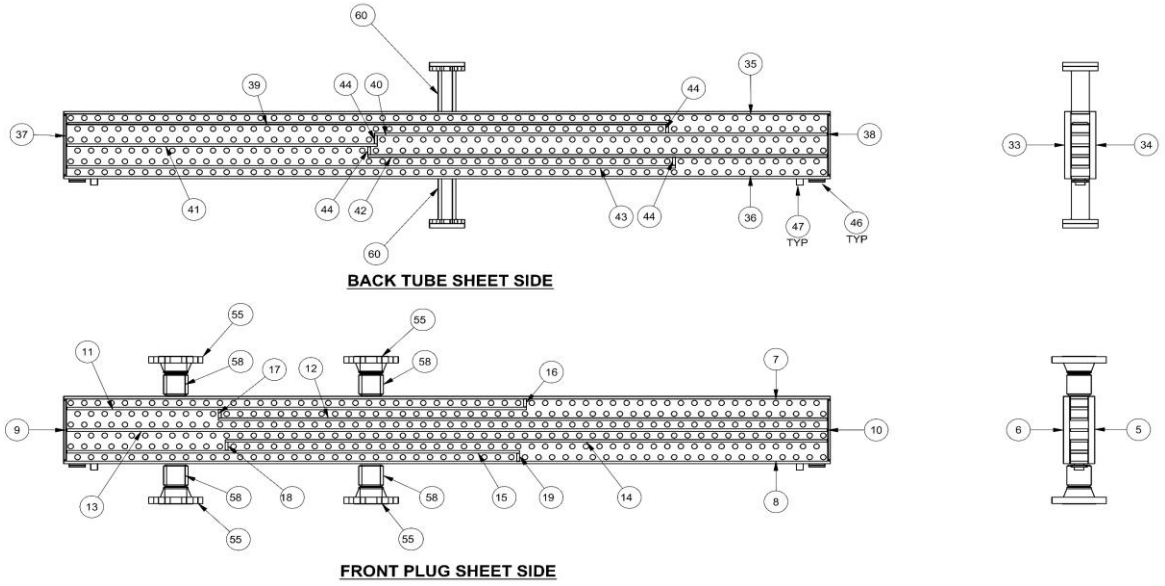

Mark No	MATERIAL DESCRIPTION		
	SUPPLIERS	HEAT No.	MATERIAL
5/6	SSAB	W2L569	SA-516-70N
7	NUCOR	1600009	SA-516-70N
8	NUCOR	1600009	SA-516-70N
9	SSAB	E2D332	SA-516-70N
10	SSAB	E2D332	SA-516-70N
11	SSAB	E2D332	SA-516-70N
12	NUCOR	1600009	SA-516-70N
13	NUCOR	1600009	SA-516-70N
14	SSAB	E2D332	SA-516-70N
15	SSAB	E2D332	SA-516-70N
16	SSAB	E2D332	SA-516-70N
17	SSAB	E2D332	SA-516-70N
18	SSAB	E2D332	SA-516-70N
19	SSAB	E2D332	SA-516-70N
33	SSAB	W2L569	SA-516-70N
34	SSAB	W2L569	SA-516-70N
35	NUCOR	1600009	SA-516-70N
36	NUCOR	1600009	SA-516-70N
37	SSAB	E2D332	SA-516-70N
38	SSAB	E2D332	SA-516-70N
39	SSAB	E2D332	SA-516-70N
40	SSAB	E2D332	SA-516-70N
41	NUCOR	1600009	SA-516-70N
42	SSAB	E2D332	SA-516-70N
43	NUCOR	1600009	SA-516-70N
44	SSAB	E2D332	SA-516-70N
46	SSAB	W1G769	SA-516-70N
47	NUCOR	8504177	SA-516-70N
48	SSAB	W1G769	SA-516-70N
55	ULMA	43HC22	SA-350LF2
58	TUBOS REUNIDOS	121087	SA-106B
60	FEDERAL FLANGE	21801292	SA-350LF2
TUBES	MANNESMANN	323095	SA-179

CUSTOMER:	AIR PRODCUTS MANUFACTURING, LLC.		FABSCO SHELL & TUBE, LLC
PO NO:	4505606038/ A8KM-4-406-PO-3	DATE	
ITEM NO:	18-XF-261A	AC	DWG No: A22-13314-3A-HS REV: 0

PO/Rel MTR 6755

PART NO.

Attn:

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SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 5: Date 22 Aug 2022

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.:TUL-400 | Mill Order No. 41-694122-11 | Shipping Manifest: AR370350

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -50F/A673-P

Ship Date: 30 Dec 22 | Cert No: 081086435
Cert Date: 30 Dec 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 1.125 X 120.0 X 480.0 (IN)

Tested Pieces:				Tensiles:					Hardness	Charpy Impact Tests								
Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Tst Dir		Abs. Energy(FTLB) 1 2 3 Avg	% Shear 1 2 3 Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W2L569	C55	1.132 (DISCRT)	C	51	75		50	T		100 100 83 94		-50F	L	10.	
W2L569	C56	1.133 (DISCRT)	C	50	74		51	T		78 96 79 84		-50F	L	10.	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W2L569	.19	1.03	.010	.002	.25	.024	.024	.23	.13	.15	.03	.004	.002	.007	.0001	.42	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-2:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
BSK EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 50 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:
W2L569 C56 40098137 PCES: 1, LBS: 18377 W2L569 C55 40098131 PCES: 1, LBS: 18377

CEQ = .42

(*) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

ANTHONY CARDWELL
04/03/2023

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MTR 6676

AMERICAN ALLOY
PLATE # 523719

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

1505 River Rd
Cofield, NC 27922
(252) 356-3700

NUCOR
It's Our Nature

Issuing Date : 01/07/2021 **B/L No. : 578594** **Load No. : 592141** **Our Order No. : 183999/2** **Cust. Order No. : 126001-OK**

Vehicle No: TTPX814051

Specification: 0.5000" x 96.000" x 480.000"
ASTM A516 70/65/60-17/ASME SA516-70/65/60 PVQ 2019/2017
Normalized Plate NACE MR0175 Annex 2.1.2 (2015), MR0103 (2010)
Section 2.1.2 Compliant (2015) 13.1.1, 13.1.2) Vacuum Degassed

Marking : 126001-OK

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
1600009	0.19	1.06	0.008	0.001	0.21	0.22	0.09	0.12	0.04	0.024	0.004	0.003	0.002	0.0078	0.0016	0.0003	0.010	0.42	0.27

			Tensile Test				Heat Treat			
Plate Serial No	Pieces	Tons	Dir.	Yield (psi)	Tensile (psi)	Elong. % in 2"	Norm (°F)	Time (min)	Temper (°F)	Time (min)
1600009-02	4	13.06	H-T	52,500	77,600	41.6	1650	23		

			Charpy Impacts																
			-------Absorbed Energy (Ft-lbs)-------					-------Lateral Expansion (in.)--------					----------Shear (%)----------						
Plate Serial No	Pieces	Tons	Dir.	(ft-lbs) 1	(ft-lbs) 2	(ft-lbs) 3	(ft-lbs) Ave	Min	(in.) 1	(in.) 2	(in.) 3	(in.) Ave	(in.) Min	(%) 1	(%) 2	(%) 3	(%) Ave	Min	Temp (°F)	Size
1600009-02	4	13.06	H-L	66.9	74.5	52.4	64.6	15											-50	10mm

CEQ = .42

MATERIAL CONFORMS TO
NACE MR0175
BHN 103 TO 159
CERTIFIED BY
AMERICAN ALLOY STEEL
BY PD DATE 1/23/23

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL
JL 6/11/2021

HOT ROLLED CARBON STEEL PLATE
TEST COUPONS TAKEN FROM HEAT TREATED PLATE
Piece frequency charpy;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2015 certified. PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant.
DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate QA-3624366

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Depretis

T. A. Depretis, Metallurgist

1/7/2021 2:00:39 PM

ANTHONY CARDWELL
04/03/2023

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Certificate of Mill Test Result

PO/Rel TUL-000000-000 Pg 1/1

PART NO. MTR 6603 Attn:

SSAB

12400 Highway 43 North, Axis, Alabama 36505, US

Test Certificate

⚠ WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.: TUL-320 | **Mill Order No.** 41-673801-02 | **Shipping Manifest:** AR357250

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -60F/A673-P

Size: 0.500 X 96.00 X 480.0 (IN)

Ship Date: 22 May 22 | **Cert No:** 081047524
Cert Date: 22 May 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Tested Pieces:

Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in	Elong % 8in	Tst Dir	Hardness
E2D332	D07	0.502 (DISCRT)	C	55	77		39		T	
E2D333	D08	0.502 (DISCRT)	C	55	76		40		T	

Charpy Impact Tests

Heat Id	Abs. Energy(FTLB) 1	2	3	Avg	% Shear 1	2	3	Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
E2D332	44	108	104	85					-60F	L	10.	
E2D333	112	80	55	82					-60F	L	10.	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
E2D332	.19	1.03	.010	<.001	.24	.032	.031	.27	.13	.13	.02	.002	.003	.008	.0002	.42	USA
E2D333	.18	1.02	.010	.001	.25	.031	.030	.26	.14	.13	.03	.002	.003	.008	.0002	.41	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-1:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 22 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

E2D332 D07	40084899	PCES:	1,	LBS:	6534	E2D332 D07	40084897	PCES:	1, LBS: 6534
E2D332 D07	40084901	PCES:	1,	LBS:	6534	E2D333 D08	40084893	PCES:	1, LBS: 6534
E2D332 D07	40084898	PCES:	1,	LBS:	6534	E2D332 D07	40084900	PCES:	1, LBS: 6534

CEQ=.42

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

Doc No. 393264 Indexed 24May22 by 145larro

AMERICAN ALLOY
PLATE #5249374

MTR 6205

SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
AMERICAN ALLOY STEEL, INC.
P.O. BOX 40469

HOUSTON
TX 77240-0469

Customer P.O.No.:127881-OK | Mill Order No. 41-648373-01 | Shipping Manifest: AR340960

Product Description: ASME SA516-70/SA516-65/SA516-60(19)
ASTM A516-70/A516-65/A516-60(17)
LCVN 15 FT.LBS@-50F/A673-P,VACUUM DEGAS

Ship Date: 11 Aug 21 | Cert No: 081001692
Cert Date: 11 Aug 21 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 0.250 X 120.0 X 480.0 (IN)

Tested Pieces:

Heat Id	Piece Id	Tested Thickness	Tst Loc	Tensiles: YS (KSI)	UTS (KSI)	%RA	Elong % 2in	Elong % 8in	Tst Dir	Hardness	Charpy Impact Tests: Abs. Energy(FTLB) 1	2	3	Avg	% Shear 1	2	3	Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W1G769	B01	0.251 (DISCRT)	C	56	77		34		T		50	48	52	50					-50F	L	5.0	
→ W1G769	B04	0.251 (DISCRT)	C	53	74		35		T		45	53	43	47					-50F	L	5.0	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W1G769	.18	.92	.011	.001	.27	.028	.028	.30	.15	.10	.03	.001	.004	.014	.0002	.39	USA

KILLED STEEL
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
EAF STEEL, CONTINUOUS CAST
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
CHARPY FULL SIZE EQUIVALENT = ABSORBED ENERGY AVG X 10 / TEST SIZE IN MM
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 14 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

CEQ = .39

W1G769	B04	40067978	PCES:	1,	LBS:	4084	W1G769	B04	40067977	PCES:	1, LBS: 4084
→ W1G769	B04	40067976	PCES:	1,	LBS:	4084	W1G769	B04	40067974	PCES:	1, LBS: 4084
W1G769	B04	40067973	PCES:	1,	LBS:	4084	W1G769	B04	40067982	PCES:	1, LBS: 4084
W1G769	B04	40067980	PCES:	1,	LBS:	4084	W1G769	B04	40067979	PCES:	1, LBS: 4084
W1G769	B04	40067975	PCES:	1,	LBS:	4084	W1G769	B04	40067972	PCES:	1, LBS: 4084
W1G769	B01	40067957	PCES:	1,	LBS:	4084	W1G769	B04	40067971	PCES:	1, LBS: 4084
W1G769	B01	40067958	PCES:	1,	LBS:	4084	W1G769	B04	40067983	PCES:	1, LBS: 4084
W1G769	B04	40067981	PCES:	1,	LBS:	4084	W1G769	B04	40067985	PCES:	1, LBS: 4084
W1G769	B04	40067984	PCES:	1,	LBS:	4084	W1G769	B01	40067964	PCES:	1, LBS: 4084
W1G769	B01	40067963	PCES:	1,	LBS:	4084	W1G769	B01	40067962	PCES:	1, LBS: 4084

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY PO DATE 8/4/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
VB 10/8/2021

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Colt Beck
PRODUCT METALLURGIST

05/10/2021 From: AMERICAN ALLOY STEEL, INC. To: ACS STEEL CO., LLC
P.O.#: 5413 S.O.#: 683385 AA PL#: 5205503
Item: 7 (1 PC) 1-1/4" X 120" X 480"
AR STOCK

MTR 8053

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

Page 1

1505 River Rd
Cofield, NC 27922
(252) 356-3700

AMERICAN ALLOY PLATE #5205503

NUCOR
It's Our Nature.

Issuing Date : 06/30/2018 B/L No. : 505891 Load No. : 515942 Our Order No. : 157228/23 Cust. Order No. : 115393-OK

Vehicle No: PTTX 147081

Specification: 1.2500" x 120.000" x 480.000"
ASTM A516 70-17/ASME SA516 70 PVQ 2015/2017 Normalized Test Coupons at 1650F Hold 30 Min per Inch of thickness Air Cooled NACE MR0175 Annex 2.1.2 (2015), MR0103(2016) Section 2.1.2 (2015) 13.1.1, 13.1.2) Compliant

Marking : 115393-OK

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
8504176	0.19	1.01	0.008	0.004	0.19	0.26	0.11	0.09	0.02	0.040	0.004	0.002	0.002		0.0040	0.0002	0.011	0.40	0.27
8504177	0.20	1.07	0.009	0.001	0.20	0.27	0.10	0.09	0.02	0.032	0.006	0.002	0.002		0.0027	0.0002	0.011	0.42	0.28

Plate Serial No	Pieces	Tons	Tensile Test Dir.	(psi) Yield	(psi) Tensile	Elong. % in 2"	Elong. % in 8"	
8504176-05	3	30.52	T	44,400	73,700		27.1	
			T	47,000	71,400		24.8	N
→ 8504177-01	5	51.04	T	43,900	73,500		25.9	
			T	46,600	72,300		25.5	N

CEQ=.42

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY VB DATE 5/10/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
J.F 8/17/2018

HOT ROLLED CARBON STEEL PLATE
Test coupons only, normalized 30 minutes per inch of thickness at 1650 F ± 25 F. Hold 30 minutes minimum. ;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate as-rolled, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@Nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2008 certified (#010940) by SRI Quality System Registrar (#0065-09). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant. DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate 14-HMPQA-723

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Dupreis

T. A. Dupreis, Metallurgist

6/30/2018 3:02:53 PM

CLIENTE / Customer / Client
INDUSTRIAL PIPING SPECIALISTS, INC
606 NORTH 145 EAST AVENUE
TULSA, OK 74116
USA

CERTIFICADO DE INSPECCION

Inspection Certificate - Certificat de Réception

FECHA: Date: **26/10/2022** | N.º No. **222251** | HOJA: Page: **1**

PRODUCTO / Article - Produit: **FLANGES**

SU PEDIDO N.º / Your Order No. / Votre Cde. N.º: **TP769202 TULSA**

DE / of. - de: **28/08/2022**

NORMAS APLICABLES / Requirements - Normes Applicables: **ASME B16.5-17**

MATERIAL CORRESPONDIENTE / Material Correspondent - Qualité: **ASME SA350LF2CL1-2-21/SA105M-21 ASTM A350LF2CL1-2-18/A105M-21**

MODO DE FUSION (*) / Steel Making - Elaboration de l'acier: **NACE MR0175/ISO15156-02/03-15 & NACE MR0103/ISO17945-15**

E = Elec. Y = Oxigeno básico

Company management certifications:
ISO 9001: 2015
ISO 14001: 2015
ISO 45001: 2018

Management Systems certified by LRQAE

Certified acc. PED 2014/68/UE+AD2000-W0 by TÜV Rheinland N.º 01 202 E/Q 02 7443 — UNE EN 10204:06 / 3.1, ISO 10474:13 / 3.1

MARCA DEL FABRICANTE / Mark of factory / Marque du fabricant

DEPARTAMENTO / Section / Département: **QUALITY ASSURANCE**

ULMA FORJA, S.COOP.
Bº Zubillaga, 3 - Apdo. 14
20560 OÑATI (Gipuzkoa) SPAIN
Tel : 34 - 943 780552
Fax: 34 - 943 781808
E-mail: ulma@ulmaforge.com

Packing List: 172392
Expedition : 414467

PARTIDA / Item / Poste	CANTIDAD / Quantity / Quantité	DESCRIPCION / Description / Description		OBSERVACIONES / Remarks / Observations (*)	COLADA N.º / Heat No / N.ºCoulée	RESISTENCIA T.Strength / Resist Rupt N/mm2	LIMITE ELAST Y.Strength 0.2 % N/mm2	ALARGAM. Elongation Allongement Lo:50mm/4d %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résilience Joules			CHARPY V 10x10mm MEDIA Average Moyenne	°C	DUREZA Hardness Dureté HBW	
10 FU1215RFBLNL2	45	BLIND 12 150LB RF A105N/A350LF2	**01G204**	NE	52AV2	521	325	38,60	74,65	105	114	111	110	-50	141	142
36 FU660RFBLNL2	11	BLIND 6 600LB RF A105N/A350LF2	**20J204**	NE	46HC22	507	307	37,92	74,37	95	83	92	90	-50	143	143
50 FU1.530RFSWXHNL2	105	SW 1.1/2 300LB XS/80 RF A105N/A350LF2	**20S207**	NE	77AV22	509	327	38,07	72,33	61	76	45	61	-50	140	143
62 FU815RFWNSTDNL2	36	WN 8 150LB STD/40 RF A105N/A350LF2	**05G209**	NE	03AE9	521	291	33,50	76,58	49	34	68	50	-50	146	149
75 FU1615RFWNXHNL2	20	WN 16 150LB XS/40 RF A105N/A350LF2	**12S208**	NE	A32A2	546	346	38,42	73,35	109	109	51	90	-50	152	152
100 FU430RFWN160NL2	48	WN 4 300LB S160 RF A105N/A350LF2	**27L216**	NE	43HC22	524	347	35,60	72,33	110	104	103	106	-50	146	149

COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE

COLADA N.º / Heat No / Ladle: L / Product: P	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	B %	CEq %	Origin of Steel
52AV2 L	0,180	0,220	1,160	0,010	0,002	0,090	0,090	0,010	0,002	0,003	0,180	0,031	0,002	0,0004	0,41	Ukraine
46HC22 L	0,180	0,210	1,140	0,010	0,003	0,080	0,100	0,010	0,002	0,003	0,140	0,035	0,002	0,0003	0,40	Ukraine
77AV22 L	0,183	0,210	1,070	0,015	0,003	0,100	0,060	0,010	0,002	0,004	0,120	0,027	0,002	0,0001	0,40	Spain
03AE9 L	0,140	0,280	1,300	0,006	0,001	0,080	0,220	0,090	0,002	0,071	0,110	0,027	0,002	0,0004	0,43	Italy
A32A2 L	0,170	0,210	1,200	0,012	0,003	0,050	0,070	0,005	0,001	0,003	0,150	0,035	0,001	0,0004	0,40	France
43HC22 L	0,180	0,230	1,160	0,007	0,002	0,070	0,070	0,008	0,001	0,002	0,120	0,029	0,002	0,0003	0,40	France

- Las dimensiones y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

EL INSPECTOR
Works Inspector - L'Inspecteur

ULMA FORJA S.COOP.
Dpto. Control de calidad
Quality Control Dept.

