

**Energy Industries of Ohio**

**Contract # S005242-F**

**Modular Coil Winding Form**

**A-6 Documentation Package**

**11/6/06**

# **This A-6 Documentation consists of:**

## **Part 1**

**Final documentation package Metal Tek Intl. – Pages 3 –  
Latest revision 11/6/2006  
Foundry documentation**

## **Part 2**

**Final documentation package Major Tool - Pages  
Latest revision  
Machine shop documentation**

## **Part 3**

**Metal Tek radiographic films from part 1 (shipped to PPPL)**

**Major Tool radiographic films from part 2 (shipped to PPPL)**

# **Energy Industries of Ohio**

**Contract # S005242-F**

**Modular Coil Winding Forms**

## **A-6 Documentation Package**

**Part 1 – Metal Tek International  
Casting Data Package**

**11/6/06**

\*\*Note – Document #'s listed in the TOC (page 4) are not necessarily the same as the number hand written on the top of the document. Please use page # to find relevant document.

# A-6 Documentation Package

## List of Documents 11-06-06

Doc #	Description	Page #
1	MTR for weighted average of chemistry – 3 ladles replaced by product analysis after PM incl MTR from Wisconsin Centrifugal	5
2	MTR for A-6 Shim	
3	Lincoln weld metal product conformance spec Lot 3018513/78308	
4	St Louis Test Lab dated 8/16/05 mech test results at RT & CVN @ 293°k for Lincoln lot 3018513/78308	
5	St Louis Test Lab dated 10/5/05 CVN @ -320°F for Lincoln weld lot 3018513/78308	
6	Westmoreland mechanical test @ -320°F dated 10/18/05 Lincoln Lot 3018513/78308	
7	Westmoreland Tensile test report @ -320°F dated	
8	St Louis Test Lab dated – incl. tensile test results @ room temp & Charpy V Notch (CVN) at 77°K & 293°K	
9	Weld map	
10	MQS Radiographic Inspection Report dated	
11	MQS Radiographic Inspection Report dated	
12	MTK Radiographic Interpretation Report dated	
13	MTK Radiographic Shooting Sketch for A coils	
14	MTK Radiographic Interpretation Report A-6 Shim	
15	A-6 Coil heat treat chart dated	
16	A-6 Coil stress relief dated	
17	A-6 Shim heat treat chart dated	
18	MTK signed MTS A-6 Coil	
19	MTK signed MTS A-6 Coil shim	
20	CA 1308 – shim chemistry out of spec	
21	CA 1323 – phosphorus level exceeds specification – applies to shim only	
22	CA 1347 – Thin wall condition on A castings	
23	CA 1671 – Failed tensile test + update	
24	Final inspection report A-6 coil –	
25	C of C for A-6 Coil – dated –	
26	Final Inspection report A-6 Shim –	
27	C of C for A-6 shim –	
28	EIO shipping release for A-6 Coil -	
11/06/06		



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### Carondelet Division

8600 Commercial Blvd. - Pevely, MO 63070 USA  
 Phone: 636-479-4499 - Fax: 636-479-3399

## Material Test Report

ENERGY INDUSTRIES OF OHIO

Purchase Order Number PPPL-FP-LTS-2  
 Pattern Number MCWF-A6 Coil  
 CAF Metal Designation CF8MNMnMod  
 Material Spec CF8MNMnMOD

Cert Number 176210-1  
 Pour Date 1/31/2006

Weighted average of 3 heats – Ladle 1 #32219 (41%), Ladle 2 #32266 (22%), Ladle 3 #32269 (37%) Total Weight 32545 lbs.

Element	Min	Actual	Max
C	0.04	0.04	0.07
MN	2.3	2.7	2.8
SI	0.0	0.3	0.7
CR	18.0	18.3	18.5
NI	13.0	13.2	13.5
MO	2.1	2.3	2.5
P	0.0	0.025	0.035
S	0.0	0.012	0.025
N	0.24	0.26	0.28

\*Over specification, see CA 1536.

#### Comparison to WC Analysis

All analysis at CAF was performed after the preventive maintenance.

Lab	I.D.	Sample	C	Si	Mn	Cr	Ni	Mo	N	P	S
Ladle #1											
CAF	32219	Button #1	0.04	0.2	2.8	18.3	13.1	2.4	0.25	0.023	0.012
CAF	32219	Button #2	**	0.2	2.8	18.2	13.2	2.4	**	0.023	0.020
WC	32219	Button #2	**	0.2	2.6	18.0	13.2	2.4	**	0.023	0.022
Ladle #2											
CAF	32266	Button #1	0.04	0.4	2.7	18.4	13.2	2.3	0.26	0.029	0.011
CAF	32266	Button #2	**	0.4	2.7	18.4	13.3	2.3	**	0.030	0.020
WC	32266	Button #2	**	0.4	2.5	18.3	13.3	2.3	**	0.031	0.026
Ladle #3											
CAF	32269	Button #1	0.04	0.3	2.7	18.2	13.3	2.3	0.26	0.026	0.012
CAF	32269	Button #2	**	0.3	2.7	18.2	13.4	2.3	**	0.027	0.021
WC	32269	Button #2	**	0.3	2.5	18.0	13.4	2.3	**	0.027	0.025

Respectfully Submitted,  
 Charles A. Ruud  
 Quality Assurance Manager

Superior Quality Engineered Metal Products

[www.MetalTekInt.Com](http://www.MetalTekInt.Com)



### Carondelet Division

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## Material Test Report

ENERGY INDUSTRIES OF OHIO

Purchase Order Number PPPL-FP-LTS-2 Heat Number 29198 Pour Date 4/28/2005  
Pattern Number SE-141-073 COIL C SHIM (-3 thru-6 Parts) Cert Number S73220-2 and  
SE-141-033 COIL A SHIM (-1 thru-6 Parts) Cert Number S76220-1  
CAF Metal Designation CF8MNMnMod S/N 6  
Material Spec CF8MNMN MOD

Revised 1/30/06

Element	Min	Actual	Max
C	0.040	0.070	0.070
CR	18.000	18.100	18.500
MN	2.300	2.970	2.800
MO	2.100	2.450	2.500
N	0.240	0.255	0.280
NI	13.000	13.120	13.500
P*	0.000	0.013	0.035
S*	0.000	0.010	0.025
SI	0.000	0.700	0.700

MN & SI previously reported on CA 1308 and were accepted.

\*P & S taken from test from heat parts were poured from and analyzed by wet chemistry, ASTM E1019-03 for sulfur and Gravimetric for Phosphorous.

This report covers the eleven castings poured from heat 29198. Only parts listed above however will be shipped for this order. Each casting has a unique number stamped in the part adjacent to the pattern number to differentiate the part and subsequent reporting that will be traced to the casting.

Specification limits have been updated to latest specification.

The certificate is produced with EDP and valid without signature.

Respectfully Submitted,  
Charles A. Ruud  
Quality Assurance Manager

# PRODUCT CONFORMANCE REPORT



Product  
Class.

LNM 4455  
EN 12072-99 G 20 16 3 Min L

Size(s) mm  
Lot/Batch  
Item No.

1,2  
3018513/78308  
692129

Customer

EUROWELD  
MOORESVILLE N.C. 28117  
UNITED STATES

Quantity  
Customer ref.  
LSW Order No.

105,0 KG  
P.O. 05 - 46  
SD427896

## Chemical analysis (%)

EN10204 2.2

C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N
0,01	0,5	7,3	0,015	0,001	20,3	15,4	2,9	0,1	0,19



## Mechanical tests, all weld metal

EN10204 2.2

### Tensile testing

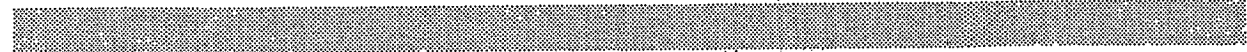
### Impact testing

Cond.	Temp. °C	Rp0.2 N/mm2	Rm N/mm2	A5 %	Cond.	Temp.1 °C	Av1 J
AW	RT	407	623	41	AW	-196	67

## Additional information

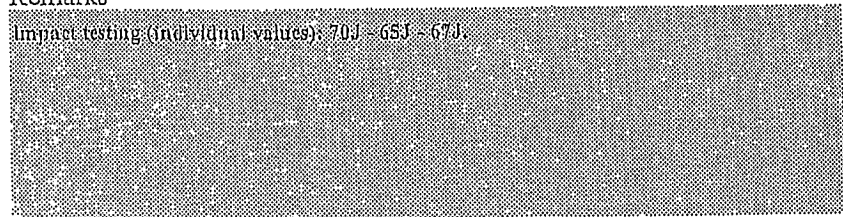
EN10204 2.2

Other tests



## Remarks

Impact testing (individual values): 70J - 65J - 67J.



The product identified above has been manufactured, tested and supplied in compliance with a Quality Assurance Programme that fulfils the requirements of EN 29000/ ISO 9000/BS 5750 or similar standard.

We herewith certify that the product complies with the above-mentioned standards. Certified ISO 9001:2000.

Company

Lincoln Smitweld B.V.

Registered Office

Nieuwe Dukenburgseweg 20  
6534 AD NIJMEGEN

Post address

P.O. Box 253  
6500 AG Nijmegen

Issued by

P. Nagels

Telephone

31 24 3522911

Function

QA Administrator 22/03/2005

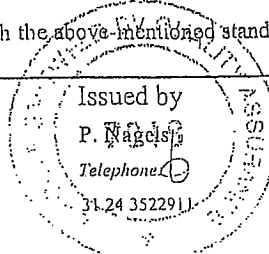
Fax:

31 24 3522200

Date

Cert.No.

3018513/7830



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 8600 Commercial Blvd.  
 Pevely, MO 63070

August 16, 2005  
 Lab No. 05P-2532  
 P.O. No. 21324  
 Page 1 of 2

Attention: Chuck Ruud

**REPORT OF CHARPY IMPACT TEST**

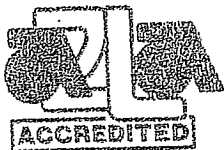
**MATERIAL (SAMPLE ID):** LNM 4455, LINCOLN LOT 3018513/78308  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** 293°K

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
LNM4455-7	104	0.085	100
LNM4455-8	106	0.093	100
LNM4455-9	99	0.084	100
<b>Average</b>	103	0.087	100

*Identification of tested specimen provided by client.*

  
 Karl Schmitz, Director  
 Materials Testing

KS/tlv



Certificate No. 0397-01  
 Certificate No. 0397-02

AN OFFICIAL COPY OF TEST REPORT WILL BE PROVIDED BY THIS LABORATORY ON REQUEST.  
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August 16, 2005  
 Lab No. 05P-2532  
 P.O. No. 21324  
 Page 2 of 2

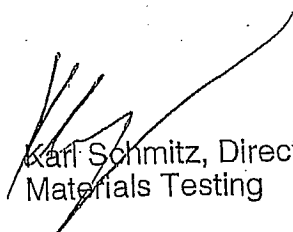
**Attention: CHUCK RUUD**

**REPORT OF MECHANICAL TESTS**

**SAMPLE ID: LNM 4455, LINCOLN LOT 3018513/78308**

Sample ID	Original Area Sq. Inches	Reduced Area Sq. Inches	Reduction in Area %	Yield Strength PSI	Tensile Strength PSI	Elongation (2.0" Gage Length)		Modules of Elasticity
						in.	%	
LNM4455	0.1932	0.0866	55.2	65200	95200	0.76	38.0	23.4

Round, reduced section tensiles  
 Yield taken at .2% offset  
 Tested in accordance with ASTM A 370-03a  
*Identification of tested specimens provided by the client.*

  
 Karl Schmitz, Director  
 Materials Testing

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October 5, 2005  
 Lab No. 05P-3096  
 P.O. No. 21324  
 Page 1 of 1

Attention: Chuck Ruud

**REPORT OF CHARPY IMPACT TEST**

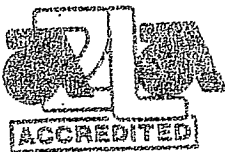
**MATERIAL (SAMPLE ID):** WELD PLATE- 3018513 / 78308  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** -320°F  
**REQUIREMENTS:** minimum 35 ft / lbs.

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
3018513/78308-1	48	0.033	50
3018513/78308-2	65	0.045	50
3018513/78308-3	48	0.033	50
<b>Average</b>	54	0.037	50

*Identification of tested specimen provided by client.*

KS/tv

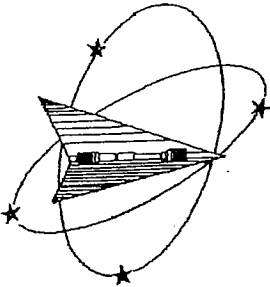
  
 Karl Schmitz, Director  
 Materials Testing



Certificate No. 0397-01  
 Certificate No. 0397-02

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*Westmoreland Mechanical Testing & Research, Inc.*  
 P.O. Box 388  
 Westmoreland Drive  
 Youngstown, Pa. 15696-0388 U.S.A.  
 Telephone: 724-537-3131 Fax: 724-537-3151  
 Website: *www.wmtr.com*  
 WMT&R is a technical leader in the material testing industry.



621-01 & 621-02



Section 1 of 1

WMT&R Report No. 5-35979  
Requisition No. 4972

October 18, 2005

**CERTIFICATION**

MetalTek International  
 The Carondelet Division  
 8600 Commercial Blvd.  
 I-55 Industrial Park  
 Pevely, MO 63070-1528

Attention: Jim Galaske

Subject: All processes, performed upon the material as received, were conducted at WMT&R, Inc. in accordance with the WMT&R Quality Assurance Manual, Rev. 9, dated 4/1/2000.  
 The following tests were performed on this order: TENSILE

TENSILE RESULTS: ASTM E21-03a

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.0030 in./in./min., 0.0500 in./min./in.

MATERIAL: METALTEK CF8MNMNMOD

DISPOSITION: Report

Specimen ID	Test Log Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	AIUR
3018513/78308	C54936	-320	184.9	123.7	33	33	32.8	18470	12350	0.3566	0.2926	1.40	1.86	0.09987403	M9	R

AIUR: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

Roy E. Stammatt Wojton  
 Technical Services Manager Tensile Supervisor

10-18-05

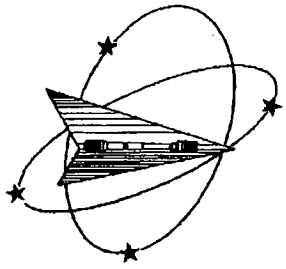
October 18, 2005

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*Testing Specialists for Aerospace, Automotive, and Material Testing Fields*  
 Locations in Youngstown, PA U.S.A. ~ Tel. (724) 537-3131 and  
 Banská Bystrica, S.K. ~ Tel. +44 (0) 1295 261211

PHX.NU: 5373081

14:29 OCT 18, 2005



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 P.O. Box 388  
 Westmoreland Drive  
 Youngstown, Pa. 15696-0388 U.S.A.  
 Telephone: 724-537-3131 Fax: 724-537-3151  
 Website: [www.wmtr.com](http://www.wmtr.com)  
 WMT&R is a technical leader in the material testing industry.



621-01 & 621-02

April 19, 2006

**CERTIFICATION**

MetalTek International  
 The Carondelet Division  
 8600 Commercial Blvd.  
 I-55 Industrial Park  
 Pevely, MO 63070-1528

Section 1 of 1

**WMT&R Report No. 6-27410**  
 P.O. No. 19386  
 Requisition No. 7580

Attention: Jim Galaske

Subject: All processes, performed upon the material as received, were conducted at WMT&R, Inc. in accordance with the WMT&R Quality Assurance Manual, Rev. 9, dated 4/1/2000.  
 The following tests were performed on this order: MICRO and TENSILE

**TENSILE RESULTS: ASTM E21-05**

Requirements: UTS ksi (Min 95\Max ---) 0.2% YS ksi (Min 72\Max ---) 4D Elong. % (Min 32\Max ---) Modulus Msi (Min 21\Max ---)

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.003 in./in./min., 0.05 in./min./in.

MATERIAL: Metaltek CF8MNMnMOD

DISPOSITION: Acceptable

Coll No.	Specimen	TestLog Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	A/U/R
A6	Z1	D43605	-320	167.3	95.8	64	65	25.8	16150	9252	0.3506	0.2082	1.40	2.30	0.09654142	M9	A
A6	Z2	D43606	-320	167.1	97.0	54	80	24.8	16180	9394	0.3511	0.1585	1.40	2.15	0.09681698	M9	A
A6	Z3	D43607	-320	189.4	116.2	51	44	31.7	18300	11220	0.3507	0.2620	1.40	2.12	0.09659650	M9	A

A/U/R: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

Requirements provided by MetalTek International

KNOWINGLY OR WILLFULLY FALSIFYING OR CONCEALING A MATERIAL FACT ON THIS FORM OR MAKING FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR REPRESENTATIONS HEREIN COULD CONSTITUTE A FELONY PUNISHABLE UNDER FEDERAL STATUTES. THIS CERTIFICATE OR REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF WMT&R, INC.

*Matthew Wojton*  
 Roy E. Starr Matt Wojton  
 Technical Services Manager Tensile Supervisor  
 4-19-06  
 April 19, 2006

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 8600 Commercial Blvd.  
 Pevely, MO 63070

March 13, 2006  
 Lab No. 06P-0711  
 P.O. No. 21324  
 Page 1 of 7

**Attention: Chuck Ruud**

**REPORT OF CHARPY IMPACT TEST**

**MATERIAL (SAMPLE ID):** Z1 COIL A6  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** 293°K / +70°F

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
Z1-1	130	0.124	100
Z1-2	116	0.106	100
Z1-3	108	0.067	80
<b>Average</b>	118	0.099	93

  
 3/13/06

*Identification of tested specimen provided by client.*

  
 Karl Schmitz, Director  
 Materials Testing

KS/tlv



Certificate No. 0397-01  
 Certificate No. 0397-02

AN OFFICIAL COPY OF TEST REPORT WILL BE PROVIDED BY THIS LABORATORY ON REQUEST.  
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 Pevely, MO 63070

March 13, 2006  
 Lab No. 06P-0711  
 P.O. No. 21324  
 Page 2 of 7

**Attention: Chuck Ruud**

**REPORT OF CHARPY IMPACT TEST**

**MATERIAL (SAMPLE ID):** Z1 COIL A6  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** 77°K / -320°F

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
Z1-4	51	0.021	40
Z1-5	76	0.049	40
Z1-6	67	0.026	40
<b>Average</b>	65	0.032	40

  
 3/13/06

*Identification of tested specimen provided by client.*

KS/tlv

  
 Karl Schmitz, Director  
 Materials Testing



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 Pevely, MO 63070

March 13, 2006  
 Lab No. 06P-0711  
 P.O. No. 21324  
 Page 3 of 7

**Attention: Chuck Ruud**

**REPORT OF CHARPY IMPACT TEST**

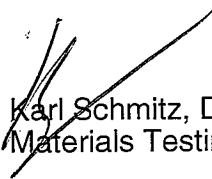
**MATERIAL (SAMPLE ID):** Z2 COIL A6  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** 293°K / +70°F

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
Z2-1	156	0.105	100
Z2-2	128	0.096	100
Z2-3	138	0.122	100
<b>Average</b>	141	0.108	100

  
 3/13/06

*Identification of tested specimen provided by client.*

KS/tlv

  
 Karl Schmitz, Director  
 Materials Testing



Certificate No. 0397-01  
 Certificate No. 0397-02

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 Pevely, MO 63070

March 13, 2006  
 Lab No. 06P-0711  
 P.O. No. 21324  
 Page 4 of 7

**Attention: Chuck Ruud**

**REPORT OF CHARPY IMPACT TEST**


**MATERIAL (SAMPLE ID):** Z2 COIL A6  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** 77°K / -320°F

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
Z2-4	87	0.053	50
Z2-5	80	0.057	50
Z2-6	75	0.033	40
<b>Average</b>	81	0.048	47



*Identification of tested specimen provided by client.*

KS/tlv

  
 Karl Schmitz, Director  
 Materials Testing



Certificate No. 0397-01  
 Certificate No. 0397-02

AN OFFICIAL COPY OF TEST REPORT WILL BE PROVIDED BY THIS LABORATORY ON REQUEST.  
 NOT OFFICIAL WITHOUT THE RAISED SEAL OF ST. LOUIS TESTING LABORATORIES, INC.  
 SEE REVERSE FOR CONDITIONS.





