITEM: 132896 ITEM: 546272

Line Total: 347.905 LB

MATERIAL IS FREE FROM MERCURY CONTAMINATION
NO WELD REPAIR PERFORMED ON MATERIAL

RAW MAT'L MTR
ID NUMBER L616140279
PART NUMBER 1050400
P/O NUMBER 9715 LMS 92-10
VENDOR EMS
DATE 8/4/14 QAOK

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Material did not come in contact with mercury while in our possession.

JIM ROHN

[Signature]

MANAGER, QUALITY ASSURANCE

R 164350

Alton Steel Test Lab
43 Cpt St/44
Alton IL 67002-9911
(618) 463-4190 EXT 2114
(618) 463-1191 (Fax)

RAW MAT'L MTH
PART I MTH
DATE 10/27/99
TIME 10:29
LMS TOS-100
LMS 4X-10
EIS SNA
QA OK

METALLURGICAL TEST CERTIFICATE
CERTIFICAT D'ESSAIS METALLURGIQUE

MR.E.G. RESCH
OHIO PIPE VALVES & FITTINGS INC.
3900 TRENT AVENUE
CLEVELAND, OH
USA 44109

stelpipe

Stelpipe Ltd.
A subsidiary of Stelmco Inc.

1/2 Sch 80 A106 *

P.O. BOX 1010
570 MAIN AVE
WILLIAM, ONTARIO L3B 5Y6
TEL: (416) 200-7257
FAX: (416) 200-7258
STELPIPE LTD.

OUR ORDER NO.
NOTRE N° DE COMMANDE

1 PAGE

DATE

REPORT NO.
N° DE RAPPORT

85417

CUSTOMER ORDER NO./N° DE COMMANDE DU CLIENT

064974

2 06 09 1001134

ASTM A106 99 GRB/ASME A106 GRB 99

SMLS HSR PIPE ASTM A106
GR B/ASME SA106 GR B REG
340" OD X 147" WALL

LB/ET
1.09

THE HENRY CHARTY TALL THE MATERIAL SHIPPED OF THE ORDER HAS BEEN TESTED AS-2/98 PARTS OF THE ORDER HAS BEEN TAKEN FROM THE LOT AS QUANTITY DESCRIBED, FOUND TO BE IN ACCORDANCE WITH THE SPECIFICATION AND/OR DRAWING THAT, SUBJECT TO THE COMPANY'S STANDARD PRACTICES OF RECORD KEEPING THE RESULTS ARE CONTAINED IN ITS RECORDS.

NOUS CERTIFIONS PAR LA PRÉSENTE QUE LE PRODUIT COMMANDE & FTE SOUS À DES ESSAIS OU INSPECTÉ OU LES DEUX À LA FOIS, À PARTIR D'ÉCHANTILLONS PRÉLEVÉS SUR LE LOT EN LA QUANTITÉ DÉCRITE, ET QU'IL EST CONFORME AUX NORMES OU AU DESIG OU LES DEUX À LA FOIS, SUIVANT DES MÉTHODES SUIVANT DE TRAVAIL DES DOSSIERS DE LA COMPAGNIE. LES RÉSULTATS SONT INSCRITS DANS SES DOSSIERS.

HEAT OR LOT NO.
N° DE COULÉE-N°
DE LOT

CHEMICAL ANALYSIS/COMPOSITION CHIMIQUE

A02478

C Mn P S Si Cu Ni Cr V Ca .0018 .020

Heat # A02478 - 1/2 80 BIK A106

RAW MAT'L MTR

ID Number: 1/2 80 BIK A106
Part Number: 576
P.O. Number: 7789
Vendor: OHIO PIPE

PRESSURE TESTED AT
PRESSION D'ESSAI

2500 PSI

HEAT OR LOT NO.
N° DE COULÉE-N°
DE LOT

A02478

DATE: 3/15/89

ROCKWELL R

77

CHARPY

SIZE/DIMENSION

%SA

LOT
NO.

MECHANICAL TESTS/ESSAIS MÉCANIQUES

PLATE/PLAQUE

DUCTILITY
DURETÉ

50% REDUCTION IN
THICKNESS

PASSED

REV. PLAT

REDUCTION EN

PLATE/PLAQUE

PLATE/PLAQUE

PLATE/PLAQUE

PLATE/PLAQUE

THIS CERTIFICATE MUST NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF STELPIPE LTD./LE PRÉSENT CERTIFICAT NE PEUT ÊTRE REPRODUIT QU'EN SA VERSION INTÉGRALE ET SANS L'AUTORISATION ÉCRITE DE STELPIPE LTD.



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TEST REPORT — EAR-CONTROLLED DATA

Date: 10/19/2018
P.O. No.: 29413-00
W/O No.: LOK003-18-10-96579-1
Date Received: 10/15/2018

Sample Description: Two (2) Test Pieces, Dwg. 8060643 Rev C, ASME BPVC IX-2017 Figure QW-462.12, QW-185.3

MICROSTRUCTURAL EVALUATION PER ASTM E 3, ASTM E 7, ASTM E 407

Direction	Transverse	Location	As Noted	Etchant	Nital
Magnification	100x			Mount #18J-333	

WELD A	Weld Top	Weld Center	Weld Bottom
Penetration	100%		
Cracks	None Observed	None Observed	None Observed
Fusion	Complete	Complete	Complete
Porosity	None Observed	None Observed	None Observed

WELD B	Weld Top	Weld Center	Weld Bottom
Penetration	100%		
Cracks	None Observed	None Observed	None Observed
Fusion	Complete	Complete	Complete
Porosity	None Observed	None Observed	None Observed

HARDNESS PROFILES PER ASTM E92

WELD A	
Location	Hardness HV10
Weld Top	Base metal
	HAZ
	Weld Metal
	HAZ
Weld Center	Base Metal
	Base metal
	HAZ
	Weld Metal
Weld Bottom	HAZ
	Base Metal
	Weld Metal
	Base metal

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 5, dated August 16, 2012. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

[*Paula Tesar*]
[Paula Tesar]
Quality Administrator



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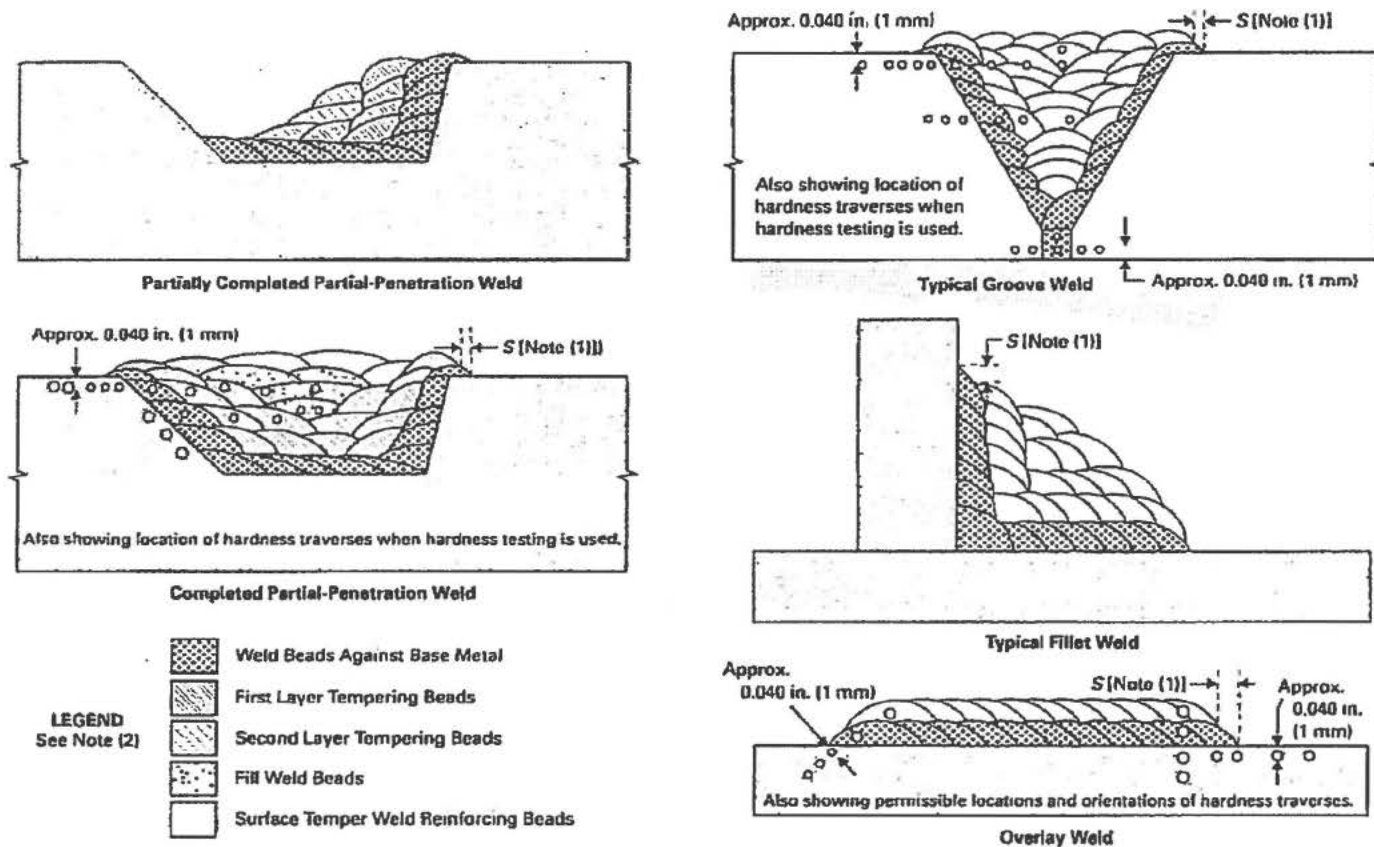
WELD B	
Location	Hardness HV10
Weld Top	Base metal
	HAZ
	Weld Metal
	HAZ
	Base Metal
Weld Center	Base metal
	HAZ
	Weld Metal
	HAZ
	Base Metal
Weld Bottom	Base metal
	HAZ
	Weld Metal
	HAZ
	Base Metal

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[Paula Tesar]
[Paula Tesar
Quality Administrator]

Figure QW-462.12
Nomenclature for Temper Bead Welding



GENERAL NOTES:

- (a) Weld beads shown above may be deposited in any sequence that will result in placement of the beads as shown.
- (b) Surface temper reinforcing beads may cover the entire weld surface, or may only be placed at the toe of the weld; they may or may not be mechanically removed.

NOTES:

- (1) The distance, S, is measured from the toe of the weld to the edge of the temper beads. Measurements shall be made parallel to the base metal surface.
- (2) Beads near the finished surface may be both tempering beads and surface temper reinforcing beads.

ASME BPVC.IX-2017

QW-462.4(b) or Figure QW-462.4(c). The test coupon for plate-to-plate shall be cut transversely to provide a center section approximately 4 in. (100 mm) long and two end sections, each approximately 1 in. (25 mm) long. For pipe-to-plate or pipe-to-pipe, the test coupon shall be cut to provide two quarter sections test specimens opposite to each other. One of the test specimens shall be fracture tested in accordance with QW-182 and the other macro-examined to the requirements of QW-184. When qualifying pipe-to-plate or pipe-to-pipe in the 5F position, the test specimens shall be removed as indicated in Figure QW-463.2(h).

QW-181.2.1 Production Assembly Mockups. Production assembly mockups may be used in lieu of the fillet-weld test coupon requirements of QW-181.2.

(a) Plate-to-Shape

(1) The mockup for plate-to-shape shall be cut transversely to provide three approximately equal test specimens not to exceed approximately 2 in. (50 mm) in length. The test specimen that contains the start and stop of the weld shall be fracture tested in accordance with QW-182. A cut end of one of the remaining test specimens shall be macro-examined in accordance with QW-184.

(b) Pipe-to-Shape

(1) The mockup for pipe-to-shape shall be cut transversely to provide two quarter sections approximately opposite to each other. The test specimen that contains the start and stop of the weld shall be fracture tested in accordance with QW-182. A cut end of the other quarter section shall be macro-examined in accordance with QW-184. When qualifying pipe-to-shape in the 5F position, the fracture specimen shall be removed from the lower 90-deg section of the mockup.