(*) OBSERVACIONES: Remarks / Observations: N_NORMALIZED ABOVE 900ºC AND COOLED IN AIR.

A22-13314-3-6-FL		43HC22	LN: 1	T0526649-1	FU430RFWN160NL2

| A22-13314-3-6-FL | | | 121087 | LN: 2 | T0526649-1 | FSTR4160PSL2 | |

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

FSTR 4160 PSL2

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

QUALITY MANAGEMENT SYSTEM certified by LRQA

THE BILLETS AND THE MATERIAL COVERED BY THIS CERTIFICATE ARE MANUFACTURED AT OUR STEEL PLANT IN AMURRIO, SPAIN.

Nº 0000342223/1 Rev. 000

CLIENTE: CUSTOMER	INDUSTRIAL PIPING SPECIALIST (IPS) P.O. BOX 581270	PEDIDO / PARTIDA: P.ORDER / ITEM	HR077735 022
PRODUCTO: ARTICLE	TUBERÍA SIN SOLDADURA LAMINADA EN CALIENTE HOT FINISHED SEAMLESS TUBES	CLI. MATERIAL: CLIENT MATERIAL	FSTR4160PSL2
EXTREMOS: ENDS	BISELADOS BEVELLED ENDS	REF. FABRICA: WORK ORDER	300018926 000220
NORMA / GRADO: APL.STANDARD AND GRADE	ASTM A53/A53M-12/ASME II SA-53/SA-53M2015/ASTM A106/A106M-15/ASME II SA-106/SA-106M2015/API 5L2012 45THED,PSL2 B/C/BN/X42N	PROTECCIÓN SUPERF: EXT. COATING	LACA SECA EXTERIOR EXTERNALLY DRY LACQUERED
ESPEC. ADICIONALES: ADITIONAL SPECS.	NACE MR0103 NACE MR0175/ISO 15156	PROCESO FUSION: MELTING PROCESS	HORNO ELECTRICO ACERO TOTALMENTE CALMADO ELECTRIC FURNACE // FULLY KILLED
FAB. DE PALANQUILLA: BILLETS MANUFACTURE	COLADA CONTINUA CONTINUOUS CASTING		
DIMENSIONES: DIMENSIONS	4" NB X SCH 160 X 40-44 FT.		
MARCAS: MARKING	ESTAMPADO: DIE STAMPING		
	PINTADO: STENCILLED	TRI API SPEC 5L 5L-0014 (SELLO API) (MM/AA) 4.500 0.531 BN/X42N L245N/ L290N PSL2 SMLS HN (HEAT) 2.970 FSI (LENGTH IN FEET) FT ASTM/ASME A/SA 53 A/SA106 B/C N.D.E. S - SPAIN	
	CODIGO COLOR: COLOUR CODE		
TRAT. TERMICO: HEAT TREATMENT	NORMALIZADO. HORNO CONTINUO. / NORMALIZED (CONT. FURNACE) 920 °C		

DESCRIPCION SUMINISTRO / DESCRIPTION OF DELIVERY

ITEM FAB. T.R. ITEM	ITEM CLI. CLIENTS ITEM	LONG.INDIV. (F) INDIVIDUAL LENGTH	COLADA CAST NR.	Nº TUBOS QUANTITY	LONG. TOTAL (F) LENGTH	PESO(KG) WEIGHT
000220		40,000 - 44,000	121087	138	5.977,166	61.006
TOTAL				138	5.977,166	61.006

Lista de Bultos / Packing 478630
Lisi

TUBOS REUNIDOS INDUSTRIAL GARANTIZA QUE TODOS LOS TUBOS CUBIERTOS POR ESTE CERTIFICADO CUMPLEN LOS REQUISITOS DEL PEDIDO Y CON LAS ESPECIFICACIONES ARRIBA MENCIONADAS.
TUBOS REUNIDOS INDUSTRIAL CERTIFY THAT ALL THE TUBES COVERED BY THIS CERTIFICATE COMPLY WITH ORDER REQUIREMENTS AND ABOVE MENTIONED SPECIFICATIONS.

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villaluenga
P.O.

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

QUALITY MANAGEMENT SYSTEM certified by LRQA

EN 10204:2004 / 3.1

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS NO DESTRUCTIVOS / NON DESTRUCTIVE TESTS

ENSAYO / TEST	%CONTROL / TEST RATE(%)	REQUISITOS / REQUIREMENTS	RESULTADO / RESULT
VISUAL Y DIMENSIONAL/ VISUAL & DIMENSIONAL INSP.	100%		O.K.
P.HIDROSTATICA/ HYDROTEST	100%	2.970,0 PSI 5 SEC.	O.K.
CORRIENTES INDUCIDAS/ EDDY CURRENTS	100%	ASTM E 309. N12.5/HS 3.2 MM	O.K.
DISPERSION FLUJO/ FLUX LEAKAGE	100%	ASTM E 570. N12.5	O.K.
MAGNETISMO RESIDUAL/ RESIDUAL MAGNETISM		MAX 30,0 GAUSS	

ENSAYOS TECNOLÓGICOS Y METALÚRGICOS / TECHNOLOGICAL AND METALLURGICAL TEST

APLASTADO /FLATTENING: AC/ A/SA53/SA106/5L -OK

ANALISIS DE COLADA / CAST ANALYSYS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1770	0,81	0,30	0,008	0,0027	0,094	0,1679	0,0588	0,2676	0,0006	0,0024	0,0011	0,0001	0,37

ANALISIS DE PRODUCTO / PRODUCT ANALYSIS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1700	0,80	0,28	0,007	0,0023	0,090	0,1700	0,0600	0,2800	0,0030	0,0010	0,0020	0,0001	0,36
121087	0,1700	0,80	0,29	0,007	0,0025	0,090	0,1800	0,0600	0,2800	0,0030	0,0010	0,0010	0,0001	0,36

FORMULAS

	(01)
MIN.	
MAX.	1,000
121087	0,603
121087	0,613

(01) Cr + Ni + Mo + Cu + V

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL

Alex Villasuso

P.O.:

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

QUALITY MANAGEMENT SYSTEM certified by LRQA

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS DE TRACCIÓN / TENSILE TEST

COLADA CAST	Nº	L/T (1)	T/P (2)	DIMENSION (inches)	L.ELAST. YIELD POINT (Mpa) (3)	R.TRACC. T.STRENGTH (Mpa)	ALARG. ELONG. (%) (4)	Estricción Reduction of Area (%)	DUREZA HARDNESS (HRB)	E / R
MIN.					290	485				
MAX.					495	655			99	0,00
121087	1	L	P	0,976 x 0,535	322	500	42		80	0,64
121087	2	L	P	0,965 x 0,520	318	510	40		80	0,62

(1) : L = LONGITUDINAL // T = TRANSVERSAL
(2) : T = Full size tube // P = Strip specimen
(3) : yield point (0,2%)
(4) : Lo = 2" (50 mm)

ENSAYOS DE IMPACTO - CHARPY V. / IMPACT TEST

COLADA CAST	Nº	L/T (1)	DIMENS (inches)		T.ª (ºC)	RESILIENCIA IMPACT TEST (J)		AVG (J)	AREA DUCTIL SHEAR AREA (%)		Exp. Lateral LATERAL EXP.
			10	10,00	0	21	27				
			10		999						
121087	1	T	0,394	0,197	0	71	72	66	70	90	1,20

(1) : L = LONGITUDINAL // T = TRANSVERSAL

ANEXOS / ANNEX

" BILLETS ARE PRODUCED AT OUR AMURRIO STEEL PLANT, SPAIN, WHICH IS ALSO CERTIFIED TO ISO 9001, THE SAME AS OUR TUBE PLANT ".

" NO WELD REPAIR "
" MERCURY FREE "

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villarreyes

P.O.:

ANTHONY CARDWELL
04/03/2023

FEDERAL FLANGE

MATERIAL TEST REPORT

FFI-QACON-F0003

Revision: 08, 05/02/2017

Mill Test Report				
INDUSTRIAL PIPING SPECIALIST	Purchase Order:	TP732627X		
PO BOX 581270	Sales Order:	174007		
TULSA,OK 74158	Line Item:	1	Qty:	112

Item Code:	FF105AU010A	Material:	A/SA105N /A/SA350 LF2 CL1
Description:	2 300# RF LONG W/N 9"		Manufactured in the U.S.A.
FID:	A7257	Heat Code:	21801292

Element		Ladle
C	Carbon	0.1900
Mn	Manganese	1.2200
P	Phosphorous	0.0130
S	Sulphur	0.0060
Si	Silicon	0.2800
Cu	Copper	0.0230
Ni	Nickel	0.0160
Cr	Chromium	0.0220

Element		Ladle
N	Nitrogen	
Mo	Molybdenum	0.0000
V	Vanadium	0.0030
CbNb	Columbium/Niobium	0.0010
Ti	Titanium	
Al	Aluminum	
B	Boron	0.0000
Sn	Tin	

Additional Chemicals

Melting Practice	EFVR	Reduction Ratio	>3

Mechanical Test Results			
Tensile (PSI)	77,595		
Yield (PSI)	48,877		
Elong (%)	32.00		
Red (%)	75.00		
CE	0.4009		
PCM			
HBW	154	to	156
CVN Test Temperature	-50		°F
Ft/Lbs.	109	135	121
Shear (%)	60	75	70
MLE	0.60	0.80	0.70
Charpy Sample	10 X 10 X 55mm		
QTC Type & Size			

Heat Treatment Information	
Normalizing Temperature (°F)	1670
Normalizing Time (HRS)	3

Additional Comments

MADE TO FINE GRAIN PRACTICE

D. Maldonado

Guadalupe Maldonado- Quality Representative

12/9/2021

Date

Product is compliant with NACE MR0175/ISO 15156 / Product is compliant with NACE MR0103
No weld repair is performed.
The product is free of Mercury contamination.
Tensile test is taken from round specimen.
Yield Strength is determined using 0.2% offset method, unless otherwise specified.
When reported on the MTR: Tensile testing per ASTM E 8, Charpy impact testing per ASTM E 23 and Brinell Hardness Testing per ASTM E 10.
Federal Flange manufactures products according to a certified QMS conforming to ISO 9001:2015.
Products are manufactured in compliance to EN 10204 Type 3.1.

Physical Address: 4014 Pinemont Dr. | Houston, TX 77018
Telephone: (713) 681-0606 | Fax: (713) 681-3005

ANTHONY CARDWELL
04/03/2023

MANNESMANN PRECISION TUBES
A Member of the Salzgitter Group

Inspection Certificate

acc to EN 10204/3.1

Certificate no.: 9220355

Purchaser:	Webco Industries, Inc 74063 Sand Springs OK	Your order no.:	10075464
Manufacturer:	Mannesmann Precision Tubes Netherlands B.V. NL-Helmond	Our order no.:	3400033

Product: Seamless cold drawn low-carbon steel heat exchanger and condenser tubes.

Specification: (S)A 179 / (S)A 450 / NACE MR0103-05 / NACE MR0175

Steelgrade:	A 179 SA 179	acc. to norm:	A179 SA179	Edition:	2021 2021

Marking: On tubes / On tags

Manufacturer's mark: **MPT-HE**

Process: Basic oxygen steel

Stamp of the mill's inspector: **(Q-MPT-NL)**

Steelmarks: (S)A 179 + N

Shipping no.: 4400548
Our shipping date: 19-05-2022

Extent of the delivery:

Item	Numbers	Dimension			Heat no.	Sample no.
70	1357	1,000" OD x 0,083" MW x 26'0"	10754,30 m	13720 kg	323095	1-6

Shipping marks:
PO : 10075464
Item : 00007
Mat. : A32010000830B
Quantity : 1357pcs.
Tag Nr. : PO# A22-13314 T-3, 4,, 5, 6
ASTM/ASME A/SA 179 SMLS
Grade 1010
OD: 1,0000" inches
Wall: 0.0830 inches MW Wall
Melting Western Europe
Hot finished tube fabrication in Germany
Cold drawn in The Netherlands
Max. 1 heat per bundle – Max 1 heat per box

	C	Mn	P	S	Cr		Heat no.
Requirements:	*0,06-0,18*	*0,27-0,63*	*≤0,035*	*≤0,035*			
Heat analysis (%)	0,16	0,51	0,016	0,002	0,04		323095

	Mo	V	Cu	Ni	Sn		Heat no.
Requirements:							
Heat analysis (%)	0,01	0,001	0,02	0,03	0,001		323095

Heat treatment: Normalized at 920 °C

Remarks: It is certified that the products have been tested in accordance to purchase specifications and found satisfactory

Helmond(NL.) : 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022

MANNESMANN
PRECISION TUBES
A Member of the Salzgitter Group

Test results

Certificate no.: 9220355

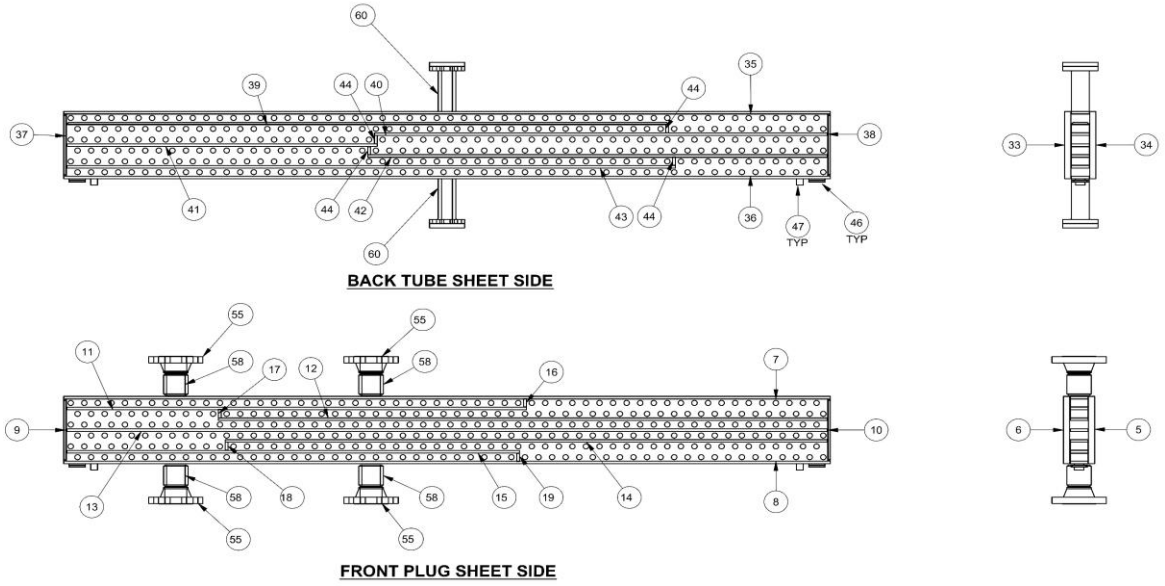
1. Visual inspection and control of dimensions: OK
2. Eddy current test acc. to: E309: OK
3. Flattening test: OK
   Flaring test: OK
4. Hardness test: OK

Mechanical data	Dimensions of the test tube mm	Hardness HRB
Requirements:		*Max 72*
1	25,40 x 2,26	70
2		71
3		70
4		70
5		71
6		72

Helmond: 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022



Mark No	MATERIAL DESCRIPTION		
	SUPPLIERS	HEAT No.	MATERIAL
5/6	SSAB	W2L569	SA-516-70N
7	NUCOR	1600009	SA-516-70N
8	NUCOR	1600009	SA-516-70N
9	SSAB	E2D332	SA-516-70N
10	SSAB	E2D332	SA-516-70N
11	SSAB	E2D332	SA-516-70N
12	NUCOR	1600009	SA-516-70N
13	NUCOR	1600009	SA-516-70N
14	NUCOR	1600009	SA-516-70N
15	SSAB	E2D332	SA-516-70N
16	SSAB	E2D332	SA-516-70N
17	SSAB	E2D332	SA-516-70N
18	SSAB	E2D332	SA-516-70N
19	SSAB	E2D332	SA-516-70N
33	SSAB	W2L569	SA-516-70N
34	SSAB	W2L569	SA-516-70N
35	NUCOR	1600009	SA-516-70N
36	NUCOR	1600009	SA-516-70N
37	NUCOR	1600009	SA-516-70N
38	NUCOR	1600009	SA-516-70N
39	SSAB	E2D332	SA-516-70N
40	SSAB	E2D332	SA-516-70N
41	NUCOR	1600009	SA-516-70N
42	SSAB	E2D332	SA-516-70N
43	NUCOR	1600009	SA-516-70N
44	SSAB	E2D332	SA-516-70N
46	SSAB	W1G769	SA-516-70N
47	NUCOR	8504177	SA-516-70N
48	SSAB	W1G769	SA-516-70N
55	ULMA	43HC22	SA-350LF2
58	TUBOS REUNIDOS	121087	SA-106B
60	FEDERAL FLANGE	21801292	SA-350LF2
TUBES	MANNESMANN	323095	SA-179

CUSTOMER:	AIR PRODCUTS MANUFACTURING, LLC.		FABSCO SHELL & TUBE, LLC
PO NO:	4505606038/ A8KM-4-406-PO-3	DATE	
ITEM NO:	18-XF-261B	AC	DWG No: A22-13314-4A-HS REV: 0

PO/Rel MTR 6755

PART NO.

Attn:

5
6
33
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SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 5: Date 22 Aug 2022

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.:TUL-400 | Mill Order No. 41-694122-11 | Shipping Manifest: AR370350

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -50F/A673-P

Ship Date: 30 Dec 22 | Cert No: 081086435
Cert Date: 30 Dec 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 1.125 X 120.0 X 480.0 (IN)

Tested Pieces:				Tensiles:					Hardness	Charpy Impact Tests								
Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Tst Dir		Abs. Energy(FTLB) 1 2 3 Avg	% Shear 1 2 3 Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W2L569	C55	1.132 (DISCRT)	C	51	75		50	T		100 100 83 94		-50F	L	10.	
W2L569	C56	1.133 (DISCRT)	C	50	74		51	T		78 96 79 84		-50F	L	10.	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W2L569	.19	1.03	.010	.002	.25	.024	.024	.23	.13	.15	.03	.004	.002	.007	.0001	.42	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-2:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
BSK EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 50 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:
W2L569 C56 40098137 PCES: 1, LBS: 18377 W2L569 C55 40098131 PCES: 1, LBS: 18377

CEQ = .42

(*) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

ANTHONY CARDWELL
04/03/2023

7
8
12
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43

MTR 6676

AMERICAN ALLOY
PLATE # 523719

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

1505 River Rd
Cofield, NC 27922
(252) 356-3700

NUCOR
It's Our Nature.