2810 Clark Avenue • St. Louis, MO 63103-2574 • (314) 531-8080 • FAX (314) 531-8085  
*Chemical, Metallurgical, Mechanical, Nondestructive, Environmental Testing, Analyses and Field Service.*

**METALTEK INTERNATIONAL**  
 8600 Commercial Blvd.  
 Pevely, MO 63070

March 13, 2006  
 Lab No. 06P-0711  
 P.O. No. 21324  
 Page 5 of 7

**Attention: Chuck Ruud**

**REPORT OF CHARPY IMPACT TEST**

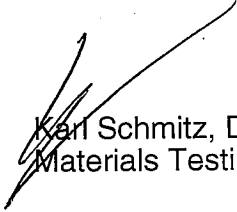
**MATERIAL (SAMPLE ID):** Z3 COIL A6  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** 293°K / +70°F

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
Z3-1	116	0.085	100
Z3-2	126	0.105	100
Z3-3	120	0.081	90
<b>Average</b>	121	0.090	97

  
 3/13/06

*Identification of tested specimen provided by client.*

KS/tlv

  
 Karl Schmitz, Director  
 Materials Testing



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 Certificate No. 0397-02

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March 13, 2006  
 Lab No. 06P-0711  
 P.O. No. 21324  
 Page 6 of 7

**Attention: Chuck Ruud**

**REPORT OF CHARPY IMPACT TEST**

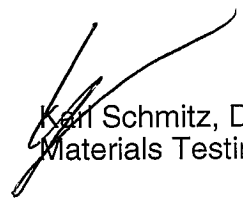
**MATERIAL (SAMPLE ID):** Z3 COIL A6  
**SPECIFICATION:** ASTM A 370-03a  
**SPECIMEN TYPE:** "A" Vee Notch  
**SPECIMEN SIZE:** 10 mm x 10 mm  
**TEMPERATURE OF TEST:** 77°K / -320°F

BASE METAL	FOOT LBS.	LATERAL EXPANSION	% SHEAR
Z3-4	74	0.050	40
Z3-5	72	0.037	40
Z3-6	72	0.038	40
<b>Average</b>	73	0.042	40

  
*3/13/06*

*Identification of tested specimen provided by client.*

KS/tiv

  
 Karl Schmitz, Director  
 Materials Testing



Certificate No. 0397-01  
 Certificate No. 0397-02

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 Pevely, MO 63070

March 13, 2006  
 Lab No. 06P-0711  
 P.O. No. 21324  
 Page 7 of 7

**Attention: Chuck Ruud**

**REPORT OF MECHANICAL TESTS**

**SAMPLE ID: Z1, Z2, Z3 COIL A6**

Sample ID	Original Area Sq. Inches	Reduced Area Sq. Inches	Reduction in Area %	Modulus of Elasticity	Yield Strength PSI	Tensile Strength PSI	Elongation (2.0" Gage Length)	
							in.	%
Z1	0.1886	0.1195	36.7	23.1	46100	90700	1.03	51.5
Z2	0.1893	0.1035	45.3	21.8	40900	85800	1.15	57.5
Z3	0.1901	0.1250	34.2	22.8	46600	91000	0.76	38.0


Round, reduced section tensiles

Yield taken at .2% offset

Tested in accordance with ASTM A 370-03a

*Identification of tested specimens provided by the client.*

KS/tlv

  
 Karl Schmitz, Director  
 Materials Testing



Certificate No. 0397-01  
 Certificate No. 0397-02

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## A-6 Coil Weld Map – Metal Tek

Map of all major welds exceeding 20% of wall, over 1 inch or over 10<sup>2</sup> inches

Defect Number	Drawing View	Length (inches)	Width (inches)	Depth (inches)
1	Left	5 ½	4	2 ½
2	Top	3	3	1 ½
3	Back	10	3	2 ¾
4	Back	8	2 ¾	2 ¾
5	Back	8	4	1
6	Left	2	2	1 ½
7	Right	9	4	Thru
8	Right	5 ½	2	1 ¼
9	Right	7 ½	5 ¼	7/8
10	Right	18	4 ½	Thru
11	Right	9 ½	4	¾
12	Top	7	2 ½	2
13	Left	10 ½	5	2
14	Left	23	6	1
15	Left	6	4	1 ½
2 RT 1	Top	4	2 ½	2
16	Top	4	2 ¼	2
17	Top	2 ½	2 ½	1

# A-6 Coil Weld Map – Metal Tek

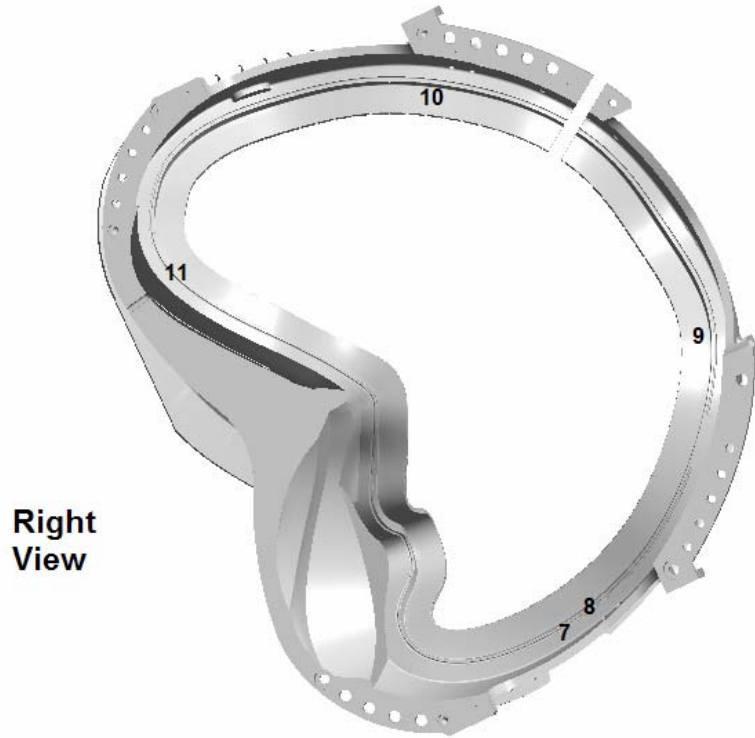
Map of all major welds exceeding 20% of wall, over 1 inch or over 10<sup>2</sup> inches

Left  
View



## A-6 Coil Weld Map – Metal Tek

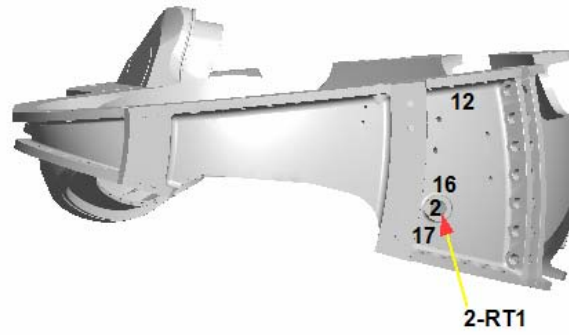
Map of all major welds exceeding 20% of wall, over 1 inch or over 10<sup>2</sup> inches



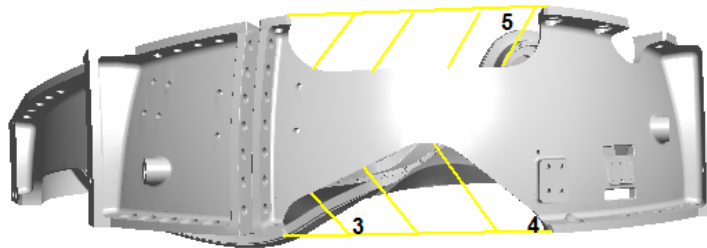
# A-6 Coil Weld Map – Metal Tek

Map of all major welds exceeding 20% of wall, over 1 inch or over 10<sup>2</sup> inches

**Top  
View**



**Back  
View**



# TEAM COOPERHEAT-MQS, INC.

## CERTIFIED RADIOGRAPHIC INSPECTION REPORT

FORM 6061-RT- 002 Rev.2

5512 W. State St. Milwaukee, WI 53208 Tel:(414)771-3060 Fax:(414)771-9481 (800)818-6403 www.cooperheat-mqs.com

CUSTOMER		DATE	WORK ORDER NO.
NAME <u>METAL TEK INTERNATIONAL</u>		<u>03/04/2006</u>	<u>361-03001-2</u>
ADDRESS <u>8600 COMMERCIAL BLVD</u>		P.O. NUMBER	XRAY <u>X</u>
CITY <u>PEVELY</u> STATE <u>MO</u> ZIP <u>63070</u>		<u>23292</u>	GAMMA
PROCEDURE SPECIFICATION	ACCEPTANCE CRITERIA	SHEET _____ OF _____	
ASTM E94-93	MSS-SP-54-1999		

PART NUMBER	Serial No	View	No Apparent Indications		Dross		Incomplete Penetration		Shrinkage		Film Artifacts		REMARKS
			Acceptable	Rejected	Included	or Porosity	Lack of Fusion	Gas Cracks	Hot Tears	Under Surface			
MCWFA-6		1-2	✓										
		2-3	✓										
Z103990		3-4	✓										
HT# M176210		4-5	✓										
CO 40851		5-6	✓						3				
		6-7	✓						1				
		7-8	✓						1				
		8-9	✓										
		9-10	✓										
		10-11			R	5							
		11-12	✓										
		12-13	✓										
		13-14	✓										
		14-15	✓							1			
		16-17	✓										
		17-18	✓										✓
		18-19	✓										
		19-20	✓										✓
		20-21	✓						2				
		21-22	✓						1	1-2			✓
		22-23	✓						1	1-2			
		23-24	✓			2							✓
		24-25	✓						1-2				
		25-26	✓						1				*

NO. ACCEPTED	0	NO. REJECTED	1	MQS TECH. NO.	12970	SHT.	REV.
COMMENTS	* 120 pore Not in View. Area for this pore on next view.			CUST. RSS NO.		SHT.	REV.
				REVIEWER	<i>John Petroske</i>		
				CERTIFIED NDT LEVEL (RT)			
				John Petroske	RT II Exp. 01/08		



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## CERTIFIED RADIOGRAPHIC INSPECTION REPORT

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CUSTOMER	DATE <u>03/04/2006</u>	WORK ORDER NO. <u>361-03001-2</u>
NAME <u>METAL TEK INTERNATIONAL</u>	P.O. NUMBER <u>23292</u>	XRAY      X GAMMA
ADDRESS <u>8600 COMMERCIAL BLVD</u>		
CITY <u>PEVELY</u> STATE <u>MO</u> ZIP <u>63070</u>		
PROCEDURE SPECIFICATION <u>ASTM E94-93</u>	ACCEPTANCE CRITERIA <u>MSS-SP-54-1999</u>	SHEET <u>2</u> OF <u>6</u>

PART NUMBER	Serial No	View	No Apparent Indications			Dross		Incomplete Penetration		Shrinkage		Film Artifacts		REMARKS
			Accep- table	Reje- cted	Inclu- sion	or Slag	Por- osity	Lack of Fusion	Gas Cracks	Hot Tears	Under cut	Sur- face		
MCWFA-6	26-27	✓												
	27-28	✓												
Z103990	28-29	✓							2				✓	
HT# M176210	29-1	✓							1					
CO 40851														

NO. ACCEPTED <u>0</u>	NO. REJECTED <u>1</u>	MQS TECH. NO. 12970	SHT.	REV.
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COMMENTS	CUST. RSS NO.	SHT.	REV.
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REVIEWER John Petroske  
 CERTIFIED ND LEVEL (RT)

John Petroske RT II Exp. 01/08

# TEAM COOPERHEAT-MQS, INC.

## CERTIFIED RADIOGRAPHIC INSPECTION REPORT

FORM 6061-RT- 002 Rev.2

5512 W. State St. Milwaukee, WI 53208 Tel:(414)771-3060 Fax:(414)771-9481 (800)818-6403 www.cooperheat-mqs.com

CUSTOMER		DATE	WORK ORDER NO.
NAME METAL TEK INTERNATIONAL		03/04/2006	361-03001-2
ADDRESS 8600 COMMERCIAL BLVD		P.O. NUMBER	XRAY X
CITY PEVELY STATE MO ZIP 63070		23292	GAMMA
PROCEDURE SPECIFICATION ASTM E94-93	ACCEPTANCE CRITERIA MSS-SP-54-1999	SHEET 3 OF 6	

PART NUMBER	Serial No	View	No Apparent Indications		Dross		Incomplete Penetration		Shrinkage		Film Artifacts		REMARKS
			Acceptable	Rejected	Inclusion	or Porosity	Lack of Fusion	Gas Cracks	Hot Tears	Under cut	Surface		
MCWFA-6	30-31	✓			2								
	31-32	✓											
Z103990	32-33			R	5								
HT# M176210	33-34	✓											
CO 40851	34-35	✓										✓	
	35-36			R							R	✓	✓
	37-38	✓										✓	
	38-39	✓							1				
	39-40	✓											
	41-42			R	4								
	43-44	✓											
	44-45			R					4			✓	
	45-46	✓											
	46-47	✓											
	47-48	✓											
	48-49	✓											
	50-51	✓											
	51-52	✓											
	52-53	✓										✓	
	54-55	✓										✓	
	55-56			R					2	4			
	57-58	✓											
	58-59			R							R		
	59-60	✓											
	60-61	✓											

NO. ACCEPTED	φ	NO. REJECTED	1	MQS TECH. NO.	12970	SHT.	REV.
COMMENTS				CUST. RSS NO.		SHT.	REV.
				REVIEWER	<i>John Petroske</i>		
				CERTIFIED NDT LEVEL (RT)	John Petroske RT II Exp. 01/08		

# TEAM COOPERHEAT-MQS, INC.

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CUSTOMER		DATE	WORK ORDER NO.
NAME METAL TEK INTERNATIONAL		03/04/2006	361-03001-2
ADDRESS 8600 COMMERCIAL BLVD		P.O. NUMBER	XRAY X
CITY PEVELY STATE MO ZIP 63070		23292	GAMMA
PROCEDURE SPECIFICATION ASTM E94-93	ACCEPTANCE CRITERIA MSS-SP-54-1999	SHEET <u>4</u> OF <u>6</u>	

PART NUMBER	Serial No	View	No Apparent Indications		Incomplete Penetration		Shrinkage		Film Artifacts		REMARKS
			Acceptable	Rejected	Dross or Slag	Porosity	Lack of Fusion	Gas Cracks	Hot Tears	Under surface	
MCWFA-6		61-62	✓								
		62-63		R					R		
Z103990	62A-63A	✓									
HT# M176210	63-64			R			4				
CO 40851	64-65	✓									
	65-65A-66	✓									✓
	66-67	✓								✓	
	67-68	✓								✓	
	68-69	✓								✓	✓
	69-70			R				4			
	70-71	✓								✓	
	71-72			R				3-4			
	72-73	✓					1			✓	
	73-74	✓									
	74-75	✓									
	75-76	✓								✓	
	76-77			R				4			
	77-78	✓						*			See 76-77
	78-79	✓			2-3						
	79-80	✓									
	80-81	✓								✓	

NO. ACCEPTED	0	NO. REJECTED	1	MQS TECH. NO.	12970	SHT.	REV.
COMMENTS				CUST. RSS NO.		SHT.	REV.
				REVIEWER	<i>John Petroske</i>		
				CERTIFIED NDT LEVEL (RT)			
				John Petroske RT II Exp. 01/08			

# TEAM COOPERHEAT-MQS, INC.

## CERTIFIED RADIOGRAPHIC INSPECTION REPORT

FORM 6061-RT- 002 Rev.2

5512 W. State St. Milwaukee, WI 53208 Tel:(414)771-3060 Fax:(414)771-9481 (800)818-6403 www.cooperheat-mqs.com

CUSTOMER		DATE	WORK ORDER NO.
NAME METAL TEK INTERNATIONAL		03/04/2006	361-03001-2
ADDRESS 8600 COMMERCIAL BLVD		P.O. NUMBER	XRAY X
CITY PEVELY STATE MO ZIP 63070		23292	GAMMA
PROCEDURE SPECIFICATION	ACCEPTANCE CRITERIA	SHEET 5 OF 6	
ASTM E94-93	MSS-SP-54-1999		

PART NUMBER	Serial No	View	No Apparent Indications		Dross		Incomplete Penetration		Shrinkage		Film Artifacts		REMARKS
			Acceptable	Rejected	Inclusion	Porosity	Lack of Fusion	Gas Cracks	Hot Tears	Under cut	Surface		
MCWFA-6	81-82	✓			2					2		✓	✓
	82-83	✓								2		✓	
Z103990	84-85	✓										✓	✓
HT# M176210	85-86	✓										✓	
CO 40851	86-87	✓										✓	
	87-88	✓											
	89-90	✓											
	90-91	✓											
	92-93	✓										✓	
	94-95	✓								2-3			
	95-96				R					4			
	96-97				R					4			
	97-98				R					4			
	98-99	✓											
	99-100				R					4			
	100-101	✓											
	102-103	✓								2			
	103-104	✓								2			
	104-105	✓								2			
	106-107				R	4-5							
	107-108	✓											
	108-109	✓								3		✓	
	109-110				R					4		✓	✓
	111-112	✓				1-2							
	112-113	✓								1-2			

NO. ACCEPTED	NO. REJECTED	MQS TECH. NO.	SHT.	REV.
4	1	12970		
COMMENTS		CUST. RSS NO.	SHT.	REV.
		REVIEWER		
		John Petroske		
		CERTIFIED NOT LEVEL (RT)		
		John Petroske RT-II Exp. 01/08		

# TEAM COOPERHEAT-MQS, INC.

## CERTIFIED RADIOGRAPHIC INSPECTION REPORT

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CUSTOMER		DATE	WORK ORDER NO.
NAME METAL TEK INTERNATIONAL		03/04/2006	361-03001-2
ADDRESS 8600 COMMERCIAL BLVD		P.O. NUMBER	XRAY X
CITY PEVELY STATE MO ZIP 63070		23292	GAMMA
PROCEDURE SPECIFICATION	ACCEPTANCE CRITERIA	SHEET 6 OF 6	
ASTM E94-93	MSS-SP-54-1999		

PART NUMBER	Serial No	View	No Apparent Indications		Dross		Incomplete Penetration		Shrinkage		Film Artifacts		REMARKS
			Acceptable	Rejected	Inclusion	Porosity	Lack of Fusion	Gas Cracks	Hot Tears	Under cut	Surface		
MCWFA-6	113	114	✓							1			
	115	116	✓							2			
Z103990	116	117	✓							3			
HT# M176210	118	119	✓									✓	
CO 40851	119	120	✓						2			✓	
	121	122	✓										✓
	122	123	✓										✓
	123	124	✓										✓
	124	125	✓							2			✓
	125	126			R					2	R		
	126	127	✓									✓	
	127	128	✓										
	128	129	✓						2	2			
	130	131	✓										
	131	132	✓										
		V133	✓										
		V134	✓										
		88-89	✓										

NO. ACCEPTED	NO. REJECTED	MQS TECH. NO.	SHT.	REV.
0	1	12970		
COMMENTS		CUST. RSS NO.	SHT.	REV.
		REVIEWER		
		John Petroske		
		CERTIFIED NOT LEVEL (RT)		
		John Petroske RT II Exp. 01/08		

# TEAM COOPERHEAT-MQS, INC.

## CERTIFIED RADIOGRAPHIC INSPECTION REPORT

FORM 6061-RT- 002 Rev.2

5512 W. State St. Milwaukee, WI 53208 Tel:(414)771-3060 Fax:(414)771-9481 (800)818-6403 www.cooperheat-mqs.com

CUSTOMER		DATE	WORK ORDER NO.
NAME METAL TEK INTERNATIONAL		04/1/2006	361-03094
ADDRESS 8600 COMMERCIAL BLVD		P.O. NUMBER	XRAY X
CITY PEVELY STATE MO ZIP 63070		23292	GAMMA
PROCEDURE SPECIFICATION	ACCEPTANCE CRITERIA	SHEET ____ OF ____	
ASTM E94-93	MSS-SP-54-1999		

PART NUMBER	Serial No	View	No Apparent Indications		Dross		Incomplete Penetration		Shrinkage		Film Artifacts		REMARKS
			Acceptable	Rejected	Inclusion	Porosity	Lack of Fusion	Gas Cracks	Hot Tears	Under cut	Surface		
MCWFA-6	R1	10-11	✓										
		32-33	✓										
Z103990		35-36	✓										
HT# M176210		41-42	✓										
CO 40851		44-45	✓					2-3					
		55-56	✓					1					
		58-58A-59	✓										
		62-63	✓										
		63-64			R			4					
		69-70	✓										
		71-72			R				4				
		76-77	✓										
		95-96	✓										
		96-97	✓						2				
		97-98	✓										
		99-100			R				4				
		100-107	✓										
		109-110	✓										
		125-126	✓						1				✓

NO. ACCEPTED	0	NO. REJECTED	/	MQS TECH. NO.	12970	SHT.	REV.
COMMENTS				CUST. RSS NO.		SHT.	REV.
				REVIEWER	<i>John Petroske</i>		
				CERTIFIED NOT LEVEL (RT)			
				John Petroske RT II Exp. 01/08			

# MetalTek

## INTERNATIONAL

### RADIOGRAPHIC INTERPRETATION REPORT

CUSTOMER <b>E.I.O.</b>		PURCHASE ORDER NUMBER <b>PPPL-FP-LTS-2</b>				DATE <b>4-4-06</b>		CONTROL NO. <b>40851</b>		PAGE <b>1 of 1</b>	
PART NO. <b>MCWFA-6</b>		SPECIFICATION <b>E446/E186</b>		CLASS <b>SeeSpec</b>		TOTAL PIECES <b>1</b>		PIECES ACCEPTED <b>1</b>			
RADIOGRAPHED BY: <b>Midgett/Kelley</b>				INTERPRETED BY: <b>Midgett/Kelley</b>				ASNT LEVEL <b>II</b>			
FILM TYPE <b>29/59/80</b>	MATERIAL <b>CFBMMNMA</b>			ISOTOPE <b>IRIDIUM 192 COBALT 60</b>				CODE <b>ASTM E94 ASME MIL-STD-453</b>			
<b>M176210</b>	V	P	A	R	S	I	P	L	S	L	COMMENTS
	IEW	ENE	CCPT	REJECT	SHRINK	INCLUSION	POROSITY	LINEAR	SURFACE	LOF/LOP	
<b>R2</b>	<b>63-64</b>	<b>30</b>	<b>5080</b>	/	/	/	/	/	/	/	
	<b>71-72</b>	<b>30</b>	<b>X</b>	<b>X</b>			<b>X</b>			<b>X</b>	
	<b>99-100</b>	<b>50</b>	/					/			
<b>R3</b>	<b>71-72</b>	<b>30</b>	/		<b>1</b>		<b>1</b>	/			