QW-182 FRACTURE TESTS

The stem of the 4 in. (100 mm) performance specimen center section in Figure QW-462.4(b) or the stem of the quarter section in Figure QW-462.4(c), as applicable, shall be loaded laterally in such a way that the root of the weld is in tension. The load shall be steadily increased until the specimen fractures or bends flat upon itself.

If the specimen fractures, the fractured surface shall show no evidence of cracks or incomplete root fusion, and the sum of the lengths of inclusions and porosity visible on the fractured surface shall not exceed $\frac{3}{8}$ in. (10 mm) in Figure QW-462.4(b) or 10% of the quarter section in Figure QW-462.4(c).

QW-183 MACRO-EXAMINATION — PROCEDURE SPECIMENS

One face of each cross section of the five test specimens in Figure QW-462.4(a) or four test specimens in Figure QW-462.4(d), as applicable shall be smoothed and etched with a suitable etchant (see QW-470) to give a clear definition to the weld metal and heat-affected zone. The examination of the cross sections shall include only one

side of the test specimen at the area where the plate or pipe is divided into sections i.e., adjacent faces at the cut shall not be used. In order to pass the test

(a) visual examination of the cross sections of the weld metal and heat-affected zone shall show complete fusion and freedom from cracks

(b) there shall be not more than $\frac{1}{8}$ in. (3 mm) difference in the length of the legs of the fillet

QW-184 MACRO-EXAMINATION — PERFORMANCE SPECIMENS

The cut end of one of the end plate sections, approximately 1 in. (25 mm) long, in Figure QW-462.4(b) or the cut end of one of the pipe quarter sections in Figure QW-462.4(c), as applicable, shall be smoothed and etched with a suitable etchant (see QW-470) to give a clear definition of the weld metal and heat-affected zone. In order to pass the test

(a) visual examination of the cross section of the weld metal and heat-affected zone shall show complete fusion and freedom from cracks, except that linear indications at the root not exceeding $\frac{1}{32}$ in. (0.8 mm) shall be acceptable

(b) the weld shall not have a concavity or convexity greater than $\frac{1}{16}$ in. (1.5 mm)

(c) there shall be not more than $\frac{1}{8}$ in. (3 mm) difference in the lengths of the legs of the fillet

QW-185 DIFFUSION WELDING — PROCEDURE AND PERFORMANCE QUALIFICATION SPECIMENS

QW-185.1 The test block shall be a minimum of 8 in. × 8 in. (200 mm × 200 mm) and of a thickness such that there are at least 50 interface planes being welded.

QW-185.2 A minimum of three tension test specimens in accordance with the requirements of SA-370 shall be taken perpendicular to the interface planes and three parallel to the interface planes. The tension test results shall comply with QW-153.

QW-153 Microstructural evaluation shall be conducted in accordance with the requirements of ASTM E3 on a minimum of three cross-sections, one each from the top, center, and bottom one-third of the test coupon. The samples shall be polished, etched, and shall be free from cracks and shall show no incomplete bond or porosity on or adjacent to the bond lines. Size of each sample shall be that which can be mounted and polished to allow examination with an optical microscope at 50× to 100× magnification.

~~Confidential Information Submitted Under 10 CFR 2.390~~

Reference 3-
Metallurgical Test Report.

~~This information is a trade secret or confidential and not subject to disclosure under any federal or state freedom of information law or regulation.~~



Metallurgical Testing Report

Metallography Report

Report Number: R-20181218-083 rev. 1

Prepared for:

[*Mark Sindelar*]
Lokring Technology LLC
38378 Apollo Parkway
Willoughby, OH 44094
P.O. #: 29874

Jan. 15. 2019



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Project Definition and Scope	3
Sample Identification	3
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Project Definition and Scope

Provide microphotographs of mounted samples.

Rev. 1 replaced images in Figure 14.

Sample Identification

Lokring Technology LLC submitted samples for evaluation. The NSL Metallurgical sample numbers, and the corresponding Lokring Technology LLC sample identifiers are listed in Table 1.

Table 1. Sample Identification

Sample Number	Client Label
S-181218-145	18J -333-1B
S-181218-146	18J -333-2A

Opinions and Interpretations

Microphotographs were taken of the mounts provided in the five areas described by customer during visit.

Sample S-181218-146 was mounted and repolished due to rounding of the sample.

Process Steps

Metallurgical preparations were made in accordance with ASTM E 3. The sample was rinsed with ethanol and acetone, pressure mounted with thermosetting epoxy resin, ground with silicon carbide abrasives, polished with diamond suspensions, and fine polished with alumina. Care was taken not to alter the microstructure during any of the above steps. Samples were microetched with 2% nital, per ASTM E 407

The evaluation was performed using optical microscopes and imaging system, per ASTM E 883. Client was present to select sites for digital microphotography.

Results

Photomicrographs of the mounted samples are contained in Figures 1-11 (S-181218-145) and Figures 12-24 (S-181218-146).

If you have any questions regarding these results, please contact us.

Report prepared by: Dave Kovarik, Metallurgist

Reviewed by: Rebecca Stawovy, Metallurgist

A handwritten signature in black ink, appearing to read "Rebecca Stawovy".

Figures

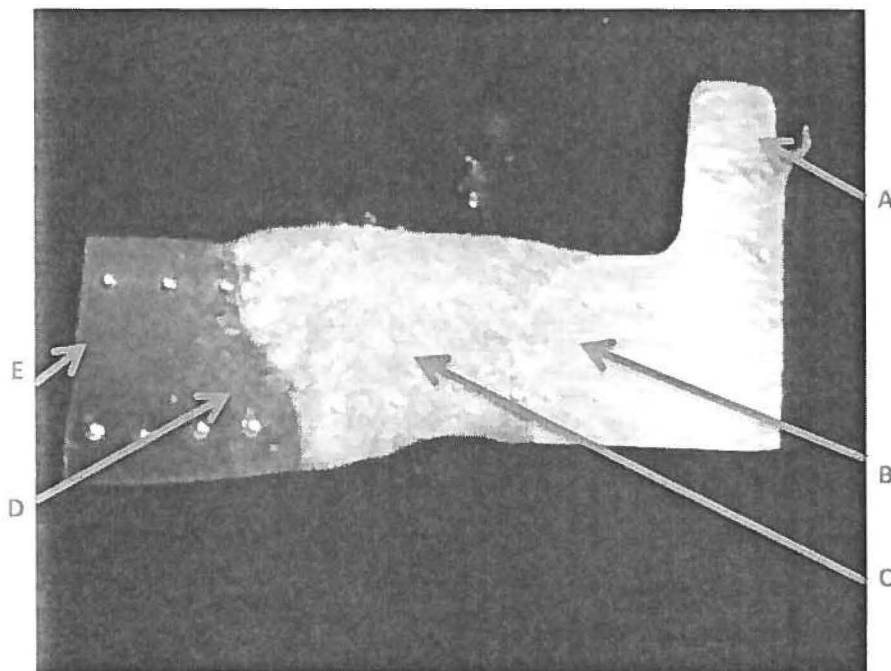


Figure 1. Macro photograph of mounted sample (S-181218-145).

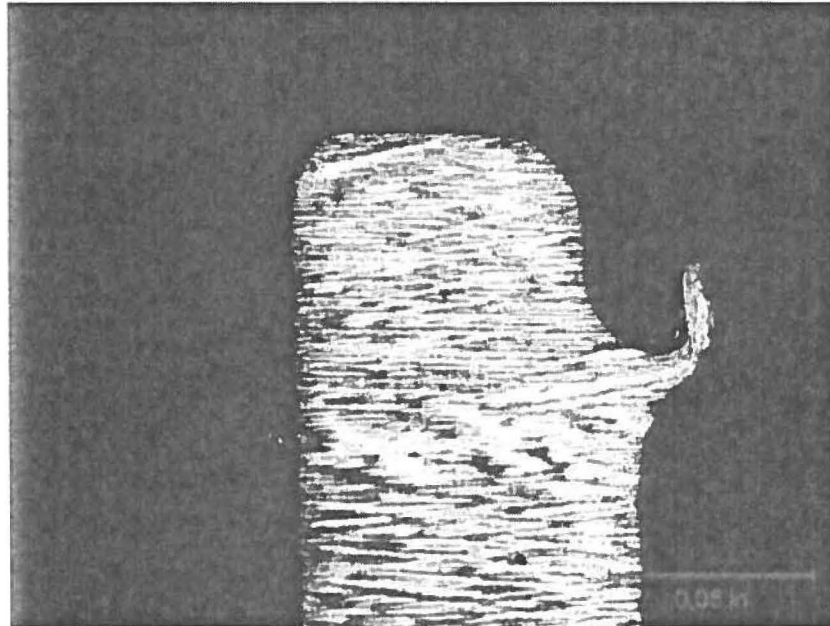


Figure 2. Macro photograph of mounted sample (S-181218-145), area A in Figure 1, 25x.

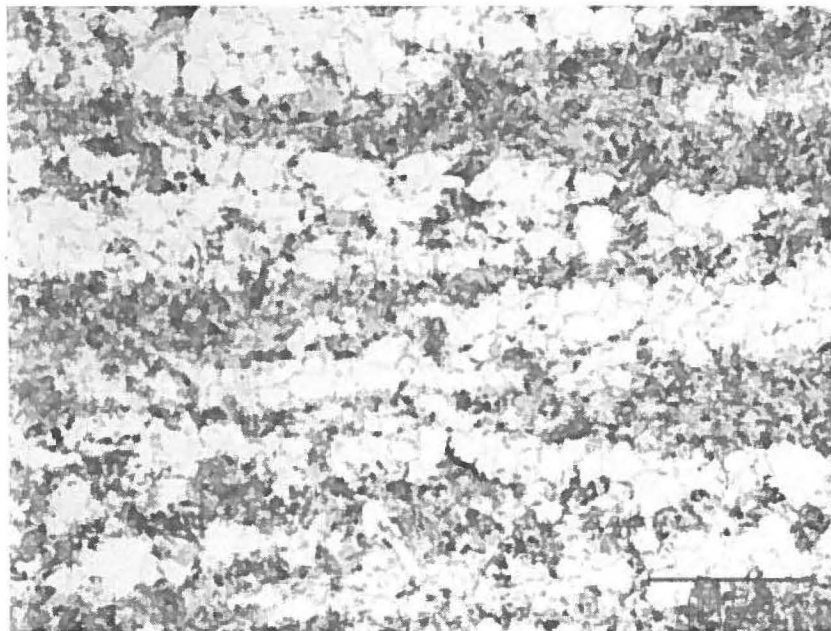


Figure 3. Macro photograph of mounted sample (S-181218-145), area A in Figure 1, 500x. Image is higher magnification photograph of the center of Figure 2.

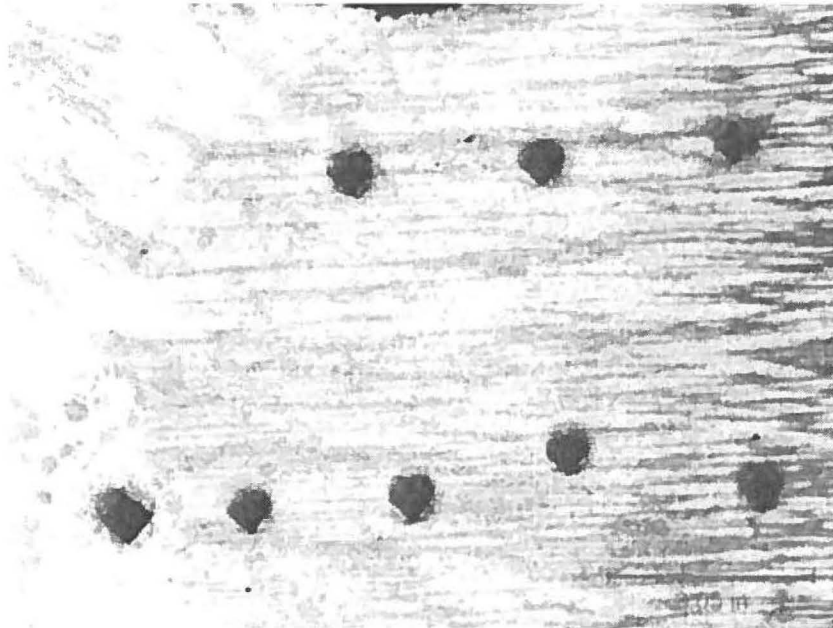


Figure 4. Macro photograph of mounted sample (S-181218-145), area B in Figure 1, 25x.