Issuing Date : 01/07/2021 **B/L No. : 578594** **Load No. : 592141** **Our Order No. : 183999/2** **Cust. Order No. : 126001-OK**

Vehicle No: TTPX814051

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Specification: 0.5000" x 96.000" x 480.000"
ASTM A516 70/65/60-17/ASMESA516-70/65/60 PVQ 2019/2017
Normalized Plate NACEMR0175 Annex 2.1.2 (2015), MR0103 (2010)
Section 2.1.2 Compliant (2015) 13.1.1, 13.1.2) Vacuum Degassed

Marking : 126001-OK

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
1600009	0.19	1.06	0.008	0.001	0.21	0.22	0.09	0.12	0.04	0.024	0.004	0.003	0.002	0.0078	0.0016	0.0003	0.010	0.42	0.27

			Tensile Test				Heat Treat			
Plate Serial No	Pieces	Tons	Dir.	Yield (psi)	Tensile (psi)	Elong. % in 2"	Norm (°F)	Time (min)	Temper (°F)	Time (min)
1600009-02	4	13.06	H-T	52,500	77,600	41.6	1650	23		

			Charpy Impacts																
			-------Absorbed Energy (Ft-lbs)-------					-------Lateral Expansion (in.)--------					----------Shear (%)----------						
Plate Serial No	Pieces	Tons	Dir.	(ft-lbs) 1	(ft-lbs) 2	(ft-lbs) 3	(ft-lbs) Ave	Min	(in.) 1	(in.) 2	(in.) 3	(in.) Ave	(in.) Min	(%) 1	(%) 2	(%) 3	(%) Ave	Min	Temp (°F)	Size
1600009-02	4	13.06	H-L	66.9	74.5	52.4	64.6	15											-50	10mm

CEQ = .42

MATERIAL CONFORMS TO
NACE MR0175
BHN 103 TO 159
CERTIFIED BY
AMERICAN ALLOY STEEL
BY RD DATE 1/23/23

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL
JL 6/11/2021

HOT ROLLED CARBON STEEL PLATE
TEST COUPONS TAKEN FROM HEAT TREATED PLATE
Piece frequency charpy;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2015 certified. PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant.
DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate QA-3624366

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Depretis, Metallurgist

1/7/2021 2:00:39 PM

ANTHONY CARDWELL
04/03/2023

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Certificate of Mill Test Result

PO/Rel TUL 000000-000 Pg 1/1

PART NO. MTR 6603 Attn:

SSAB

12400 Highway 43 North, Axis, Alabama 36505, US

Test Certificate

⚠ WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.: TUL-320 | **Mill Order No.** 41-673801-02 | **Shipping Manifest:** AR357250

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -60F/A673-P

Size: 0.500 X 96.00 X 480.0 (IN)

Ship Date: 22 May 22 | **Cert No:** 081047524
Cert Date: 22 May 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Tested Pieces:				Tensiles:						Charpy Impact Tests							
Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Tst Dir	Hardness	Abs. Energy(FTLB) 1 2 3 Avg	% Shear 1 2 3 Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
E2D332	D07	0.502 (DISCRT)	C	55	77		39	T		44 108 104 85		-60F	L	10.	
E2D333	D08	0.502 (DISCRT)	C	55	76		40	T		112 80 55 82		-60F	L	10.	

Chemical Analysis																	
Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
E2D332	.19	1.03	.010	<.001	.24	.032	.031	.27	.13	.13	.02	.002	.003	.008	.0002	.42	USA
E2D333	.18	1.02	.010	.001	.25	.031	.030	.26	.14	.13	.03	.002	.003	.008	.0002	.41	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-1:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 22 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

E2D332	D07	40084899	PCES:	1,	LBS:	6534	E2D332	D07	40084897	PCES:	1, LBS: 6534
E2D332	D07	40084901	PCES:	1,	LBS:	6534	E2D333	D08	40084893	PCES:	1, LBS: 6534
E2D332	D07	40084898	PCES:	1,	LBS:	6534	E2D332	D07	40084900	PCES:	1, LBS: 6534

CEQ=.42

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

Doc No. 393264 Indexed 24May22 by 145larro

AMERICAN ALLOY
PLATE #5249374

MTR 6205

SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
AMERICAN ALLOY STEEL, INC.
P.O. BOX 40469

HOUSTON
TX 77240-0469

Customer P.O.No.:127881-OK | Mill Order No. 41-648373-01 | Shipping Manifest: AR340960

Product Description: ASME SA516-70/SA516-65/SA516-60(19)
ASTM A516-70/A516-65/A516-60(17)
LCVN 15 FT.LBS@-50F/A673-P,VACUUM DEGAS

Ship Date: 11 Aug 21 | Cert No: 081001692
Cert Date: 11 Aug 21 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 0.250 X 120.0 X 480.0 (IN)

Tested Pieces:

Heat Id	Piece Id	Tested Thickness	Tst Loc	Tensiles: YS (KSI)	UTS (KSI)	%RA	Elong % 2in	Elong % 8in	Tst Dir	Hardness	Charpy Impact Tests: Abs. Energy(FTLB) 1	2	3	Avg	% Shear 1	2	3	Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W1G769	B01	0.251 (DISCRT)	C	56	77		34		T		50	48	52	50					-50F	L	5.0	
→ W1G769	B04	0.251 (DISCRT)	C	53	74		35		T		45	53	43	47					-50F	L	5.0	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W1G769	.18	.92	.011	.001	.27	.028	.028	.30	.15	.10	.03	.001	.004	.014	.0002	.39	USA

KILLED STEEL
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
EAF STEEL, CONTINUOUS CAST
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
CHARPY FULL SIZE EQUIVALENT = ABSORBED ENERGY AVG X 10 / TEST SIZE IN MM
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 14 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

CEQ = .39

W1G769	B04	40067978	PCES:	1,	LBS:	4084	W1G769	B04	40067977	PCES:	1, LBS: 4084
→ W1G769	B04	40067976	PCES:	1,	LBS:	4084	W1G769	B04	40067974	PCES:	1, LBS: 4084
W1G769	B04	40067973	PCES:	1,	LBS:	4084	W1G769	B04	40067982	PCES:	1, LBS: 4084
W1G769	B04	40067980	PCES:	1,	LBS:	4084	W1G769	B04	40067979	PCES:	1, LBS: 4084
W1G769	B04	40067975	PCES:	1,	LBS:	4084	W1G769	B04	40067972	PCES:	1, LBS: 4084
W1G769	B01	40067957	PCES:	1,	LBS:	4084	W1G769	B04	40067971	PCES:	1, LBS: 4084
W1G769	B01	40067958	PCES:	1,	LBS:	4084	W1G769	B04	40067983	PCES:	1, LBS: 4084
W1G769	B04	40067981	PCES:	1,	LBS:	4084	W1G769	B04	40067985	PCES:	1, LBS: 4084
W1G769	B04	40067984	PCES:	1,	LBS:	4084	W1G769	B01	40067964	PCES:	1, LBS: 4084
W1G769	B01	40067963	PCES:	1,	LBS:	4084	W1G769	B01	40067962	PCES:	1, LBS: 4084

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY PO DATE 8/4/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
VB 10/8/2021

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Colt Beck
PRODUCT METALLURGIST

05/10/2021 From: AMERICAN ALLOY STEEL, INC. To: ACS STEEL CO., LLC
P.O.#: 5413 S.O.#: 683385 AA PL#: 5205503
Item: 7 (1 PC) 1-1/4" X 120" X 480"
AR STOCK

MTR 8053

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

Page 1

1505 River Rd
Cofield, NC 27922
(252) 356-3700

AMERICAN ALLOY PLATE #5205503

NUCOR
It's Our Nature.

Issuing Date : 06/30/2018 B/L No. : 505891 Load No. : 515942 Our Order No. : 157228/23 Cust. Order No. : 115393-OK

Vehicle No: PTTX 147081

Specification: 1.2500" x 120.000" x 480.000"
ASTM A516 70-17/ASME SA516 70 PVQ 2015/2017 Normalized Test Coupons at 1650F Hold 30 Min per Inch of thickness Air Cooled NACE MR0175 Annex 2.1.2 (2015), MR0103(2016) Section 2.1.2 (2015) 13.1.1, 13.1.2) Compliant

Marking : 115393-OK

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
8504176	0.19	1.01	0.008	0.004	0.19	0.26	0.11	0.09	0.02	0.040	0.004	0.002	0.002		0.0040	0.0002	0.011	0.40	0.27
8504177	0.20	1.07	0.009	0.001	0.20	0.27	0.10	0.09	0.02	0.032	0.006	0.002	0.002		0.0027	0.0002	0.011	0.42	0.28

Plate Serial No	Pieces	Tons	Tensile Test Dir.	(psi) Yield	(psi) Tensile	Elong. % in 2"	Elong. % in 8"	
8504176-05	3	30.52	T	44,400	73,700		27.1	
			T	47,000	71,400		24.8	N
→ 8504177-01	5	51.04	T	43,900	73,500		25.9	
			T	46,600	72,300		25.5	N

CEQ=.42

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY VB DATE 5/10/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
J.F 8/17/2018

HOT ROLLED CARBON STEEL PLATE
Test coupons only, normalized 30 minutes per inch of thickness at 1650 F ± 25 F. Hold 30 minutes minimum. ;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate as-rolled, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@Nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2008 certified (#010940) by SRI Quality System Registrar (#0065-09). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant. DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate 14-HMPQA-723

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Dupreis

T. A. Dupreis, Metallurgist

6/30/2018 3:02:53 PM

CLIENTE / Customer / Client
INDUSTRIAL PIPING SPECIALISTS, INC
606 NORTH 145 EAST AVENUE
TULSA, OK 74116
USA

CERTIFICADO DE INSPECCION

Inspection Certificate - Certificat de Réception

FECHA: Date: **26/10/2022** | N.º No. **222251** | HOJA: Page: **1**

PRODUCTO / Article - Produit: **FLANGES**

SU PEDIDO N.º / Your Order No. / Votre Cde. N.º: **TP769202 TULSA**

DE / of. - de: **28/08/2022**

NORMAS APLICABLES / Requirements - Normes Applicables: **ASME B16.5-17**

MATERIAL CORRESPONDIENTE / Material Correspondent - Qualité: **ASME SA350LF2CL1-2-21/SA105M-21 ASTM A350LF2CL1-2-18/A105M-21**

MODO DE FUSION (*) / Steel Making - Elaboration de l'acier: **NACE MR0175/ISO15156-02/03-15 & NACE MR0103/ISO17945-15**

E = Elec. Y = Oxigeno básico

Company management certifications:
ISO 9001: 2015
ISO 14001: 2015
ISO 45001: 2018

Management Systems certified by LRQAE

Certified acc. PED 2014/68/UE+AD2000-W0 by TÜV Rheinland N.º 01 202 E/Q 02 7443 — UNE EN 10204:06 / 3.1, ISO 10474:13 / 3.1

MARCA DEL FABRICANTE / Mark of factory / Marque du fabricant

DEPARTAMENTO / Section / Département: **QUALITY ASSURANCE**

ULMA FORJA, S.COOP.
Bº Zubillaga, 3 - Apdo. 14
20560 OÑATI (Gipuzkoa) SPAIN
Tel : 34 - 943 780552
Fax: 34 - 943 781808
E-mail: ulma@ulmaforge.com

Packing List: 172392
Expedition : 414467

PARTIDA / Item / Poste	CANTIDAD / Quantity / Quantité	DESCRIPCION / Description / Description		OBSERVACIONES / Remarks / Observations (*)	COLADA N.º / Heat No / N.ºCoulée	RESISTENCIA T.Strength / Resist Rupt N/mm2	LIMITE ELAST Y.Strength 0.2 % N/mm2	ALARGAM. Elongation Allongement Lo:50mm/4d %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résilience Joules			CHARPY V 10x10mm MEDIA Average Moyenne	°C	DUREZA Hardness Dureté HBW	
10 FU1215RFBLNL2	45	BLIND 12 150LB RF A105N/A350LF2	**01G204**	NE	52AV2	521	325	38,60	74,65	105	114	111	110	-50	141	142
36 FU660RFBLNL2	11	BLIND 6 600LB RF A105N/A350LF2	**20J204**	NE	46HC22	507	307	37,92	74,37	95	83	92	90	-50	143	143
50 FU1.530RFSWXHNL2	105	SW 1.1/2 300LB XS/80 RF A105N/A350LF2	**20S207**	NE	77AV22	509	327	38,07	72,33	61	76	45	61	-50	140	143
62 FU815RFWNSTDNL2	36	WN 8 150LB STD/40 RF A105N/A350LF2	**05G209**	NE	03AE9	521	291	33,50	76,58	49	34	68	50	-50	146	149
75 FU1615RFWNXHNL2	20	WN 16 150LB XS/40 RF A105N/A350LF2	**12S208**	NE	A32A2	546	346	38,42	73,35	109	109	51	90	-50	152	152
100 FU430RFWN160NL2	48	WN 4 300LB S160 RF A105N/A350LF2	**27L216**	NE	43HC22	524	347	35,60	72,33	110	104	103	106	-50	146	149

COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE

COLADA N.º / Heat No / Ladle: L / Product: P	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	B %	CEq %	Origin of Steel
52AV2 L	0,180	0,220	1,160	0,010	0,002	0,090	0,090	0,010	0,002	0,003	0,180	0,031	0,002	0,0004	0,41	Ukraine
46HC22 L	0,180	0,210	1,140	0,010	0,003	0,080	0,100	0,010	0,002	0,003	0,140	0,035	0,002	0,0003	0,40	Ukraine
77AV22 L	0,183	0,210	1,070	0,015	0,003	0,100	0,060	0,010	0,002	0,004	0,120	0,027	0,002	0,0001	0,40	Spain
03AE9 L	0,140	0,280	1,300	0,006	0,001	0,080	0,220	0,090	0,002	0,071	0,110	0,027	0,002	0,0004	0,43	Italy
A32A2 L	0,170	0,210	1,200	0,012	0,003	0,050	0,070	0,005	0,001	0,003	0,150	0,035	0,001	0,0004	0,40	France
43HC22 L	0,180	0,230	1,160	0,007	0,002	0,070	0,070	0,008	0,001	0,002	0,120	0,029	0,002	0,0003	0,40	France

- Las dimensiones y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

EL INSPECTOR
Works Inspector - L'Inspecteur

ULMA FORJA S.COOP.
Dpto. Control de calidad
Quality Control Dept.

(*) OBSERVACIONES: Remarks / Observations: N_NORMALIZED ABOVE 900ºC AND COOLED IN AIR.

A22-13314-3-6-FL		43HC22	LN: 1	T0526649-1	FU430RFWN160NL2

| A22-13314-3-6-FL | | | 121087 | LN: 2 | T0526649-1 | FSTR4160PSL2 | |

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

FSTR 4160 PSL2

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

QUALITY MANAGEMENT SYSTEM certified by LRQA

THE BILLETS AND THE MATERIAL COVERED BY THIS CERTIFICATE ARE MANUFACTURED AT OUR STEEL PLANT IN AMURRIO, SPAIN.

Nº 0000342223/1 Rev. 000

CLIENTE: CUSTOMER	INDUSTRIAL PIPING SPECIALIST (IPS) P.O. BOX 581270	PEDIDO / PARTIDA: P.ORDER / ITEM	HR077735 022
PRODUCTO: ARTICLE	TUBERÍA SIN SOLDADURA LAMINADA EN CALIENTE HOT FINISHED SEAMLESS TUBES	CLI. MATERIAL: CLIENT MATERIAL	FSTR4160PSL2
EXTREMOS: ENDS	BISELADOS BEVELLED ENDS	REF. FABRICA: WORK ORDER	300018926 000220
NORMA / GRADO: APL.STANDARD AND GRADE	ASTM A53/A53M-12/ASME II SA-53/SA-53M2015/ASTM A106/A106M-15/ASME II SA-106/SA-106M2015/API 5L2012 45THED,PSL2 B/C/BN/X42N	PROTECCIÓN SUPERF: EXT. COATING	LACA SECA EXTERIOR EXTERNALLY DRY LACQUERED
ESPEC. ADICIONALES: ADITIONAL SPECS.	NACE MR0103 NACE MR0175/ISO 15156	PROCESO FUSION: MELTING PROCESS	HORNO ELECTRICO ACERO TOTALMENTE CALMADO ELECTRIC FURNACE // FULLY KILLED
FAB. DE PALANQUILLA: BILLETS MANUFACTURE	COLADA CONTINUA CONTINUOUS CASTING		
DIMENSIONES: DIMENSIONS	4" NB X SCH 160 X 40-44 FT.		
MARCAS: MARKING	ESTAMPADO: DIE STAMPING		
	PINTADO: STENCILLED	TRI API SPEC 5L 5L-0014 (SELLO API) (MM/AA) 4.500 0.531 BN/X42N L245N/ L290N PSL2 SMLS HN (HEAT) 2.970 FSI (LENGTH IN FEET) FT ASTM/ASME A/SA 53 A/SA106 B/C N.D.E. S - SPAIN	
	CODIGO COLOR: COLOUR CODE		
TRAT. TERMICO: HEAT TREATMENT	NORMALIZADO. HORNO CONTINUO. / NORMALIZED (CONT. FURNACE) 920 °C		

DESCRIPCION SUMINISTRO / DESCRIPTION OF DELIVERY

ITEM FAB. T.R. ITEM	ITEM CLI. CLIENTS ITEM	LONG.INDIV. (F) INDIVIDUAL LENGTH	COLADA CAST NR.	Nº TUBOS QUANTITY	LONG. TOTAL (F) LENGTH	PESO(KG) WEIGHT
000220		40,000 - 44,000	121087	138	5.977,166	61.006
TOTAL				138	5.977,166	61.006

Lista de Bultos / Packing 478630
Lisi

TUBOS REUNIDOS INDUSTRIAL GARANTIZA QUE TODOS LOS TUBOS CUBIERTOS POR ESTE CERTIFICADO CUMPLEN LOS REQUISITOS DEL PEDIDO Y CON LAS ESPECIFICACIONES ARRIBA MENCIONADAS.
TUBOS REUNIDOS INDUSTRIAL CERTIFY THAT ALL THE TUBES COVERED BY THIS CERTIFICATE COMPLY WITH ORDER REQUIREMENTS AND ABOVE MENTIONED SPECIFICATIONS.

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villaluenga
P.O.

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

QUALITY MANAGEMENT SYSTEM certified by LRQA

EN 10204:2004 / 3.1

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS NO DESTRUCTIVOS / NON DESTRUCTIVE TESTS

ENSAYO / TEST	%CONTROL / TEST RATE(%)	REQUISITOS / REQUIREMENTS	RESULTADO / RESULT
VISUAL Y DIMENSIONAL/ VISUAL & DIMENSIONAL INSP.	100%		O.K.
P.HIDROSTATICA/ HYDROTEST	100%	2.970,0 PSI 5 SEC.	O.K.
CORRIENTES INDUCIDAS/ EDDY CURRENTS	100%	ASTM E 309. N12.5/HS 3.2 MM	O.K.
DISPERSION FLUJO/ FLUX LEAKAGE	100%	ASTM E 570. N12.5	O.K.
MAGNETISMO RESIDUAL/ RESIDUAL MAGNETISM		MAX 30,0 GAUSS	

ENSAYOS TECNOLÓGICOS Y METALÚRGICOS / TECHNOLOGICAL AND METALLURGICAL TEST

APLASTADO /FLATTENING: AC/ A/SA53/SA106/5L -OK

ANALISIS DE COLADA / CAST ANALYSYS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1770	0,81	0,30	0,008	0,0027	0,094	0,1679	0,0588	0,2676	0,0006	0,0024	0,0011	0,0001	0,37

ANALISIS DE PRODUCTO / PRODUCT ANALYSIS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1700	0,80	0,28	0,007	0,0023	0,090	0,1700	0,0600	0,2800	0,0030	0,0010	0,0020	0,0001	0,36
121087	0,1700	0,80	0,29	0,007	0,0025	0,090	0,1800	0,0600	0,2800	0,0030	0,0010	0,0010	0,0001	0,36

FORMULAS

	(01)
MIN.	
MAX.	1,000
121087	0,603
121087	0,613

(01) Cr + Ni + Mo + Cu + V

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL

Alex Villasuso

P.O.:

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

QUALITY MANAGEMENT SYSTEM certified by LRQA

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS DE TRACCIÓN / TENSILE TEST

COLADA CAST	Nº	L/T (1)	T/P (2)	DIMENSION (inches)	L.ELAST. YIELD POINT (Mpa) (3)	R.TRACC. T.STRENGTH (Mpa)	ALARG. ELONG. (%) (4)	Estricción Reduction of Area (%)	DUREZA HARDNESS (HRB)	E / R
MIN.					290	485				
MAX.					495	655			99	0,00
121087	1	L	P	0,976 x 0,535	322	500	42		80	0,64
121087	2	L	P	0,965 x 0,520	318	510	40		80	0,62

(1) : L = LONGITUDINAL // T = TRANSVERSAL
(2) : T = Full size tube // P = Strip specimen
(3) : yield point (0,2%)
(4) : Lo = 2" (50 mm)

ENSAYOS DE IMPACTO - CHARPY V. / IMPACT TEST

COLADA CAST	Nº	L/T (1)	DIMENS (inches)		T.ª (ºC)	RESILIENCIA IMPACT TEST (J)		AVG (J)	AREA DUCTIL SHEAR AREA (%)		Exp. Lateral LATERAL EXP.
			10	10,00	0	21	27				
			10		999						
121087	1	T	0,394	0,197	0	71	72	66	70	90	1,20

(1) : L = LONGITUDINAL // T = TRANSVERSAL

ANEXOS / ANNEX

" BILLETS ARE PRODUCED AT OUR AMURRIO STEEL PLANT, SPAIN, WHICH IS ALSO CERTIFIED TO ISO 9001, THE SAME AS OUR TUBE PLANT ".