# Metaltek INTERNATIONAL

## RADIOGRAPHIC STANDARD SHOOTING SKETCH

Customer <u>E.I.O.</u>	Pattern Number <u>MCWFA-6</u>
Material <u>CF8M N N MoA</u>	Traceability Number
Film Manufacturer <u>FUJI</u>	Source Number <u>CO</u>
IQI LEVEL <u>2-2T</u> From CQP 401 <input checked="" type="checkbox"/> Other (Specify, E.G. 2-4T, 2-1T) <u>N/A</u>	

Exposures (views)	<u>6364</u>	<u>71-72</u>	<u>99-100</u>																	
Thickness (IN.)	<u>1 1/2" x 4"</u>	<u>1 1/2"</u>	<u>2 3/4"</u>																	
S/F Distance (IN.)	<u>20"</u>	←————→																		
Penetrator	<u>30x2 50 80</u>	<u>30x2</u>	<u>x2 50</u>																	
Time (MIN.)	<u>2 min</u>	<u>5W55</u>	<u>8W255</u>																	
Focal Spot (IN.)	<u>.1</u>	←————→																		
Film Size (IN.)	<u>14x17</u>	←————→																		
Screen Size (Pb) Front/Back	<u>.01</u>	←————→																		
S.W.E./D.W.E.	<u>SWE</u>	←————→																		
S.W.V/D.W.V.	<u>SWV</u>	←————→																		
Film Type	<u>29 59 80</u>	<u>80</u>	→																	
Acceptance Standard	<u>E444 E186</u>	←————→																		
Severity Level	<u>See Spec</u>	→																		

Shooting Sketch (Use Additional Pages as Needed)

Accept to MSS-SP-54-1999

Technique Prepared By: Ron Kelly      Level: II      Date: 4-4-06  
 Technique Approved By: \_\_\_\_\_      Level: \_\_\_\_\_      Date: \_\_\_\_\_



# MetalTek INTERNATIONAL

## RADIOGRAPHIC INTERPRETATION REPORT

CUSTOMER <i>Energy Industries of Ohio</i>	PURCHASE ORDER NUMBER <i>PPL-FP-LTS-2</i>	DATE <i>12-16-05</i>	CONTROL NO. <i>40851</i>	PAGE <i>1 of 1</i>
PART NO. <i>SE-141-033-6</i>	SPECIFICATION <i>F186</i>	CLASS <i>III</i>	TOTAL PIECES <i>1</i>	PIECES ACCEPTED <i>1</i>

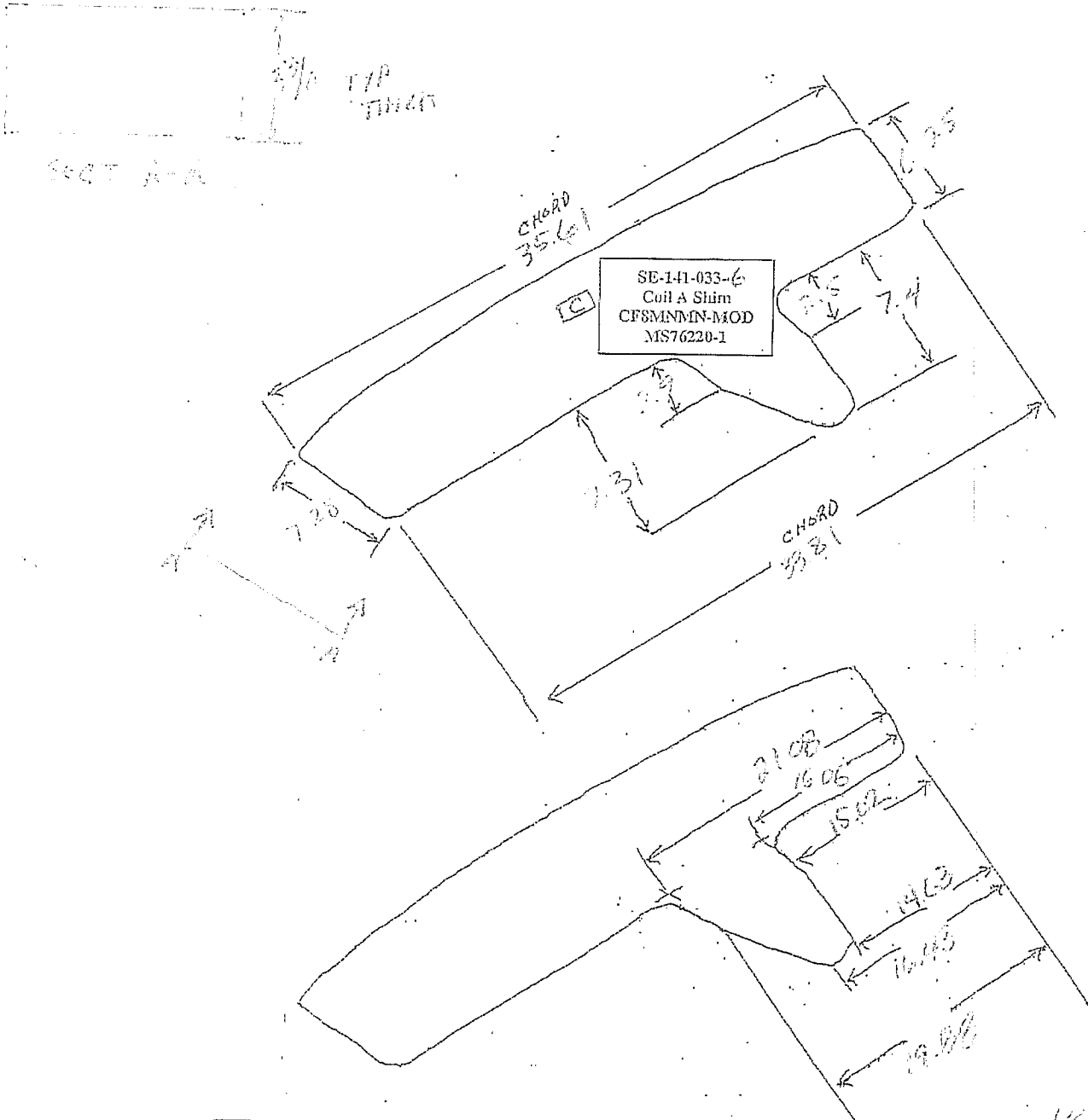
RADIOGRAPHED BY: <i>Midgett</i>	INTERPRETED BY: <i>Midgett</i>	ASNT LEVEL <i>#</i>
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FILM TYPE <i>80</i>	MATERIAL <i>CF8MNMND</i>	ISOTOPE <i>IRIDIUM 192 COBALT 60</i>	CODE <i>ASTM E94 ASME MIL-STD-453</i>
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VIEWS	PENETRATION	ACCEPT	REJECT	SHRINK	INCLUSION	POROSITY	LINEAR	SURFACE	LOF/LOP	COMMENTS
										<i>M576220</i>
										<i>RT6</i>
										<i>A COIL</i>
										<i>skin</i>
										<i>SN #6</i>

S:DRIVE/MANUAL FORMS/RADIOGRAPHY  
RIR-01 REV.0 6/9/03  
FORM CC034

# Metaltek INTERNATIONAL



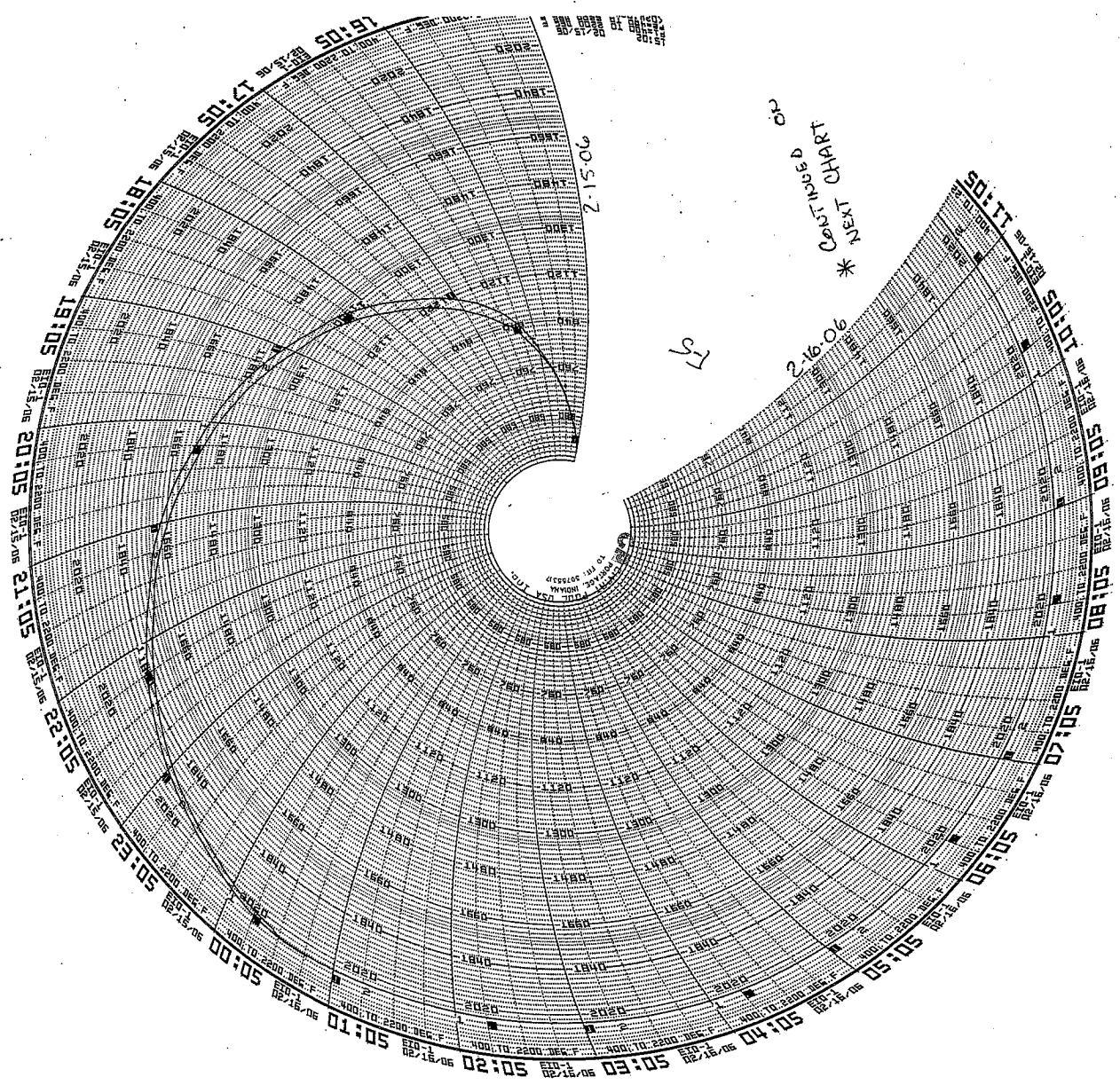
Inspected By: *[Signature]* Date Inspected: *1/27/10*

PG 1 of 2 E10 2-15-06

A6

M176210-1

1 Pc



15

Re 20F2

EIO 2-15-06

A6

M176210-1

IPc

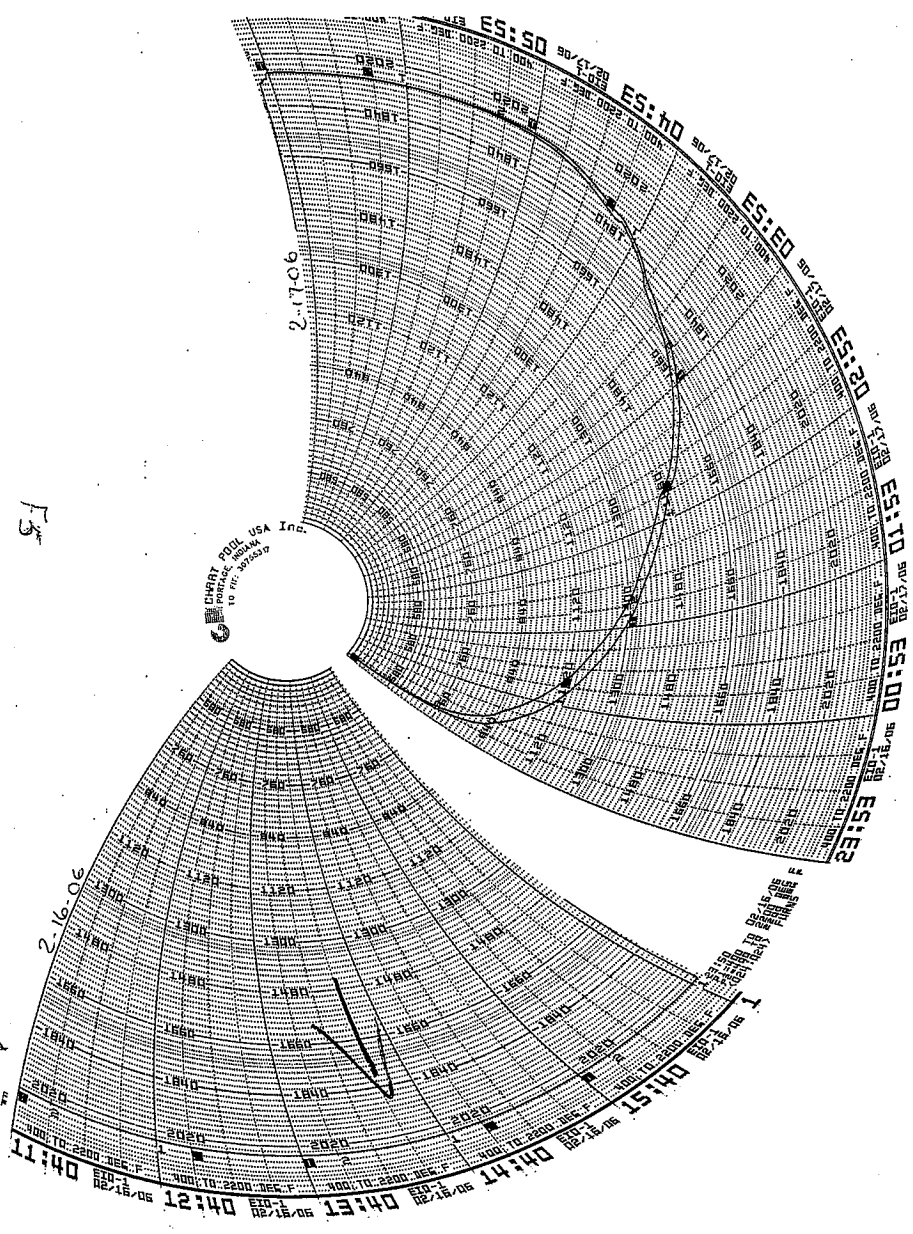
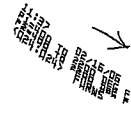


Chart From  
Previous Chart



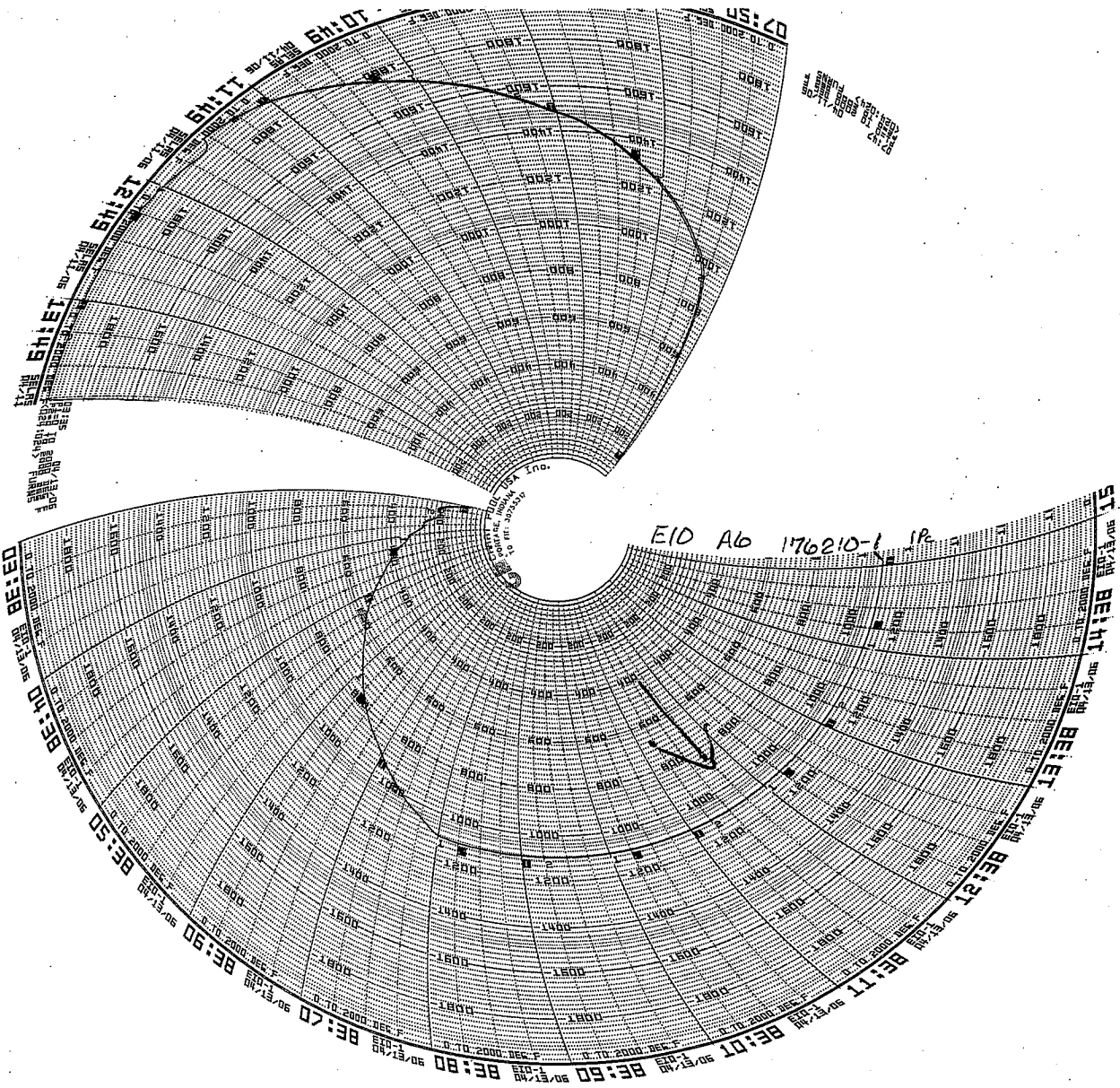
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E10 4-13-06

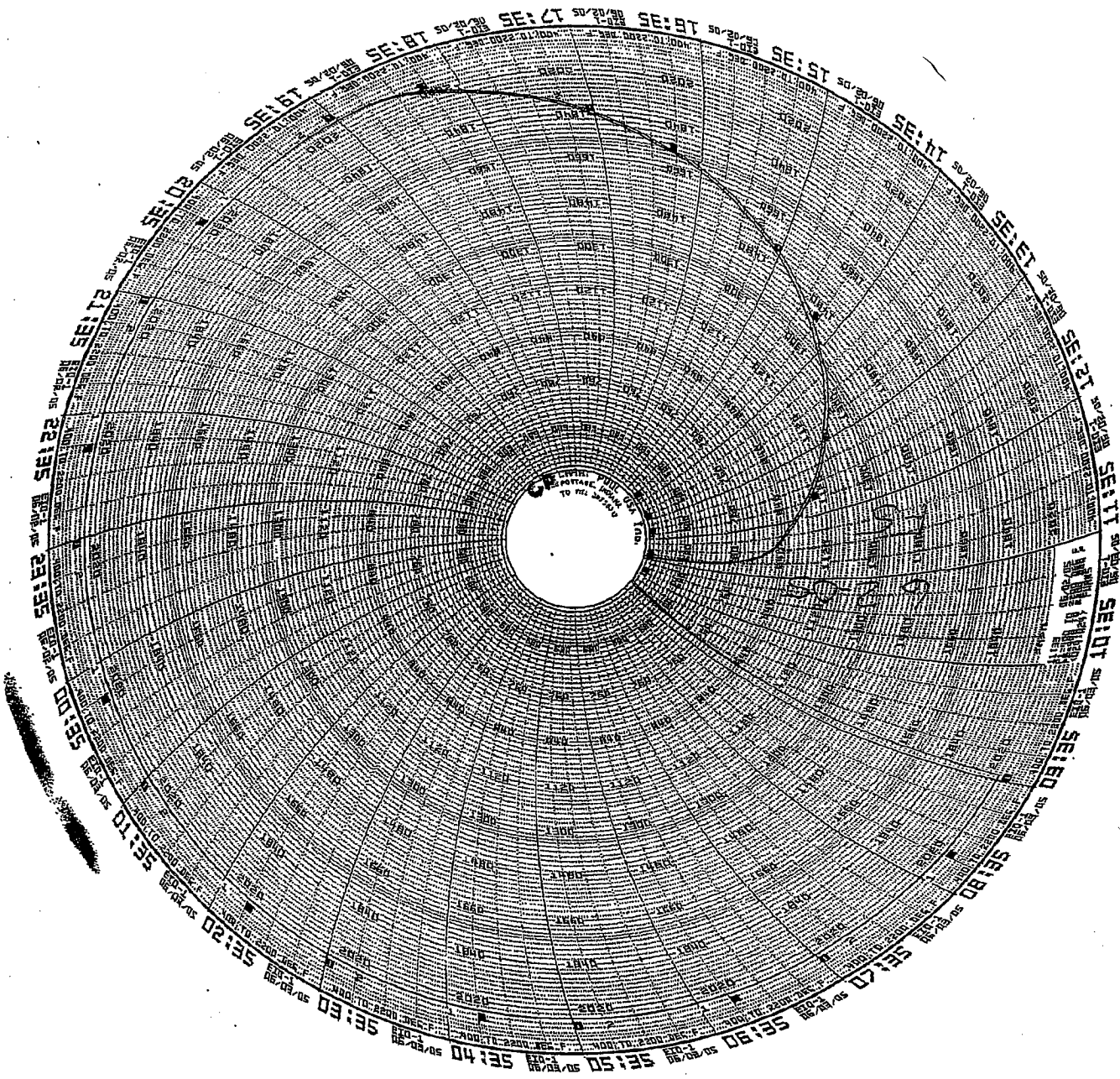
A6

M176210-1

1Pc



A+C Shims CTR



Energy Industries of Ohio  
 Manufacturing and Test Sequence (MTS) ALL Coils A 6 COIL  
 1 OF 11 CO# 40851 Dated 3-9-05 Revision: Rev10 Dated Issued:1-18-06

