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 – 85
Latest revision 11/6/2006
Foundry documentation

Part 2

Final documentation package Major Tool - Pages 85 -
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

MetalTek INTERNATIONAL

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

MetalTek INTERNATIONAL

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 Heat Number 29198 Pour Date4/28/2005

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	LNM 4455	Size(s) mm	1.2
Class.	EN 12072-99: G 20 16 3 Mn L	Lot/Batch	3018513/78308
		Item No.	692129
Customer	EUROWELD MOORESVILLE N.C. 28117 UNITED STATES	Quantity	105,0 KG
		Customer ref.	P.O. 05 - 46
		LSW Order No.	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

Cond.	Temp. °C	Rp0.2 N/mm2	Rm N/mm2	A5 %
AW	RT	407	623	41

Impact testing

Cond.	Temp.1 °C	Av1 J
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	Issued by	Function	Date	Cert.No.
Lincoln Smitweld B.V.	P. Nagels	QA Administrator	22/03/2005	3018513/7830

Registered Office
Nieuwe Dukenburgseweg 20
6534 AD NIJMEGEN

Post address
P.O. Box 253
6500 AG Nijmegen

Telephone
31 24 3522911

Fax:
31 24 3522200

V2Dec3

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

METALTEK INTERNATIONAL
8600 Commercial Blvd.
Pevely, MO 63070

August 16, 2005
Lab No. 05P-2532
P.O. No. 21324

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
Average	103	0.087	100

Identification of tested specimen provided by client.

Karl Schmitz, Director
Materials Testing

KS/tlv

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8600 Commercial Blvd.
Pevely, MO 63070

August 16, 2005
Lab No. 05P-2532
P.O. No. 21324

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) in.	Elongation (2.0" Gage Length) %	Modules of Elasticity
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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METALTEK INTERNATIONAL
8600 Commercial Blvd.
Pevely, MO 63070

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

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
Average	54	0.037	50

Identification of tested specimen provided by client.

Karl Schmitz, Director
Materials Testing

KS/tlv

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.

ACCREDITED
621-01 & 621-02

Accredited Nadcap Materials Testing Laboratory

October 18, 2005

CERTIFICATION

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

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.
DISPOSITION: Report
MATERIAL: METALTEK CF8MNMNMOD

Specimen ID	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
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

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

Roy E. Stam/Matt Wojton
Technical Services Manager / Tensile Supervisor

10-18-05
October 18, 2005

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.

ACCREDITED
621-01 & 621-02

Accredited Nadcap Materials Testing Laboratory

April 19, 2006

CERTIFICATION

Section 1 of 1

WMT&R Report No. 6-27410
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: 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

Roy E. Starr\Matt Wojton
Technical Services Manager / Tensile Supervisor

4-19-06
April 19, 2006

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METALTEK INTERNATIONAL
8600 Commercial Blvd.
Pevely, MO 63070

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

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
Average	118	0.099	93

3/13/06

Identification of tested specimen provided by client.

Karl Schmitz, Director
Materials Testing

KS/tlv

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

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
Average	65	0.032	40

3/13/06

Identification of tested specimen provided by client.

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

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
Average	141	0.108	100

3/13/06

Identification of tested specimen provided by client.

Karl Schmitz, Director
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Pevely, MO 63070

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

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
Average	81	0.048	47

3/13/06

Identification of tested specimen provided by client.

Karl Schmitz, Director
Materials Testing

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

MEMBER ACIL

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METALTEK INTERNATIONAL
8600 Commercial Blvd.
Pevely, MO 63070

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

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
Average	121	0.090	97

3/13/06

Identification of tested specimen provided by client.

Karl Schmitz, Director
Materials Testing

KS/tlv

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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

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
Average	73	0.042	40

3/13/06

Identification of tested specimen provided by client.

Karl Schmitz, Director
Materials Testing

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METALTEK INTERNATIONAL
8600 Commercial Blvd.
Pevely, MO 63070

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

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.

Karl Schmitz, Director
Materials Testing

KS/tlv

A-6 Coil Weld Map – Metal Tek

Map of all major welds exceeding 20% of wall, over 1 inch or over 10^2 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	⅞
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

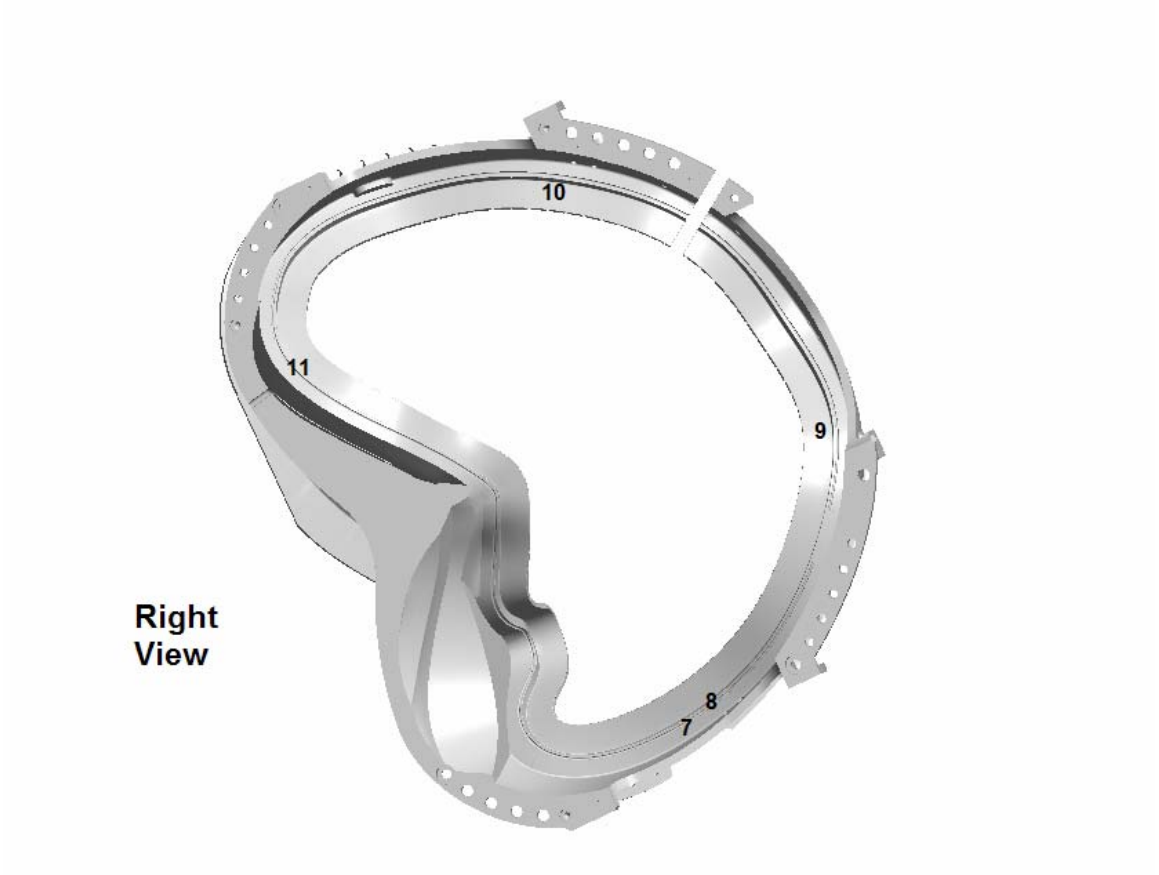
A-6 Coil Weld Map – Metal Tek

Map of all major welds exceeding 20% of wall, over 1 inch or over 10^2 inches

Left View

A-6 Coil Weld Map – Metal Tek

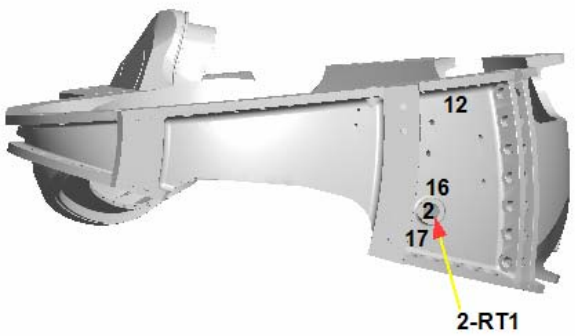
Map of all major welds exceeding 20% of wall, over 1 inch or over 10^2 inches



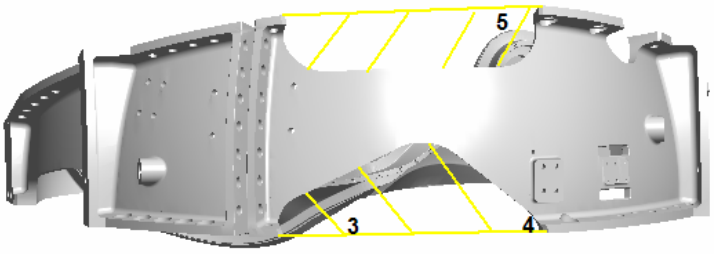
A-6 Coil Weld Map – Metal Tek

Map of all major welds exceeding 20% of wall, over 1 inch or over 10^2 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

NAME METAL TEK INTERNATIONAL

ADDRESS 8600 COMMERCIAL BLVD

CITY PEVELY STATE MO ZIP 63070

DATE 03/04/2006

P.O. NUMBER 23292

WORK ORDER NO. 361-03001-2

XRAY X

GAMMA

PROCEDURE SPECIFICATION ASTM E94-93

ACCEPTANCE CRITERIA MSS-SP-54-1999

SHEET ____ OF ____

PART NUMBER	Serial No	View	No Apparent Indications: Acceptable	Rejected	Inclusion	Dross or Slag	Incomplete Penetration: Porosity	Lack of Fusion	Shrinkage: Gas Cracks	Hot Tears	Under cut	Film Artifacts: Surface		REMARKS
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	✓											
		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 Ø NO. REJECTED 1

MQS TECH. NO. 12970 SHT. REV.

CUST. RSS NO. SHT. REV.

COMMENTS * 120 Pene Not in View. Aim for this Pene on Next view.

REVIEWER John Petroske

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

NAME METAL TEK INTERNATIONAL

ADDRESS 8600 COMMERCIAL BLVD

CITY PEVELY STATE MO ZIP 63070

DATE 03/04/2006

WORK ORDER NO. 361-03001-2

P.O. NUMBER 23292

XRAY X

GAMMA

PROCEDURE SPECIFICATION ASTM E94-93

ACCEPTANCE CRITERIA MSS-SP-54-1999

SHEET 2 OF 6

PART NUMBER	Serial No	View	No Apparent Indications: Acceptable	Rejected	Inclusion	Dross or Slag	Incomplete Penetration: Porosity	Lack of Fusion	Shrinkage: Gas	Cracks	Hot Tears	Under cut	Film Artifacts: Surface		REMARKS
MCWFA-6		26-27	✓												
		27-28	✓										✓		
Z103990		28-29	✓						2						
HT# M176210		29-1	✓						1						
CO 40851															

NO. ACCEPTED 4 NO. REJECTED 1

COMMENTS

MQS TECH. NO. 12970 SHT. REV.