" NO WELD REPAIR "
" MERCURY FREE "

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villarreyes

P.O.:

ANTHONY CARDWELL
04/03/2023

FEDERAL FLANGE

MATERIAL TEST REPORT

FFI-QACON-F0003

Revision: 08, 05/02/2017

Mill Test Report				
INDUSTRIAL PIPING SPECIALIST	Purchase Order:	TP732627X		
PO BOX 581270	Sales Order:	174007		
TULSA,OK 74158	Line Item:	1	Qty:	112

Item Code:	FF105AU010A	Material:	A/SA105N /A/SA350 LF2 CL1
Description:	2 300# RF LONG W/N 9"		Manufactured in the U.S.A.
FID:	A7257	Heat Code:	21801292

Element		Ladle
C	Carbon	0.1900
Mn	Manganese	1.2200
P	Phosphorous	0.0130
S	Sulphur	0.0060
Si	Silicon	0.2800
Cu	Copper	0.0230
Ni	Nickel	0.0160
Cr	Chromium	0.0220

Element		Ladle
N	Nitrogen	
Mo	Molybdenum	0.0000
V	Vanadium	0.0030
CbNb	Columbium/Niobium	0.0010
Ti	Titanium	
Al	Aluminum	
B	Boron	0.0000
Sn	Tin	

Additional Chemicals

Melting Practice	EFVR	Reduction Ratio	>3

Mechanical Test Results			
Tensile (PSI)	77,595		
Yield (PSI)	48,877		
Elong (%)	32.00		
Red (%)	75.00		
CE	0.4009		
PCM			
HBW	154	to	156
CVN Test Temperature	-50		°F
Ft/Lbs.	109	135	121
Shear (%)	60	75	70
MLE	0.60	0.80	0.70
Charpy Sample	10 X 10 X 55mm		
QTC Type & Size			

Heat Treatment Information	
Normalizing Temperature (°F)	1670
Normalizing Time (HRS)	3

Additional Comments

MADE TO FINE GRAIN PRACTICE

D. Maldonado

Guadalupe Maldonado- Quality Representative

12/9/2021

Date

Product is compliant with NACE MR0175/ISO 15156 / Product is compliant with NACE MR0103
No weld repair is performed.
The product is free of Mercury contamination.
Tensile test is taken from round specimen.
Yield Strength is determined using 0.2% offset method, unless otherwise specified.
When reported on the MTR: Tensile testing per ASTM E 8, Charpy impact testing per ASTM E 23 and Brinell Hardness Testing per ASTM E 10.
Federal Flange manufactures products according to a certified QMS conforming to ISO 9001:2015.
Products are manufactured in compliance to EN 10204 Type 3.1.

Physical Address: 4014 Pinemont Dr. | Houston, TX 77018
Telephone: (713) 681-0606 | Fax: (713) 681-3005

ANTHONY CARDWELL
04/03/2023

MANNESMANN PRECISION TUBES
A Member of the Salzgitter Group

Inspection Certificate

acc to EN 10204/3.1

Certificate no.: 9220355

Purchaser:	Webco Industries, Inc 74063 Sand Springs OK	Your order no.:	10075464
Manufacturer:	Mannesmann Precision Tubes Netherlands B.V. NL-Helmond	Our order no.:	3400033

Product: Seamless cold drawn low-carbon steel heat exchanger and condenser tubes.

Specification: (S)A 179 / (S)A 450 / NACE MR0103-05 / NACE MR0175

Steelgrade:	A 179 SA 179	acc. to norm:	A179 SA179	Edition:	2021 2021

Marking: On tubes / On tags

Manufacturer's mark: **MPT-HE**

Process: Basic oxygen steel

Stamp of the mill's inspector: **(Q-MPT-NL)**

Steelmarks: (S)A 179 + N

Shipping no.: 4400548
Our shipping date: 19-05-2022

Extent of the delivery:

Item	Numbers	Dimension			Heat no.	Sample no.
70	1357	1,000" OD x 0,083" MW x 26'0"	10754,30 m	13720 kg	323095	1-6

Shipping marks:
PO : 10075464
Item : 00007
Mat. : A32010000830B
Quantity : 1357pcs.
Tag Nr. : PO# A22-13314 T-3, 4,, 5, 6
ASTM/ASME A/SA 179 SMLS
Grade 1010
OD: 1,0000" inches
Wall: 0.0830 inches MW Wall
Melting Western Europe
Hot finished tube fabrication in Germany
Cold drawn in The Netherlands
Max. 1 heat per bundle – Max 1 heat per box

	C	Mn	P	S	Cr		Heat no.
Requirements:	*0,06-0,18*	*0,27-0,63*	*≤0,035*	*≤0,035*			
Heat analysis (%)	0,16	0,51	0,016	0,002	0,04		323095

	Mo	V	Cu	Ni	Sn		Heat no.
Requirements:							
Heat analysis (%)	0,01	0,001	0,02	0,03	0,001		323095

Heat treatment: Normalized at 920 °C

Remarks: It is certified that the products have been tested in accordance to purchase specifications and found satisfactory

Helmond(NL.) : 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022

MANNESMANN
PRECISION TUBES
A Member of the Salzgitter Group

Test results

Certificate no.: 9220355

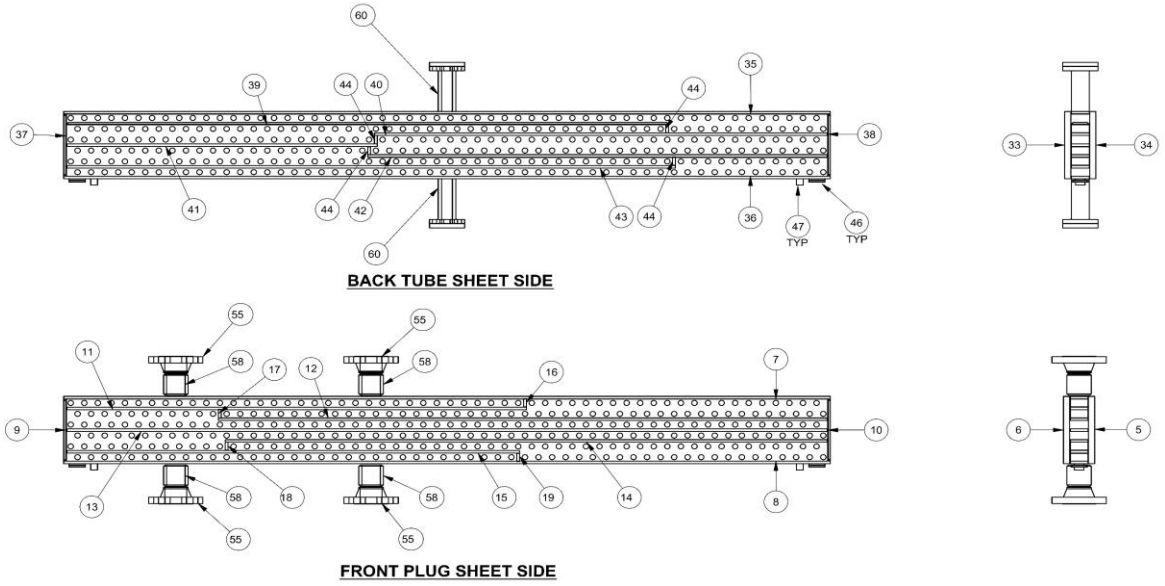
1. Visual inspection and control of dimensions: OK
2. Eddy current test acc. to: E309: OK
3. Flattening test: OK
   Flaring test: OK
4. Hardness test: OK

Mechanical data	Dimensions of the test tube mm	Hardness HRB
Requirements:		*Max 72*
1	25,40 x 2,26	70
2		71
3		70
4		70
5		71
6		72

Helmond: 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022



Mark No	MATERIAL DESCRIPTION		
	SUPPLIERS	HEAT No.	MATERIAL
5/6	SSAB	W2L569	SA-516-70N
7	NUCOR	1600009	SA-516-70N
8	NUCOR	1600009	SA-516-70N
9	NUCOR	1600009	SA-516-70N
10	NUCOR	1600009	SA-516-70N
11	SSAB	E2D332	SA-516-70N
12	NUCOR	1600009	SA-516-70N
13	NUCOR	1600009	SA-516-70N
14	NUCOR	1600009	SA-516-70N
15	SSAB	E2D332	SA-516-70N
16	SSAB	E2D332	SA-516-70N
17	SSAB	E2D332	SA-516-70N
18	SSAB	E2D332	SA-516-70N
19	SSAB	E2D332	SA-516-70N
33	SSAB	W2L569	SA-516-70N
34	SSAB	W2L569	SA-516-70N
35	NUCOR	1600009	SA-516-70N
36	NUCOR	1600009	SA-516-70N
37	NUCOR	1600009	SA-516-70N
38	NUCOR	1600009	SA-516-70N
39	NUCOR	1600009	SA-516-70N
40	SSAB	E2D332	SA-516-70N
41	NUCOR	1600009	SA-516-70N
42	SSAB	E2D332	SA-516-70N
43	NUCOR	1600009	SA-516-70N
44	SSAB	E2D332	SA-516-70N
46	SSAB	W1G769	SA-516-70N
47	NUCOR	8504177	SA-516-70N
48	SSAB	W1G769	SA-516-70N
55	ULMA	43HC22	SA-350LF2
58	TUBOS REUNIDOS	121087	SA-106B
60	FEDERAL FLANGE	21801292	SA-350LF2
TUBES	MANNESMANN	323095	SA-179

CUSTOMER:	AIR PRODCUTS MANUFACTURING, LLC.		FABSCO SHELL & TUBE, LLC
PO NO:	4505606038/ A8KM-4-406-PO-3	DATE	
ITEM NO:	18-XF-261C	AC	DWG No: A22-13314-5A-HS REV: 0

PO/Rel MTR 6755

PART NO.

Attn:

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SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 5: Date 22 Aug 2022

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.:TUL-400 | Mill Order No. 41-694122-11 | Shipping Manifest: AR370350

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -50F/A673-P

Ship Date: 30 Dec 22 | Cert No: 081086435
Cert Date: 30 Dec 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 1.125 X 120.0 X 480.0 (IN)

Tested Pieces:				Tensiles:					Hardness	Charpy Impact Tests								
Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Tst Dir		Abs. Energy(FTLB) 1 2 3 Avg	% Shear 1 2 3 Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W2L569	C55	1.132 (DISCRT)	C	51	75		50	T		100 100 83 94		-50F	L	10.	
W2L569	C56	1.133 (DISCRT)	C	50	74		51	T		78 96 79 84		-50F	L	10.	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W2L569	.19	1.03	.010	.002	.25	.024	.024	.23	.13	.15	.03	.004	.002	.007	.0001	.42	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-2:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
BSK EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 50 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:
W2L569 C56 40098137 PCES: 1, LBS: 18377 W2L569 C55 40098131 PCES: 1, LBS: 18377

CEQ = .42

(*) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

ANTHONY CARDWELL
04/03/2023

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MTR 6676

AMERICAN ALLOY
PLATE #523719

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

1505 River Rd
Cofield, NC 27922
(252) 356-3700

NUCOR
It's Our Nature.

Issuing Date : 01/07/2021 **B/L No. : 578594** **Load No. : 592141** **Our Order No. : 183999/2** **Cust. Order No. : 126001-OK**

Vehicle No: TTPX814051

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Specification: 0.5000" x 96.000" x 480.000"
ASTM A516 70/65/60-17/ASMESA516-70/65/60 PVQ 2019/2017
Normalized Plate NACEMR0175 Annex 2.1.2 (2015), MR0103 (2010)
Section 2.1.2 Compliant (2015) 13.1.1, 13.1.2) Vacuum Degassed

Marking : 126001-OK

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
1600009	0.19	1.06	0.008	0.001	0.21	0.22	0.09	0.12	0.04	0.024	0.004	0.003	0.002	0.0078	0.0016	0.0003	0.010	0.42	0.27

			Tensile Test				Heat Treat			
Plate Serial No	Pieces	Tons	Dir.	Yield (psi)	Tensile (psi)	Elong. % in 2"	Elong. % in 8"	Norm (°F)	Time (min)	Temper (°F)	Time (min)
1600009-02	4	13.06	H-T	52,500	77,600	41.6		1650	23		

			Charpy Impacts																
			-------Absorbed Energy (Ft-lbs)-------					-------Lateral Expansion (in.)--------					----------Shear (%)----------						
Plate Serial No	Pieces	Tons	Dir.	(ft-lbs) 1	(ft-lbs) 2	(ft-lbs) 3	(ft-lbs) Ave	Min	(in.) 1	(in.) 2	(in.) 3	(in.) Ave	(in.) Min	(%) 1	(%) 2	(%) 3	(%) Ave	Min	Temp (°F)	Size
1600009-02	4	13.06	H-L	66.9	74.5	52.4	64.6	15											-50	10mm

CEQ = .42

MATERIAL CONFORMS TO
NACE MR0175
BHN 103 TO 159
CERTIFIED BY
AMERICAN ALLOY STEEL
BY PD DATE 1/23/23

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL
JL 6/11/2021

HOT ROLLED CARBON STEEL PLATE
TEST COUPONS TAKEN FROM HEAT TREATED PLATE
Piece frequency charpy;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2015 certified. PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant.
DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate QA-3624366

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Depretis

T. A. Depretis, Metallurgist

1/7/2021 2:00:39 PM

ANTHONY CARDWELL
04/03/2023

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Certificate of Mill Test Result

PO/Rel TUL 000000-000 Pg 1/1

PART NO. MTR 6603 Attn:

SSAB

12400 Highway 43 North, Axis, Alabama 36505, US

Test Certificate

⚠ WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.: TUL-320 | **Mill Order No.** 41-673801-02 | **Shipping Manifest:** AR357250

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -60F/A673-P

Size: 0.500 X 96.00 X 480.0 (IN)

Ship Date: 22 May 22 | **Cert No:** 081047524
Cert Date: 22 May 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Tested Pieces:				Tensiles:						Charpy Impact Tests							
Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Tst Dir	Hardness	Abs. Energy(FTLB) 1 2 3 Avg	% Shear 1 2 3 Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
E2D332	D07	0.502 (DISCRT)	C	55	77		39	T		44 108 104 85		-60F	L	10.	
E2D333	D08	0.502 (DISCRT)	C	55	76		40	T		112 80 55 82		-60F	L	10.	

Chemical Analysis																	
Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	CEIIW	ORGN
E2D332	.19	1.03	.010	<.001	.24	.032	.031	.27	.13	.13	.02	.002	.003	.008	.0002	.42	USA
E2D333	.18	1.02	.010	.001	.25	.031	.030	.26	.14	.13	.03	.002	.003	.008	.0002	.41	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-1:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 22 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

E2D332	D07	40084899	PCES:	1,	LBS:	6534	E2D332	D07	40084897	PCES:	1, LBS: 6534
E2D332	D07	40084901	PCES:	1,	LBS:	6534	E2D333	D08	40084893	PCES:	1, LBS: 6534
E2D332	D07	40084898	PCES:	1,	LBS:	6534	E2D332	D07	40084900	PCES:	1, LBS: 6534

CEQ=.42

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

Doc No. 393264 Indexed 24May22 by 145larro

AMERICAN ALLOY
PLATE #5249374

MTR 6205

SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
AMERICAN ALLOY STEEL, INC.
P.O. BOX 40469

HOUSTON
TX 77240-0469

Customer P.O.No.:127881-OK | Mill Order No. 41-648373-01 | Shipping Manifest: AR340960

Product Description: ASME SA516-70/SA516-65/SA516-60(19)
ASTM A516-70/A516-65/A516-60(17)
LCVN 15 FT.LBS@-50F/A673-P,VACUUM DEGAS

Ship Date: 11 Aug 21 | Cert No: 081001692
Cert Date: 11 Aug 21 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 0.250 X 120.0 X 480.0 (IN)

Tested Pieces:

Heat Id	Piece Id	Tested Thickness	Tst Loc	Tensiles: YS (KSI)	UTS (KSI)	%RA	Elong % 2in	Elong % 8in	Tst Dir	Hardness	Charpy Impact Tests: Abs. Energy(FTLB) 1	2	3	Avg	% Shear 1	2	3	Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W1G769	B01	0.251 (DISCRT)	C	56	77		34		T		50	48	52	50					-50F	L	5.0	
→ W1G769	B04	0.251 (DISCRT)	C	53	74		35		T		45	53	43	47					-50F	L	5.0	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W1G769	.18	.92	.011	.001	.27	.028	.028	.30	.15	.10	.03	.001	.004	.014	.0002	.39	USA

KILLED STEEL
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
EAF STEEL, CONTINUOUS CAST
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
CHARPY FULL SIZE EQUIVALENT = ABSORBED ENERGY AVG X 10 / TEST SIZE IN MM
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 14 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

CEQ = .39

W1G769	B04	40067978	PCES:	1,	LBS:	4084	W1G769	B04	40067977	PCES:	1, LBS: 4084
→ W1G769	B04	40067976	PCES:	1,	LBS:	4084	W1G769	B04	40067974	PCES:	1, LBS: 4084
W1G769	B04	40067973	PCES:	1,	LBS:	4084	W1G769	B04	40067982	PCES:	1, LBS: 4084
W1G769	B04	40067980	PCES:	1,	LBS:	4084	W1G769	B04	40067979	PCES:	1, LBS: 4084
W1G769	B04	40067975	PCES:	1,	LBS:	4084	W1G769	B04	40067972	PCES:	1, LBS: 4084
W1G769	B01	40067957	PCES:	1,	LBS:	4084	W1G769	B04	40067971	PCES:	1, LBS: 4084
W1G769	B01	40067958	PCES:	1,	LBS:	4084	W1G769	B04	40067983	PCES:	1, LBS: 4084
W1G769	B04	40067981	PCES:	1,	LBS:	4084	W1G769	B04	40067985	PCES:	1, LBS: 4084
W1G769	B04	40067984	PCES:	1,	LBS:	4084	W1G769	B01	40067964	PCES:	1, LBS: 4084
W1G769	B01	40067963	PCES:	1,	LBS:	4084	W1G769	B01	40067962	PCES:	1, LBS: 4084

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY PO DATE 8/4/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
VB 10/8/2021

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Colt Beck
PRODUCT METALLURGIST

05/10/2021 From: AMERICAN ALLOY STEEL, INC. To: ACS STEEL CO., LLC
P.O.#: 5413 S.O.#: 683385 AA PL#: 5205503
Item: 7 (1 PC) 1-1/4" X 120" X 480"
AR STOCK

MTR 8053

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

Page 1

1505 River Rd
Cofield, NC 27922
(252) 356-3700

AMERICAN ALLOY PLATE #5205503

NUCOR
It's Our Nature.