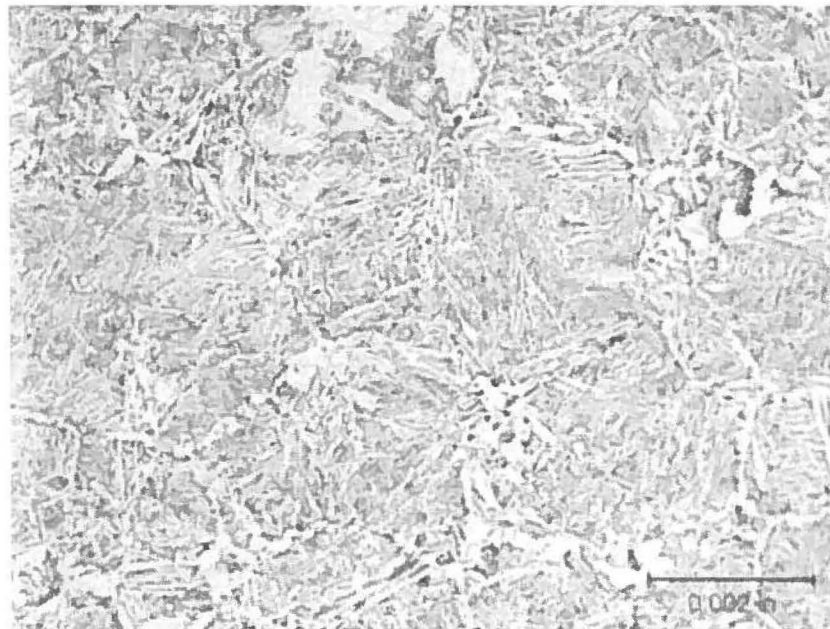


Figure 5. Macro photograph of mounted sample (S-181218-145), area B in Figure 1, 500x. Image is higher magnification photograph of the center of Figure 4.

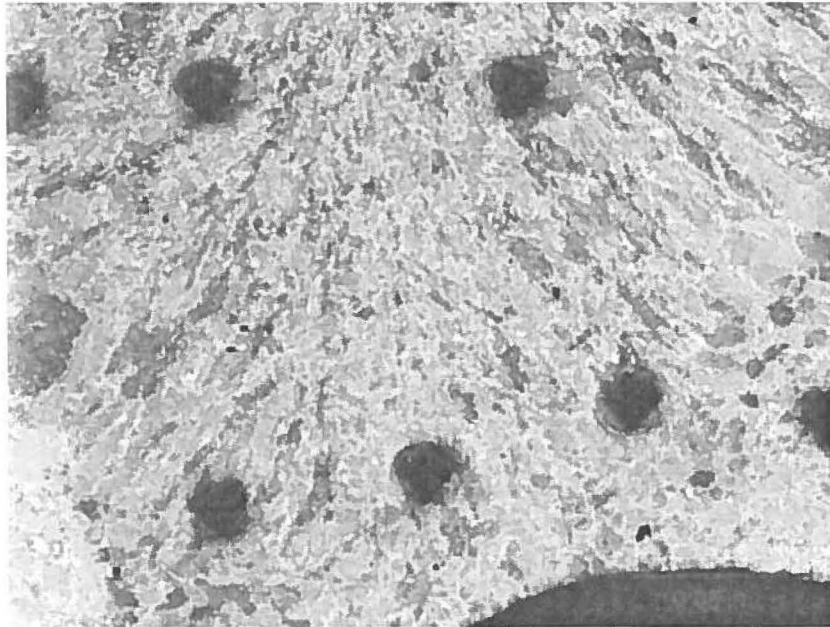


Figure 6. Macro photograph of mounted sample (S-181218-145), area C in Figure 1, 25x.

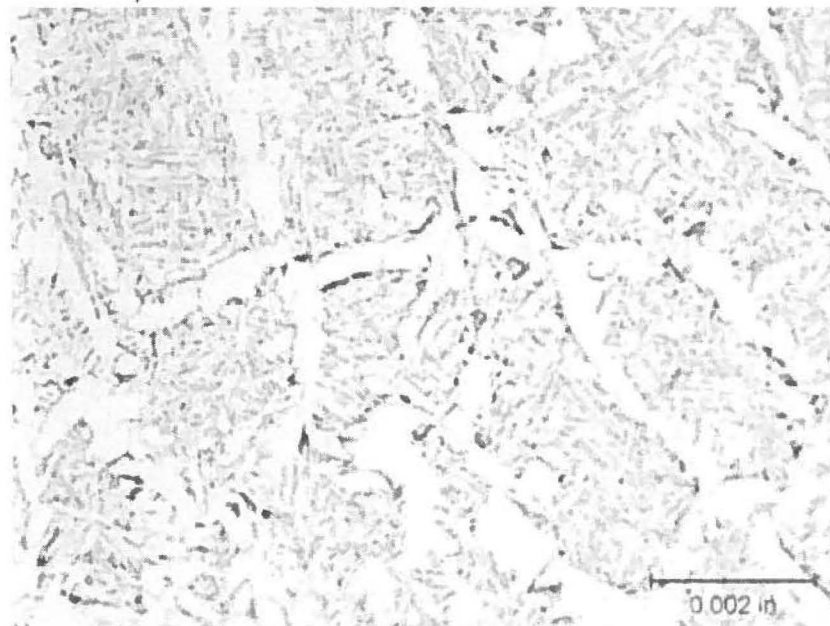


Figure 7. Macro photograph of mounted sample (S-181218-145), area C in Figure 1, 500x. Image is higher magnification photograph of the center of Figure 6.

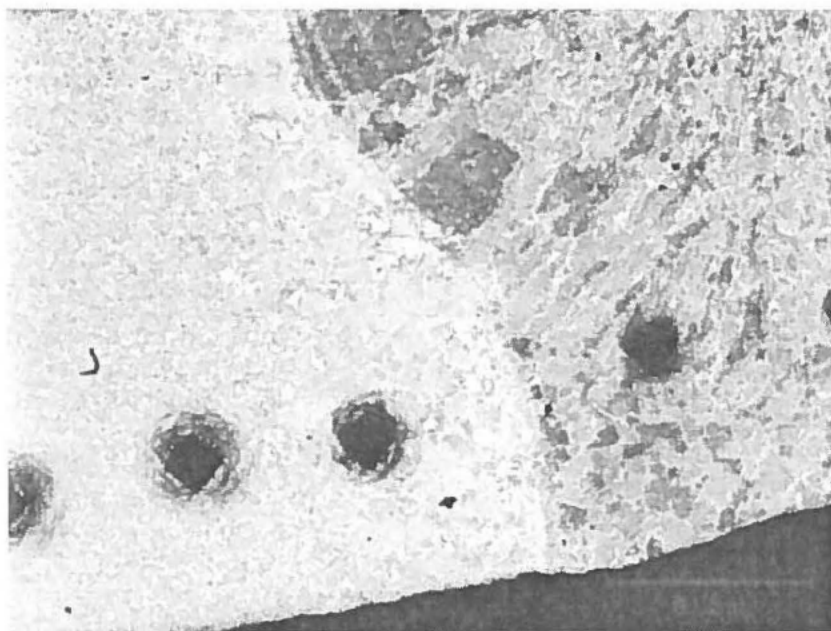


Figure 8. Macro photograph of mounted sample (S-181218-145), area D in Figure 1, 25x.

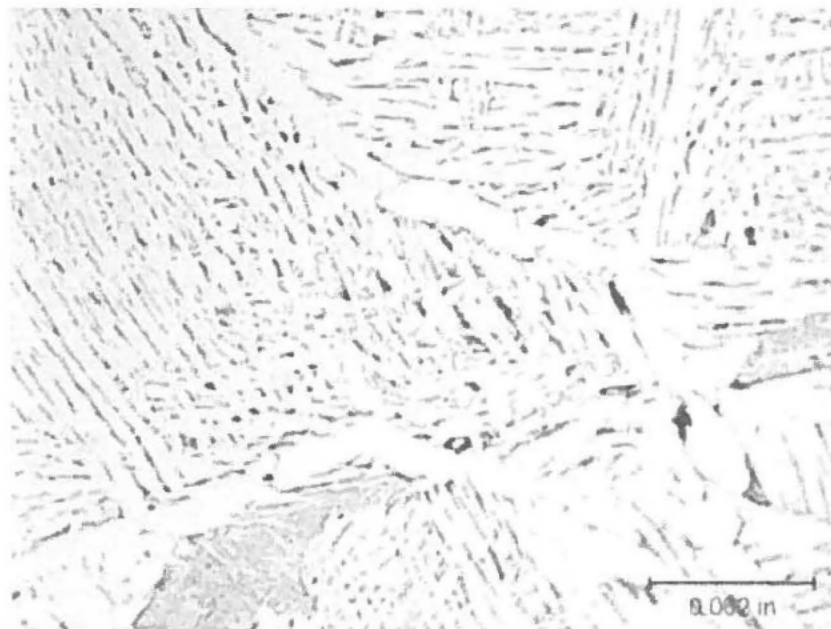


Figure 9. Macro photograph of mounted sample (S-181218-145), area D in Figure 1, 500x. Image is higher magnification photograph of slightly above the center of Figure 8.

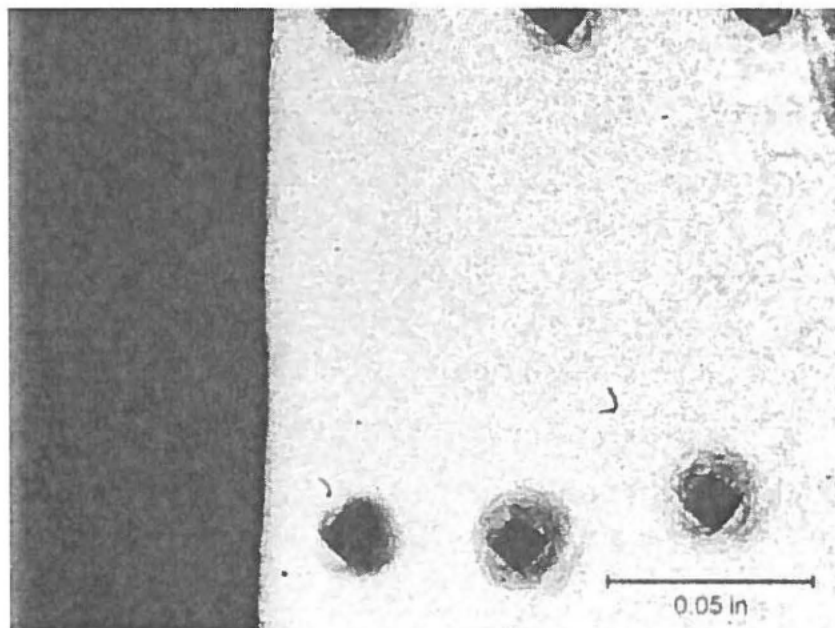


Figure 10. Macro photograph of mounted sample (S-181218-145), area E in Figure 1, 25x.

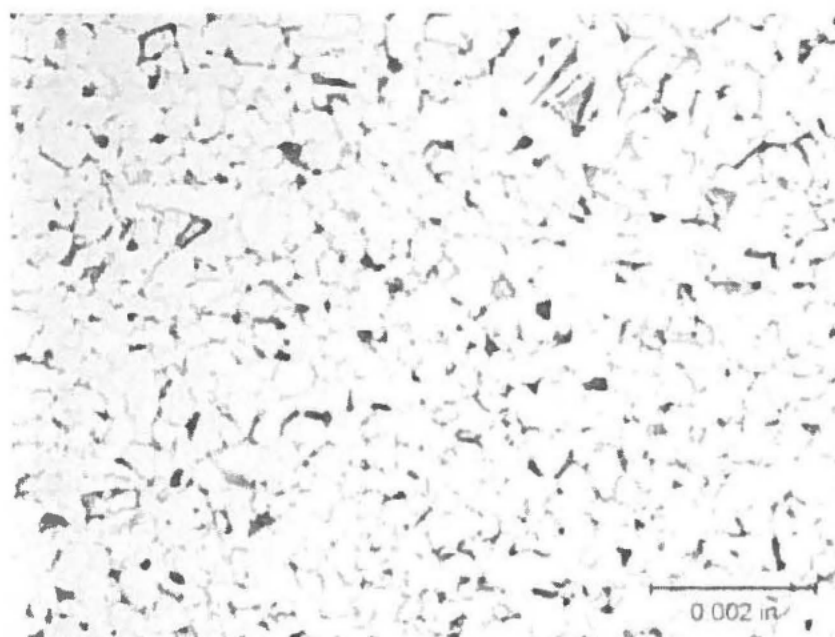


Figure 11. Macro photograph of mounted sample (S-181218-145), area E in Figure 1, 500x. Image is higher magnification photograph of the center of Figure 10.