CUST. RSS NO. SHT. REV.

REVIEWER John Petroske

CERTIFIED NDT LEVEL (RT)

John Petroske RT II Exp. 01/08

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P.O. NUMBER 23292

XRAY X

GAMMA

PROCEDURE SPECIFICATION ASTM E94-93

ACCEPTANCE CRITERIA MSS-SP-54-1999

SHEET 3 OF 6

PART NUMBER	Serial No	View	No Apparent Indications: Acceptable	Rejected	Incomplete Penetration: Inclusion	Dross or Slag	Porosity	Lack of Fusion	Shrinkage: Gas	Cracks	Hot Tears	Under cut	Film Artifacts: Surface		REMARKS
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	✓												
	58-5	58A-59		R							R				
		59-60	✓												
		60-61	✓												

NO. ACCEPTED 0

NO. REJECTED 1

MQS TECH. NO. 12970 SHT. REV.

CUST. RSS NO. SHT. REV.

COMMENTS

REVIEWER John Petroske

CERTIFIED NDT LEVEL (RT)

John Petroske RT II Exp. 01/08

TEAM COOPERHEAT-MQS, INC.

CERTIFIED RADIOGRAPHIC INSPECTION REPORT

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CUSTOMER

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CITY PEVELY STATE MO ZIP 63070

DATE 03/04/2006

WORK ORDER NO. 361-03001-2

P.O. NUMBER 23292

XRAY X

GAMMA

PROCEDURE SPECIFICATION ASTM E94-93

ACCEPTANCE CRITERIA MSS-SP-54-1999

SHEET 4 OF 6

PART NUMBER	Serial No	View	No Apparent Indications: Acceptable	Rejected	Dross Inclusion	Dross or Slag	Incomplete Penetration: Porosity	Lack of Fusion	Shrinkage: Gas Cracks	Hot Tears	Under cut	Film Artifacts: Surface		REMARKS
MCWFA-6		61-62	✓											
		62-63		R						R				
Z103990		63-63A	✓											
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

COMMENTS

MQS TECH. NO. 12970 SHT. REV.

CUST. RSS NO. SHT. REV.

REVIEWER John Petroske

CERTIFIED NDT LEVEL (RT)

John Petroske RT II Exp. 01/08

TEAM COOPERHEAT-MQS, INC.

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CUSTOMER

NAME METAL TEK INTERNATIONAL

ADDRESS 8600 COMMERCIAL BLVD

CITY PEVELY STATE MO ZIP 63070

DATE 03/04/2006

WORK ORDER NO. 361-03001-2

P.O. NUMBER 23292

XRAY X

GAMMA

PROCEDURE SPECIFICATION ASTM E94-93

ACCEPTANCE CRITERIA MSS-SP-54-1999

SHEET 5 OF 6

PART NUMBER	Serial No	View	No Apparent Indications: Acceptable	Rejected	Dross Inclusion	Dross or Slag	Incomplete Penetration: Porosity	Lack of Fusion	Shrinkage: Gas	Cracks	Hot Tears	Under cut	Film Artifacts: Surface		REMARKS
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 4

NO. REJECTED 1

MQS TECH. NO. 12970 SHT. REV.

CUST. RSS NO. SHT. REV.

COMMENTS

REVIEWER John Petroske

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

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CUSTOMER

NAME METAL TEK INTERNATIONAL

ADDRESS 8600 COMMERCIAL BLVD

CITY PEVELY STATE MO ZIP 63070

DATE 03/04/2006

WORK ORDER NO. 361-03001-2

P.O. NUMBER 23292

XRAY X

GAMMA

PROCEDURE SPECIFICATION ASTM E94-93

ACCEPTANCE CRITERIA MSS-SP-54-1999

SHEET 6 OF 6

PART NUMBER	Serial No	View	No Apparent Indications: Acceptable	Rejected	Dross Inclusion	Dross or Slag	Incomplete Penetration: Porosity	Lack of Fusion	Shrinkage: Gas	Cracks	Hot Tears	Under cut	Film Artifacts: Surface		REMARKS
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 Ø NO. REJECTED 1

MQS TECH. NO. 12970 SHT. REV.

CUST. RSS NO. SHT. REV.

COMMENTS

REVIEWER John Petroske

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

NAME METAL TEK INTERNATIONAL

ADDRESS 8600 COMMERCIAL BLVD

CITY PEVELY STATE MO ZIP 63070

DATE 04/1/2006

WORK ORDER NO. 361-03094

P.O. NUMBER 23292

XRAY X

GAMMA

PROCEDURE SPECIFICATION ASTM E94-93

ACCEPTANCE CRITERIA MSS-SP-54-1999

SHEET ____ OF ____

PART NUMBER	Serial No	View	No Apparent Indications: Acceptable	Rejected	Inclusion	Dross or Slag	Porosity	Incomplete Penetration: Lack of Fusion	Gas	Shrinkage: Cracks	Hot Tears	Under cut	Surface	Film Artifacts	REMARKS
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				
	106-107		✓												
	109-110		✓											✓	
	125-126		✓								1				

NO. ACCEPTED 0 NO. REJECTED 1

MQS TECH. NO. 12970 SHT. REV.

CUST. RSS NO. SHT. REV.

COMMENTS

REVIEWER John Petroske

CERTIFIED NDT LEVEL (RT)

John Petroske RT II Exp. 01/08

MetalTek INTERNATIONAL

RADIOGRAPHIC INTERPRETATION REPORT

CUSTOMER	PURCHASE ORDER NUMBER	DATE	CONTROL NO.	PAGE
E.I.O.	PPPL-FP-LTS-2	4-4-06	40851	1 of 1

PART NO.	SPECIFICATION	CLASS	TOTAL PIECES	PIECES ACCEPTED
MCWFA-6	E446/E186	SeeSpec	1	1

RADIOGRAPHED BY:	INTERPRETED BY:	ASNT LEVEL
Midgett/Kelley	Midgett/Kelley	II

FILM TYPE	MATERIAL	ISOTOPE	CODE
29/59/80	CF8M/M/NMOA	IRIDIUM 192 COBALT 60 ✓	ASTM E94 ASME MIL-STD-453

VIEW	PENE	ACCEPT	REJECT	SHRINK	INCLUSION	POROSITY	LINEAR	SURFACE	LOF/LOP	COMMENTS
M176210										
R2	63-64	30 50 80 ✓			1		1		✓	
	71-72	30	X	X			X			X
	99-100	50	✓						✓	
R3	71-72	30 ✓			1		1		✓	

Metal Tek INTERNATIONAL

RADIOGRAPHIC STANDARD SHOOTING SKETCH

Customer	E.I.O.	Pattern Number	MCWFA-6
Material	CF8MN MN MoA	Traceability Number	
Film Manufactuer	FUJI	Source Number	CO
IQI LEVEL 2-2T From CQP 401 X Other (Specify, E.G. 2-4T, 2-1T) N/A			

Exposures (views)	63&4	71-72	99-100									
Thickness (IN.)	1½"→4"	1½"	2¾"									
S/F Distance (IN.)	20"	→	→									
Penetrameter	30X2 50 80	30X2	X2 50									
Time (MIN.)	2min	5m45s	8m25s									
Focal Spot (IN.)	.1	→	→									
Film Size (IN.)	14X17	→	→									
Screen Size (Pb) Front/Back	.01	→	→									
S.W.E./D.W.E.	SWE	→	→									
S.W.V/D.W.V.	SWV	→	→									
Film Type	29 59 80	80	→									
Acceptance Standard	E446 E186	→	→									
Severity Level	See Spec	→	→									

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	PURCHASE ORDER NUMBER	DATE	CONTROL NO.	PAGE
Energy Industries of Ohio	PPL-FP-LTS-2	12-16-05	40851	1 of 1

PART NO.	SPECIFICATION	CLASS	TOTAL PIECES	PIECES ACCEPTED
SE-141-033-6	F 186	III	1	1

RADIOGRAPHED BY:	INTERPRETED BY:	ASNT LEVEL
Midget	Midget	II

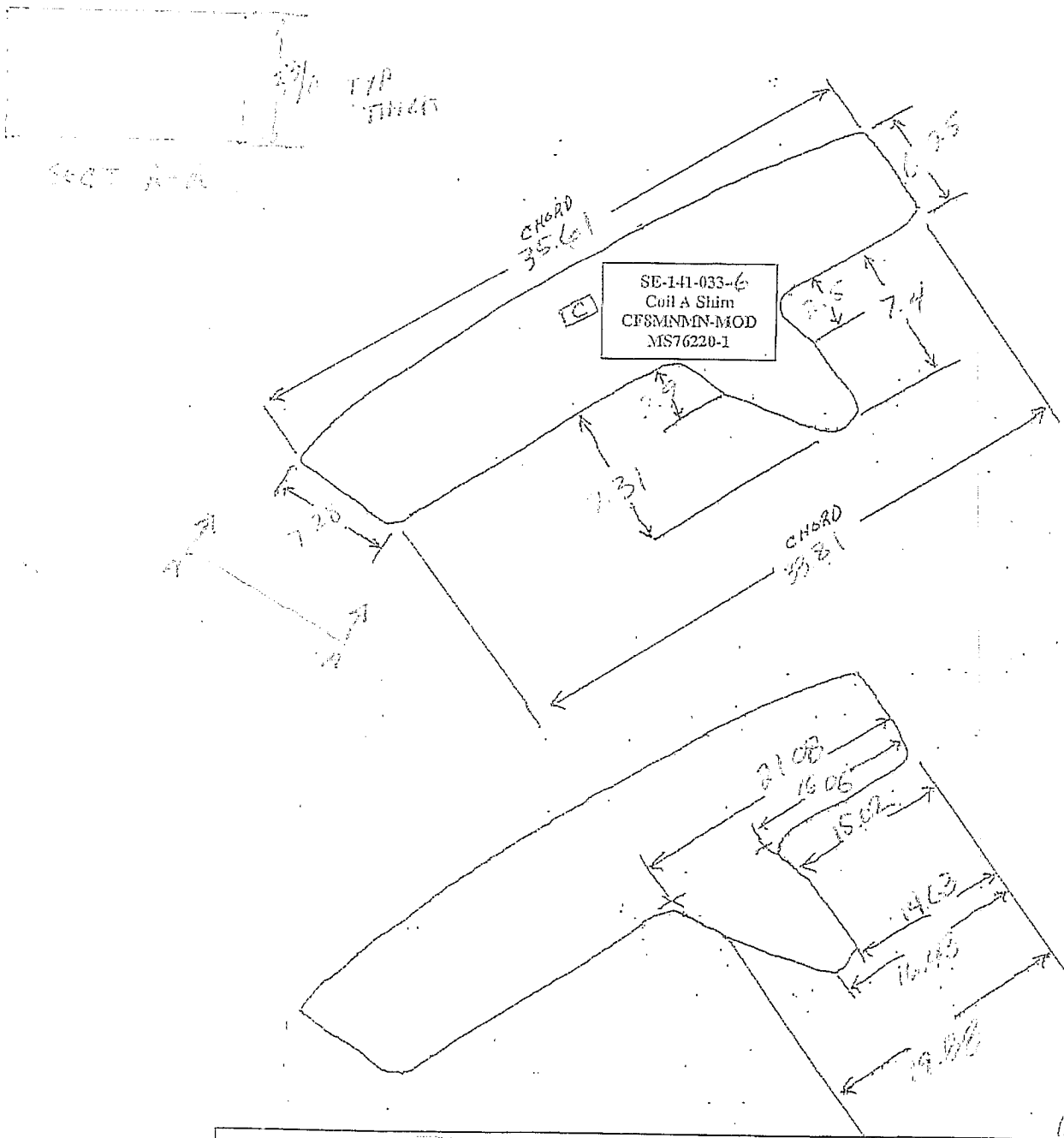
FILM TYPE	MATERIAL	ISOTOPE	CODE
80	CF8MW MW MON	IRIDIUM 192 COBALT 60 ✓	ASTM E94 ✓ ASME MIL-STD-453