OPER. #	STATION	DESCRIPTION OF PROCESS	Name	Date
10	QUALITY RELEASE	REVIEW AND APPROVE MTS. RECEIVED APPROVAL FROM EIO ON xxxxx FROM Pete D. SIGNED QUALITY MANAGER		
15	PATTERN NPAT SOP 0100REV2	APPLY APPROPRIATE PART NUMBER, SERIAL NUMBER, AND FOUNDRY MARK, TO THE PATTERN. CAST ON TEST BARS AND CAST ON BLOCKS (extra 3"x3"x1" specimens) REQUIRED, ID AS TO COIL NUMBER AND ZONE LOCATION.		
20	COREMAKE CORE SOP 0100 REV 6 CALIBRATION PER CORE SOP 0200R4/0300R6	MAKE CORES IN SAND MIXTURES AS DESCRIBED BY METALTEK ENGINEERING AND VERIFIED IN MODELING TRIALS. METALTEK CORE SOP 0100 REV 6) CORE WASH WITH ZIRCONIUM CORE WASH. (CALIBRATION OF EQUIPMENT REQUIRED PER CORE SOP 0200,R4 / 0300,R6)  VERIFY COUNT AND INSPECT.	REB	1/25/06
30	MOLD MOLD SOP 0400 REV 8 CALIBRATION PER MOLD SOP 0900 REV 5 PREPARATION PER MOLD SOP 1100R2/1200R2/1300R1 SAND TESTING PER MOLD SOP 1400R2/1500R3/1600R2	MOLD PER WORK INSTRUCTIONS IN MAPICS ROUTING AND SOPS REFERENCED. ENGINEER OF RECORD - ROGER BROMAN, CONSULT ON MOLD-RELATED CONCERNS. MOLD MATERIALS REQUIRED PER MAPICS BOM. NOTIFY ENGINEER OF ANY SUBSTITUTIONS.	JLR	1/27/06
40	POUR MELT SOP 0100R5 MELT SOP 0700R2 MELT SOP 0600R2	METAL MUST BE AOD REFINED OR AOD INGOT. VIRGIN METAL ADDITIONS ALLOWED. RECORD POURING TEMPERATURE: <u>2750</u> CASTING POURED AT: <u>2750</u> DATE: <u>1/31/06</u> HEAT #'s: <u>3224667, 68, 69</u> ELAPSED POUR TIME <u>60 sec</u> KEEL BLOCKS POURED: <u>NA Yes</u> Sample from ladle to be analyzed for final chemical analysis and reported on material certifications. Sample Taken by: <u>SR</u> Analyzed: <u>GR</u> Date: <u>1/31</u>	SR	1/31/06
50	MELT SOP 0800R2	SHAKEOUT	CR	2/4/06
60	ARC RISE SOP 0100R1	REMOVE RISERS AS DIRECTED BY SUPERVISOR.	DKS	2-23-04

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70	HEAT TREAT HEAT SOP 0103R5	SOLUTION ANNEAL. MAKE SURE TO BLOCK ALL FLANGES OF FORM AND RACETRACK TO MINIMIZE CREEP DISTORTION. Soak Temp: 2050F, Soak Time: At least 7 hours, Quench Type: Air Cool MAKE SURE TEST MATERIAL IS PLACED IN THE CORRECT ZONE.	F5-1	DCS 2-15-06
80	PHYSICAL TESTING	OBTAIN TEST SPECIMENS AND SUBMIT FOR PHYSICAL TESTING. REPORT RESULTS AS PART OF STEP 530. DCMA IS TO WITNESS CHARPY TESTING AT LAB.	WH	2/15
NOTE		<b>THE ORDER OF CLEANING PROCESSES MAY BE ALTERED DUE TO CAPACITY CONSTRAINTS. HOLD POINTS AND COMPLIANCE WILL NOT BE COMPROMISED. EIO WILL BE ADVISED OF ALL CHANGES THAT MAY RESULT IN A REQUEST FOR DEVIATION FROM REQUIREMENTS.</b>		
90	GRIND GSAW SOP 0100R3	SWING GRIND TO REMOVE RISER REMAINS AND FLASH IF REQUIRED.	TH	2/23/06
100	GRIND GCHI SOP 0100R2	CHIP AND HAND GRIND SURFACE OF PART AS REQUIRED FOR CONTOUR.	A.B. <del>M.G.</del>	2/25/06
110	SAND BLAST BLAS SOP 0100R6	SANDBLAST (REMOVE ALL BLAST MATERIAL FROM CASTING) SANDBLASTING WILL BE DONE USING RECYCLED SHARP ANGULAR AGGREGATE.	CGD	2/27/06
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF X-RAY. EIO NOTIFIED ON <u>2/15</u> DCMA NOTIFIED ON <u>2/15</u>	Q ENG OR QA MGR	cta
120	X-RAY AT MQS MQS PROCEDURE 20.H.010 REV 0	X-RAY PER TECHNIQUE # 12726 USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. WHEN MARKING USE BLACK MARKERS. ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.	RT - LEVEL II RBK	3-29-06
130	X-RAY CQP 401 REV 5	X-RAY INTERPRETATION. ACCEPTANCE MSS SP 54. ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET. IF OK CHECK HERE <input type="checkbox"/> AND SEND TO STEP 160. REJECTED CHECK HERE <input checked="" type="checkbox"/> MARK UP DEFECTS AND SEND THE CASTING TO STEP 140.	RT - LEVEL II RBK	3-29-06
140	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS FOUND DURING 100% RT INSPECTION.	DW	3-21-06
150	GRIND GCHI SOP 0100R2	CHIP AND HAND GRIND EXCAVATION AS REQUIRED.	M.N. N.M	3/21/06

07



**Energy Industries of Ohio**  
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160	INTERIM VISUAL INSPECTION CQP-500 REV. 4	VISUALLY INSPECT 100% of COMPONENT ACCORDING TO ASTM A802 LEVEL 3 IN NON MACHINED AREAS AND LEVEL 2 IN MACHINED AREAS. IF OK CHECK HERE _____ IF REJECTED CHECK HERE _____. MARK AND REPAIR AT STEP 190.	VT - LEVEL II <i>KLTA</i>	3/21
170	INTERIM 100% L.P. CQP 0300 REV 10	L.P. 100% OF COMPONENT. ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING. IF OK CHECK HERE _____ GO TO 190. IF REJECTED CHECK HERE <u>X</u>	LP - LEVEL II <i>JPS</i>	3-21
180	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS FOUND DURING 100% VISUAL AND LP INSPECTION.	<i>BW</i>	3/22
190	GRIND GCHI SOP 0100R2	CHIP AND HAND GRIND EXCAVATION OR VISUAL DEFECTS AS REQUIRED.	<i>BW</i>	3/23
200	L.P. EXCAVATION CQP-300 REV 10	L.P. ALL EXCAVATIONS PRIOR TO WELDING TO ENSURE REMOVAL OF DEFECT. ACCEPTANCE PER A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING. IF OK CHECK HERE _____ IF REJECTED SEND BACK TO STEP 190	LP - LEVEL II <i>TC</i>	3/23
210	SAND BLAST BLAS SOP 0100R6	SANDBLAST (REMOVE ALL BLAST MATERIAL FROM CASTING) SANDBLASTING WILL BE DONE USING RECYCLED SHARP ANGULAR AGGREGATE.	<i>Chad</i>	3/23
220	WELD MAP	MAP ALL MAJOR WELDS WITH DIGITAL PHOTO/MAPS INDICATING LOCATION. SERIALIZE DEFECTS ON CASTING, USE SCALE IN PHOTOS AND DOCUMENT SIZE. THIS IS TO BE PERFORMED BY SUPERVISOR, INSPECTION LEAD MAN OR THEIR DESIGNEE, FILE WITH QA. USE YELLOW MARKER. SUBMIT MAP WITHIN 24 HOURS OF START OF WELDING. MUST INDICATE ON MAP ALL MAJOR WELDS, DEFINED AS GREATER THAN 20% OF THE WALL OR 1 INCH WHICHEVER IS LESS OR 10 SQUARE INCHES APPROXIMATLY 3.3"X3.3".	<i>JB</i>	3/23 + 3/24
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF WELD STEP. EIO NOTIFIED ON <u>3/15</u> DCMA NOTIFIED ON <u>3/15</u>	Q ENG OR QA MGR	<i>BC</i>
230	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: _____ LIST ALL MATERIAL/LOTS USED: <u>78308</u> QUALITY ENG. Name: <u>Ch</u> Date: <u>3/23</u>		
240	WELD SOP 0100 REV 7	WELD REPAIR DEFECTS AS MARKED. FOR WELDS <2" - WPS 10-SMAW-CF8MNMN MOD REV 1(Flat) or 25 SMAW-CF8MNMN MOD	<i>WP</i>	3/23

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		REV 0 (Vertical) FOR WELDS <8" - WPS 15-GMAW-CF8MNMN MOD REV 2	T.S	3/24					
250	GRIND GCHI SOP 0100R2	HAND GRIND WELDS.	CA						
260	L.P. WELD CQP 0300 REV 10	L.P. WELD REPAIRS ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING. IF OK CHECK HERE <input checked="" type="checkbox"/> WASH AND SEND TO STEP 280. IF REJECTED CHECK HERE _____	LP - LEVEL II CC	3/24					
270	REPEAT	REPEAT STEPS S180 TO S250AS REQUIRED TILL CLEAR THROUGH VISUAL INSPECTION & PENETRANT INSPECTION. IF OK CHECK HERE <input checked="" type="checkbox"/> AND PROCEED TO STEP 280.	CC						
280	REPEAT STEPS	SUPPLEMENTAL REPAIR STEPS			1 <sup>ST</sup>	2 <sup>ND</sup>	3 <sup>RD</sup>	4 <sup>TH</sup>	5 <sup>TH</sup>
S180	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS FOUND DURING RADIOGRAPHY.			TAD 3/24				
S190	GRIND GCHI SOP 0100R2	CHIP AND HAND GRIND EXCAVATION OR VISUAL DEFECTS AS REQUIRED.			TAD 3/24				
S200	L.P. EXCAVATION CQP-300 REV 10	L.P. ALL EXCAVATIONS PRIOR TO WELDING TO ENSURE REMOVAL OF DEFECT. ACCEPTANCE PER A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING.	LP - LEVEL II TKC	3/24					
S210	WELD MAP	MAP ALL MAJOR WELDS WITH DIGITAL PHOTO/MAPS INDICATING LOCATION. SERIALIZE DEFECTS ON CASTING, USE SCALE IN PHOTOS AND DOCUMENT SIZE. THIS IS TO BE PERFORMED BY SUPERVISOR, INSPECTION LEAD MAN OR THEIR DESIGNEE, FILE WITH QA. USE YELLOW MARKER. MUST INDICATE ON MAP ALL MAJOR WELDS, DEFINED AS GREATER THAN 20% OF THE WALL OR 1 INCH WHICHEVER IS LESS OR 10 SQUARE INCHES APPROXIMATLY 3.3"X3.3". SUBMIT MAP WITHIN 24 HOURS OF START OF WELDING.			JB 3/24				
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF WELD STEP. EIO NOTIFIED ON <u>3/20</u> DCMA NOTIFIED ON <u>3/20</u>	Q ENG OR QA MGR PC						
S220	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: _____ MATERIAL /LOT USED: <u>78306</u> QUALITY ENG. Name: <u>SC</u> Date: <u>3/24</u>							
S230	WELD SOP 0100 REV 7	WELD REPAIR DEFECTS AS MARKED. FOR WELDS <2" - WPS 10-SMAW-CF8MNMN MOD REV 1(Flat) or 25 SMAW-CF8MNMN MOD REV 0 (Vertical)			TAD 3/24	WD 3/15	BD 3/29		

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		FOR WELDS <8" - WPS 15-GMAW-CF8MNMN MOD REV 2						
S240	GRIND GCHI SOP 0100R2	HAND GRIND WELDS.	4GM 3/30					
S250	L.P. WELD CQP 0300 REV 10	L.P. WELD REPAIRS ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING. IF OK CHECK HERE _____ WASH AND SEND TO STEP 280. IF REJECTED CHECK HERE _____ AND RETURN TO STEP S180.	LP - LEVEL II	OK T	OK	OK	OK	
	REPEAT	REPEAT STEPS S180 TO S250 AS REQUIRED TILL CLEAR THROUGH VISUAL INSPECTION & PENETRANT INSPECTION.	QA ENG.	BC				
280	TEST MAG PERM SOP MAG PERM 100, REV 1	TEST MAG PERMEABILITY REPAIR AREAS TEST AT LEAST EVERY 2 INCH SQUARE OF WELD. ACCEPTANCE 1.02. IF OK CHECK HERE <input checked="" type="checkbox"/> AND GO TO STEP 300. IF REJECTED CHECK HERE _____.			CA		3/31	
290	GRIND GCHI SOP 0100R2	GRIND AREAS OF NON COMPLIANCE AND RETURN TO STEP 280. REPEAT UNTIL COMPLIANCE IS ACHIEVED.			NA			
300	X-RAY (NOTE)	IF RADIO GRAPHED AREAS ARE GREATER THAN FOUR TO FIVE INCHES THE CASTING WILL BE SENT TO MQS. SEND TO MQS CHECK HERE <input checked="" type="checkbox"/> . RADIOGRAPH AT CAF CHECK HERE _____.			QA ENGINE ER		RBK 4-3-06	
310 A	MQS X-RAY DEFECTS REPAIRED BY WELDING	X-RAY PER TECHNIQUE # 12726 USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. <b>ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.</b> ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.			LEVEL II		RBK 4/3/06	
310 B	CAF X-RAY DEFECTS REPAIRED BY WELDING CQP 401 REV 5	X-RAY PER TECHNIQUE # 12726 USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. <b>ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.</b> ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.			RT - LEVEL II		RBK 4-3-06	
320	X-RAY CQP 401 REV 5	X-RAY INTERPRETATION. ACCEPTANCE MSS SP 54. ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET. IF OK CHECK HERE _____ AND SEND TO STEP 340. REJECTED CHECK HERE _____ MARK UP DEFECTS AND SEND THE CASTING TO STEP S321.			RT - LEVEL II		RBK 4-3-06	
	REPEAT STEPS	SUPPLEMENTAL REPAIR STEPS			1 <sup>ST</sup>	2 <sup>ND</sup>	3 <sup>RD</sup>	4 <sup>TH</sup>

1<sup>ST</sup> DWK  
 4/4/06  
 R2  
 R3  
 2<sup>ND</sup> RBK  
 4/4/06  
 R3  
 Accept

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S321	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS FOUND DURING RADIOGRAPHY.							
S322	L.P. EXCAVATION CQP-300 REV 10	L.P. ALL EXCAVATIONS PRIOR TO WELDING TO ENSURE REMOVAL OF DEFECT. ACCEPTANCE PER A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING.	LP - LEVEL II	TAD 4/5/06	T.P.C.	4/5/06			
S323	WELD MAP	MAP ALL MAJOR WELDS WITH DIGITAL PHOTO/MAPS INDICATING LOCATION. SERIALIZE DEFECTS ON CASTING, USE SCALE IN PHOTOS AND DOCUMENT SIZE. THIS IS TO BE PERFORMED BY SUPERVISOR, INSPECTION LEAD MAN OR THEIR DESIGNEE, FILE WITH QA. USE YELLOW MARKER. MUST INDICATE ON MAP ALL MAJOR WELDS, DEFINED AS GREATER THAN 20% OF THE WALL OR 1 INCH WHICHEVER IS LESS OR 10 SQUARE INCHES APPROXIMATELY 3.3"X3.3". SUBMIT MAP WITHIN 24 HOURS OF START OF WELDING. SUBMIT MAP WITHIN 24 HOURS OF START OF WELDING.		J.R.3	J.R.B.	4/7/06			
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF WELD STEP. EIO NOTIFIED ON <u>4/1</u> DCMA NOTIFIED ON <u>4/1</u>	Q ENG OR QA MGR						
S324	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: <u>15-GMAW-CF8MNMN MOD</u> MATERIAL /LOT USED: <u>316MWNF, 3018513 78308</u> QUALITY ENG. Name: <u>CH</u> Date: _____		TAD 4/5/06					
S325	WELD SOP 0100 REV 7	WELD REPAIR DEFECTS AS MARKED. FOR WELDS <2" - WPS 10-SMAW-CF8MNMN MOD REV 1(Flat) or 25 SMAW-CF8MNMN MOD REV 0 (Vertical) FOR WELDS <8" - WPS 15-GMAW-CF8MNMN MOD REV 2		TAD 4/5/06	TAD	4/10/06	TAD	4/13/06	
S326	GRIND GCHI SOP 0100R2	HAND GRIND WELDS.		KLB 4/5/06					
S327	L.P. WELD CQP 0300 REV 10	L.P. WELD REPAIRS ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING. IF OK CHECK HERE _____ WASH AND SEND TO STEP S328. IF REJECTED CHECK HERE <input checked="" type="checkbox"/> AND RETURN TO STEP S321.	LP - LEVEL II	OK 4/11/06	OK (OK) T.R.C.	OK 4/13	OK	OK	OK
S 328 A	MQS X-RAY DEFECTS REPAIRED BY WELDING	X-RAY PER TECHNIQUE # 12726 USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. <b>ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.</b> ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.	RT- LEVE L II						

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S 328 B	CAF X-RAY DEFECTS REPAIRED BY WELDING CQP 401 REV 5	X-RAY PER TECHNIQUE # 12726 USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. <b>ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.</b> ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.	RT - LEVE L II	4-3-06 Dun Rejet			
S 329	X-RAY CQP 401 REV 5	X-RAY INTERPRETATION. ACCEPTANCE MSS SP 54. ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET. IF OK CHECK HERE _____ AND SEND TO STEP 340. REJECTED CHECK HERE <input checked="" type="checkbox"/> MARK UP DEFECTS AND SEND THE CASTING TO STEP S321.	RT - LEVE L II	4-3-06 Dun			
	REPEAT	REPEAT STEPS S321 TO S329 AS REQUIRED TILL CLEAR THROUGH VISUAL, PENETRANT AND RT INSPECTION.	QA ENG.	OK 4-4-06 Dun			
340	SAND BLAST BLAS SOP 0100R6	SANDBLAST (REMOVE ALL BLAST MATERIAL FROM CASTING) SANDBLASTING WILL BE DONE USING RECYCLED SHARP ANGULAR AGGREGATE.					
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF VISUAL AND LP STEPS. EIO NOTIFIED ON _____ DCMA NOTIFIED ON _____	Q ENG OR QA MGR				
350	FINAL VISUAL INSPECTION CQP-500 REV 4	VISUALLY INSPECT 100% of COMPONENT ACCORDING TO ASTM A802 LEVEL 3 IN NON MACHINED AREAS AND LEVEL 2 IN MACHINED AREAS. IF OK CHECK HERE _____. SEND TO STEP 453. IF REJECTED CHECK HERE _____. MARK AND REPAIR. INITIAL WHEN COMPLETE. MUST BE PERFORMED BY LEVEL II in VT.	VT - LEVEL II				
360	FINAL L.P. CQP 0300 REV 10	FINAL L.P. 100% OF COMPONENT. ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH-STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING. IF OK CHECK HERE <input checked="" type="checkbox"/> WASH AND SEND TO STEP 453. IF REJECTED CHECK HERE _____	LP - LEVEL II	T.R.C.			4/18/06
380	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS FOUND DURING FINAL PENETRANT INSPECTION.					
385	GRIND GCHI SOP 0100R2	CHIP AND HAD GRIND EXCAVATION AS REQUIRED.					