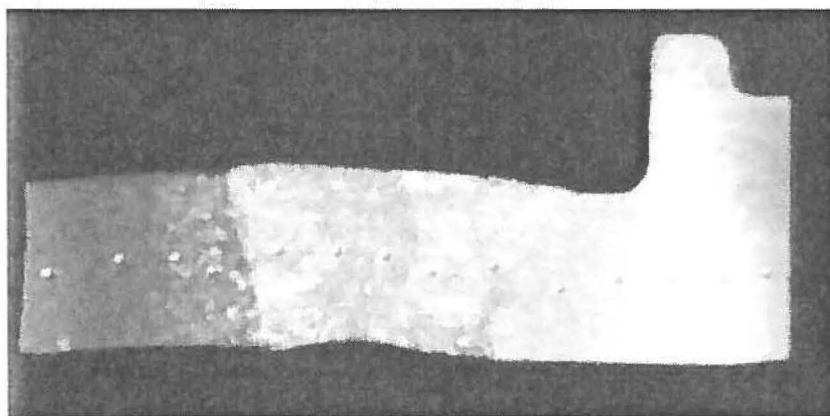
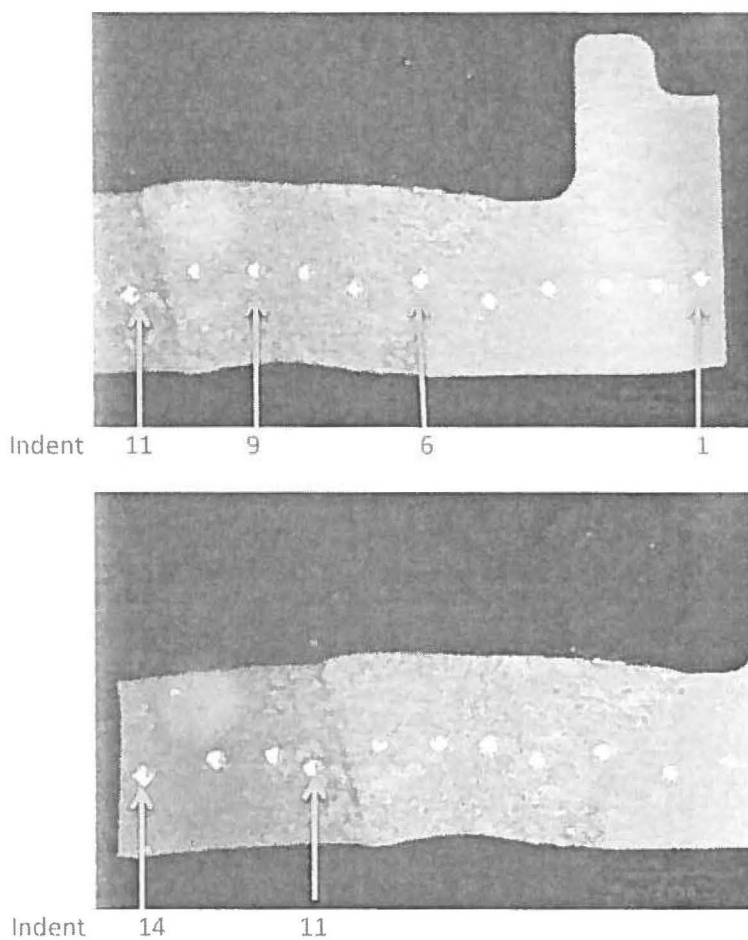


Figure 12. Macro photograph of mounted sample, as-received (S-181218-146).



Indent 14 11

Figure 13. Macro photograph of mounted sample, as-received (S-181218-146). Indents are numbered right to left in these photos.

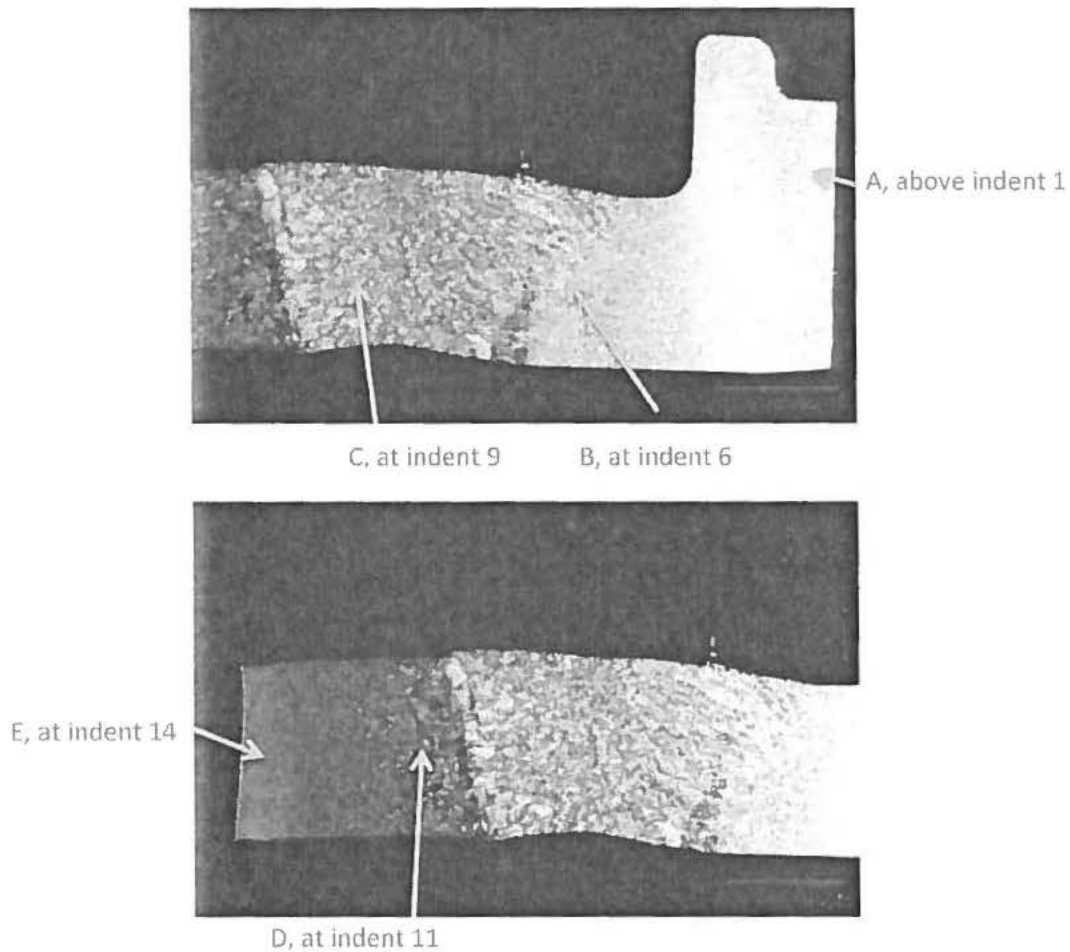


Figure 14. Macro photograph of remounted sample, as-received (S-181218-146). Arrows show approximate location where images in Figures 15-24 were taken.

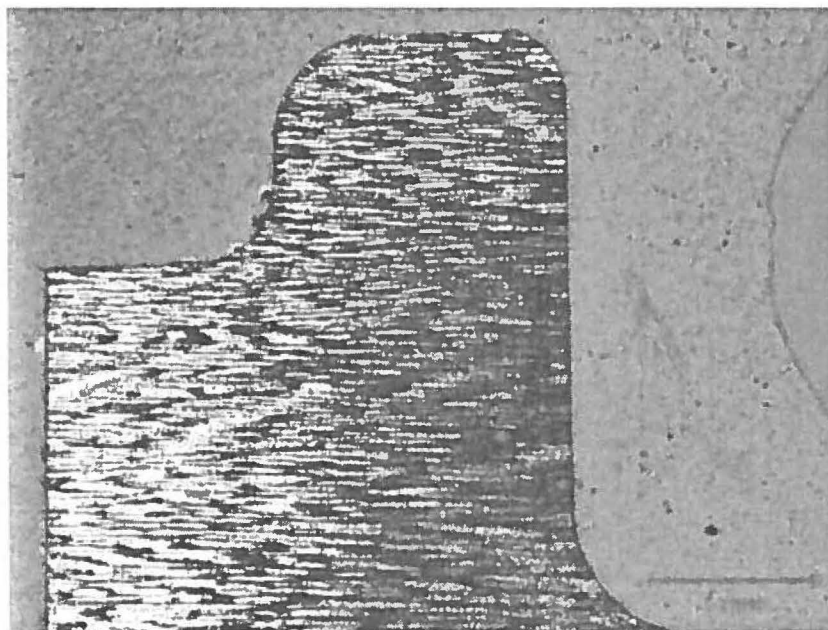


Figure 15. Macro photograph of mounted sample (S-181218-146), area A in Figure 14, 25x. (Camera optics are reversed from Figures 13 and 14).

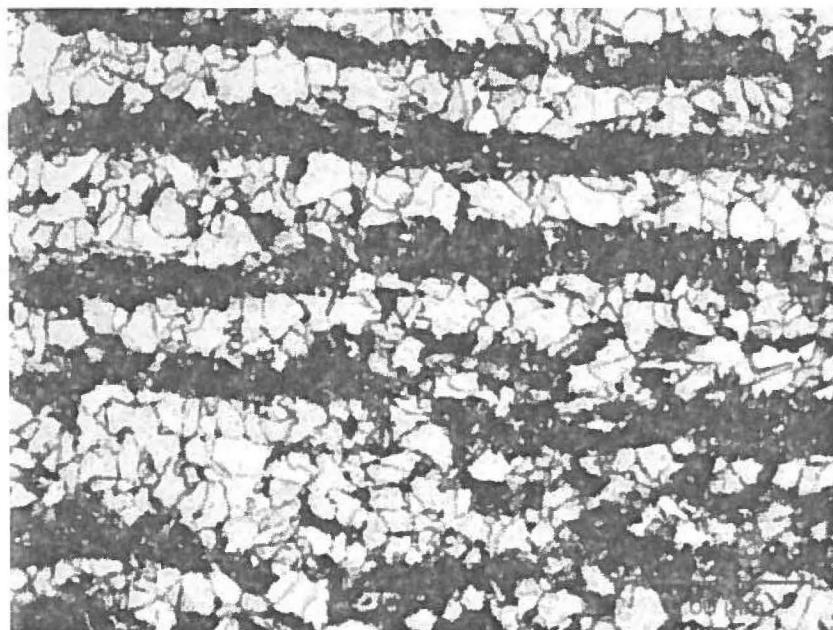


Figure 16. Macro photograph of mounted sample (S-181218-146), area A in Figure 14, 500x. Image is higher magnification image of center of Figure 15. (Camera optics are reversed from Figures 13 and 14).

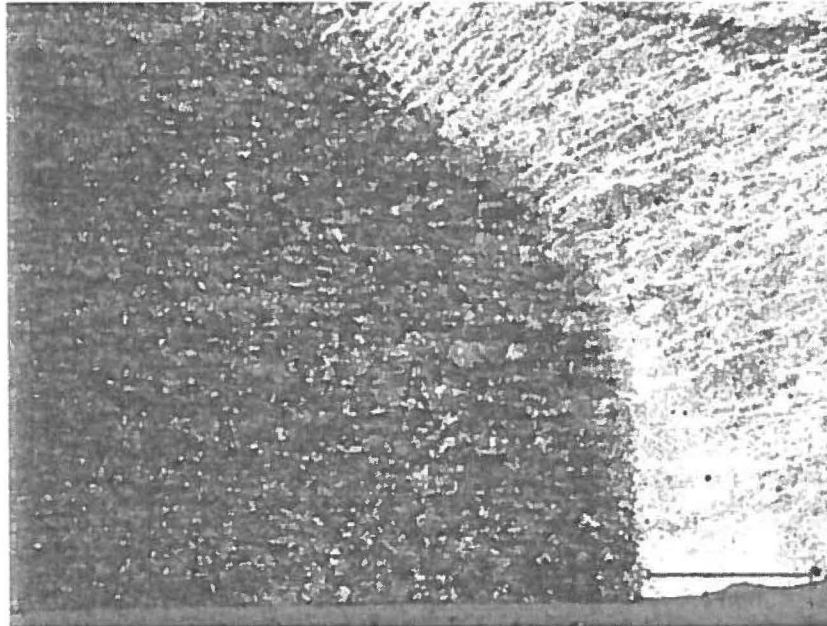


Figure 17. Macro photograph of mounted sample (S-181218-146), area B in Figure 14, 25x. (Camera optics are reversed from Figures 13 and 14).