	VIEW	PENE	ACCEPT	REJECT	SHRINK	INCLUSION	POROSITY	LINEAR	SURFACE	LOF/LOP	COMMENTS
MS76220											
RT-6	A	50	✓								
ACOIL	B	"	✓						✓		
Shim	C	"	✓						✓		
SN #6	D	↓	✓								

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

FORM CC034

Metal Tek INTERNATIONAL



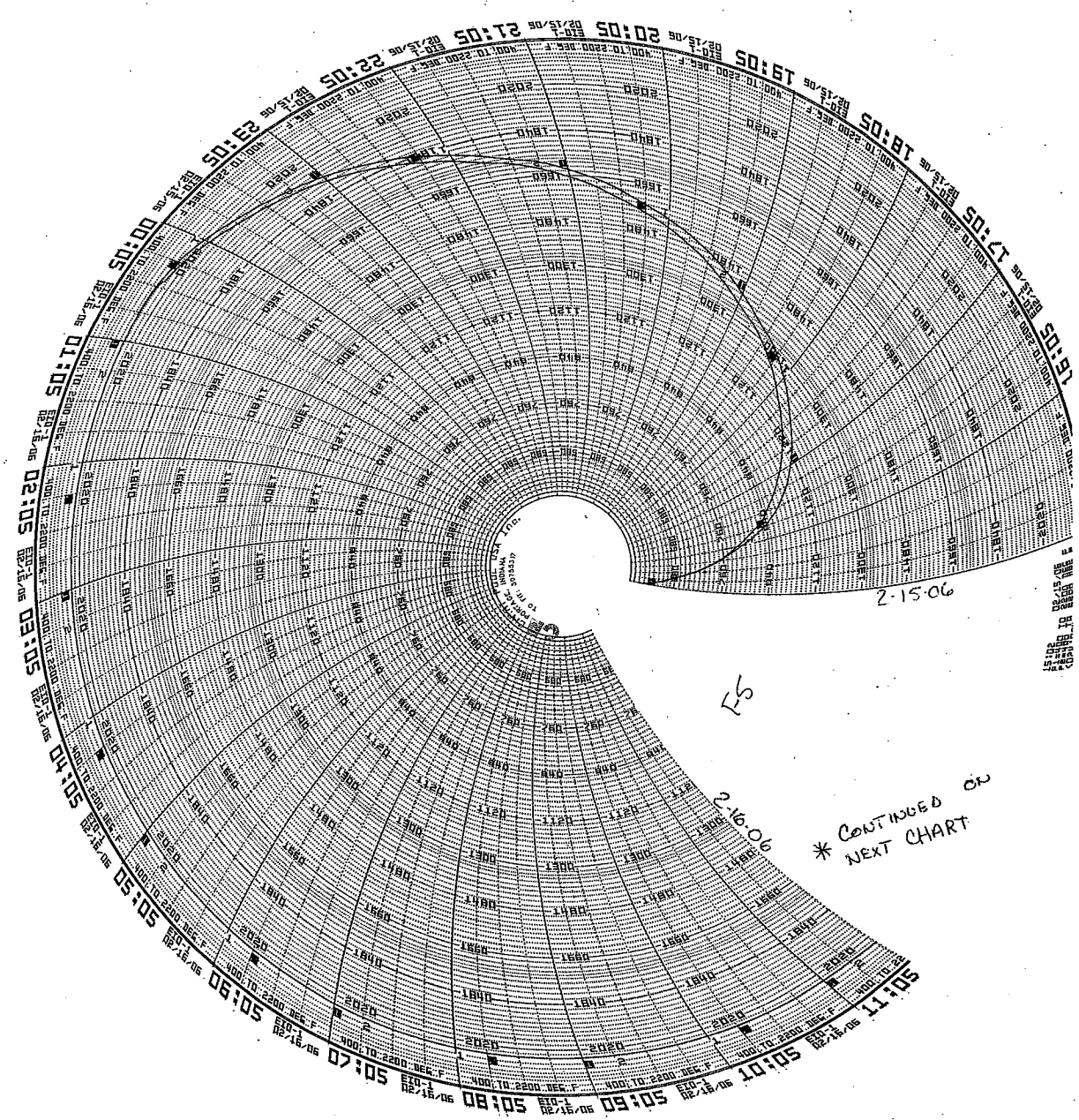
Inspected By:	Date Inspected:

Pg 1 of 2 E10 2-15-06

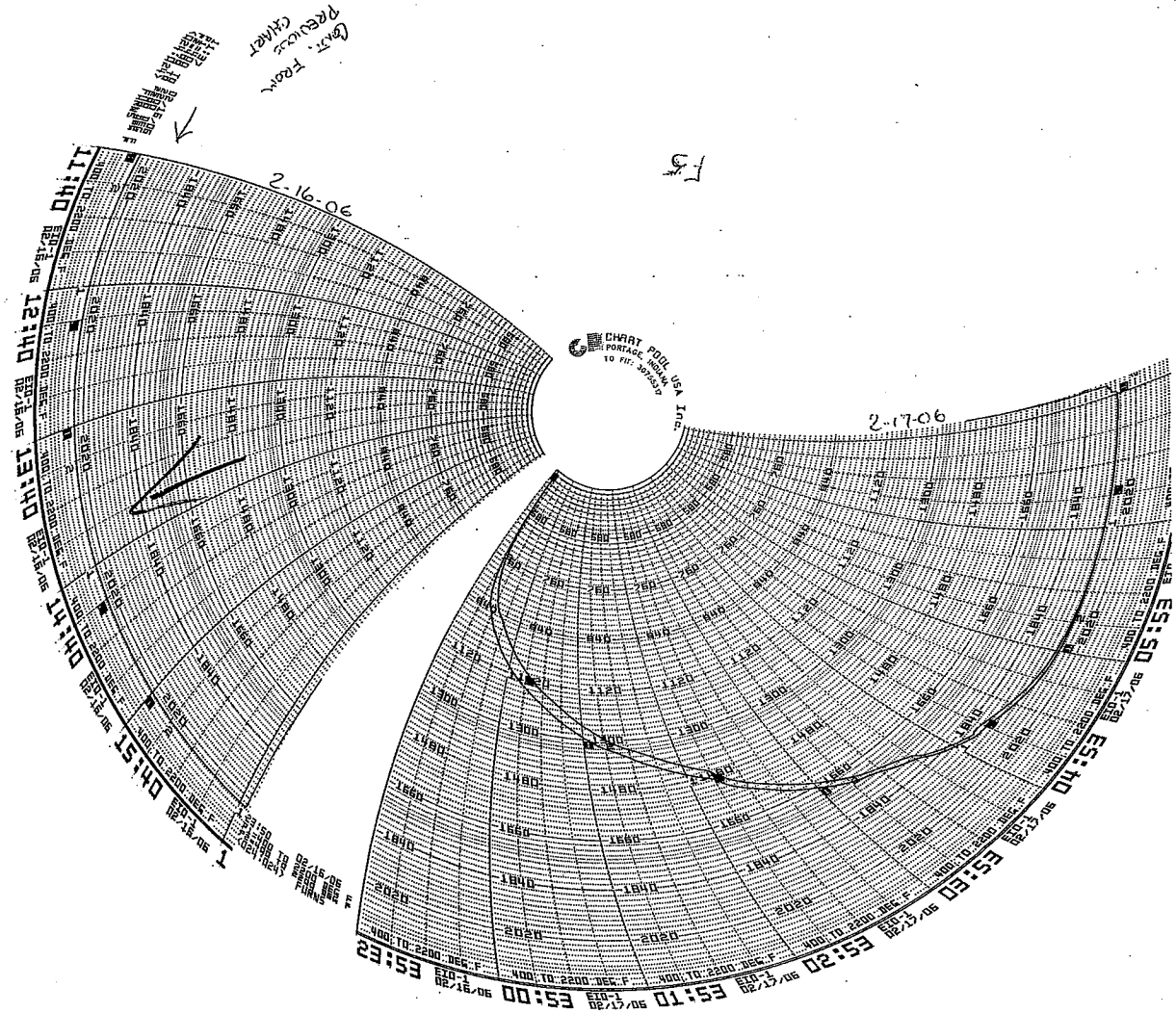
A6

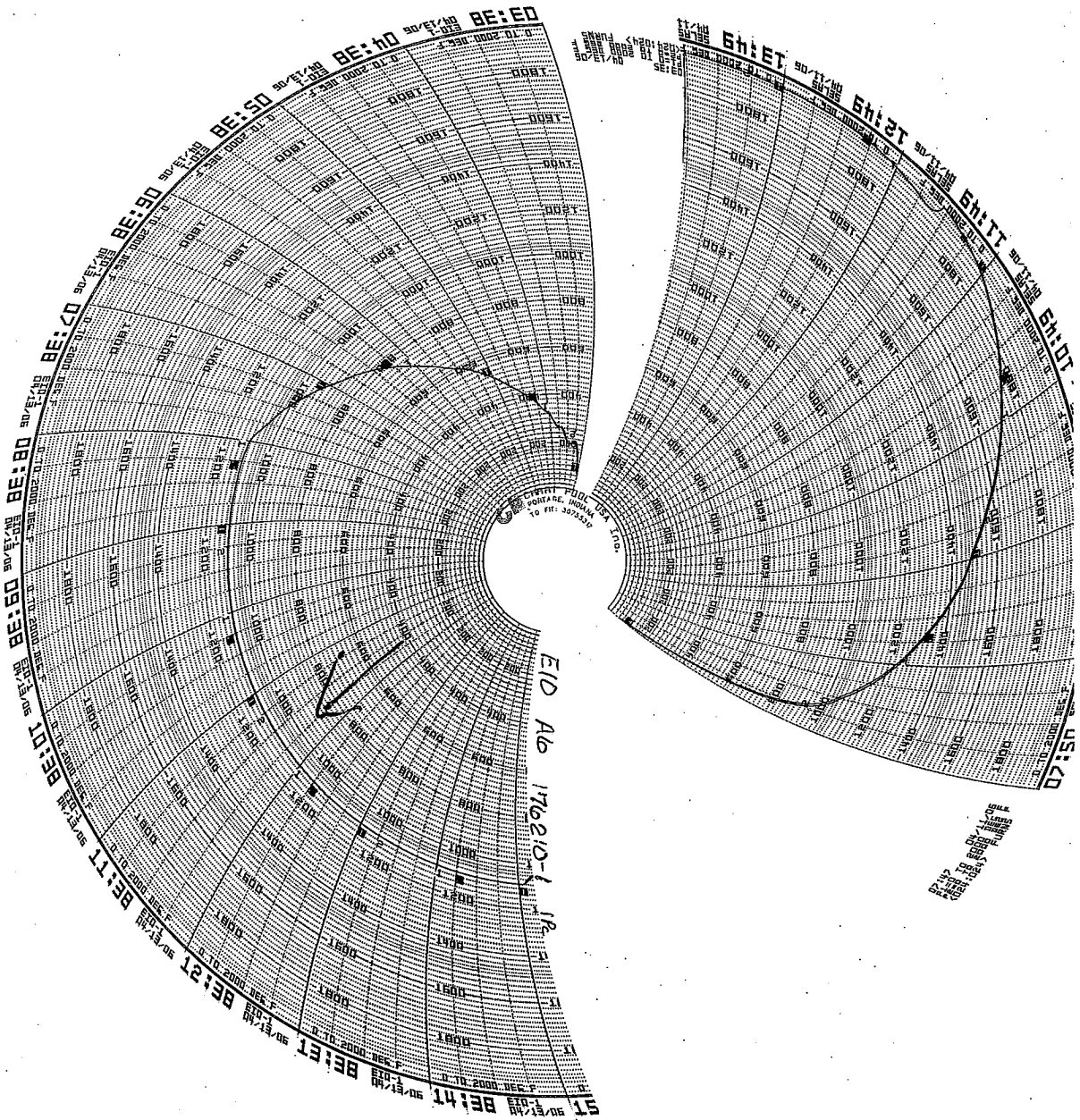
M176210-1

1 Pc



E10 2-15-06
A6
M176210-1
1Pc





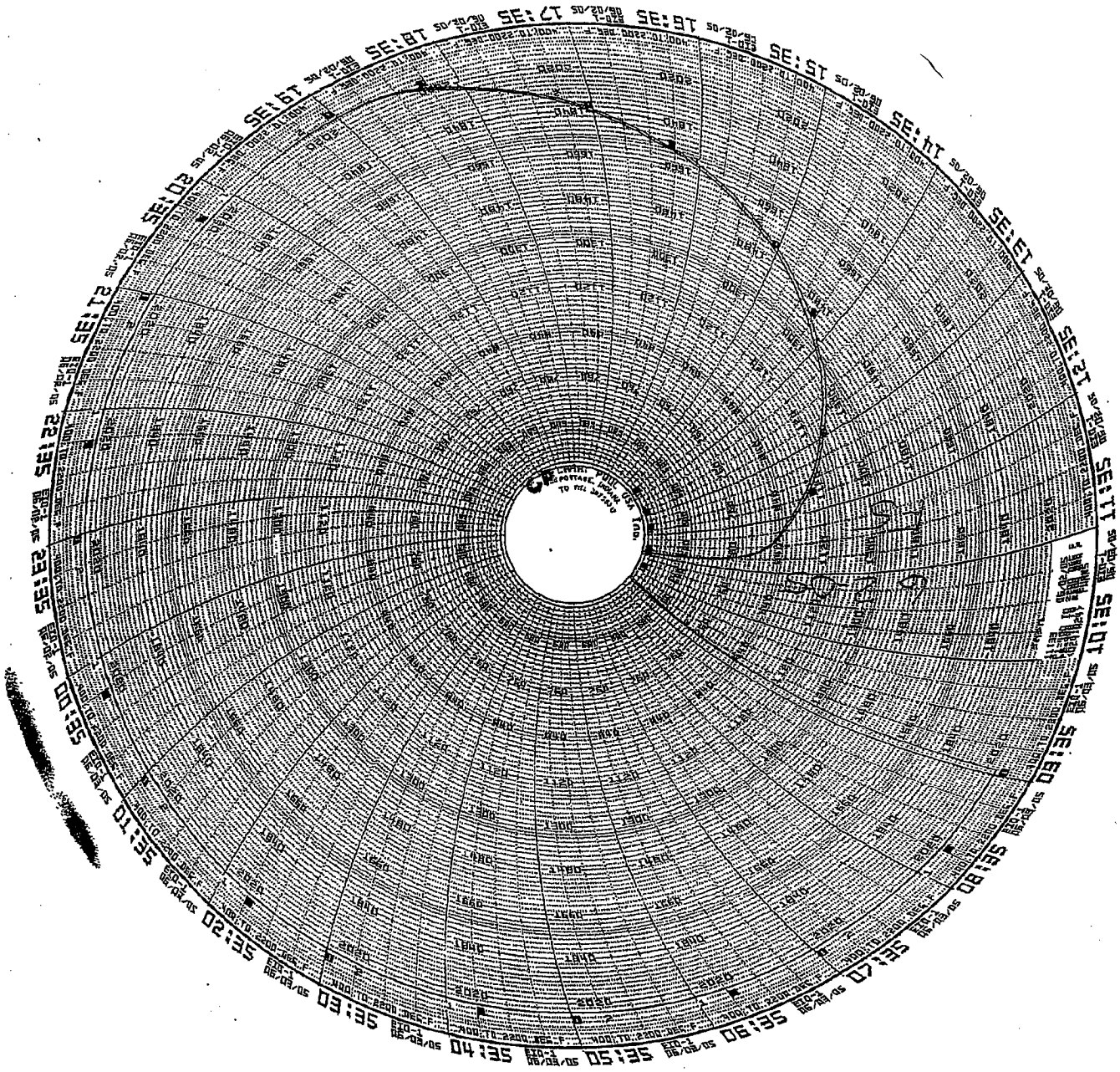
E10 4-13-06

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 "A-6" in Core Box	GAL	1/18/06
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.	CAR	
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: 2750 CASTING POURED AT: 2750 DATE: 1/31/06 HEAT #'s: 322666768,669 ELAPSED POUR TIME 60 sec KEEL BLOCKS POURED: NA 4@ Sample from ladle to be analyzed for final chemical analysis and reported on material certifications. Sample Taken by: SR Analyzed: GH Date: 1/31	SR	1/31/06
50	MELT SOP 0800R2	SHAKEOUT	CAR	2/4/06
60	ARC RISE SOP 0100R1	REMOVE RISERS AS DIRECTED BY SUPERVISOR.	[illegible]	2-23-06

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	2/16
NOTE		**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.**		
90	GRIND GSWA SOP 0100R3	SWING GRIND TO REMOVE RISER REMAINS AND FLASH IF REQUIRED.	TH	2/23/06
100	GRIND GCHI SOP 0100R2	CHIP AND HAD GRIND SURFACE OF PART AS REQUIRED FOR CONTOUR.	A.B. M.G.	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 2/15 DCMA NOTIFIED ON 2/15	Q ENG OR QA MGR	ch
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 _____ AND SEND TO STEP 160. REJECTED CHECK HERE ___✓___ 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.M.~~ N.M	3/21/06

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 KLR	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 X	LP - LEVEL II JPS	3.21
180	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS FOUND DURING 100% VISUAL AND LP INSPECTION.	BW	3/22
190	GRIND GCHI SOP 0100R2	CHIP AND HAND GRIND EXCAVATION OR VISUAL DEFECTS AS REQUIRED.	BW	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 TC	3/23
210	SAND BLAST BLAS SOP 0100R6	SANDBLAST (REMOVE ALL BLAST MATERIAL FROM CASTING) SANDBLASTING WILL BE DONE USING RECYCLED SHARP ANGULAR AGGREGATE.		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".	JB	3/23 or 3/24
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF WELD STEP. EIO NOTIFIED ON 3/15 DCMA NOTIFIED ON 3/15	Q ENG OR QA MGR	BC
230	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: _____, _____, _____ LIST ALL MATERIAL/LOTS USED: 78308, _____, _____ QUALITY ENG. Name: CA Date: 3/23		
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	WP	3/23

		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 ✓ WASH AND SEND TO STEP 280. IF REJECTED CHECK HERE _____	LP - LEVEL II CL				3/24
270	REPEAT	REPEAT STEPS S180 TO S250AS REQUIRED TILL CLEAR THROUGH VISUAL INSPECTION & PENETRANT INSPECTION. IF OK CHECK HERE ✓ AND PROCEED TO STEP 280.	CC				
280	REPEAT STEPS	SUPPLEMENTAL REPAIR STEPS	1ST	2ND	3RD	4TH	5TH
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 3/20 DCMA NOTIFIED ON 3/20	Q ENG OR QA MGR BC				
S220	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: _____, _____ MATERIAL /LOT USED : 78306 BC _____ QUALITY ENG. Name: _____ Date: 3/24					
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)	3/24	WD 3/25	BD 3/29		

		FOR WELDS <8" - WPS 15-GMAW-CF8MNMN MOD REV 2					
S240	GRIND GCHI SOP 0100R2	HAND GRIND WELDS.	AGM 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 TC	OK REJ	OK REJ	OK REJ	OK REJ
	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 ✓ 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 ✓. RADIOGRAPH AT CAF CHECK HERE _____.	QA ENGINEER	RBK 4-3-06			
310 A	MQS X-RAY DEFECTS REPAIRED BY WELDING	X-RAY PER TECHNIQUE # 12726 USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. **ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.** 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. **ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.** 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	1ST DWH 4/4/06 R2 RJ	2ND RBK 4/4/0 R3 Accept	3RD	4TH	5TH