Issuing Date : 06/30/2018 B/L No. : 505891 Load No. : 515942 Our Order No. : 157228/23 Cust. Order No. : 115393-OK

Vehicle No: PTTX 147081

Specification: 1.2500" x 120.000" x 480.000"
ASTM A516 70-17/ASME SA516 70 PVQ 2015/2017 Normalized Test Coupons at 1650F Hold 30 Min per Inch of thickness Air Cooled NACE MR0175 Annex 2.1.2 (2015), MR0103(2016) Section 2.1.2 (2015) 13.1.1, 13.1.2) Compliant

Marking : 115393-OK

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
8504176	0.19	1.01	0.008	0.004	0.19	0.26	0.11	0.09	0.02	0.040	0.004	0.002	0.002		0.0040	0.0002	0.011	0.40	0.27
8504177	0.20	1.07	0.009	0.001	0.20	0.27	0.10	0.09	0.02	0.032	0.006	0.002	0.002		0.0027	0.0002	0.011	0.42	0.28

Plate Serial No	Pieces	Tons	Tensile Test Dir.	(psi) Yield	(psi) Tensile	Elong. % in 2"	Elong. % in 8"	
8504176-05	3	30.52	T	44,400	73,700		27.1	
			T	47,000	71,400		24.8	N
→ 8504177-01	5	51.04	T	43,900	73,500		25.9	
			T	46,600	72,300		25.5	N

CEQ=.42

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY VB DATE 5/10/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
J.F 8/17/2018

HOT ROLLED CARBON STEEL PLATE
Test coupons only, normalized 30 minutes per inch of thickness at 1650 F ± 25 F. Hold 30 minutes minimum. ;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate as-rolled, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@Nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2008 certified (#010940) by SRI Quality System Registrar (#0065-09). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant. DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate 14-HMPQA-723

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Dupreis

T. A. Dupreis, Metallurgist

6/30/2018 3:02:53 PM

CLIENTE / Customer / Client
INDUSTRIAL PIPING SPECIALISTS, INC
606 NORTH 145 EAST AVENUE
TULSA, OK 74116
USA

CERTIFICADO DE INSPECCION

Inspection Certificate - Certificat de Réception

FECHA: Date: **26/10/2022** | N.º No. **222251** | HOJA: Page: **1**

PRODUCTO / Article - Produit: **FLANGES**

SU PEDIDO N.º / Your Order No. / Votre Cde. N.º: **TP769202 TULSA**

DE / of. - de: **28/08/2022**

NORMAS APLICABLES / Requirements - Normes Applicables: **ASME B16.5-17**

MATERIAL CORRESPONDIENTE / Material Correspondent - Qualité: **ASME SA350LF2CL1-2-21/SA105M-21 ASTM A350LF2CL1-2-18/A105M-21**

MODO DE FUSION (*) / Steel Making - Elaboration de l'acier: **NACE MR0175/ISO15156-02/03-15 & NACE MR0103/ISO17945-15**

E = Elec. Y = Oxigeno básico

Company management certifications:
ISO 9001: 2015
ISO 14001: 2015
ISO 45001: 2018

Management Systems certified by LRQAE

Certified acc. PED 2014/68/UE+AD2000-W0 by TÜV Rheinland N.º 01 202 E/Q 02 7443 — UNE EN 10204:06 / 3.1, ISO 10474:13 / 3.1

MARCA DEL FABRICANTE / Mark of factory / Marque du fabricant

DEPARTAMENTO / Section / Département: **QUALITY ASSURANCE**

ULMA FORJA, S.COOP.
Bº Zubillaga, 3 - Apdo. 14
20560 OÑATI (Gipuzkoa) SPAIN
Tel : 34 - 943 780552
Fax: 34 - 943 781808
E-mail: ulma@ulmaforge.com

Packing List: 172392
Expedition : 414467

PARTIDA / Item / Poste	CANTIDAD / Quantity / Quantité	DESCRIPCION / Description / Description		OBSERVACIONES / Remarks / Observations (*)	COLADA N.º / Heat No / N.ºCoulée	RESISTENCIA T.Strength / Resist Rupt N/mm2	LIMITE ELAST Y.Strength 0.2 % N/mm2	ALARGAM. Elongation Allongement Lo:50mm/4d %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résilience Joules			CHARPY V 10x10mm MEDIA Average Moyenne	°C	DUREZA Hardness Dureté HBW	
10 FU1215RFBLNL2	45	BLIND 12 150LB RF A105N/A350LF2	**01G204**	NE	52AV2	521	325	38,60	74,65	105	114	111	110	-50	141	142
36 FU660RFBLNL2	11	BLIND 6 600LB RF A105N/A350LF2	**20J204**	NE	46HC22	507	307	37,92	74,37	95	83	92	90	-50	143	143
50 FU1.530RFSWXHNL2	105	SW 1.1/2 300LB XS/80 RF A105N/A350LF2	**20S207**	NE	77AV22	509	327	38,07	72,33	61	76	45	61	-50	140	143
62 FU815RFWNSTDNL2	36	WN 8 150LB STD/40 RF A105N/A350LF2	**05G209**	NE	03AE9	521	291	33,50	76,58	49	34	68	50	-50	146	149
75 FU1615RFWNXHNL2	20	WN 16 150LB XS/40 RF A105N/A350LF2	**12S208**	NE	A32A2	546	346	38,42	73,35	109	109	51	90	-50	152	152
100 FU430RFWN160NL2	48	WN 4 300LB S160 RF A105N/A350LF2	**27L216**	NE	43HC22	524	347	35,60	72,33	110	104	103	106	-50	146	149

COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE

COLADA N.º / Heat No / Ladle: L / Product: P	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	B %	CEq %	Origin of Steel
52AV2 L	0,180	0,220	1,160	0,010	0,002	0,090	0,090	0,010	0,002	0,003	0,180	0,031	0,002	0,0004	0,41	Ukraine
46HC22 L	0,180	0,210	1,140	0,010	0,003	0,080	0,100	0,010	0,002	0,003	0,140	0,035	0,002	0,0003	0,40	Ukraine
77AV22 L	0,183	0,210	1,070	0,015	0,003	0,100	0,060	0,010	0,002	0,004	0,120	0,027	0,002	0,0001	0,40	Spain
03AE9 L	0,140	0,280	1,300	0,006	0,001	0,080	0,220	0,090	0,002	0,071	0,110	0,027	0,002	0,0004	0,43	Italy
A32A2 L	0,170	0,210	1,200	0,012	0,003	0,050	0,070	0,005	0,001	0,003	0,150	0,035	0,001	0,0004	0,40	France
43HC22 L	0,180	0,230	1,160	0,007	0,002	0,070	0,070	0,008	0,001	0,002	0,120	0,029	0,002	0,0003	0,40	France

- Las dimensiones y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

EL INSPECTOR
Works Inspector - L'Inspecteur

ULMA FORJA S.COOP.
Dpto. Control de calidad
Quality Control Dept.

(*) OBSERVACIONES: Remarks / Observations: N_NORMALIZED ABOVE 900ºC AND COOLED IN AIR.

A22-13314-3-6-FL		43HC22	LN: 1	T0526649-1	FU430RFWN160NL2

| A22-13314-3-6-FL | | | 121087 | LN: 2 | T0526649-1 | FSTR4160PSL2 | |

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

FSTR 4160 PSL2

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

QUALITY MANAGEMENT SYSTEM certified by LRQA

THE BILLETS AND THE MATERIAL COVERED BY THIS CERTIFICATE ARE MANUFACTURED AT OUR STEEL PLANT IN AMURRIO, SPAIN.

Nº 0000342223/1 Rev. 000

CLIENTE: CUSTOMER	INDUSTRIAL PIPING SPECIALIST (IPS) P.O. BOX 581270	PEDIDO / PARTIDA: P.ORDER / ITEM	HR077735 022
PRODUCTO: ARTICLE	TUBERÍA SIN SOLDADURA LAMINADA EN CALIENTE HOT FINISHED SEAMLESS TUBES	CLI. MATERIAL: CLIENT MATERIAL	FSTR4160PSL2
EXTREMOS: ENDS	BISELADOS BEVELLED ENDS	REF. FABRICA: WORK ORDER	300018926 000220
NORMA / GRADO: APL.STANDARD AND GRADE	ASTM A53/A53M-12/ASME II SA-53/SA-53M2015/ASTM A106/A106M-15/ASME II SA-106/SA-106M2015/API 5L2012 45THED,PSL2 B/C/BN/X42N	PROTECCIÓN SUPERF: EXT. COATING	LACA SECA EXTERIOR EXTERNALLY DRY LACQUERED
ESPEC. ADICIONALES: ADITIONAL SPECS.	NACE MR0103 NACE MR0175/ISO 15156	PROCESO FUSION: MELTING PROCESS	HORNO ELECTRICO ACERO TOTALMENTE CALMADO ELECTRIC FURNACE // FULLY KILLED
FAB. DE PALANQUILLA: BILLETS MANUFACTURE	COLADA CONTINUA CONTINUOUS CASTING		
DIMENSIONES: DIMENSIONS	4" NB X SCH 160 X 40-44 FT.		
MARCAS: MARKING	ESTAMPADO: DIE STAMPING		
	PINTADO: STENCILLED	TRI API SPEC 5L 5L-0014 (SELLO API) (MM/AA) 4.500 0.531 BN/X42N L245N/ L290N PSL2 SMLS HN (HEAT) 2.970 FSI (LENGTH IN FEET) FT ASTM/ASME A/SA 53 A/SA106 B/C N.D.E. S - SPAIN	
	CODIGO COLOR: COLOUR CODE		
TRAT. TERMICO: HEAT TREATMENT	NORMALIZADO. HORNO CONTINUO. / NORMALIZED (CONT. FURNACE) 920 °C		

DESCRIPCION SUMINISTRO / DESCRIPTION OF DELIVERY

ITEM FAB. T.R. ITEM	ITEM CLI. CLIENTS ITEM	LONG.INDIV. (F) INDIVIDUAL LENGTH	COLADA CAST NR.	Nº TUBOS QUANTITY	LONG. TOTAL (F) LENGTH	PESO(KG) WEIGHT
000220		40,000 - 44,000	121087	138	5.977,166	61.006
TOTAL				138	5.977,166	61.006

Lista de Bultos / Packing 478630
Lisi

TUBOS REUNIDOS INDUSTRIAL GARANTIZA QUE TODOS LOS TUBOS CUBIERTOS POR ESTE CERTIFICADO CUMPLEN LOS REQUISITOS DEL PEDIDO Y CON LAS ESPECIFICACIONES ARRIBA MENCIONADAS.
TUBOS REUNIDOS INDUSTRIAL CERTIFY THAT ALL THE TUBES COVERED BY THIS CERTIFICATE COMPLY WITH ORDER REQUIREMENTS AND ABOVE MENTIONED SPECIFICATIONS.

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villaluenga
P.O.

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

QUALITY MANAGEMENT SYSTEM certified by LRQA

EN 10204:2004 / 3.1

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS NO DESTRUCTIVOS / NON DESTRUCTIVE TESTS

ENSAYO / TEST	%CONTROL / TEST RATE(%)	REQUISITOS / REQUIREMENTS	RESULTADO / RESULT
VISUAL Y DIMENSIONAL/ VISUAL & DIMENSIONAL INSP.	100%		O.K.
P.HIDROSTATICA/ HYDROTEST	100%	2.970,0 PSI 5 SEC.	O.K.
CORRIENTES INDUCIDAS/ EDDY CURRENTS	100%	ASTM E 309. N12.5/HS 3.2 MM	O.K.
DISPERSION FLUJO/ FLUX LEAKAGE	100%	ASTM E 570. N12.5	O.K.
MAGNETISMO RESIDUAL/ RESIDUAL MAGNETISM		MAX 30,0 GAUSS	

ENSAYOS TECNOLÓGICOS Y METALÚRGICOS / TECHNOLOGICAL AND METALLURGICAL TEST

APLASTADO /FLATTENING: AC/ A/SA53/SA106/5L -OK

ANALISIS DE COLADA / CAST ANALYSYS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1770	0,81	0,30	0,008	0,0027	0,094	0,1679	0,0588	0,2676	0,0006	0,0024	0,0011	0,0001	0,37

ANALISIS DE PRODUCTO / PRODUCT ANALYSIS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1700	0,80	0,28	0,007	0,0023	0,090	0,1700	0,0600	0,2800	0,0030	0,0010	0,0020	0,0001	0,36
121087	0,1700	0,80	0,29	0,007	0,0025	0,090	0,1800	0,0600	0,2800	0,0030	0,0010	0,0010	0,0001	0,36

FORMULAS

	(01)
MIN.	
MAX.	1,000
121087	0,603
121087	0,613

(01) Cr + Ni + Mo + Cu + V

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL

Alex Villasuso

P.O.:

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

QUALITY MANAGEMENT SYSTEM certified by LRQA

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS DE TRACCIÓN / TENSILE TEST

COLADA CAST	Nº	L/T (1)	T/P (2)	DIMENSION (inches)	L.ELAST. YIELD POINT (Mpa) (3)	R.TRACC. T.STRENGTH (Mpa)	ALARG. ELONG. (%) (4)	Estricción Reduction of Area (%)	DUREZA HARDNESS (HRB)	E / R
MIN.					290	485				
MAX.					495	655			99	0,00
121087	1	L	P	0,976 x 0,535	322	500	42		80	0,64
121087	2	L	P	0,965 x 0,520	318	510	40		80	0,62

(1) : L = LONGITUDINAL // T = TRANSVERSAL
(2) : T = Full size tube // P = Strip specimen
(3) : yield point (0,2%)
(4) : Lo = 2" (50 mm)

ENSAYOS DE IMPACTO - CHARPY V. / IMPACT TEST

COLADA CAST	Nº	L/T (1)	DIMENS (inches)		T.ª (ºC)	RESILIENCIA IMPACT TEST (J)		AVG (J)	AREA DUCTIL SHEAR AREA (%)		Exp. Lateral LATERAL EXP.
			10	10,00	0	21	27				
			10		999						
121087	1	T	0,394	0,197	0	71	72	66	70	90	1,20

(1) : L = LONGITUDINAL // T = TRANSVERSAL

ANEXOS / ANNEX

" BILLETS ARE PRODUCED AT OUR AMURRIO STEEL PLANT, SPAIN, WHICH IS ALSO CERTIFIED TO ISO 9001, THE SAME AS OUR TUBE PLANT ".

" NO WELD REPAIR "
" MERCURY FREE "

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villarreyes

P.O.:

ANTHONY CARDWELL
04/03/2023

FEDERAL FLANGE

MATERIAL TEST REPORT

FFI-QACON-F0003

Revision: 08, 05/02/2017

Mill Test Report				
INDUSTRIAL PIPING SPECIALIST	Purchase Order:	TP732627X		
PO BOX 581270	Sales Order:	174007		
TULSA,OK 74158	Line Item:	1	Qty:	112

Item Code:	FF105AU010A	Material:	A/SA105N /A/SA350 LF2 CL1
Description:	2 300# RF LONG W/N 9"		Manufactured in the U.S.A.
FID:	A7257	Heat Code:	21801292

Element		Ladle
C	Carbon	0.1900
Mn	Manganese	1.2200
P	Phosphorous	0.0130
S	Sulphur	0.0060
Si	Silicon	0.2800
Cu	Copper	0.0230
Ni	Nickel	0.0160
Cr	Chromium	0.0220

Element		Ladle
N	Nitrogen	
Mo	Molybdenum	0.0000
V	Vanadium	0.0030
CbNb	Columbium/Niobium	0.0010
Ti	Titanium	
Al	Aluminum	
B	Boron	0.0000
Sn	Tin	

Additional Chemicals

Melting Practice	EFVR	Reduction Ratio	>3

Mechanical Test Results			
Tensile (PSI)	77,595		
Yield (PSI)	48,877		
Elong (%)	32.00		
Red (%)	75.00		
CE	0.4009		
PCM			
HBW	154	to	156
CVN Test Temperature	-50		°F
Ft/Lbs.	109	135	121
Shear (%)	60	75	70
MLE	0.60	0.80	0.70
Charpy Sample	10 X 10 X 55mm		
QTC Type & Size			

Heat Treatment Information	
Normalizing Temperature (°F)	1670
Normalizing Time (HRS)	3

Additional Comments

MADE TO FINE GRAIN PRACTICE

D. Maldonado

Guadalupe Maldonado- Quality Representative

12/9/2021

Date

Product is compliant with NACE MR0175/ISO 15156 / Product is compliant with NACE MR0103
No weld repair is performed.
The product is free of Mercury contamination.
Tensile test is taken from round specimen.
Yield Strength is determined using 0.2% offset method, unless otherwise specified.
When reported on the MTR: Tensile testing per ASTM E 8, Charpy impact testing per ASTM E 23 and Brinell Hardness Testing per ASTM E 10.
Federal Flange manufactures products according to a certified QMS conforming to ISO 9001:2015.
Products are manufactured in compliance to EN 10204 Type 3.1.

Physical Address: 4014 Pinemont Dr. | Houston, TX 77018
Telephone: (713) 681-0606 | Fax: (713) 681-3005

ANTHONY CARDWELL
04/03/2023

MANNESMANN PRECISION TUBES
A Member of the Salzgitter Group

Inspection Certificate

acc to EN 10204/3.1

Certificate no.: 9220355

Purchaser:	Webco Industries, Inc 74063 Sand Springs OK	Your order no.:	10075464
Manufacturer:	Mannesmann Precision Tubes Netherlands B.V. NL-Helmond	Our order no.:	3400033

Product: Seamless cold drawn low-carbon steel heat exchanger and condenser tubes.