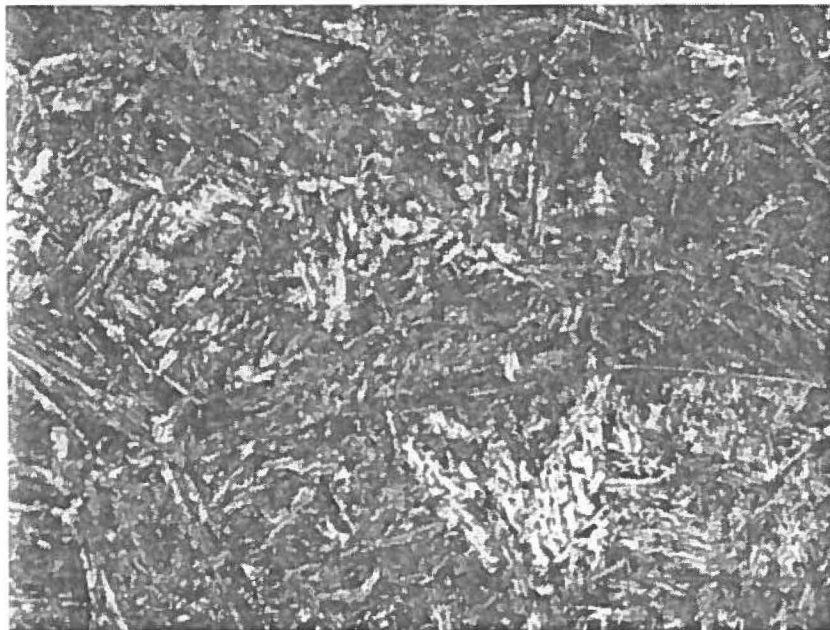


Figure 18. Macro photograph of mounted sample (S-181218-146), area B in Figure 14, 500x. Image is higher magnification image of center of Figure 17. (Camera optics are reversed from Figures 13 and 14).

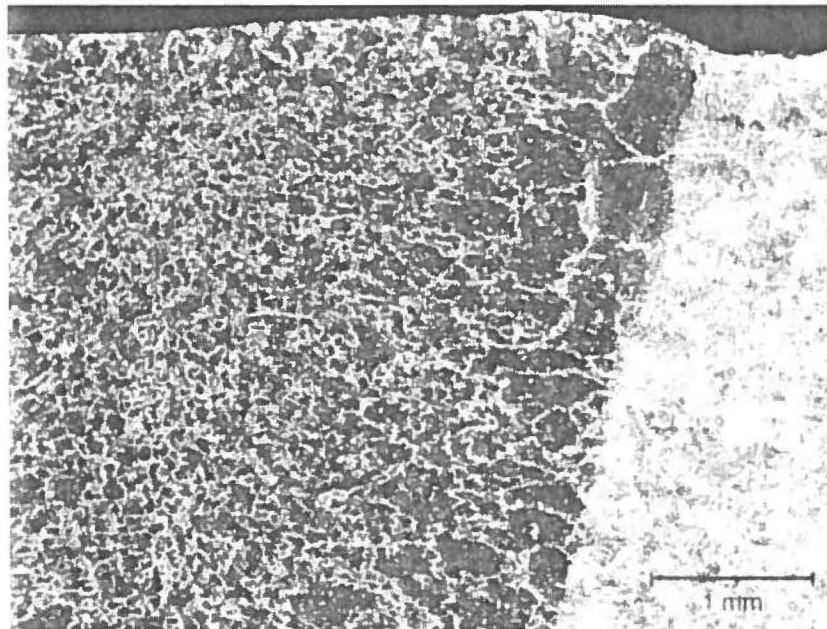


Figure 19. Macro photograph of mounted sample (S-181218-146), area C in Figure 14, 25x. (Camera optics are reversed from Figures 13 and 14).

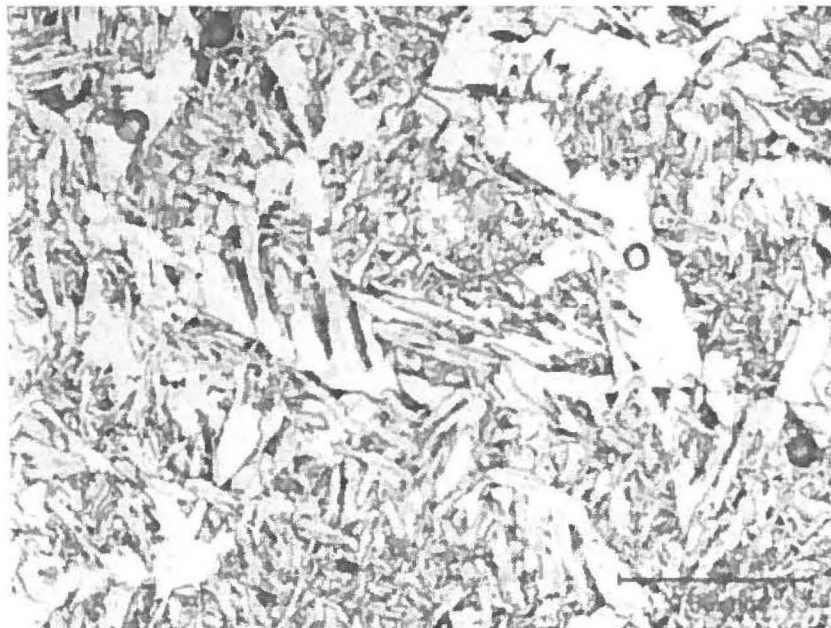


Figure 20. Macro photograph of mounted sample (S-181218-146), area C in Figure 14, 500x. Image is higher magnification image of center of Figure 19. (Camera optics are reversed from Figures 13 and 14).

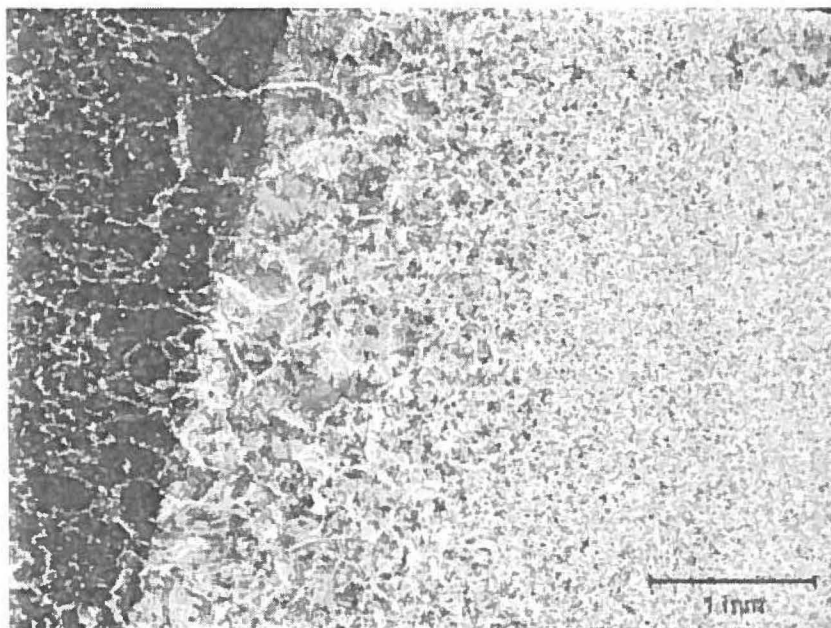


Figure 21. Macro photograph of mounted sample (S-181218-146), area D in Figure 14, 25x. (Camera optics are reversed from Figures 13 and 14).



Figure 22. Macro photograph of mounted sample (S-181218-146), area D in Figure 14, 500x. Image is higher magnification image of center of Figure 21. (Camera optics are reversed from Figures 13 and 14).

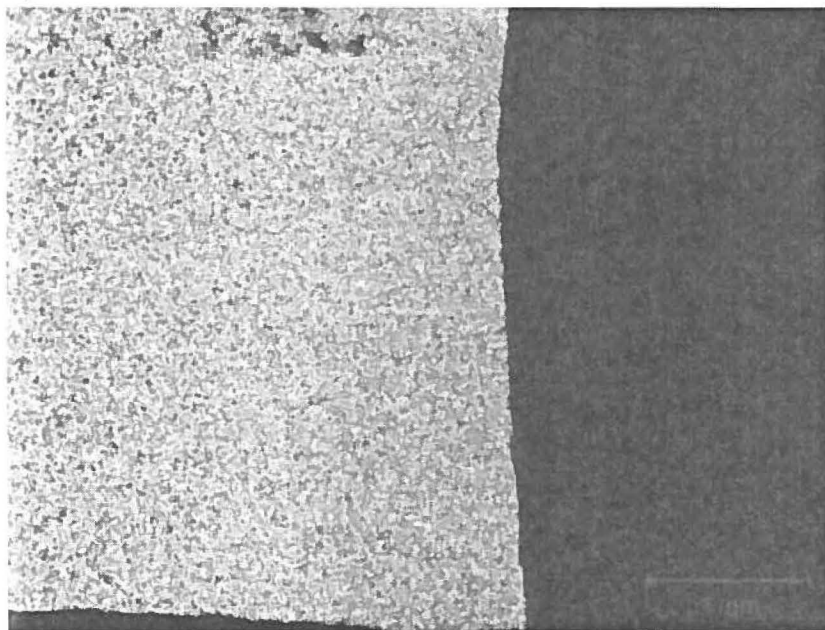


Figure 23. Macro photograph of mounted sample (S-181218-146), area E in Figure 14, 25x. (Camera optics are reversed from Figures 13 and 14).

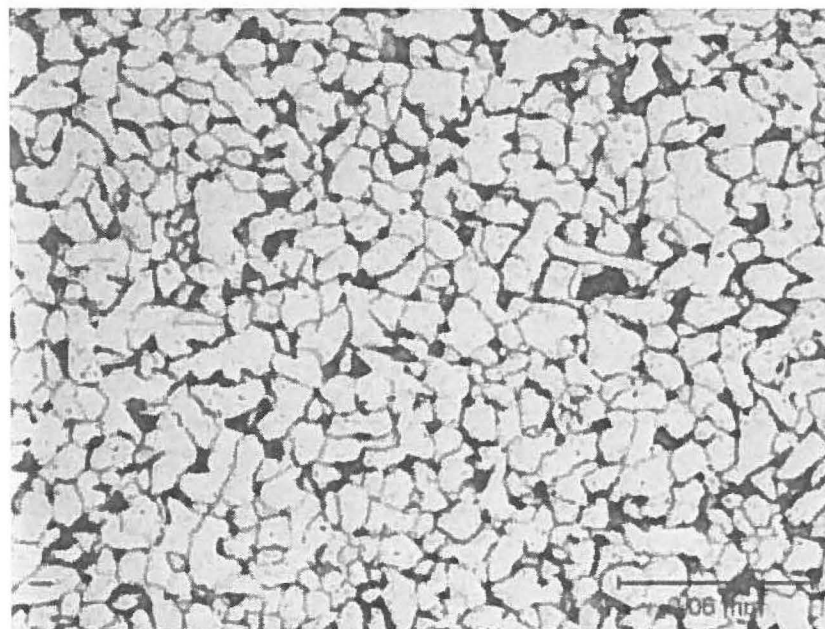


Figure 24. Macro photograph of mounted sample (S-181218-146), area E in Figure 14, 500x. Image is higher magnification image of center of Figure 23. (Camera optics are reversed from Figures 13 and 14).