S321	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS FOUND DURING RADIOGRAPHY.	TAD 4/5/06				
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 JRC	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 APPROXIMATLY 3.3"X3.3". SUBMIT MAP WITHIN 24 HOURS OF START OF WELDING. SUBMIT MAP WITHIN 24 HOURS OF START OF WELDING.	JR.3 3/23/06 3/23/06	JRS 4/7/06			
NOTICE	WITNESS NOTIFICATION	PROVIDE NOTICE TO EIO AND DCMA AT LEAST FIVE DAYS IN ADVANCE OF WELD STEP. EIO NOTIFIED ON 4/1 DCMA NOTIFIED ON 4/1	Q ENG OR QA MGR				
S324	QA APPROVAL HOLD POINT	QA TO APPROVE ELECTRODE PRIOR TO USE. PROCEDURE USED: 15-GMAW-CF8MNMN MOD MATERIAL /LOT USED: 316MWE, 3018513 7.8308 QUALITY ENG. Name: CN 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	[redacted]	AGM 4/13/06		
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 ✓ AND RETURN TO STEP S321.	LP - LEVEL II T.R.C.	OK 4/11/06 REJ	OK T.R.C. 4/13 REJ	OK REJ	OK REJ
S 328 A	MQS X-RAY DEFECTS REPAIRED BY WELDING	X-RAY PER TECHNIQUE # 12726 USE CALIBRATED DENSITOMETER FOR DENSITY VERIFICATION. **ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.** ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.	RT-LEVE L II				

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. **ALL RT REJECTS, INCLUDING SURFACE DEFECTS WILL BE VERIFIED BY RT.** ATTACH TECHNIQUE, READER SHEET FOR ALL RADIOGRAPHS. MUST INDICATE RADIOGRAPHER AND ASNT CERTIFICATION LEVEL ON READER SHEET.	RT - LEVE L II	4-3-06 own Reject			
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 ___√___ MARK UP DEFECTS AND SEND THE CASTING TO STEP S321.	RT - LEVE L II	4-3-06 Dan			
	REPEAT	REPEAT STEPS S321 TO S329 AS REQUIRED TILL CLEAR THROUGH VISUAL, PENETRANT AND RT INSPECTION.	QA ENG.	OK 4-4-06 Dan			
340	SAND BLAST BLAS SOP 0100R6	SANDBLAST (REMOVE ALL BLAST MATERIAL FROM CASTING) SANDBLASTING WILL BE DONE USING RECYCLED SHARP ANGULAR AGGREGATE.					4/18
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			TO 455 N/A
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 ___√___ 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.					

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	

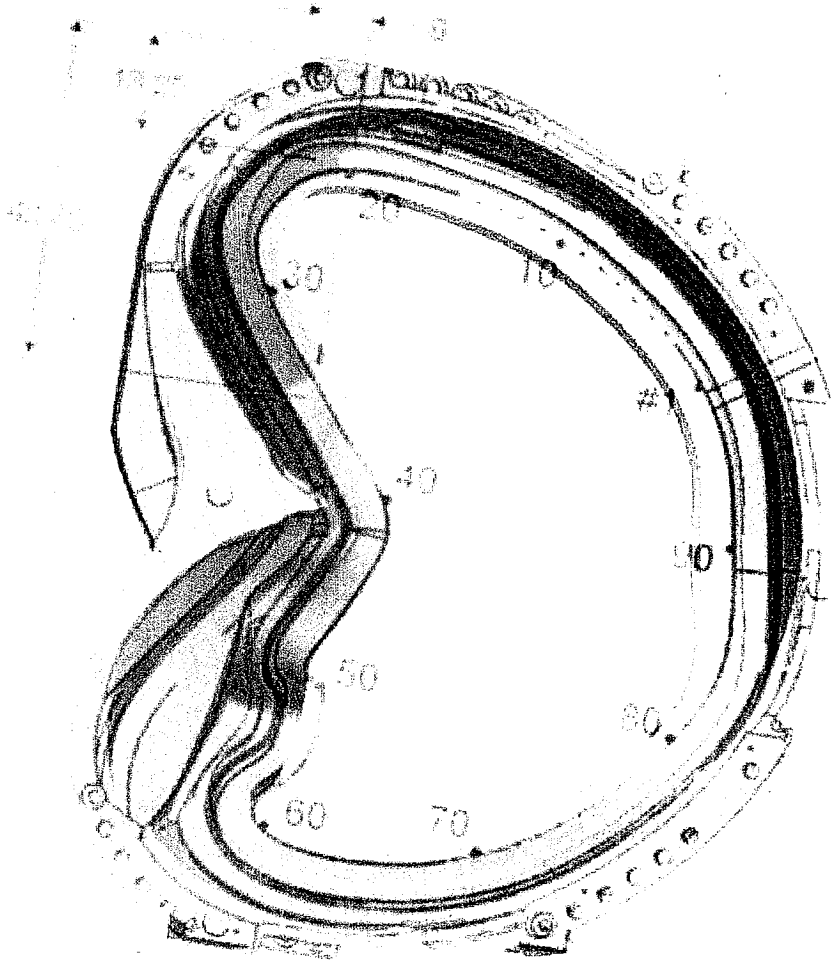
453	INTERIM LAYOUT SOP LAYOUT 0100	INSPECT CASTING TO VERIFY DIMENSIONS. THIS STEP MAY BE MOVED. NOTE: THE FIRST PART PRODUCED OF EACH TYPE A, B AND C WILL BE DIMENSIONED BY LAWTON PATTERN. IF DIMENSIONED BY LAWTON IT WILL BE DOCUMENTED HERE. Subsequent casting done internally per Romer Arm.	SCAN	
455	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 4/11 DCMA NOTIFIED ON 4/11	Q ENG OR QA MGR	
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 ✓. IF REJECTED CHECK HERE _____. MARK AND REPAIR AT STEP 510. MUST BE PERFORMED BY LEVEL II in VT.	VT - LEVEL II	4/18/06
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 ✓. DOCUMENT REPAIRS USING A SUPPLEMENTAL MTS.	LP - LEVEL II T.R.C.	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 4/11 DCMA NOTIFIED ON 4/11	Q ENG OR QA MGR	
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 ✓.	CA	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.	TAD 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 ✓. IF REJECTED CHECK HERE _____ RETURN TO STEP 510.	CA	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)	CA	

4/18/06

4/18/06

NOTICE	RELEASE FROM EIO	PROVIDE DOCUMENTS TO EIO. SENT ON 4/20 BY CAR. RECEIVED RELEASE FROM EIO ON 4/20.	Q ENG OR QA MGR	CAR
540	PACK AND SHIP	PACKAGE AND SHIP TO MAJOR TOOL. **MARK ON CASTING THE COIL NUMBER e.g. "A-6"** CAR		
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

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. **SHADED BOXES NEED NOT BE SIGNED.**	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 #: 2825 Sample from ladle to be analyzed for final chemical analysis and reported on material certifications. Sample Taken by: SR Analyzed: GH	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 ✓. MARK AND REPAIR AT STEP 130OR 140 IF WELDING IS REQUIRED. MAY PERFORM STEPS 110 AND 120 TOGETHER.	VT - LEVEL II KLA	12/27

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 __X__ MARK AND REPAIR AT STEP 130 OR 140 IF WELDING IS REQUIRED. Grind only	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 ✓ AND GO TO STEP 170. IF WELDING IS NEEDED GO TO STEP 130.		CAH 1-14-06
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 DWH	12/16/05
160	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 200. REJECTED CHECK HERE _____ MARK UP DEFECTS. DOCUMENT REPAIRS ON S10 TO S70.	RT - LEVEL II DWH	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.		3/8/06
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 ✓ 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 ✓ 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. Mag. Perm. OK	BDR	3-13-06
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)		

NOTICE	RELEASE FROM EIO	PROVIDE DOCUMENTS TO EIO. SENT ON 4/20 BY CR RECEIVED RELEASE FROM EIO ON 4/20.	Q ENG OR QA MGR CR	
	PACK AND SHIP	PACKAGE AND SHIP TO MAJOR TOOL.	CR	
1000	REVISION HISTORY	ORIGINAL12-14-04. Rev1 complete rewrite due to specification changes.	CARUUD	
SUPPLEMENTAL MTS FOR WELD REPAIRS.			FOR VT&LP/	FOR RT
S10	WELD SOP 0100 REV 7	EXCAVATE ANY DEFECTS.	NA	
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.		
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 STEPSS10 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

MetalTek INTERNATIONAL

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.

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 egree 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'

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 40
CA 1323

Founded 1929 St. Louis Testing Laboratories INCORPORATED

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

RES/nmc

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.

		Shell Type A		Coil Type A		All Coils	
Run #	Configuration	Max. Displacement - mm	Max. Stress - Mpa	Max. Displacement - mm	Max. Stress - Mpa	Max. Displacement - mm	Max. 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'

Tech. Rep.

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'

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 Stellalloy 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.

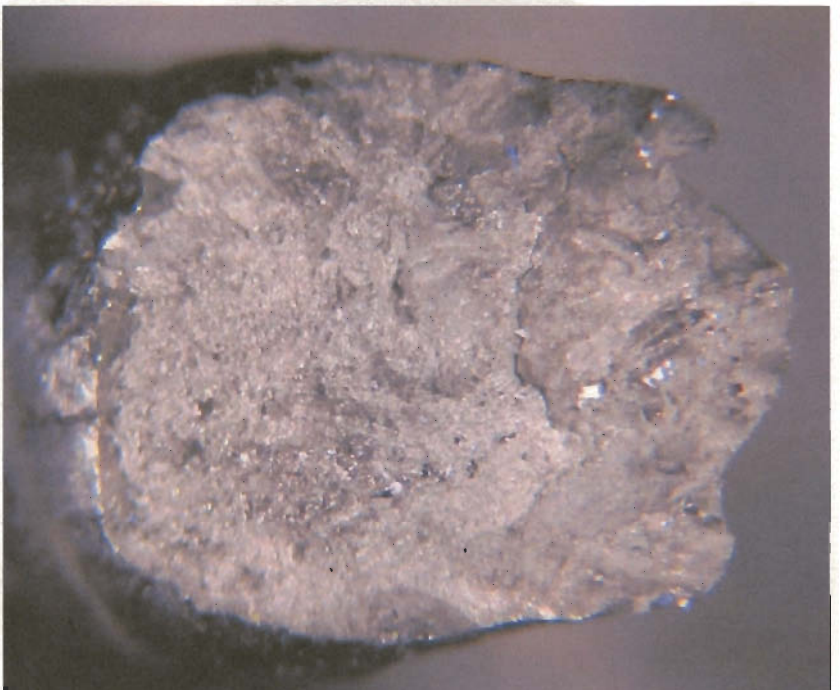
These are better photos forwarded to me by MetalTek in relation