Specification: (S)A 179 / (S)A 450 / NACE MR0103-05 / NACE MR0175

Steelgrade:	A 179 SA 179	acc. to norm:	A179 SA179	Edition:	2021 2021

Marking: On tubes / On tags

Manufacturer's mark: **MPT-HE**

Process: Basic oxygen steel

Stamp of the mill's inspector: **(Q-MPT-NL)**

Steelmarks: (S)A 179 + N

Shipping no.: 4400548
Our shipping date: 19-05-2022

Extent of the delivery:

Item	Numbers	Dimension			Heat no.	Sample no.
70	1357	1,000" OD x 0,083" MW x 26'0"	10754,30 m	13720 kg	323095	1-6

Shipping marks:
PO : 10075464
Item : 00007
Mat. : A32010000830B
Quantity : 1357pcs.
Tag Nr. : PO# A22-13314 T-3, 4,, 5, 6
ASTM/ASME A/SA 179 SMLS
Grade 1010
OD: 1,0000" inches
Wall: 0.0830 inches MW Wall
Melting Western Europe
Hot finished tube fabrication in Germany
Cold drawn in The Netherlands
Max. 1 heat per bundle – Max 1 heat per box

	C	Mn	P	S	Cr		Heat no.
Requirements:	*0,06-0,18*	*0,27-0,63*	*≤0,035*	*≤0,035*			
Heat analysis (%)	0,16	0,51	0,016	0,002	0,04		323095

	Mo	V	Cu	Ni	Sn		Heat no.
Requirements:							
Heat analysis (%)	0,01	0,001	0,02	0,03	0,001		323095

Heat treatment: Normalized at 920 °C

Remarks: It is certified that the products have been tested in accordance to purchase specifications and found satisfactory

Helmond(NL.) : 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022

MANNESMANN
PRECISION TUBES
A Member of the Salzgitter Group

Test results

Certificate no.: 9220355

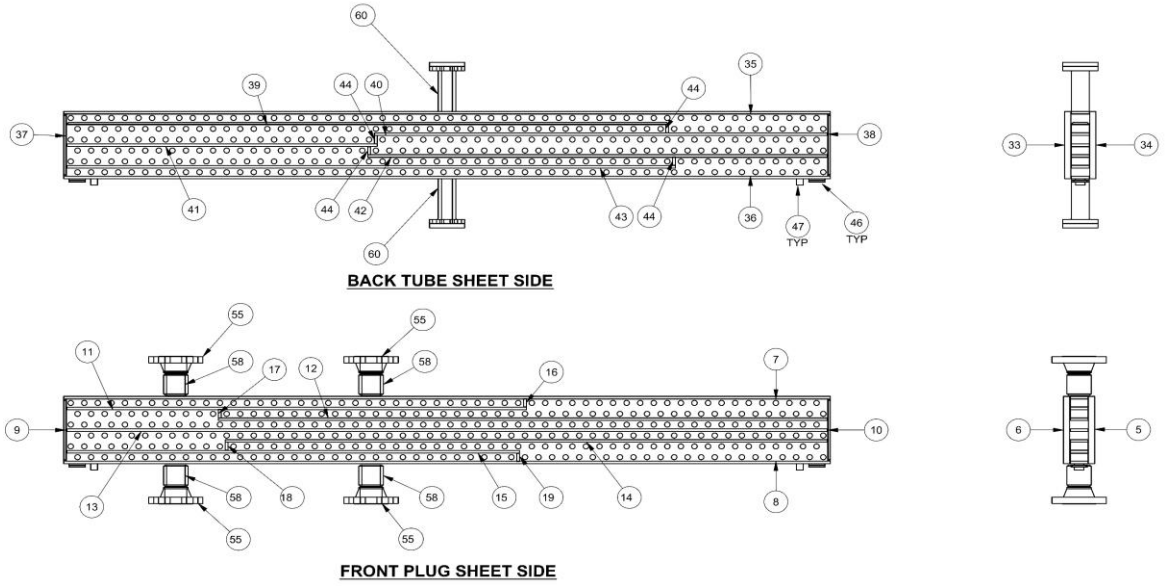
1. Visual inspection and control of dimensions: OK
2. Eddy current test acc. to: E309: OK
3. Flattening test: OK
   Flaring test: OK
4. Hardness test: OK

Mechanical data	Dimensions of the test tube mm	Hardness HRB
Requirements:		*Max 72*
1	25,40 x 2,26	70
2		71
3		70
4		70
5		71
6		72

Helmond: 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022



Mark No	MATERIAL DESCRIPTION		
	SUPPLIERS	HEAT No.	MATERIAL
5/6	SSAB	W2L569	SA-516-70N
7	NUCOR	1600009	SA-516-70N
8	NUCOR	1600009	SA-516-70N
9	NUCOR	1600009	SA-516-70N
10	NUCOR	1600009	SA-516-70N
11	SSAB	E2D332	SA-516-70N
12	NUCOR	1600009	SA-516-70N
13	NUCOR	1600009	SA-516-70N
14	NUCOR	1600009	SA-516-70N
15	SSAB	E2D332	SA-516-70N
16	SSAB	E2D332	SA-516-70N
17	SSAB	E2D332	SA-516-70N
18	SSAB	E2D332	SA-516-70N
19	SSAB	E2D332	SA-516-70N
33	SSAB	W2L569	SA-516-70N
34	SSAB	W2L569	SA-516-70N
35	NUCOR	1600009	SA-516-70N
36	NUCOR	1600009	SA-516-70N
37	NUCOR	1600009	SA-516-70N
38	SSAB	E2D332	SA-516-70N
39	NUCOR	1600009	SA-516-70N
40	SSAB	E2D332	SA-516-70N
41	NUCOR	1600009	SA-516-70N
42	SSAB	E2D332	SA-516-70N
43	NUCOR	1600009	SA-516-70N
44	SSAB	E2D332	SA-516-70N
46	SSAB	W1G769	SA-516-70N
47	NUCOR	8504177	SA-516-70N
48	SSAB	W1G769	SA-516-70N
55	ULMA	43HC22	SA-350LF2
58	TUBOS REUNIDOS	121087	SA-106B
60	FEDERAL FLANGE	21801292	SA-350LF2
TUBES	MANNESMANN	323095	SA-179

CUSTOMER:	AIR PRODCUTS MANUFACTURING, LLC.		FABSCO SHELL & TUBE, LLC
PO NO:	4505606038/ A8KM-4-406-PO-3	DATE	
ITEM NO:	18-XF-261D	AC	DWG No: A22-13314-6A-HS REV: 0

PO/Rel MTR 6755

PART NO.

Attn:

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SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 5: Date 22 Aug 2022

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.:TUL-400 | Mill Order No. 41-694122-11 | Shipping Manifest: AR370350

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -50F/A673-P

Ship Date: 30 Dec 22 | Cert No: 081086435
Cert Date: 30 Dec 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 1.125 X 120.0 X 480.0 (IN)

Tested Pieces:				Tensiles:					Hardness	Charpy Impact Tests								
Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Tst Dir		Abs. Energy(FTLB) 1 2 3 Avg	% Shear 1 2 3 Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W2L569	C55	1.132 (DISCRT)	C	51	75		50	T		100 100 83 94		-50F	L	10.	
W2L569	C56	1.133 (DISCRT)	C	50	74		51	T		78 96 79 84		-50F	L	10.	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W2L569	.19	1.03	.010	.002	.25	.024	.024	.23	.13	.15	.03	.004	.002	.007	.0001	.42	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-2:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
BSK EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 50 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:
W2L569 C56 40098137 PCES: 1, LBS: 18377 W2L569 C55 40098131 PCES: 1, LBS: 18377

CEQ = .42

(*) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

ANTHONY CARDWELL
04/03/2023

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MTR 6676

AMERICAN ALLOY
PLATE #523719

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

1505 River Rd
Cofield, NC 27922
(252) 356-3700

NUCOR
It's Our Nature.

Issuing Date : 01/07/2021 **B/L No. : 578594** **Load No. : 592141** **Our Order No. : 183999/2** **Cust. Order No. : 126001-OK**

Vehicle No: TTPX814051

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Specification: 0.5000" x 96.000" x 480.000"
ASTM A516 70/65/60-17/ASMESA516-70/65/60 PVQ 2019/2017
Normalized Plate NACEMR0175 Annex 2.1.2 (2015), MR0103 (2010)
Section 2.1.2 Compliant (2015) 13.1.1, 13.1.2) Vacuum Degassed

Marking : 126001-OK

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
1600009	0.19	1.06	0.008	0.001	0.21	0.22	0.09	0.12	0.04	0.024	0.004	0.003	0.002	0.0078	0.0016	0.0003	0.010	0.42	0.27

Tensile Test / **Heat Treat**

Plate Serial No	Pieces	Tons	Dir.	Yield (psi)	Tensile (psi)	Elong. % in 2"	Elong. % in 8"	Norm (°F)	Time (min)	Temper (°F)	Time (min)
1600009-02	4	13.06	H-T	52,500	77,600	41.6		1650	23		

Charpy Impacts

Plate Serial No	Pieces	Tons	Dir.	Absorbed Energy (Ft-lbs) 1	2	3	Ave	Min	Lateral Expansion (in.) 1	2	3	Ave	Min	Shear (%) 1	2	3	Ave	Min	Temp (°F)	Size
1600009-02	4	13.06	H-L	66.9	74.5	52.4	64.6	15											-50	10mm

CEQ = .42

MATERIAL CONFORMS TO
NACE MR0175
BHN 103 TO 159
CERTIFIED BY
AMERICAN ALLOY STEEL
BY PD DATE 1/23/23

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL
JL 6/11/2021

HOT ROLLED CARBON STEEL PLATE
TEST COUPONS TAKEN FROM HEAT TREATED PLATE
Piece frequency charpy;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2015 certified. PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant.
DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate QA-3624366

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Depretis, Metallurgist

1/7/2021 2:00:39 PM

ANTHONY CARDWELL
04/03/2023

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Certificate of Mill Test Result

PO/Rel TUL-000000-000 Pg 1/1

PART NO. MTR 6603 Attn:

SSAB

12400 Highway 43 North, Axis, Alabama 36505, US

Test Certificate

⚠ WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
CHAPEL STEEL CORPORATION
PO BOX 1000

SPRING HOUSE
PA 19477

Customer P.O.No.: TUL-320 | **Mill Order No.** 41-673801-02 | **Shipping Manifest:** AR357250

Product Description: ASME SA516-70/SA516-65/SA516-60(21)
ASTM A516-70/A516-65/A516-60(17)
VACUUM DEGAS; C.23%,S.015% MAX;ELG 2"
LCVN 20 FT.LBS. @ -60F/A673-P

Size: 0.500 X 96.00 X 480.0 (IN)

Ship Date: 22 May 22 | **Cert No:** 081047524
Cert Date: 22 May 22 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Tested Pieces:				Tensiles:						Charpy Impact Tests							
Heat Id	Piece Id	Tested Thickness	Tst Loc	YS (KSI)	UTS (KSI)	%RA	Elong % 2in 8in	Tst Dir	Hardness	Abs. Energy(FTLB) 1 2 3 Avg	% Shear 1 2 3 Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
E2D332	D07	0.502 (DISCRT)	C	55	77		39	T		44 108 104 85		-60F	L	10.	
E2D333	D08	0.502 (DISCRT)	C	55	76		40	T		112 80 55 82		-60F	L	10.	

Chemical Analysis																	
Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
E2D332	.19	1.03	.010	<.001	.24	.032	.031	.27	.13	.13	.02	.002	.003	.008	.0002	.42	USA
E2D333	.18	1.02	.010	.001	.25	.031	.030	.26	.14	.13	.03	.002	.003	.008	.0002	.41	USA

KILLED STEEL.
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
NACE MR0175/ISO15156-2:2015 ANNEX A2.1.2 COMPLIANT
NACE MR0103/ISO 17495-1:2015 13.1.1(A) AND 13.1.1(C) COMPLIANT
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 22 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

E2D332	D07	40084899	PCES:	1,	LBS:	6534	E2D332	D07	40084897	PCES: 1,	LBS: 6534
E2D332	D07	40084901	PCES:	1,	LBS:	6534	E2D333	D08	40084893	PCES: 1,	LBS: 6534
E2D332	D07	40084898	PCES:	1,	LBS:	6534	E2D332	D07	40084900	PCES: 1,	LBS: 6534

CEQ=.42

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Jason Thomas
Director Technical Services

Doc No. 393264 Indexed 24May22 by 145larro

AMERICAN ALLOY
PLATE #5249374

MTR 6205

SSAB

Test Certificate

12400 Highway 43 North, Axis, Alabama 36505, US

WARNING: This product can expose you to chemicals including nickel and nickel compounds, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Form TC1: Revision 4: Date 6 Feb 2019

Customer:
AMERICAN ALLOY STEEL, INC.
P.O. BOX 40469

HOUSTON
TX 77240-0469

Customer P.O.No.:127881-OK | Mill Order No. 41-648373-01 | Shipping Manifest: AR340960

Product Description: ASME SA516-70/SA516-65/SA516-60(19)
ASTM A516-70/A516-65/A516-60(17)
LCVN 15 FT.LBS@-50F/A673-P,VACUUM DEGAS

Ship Date: 11 Aug 21 | Cert No: 081001692
Cert Date: 11 Aug 21 | (Page 1 of 1)

Heat Treat Type: NORMALIZED

Size: 0.250 X 120.0 X 480.0 (IN)

Tested Pieces:

Heat Id	Piece Id	Tested Thickness	Tst Loc	Tensiles: YS (KSI)	UTS (KSI)	%RA	Elong % 2in	Elong % 8in	Tst Dir	Hardness	Charpy Impact Tests: Abs. Energy(FTLB) 1	2	3	Avg	% Shear 1	2	3	Avg	Tst Tmp	Tst Dir	Tst Siz (mm)	BDWTT Tmp %Shr
W1G769	B01	0.251 (DISCRT)	C	56	77		34		T		50	48	52	50					-50F	L	5.0	
→ W1G769	B04	0.251 (DISCRT)	C	53	74		35		T		45	53	43	47					-50F	L	5.0	

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Sol Al	Cu	Ni	Cr	Mo	Cb	V	Ti	B	IIW	ORGN
W1G769	.18	.92	.011	.001	.27	.028	.028	.30	.15	.10	.03	.001	.004	.014	.0002	.39	USA

KILLED STEEL
MERCURY IS NOT A METALLURGICAL COMPONENT OF THE STEEL AND NO MERCURY WAS INTENTIONALLY ADDED DURING THE MANUFACTURE OF THIS PRODUCT.
CEV (IIW) = C + MN/6 + (CR+MO+V)/5 + (NI+CU)/15
KILLED STEEL, PRODUCED TO A FINE GRAIN PRACTICE
EAF STEEL, CONTINUOUS CAST
MTR EN 10204:2004 INSPECTION CERTIFICATE 3.1 COMPLIANT
100% MELTED, POURED, AND ROLLED IN THE USA
CHARPY FULL SIZE EQUIVALENT = ABSORBED ENERGY AVG X 10 / TEST SIZE IN MM
NO WELD REPAIR HAS BEEN PERFORMED ON THIS MATERIAL.
NORMALIZED PLATES. HEATED AT 1665F FOR 14 MINUTES.
TEST COUPONS TAKEN FROM HEAT TREATED PLATE.
PRODUCTS SHIPPED:

CEQ = .39

W1G769	B04	40067978	PCES:	1,	LBS:	4084	W1G769	B04	40067977	PCES:	1, LBS: 4084
→ W1G769	B04	40067976	PCES:	1,	LBS:	4084	W1G769	B04	40067974	PCES:	1, LBS: 4084
W1G769	B04	40067973	PCES:	1,	LBS:	4084	W1G769	B04	40067982	PCES:	1, LBS: 4084
W1G769	B04	40067980	PCES:	1,	LBS:	4084	W1G769	B04	40067979	PCES:	1, LBS: 4084
W1G769	B04	40067975	PCES:	1,	LBS:	4084	W1G769	B04	40067972	PCES:	1, LBS: 4084
W1G769	B01	40067957	PCES:	1,	LBS:	4084	W1G769	B04	40067971	PCES:	1, LBS: 4084
W1G769	B01	40067958	PCES:	1,	LBS:	4084	W1G769	B04	40067983	PCES:	1, LBS: 4084
W1G769	B04	40067981	PCES:	1,	LBS:	4084	W1G769	B04	40067985	PCES:	1, LBS: 4084
W1G769	B04	40067984	PCES:	1,	LBS:	4084	W1G769	B01	40067964	PCES:	1, LBS: 4084
W1G769	B01	40067963	PCES:	1,	LBS:	4084	W1G769	B01	40067962	PCES:	1, LBS: 4084

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY PO DATE 8/4/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
VB 10/8/2021

(P) Cust Part #:

WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH, AND MEETS THE REQUIREMENTS OF, THE APPROPRIATE SPECIFICATION

Colt Beck
PRODUCT METALLURGIST

05/10/2021 From: AMERICAN ALLOY STEEL, INC. To: ACS STEEL CO., LLC
P.O.#: 5413 S.O.#: 683385 AA PL#: 5205503
Item: 7 (1 PC) 1-1/4" X 120" X 480"
AR STOCK

MTR 8053

NUCOR
PLATE MILL

P.O.Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

Page 1

1505 River Rd
Cofield, NC 27922
(252) 356-3700

AMERICAN ALLOY PLATE #5205503

NUCOR
It's Our Nature.

Issuing Date : 06/30/2018 B/L No. : 505891 Load No. : 515942 Our Order No. : 157228/23 Cust. Order No. : 115393-OK

Vehicle No: PTTX 147081

Specification: 1.2500" x 120.000" x 480.000"
ASTM A516 70-17/ASME SA516 70 PVQ 2015/2017 Normalized Test Coupons at 1650F Hold 30 Min per Inch of thickness Air Cooled NACE MR0175 Annex 2.1.2 (2015), MR0103(2016) Section 2.1.2 (2015) 13.1.1, 13.1.2) Compliant

Marking : 115393-OK

Sold To: AMERICAN ALLOY STEEL INC
6230 N HOUSTON ROSSLYN RD
PO BOX 40469
NORTH HOUSTON,TX 77091

Ship To: AMERICAN ALLOY STEEL
6350 N ERIE AVE
C/O SKOL TRACK #21
OWASSO,OK 74055

Heat No	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al(tot)	V	Nb	Ti	N	Ca	B	Sn	Ceq	Pcm
8504176	0.19	1.01	0.008	0.004	0.19	0.26	0.11	0.09	0.02	0.040	0.004	0.002	0.002		0.0040	0.0002	0.011	0.40	0.27
8504177	0.20	1.07	0.009	0.001	0.20	0.27	0.10	0.09	0.02	0.032	0.006	0.002	0.002		0.0027	0.0002	0.011	0.42	0.28

Plate Serial No	Pieces	Tons	Tensile Test Dir.	(psi) Yield	(psi) Tensile	Elong. % in 2"	Elong. % in 8"	
8504176-05	3	30.52	T	44,400	73,700		27.1	
			T	47,000	71,400		24.8	N
→ 8504177-01	5	51.04	T	43,900	73,500		25.9	
			T	46,600	72,300		25.5	N

CEQ=.42

MATERIAL CONFORMS TO
NACE MR0175
BHN 143 TO 149
CERTIFIED BY
AMERICAN ALLOY STEEL
BY VB DATE 5/10/21

Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.
Reviewed By:
J.F 8/17/2018

HOT ROLLED CARBON STEEL PLATE
Test coupons only, normalized 30 minutes per inch of thickness at 1650 F ± 25 F. Hold 30 minutes minimum. ;

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast discrete plate as-rolled, unless otherwise noted in Specification. For Mexico shipments:nhc-SalesMX@Nucor.com
Yield by 0.5EUL method unless otherwise specified. Ceq = C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
Pcm = C+(Si/30)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B
Melted and Manufactured in the USA. ISO 9001:2008 certified (#010940) by SRI Quality System Registrar (#0065-09). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant. DIN 50049 3.1.B/EN 10204 3.1B(2004), DIN EN 10204 3.1(2005) compliant. For ABS grades only, Quality Assurance certificate 14-HMPQA-723

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications, including customer specifications.

T. A. Dupreis

T. A. Dupreis, Metallurgist

6/30/2018 3:02:53 PM

CLIENTE / Customer / Client
INDUSTRIAL PIPING SPECIALISTS, INC
606 NORTH 145 EAST AVENUE
TULSA, OK 74116
USA

CERTIFICADO DE INSPECCION

Inspection Certificate - Certificat de Réception

FECHA: Date: **26/10/2022** | N.º No. **222251** | HOJA: Page: **1**

PRODUCTO / Article - Produit: **FLANGES**

SU PEDIDO N.º / Your Order No. / Votre Cde. N.º: **TP769202 TULSA**

DE / of. - de: **28/08/2022**

NORMAS APLICABLES / Requirements - Normes Applicables: **ASME B16.5-17**

MATERIAL CORRESPONDIENTE / Material Correspondent - Qualité: **ASME SA350LF2CL1-2-21/SA105M-21 ASTM A350LF2CL1-2-18/A105M-21**

MODO DE FUSION (*) / Steel Making - Elaboration de l'acier: **NACE MR0175/ISO15156-02/03-15 & NACE MR0103/ISO17945-15**

E = Elec. Y = Oxigeno básico

Company management certifications:
ISO 9001: 2015
ISO 14001: 2015
ISO 45001: 2018

Management Systems certified by LRQAE

Certified acc. PED 2014/68/UE+AD2000-W0 by TÜV Rheinland N.º 01 202 E/Q 02 7443 — UNE EN 10204:06 / 3.1, ISO 10474:13 / 3.1

MARCA DEL FABRICANTE / Mark of factory / Marque du fabricant

DEPARTAMENTO / Section / Département: **QUALITY ASSURANCE**

ULMA FORJA, S.COOP.
Bº Zubillaga, 3 - Apdo. 14
20560 OÑATI (Gipuzkoa) SPAIN
Tel : 34 - 943 780552
Fax: 34 - 943 781808
E-mail: ulma@ulmaforge.com

Packing List: 172392
Expedition : 414467

PARTIDA / Item / Poste	CANTIDAD / Quantity / Quantité	DESCRIPCION / Description / Description		OBSERVACIONES / Remarks / Observations (*)	COLADA N.º / Heat No / N.ºCoulée	RESISTENCIA T.Strength / Resist Rupt N/mm2	LIMITE ELAST Y.Strength 0.2 % N/mm2	ALARGAM. Elongation Allongement Lo:50mm/4d %	ESTRICCION Red. Area Striction %	RESILIENCIA Impact test Résilience Joules			CHARPY V 10x10mm MEDIA Average Moyenne	°C	DUREZA Hardness Dureté HBW	
10 FU1215RFBLNL2	45	BLIND 12 150LB RF A105N/A350LF2	**01G204**	NE	52AV2	521	325	38,60	74,65	105	114	111	110	-50	141	142
36 FU660RFBLNL2	11	BLIND 6 600LB RF A105N/A350LF2	**20J204**	NE	46HC22	507	307	37,92	74,37	95	83	92	90	-50	143	143
50 FU1.530RFSWXHNL2	105	SW 1.1/2 300LB XS/80 RF A105N/A350LF2	**20S207**	NE	77AV22	509	327	38,07	72,33	61	76	45	61	-50	140	143
62 FU815RFWNSTDNL2	36	WN 8 150LB STD/40 RF A105N/A350LF2	**05G209**	NE	03AE9	521	291	33,50	76,58	49	34	68	50	-50	146	149
75 FU1615RFWNXHNL2	20	WN 16 150LB XS/40 RF A105N/A350LF2	**12S208**	NE	A32A2	546	346	38,42	73,35	109	109	51	90	-50	152	152
100 FU430RFWN160NL2	48	WN 4 300LB S160 RF A105N/A350LF2	**27L216**	NE	43HC22	524	347	35,60	72,33	110	104	103	106	-50	146	149

COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE

COLADA N.º / Heat No / Ladle: L / Product: P	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Nb %	V %	Cu %	Al %	Ti %	B %	CEq %	Origin of Steel
52AV2 L	0,180	0,220	1,160	0,010	0,002	0,090	0,090	0,010	0,002	0,003	0,180	0,031	0,002	0,0004	0,41	Ukraine
46HC22 L	0,180	0,210	1,140	0,010	0,003	0,080	0,100	0,010	0,002	0,003	0,140	0,035	0,002	0,0003	0,40	Ukraine
77AV22 L	0,183	0,210	1,070	0,015	0,003	0,100	0,060	0,010	0,002	0,004	0,120	0,027	0,002	0,0001	0,40	Spain
03AE9 L	0,140	0,280	1,300	0,006	0,001	0,080	0,220	0,090	0,002	0,071	0,110	0,027	0,002	0,0004	0,43	Italy
A32A2 L	0,170	0,210	1,200	0,012	0,003	0,050	0,070	0,005	0,001	0,003	0,150	0,035	0,001	0,0004	0,40	France
43HC22 L	0,180	0,230	1,160	0,007	0,002	0,070	0,070	0,008	0,001	0,002	0,120	0,029	0,002	0,0003	0,40	France

- Las dimensiones y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.

- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

EL INSPECTOR
Works Inspector - L'Inspecteur

ULMA FORJA S.COOP.
Dpto. Control de calidad
Quality Control Dept.

(*) OBSERVACIONES: Remarks / Observations: N_NORMALIZED ABOVE 900ºC AND COOLED IN AIR.

A22-13314-3-6-FL		43HC22	LN: 1	T0526649-1	FU430RFWN160NL2

| A22-13314-3-6-FL | | | 121087 | LN: 2 | T0526649-1 | FSTR4160PSL2 | |

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

FSTR 4160 PSL2

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

QUALITY MANAGEMENT SYSTEM certified by LRQA

THE BILLETS AND THE MATERIAL COVERED BY THIS CERTIFICATE ARE MANUFACTURED AT OUR STEEL PLANT IN AMURRIO, SPAIN.

Nº 0000342223/1 Rev. 000

CLIENTE: CUSTOMER	INDUSTRIAL PIPING SPECIALIST (IPS) P.O. BOX 581270	PEDIDO / PARTIDA: P.ORDER / ITEM	HR077735 022
PRODUCTO: ARTICLE	TUBERÍA SIN SOLDADURA LAMINADA EN CALIENTE HOT FINISHED SEAMLESS TUBES	CLI. MATERIAL: CLIENT MATERIAL	FSTR4160PSL2
EXTREMOS: ENDS	BISELADOS BEVELLED ENDS	REF. FABRICA: WORK ORDER	300018926 000220
NORMA / GRADO: APL.STANDARD AND GRADE	ASTM A53/A53M-12/ASME II SA-53/SA-53M2015/ASTM A106/A106M-15/ASME II SA-106/SA-106M2015/API 5L2012 45THED,PSL2 B/C/BN/X42N	PROTECCIÓN SUPERF: EXT. COATING	LACA SECA EXTERIOR EXTERNALLY DRY LACQUERED
ESPEC. ADICIONALES: ADITIONAL SPECS.	NACE MR0103 NACE MR0175/ISO 15156	PROCESO FUSION: MELTING PROCESS	HORNO ELECTRICO ACERO TOTALMENTE CALMADO ELECTRIC FURNACE // FULLY KILLED
FAB. DE PALANQUILLA: BILLETS MANUFACTURE	COLADA CONTINUA CONTINUOUS CASTING		
DIMENSIONES: DIMENSIONS	4" NB X SCH 160 X 40-44 FT.		
MARCAS: MARKING	ESTAMPADO: DIE STAMPING		
	PINTADO: STENCILLED	TRI API SPEC 5L 5L-0014 (SELLO API) (MM/AA) 4.500 0.531 BN/X42N L245N/ L290N PSL2 SMLS HN (HEAT) 2.970 FSI (LENGTH IN FEET) FT ASTM/ASME A/SA 53 A/SA106 B/C N.D.E. S - SPAIN	
	CODIGO COLOR: COLOUR CODE		
TRAT. TERMICO: HEAT TREATMENT	NORMALIZADO. HORNO CONTINUO. / NORMALIZED (CONT. FURNACE) 920 °C		

DESCRIPCION SUMINISTRO / DESCRIPTION OF DELIVERY

ITEM FAB. T.R. ITEM	ITEM CLI. CLIENTS ITEM	LONG.INDIV. (F) INDIVIDUAL LENGTH	COLADA CAST NR.	Nº TUBOS QUANTITY	LONG. TOTAL (F) LENGTH	PESO(KG) WEIGHT
000220		40,000 - 44,000	121087	138	5.977,166	61.006
TOTAL				138	5.977,166	61.006

Lista de Bultos / Packing 478630
Lisi

TUBOS REUNIDOS INDUSTRIAL GARANTIZA QUE TODOS LOS TUBOS CUBIERTOS POR ESTE CERTIFICADO CUMPLEN LOS REQUISITOS DEL PEDIDO Y CON LAS ESPECIFICACIONES ARRIBA MENCIONADAS.
TUBOS REUNIDOS INDUSTRIAL CERTIFY THAT ALL THE TUBES COVERED BY THIS CERTIFICATE COMPLY WITH ORDER REQUIREMENTS AND ABOVE MENTIONED SPECIFICATIONS.

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villaluenga
P.O.

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

QUALITY MANAGEMENT SYSTEM certified by LRQA

EN 10204:2004 / 3.1

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS NO DESTRUCTIVOS / NON DESTRUCTIVE TESTS

ENSAYO / TEST	%CONTROL / TEST RATE(%)	REQUISITOS / REQUIREMENTS	RESULTADO / RESULT
VISUAL Y DIMENSIONAL/ VISUAL & DIMENSIONAL INSP.	100%		O.K.
P.HIDROSTATICA/ HYDROTEST	100%	2.970,0 PSI 5 SEC.	O.K.
CORRIENTES INDUCIDAS/ EDDY CURRENTS	100%	ASTM E 309. N12.5/HS 3.2 MM	O.K.
DISPERSION FLUJO/ FLUX LEAKAGE	100%	ASTM E 570. N12.5	O.K.
MAGNETISMO RESIDUAL/ RESIDUAL MAGNETISM		MAX 30,0 GAUSS	

ENSAYOS TECNOLÓGICOS Y METALÚRGICOS / TECHNOLOGICAL AND METALLURGICAL TEST

APLASTADO /FLATTENING: AC/ A/SA53/SA106/5L -OK

ANALISIS DE COLADA / CAST ANALYSYS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1770	0,81	0,30	0,008	0,0027	0,094	0,1679	0,0588	0,2676	0,0006	0,0024	0,0011	0,0001	0,37

ANALISIS DE PRODUCTO / PRODUCT ANALYSIS

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Ti	Nb	B	C.E.
MIN.		0,29	0,10											
MAX.	0,23	1,06	0,40	0,025	0,0100	0,300	0,3000	0,1500	0,4000	0,0600	0,0400	0,0500	0,0010	0,44
121087	0,1700	0,80	0,28	0,007	0,0023	0,090	0,1700	0,0600	0,2800	0,0030	0,0010	0,0020	0,0001	0,36
121087	0,1700	0,80	0,29	0,007	0,0025	0,090	0,1800	0,0600	0,2800	0,0030	0,0010	0,0010	0,0001	0,36

FORMULAS

	(01)
MIN.	
MAX.	1,000
121087	0,603
121087	0,613

(01) Cr + Ni + Mo + Cu + V

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL

Alex Villasuso

P.O.:

ANTHONY CARDWELL
04/03/2023

TUBOS REUNIDOS INDUSTRIAL, S.L.U

Barrio Sagarribai, 2 - 01470 AMURRIO (Spain)

EN 10204:2004 / 3.1

QUALITY MANAGEMENT SYSTEM certified by LRQA

CERTIFICADO DE CALIDAD
MILL TEST CERTIFICATE

Nº 0000342223/1 Rev. 000

ENSAYOS DE TRACCIÓN / TENSILE TEST

COLADA CAST	Nº	L/T (1)	T/P (2)	DIMENSION (inches)	L.ELAST. YIELD POINT (Mpa) (3)	R.TRACC. T.STRENGTH (Mpa)	ALARG. ELONG. (%) (4)	Estricción Reduction of Area (%)	DUREZA HARDNESS (HRB)	E / R
MIN.					290	485				
MAX.					495	655			99	0,00
121087	1	L	P	0,976 x 0,535	322	500	42		80	0,64
121087	2	L	P	0,965 x 0,520	318	510	40		80	0,62

(1) : L = LONGITUDINAL // T = TRANSVERSAL
(2) : T = Full size tube // P = Strip specimen
(3) : yield point (0,2%)
(4) : Lo = 2" (50 mm)

ENSAYOS DE IMPACTO - CHARPY V. / IMPACT TEST

COLADA CAST	Nº	L/T (1)	DIMENS (inches)		T.ª (ºC)	RESILIENCIA IMPACT TEST (J)		AVG (J)	AREA DUCTIL SHEAR AREA (%)		Exp. Lateral LATERAL EXP.
			10	10,00	0	21	27				
			10		999						
121087	1	T	0,394	0,197	0	71	72	66	70	90	1,20

(1) : L = LONGITUDINAL // T = TRANSVERSAL

ANEXOS / ANNEX

" BILLETS ARE PRODUCED AT OUR AMURRIO STEEL PLANT, SPAIN, WHICH IS ALSO CERTIFIED TO ISO 9001, THE SAME AS OUR TUBE PLANT ".

" NO WELD REPAIR "
" MERCURY FREE "

AMURRIO 23.10.2017

CONTROL DE CALIDAD DE TUBOS REUNIDOS INDUSTRIAL
TUBOS REUNIDOS INDUSTRIAL QUALITY CONTROL)
Alex Villarreyes

P.O.:

ANTHONY CARDWELL
04/03/2023

FEDERAL FLANGE

MATERIAL TEST REPORT

FFI-QACON-F0003

Revision: 08, 05/02/2017

Mill Test Report				
INDUSTRIAL PIPING SPECIALIST	Purchase Order:	TP732627X		
PO BOX 581270	Sales Order:	174007		
TULSA,OK 74158	Line Item:	1	Qty:	112

Item Code:	FF105AU010A	Material:	A/SA105N /A/SA350 LF2 CL1
Description:	2 300# RF LONG W/N 9"		Manufactured in the U.S.A.
FID:	A7257	Heat Code:	21801292

Element		Ladle
C	Carbon	0.1900
Mn	Manganese	1.2200
P	Phosphorous	0.0130
S	Sulphur	0.0060
Si	Silicon	0.2800
Cu	Copper	0.0230
Ni	Nickel	0.0160
Cr	Chromium	0.0220

Element		Ladle
N	Nitrogen	
Mo	Molybdenum	0.0000
V	Vanadium	0.0030
CbNb	Columbium/Niobium	0.0010
Ti	Titanium	
Al	Aluminum	
B	Boron	0.0000
Sn	Tin	

Additional Chemicals

Melting Practice	EFVR	Reduction Ratio	>3

Mechanical Test Results			
Tensile (PSI)	77,595		
Yield (PSI)	48,877		
Elong (%)	32.00		
Red (%)	75.00		
CE	0.4009		
PCM			
HBW	154	to	156
CVN Test Temperature	-50		°F
Ft/Lbs.	109	135	121
Shear (%)	60	75	70
MLE	0.60	0.80	0.70
Charpy Sample	10 X 10 X 55mm		
QTC Type & Size			

Heat Treatment Information	
Normalizing Temperature (°F)	1670
Normalizing Time (HRS)	3

Additional Comments

MADE TO FINE GRAIN PRACTICE

D. Maldonado

Guadalupe Maldonado- Quality Representative

12/9/2021

Date

Product is compliant with NACE MR0175/ISO 15156 / Product is compliant with NACE MR0103
No weld repair is performed.
The product is free of Mercury contamination.
Tensile test is taken from round specimen.
Yield Strength is determined using 0.2% offset method, unless otherwise specified.
When reported on the MTR: Tensile testing per ASTM E 8, Charpy impact testing per ASTM E 23 and Brinell Hardness Testing per ASTM E 10.
Federal Flange manufactures products according to a certified QMS conforming to ISO 9001:2015.
Products are manufactured in compliance to EN 10204 Type 3.1.

Physical Address: 4014 Pinemont Dr. | Houston, TX 77018
Telephone: (713) 681-0606 | Fax: (713) 681-3005

ANTHONY CARDWELL
04/03/2023

MANNESMANN PRECISION TUBES
A Member of the Salzgitter Group

Inspection Certificate

acc to EN 10204/3.1

Certificate no.: 9220355

Purchaser:	Webco Industries, Inc 74063 Sand Springs OK	Your order no.:	10075464
Manufacturer:	Mannesmann Precision Tubes Netherlands B.V. NL-Helmond	Our order no.:	3400033

Product: Seamless cold drawn low-carbon steel heat exchanger and condenser tubes.

Specification: (S)A 179 / (S)A 450 / NACE MR0103-05 / NACE MR0175

Steelgrade:	A 179 SA 179	acc. to norm:	A179 SA179	Edition:	2021 2021

Marking: On tubes / On tags

Manufacturer's mark: **MPT-HE**

Process: Basic oxygen steel

Stamp of the mill's inspector: **(Q-MPT-NL)**

Steelmarks: (S)A 179 + N

Shipping no.: 4400548
Our shipping date: 19-05-2022

Extent of the delivery:

Item	Numbers	Dimension			Heat no.	Sample no.
70	1357	1,000" OD x 0,083" MW x 26'0"	10754,30 m	13720 kg	323095	1-6

Shipping marks:
PO : 10075464
Item : 00007
Mat. : A32010000830B
Quantity : 1357pcs.
Tag Nr. : PO# A22-13314 T-3, 4,, 5, 6
ASTM/ASME A/SA 179 SMLS
Grade 1010
OD: 1,0000" inches
Wall: 0.0830 inches MW Wall
Melting Western Europe
Hot finished tube fabrication in Germany
Cold drawn in The Netherlands
Max. 1 heat per bundle – Max 1 heat per box

	C	Mn	P	S	Cr		Heat no.
Requirements:	*0,06-0,18*	*0,27-0,63*	*≤0,035*	*≤0,035*			
Heat analysis (%)	0,16	0,51	0,016	0,002	0,04		323095

	Mo	V	Cu	Ni	Sn		Heat no.
Requirements:							
Heat analysis (%)	0,01	0,001	0,02	0,03	0,001		323095

Heat treatment: Normalized at 920 °C

Remarks: It is certified that the products have been tested in accordance to purchase specifications and found satisfactory

Helmond(NL.) : 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022

MANNESMANN
PRECISION TUBES
A Member of the Salzgitter Group

Test results

Certificate no.: 9220355

1. Visual inspection and control of dimensions: OK
2. Eddy current test acc. to: E309: OK
3. Flattening test: OK
   Flaring test: OK
4. Hardness test: OK

Mechanical data	Dimensions of the test tube mm	Hardness HRB
Requirements:		*Max 72*
1	25,40 x 2,26	70
2		71
3		70
4		70
5		71
6		72

Helmond: 31-05-2022

Mannesmann Precision Tubes - NL
Inspector
B. van Lier

ANTHONY CARDWELL
10/24/2022

NIDEC MOTOR CORPORATION
8050 WEST FLORISSANT AVE.
ST. LOUIS, MO 63136

DATE: 10/31/2022

P.O. NO.: GA41
Order/Line NO.: 24829 MN 100

TO:

Model Number: GA41
Catalog Number: 8D25P2C
841 Plus Configuration
CONF,MOTOR,841 PLUS

REVISIONS:
(NONE)

ALL DOCUMENTS HEREIN ARE CONSIDERED CERTIFIED BY NIDEC MOTOR CORPORATION.
THANK YOU FOR YOUR ORDER AND THE OPPORTUNITY TO SERVE YOU.

Features:

Horsepower ..... 00025.00 ~ KW: 18.65
Enclosure ..... TEFC
Poles ..... 04 ~ RPM: 1800
Frame Size ..... 284~T
Phase/Frequency/Voltage.. 3~060~460
Winding Type ..... Random Wound
Service Factor 1.15
Insulation Class ..... Class "F" ~ Insulife 2000
Altitude In Feet (Max) .. 3300 Ft.(1000 M)
Ambient In Degree C (Max) +40 C
Assembly Position ..... "F-1" Assembly Position
Efficiency Class ..... Premium Efficiency
Application ..... Air Cooler Fan
~
Customer Part Number ....
"AK" Dimension (Inches).. NA
Temperature Rise (Sine Wave): "B" Rise @ 1.0 SF (Resist)
Design Letter ..... B
Starting Method ..... Direct-On-Line Start or VFD
Duty Cycle ..... Continuous Duty
Efficiency Value ..... 93.6 % ~ NEMA Nominal
Load Inertia: NEMA ~ Standard Inertia: 122 LB-FT2
Number Of Starts Per Hour: NEMA
Motor Type Code ..... CE

Rotor Inertia (LB-FT²)	3.48 LB-FT²
Qty. of Bearings PE (Shaft)	1
Qty. of Bearings SE (OPP)	1
Bearing Number PE (Shaft)	6310-J/C3
Bearing Number SE (OPP)	6310-J/C3

Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

NIDEC MOTOR CORPORATION

8050 WEST FLORISSANT AVE.
ST. LOUIS, MO 63136

DATE: 10/31/2022

P.O. NO.: GA41
Order/Line NO.: 24829 MN 100

TO:

Model Number: GA41
Catalog Number: 8D25P2C
841 Plus Configuration
CONF,MOTOR,841 PLUS

REVISIONS:
(NONE)

ALL DOCUMENTS HEREIN ARE CONSIDERED CERTIFIED BY NIDEC MOTOR CORPORATION.
THANK YOU FOR YOUR ORDER AND THE OPPORTUNITY TO SERVE YOU.