~~Confidential Information Submitted Under 10 CFR 2.390~~

Reference 4-
HAZ Hardness Testing.

~~This information is a trade secret or confidential and not subject to disclosure under any federal or state freedom of information law or regulation.~~



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Direction	Transverse	Location	As Noted	Etchant	Nital
Magnification	100x			Mount #18J-333	

WELD A	Weld Top	Weld Center	Weld Bottom
Penetration		100%	
Cracks	None Observed	None Observed	None Observed
Fusion	Complete	Complete	Complete
Porosity	None Observed	None Observed	None Observed

WELD B	Weld Top	Weld Center	Weld Bottom
Penetration		100%	
Cracks	None Observed	None Observed	None Observed
Fusion	Complete	Complete	Complete
Porosity	None Observed	None Observed	None Observed

HARDNESS PROFILES PER ASTM E92

WELD A	
Location	Hardness HV10
Weld Top	Base metal
	HAZ
	Weld Metal
	HAZ
Weld Center	Base Metal
	Base metal
	HAZ
	Weld Metal
Weld Bottom	HAZ
	Base Metal
	Base metal
	Weld Metal
	HAZ
	Base Metal

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WELD B		
Location		Hardness HV10
Weld Top	Base metal	
	HAZ	
	Weld Metal	
	HAZ	
	Base Metal	
Weld Center	Base metal	
	HAZ	
	Weld Metal	
	HAZ	
	Base Metal	
Weld Bottom	Base metal	
	HAZ	
	Weld Metal	
	HAZ	
	Base Metal	

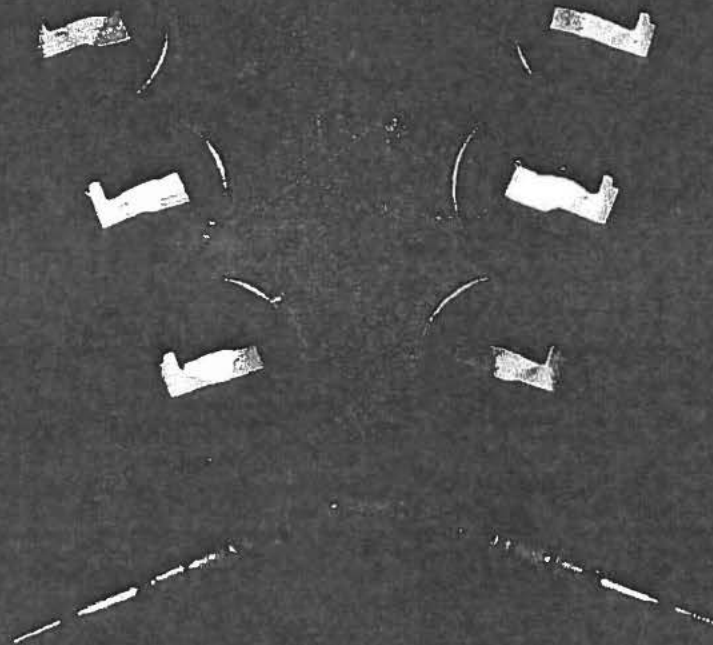
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The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 5, dated August 18, 2012. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

[*Paula Tesar*]
Paula Tesar
Quality Administrator

Lokring
181896579
MAINT # 185-333
WELD B

Lokring
181896579
MAINT # 185-333
WELD A

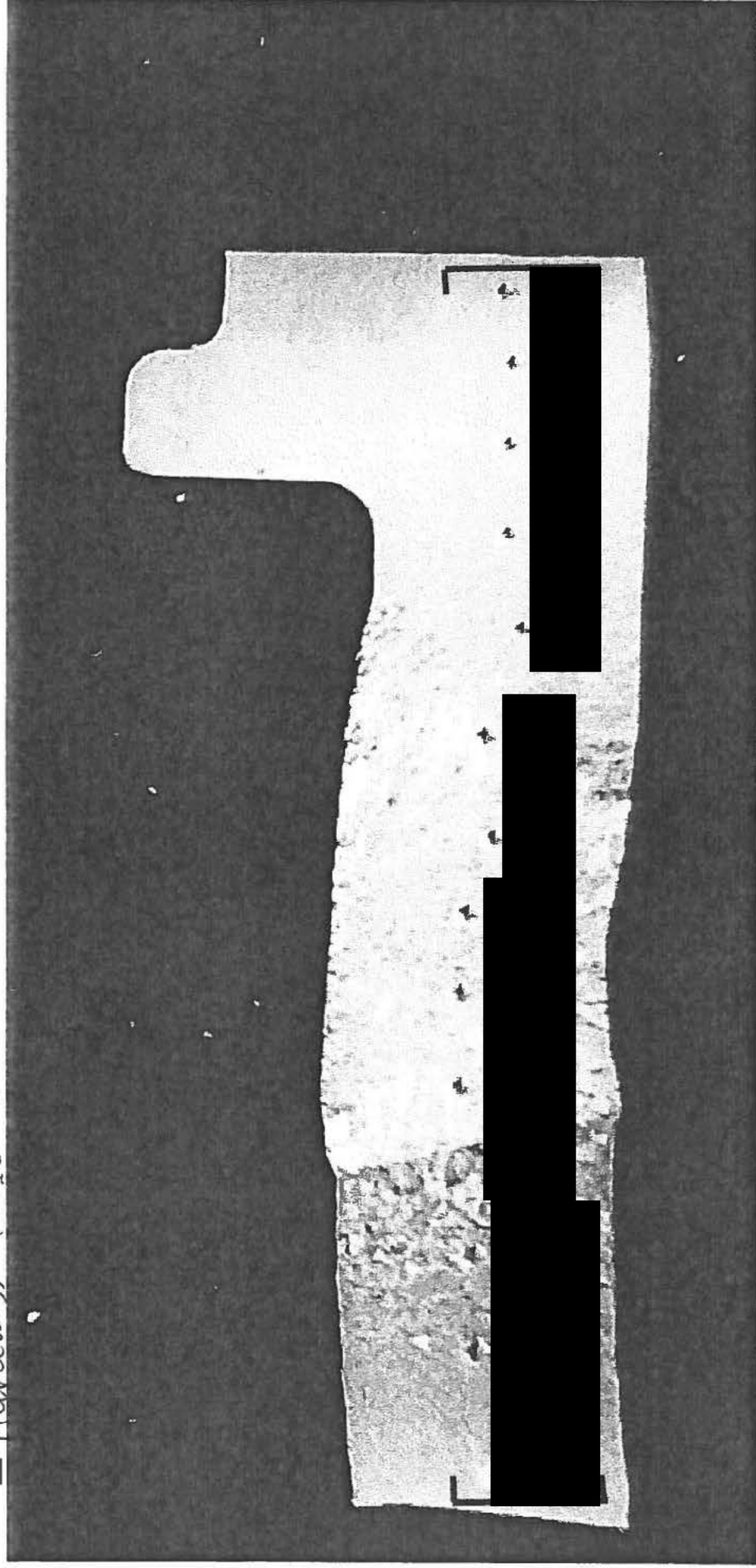


Lokring MAS-3000 P12 (NPS 3/4") 45 degree elbow.

Hardness Profile Per ASTM E92

~~Confidential Information Submitted Under 10-CFR 2.390~~
Element Report LOK 003-18-10-96579-1

1" Weld A" Location: Weld Center
[Hardness Hv70]



B16.9 45 degree Elbow
Heat E827

Weld Per
Coloring WPS
LOK CS002

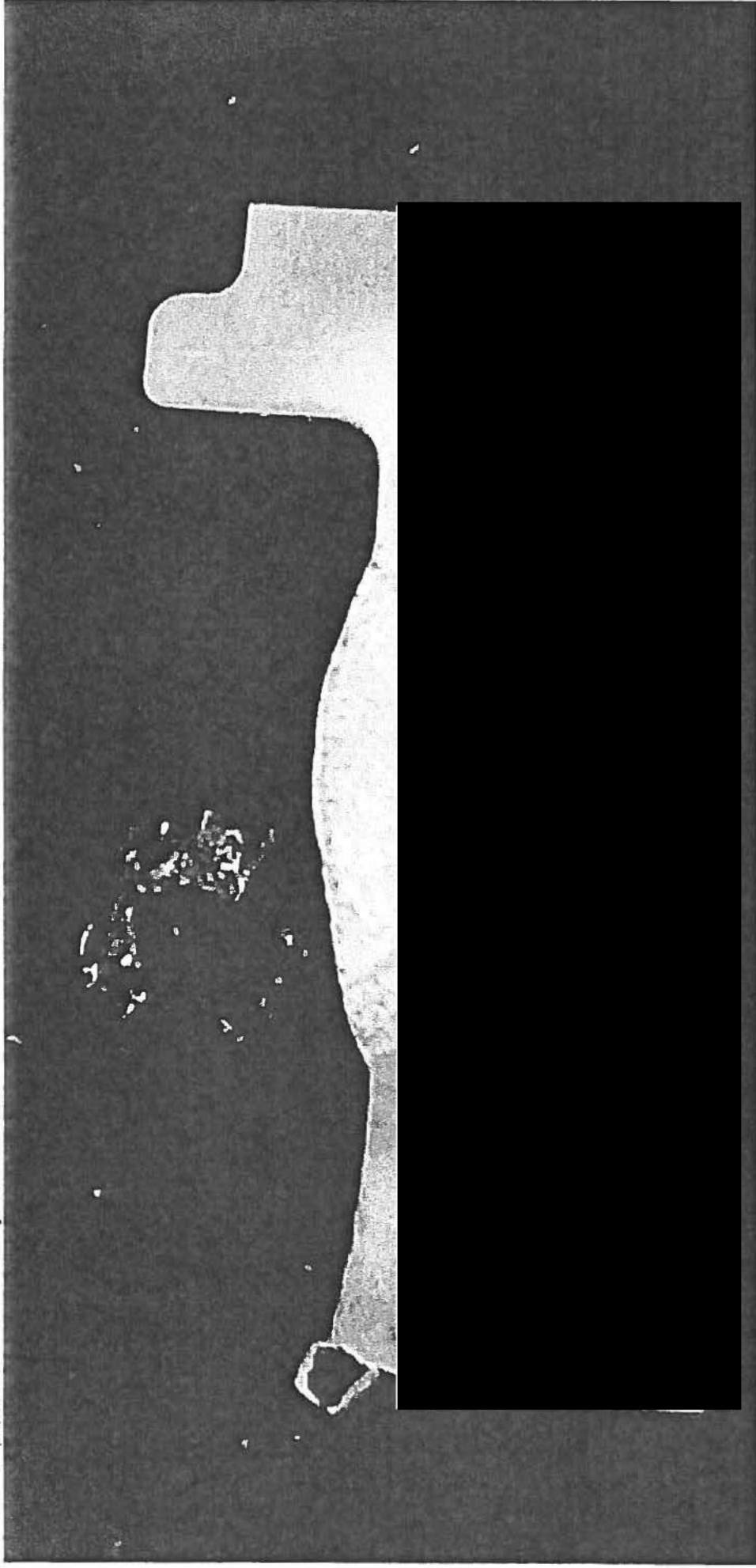
Coloring Blat Body
NARS 15V24
MTR LOK 170018

Hardness < Profile per ASTM E92

~~Confidential Information Submitted Under 10 CFR 2.390~~
Element Report LOK003-18-10-96579-1

"Weld A" Location: Weld "Top" and Weld "Bottom"

[Hardness HV 10]