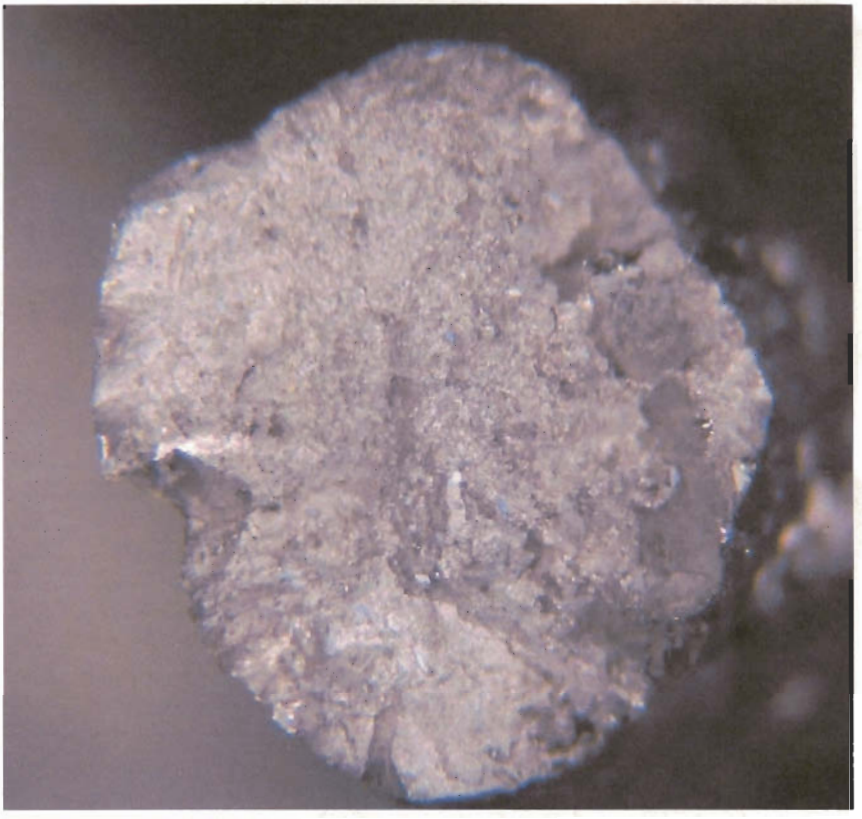
to A6 test bar failures.

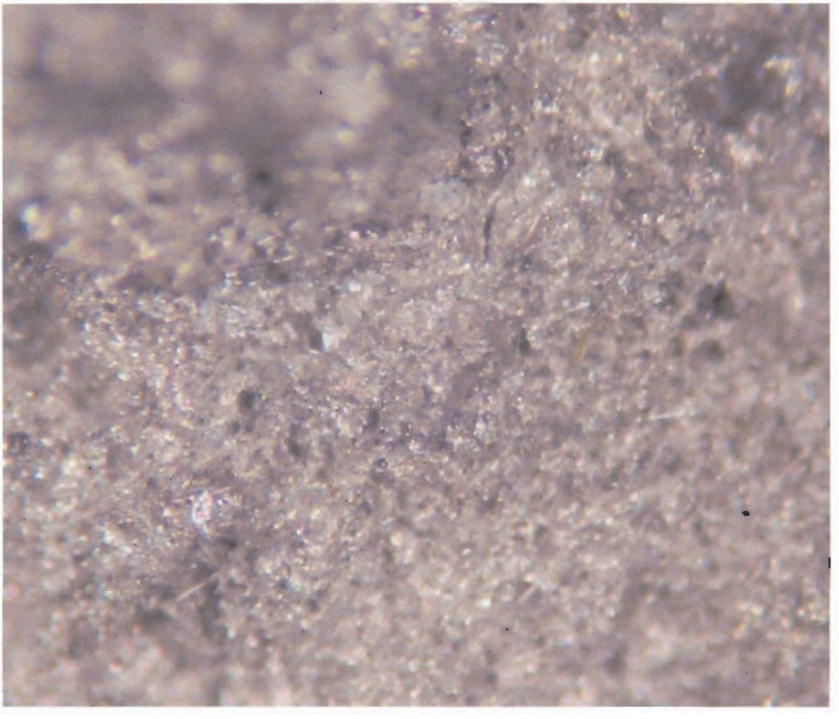
Sincerely,

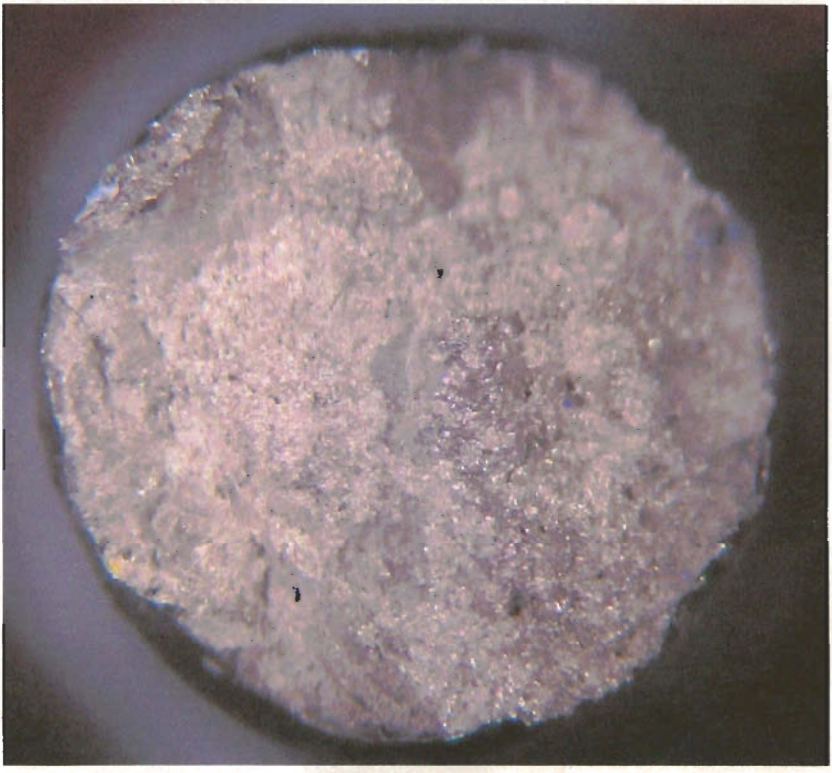
Peter Djordjevich

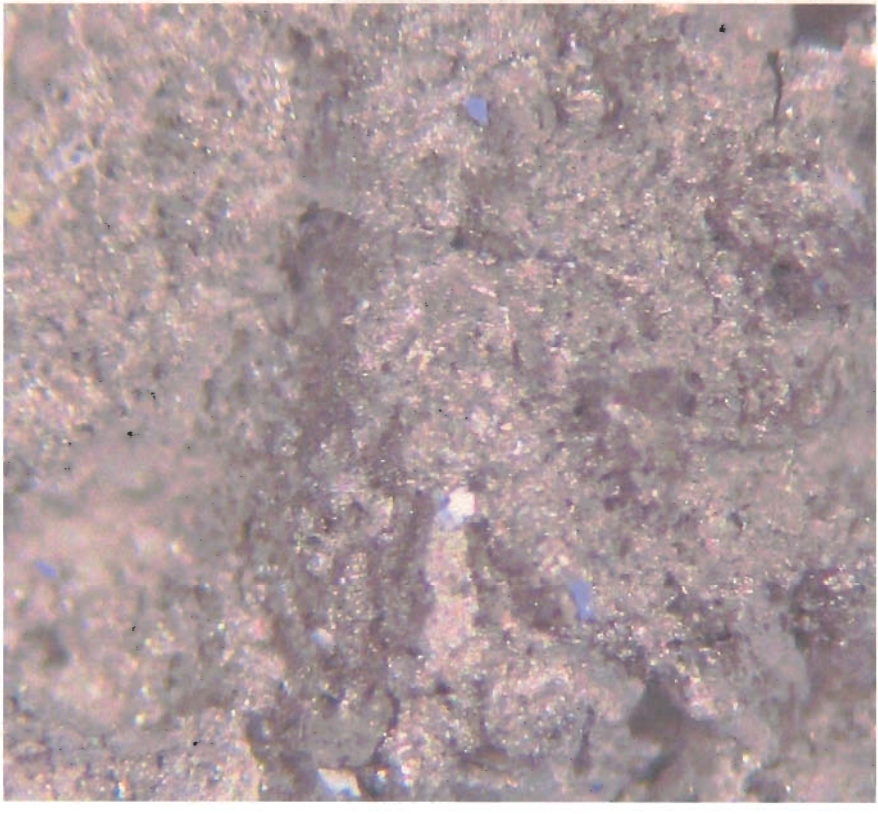
CA 1671 Photos

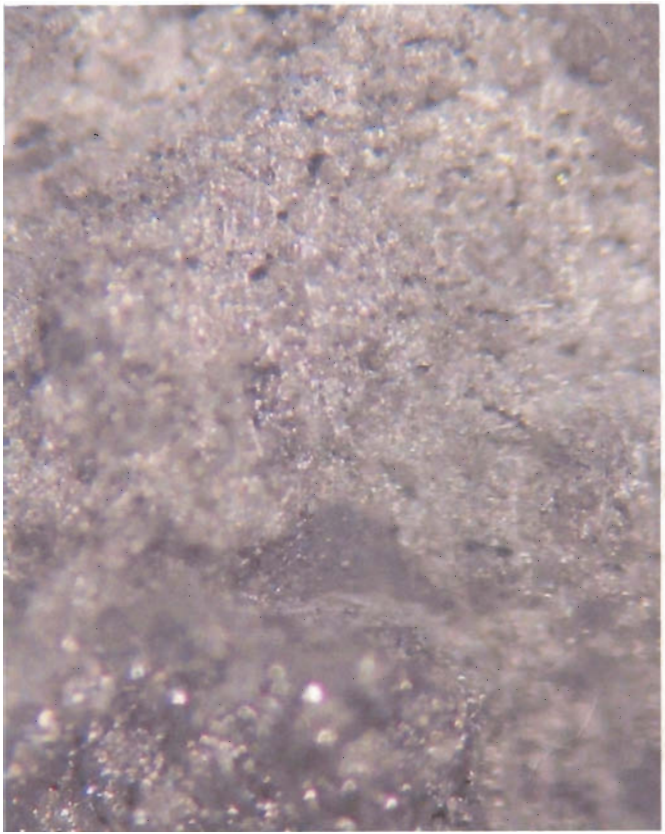












Carondelet Division
8600 Commercial Blvd. • Pevely, MO 63070 USA
Phone: 636-475-2199 • Fax: 636-479-3399
E-Mail: Charles.Ruud@MetalTek.com

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.
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.