455  
NA  
↓

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8 OF 11 **CO# 40851 Dated 3-9-05 Revision: Rev10 Dated Issued:1-18-06**

NA

390	L.P. EXCAVATION CQP-300 REV 10	L.P. ALL EXCAVATIONS PRIOR TO WELDING TO ENSURE REMOVAL OF DEFECT. ACCEPTANCE PER A903. IF OK CHECK HERE _____ IF REJECTED SEND BACK TO STEP 385.	LP - LEVEL II	
400	WELD MAP	MAP ALL MAJOR WELDS WITH DIGITAL PHOTO/MAPS INDICATING LOCATION. SERIALIZE DEFECTS ON CASTING, USE SCALE IN PHOTOS AND DOCUMENT SIZE. THIS IS TO BE PERFORMED BY SUPERVISOR, INSPECTION LEAD MAN OR THEIR DESIGNEE, FILE WITH QA. USE YELLOW MARKER. SEND MAPS WITHIN 24 HOURS OF WELDING. MUST INDICATE ON MAP ALL MAJOR WELDS, DEFINED AS GREATER THAN 20% OF THE WALL OR 1 INCH WHICHEVER IS LESS OR 10 SQUARE INCHES APPROXIMATLY 3.3"X3.3".		
420	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: _____ MATERIAL/LOT USED: _____ QUALITY ENG. Name: _____ Date: _____		
430	WELD SOP 0100 REV 7	WELD REPAIR DEFECTS AS MARKED. FOR WELDS <2" - WPS 10-SMAW-CF8MNMN MOD REV 1(Flat) or 25 SMAW-CF8MNMN MOD REV 0 (Vertical) FOR WELDS <8" - WPS 15-GMAW-CF8MNMN MOD REV 2		
440	GRIND GCHI SOP 0100 REV 2	HAND GRIND WELDS.		
450	L.P. WELDS CQP 0300 REV 10	L.P. WELD REPAIRS ACCEPTANCE PER ASTM A903. IF OK CHECK HERE _____ WASH AND SEND TO STEP 453. IF REJECTED CHECK HERE _____ AND RETURN TO STEP 440.	LP - LEVEL II	
	REPEAT	REPEAT STEPS __ 350 TO 450 __ AS REQUIRED TILL WELDS CLEAR FINAL LIQUID PENETRANT INSPECTION. DOCUMENT REWORK ON A SUPPLEMENTAL MTS	QA ENG.	
451	TEST MAG PERM SOP MAG PERM 100, REV 1	TEST MAG PERMEABILITY REPAIR AREAS. RECORD ON WELD MAP LIST. TEST AT LEAST EVERY 2" SQUARE OF WELD. ACCEPTANCE 1.02. IF OK CHECK HERE _____ AND GO TO STEP 430. IF REJECTED CHECK HERE _____.		
452	GRIND GCHI SOP 0100R2	GRIND AREAS OF NON COMPLIANCE AND RETURN TO STEP 451. REPEAT UNTIL COMPLIANCE IS ACHIEVED.		
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF LAYOUT. EIO NOTIFIED ON _____ DCMA NOTIFIED ON _____  APPROVAL RECEIVED ON _____	Q ENG OR QA MGR	



**Energy Industries of Ohio  
Manufacturing and Test Sequence (MTS) ALL Coils A 6 COIL**

9 OF 11 CO# 40851 Dated 3-9-05 Revision: Rev10 Dated Issued:1-18-06

453	INTERIM LAYOUT SOP LAYOUT 0100	INSPECT CASTING TO VERIFY DIMENSIONS. THIS STEP MAY BE MOVED. NOTE: THE FIRST PART PRODUCED OF EACH TYPE A, B AND C WILL BE DIMENSIONED BY LAWTON PATTERN. IF DIMENSIONED BY LAWTON IT WILL BE DOCUMENTED HERE. Subsequent casting done internally per Romer Arm.	5 CAN JD
455	HEAT TREAT	STRESS RELIEF. Load casting into cold furnace. Ramp up to 1100 F at rate of 200 F per hour. Hold at temp 4 hours. Furnace cool to 500 F at 50 F per hour. Air cool. Submit furnace charts to QA.	DLS 4-13-06
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF VISUAL AND LP STEPS. EIO NOTIFIED ON <u>4/11</u> DCMA NOTIFIED ON <u>4/11</u>	Q ENG OR QA MGR C/A
460	FINAL VISUAL INSPECTION CQP-500 REV 4	VISUALLY INSPECT 100% of COMPONENT ACCORDING TO ASTM A802 LEVEL 3 ALL CONDITIONS. THIS STEP MAY BE UNNECESSARY IF OK AT STEP 350. IF OK CHECK HERE <input checked="" type="checkbox"/> IF REJECTED CHECK HERE _____ MARK AND REPAIR AT STEP 510. MUST BE PERFORMED BY LEVEL II in VT.	VT - LEVEL II 4/18/06 C/A
470	FINAL L.P. CQP 0300 REV 10	FINAL L.P. 100% OF COMPONENT. ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA-LEVEL 1 FOR HIGH STRESSED AREAS, LEVEL 2 FOR ALL OTHER AREAS. SEE LP DRAWING. THIS STEP MAY BE UNNECESSARY IF OK AT STEP 360. IF OK CHECK HERE _____ WASH AND SEND TO STEP 500. IF REJECTED CHECK HERE <input checked="" type="checkbox"/> DOCUMENT REPAIRS USING A SUPPLEMENTAL MTS.	LP - LEVEL II T.R.C. 4/18/06 4/18/06
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF MAG PERM STEPS. EIO NOTIFIED ON <u>4/11</u> DCMA NOTIFIED ON <u>4/11</u>	Q ENG OR QA MGR C/A
500	FINAL MAG PERM INSPECTION SOP MAG PERM 100, REV 1	PERFORM MAG PERM TESTING WITH SEVRIN GAUGE. ACCEPTANCE 1.02. CHECK THE ENTIRE SURFACE ON A 6"BY6" GRID. REPORT RESULTS. USE A 6" SQUARE BLOCK TO INDICATE TEST LOCATIONS AND RECORD RESULTS. COMPLIANT AREAS WILL NOT BE MARKED. MARK NONCOMPLIANT AREAS WITH AN "X" FOR REPAIR. OK CHECK HERE _____ AND GO TO STEP 530. IF REJECTED CHECK HERE <input checked="" type="checkbox"/>	C/A 4/18/06 4/18/06
510	GRIND GCHI SOP 0100 REV 2	HAND GRIND WITH SUITABLE CONE OR OTHER SIMILAR GRINDER AS REQUIRED TO ENSURE REMOVAL OF MATERIAL TO ACHIEVE MAG PERM REQUIREMENT. CIRCLE AREA REMEDIATE FOR RETEST.	TAP 4/18/06
520	RETEST MAG PERM SOP MAG PERM 100, REV 1	RETEST MAG PERMEABILITY AT FAILED TEST POINTS. MARK NONCOMPLIANT AREAS WITH AN "X" FOR REPAIR. ACCEPTANCE 1.02. IF OK CHECK HERE <input checked="" type="checkbox"/> IF REJECTED CHECK HERE _____ RETURN TO STEP 510.	C/A 4/19/06
530	DOC. REVIEW	REVIEW DOCUMENTS AS REQUIRED IN CAF CHECKLIST, ALL DOCUMENTS NOTED TO BE ACCESSIBLE FOR AUDITING. (SHIPPER, C OF C, M.T.R., M.T.S., INSPECTION REPORT, X-RAY READER SHEETS AND HEAT TREAT CHARTS)	C/A

**Energy Industries of Ohio**

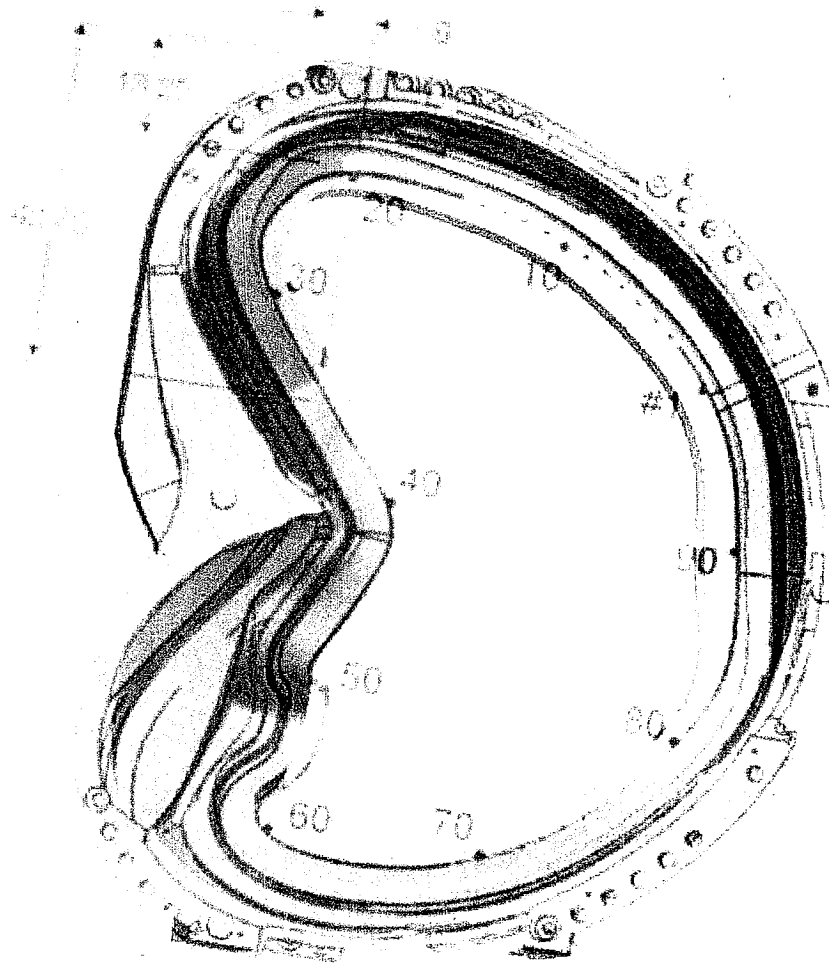
**Manufacturing and Test Sequence (MTS) ALL Coils A 6 COIL**

10 OF 11 **CO# 40851 Dated 3-9-05 Revision: Rev10 Dated Issued:1-18-06**

NOTICE	RELEASE FROM EIO	PROVIDE DOCUMENTS TO EIO. SENT ON <u>4/20</u> BY <u>Ch</u> . RECEIVED RELEASE FROM EIO ON <u>4/20</u> .	Q ENG OR QA MGR	<u>Ch</u>
540	PACK AND SHIP	PACKAGE AND SHIP TO MAJOR TOOL. <b>MARK ON CASTING THE COIL NUMBER</b> e.g. "A- <del>6</del> <u>Ch</u>		
1000	REVISION HISTORY	ORIGINAL 12-14-04. Approved 12-14-04. Revision level 1- Revised 1-26-05 new page 8, correct High stress areas, Revision level 2 3-16-05, delete LO step 455. Revision 3 3-28-05 Added note regarding hold point at weld step 400. Revision level 4 written for C-2 casting 4-18-05. Rev 5 added Layout SOP# and note regarding first casting layout responsibility. 5-10-05. Rev 6 added word LOT to weld material steps. 5-29-05. Rev 7 6-14-05 added "LOT" to weld step on supplement page. Rev. 8 7-29-05 added stress relief, deleted weld hold points, added vertical weld procedure, and several editorial changes. REV 9 8-28-05 – MODIFIED RT STEPS AND ADDED REQUIREMENT TO RT ALL RT DEFECTS INCLUDING SURFACE. 1-9-06 Rev 10 – added note to mark casting in step 540.	CARUUD	



RED AREA INDICATES HIGH STRESSED AREA



**MetalTek International – Carondelet Division**  
**Manufacturing and Test Sequence (MTS) Coil Shim A COIL S/N 6**  
**Dated 12-14-04 Revision:1 Dated Issued:10-25-05 Page 1 of 3**

OPER. #	STATION	DESCRIPTION OF PROCESS	Name	Date
10	QUALITY RELEASE	REVIEW AND APPROVE MTS. RECEIVED APPROVAL FROM EIO ON 11-1-05 FROM Pete D. SIGNED QUALITY MANAGER. <b>SHADED BOXES NEED NOT BE SIGNED.</b>	CAR	11-1-05
20	PATTERN NPAT SOP 0100REV2	APPLY APPROPRIATE PART NUMBER, SERIAL NUMBER, FOUNDRY MARK, TO THE PATTERN.		
30	MOLD	MOLD PER WORK INSTRUCTIONS IN MAPICS ROUTING AND SOPS REFERENCED. MOLD MATERIALS REQUIRED PER MAPICS BOM. NOTIFY ENGINEER OF ANY SUBSTITUTIONS. MOLD SOP 0400 REV 8 CALIBRATION PER MOLD SOP 0900 REV 5 PREPARATION PER MOLD SOP 1100R2/1200R2/1300R1 SAND TESTING PER MOLD SOP 1400R2/1500R3/1600R2		
40	POUR MELT SOP 0100R5 MELT SOP 0700R2 MELT SOP 0600R2	METAL MUST BE AOD REFINED OR AOD INGOT. VIRGIN METAL ADDITIONS ALLOWED. HEAT #: <u>2825</u>  Sample from ladle to be analyzed for final chemical analysis and reported on material certifications. Sample Taken by: <u>SR</u> Analyzed: <u>GH</u>	JG	4/28
50	MELT SOP 0800R2	SHAKEOUT.		
60	ARC RISE SOP 0100R1	REMOVE RISERS AS DIRECTED BY SUPERVISOR.		
70	HEAT TREAT HEAT SOP 0103R5	SOLUTION ANNEAL. MINIMUM 4.HOURS AT 2050 F. AIR COOL.	DLS	6/2
80	GRIND GSWA SOP 0100R3 GCHI SOP 0100R2	SWING GRIND TO REMOVE RISER REMAINS AND FLASH IF REQUIRED. CHIP AND HAND GRIND SURFACE OF PART AS REQUIRED.		
90	SAND BLAST BLAS SOP 0100R6	SANDBLAST (REMOVE ALL BLAST MATERIAL FROM CASTING) SANDBLASTING WILL BE DONE USING RECYCLED SHARP ANGULAR AGGREGATE.		
100	VISUAL INSPECTION CQP-500 REV 4	VISUALLY INSPECT 100% of COMPONENT ACCORDING TO ASTM A802 LEVEL 3 ALL CONDITIONS. IF OK CHECK HERE _____ IF REJECTED CHECK HERE <input checked="" type="checkbox"/> . MARK AND REPAIR AT STEP 130OR 140 IF WELDING IS REQUIRED. MAY PERFORM STEPS 110 AND 120 TOGETHER.	VT - LEVEL II KLA	12/27

MetalTek International - Carondelet Division

Manufacturing and Test Sequence (MTS) Coil Shim A COIL S/N 6

Dated 12-14-04 Revision:1 Dated Issued:10-25-05

Page 2 of 3

120	100% L.P. CQP 0300 REV 10	L.P. 100% OF COMPONENT. ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA- LEVEL 2. IF OK CHECK HERE _____ GO TO 150. IF REJECTED CHECK HERE <u>x</u> MARK AND REPAIR AT STEP 130 OR 140 IF WELDING IS REQUIRED. <i>Grind only</i>	LP - LEVEL II	SSB 12-27
130	GRIND GCHI SOP 0100R2	HAND GRIND DEFECTS. CONFIRM REPAIRS VISUALL AND BY LP. ACCEPTANCE AS NOTED ABOVE. IF OK, CHECK HERE <input checked="" type="checkbox"/> AND GO TO STEP 170. IF WELDING IS NEEDED GO TO STEP 130.		CAFH 6-14-06
140 IF NEEDED		IF REPAIRS BY WELDING ARE REQUIRED DOCUMENT ON SUPPLEMENTAL MTS ON LAST PAGE.	NA	
150	CAF X-RAY DEFECTS REPAIRED BY WELDING CQP 401 REV 5	X-RAY PER TECHNIQUE: SE-141-073-C SHIM. USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.	RT - LEVEL II	DWM 12/16/05
160	X-RAY CQP 401 REV 5	X-RAY INTERPRETATION. ACCEPTANCE MSS 54. ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET. IF OK CHECK HERE <input checked="" type="checkbox"/> AND SEND TO STEP 200. REJECTED CHECK HERE _____ MARK UP DEFECTS. DOCUMENT REPAIRS ON S10 TO S70.	RT - LEVEL II	DWM 12/16/05
	REPEAT	REPEAT STEPS S10 TO S70 AS REQUIRED TILL WELDS CLEAR X-RAY.	QA ENG.	
170	SAND BLAST BLAS SOP 0100R6	SANDBLAST (REMOVE ALL BLAST MATERIAL FROM CASTING) SANDBLASTING WILL BE DONE USING RECYCLED SHARP ANGULAR AGGREGATE.		
180	LAYOUT SOP 0100 ORIGINAL	INSPECT CASTING TO VERIFY DIMENSIONS. THIS MAY BE PERFORMED EARLIER IF DESIRED. SUBMIT RPORT TO QA		Fred 2/8/06
190	FINAL VISUAL INSPECTION CQP-500 REV 4	VISUALLY INSPECT 100% of COMPONENT ACCORDING TO ASTM A802 LEVEL 2 ALL CONDITIONS. IF OK CHECK HERE <input checked="" type="checkbox"/> IF REJECTED CHECK HERE _____ MARK AND REPAIR DOCUMENT REWORK ON A SUPPLEMENTAL MTS	VT - LEVEL II	KA 4/18/06
200	FINAL L.P. CQP 0300 REV 10	FINAL L.P. 100% OF COMPONENT. ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA- LEVEL 2 ALL AREAS. IF OK CHECK HERE <input checked="" type="checkbox"/> WASH AND SEND TO NEXT STEP. IF REJECTED CHECK HERE _____ MAKE REPAIRS AND DOCUMENT ON SUPPLEMENTL MTS.	LP - LEVEL II	TCC 1-14-06
210	FINAL MAG PERM- INSPECTION SOP MAG PERM 100, REV 1 GRIND GCHI SOP 0100 REV 2	PERFORM MAG PERM TESTING WITH SEVRIN GAUGE. ACCEPTANCE 1.02. CHECK THE ENTIRE SURFACE ON A 6"BY6" GRID. REPORT RESULTS. HAND GRIND WITH SUITABLE CONE OR OTHER SIMILAR GRINDER AS REQUIRED TO ENSURE REMOVAL OF MATERIAL TO ACHIEVE MAG PERM REQUIREMENT. <i>Mag. Perm. OK</i>		BDR 3-3-06
220	DOC. REVIEW	REVIEW DOCUMENTS ALL DOCUMENTS NOTED TO BE ACCESSIBLE FOR AUDITING. (C OF C, M.T.R., SIGNED M.T.S., LAYOUT INSPECTION REPORT, X-RAY READER SHEETS AND HEAT TREAT CHARTS)		

**MetalTek International – Carondelet Division**

**Manufacturing and Test Sequence (MTS) Coil Shim A COIL S/N 6**

**Dated 12-14-04 Revision:1 Dated Issued:10-25-05 Page 3 of 3**

NOTICE	RELEASE FROM EIO	PROVIDE DOCUMENTS TO EIO. SENT ON <u>4/20</u> BY <u>Ch</u> . RECEIVED RELEASE FROM EIO ON <u>4/20</u> .	Q ENG OR QA MGR <u>Ch</u>
	PACK AND SHIP	PACKAGE AND SHIP TO MAJOR TOOL.	<u>Ch</u>
1000	REVISION HISTORY	ORIGINAL 12-14-04. Rev1 complete rewrite due to specification changes.	CARUUD <input checked="" type="checkbox"/>

**SUPPLEMENTAL MTS FOR WELD REPAIRS.**

FOR VT&LP/ FOR RT

S10	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS.	<u>NA</u>	
S20	L.P. EXCAVATION CQP-300 REV 10	L.P. ALL EXCAVATIONS PRIOR TO WELDING TO ENSURE REMOVAL OF DEFECT. ACCEPTANCE PER A903. ACCEPTANCE CRITERIA- LEVEL 2.	LP - LEVEL II	LP - LEVEL II
S30	WELD MAP	MAP ALL WELDS WITH DIGITAL PHOTO/MAPS. SERIALIZE DEFECTS ON CASTING, USE SCALE IN PHOTOS AND DOCUMENT SIZE. THIS IS TO BE PERFORMED BY SUPERVISOR, INSPECTION LEAD MAN OR THEIR DESIGNEE, FILE WITH QA.. USE YELLOW MARKER. MUST SEND REPORT ON ALL AJOR WELDS, DEFINED AS OVER 20% OF WALL THICKNESS OR 1 INCH WHICHEVER IS LESS OR 10 SQUARE INCHES TO CUSTOMER. MAJOR WELDS YES _____, REPORT SENT BY _____ DATE _____ NO MAJOR WELDS CHECK HERE _____ AND GO TO STEP 170.		<u>Y</u>
S40	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: _____ MATERIAL USED: _____ QUALITY ENG. Name: _____ Date: _____		
S50	WELD SOP 0100 REV 7	WELD REPAIR DEFECTS AS-MARKED. FOR WELDS <2" - WPS 10-SMAW-CF8MNMN MOD REV 1 FOR WELDS <8" - WPS 15-GMAW-CF8MNMN MOD REV 2		
S60	GRIND GCHI SOP 0100R2	HAND GRIND WELDS.		
S70	L.P. WELD CQP 0300 REV 10	L.P. WELD REPAIRS ACCEPTANCE PER ASTM A903. ACCEPTANCE CRITERIA-LEVEL 2. IF OK CHECK HERE _____ WASH AND SEND TO STEP 300. IF REJECTED CHECK HERE _____ AND RETURN TO STEP 220.	LP - LEVEL II	LP - LEVEL II
	REPEAT	REPEAT STEPS 10 TO S70 AS REQUIRED TILL CLEAR THROUGH VISUAL INSPECTION & PENETRANT INSPECTION.	QA ENG.	QA ENG.
S80	TEST MAG PERM SOP MAG PERM: 100, REV 1	TEST MAG PERMEABILITY REPAIR AREAS RECORD ON WELD MAP LIST. TEST AT LEAST 5 POINTS PER WELD. ACCEPTANCE 1.02. IF OK CHECK HERE _____ AND GO TO STEP 170. GRIND AS NEEDED TO REMEDIATE.		