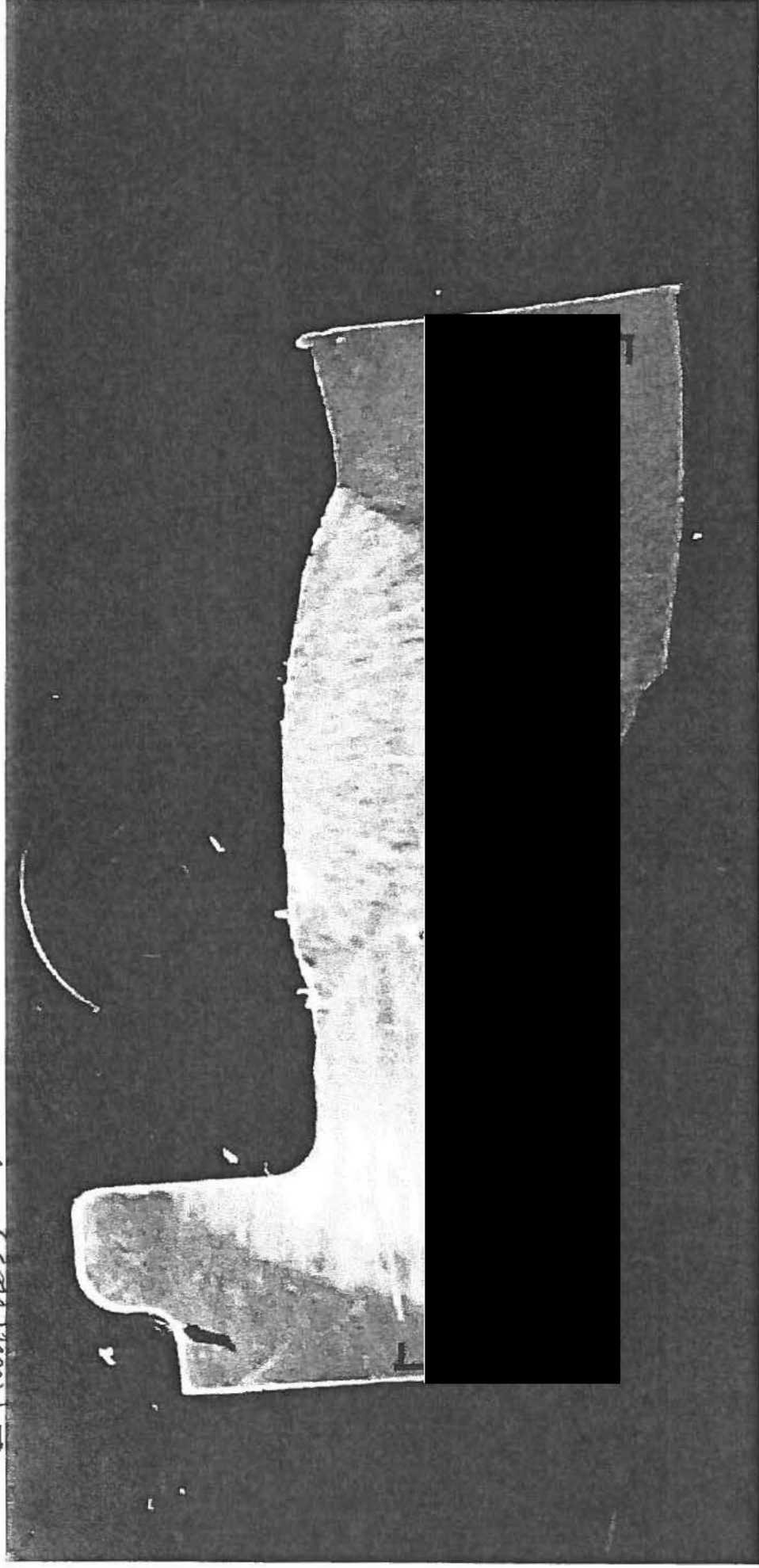
B16.9 45 degree Elbow
Heat E827

Weld per
Lohring WPS
Coke CS002

Lohring Hault Body
IMAF 15V24
MTR LOK170018

Hardness Profile per ASTM E92

"Weld B" Location: Weld Center
[Hardness HV10]



Lobring Hatt Body
WAS 15V24
MTR Lok 170018

Weld Per
Lobring WPS
LokCS002

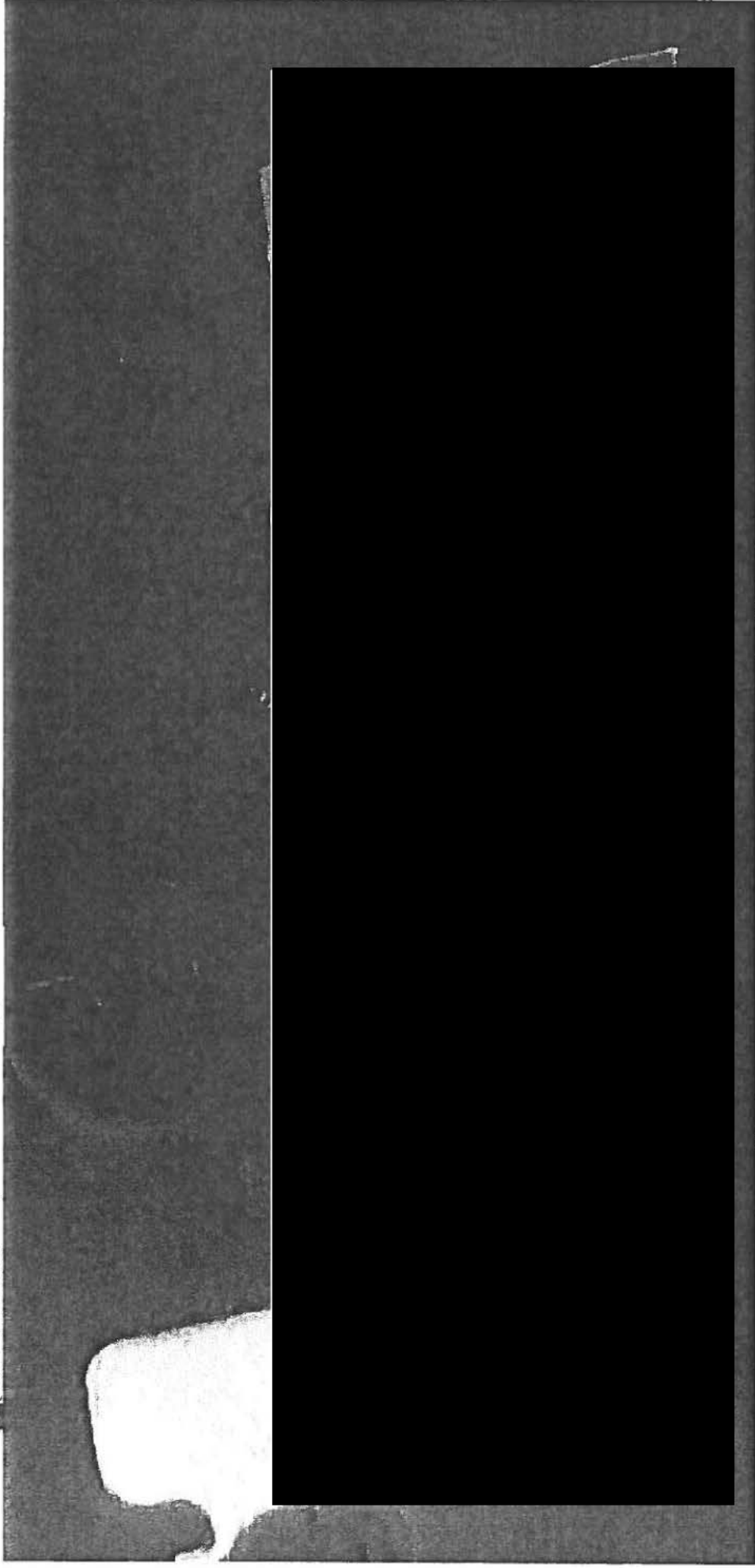
B16.9 45degree Elbow
Heat E827

Hardness Profile Per ASTM E92

Element Report Lok 003-19-10-96579-1

11. Weld B" Location: Weld "Top" and Weld "Bottom"

[Hardness HV 10]



Corriving Half Body

MAF 15V24

WTR Lok 170018

Weld Per

Corriving WPS

Lok CS002

B16.9 45 degree Elbow

Heat E827

R137763

CERTIFIED TRUE COPY OF ORIGINAL MTR
ID NUMBER LOK170018
PART NUMBER 1020237
PIO# 26099 LMS 92-10
VENDOR EMJ
DATE 6-5-17 PMIV & QA TS

WELDBEND

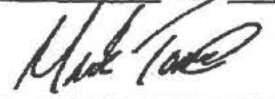
5600 South Harlem Avenue
Argo, IL 60501-1930

Material Test Report

WILLIAMS-PORTER
WILLIAMS-PORTER, CH 44094
PO: 4375334

Quantity	Product	Heat Code	Heat Treatment Info	Steel Mill																
50	2" XS LR 90° Elbow	1M68254	Hot Formed	MICHIGAN SEAMLESS																
C 0.17	Mn 0.75	P 0.008	S 0.019	Si 0.19	Cu 0.14	Ni 0.05	Cr 0.15	Mo 0.010	V 0.00	Al 0.019	Ti -	B -	Cb 0.001	Tens. 78,500	Yield 39,900	Elong 42.00	ROA -	BHN 150	BHN2 149	A 234-10 Dimensional Specification: B16.9
CE (IIV): 0.340																				WPB
50	1" XS LR 90° Elbow	J4K5292	Hot Formed	NIPPON																
C 0.19	Mn 0.73	P 0.013	S 0.010	Si 0.19	Cu 0.03	Ni 0.02	Cr 0.05	Mo 0.010	V 0.00	Al 0.021	Ti -	B -	Cb 0.000	Tens. 67,443	Yield 39,900	Elong 55.00	ROA -	BHN 156	BHN2 159	A 234 WPB-13 Dimensional Specification: B16.9
CE (IIV): 0.327																				WPB
20	1/2" XS LR 45° Elbow	E827	Heat Treat: Stress Relieved	PODBRE																
C 0.14	Mn 0.39	P 0.009	S 0.003	Si 0.26	Cu 0.15	Ni 0.06	Cr 0.08	Mo 0.000	V 0.00	Al -	Ti -	B -	Cb 0.000	Tens. 66,573	Yield 39,900	Elong 37.00	ROA -	BHN 144	BHN2	A 234-94 Dimensional Specification: B16.9
CE (IIV): 0.235																				WPB
30	2" XS Straight Tee	J4L1033	Heat Treat: Normalized	NIPPON																
Mn 0.67	P 0.023	S 0.006	Si 0.26	Cu 0.02	Ni 0.02	Cr 0.05	Mo 0.010	V 0.00	Al 0.025	Ti -	B -	Cb 0.000	Tens. 67,700	Yield 39,900	Elong 42.00	ROA -	BHN 135	BHN2 136	A 234-11 Dimensional Specification: B16.9	
CE (IIV): 0.316																				WPB

FITTING MTR
PART NUMBER 8062205
HEAT NUMBER E827
P/O NUMBER 25360
VENDOR MACOMB

DATE 2-20-17 QA TB

Mark Torres
Quality Assurance Department
2/17/2017



Scan For Online
Report

We hereby certify that the material meets the following:
- ISO 9001:2008 CERTIFIED MANUFACTURER
- Test Results herein are correct as contained in test records retained by the company in accordance with EN 10 204 Para 3.1 in accordance with PED 97/23/EC, 7/2.
- No Weld Repair Performed. No Lead Content. No Mercury Content.
- Knowingly making false, fictitious, or fraudulent statements on a MTR may result in legal liability.
- Material has been manufactured/supplied and tested in accordance with the Weldbend Quality System Program 01/26/2015 Rev. 3

We hereby certify that the material meets the following:
- All fittings and flanges meet NACE MRO-175/ISO 15156-Latest Revision.
- All fittings and flanges meet NACE MRO-103 - Latest Revision.
- All non high-yield fittings meet the requirements of ASTM A-234 WPB (AND SA-234).
- All fittings are seamless except as noted.
- All non-high yield flanges meet the requirements of ASTM A-105 (AND SA-105).
- Starting Material Seamless Pipe for elbows, tees and reducers;
- Plate for caps and welded fittings.
- Bars, Billets or Blooms for flanges and certain caps and tees.
- Ladle chemistry reported.
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Cert #199601

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Page 1 of 1

Reference 5-
Elevated Temperature Tensile Testing.

Request for ASME B31 Code Case for
Micro-Alloyed Carbon Steel Bar

Attachment 2
MATERIAL TEST RESULTS AT TEMPERATURE

Summary of Yield Strengths at Temperature (ksi)

Temperature	3-1/4" bar	1-7/8" bar	2-5/8" bar
Room	84.1	85.9	98.2
100°F	83.8	87.0	94.4
200°F	82.2	82.0	94.4
300°F	72.6	73.4	94.3
400°F	70.7	74.5	100.0
500°F	72.3	72.9	97.9
600°F	70.1	71.3	94.2
650°F	65.7	75.5	90.9
750°F	63.5	67.2	86.6

Summary of Tensile Strengths at Temperature (ksi)

Temperature	3-1/4" bar	1-7/8" bar	2-5/8" bar
Room	114.0	119.0	127.0
100°F	114.0	120.0	124.0
200°F	110.0	117.0	124.0
300°F	106.0	113.0	120.0
400°F	107.0	117.0	122.0
500°F	111.0	117.0	125.0
600°F	106.0	112.0	128.0
650°F	102.0	110.0	117.0
750°F	92.5	97.8	107.0

Anamet Laboratories, Inc.