ACCREDITED
621-01 & 621-02

Accredited Nadcap Materials Testing Laboratory

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	A\U\R
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

A\U\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: 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	A\U\R
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

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

Roy E. Starr\Matt Wojton 3-9-06
Technical Services Manager\ Tensile Supervisor March 9, 2006

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.

ACCREDITED
621-01 & 621-02

Accredited Nadcap Materials Testing Laboratory

April 3, 2006

CERTIFICATION

Section 1 of 1

WMT&R Report No. 6-25662
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: Metaltek CF8MNMnMOD

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	A\U\R
A6	Z2	D30719	-320	166.2	99.8	58	44	25.3	16120	9677	0.3514	0.2622	1.40	2.24	0.09698250	M9	A

A\U\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 CF8MNMnMOD

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	A\U\R
A6	Z1	D30718	-320	166.1	108.1	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

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

Requirements provided by MetalTek International

D - Ruptured outside middle half of gage length.

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 WMTR, INC.

Roy E. Starr\Matt Wolton
Technical Services Manager \ Tensile Supervisor

4-3-06
April 3, 2006

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.

ACCREDITED
621-01 & 621-02

Accredited Nadcap Materials Testing Laboratory

April 10, 2006

CERTIFICATION

Section 1 of 1
WMT&R Report No. 6-26780
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: Metaltek CF8MNMnMOD
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	A\U\R
A6	Z2	D38883	-320	165.8	100.8	36	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

A\U\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 CF8MNMnMOD
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	A\U\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

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

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

Roy E. Starr\Matt Wojton
Technical Services Manager\Tensile Supervisor
4-10-06
April 10, 2006

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 Zone1 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

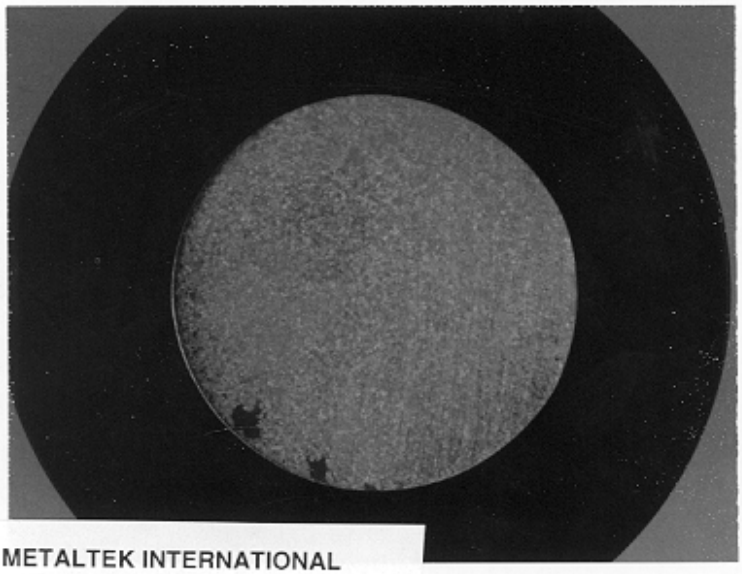
The test specimens are attached to metal feeders (“risers”) in the modular coil casting mold. The attachment of these test specimens is largely determined by convenience due to accessibility of the feeder and orientation to a natural interface between mold components (cope, drag, and cores). Metal is 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.

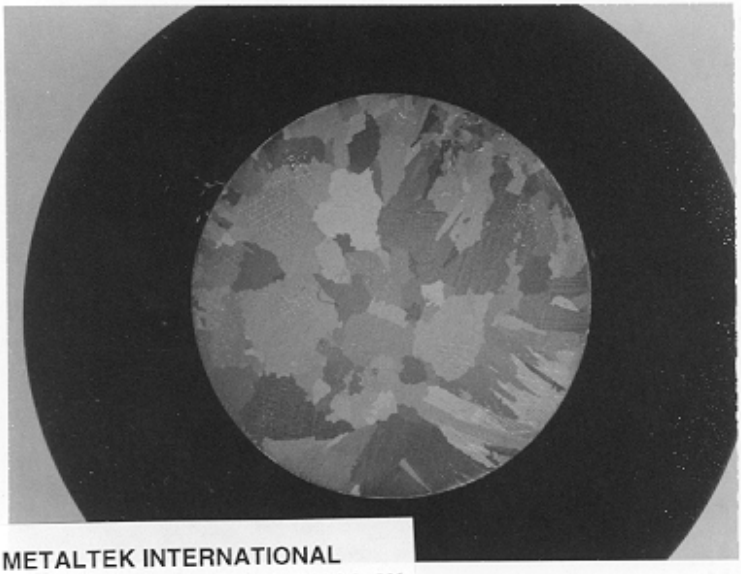
Results

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.

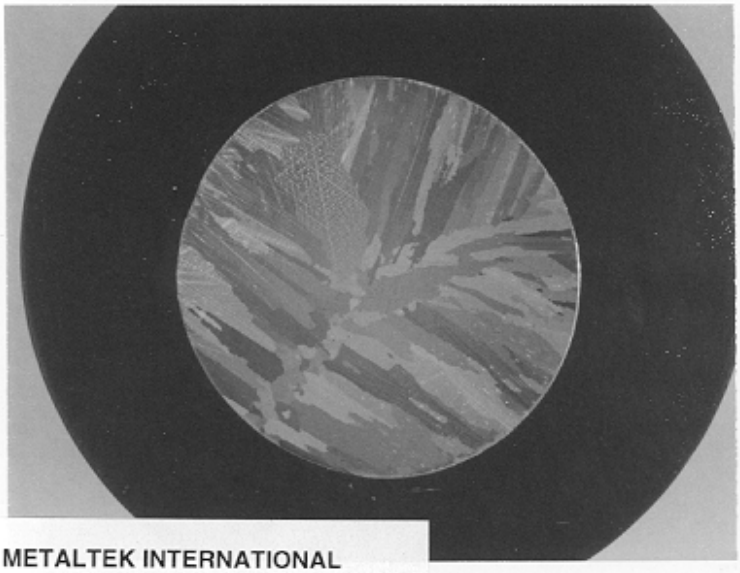
Table III	High MetalTemperature	Low Metal Temperature
High Mold Temperature	Little incentive for nucleation and low thermal gradients. Large columnar grains.	Multiple nucleation sites within material, but little thermal gradient to mold. Creates finely dispersed equiaxed structure within metal with little 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

MetalTek International

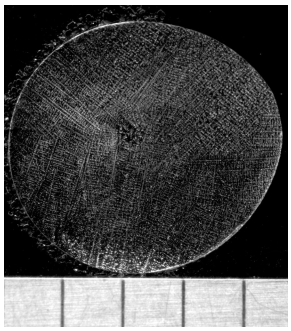
P.O. No. 19386

Requisition No. 7580

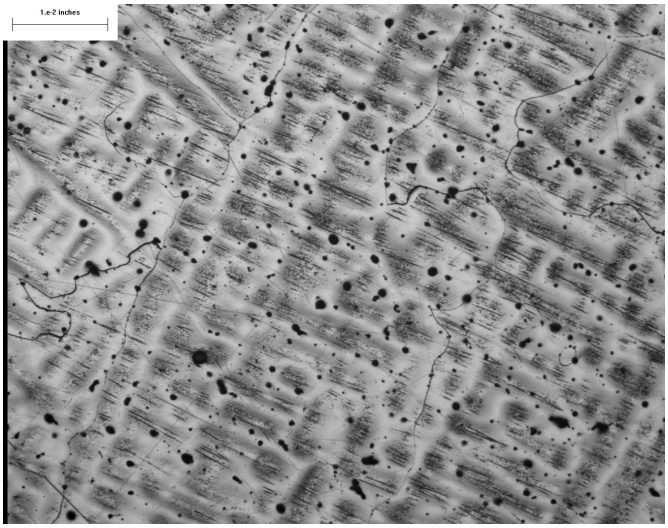
Material : CF8MNMnMod

WMTR Report No. 6-26780

Specimen No. Z1



Magnification: 3x



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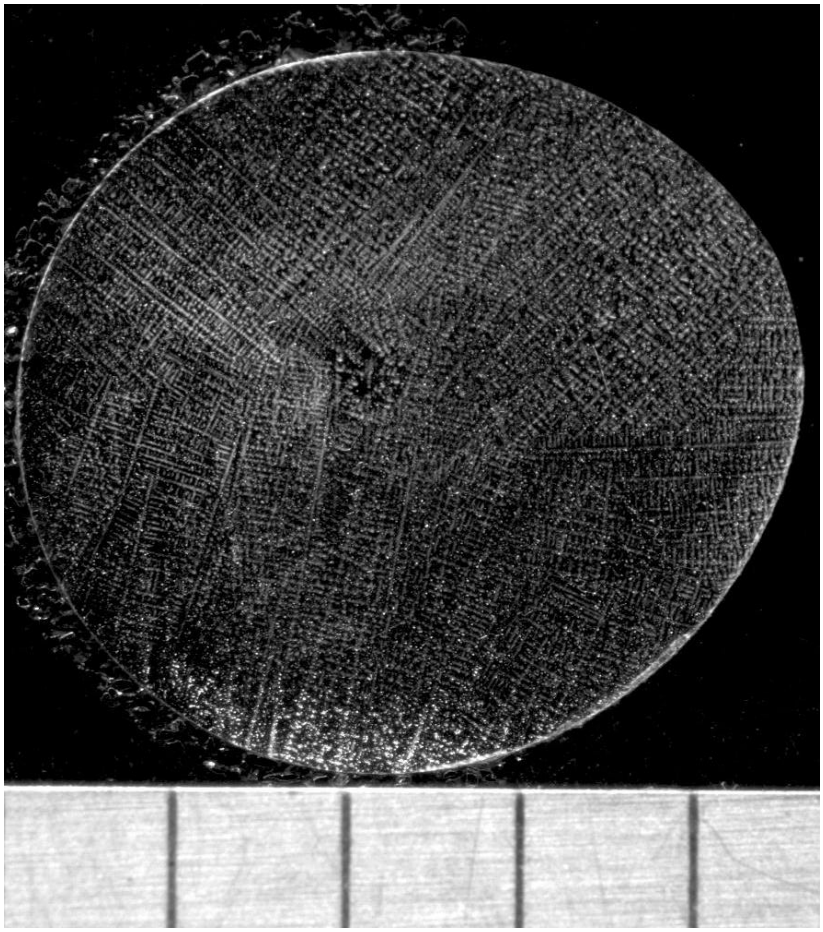