4

Corrective Action 1308  
Carondelet Division - CA / PA / RGA Database  
Corrective Action Type NCR  
Date 6/13/2005  
CA Originator C. Ruud  
Pattern Number: C and A Coil Shims 11 Pieces

**Description of Defect / Non-Conformance**

Chemistry for 11 shim castings is out of specification.

**Root Cause**

Chemistry specification was not changed in system and not communicated to Lab personnel.

**Corrective Action**

Specification was corrected in system and Lab personnel trained. Mag permeability was checked on the parts and are less than 1.02u.

**Verification of Corrective Action**

Chemistries were checked on subsequent parts and are within specification.

**Preventive Action**

Create Inspection and Test Plan summarizing all requirements.

**Estimated Completion Date**

6/15/05

**Actual Completion Date**

Complete.

A handwritten signature in black ink, appearing to read "C. Ruud".

Signed: C. Ruud

CC: Roger Broman, Barry Craig, Joe Edwards, E.J. Kubick

**Nonconformance Report: CA 1323 (phosphorus levels exceeds specification limits for castings C1- C4 and A1 and C1 shim and four Type C and six A coil shims)**

**Project Disposition:**

The erroneous levels were due to calibration errors with the spectrometer. As reported in MTK's attached report, preventive maintenance has since been performed on the spectrometer. The reported chemistry will be accepted for the castings and shims noted above. The specification chemistry will not be changed at this time.

**Approvals:**

**Phil  
Heitzenroeder**

Digitally signed by Phil Heitzenroeder  
DN: CN = Phil Heitzenroeder, C = US,  
O = PPPL, OU = Mech. Eng. Division  
Reason: I agree to 'specified' portions  
of this document  
Date: 2006.02.21 11:49:56 -05'00'

---

Procurement Technical Representative

**Brad  
Nelson**

Digitally signed by Brad Nelson  
DN: cn=Brad Nelson, c=US,  
o=ORNL, ou=FED,  
email=nelsonbe@ornl.gov  
Date: 2006.02.21 14:16:12  
-05'00'

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Responsible Line Manager:



Corrective Action 1323  
Carondelet Division - CA / PA / RGA Database  
Corrective Action Type NCR  
Date 7/27/2005  
CA Originator C. Ruud  
Applies to: Coil castings C-1, C-2, C-3, C-4 and A-1 and C 1 shim and four C coil and six A coil shims

#### **Description of Defect / Non-Conformance**

Phosphorus levels in material produced to date exceed specification limits. Both phosphorus and sulfur readings reported erroneously in certifications.

Certification reports have shown phosphorus and sulfur levels in the  $<.01\%$  range. Independent laboratory data confirmed phosphorus in the  $.018$  to  $.033\%$  range and sulfur in the  $.005$  to  $.022\%$  range. Actual levels of some tests are above those in PPPL Specification NCSX-CSPEC-141-03-07 Rev 7.

Nonconformance was first suspected as a result of analysis of zoned attached test specimens volunteered by MetalTek International as response to PPPL questions on weighted average chemical analysis and quality of blending in the gating system. Nonconformance was verified on the bars used in the study and has been extended to evaluation of previously poured products.

#### **Root Cause**

Specification limits were set below the levels achievable through use of available raw materials. Spectrometer did not properly calibrate for phosphorus and sulfur at levels of specification due to equipment malfunction.

The chemical specification of EIO heats uses alloy CF8MNMn-Mod which incorporates a type standard calibration with a certified reference material (CRM) BS180. This enables the operator of the spectrometer to match the elemental concentrations of this alloy with corrective factors. These factors are determined by analyzing the CRM and having them compared with the calibration curves for each element. The phosphorus and sulfur content have very low measured intensities due to low concentrations. Intermittent failure of the spectrometer intensity measuring card caused higher intensity readings for phosphorus and sulfur. Subsequent checks with the CRM resulted in low corrective factors that were not detected. This in turn resulted in low reported concentrations for the EIO samples. All the major elements, which are measured on other intensity cards, have been closely monitored and matched very well with the CRM and thus were reported correctly.

#### **Corrective Action**

Modification to specification for phosphorus and sulfur will be requested. Limits will be set based on process capability and consistent with other stainless steel grades. Replacement of deficient card in spectrometer will be made upon delivery.

Subsequent immediate analysis of chemistry results, obtained by wet analysis, is attached and demonstrate top of specification for sulfur and over specification for phosphorus. The spectrometer manufacturer has performed an analysis to determine the cause of the malfunction and verified that the intensity card has an intermittent fault and must be replaced. The card has been ordered and scheduled for replacement on August 15, 2005.

Until the card is replaced we will be performing additional type standardizations to ensure accurate sulfur and phosphorus analysis. Additionally, for coils made until the card is replaced, an independent laboratory will perform a verification of the chemical analysis.

**Verification of Corrective Action**

Will be determined at a later date.

**Preventive Action**

In addition to spectrometer faults, we have identified that the specification ranges for sulfur and phosphorus is unattainable. Analysis and specifications for virgin charge materials predict sulfur at 0.040% maximum and phosphorus at 0.040% maximum. We have no way to remove phosphorus from the melt and do not intentionally add phosphorus. So, the confirmed coil analyses, along with analyses of virgin material heats, demonstrate sulfur in the range of 0.010% to 0.022% and phosphorus in the range of 0.018% to 0.033%. These results are consistent with our charge material analysis. We will request a deviation for phosphorus in the subject parts and also request a permanent specification change to 0.040% maximum for both phosphorus and sulfur, to allow us to provide non-discrepant material. This change will not affect, in any way, the physical properties or material performance because all coils and test material exhibited sulfur and phosphorus within the new ranges despite inaccurate reporting. Other actions: Specifications have been added to the BS 180 standard and the type standard will be measured against the criteria.

**Estimated Completion Date**

August 15, 2005

**Actual Completion Date TBD**

Signed: C. Ruud



CC: Jim Galaske, Barry Craig, Joe Edwards, E.J. Kubick



**Guide to St Louis Testing Report Dated 7-26-05**

Sample name	Sample origin
A1Z1	Cast on bar A-1 coil, zone 1
A1Z2	Cast on bar A-1 coil, zone 2
A1Z3	Cast on bar A-1 coil, zone 3
C1	Cast on bar C-1 coil
C2Z1	Cast on bar C-2 coil, zone 1
C2Z2	Cast on bar C-2 coil, zone 2
C2Z3	Cast on bar C-2 coil, zone 3
C3Z1	Cast on bar C-3 coil, zone 1
C3Z2	Cast on bar C-3 coil, zone 2
C3Z3	Cast on bar C-3 coil, zone 3
F1	Final analysis button from ladle for C-4 coil
F2	Final analysis button from ladle for C-4 coil
F3	Final analysis button from ladle for C-4 coil
P1	Preliminary analysis button from ladle for C-4 coil

Testing is underway of the heat used to pour the four C coil and six A coil shims.

*Attachment to  
CA 1323*



Chemical, Metallurgical, Mechanical, Nondestructive, Environmental Testing, Analyses and Field Service.

July 26, 2005  
Lab No. 05C-0608  
Invoice No. 59891  
P.O. No. 21324  
Page 1 of 1

**METALTEK INTERNATIONAL**  
8600 Commercial Blvd.  
Pevely, MO 63070

**Attention: Chuck Ruud**

**REPORT OF CHEMICAL ANALYSIS**

**SAMPLE ID:** A1 Z1, A1 Z2, A1 Z3, C1, C2 Z1, C2 Z2, C2 Z3,  
C3 Z1, C3 Z2, C3 Z3, F1, F2, F3, P1

**RESULTS: %**

ANALYTE	A1Z1	A1Z2	A1Z3
Sulfur	.013	.005	.010
Phosphorus	.025	.023	.018

ANALYTE	C1	C2Z1	C2Z2	C2Z3
Sulfur	.014	.022	.018	.015
Phosphorus	.018	.024	.021	.025

ANALYTE	C3Z1	C3Z2	C3Z3
Sulfur	.013	.014	.012
Phosphorus	.024	.025	.021

ANALYTE	F1	F2	F3	P1
Sulfur	.014	.015	.012	.010
Phosphorus	.029	.033	.028	.030

Sulfur Test Method: ASTM E1019-03

Phosphorous Test Method: Colormetric

Identification of tested specimen provided by the client.

Robin E. Sinn  
Laboratory Director





## Carondelet Division

8600 Commercial Blvd. • Pevely, MO 63070 USA

Phone: 636-475-2199 • Fax: 636-479-3399

E-Mail: Charles.Ruud@MetalTek.com

Corrective Action 1347  
Carondelet Division - CA / PA / RGA Database  
Corrective Action Type NCR  
Date 8/1/2005 Revised 1-31-06  
CA Originator C. Ruud  
Applies to: A-1Coil

### Description of Defect / Non-Conformance

Wall thickness below model minimum. Localized areas were measured below the 1.375" minimum wall thickness during metrology. MetalTek independently verified wall thickness and confirmed condition.

### Root Cause

The tooling produces a casting with a wall thickness less than required by the model. Measurements taken on A-3, A-4 and A-5 are consistent and lower than predicted by the model. Material losses during normal processing and heat treat with A-1 and A-2 are also a factor.

### Corrective Action

Request "Use As Is" disposition on wall thickness related dimensions on A-1 coil.

### Verification of Corrective Action

Not required. PPPL independently verified in conjunction with ORNL the design performance at a wall thickness of 1.05". Results were deemed adequate. Minimum measured dimension is 1.18" (to be verified). **Scans of A-2 and 3 coils shows that the walls are above the 1.18" minimum dimension in all but a few isolated locations. The areas were identified and repaired by approved welding procedures.**

### Preventive Action

Several steps need to be taken to resolve and propose:

1. Validation of 3D Scanco data. MetalTek proposes to use Romer Arm with Laser scanner as validation technique. This instrument will be used to validate subsequent parts and minimizes measurement technique error.  
- Completed - The data provided by 3D Scanco has been validated on A1.
2. Report to PPPL/ORNL. Understanding the concern that the wall not be thinner than measured and the limitations of the process, e.g. setting a large core into a mold with overhead crane, MetalTek will submit layout results to EIO wand set teleconference to review remediations to tool.  
- It was determined to produce A2 with no tooling changes.

3. Upon verification of 3D Scanco data, MetalTek will confirm results to EIO team to begin root cause determination. Additional layout may be required to assure compliance of tooling, depending on results of layout.
  - Transfer caliper dimensions were taken on A-2 and A-3 at pre-clean step and shown to exceed required minimum wall thickness. **However scans performed using Romer Arm on A-2 and A-3 indicated dimensions consistent with A-1.**
4. Modification to tooling. Limited tooling modifications may be performed without severely impacting schedule or negating previous engineering (solidification modeling, etc.). These will be evaluated and proposed, where appropriate.
  - No tooling changes have been made.
5. Permanent deviation. Based on results of above, a permanent deviation may be required to dimensional tolerances in limited areas of the component. These will be known in greater detail later.

**Actual Completion Date**

All items complete, except a deviation.

Signed: C. Ruud



CC: Roger Broman, Barry Craig, Joe Edwards, E.J. Kubick, J. Markham

## NCSX Disposition to CA 1347

Analyses were performed to determine the effect of the thin section on deflections and stresses and are summarized below.

- Thin shell areas like that of A1 **has an extremely minor affect on the stresses and displacements in ANY of the coils or shells** with the thickness being either 1.18" as for A1 or even with the thickness being 1.05" which MTK projects is the minimum if the shell is not changed. Reasons:
  - a) The shape of the tee is not changed by this, and the tee provides most of the bending stiffness
  - b) Some EM forces are transferred to the shell B from the wing.
  - c) The thin wall region is not the location for the peak stress and much of the area will be machined away.

Run #	Configuration	Shell Type A		Coil Type A		All Coils	
		Max.	Max.	Max.	Max.	Max.	Max.
		Displacement - mm	Stress - Mpa	Displacement - mm	Stress - Mpa	Displacement - mm	Stress - Mpa
1	Baseline	0.98	168	1.246	239	2.711	239
5	Updated E	1.17	160	1.513	248	2.934	248
6	Updated E; thin sect. =1.18"	1.169	161	1.516	249	2.984	249
4	Updated E; thin sect. =1.05"	1.168	161	1.517	248	2.971	248

Since the effect has been shown to be extremely minor, the disposition for the A1 winding form is **Accept As Is**.

**However, since the root cause determination is still underway, this NCR should be kept open. It is requested that EIO re-issue an amended CA with the root cause determination and preventive action; PPPL will disposition that portion of the NCR at that time.**

**Approved:**

Phil Heitzenroeder  
2005.08.19 14:10:46 -04'00'

**P. Heitzenroeder, Tech. Rep.**

**Brad Nelson**

Digitally signed by Brad Nelson  
DN: cn=Brad Nelson, c=US,  
o=ORNL, ou=FED,  
email=nelsonbe@ornl.gov  
Date: 2005.08.19 16:56:28 -04'00'

**B. Nelson, RLM**

## Update to CA 1671

Since this CA was originally dispositioned on April 20, MTK was able to provide some photos from the test bars (attached). This update is being written to include this additional information.

These photos were sent to Bob Keilback for his assessment (see e-mail below). Based on this update, this CA is now considered CLOSED; as Bob indicated, the test bars did, indeed contain flaws that contributed to the lower test values exhibited.

Approved by:

**Phil  
Heitzenroeder**

Digitally signed by Phil  
Heitzenroeder  
DN: cn=Phil Heitzenroeder,  
c=US, o=PPPL, ou=Mech. Eng.  
Division  
Date: 2006.07.18 10:55:40 -04'00'

**Brad  
Nelson**

Digitally signed by Brad Nelson  
DN: cn=Brad Nelson, c=US,  
o=ORNL, ou=FED,  
email=nelsonbe@ornl.gov  
Date: 2006.07.18 12:08:10  
-04'00'

Tech. Rep.

RLM

---

-----Original Message-----

From: Keilbach, Robert [mailto:Robert.Keilbach@wgint.com]  
Sent: Thursday, June 08, 2006 8:33 AM  
To: Phil Heitzenroeder  
Cc: Frank A. Malinowski  
Subject: RE: Two requests

Phil,

1. The test specimen failure surfaces appear to be not homogeneous, with some evidence of pores and inclusions.
2. We do not have a qualified WPS. However, the addition of tack welds would likely hold the nut in place for tightening; even if the weld(s) cracked, the obstruction caused by the weld on the Stelalloy should prevent the nut from turning.

Bob

---

From: Phil Heitzenroeder [mailto:pheitzen@pppl.gov]  
Sent: Wed 6/7/2006 9:57 AM  
To: Keilbach, Robert  
Cc: fmalinowski@pppl.gov  
Subject: Two requests

Bob,

I'd appreciate your feedback on two issues that came up on NCSX:

1) The attached ZIP file contains photos of the test bars for A6, which had the lower elongation values. Could you please give me your opinion as to the quality of the test samples? Originally MTK said the lower values were due to defects in the bars. Unfortunately the half of the bars that they based this opinion on were discarded by the test lab. "

They feel that these halves do not support this "defect" assessment fully; what do you think?

2) Some of the flange counterbores will not be accessible to hold the nuts for tightening. We were wondering if we simply got A286 nuts if we could tack weld them to the Stellite to hold them during torquing. Do you know if we could weld these two alloys together?

Thanks!

Phil

From: PETER DJORDJEVICH [mailto:pdjord@sbcglobal.net]  
Sent: Tuesday, June 06, 2006 12:07 PM  
To: Frank A. Malinowski; Phil Heitzenroeder; Nancy Flowen  
Subject: A6 test bar photos

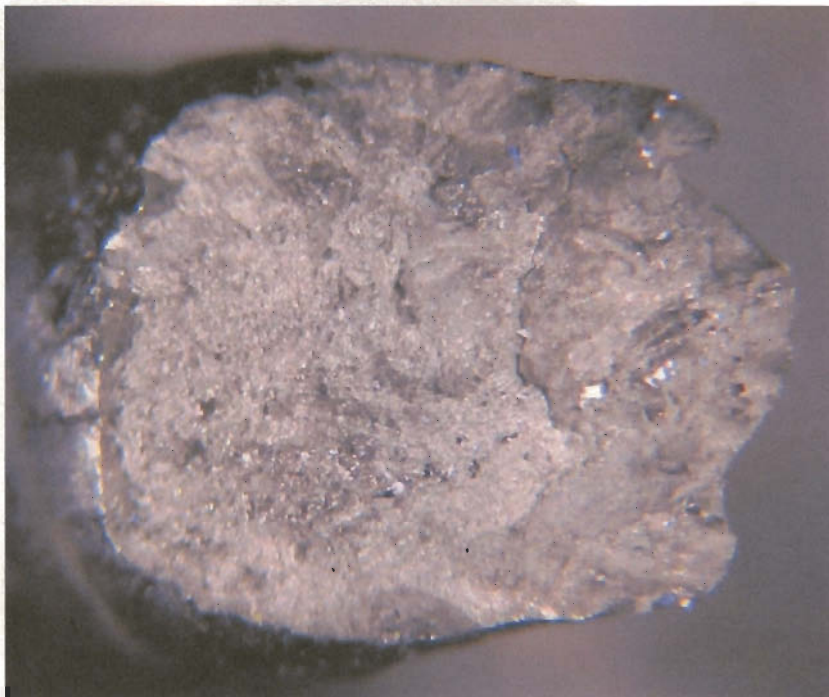
File changed to TXT from zip.

These are better photos forwarded to me by MetalTek in relation to A6 test bar failures.