3400 INVESTMENT BOULEVARD • HAYWARD, CALIFORNIA 94545-3811 • (510) 887-8811

Laboratory Number: 692.148
Purchase Order: P2060150
Date Submitted: June 23, 1992
Date Reported: June 29, 1992

Lokring Corporation
[ATTN: Melvin Biersteker]
396 Hatch Drive
Foster City, CA 94404

SUBJECT

One bar was submitted for tensile testing. The sample was identified as 1 ea. 3-1/4" dia. x 6" bar, 15V24 Micro Alloyed Steel.

TENSILE TEST

	1	2	3
Temperature	Room	+100° F	+200° F
Dimensions of Specimen (in.)	0.505	0.504	0.504
Area (sq. in.)	0.200	0.200	0.200
Tensile Strength (psi)	114000	114000	110000
Yield Point (psi)	84100	83800	82200
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			
	4	5	6
Temperature	+300° F	+400° F	+500° F
Diameter of Specimen (in.)	0.504	0.505	0.506
Area (sq. in.)	0.200	0.200	0.201
Tensile Strength (psi)	106000	107000	111000
Yield Strength @ 0.2% Offset (psi)	72600*	70700	72300
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

*Yield Point (psi)

Page 2

Lab. No. 692.148

TENSILE TEST

	<u>1</u>	<u>2</u>	<u>3</u>
Temperature	+600° F	+650° F	+750° F
Diameter of Specimen (in.)	0.504	0.505	0.505
Area (sq. in.)	0.200	0.200	0.200
Tensile Strength (psi)	106000	102000	92500
Yield Strength @ 0.2% Offset (psi)	70100	65700	63500
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

This testing was performed in accordance with the purchase order.

Submitted by:

[E. A. Foreman]

E. A. Foreman
Manager, Laboratory Operations

pa/153

LABORATORY CERTIFICATE

Anamet Laboratories, Inc.

3400 INVESTMENT BOULEVARD • HAYWARD, CALIFORNIA 94545-3811 • (510) 887-8811

Laboratory Number: 792.128
Purchase Order: P2070137
Date Submitted: July 21, 1992
Date Reported: August 4, 1992

Lokring Corporation
[ATTN: Melvin Biersteker]
396 Hatch Drive
Foster City, CA 94404

SUBJECT

Two bars were submitted for tensile testing. The samples were identified as 15V24 Micro Alloyed Steel Bar, 1 7/8" dia. x 30" from Inland Steel and 2 5/8" dia. x 15" from North Star Steel.

TENSILE TEST

1 7/8" Diameter

	<u>6A</u>	<u>7A</u>	<u>9A</u>
Temperature	Room	100°F	200°F
Diameter of Specimen (in.)	0.503	0.504	0.504
Area (sq. in.)	0.199	0.200	0.200
Tensile Strength (psi)	119000	120000	117000
Yield Strength @ 0.2% Offset (psi)	85900	87000	82000
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

TENSILE TEST

1 7/8" Diameter

	<u>3A</u>	<u>1A</u>	<u>2A</u>
Temperature	300°F	400°F	500°F
Diameter of Specimen (in.)	0.504	0.503	0.501
Area (sq. in.)	0.200	0.199	0.197
Tensile Strength (psi)	113000	117000	117000
Yield Strength @ 0.2% Offset (psi)	73400	74500	72900
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

Page 2

Lab. No. 792.128

TENSILE TEST

1 7/8" Diameter

	<u>4A</u>	<u>5A</u>	<u>8A</u>
Temperature	600°F	650°F	750°F
Diameter of Specimen (in.)	0.505	0.500	0.501
Area (sq. in.)	0.200	0.196	0.197
Tensile Strength (psi)	112000	110000	97800
Yield Strength @ 0.2% Offset (psi)	71300	75500	67200
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

TENSILE TEST

2 5/8" Diameter

	<u>1B</u>	<u>2B</u>	<u>3B</u>
Temperature	Room	100°F	200°F
Diameter of Specimen (in.)	0.503	0.502	0.503
Area (sq. in.)	0.199	0.198	0.199
Tensile Strength (psi)	127000	124000	124000
Yield Strength @ 0.2% Offset (psi)	98200	94400	94400
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

TENSILE TEST

2 5/8" Diameter

	<u>4B</u>	<u>5B</u>	<u>6B</u>
Temperature	300°F	400°F	500°F
Diameter of Specimen (in.)	0.504	0.503	0.503
Area (sq. in.)	0.200	0.199	0.199
Tensile Strength (psi)	120000	122000	125000
Yield Strength @ 0.2% Offset (psi)	94300	100000	97900
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

Page 3

Lab. No. 792.128

TENSILE TEST

2 5/8" Diameter

	<u>7B</u>	<u>8B</u>	<u>9B</u>
Temperature	600°F	650°F	750°F
Diameter of Specimen (in.)	0.504	0.503	0.503
Area (sq. in.)	0.200	0.199	0.199
Tensile Strength (psi)	128000	117000	107000
Yield Strength @ 0.2% Offset (psi)	94200	90900	86600
Elongation in 2.0" Gage (%)			
Reduction of Area (%)			

This testing was performed in accordance with the purchase order.

Submitted by:

[E. A. Foreman]

E. A. Foreman
Manager, Laboratory Operations

mh/098

**Request for ASME B31 Code Case for
Micro-Alloyed Carbon Steel Bar**

**Attachment 3
MATERIAL CERTIFICATES OF COMPLIANCE**

Summary of Relevant Certificates of Compliance

Bar Size	Supplier	Heat No.
3-1/8" [Note 1]	Inland Steel	96959
1-7/8"	Northern Cross Steel	96960
2-5/8"	Northern Cross Steel	M39216

Note 1: In subsequent testing this bar size was referred to as 3-1/4".



TEST REPORT

REG., JOB, CONTRACT NO.

PURCHASE ORDER NO.

V
E
N
D
O
R

INLAND STEEL BAR COMPANY
QUALITY DEPARTMENT 4-446
3300 DICKEY ROAD
EAST CHICAGO, INDIANA 46312

SHIPPER'S NO.

10" MILL

MILL ORDER NO.

15/06 2

INVOICE DATE

INVOICE NO.

VEHICLE IDENTIFICATION

We hereby certify that the analysis and/or test results shown are correct as contained in the records of the company..



George Osan

George Osan
Section Manager - Quality

SOLD TO

[LOKRING CORP
ATTN: MELVIN BIERSTEKER]
396 HATCH DRIVE

SHIP TO

LOKRING CORP
396 HATCH DRIVE

STATE OF INDIANA
COUNTY OF LAKE

Subscribed and sworn to before me this

day of

A.D., 19

Notary Public

MY COMMISSION EXPIRES:

FOSTER CITY CA 94404 FOSTER CITY CA 94404
SPECIFICATION INLAND CMS (REG. TM) HOT ROLLED ROUNDS, AISI 15V24 MICROALLOY



Inland Steel Company Chemical and Metallurgical Labs are accredited by the American Association for Laboratory Accreditation (A2LA) in the chemical, mechanical, and environmental fields of testing, as listed in the current A2LA Directory of Accredited Laboratories.

ITEM NO.	MATERIAL DESCRIPTION	QUANT.	WEIGHT	HEAT NO.	TEST OR PC. ID. NO.
RND 3-1/8 IN				96959	

TEST RESULTS

YLD PT LBS./SQ. IN.	TEN STR LBS./SQ. IN.	ELONG IN. %
86,100	120,700	2 21%

1ST BATCH OF MATERIAL (C1)
USED FOR DEVELOPMENT

HEAT NO.	C	Mn	P	S	SI	Cu	NI	Mo	Cr	Cb	V	Al	N
96959	.24	1.57	.005	.008	.25	.06	.05	.05	.08		.15	.019	.019

HEAT ANALYSIS

CERTIFICATE OF TESTS

C7432

No. _____

NORTHERN CROSS STEEL COMPANY

Producers of fine cold finished steel bars

17382 FOLTZ INDUSTRIAL PARKWAY • STRONGSVILLE, OHIO 44136



PHONE: (216) 572-0550

FAX: (216) 572-9682

SOLD TO:

LOKRING CORPORATION
396 HATCH DRIVE
FOSTER CITY CA 94404

SHIP TO:

WILL ADVISE

CUSTOMER ORDER NO.	DATE SHIPPED	DATE PROMISED	DATE ENTERED	SALESMAN	NUMBER BUNDLES
P2070031	07/15/92	SEE BELOW	07/09/92	House	1(5 Bars)
CARRIER	ITEM	TERMS	COMPETITIVE FREIGHT FROM	PPD	QTY. SHIPP
ABF Freight	*	1 of 1			
QTY. ORDERED	SIZE	GRADE	CONDITION	LENGTH	HEAT
1,013# 4pcs	2-1/8" Rd.	15V24	HR	20'-8"	96960
195# 1pc.	1-7/8" Rd.	15V24	HR	20'-8"	96959
1,440# 3pcs	3" Rd.	15V24	HR	20'-8"	M39216
405# 1pc.	2-5/8" Rd.	15V24	HR	22'	
	Date Promised:	RUSH			
PARTIAL SHIPMENT					

CHEMICAL ANALYSIS

HEAT	CARBON	MANGANESE	PHOSPHORUS	SULPHUR	SILICON	NICKEL	CHROMIUM	MOLYBDENUM	COPPER	LEAD	ALUM.	Van.
96960							.180	.050	.050		.023	
96959							.180	.050	.060		.019	
M39216							.120	.100	.110		.031	

CERTIFICATE OF TESTS

MECHANICAL:		CERTIFICATE OF TESTS											
HEAT		YIELD STRENGTH P.S.I.		TENSILE STRENGTH P.S.I.		EL. % 2"		RED. AREA		HARDNESS		GRAIN	
96960													
96959													
M39216													
JOMINY HARDENABILITY:													
HEAT		1	2	4	8	12	16	20	24	28			
96960		NA	NA	NA	NA	NA	NA	NA	NA	NA			
96959		NA	NA	NA	NA	NA	NA	NA	NA	NA			
M39216		NA	NA	NA	NA	NA	NA	NA	NA	NA			

CHEMICAL, MECHANICAL, AND PHYSICAL TESTS REPORTED ABOVE ARE CORRECT AS CONTAINED IN OUR RECORDS.

NORTHERN CROSS STEEL COMPANY

[BOB ROSS]

[CERTIFIED BY]

Request for ASME B31 Code Case for
Micro-Alloyed Carbon Steel Bar

Attachment 4
MATERIAL CHEMICAL ANALYSIS REPORT

Anamet Laboratories, Inc.

3400 INVESTMENT BOULEVARD • HAYWARD, CALIFORNIA 94545-3811 • (510) 887-8811


Laboratory Number: 792.186
Purchase Order: P2070136
Date Submitted: July 30, 1992
Date Reported: August 5, 1992

Lokring Corporation
[Attn: Melvin Biersteker]
396 Hatch Drive
Foster City, CA 94404

SUBJECT

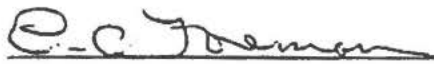
Four coupons were submitted for chemical analysis. The samples were identified as steel bar, 3", 2-5/8", and 1-7/8" dia.

SPECTROCHEMICAL ANALYSIS (Reported as Wt. %)

		<u>3"</u>	<u>2-5/8"</u>	<u>1-7/8"</u>
Aluminum	(Al)			
Carbon	(C)			
Chromium	(Cr)			
Copper	(Cu)			
Manganese	(Mn)			
Molybdenum	(Mo)			
Nickel	(Ni)			
Phosphorus	(P)			
Silicon	(Si)			
Sulfur	(S)			
Titanium	(Ti)			
Vanadium	(V)			

This testing was performed in accordance with the purchase order.

Submitted by:

[]
E. A. Foreman
Manager, Laboratory Operations

ch\156