Magnification: 9x

Etchant HCL + H2O + H2O2

MetalTek International

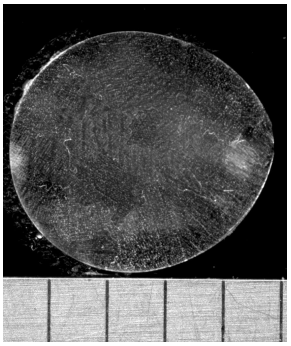
P.O. No. 19386

Requisition No. 7580

Material : CF8MNMnMod

WMTR Report No. 6-26780

Specimen No. Z2



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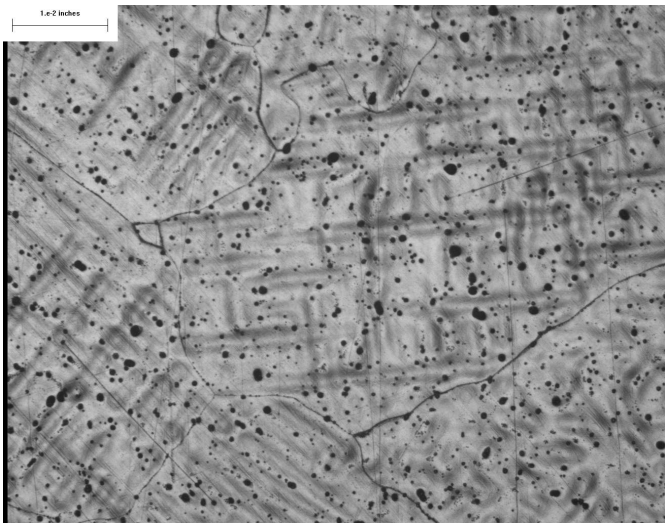

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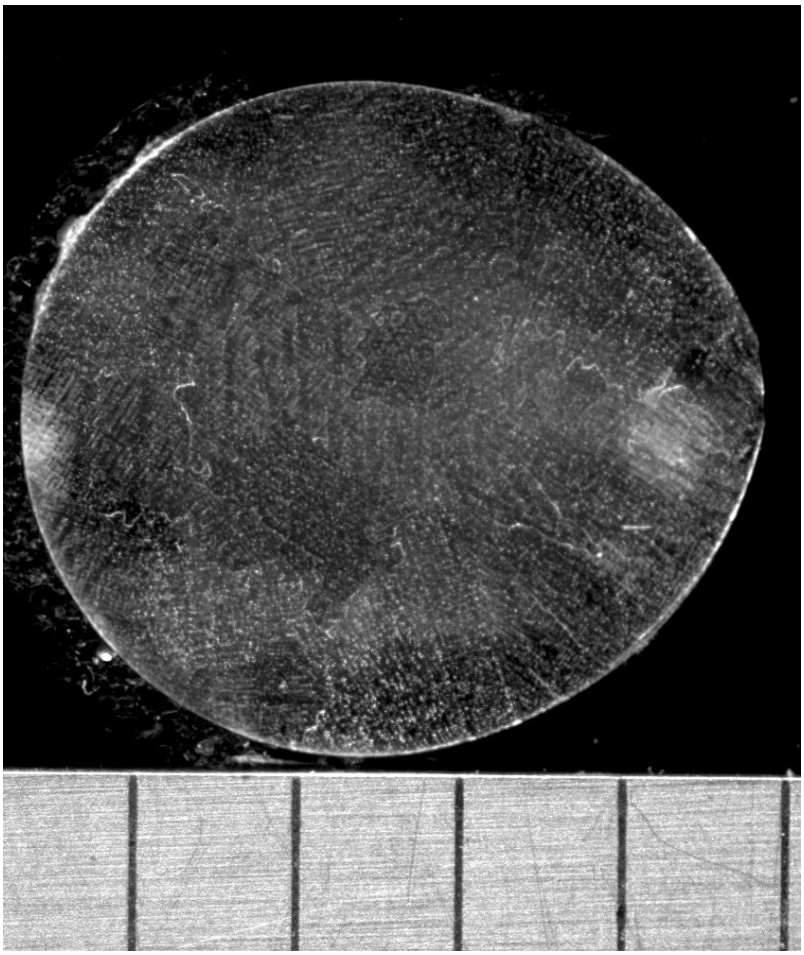


Magnification: 9x

Etchant HCL + H2O + H2O2

MetalTek International

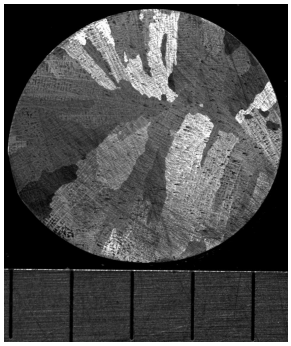
P.O. No. 19386

Requisition No. 7580

Material : CF8MNMnMod

WMTR Report No. 6-26780

Specimen No. Z3



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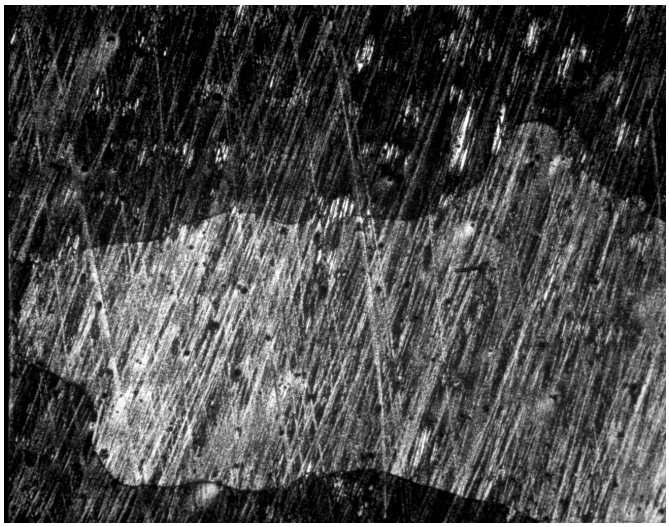

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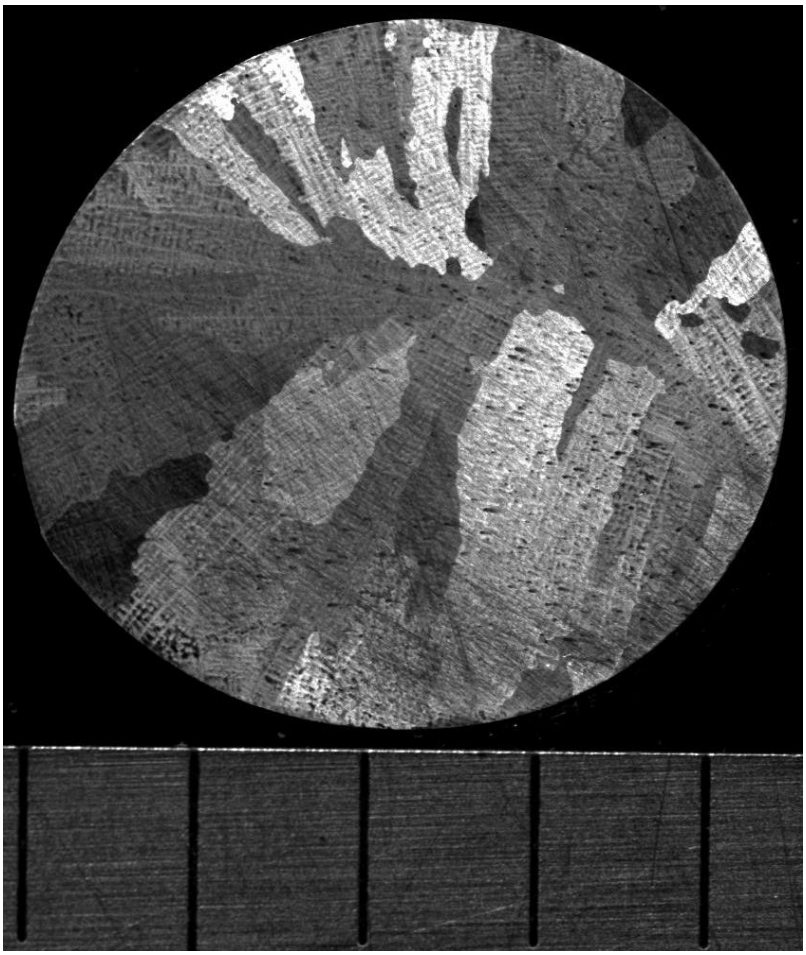

Magnification: 9x

Etchant HCL + H2O + H2O2

Table I

C-5 Coil 11/18/2005

Casting	77K (-320F)							293K (RT)						
		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

		Test #1 77K (-320F)			Test #2 77K (-320F)			Test #3 77K (-320F)			Test #4 77K (-320F)				Test #1 293K (RT)		
Property	**Required**	**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**	**Required**	**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

MetalTek INTERNATIONAL

Carondelet Division

8600 Commericial 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

MetalTek INTERNATIONAL

Carondelet Division

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

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

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

Superior Quality Engineered Metal Products

www.MetalTekInt.Com

MetalTek INTERNATIONAL

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

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

MetalTek INTERNATIONAL

Carondelet Division

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

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

11/26/04
Rev. 01

EIO
Energy Industries of Ohio
SUPPLIER QUALITY RELEASE

		Date:

I. General Information:			
Project Name:	Modular Coil Winding Form A6		
PO No:	NCSX-SOW-141-02-01	Rev.:	11
Supplier:	MetalTek		
Procurement Agent:	EIO		
Shipment:	☒ Partial ☐ Final		

II. Material Description
Casting A6 Coil & Shim

III. Release Checklist		
Plan Requirements Complete?	☒ Yes ☐ No ☐ N/A	(If identified "No" provide explanation in comments section below)
Variances?	☒ Yes ☐ No ☐ N/A	(If identified "No" provide explanation in comments section below)
Princeton Notified of Shipment?	☒ Yes ☐ No ☐ N/A	(If identified "No" provide explanation in comments section below)
DCMA Notified of Shipment?	☒ Yes ☐ No ☐ N/A	(If identified "No" provide explanation in comments section below)
☒ Conditional ☐ Unconditional	Explain conditional releases in comments section.	

IV. Comments
Variances – See dock pack for CA's/NCR's

By signing below you acknowledge that the casting has met all applicable standards and contractual requirements

V. Supplier Quality Representative Sign Off		
Chuck Ruud	X	
Supplier Quality Representative (SQR) Print/Type Name	Supplier Quality Representative (SQR) Signature	Date

VI. Supplier Approval For Shipment		
Procurement Agent Notified of Shipment	Date: 4-20-06	
Required Vendor Data Ready for Shipment	Date: 4-20-06	
Nancy K. Horton EIO Program Mgr for NCSX	X	4/20/06
Supplier's Representative Print/Type Name	Supplier's Signature	Date