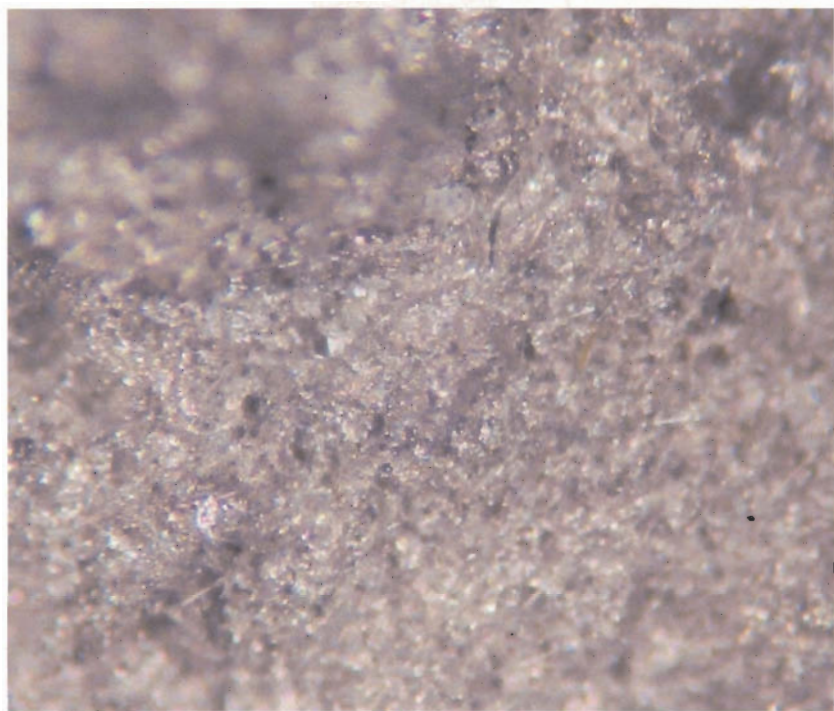
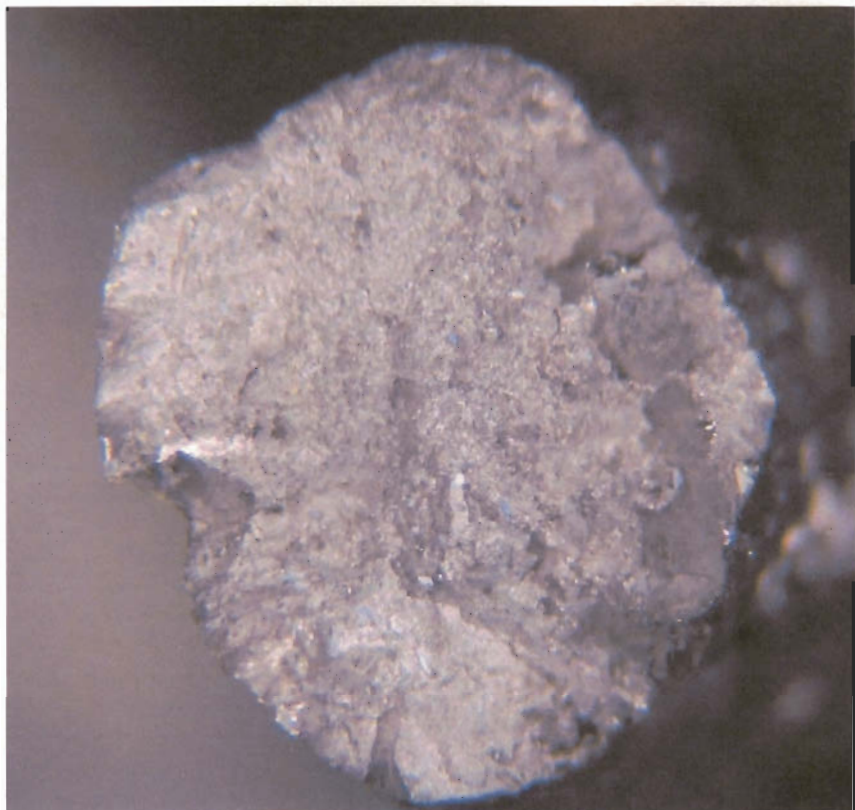
Sincerely,

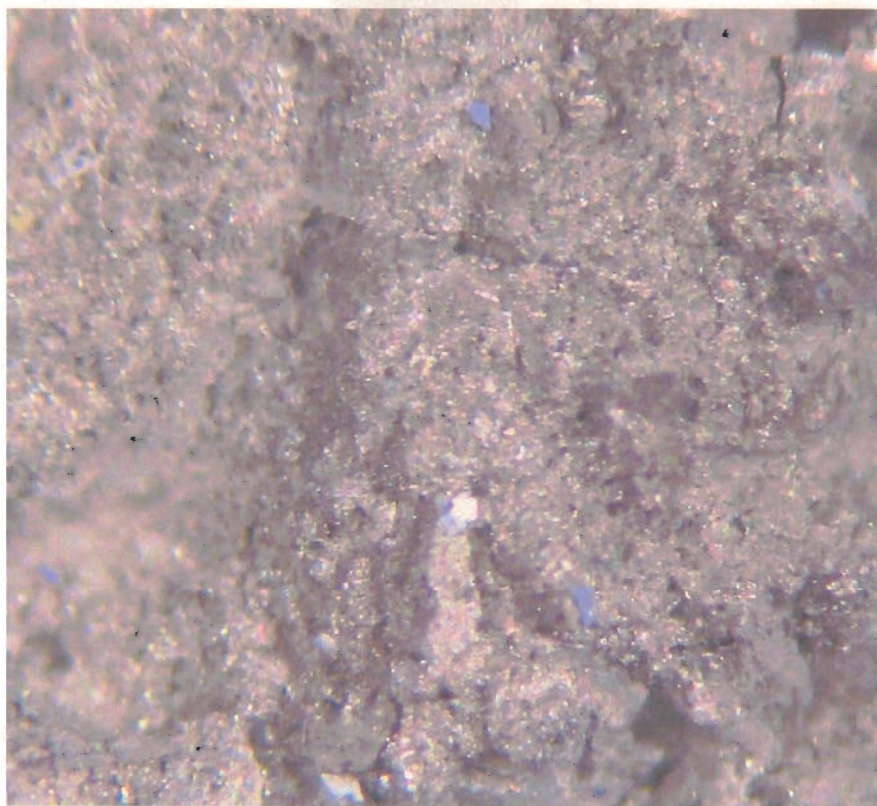
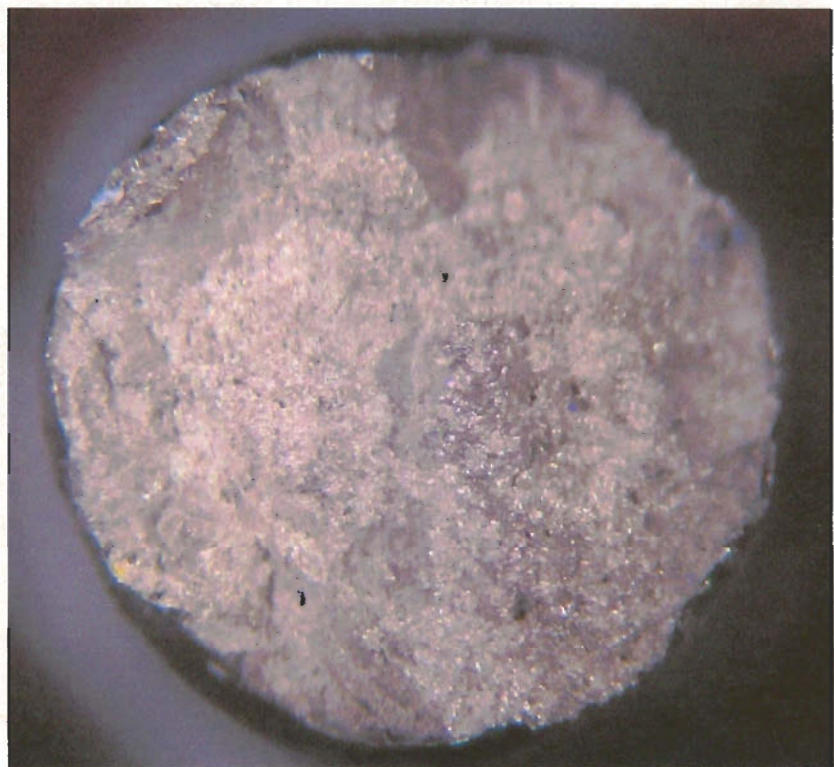
Peter Djordjevich

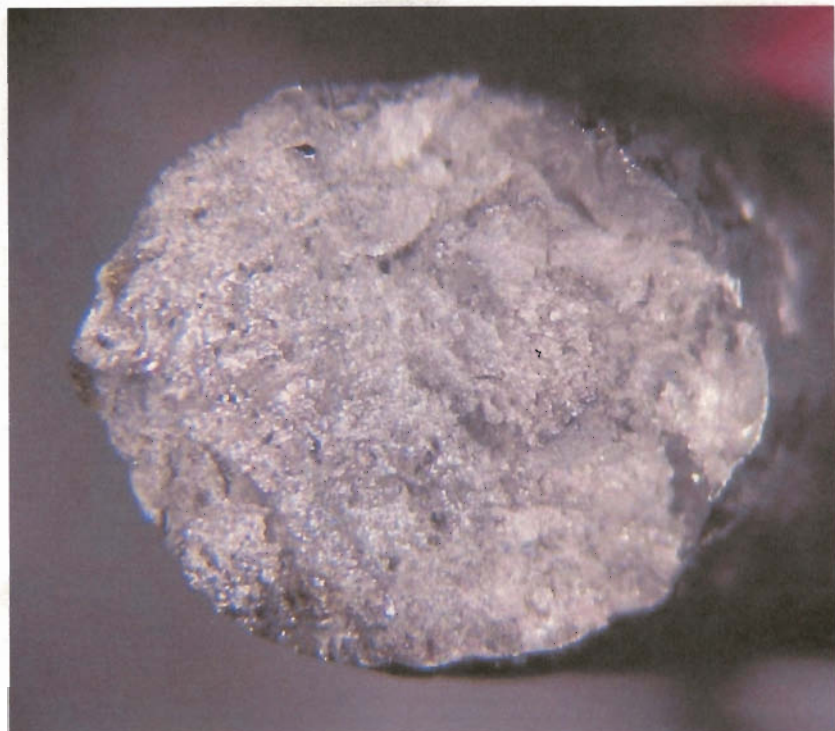
CA 1671 Photos













## Carondelet Division

8600 Commercial Blvd. • Pevely, MO 63070 USA

Phone: 636-475-2199 • Fax: 636-479-3399

E-Mail: Charles.Ruud@MetalTek.com

**Draft Corrective Action** 1671

Carondelet Division

Corrective Action Type NCR

Date 4-10-06 **Revised 4-17-06**

CA Originator C. Ruud

Applies to: A-6 Coil

### **Description of Defect / Non-Conformance**

Test bar from zone 1 failed elongation at -320 F. Result was 20% versus a minimum of 32%. The original set of three bars, Z-1, Z-2 and Z-3 were sent for testing. Z-1 failed for elongation, 26% vs 32% minimum and Z-3 failed for elongation 19% vs 32% minimum. All other results were acceptable. Retests were ordered. The second results were similar. Z-1 failed for elongation, 25% vs 32% minimum and Z-3 failed for elongation 13% vs 32% minimum, but broke outside the gauge length. The third set of bars was tested. Z-3 passed and Z-1 failed for elongation, 20% vs 32% minimum, but broke outside the gauge length. All other test results were acceptable. See attached test reports.

### **Root Cause**

See attached report, with attachments.

### **Corrective Action**

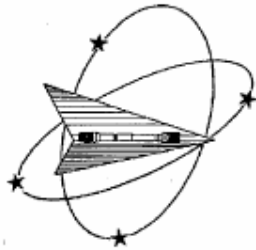
Use A-6 as is.

### **Actual Completion Date**

TBD

Signed: C. Ruud

CC: B. Craig, J. Edwards, E.J. Kubick, J. Markham, J. Galaske



**Westmoreland Mechanical Testing & Research, Inc.**

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621-01 & 621-02



March 9, 2006

**CERTIFICATION**

Section 1 of 1

WMT&R Report No. 6-23847  
 P.O. No. 19386  
 Requisition No. 7580

MetalTek International  
 The Carondelet Division  
 8600 Commercial Blvd.  
 I-55 Industrial Park  
 Pevely, MO 63070-1528

Attention: Jim Galaske

Subject: All processes, performed upon the material as received, were conducted at WMT&R, Inc. in accordance with the WMT&R Quality Assurance Manual, Rev. 9, dated 4/1/2000.  
 The following tests were performed on this order: TENSILE

**TENSILE RESULTS: ASTM E21-05**

Requirements: UTS ksi (Min 95\Max ---) 0.2% YS ksi (Min 72\Max ---) 4D Elong. % (Min 32\Max ---) Modulus Msi (Min 21\Max ---)

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.003 in./in./min., 0.05 in./min./in.

MATERIAL: 316 S/S

DISPOSITION: Acceptable

Coil No.	Specimen	TestLog Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	AUUR
A6	Z2	D18313	-320	163.7	100.1	61	41	28.0	15730	9616	0.3498	0.2698	1.40	2.25	0.09610135	M9	A

AUUR: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

**TENSILE RESULTS: ASTM E21-05**

Requirements: UTS ksi (Min 95\Max ---) 0.2% YS ksi (Min 72\Max ---) 4D Elong. % (Min 32\Max ---) Modulus Msi (Min 21\Max ---)

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.003 in./in./min., 0.05 in./min./in.

MATERIAL: 316 S/S

DISPOSITION: Unacceptable

Coil No.	Specimen	TestLog Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	AUUR
A6	Z1	D18312	-320	161.1	108.9	26	30	29.7	15470	10460	0.3497	0.2929	1.40	1.76	0.09604641	M9	U
A6	Z3	D18314	-320	157.5	111.2	19	28	30.9	15140	10690	0.3498	0.2959	1.40	1.67	0.09610135	M9	U

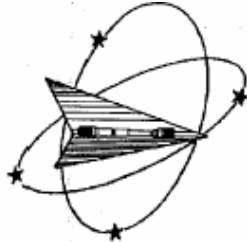
AUUR: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

*Matthew Wojton* 3-9-06  
 Roy E. Starr/Matt Wojton  
 Technical Services Manager/Tensile Supervisor

March 9, 2006

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621-01 & 621-02



April 3, 2006

**CERTIFICATION**

Section 1 of 1

MetalTek International  
The Carondelet Division  
8600 Commercial Blvd.  
I-55 Industrial Park  
Pevely, MO 63070-1528

WMT&R Report No. 6-25662  
P.O. No. 19386  
Requisition No. 7580

Attention: Jim Galaske

Subject: All processes, performed upon the material as received, were conducted at WMT&R, Inc. in accordance with the WMT&R Quality Assurance Manual, Rev. 9, dated 4/1/2000.  
The following tests were performed on this order: TENSILE

**TENSILE RESULTS: ASTM E21-05**

Requirements: UTS ksi (Min 95/Max →) 0.2% YS ksi (Min 72/Max →) 4D Elong. % (Min 32/Max →) Modulus Msi (Min 21/Max →)

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.003 in./in./min., 0.05 in./min./in.

MATERIAL: Metaltek CF8NMnMOD

DISPOSITION: Acceptable

Coil No.	Specimen	TestLog Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	AIUR
A6	Z2	D30710	-320	166.2	99.8	58	44	25.3	16120	9677	0.3514	0.2622	1.40	2.21	0.09698250	M9	A

AIUR: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

**TENSILE RESULTS: ASTM E21-05**

Requirements: UTS ksi (Min 95/Max →) 0.2% YS ksi (Min 72/Max →) 4D Elong. % (Min 32/Max →) Modulus Msi (Min 21/Max →)

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.003 in./in./min., 0.05 in./min./in.

MATERIAL: Metaltek CF8NMnMOD

DISPOSITION: Unacceptable

Coil No.	Specimen	TestLog Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Codes	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	AIUR
A6	Z1	D30718	-320	166.1	106.1	25	26	27.6	—	16050	10450	0.3508	0.3024	1.40	1.75	0.09665160	M9	U
A6	Z3	D30720	-320	129.7	105.2	13	19	27.9	D	12540	10170	0.3508	0.3153	1.40	1.58	0.09665160	M9	U

AIUR: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

Requirements provided by MetalTek International

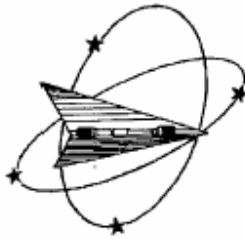
D - Ruptured outside middle half of gage length.

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*Matthew J. Dayton*  
Roy E. Starr/Matt Wojton  
Technical Services Manager / Testable Supervisor

4-3-06  
April 3, 2006

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621-01 & 621-02

April 10, 2006

**CERTIFICATION**

MetalTek International  
 The Carondelet Division  
 8600 Commercial Blvd.  
 I-55 Industrial Park  
 Pevely, MO 63070-1528

Attention: Jim Galaske

Subject: All processes, performed upon the material as received, were conducted at WMT&R, Inc. in accordance with the WMT&R Quality Assurance Manual, Rev. 9, dated 4/1/2000.  
 The following tests were performed on this order: TENSILE

Section 1 of 1

WMT&R Report No. 6-26780  
 P.O. No. 19386  
 Requisition No. 7580

**TENSILE RESULTS: ASTM E21-05**

Requirements: UTS ksi (Min 95\Max ---) 0.2% YS ksi (Min 72\Max ---) 4D Elong. % (Min 32\Max ---) Modulus Msi (Min 21\Max ---)

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.003 in./in./min., 0.05 in./min./in.

MATERIAL: Metaltek CF8MNmMOD

DISPOSITION: Acceptable

Coil No.	Specimen	Test Log Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	AU/R
A6	Z2	D38883	-320	165.8	100.8	35	31	28.6	16070	9774	0.3513	0.2923	1.40	1.90	0.09692731	M9	A
A6	Z3	D38884	-320	160.9	93.7	44	41	25.5	15540	9049	0.3507	0.2686	1.40	2.02	0.09659650	M9	A

AU/R: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

**TENSILE RESULTS: ASTM E21-05**

Requirements: UTS ksi (Min 95\Max ---) 0.2% YS ksi (Min 72\Max ---) 4D Elong. % (Min 32\Max ---) Modulus Msi (Min 21\Max ---)

SOAK TIME: 5 Minutes

SPEED OF TESTING: 0.003 in./in./min., 0.05 in./min./in.

MATERIAL: Metaltek CF8MNmMOD

DISPOSITION: Unacceptable

Coil No.	Specimen	Test Log Number	Temp. °F	UTS ksi	0.2% YS ksi	Elong %	RA %	Modulus Msi	Codes	Ult. Load lbf	0.2% YLD. lbf	Orig. Dia. (in.)	Final Dia. (in.)	4D Orig GL (in.)	4D Final GL (in.)	Orig. Area (sq. in.)	Machine Number	AU/R
A6	Z1	D38882	-320	134.7	100.2	20	23	26.0	D	13030	9700	0.3510	0.3084	1.40	1.68	0.09676184	M9	U

AU/R: A=ACCEPTABLE, U=UNACCEPTABLE, R=REPORT

Requirements provided by MetalTek International  
 D - Ruptured outside middle half of gage length.

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*Mattew J. Wagoner* 4-10-06  
 Roy E. Starr/Matt Wagoner  
 Technical Services Manager/Tensile Supervisor April 10, 2006

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## Addendum to CA 1671

### Effect of Solidification Microstructure on Tensile Properties of Stellaloy

J. Edwards and C. Ruud, MetalTek International

#### Overview

The development of “Stellaloy” by MetalTek International commenced in 2003 with the modification of the base 316 material primarily for magnetic permeability requirements. Initial results demonstrated that this material is extremely robust mechanically at both ambient and cryogenic temperature ranges. Tensile properties gathered from integrally cast test specimens poured with the modules have shown variability. While most have far exceeded the specification minima, outliers have shown to demonstrate reduced elongation.

#### Background

Initial tests on the C5 casting showed that the elongation was lower in test bars associated with Zone 1 than in other areas of the casting. Repeat tests showed the same result (Table I). Based on this result, the microstructure of the test specimen was examined and characterized compared to other test bars integral to the same modular coil casting. Results are shown in figures Lab report 05M1167, Figures 1, 2 and 3.

Similarly, testing of the A6 casting has shown a lower elongation in the test specimens associated with Zone 1. Testing was repeated in specimens from the same zone with reproducible results (25-26% elongation at 77K), although one test demonstrated a 20% elongation with breakage outside the gauge. Results of this test are shown in Table II and associated microstructures in Figures conyained in WMTR#6-26780.

The tensile test variation seems to demonstrate correlation to microstructure with finer grains and heavily dendritic structures showing lower elongation. Other properties are generally well above specification for both samples.

The attached test specimens from the production coils are machined to a 0.350” diameter (“sub size” or SS) bar. The strain rate on the production components is 0.003 in/in/min to yield and 0.05 in/min/in to fracture.

#### Analysis

The test specimens are attached to metal feeders (“risers”) in the modular coil casting mold. The attachment of these test specimens is largely determined by convenience due to accessibility of the feeder and orientation to a natural interface between mold components (cope, drag, and cores). Metal is introduced into the mold through a series of ceramic tubes from any of 3 ladles and mixes naturally upon entry into the mold cavity. Attached test specimens are filled by the molten metal at different temperatures and at different elapsed time from mold filling onset. The combination of elapsed time and geometric location of the attached specimens results in a range of solidification structures based on the superheat of the metal entering the specimen as well as the rate of heat extraction from the metal through the sand wall due to mold temperature surrounding the specimen (Table III). In general, cooler metal temperatures favor multiple nucleation sites while cooler mold temperatures promote nucleation at an accelerated rate on the mold

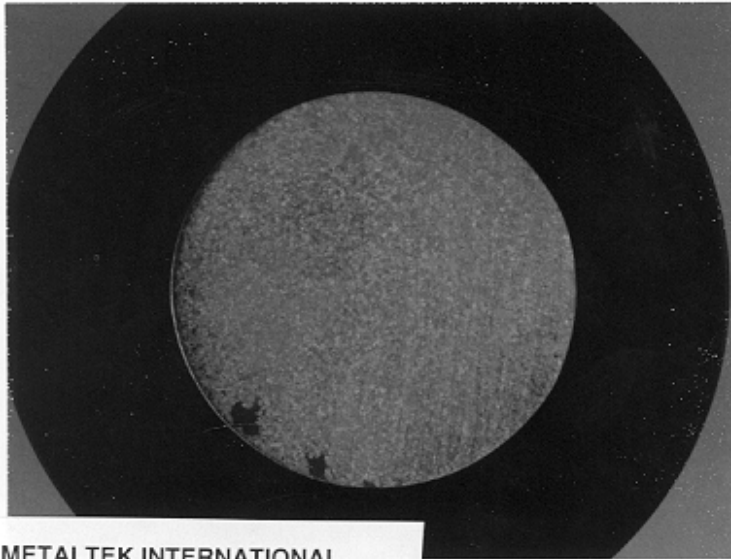


surface. Hotter metal temperatures result in fewer nucleation sites and more growth of individual grains during solidification.

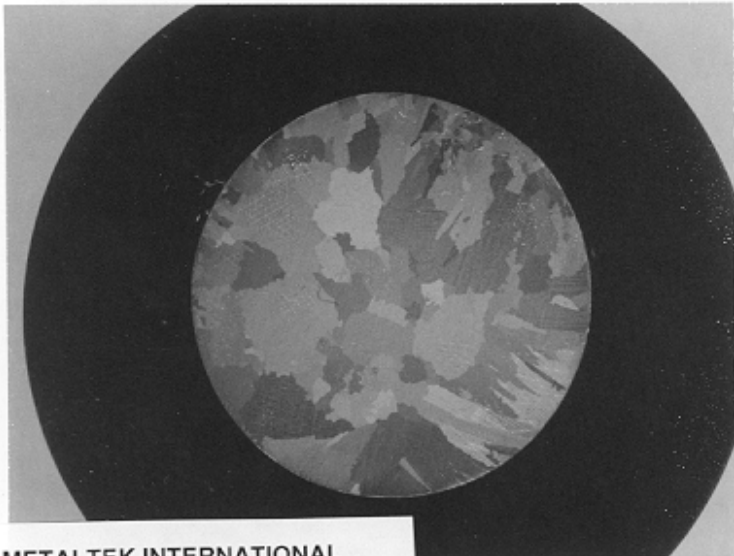
## Results

1. The properties measured from attached test specimens vary; however, exceed the specification minima in most cases.
2. Isolated test bars have shown depressed elongation values of approximately 25-29%. Microstructural analysis of these test bars demonstrate that the microstructure is generally fine grained and may or may not contain heavily dendritic structure.
3. Test bar structure is the result of solidification physics of the test material and not associated with physical differences of Zone location.
4. Stellaloy continues to test well across a variety of microstructures at both 77K and RT.

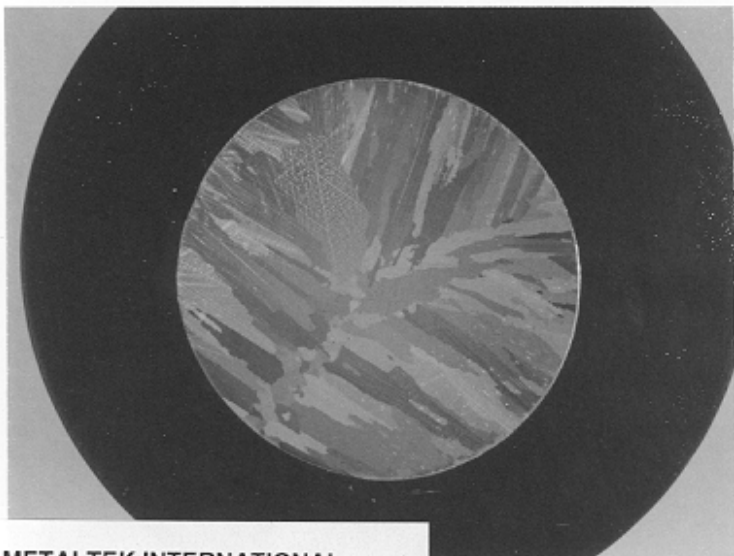
Table III	High Metal Temperature	Low Metal Temperature
High Mold Temperature	Little incentive for nucleation and low thermal gradients. Large columnar grains.	Multiple nucleation sites within material, but little thermal gradient to mold. Creates finely dispersed equiaxed structure within metal with little correlation to mold wall.
Low Mold Temperature	Strong dendritic structure with multiple mold surface nucleation sites. Relatively "fine" appearance of closely spaced dendrites.	Multiple nucleation sites with primary sites on mold walls. Intraspecimen nucleation as solidification progresses. Broken dendritic with equiaxed.



METALTEK INTERNATIONAL  
Lab No. 05M1167, Fig. 1, 54933, 3X



METALTEK INTERNATIONAL  
Lab No. 05M1167, Fig. 2, 54934, 3X



METALTEK INTERNATIONAL  
Lab No. 05M1167, Fig. 3, 54935, 3X

P.O. No. 19386

Requisition No. 7580

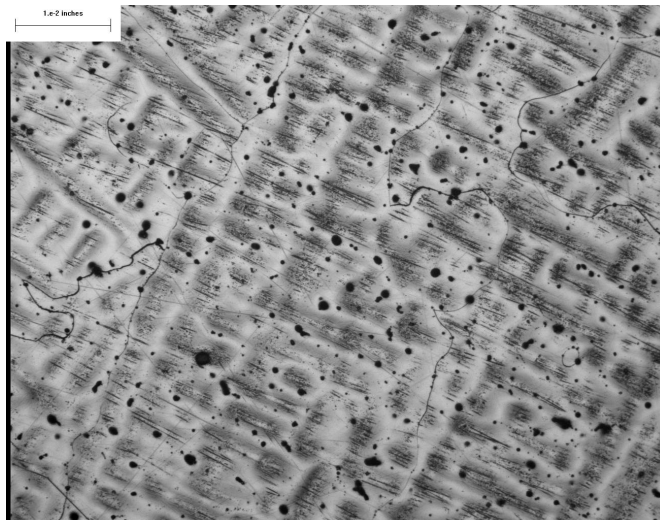
Material : CF8MNMnMod

WMTR Report No. 6-26780

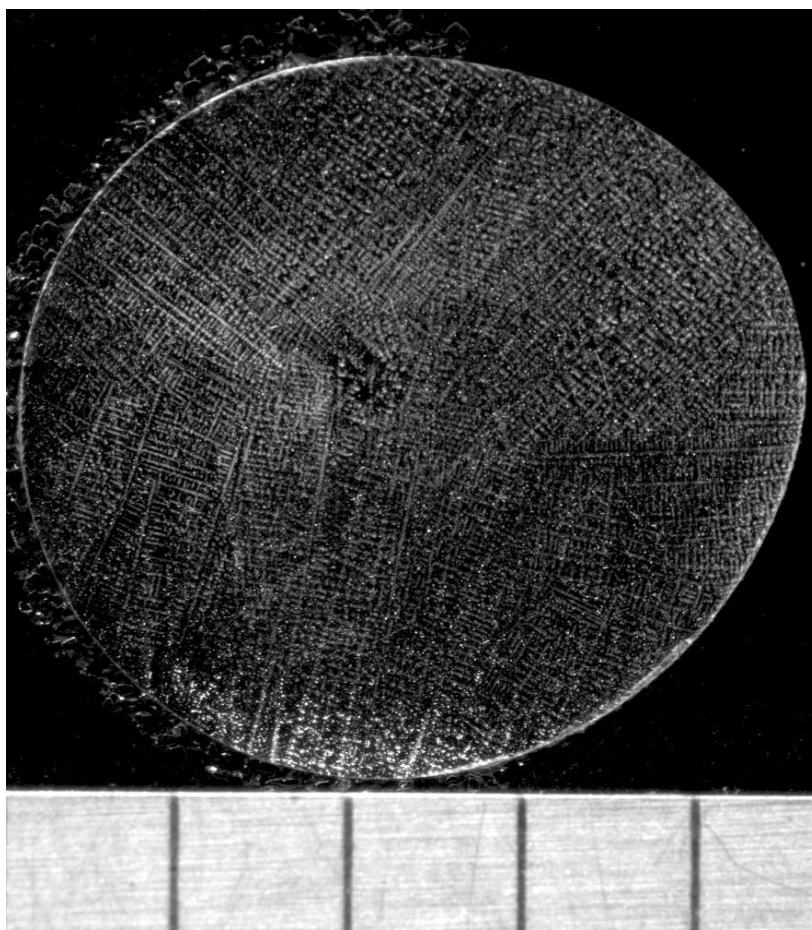
Specimen No. Z1



Magnification: 3x



Magnification: 50x



Magnification: 9x

Etchant HCL + H2O + H2O2

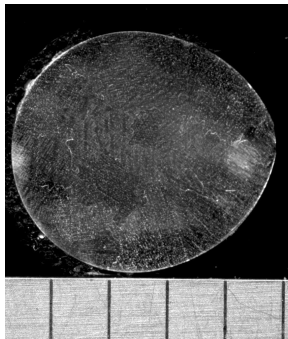
P.O. No. 19386

Requisition No. 7580

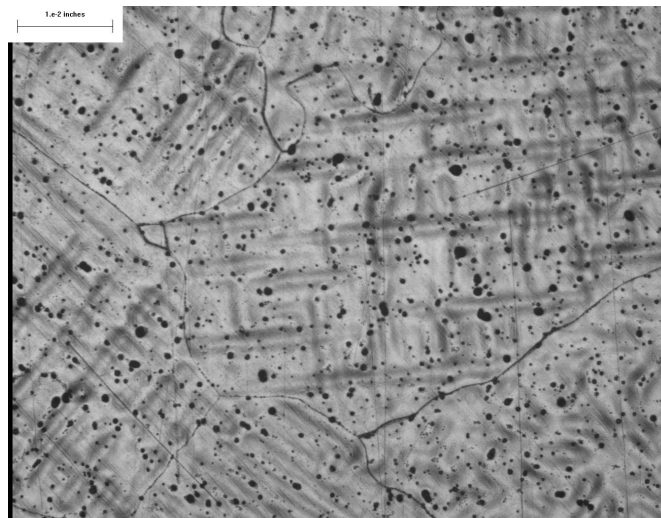
Material : CF8MNMnMod

WMTR Report No. 6-26780

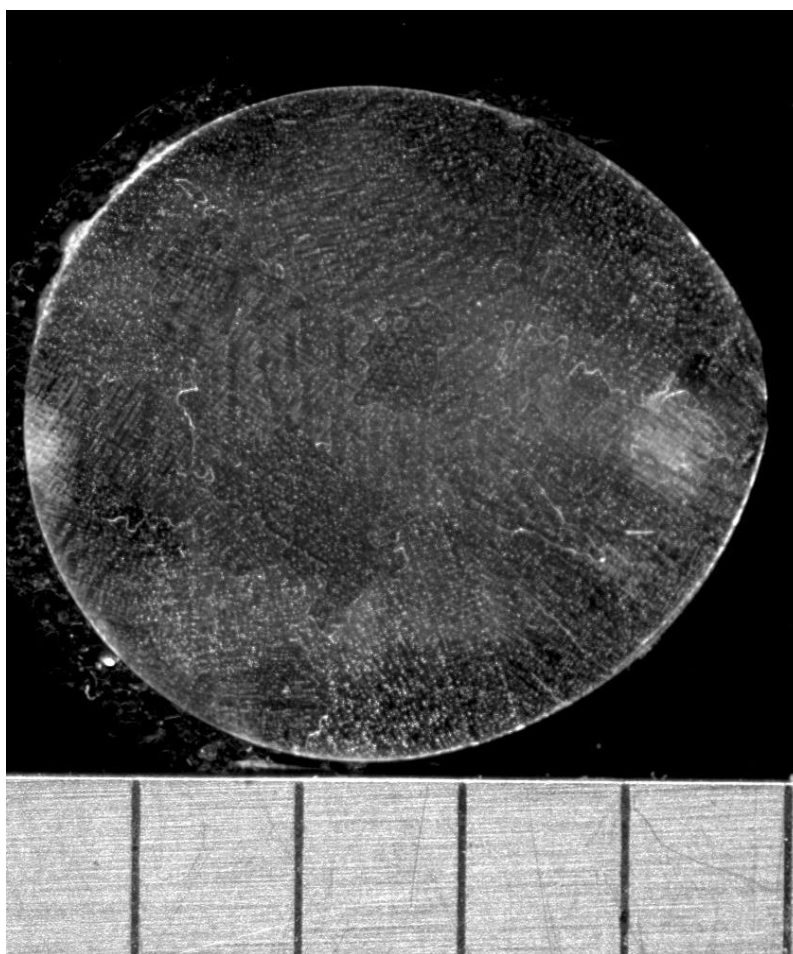
Specimen No. Z2



Magnification: 3x



Magnification: 50x



Magnification: 9x

Etchant HCL + H2O + H2O2

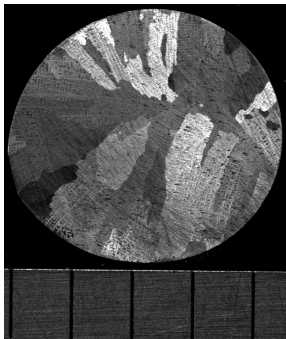
P.O. No. 19386

Requisition No. 7580

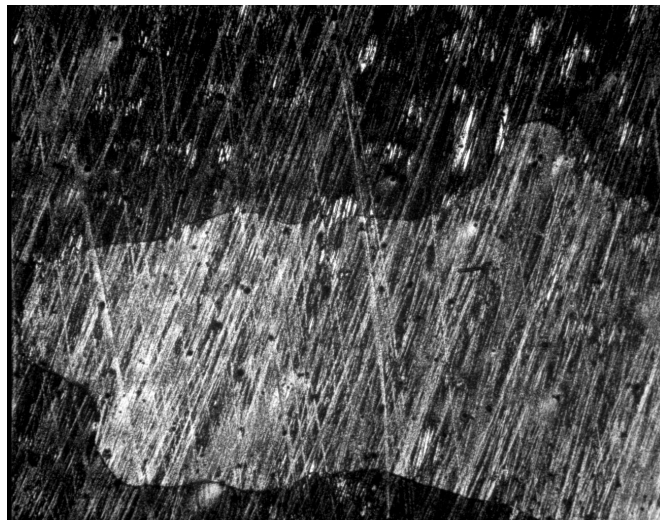
Material : CF8MNMnMod

WMTR Report No. 6-26780

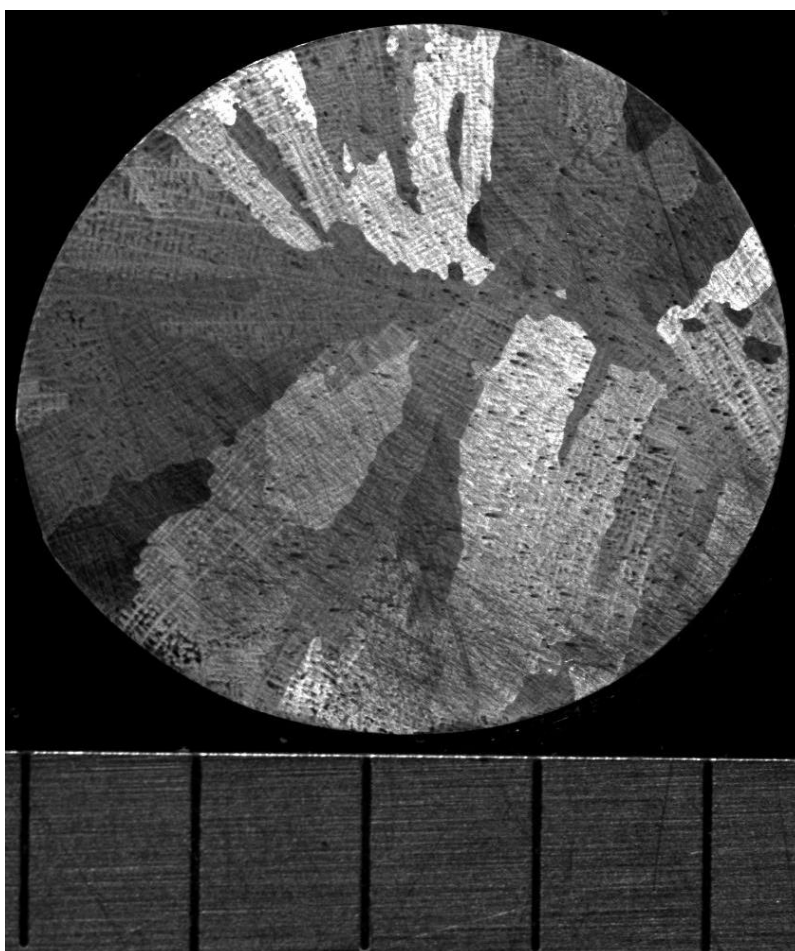
Specimen No. Z3



Magnification: 3x



Magnification: 50x



Magnification: 9x

Etchant HCL + H2O + H2O2

Table I

C-5 Coil

11/18/2005

77K (-320F)

293K (RT)

Casting	Test 1						Test 2								
	Property	Required	C5-1Z	C5-2Z	C5-3Z	C5-1Z	C5-2Z	C5-3Z	Required	C5-1Z	C5-2Z	C5-3Z			
Elastic Modulus	21 Msi (144.8 Gpa)	33	31.8	28	34.5	28.2	25.9	20 Msi (137.9 Gpa)	28.4	27.7	25.9				
0.2% Yield Strength	72 ksi (496.4 Mpa)	112.6	98.3	95.5	111.2	102.5	95	30 ksi	41.5	37.7	37.1				
Tensile Strength	95 ksi (655 Mpa)	182.5	166.1	163.7	177.4	172.3	163.5	78 ksi (537.8 Mpa)	92.9	84.4	83.7				
Elongation	32%	31%	52%	59%	29%	41%	64%	36%	55%	52%	67%				
Charpy V – notch Energy	35 ft. lbs. (47.4 J)	81	73	87				50 ft-lbs (67.8 J)	130	131	156				

Table II

A-6 Coil

4/17/2006

Property	Required	Test #1 77K (-320F)			Test #2 77K (-320F)			Test #3 77K (-320F)			Test #4 77K (-320F)			Required	Test #1 293K (RT)		
		A-6-1Z	A-6-2Z	A-6-3Z	A-6-1Z	A-6-2Z	A-6-3Z	A-6-1Z	A-6-2Z	A-6-3Z	A-6-1Z	A-6-2Z	A-6-3Z		A-6-1Z	A-6-2Z	A-6-3Z
Elastic Modulus	21 Msi (144.8 Gpa)	29.7	28	30.9	27.6	25.3	27.9	26	28.6	25.5				20 Msi (137.9 Gpa)	23.1	21.8	22.8
0.2% Yield Strength	72 ksi (496.4 Mpa)	108.9	100.1	111.2	108.1	99.6	105.1	100.2	100.8	93.7				30 ksi	46.1	40.9	46.6
Tensile Strength	95 ksi (655 Mpa)	161.1	163.7	157.5	166.1	166.2	129.7*	134	165.6	160.9				78 ksi (537.8 Mpa)	90.7	85.8	91
Elongation	32%	26%	61%	19%	25%	56%	13%*	20%*	36%	44%				36%	52%	58%	38%
Charpy V – notch Energy	35 ft. lbs. (47.4 J)	65	81	73	NA	NA	NA	NA	NA	NA	NA	NA	NA	50 ft-lbs (67.8 J)	118	141	121



## Carondelet Division

8600 Commercial Blvd. - Pevely, MO 63070 USA  
Phone: 636-479-4499 - Fax: 636-479-3399

### Final Inspection Report

Customer ENERGY INDUSTRIES OF OHIO  
Pattern: MCWF - A6 COIL

Order PPPL-FP-LTS-2

ASTM Metal CF8MNMN MOD

Date 4/19/2006

Type Description	Cert Number	Procedure	Acceptance Criteria	Actual
Liquid Penetrant	176210-1	CQP - 300 Rev 9	SEE NOTE	Acceptable
Notes	Acceptance per ASTM A903. Acceptance criteria - level 1 for high stressed areas, level 2 for all other areas.			
Mag Perm	176210-1	SOP Mag Perm 100 Rev 1	<1.02	Acceptable
Radiographic	176210-1	Technique # 12726	MSS SP 54	Acceptable
Visual	176210-1	CQP - 500 REV 4	ASTM A802 LEVEL 2	Acceptable

#### Liquid Penetrant

Technician: Tom Chapman  
ASNT Level II

#### Visual

Technician: Kevin Anderson  
ASNT Level II

Respectfully Submitted,  
Charles A. Ruud  
Quality Assurance Manager

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### Certificate of Conformance

ENERGY INDUSTRIES OF OHIO

Order Number PPPL-FP-LTS-2

Pattern MCWF - A6 COIL

ASTM CF8MNMN MOD

Date 4/19/2006

Cert Number

176210-1

A handwritten signature in black ink, appearing to read "C.A. Ruud", is located in the lower right quadrant of the page.

We certify that we have complied in accordance with the drawings(s) and specifications(s) listed on the above purchase order. The articles furnished were made and/or processed from parts and/or materials in accordance with all applicable drawings(s) and specifications(s) pursuant to the afore mention purchase order.

Respectfully Submitted,  
Charles A. Ruud  
Quality Assurance Manager

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### Final Inspection Report

Customer ENERGY INDUSTRIES OF OHIO  
Pattern: SE-141-033 COIL A SHIM S/N 6

Order PPPL-FP-LTS-2

ASTM Metal CF8MNMN MOD

Date 4/19/2006

Type Description	Cert Number	Procedure	Acceptance Criteria	Actual
Liquid Penetrant	S76220-1	CQP - 300 Rev 9	ASTM A903 Level II	Acceptable
Mag Perm	S76220-1	SOP Mag Perm 100 Rev 1	<1.02	Acceptable
Radiographic	S76220-1	Technique # 12726	MSS SP 54	Acceptable
Visual	S76220-1	CQP - 500 REV 4	ASTM A802 LEVEL 2	Acceptable

#### Liquid Penetrant

Technician: Tom Chapman  
ASNT Level II

#### Visual

Technician: Kevin Anderson  
ASNT Level II

Respectfully Submitted,  
Charles A. Ruud  
Quality Assurance Manager

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### Certificate of Conformance

ENERGY INDUSTRIES OF OHIO

Order Number	PPPL-FP-LTS-2		
Pattern	SE-141-033 COIL A SHIM	S/N	.6
Alloy	CF8MNMnMOD	Date	4/19/2006
Cert Number	S76220-1		

A shim for A-6 coil was poured from heat number 29198. No weld repairs were necessary.

We certify that we have complied in accordance with the drawings(s) and specifications(s) listed on the above purchase order. The articles furnished were made and/or processed from parts and/or materials in accordance with all applicable drawings(s) and specifications(s) pursuant to the afore mention purchase order except as noted by corrective actions.

Respectfully Submitted,  
Charles A. Ruud  
Quality Assurance Manager

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