Accessories:

THIS MOTOR WILL BE LABELED AS: IEEE STD 841-2021 Inpro Seals - Both Ends
Stainless Steel T-Drains-Both
Corro-Duty
Special Foot Flatness
Grease Fittings/Press. Drains
Ground Lug In Conduit Box
Grounding Terminal on Frame (Two 3/8" dia UNC coarse threaded holes located in motor frame on each side of the junction box)
Precision Balance
Standard Leadtime: NA
F.O.B.:
PRIMARY GROUND
LOCATED IN MAIN
CONDUIT BOX

THIS MOTOR WILL BE~ LABELED AS:
IEEE STD 841-2021~

USE THE DATA PROVIDED BELOW TO SELECT THE APPROPRIATE DIMENSION PRINT

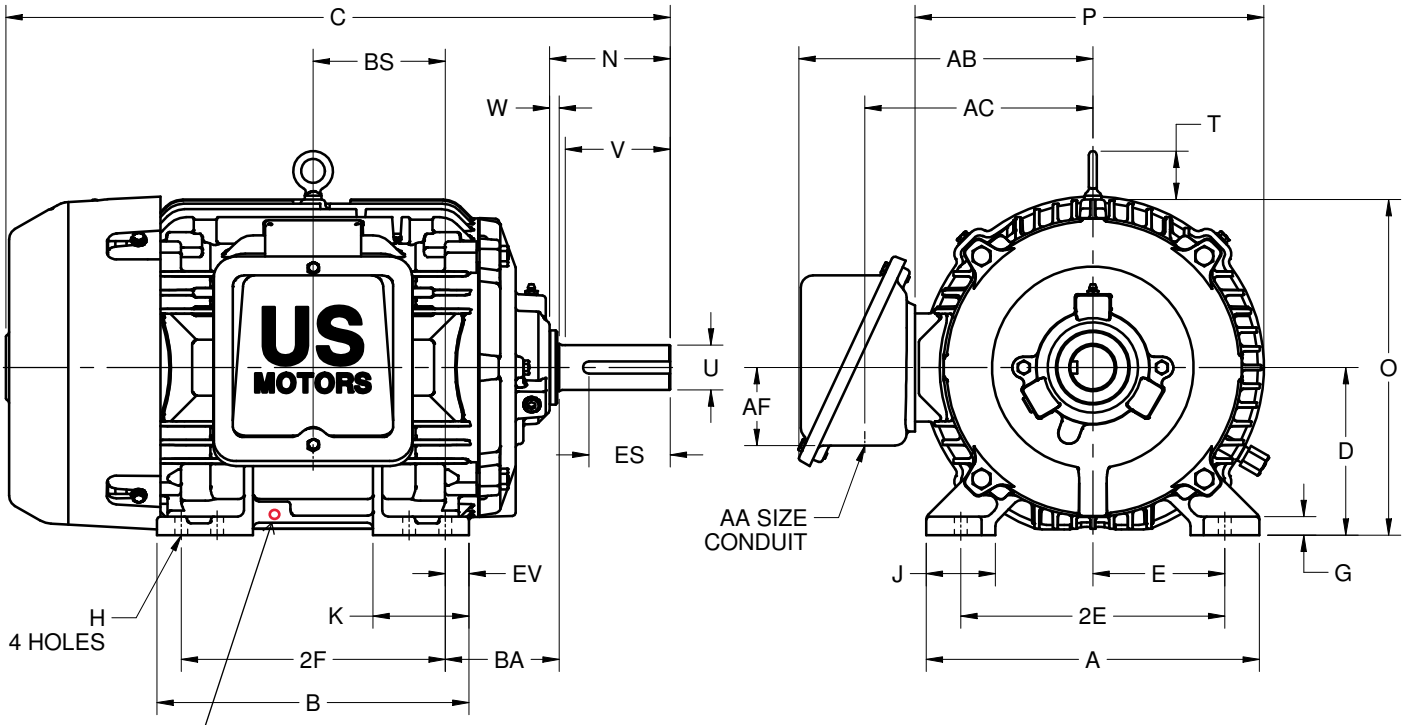
Horsepower	25
Pole(s)	04
Voltage(s)	460
Frame Size	284T
Shaft U Diameter	1.875
Outlet Box AF	3.25
Outlet Box AA	1.50

Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

- Additional Modifications -

(3) to make a total of (4) Grounding Lugs
in the Junction Box and Shaft
Slinger for Shaft Down.

EFFECTIVE: 02-FEB-18	DIMENSION PRINT WORLD MOTOR 841 PLUS FRAME: 284T, 286T BASIC TYPE: CE	PRINT: 08-1003
SUPERSEDES: 22-DEC-16		SHEET: 1 OF 1



(Two 3/8" dia UNC coarse threaded holes located in motor frame on each side of the junction box)

ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS

UNITS	A	B	C	D -.06	E	2E ±.03	G	H +.05	J	K	N	O	P [2]
IN	13.88	13.00	27.69	7.00	5.50	11.00	.78	.53	2.88	4.00	5.03	14.00	14.78
MM	353	330	703	178	140	279	20	13	73	102	128	356	375

UNITS	T	U -.001	V MIN	W	AA	AB	AC	AF	BA	BS	EV	ES MIN	SQ KEY
IN	2.03	1.875	4.38	.41	1-1/2 NPT	12.25	9.50	3.25	4.75	5.50	1.00	3.28	.500
MM	52	47.63	111	10		311	241	83	121	140	25	83	12.70

FRAME	UNITS	2F ±.03
284T	IN	9.50
	MM	241
286T	IN	11.00
	MM	279

Note:
4 grounding lugs located inside conduit box. Bolts are steel and lugs are SS or brass. Lug hole size = 3/8-inch diameter

1. DIMENSIONS MAY VARY .25" DUE TO CASTING AND/OR FABRICATION VARIATIONS
2. LARGEST MOTOR WIDTH
3. STANDARD ASSEMBLY POSITION F-1 IS SHOWN. F-2 IS PROVIDED WHEN SPECIFIED. CONDUIT OPENING MAY BE LOCATED IN STEPS OF 90° REGARDLESS OF THE LOCATION
4. TOLERANCES ARE SHOWN IN INCHES ONLY

Nidec Motor Corporation
St. Louis, Missouri

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ISSUED BY	R. TIMMERMANN
APPROVED BY	M. CULLEN

IHP_DP_NMCA (MAR-2011) SOLIDEDGE

NAMEPLATE DATA

CATALOG NUMBER:	8D25P2C		NAMEPLATE PART #:	2104620-007	
MODEL	GA41	FR	284T	TYPE	CE	ENCL	TEFC-IP55
SHAFT END BRG	6310-J/C3 - QTY 1		OPP END BRG	6310-J/C3 - QTY 1	
PH	3	MAX AMB	40 C	ID#			
INSUL CLASS	F	Asm. Pos.	F1	DUTY	CONT		

HP	25	RPM	1775	HP		RPM	
VOLTS	460			VOLTS			
FL AMPS	29.2			FL AMPS			
SF AMPS	33.0			SF AMPS			
SF	1.15	DESIGN	B	CODE	G	SF		DESIGN		CODE	
NEMA NOM EFFICIENCY	93.6	NOM PF	85.5	KiloWatt	18.65	NEMA NOM EFFICIENCY		NOM PF			
GUARANTEED EFFICIENCY	92.4	MAX KVAR	6.6	HZ	60	GUARANTEED EFFICIENCY		MAX KVAR		HZ	

HAZARDOUS LOCATION DATA (IF APPLICABLE):

DIVISION		CLASS I		GROUP I	
TEMP CODE		CLASS II		GROUP II	

Class 1 Div 2
Gas Group A,B,C,D
Temp Code T3C

VFD DATA (IF APPLICABLE):

VOLTS	460	AMPS	30.7
TORQUE 1	73.90LB-FT	TORQUE 2	
VFD LOAD TYPE 1	VT/PWM	VFD LOAD TYPE 2	
VFD HERTZ RANGE 1	3-60	VFD HERTZ RANGE 2	
VFD SPEED RANGE 1	90-1800	VFD SPEED RANGE 2	
SERVICE FACTOR	1.00	FL SLIP	
NO. POLES		MAGNETIZING AMPS	
VECTOR MAX RPM		Encoder PPR	
Radians / Seconds		Encoder Volts	

TEAO DATA (IF APPLICABLE):

HP (AIR OVER)		HP (AIR OVER M/S)		RPM (AIR OVER)		RPM (AIR OVER M/S)	
FPM AIR VELOCITY		FPM AIR VELOCITY M/S		FPM AIR VELOCITY SEC			

ADDITIONAL NAMEPLATE DATA:

Decal / Plate	WD=499495	Customer PN	
Notes		Non Rev Ratchet	
Max Temp Rise		OPP/Upper Oil Cap	GREASE
Thermal (WDG)		SHAFT/Lower Oil Cap	GREASE
Altitude		Usable At	
Regulatory Notes		Regulatory Compliance	CC 030A
COS		Marine Duty	
Balance	0.05 IN/SEC	Arctic Duty	
3/4 Load Eff.	94.2	Inrush Limit	
Motor Weight (LBS)	340	Direction of Rotation	
Sound Level		Special Note 1	
Vertical Thrust (LBS)		Special Note 2	
Thrust Percentage		Special Note 3	
Bearing Life		Special Note 4	
Starting Method		Special Note 5	
Number of Starts		Special Note 6	
200/208V 60Hz Max Amps		SH Max. Temp.	
190V 50 hz Max Amps		SH Voltage	
380V 50 Hz Max Amps		SH Watts	
NEMA Inertia		Load Inertia	
Sumpheater Voltage		Sumpheater Wattage	
Special Accessory Note 1		Special Accessory Note 16	
Special Accessory Note 2		Special Accessory Note 17	
Special Accessory Note 3		Special Accessory Note 18	
Special Accessory Note 4		Special Accessory Note 19	
Special Accessory Note 5		Special Accessory Note 20	
Special Accessory Note 6		Special Accessory Note 21	
Special Accessory Note 7		Special Accessory Note 22	
Special Accessory Note 8		Special Accessory Note 23	
Special Accessory Note 9		Special Accessory Note 24	
Special Accessory Note 10		Special Accessory Note 25	
Special Accessory Note 11		Special Accessory Note 26	
Special Accessory Note 12		Special Accessory Note 27	
Special Accessory Note 13		Special Accessory Note 28	
Special Accessory Note 14		Special Accessory Note 29	
Special Accessory Note 15		Special Accessory Note 30	
Heater in C/B Voltage		Heater in C/B Watts	
Zone 2 Group		Division 2 Service Factor	
Note 1	CL.I GR.A B C D	Note 2	CL.II GR.F
Note 3	T3C TEMP CODE DIV 2	Note 4	AT 1.0 S.F.
Note 5		Note 6	
Note 7		Note 8	
Note 9		Note 10	
Note 11		Note 12	
Note 13		Note 14	
Note 15		Note 16	
Note 17		Note 18	
Note 19		Note 20	
Note 21		Note 22	

NIDEC MOTOR CORPORATION
ST. LOUIS, MO

TYPICAL NAMEPLATE DATA
ACTUAL MOTOR NAMEPLATE LAYOUT MAY VARY
SOME FIELDS MAY BE OMITTED

Nidec trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

MOTOR PERFORMANCE

MODEL NO.	CATALOG NO.	PHASE	TYPE	FRAME
GA41	8D25P2C	3	CE	284T

ORDER NO.	24829	LINE NO.	

MPI:	217657
HP:	25
POLES:	4
VOLTS:	460
HZ:	60
SERVICE FACTOR:	1.15
EFFICIENCY (%):	
S.F.	93.1
FULL	93.6
3/4	94.2
1/2	93.8
1/4	90.8
POWER FACTOR (%):	
S.F.	86.3
FULL	85.5
3/4	82.5
1/2	74.6
1/4	54.2
NO LOAD	4.9
LOCKED ROTOR	40
AMPS:	
S.F.	33
FULL	29.2
3/4	22.6
1/2	16.7
1/4	11.9
NO LOAD	9.8
LOCKED ROTOR	195.5
NEMA CODE LETTER	G
NEMA DESIGN LETTER	B
FULL LOAD RPM	1775
NEMA NOMINAL / EFFICIENCY (%)	93.6
GUARANTEED EFFICIENCY (%)	92.4
MAX KVAR	6.6
AMBIENT (°C)	40
ALTITUDE (FASL)	3300
SAFE STALL TIME-HOT (SEC)	30
SOUND PRESSURE (DBA @ 1M)	0
TORQUES:	
BREAKDOWN{% F.L.}	280
LOCKED ROTOR{% F.L.}	210
FULL LOAD{LB-FT}	73.9

NEMA Nominal and Guaranteed Efficiencies are up to 3,300 feet above sea level and 25 ° C ambient

The Above Data Is Typical, Sinewave Power Unless Noted Otherwise

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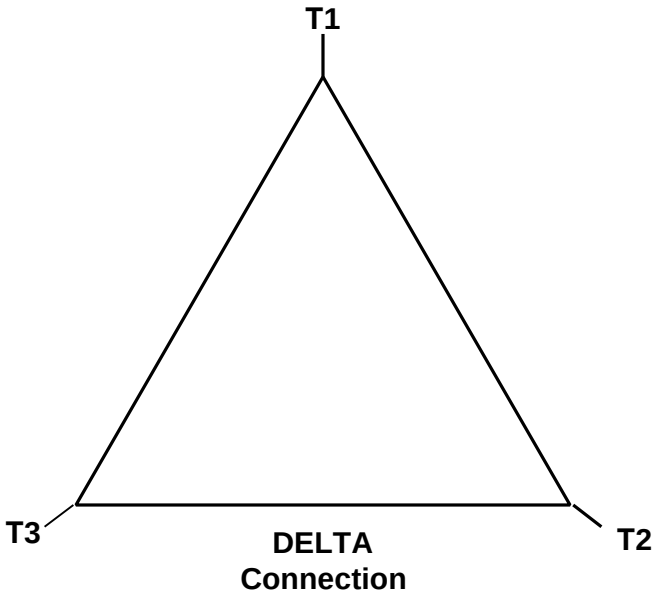
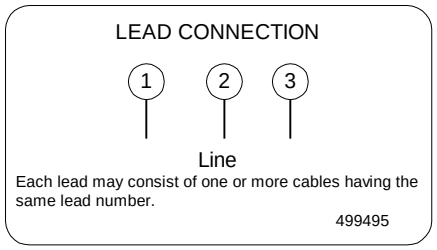
499495

Motor Wiring Diagram

MOTOR LEAD SIZE
SHALL BE DETERMINED
BY OTHERS





To reverse direction of rotation interchange connections L1 and L2.
Each lead may be comprised of one or more cables.
Each cable will be marked with the appropriate lead number.

EFFECTIVE: 2/27/96
SUPERCEDES: X736618, 96441, 179879, 284138
Connection Plate: 499495
Connection Decal: 912113

Certificate of Compliance

Certificate: 1175021 (LR 13009-55) **Master Contract:** 191252

Project: 2608857 **Date Issued:** June 19, 2013

Issued to: **Nidec Motor Corporation**

8050 West Florissant Ave.
St. Louis, MO 63136
USA
Attention: Joel Northwall

The products listed below are eligible to bear the CSA Mark shown

D. Somma

Issued by: D. Somma, C.E.T.

PRODUCTS

CLASS 4228 01 - MOTORS AND GENERATORS - For Hazardous Locations

Class I, Division 2, Groups A, B, C and D:Temperature Coded T3C, T3B, T3A, T3, T2D or T2C(where applicable)

Three phase, squirrel cage induction motors, Class B or F insulation, 50 or 60Hz, 2, 4, 6, 8 or 10 pole.

- Types TU, TV, TV-4, CTV, CTV-4, CTV-9; Rated 600 V max, 30 HP max, Frame Sizes 143T to 286T; TEFC, Temperature Coded T3C/T3B[1] - Notes: b, d, e, f
- Types TV-9, CT; Rated 600 V max, 200 HP max, Frame Sizes 143T to 447T; TEFC, Temperature Coded T3C - Notes: a, b, c, d, e, f
- Types TVC, TVC-4, TVC-9, CE, TC, TUC; Rated 600 V max, 200 Hp max, Frame Sizes 143T to 447T; TEFC , Temperature Coded T3C - Notes: a, b, d, e, f
- Types JU, JV, JV4; Rated 600 V max, 350 HP max, Frame Size 449, TEFC, Temperature Coded T3/T2B[aaaa]- Notes: b, d, e
- Types J, JC; Rated 600 V max, 400 HP max, Frame Size 449, TEFC, Temperature Coded T3/T2D[a]- Notes: a, b, d, e
- Types JU, JV, JV4; Rated 6900 V max, 600 HP max, Frame Sizes 5807 - 5811, TEFC, Temperature Coded T3C/T3[aa] - Notes: b, d, e, f
- Types JU, JV, JV4; Rated 6900 V mac, 1250 HP max, Frame Size 5812, TEFC, Temperature Coded T3B/ T3[aaa] - Notes b, d, e
- Types R, RS; Rated 6900 V max, 1000 HP max, Frame Sizes 5006 - 5012, ODP, WPI, WPII, Temperature Coded T3C/T_[2] - Notes: b, d, e, f
- Types R, RS; Rated 6900 V max, 2000 HP max, Frame Sizes 5800 - 5813, ODP, WPI, WPII, Temperature Coded T3C/T_[2] - Notes: b, d, e, f

Certificate: 1175021 (LR 13009-55) **Master Contract:** 191252

Project: 2608857 **Date Issued:** June 19, 2013

- Types RU, RV, RV-4; Rated 6900 V max, 1750 HP max, Frame Size 5813, ODP, WPI, WPII, Temperature Coded T3A; Notes: b, d, e
- Types J, JC, JP ; Rated 6900 V max, 700 HP max, Frame Sizes 5008 - 5012, TEFC, Temperature Coded T3/T2D[3] - Notes: b, d, e, f
- Types J, JC, JP; Rated 6900 V max, 1000 HP max, Frame Sizes 5810 - 5812, TEFC, Temperature Coded T3C/T3AΦ - Notes: b, d, e

Where:

[1] T3B is for Frame Size 280 when used with Inverter Duty

[2] (i) T3 is for Frame Size 5012, 2 pole, 800 HP and Frame Size 5813, 2 pole, 1250 HP

(ii) T2D is for Frame Size 5012, 2 pole, 800 HP and Frame Size 5813, 2 pole, 1250 HP when used with Inverter Duty

[3] T2D when used with Inverter Duty

Φ T3C for 1.0 S.F. @ 60 Hz; T3A for 1.15 S.F.@ 60 Hz

[a] (i) 350 HP max @ 600V max, when used with Inverter Duty @ 4:1 CT= T2C

(ii) 350 HP max @ 600V max when used with Inverter Duty @ 3:1 CT or VT (10:1) = T3A

(iii) 300 HP max @ 600V max when used with Inverter Duty @4:1 CT or VT (10:1) = T3A

[aa] Where T3C for HP rating up to 400 HP and T3 for 600 HP ratings

[aaa] Temperature Coded T3B for 1.0 S.F. and T3 for 1.15 S.F. ratings

[aaaa] T2B for VT 10:1, 200HP max [JU, JV, JV4 for 449 Frame, 600V max]

Notes:

a) May be C-Face or D-Flange mounted on frames less than 5000 or p-base mounted on all frames.

b) Cast iron stator frame, except 143T and 145T stator frame which may be optionally steel construction, 1.15 SF.

c) 1.15 SF on Frames 286T-447T, 1.0 SF max below, HP times SF = 350 max on 449T.

(Frame 449 rated 350 HP @ 1.15 S.F.)

d) May include options; motor shroud, auxiliary junction box, corro duty, bearing temperature sensing device, Therma- Sentry, thermistors or RTD's embedded in winding.

e) Basic motor Types TV, TU, TVC, CE, CT, CTV, J, JC, JP, JV, JU, R, RS and TC may be provided with additional prefix and/or suffix letters or numbers to signify types of electrical and/or mechanical variations which do not affect Certification.

f) Motors used with Inverter Duty: 0 to 60 Hz, Type of application: Variable Torque (VT), 10:1 or Constant Torque (CT) 4:1 or 3:1; Inverter Types; PWM, VSI or CSI; SF 1.0 max.

APPLICABLE REQUIREMENTS

CAN/CSA-C22.2 No 0-M1991 - General Requirements - Canadian Electrical Code Part II.

CAN/CSA-C22.2 No.100-04 - Motors and Generators

CAN/CSA-C22.2 No.145-M1986 - Motors and Generators for Use in Hazardous Locations (For Guidance)

CAN/CSA-C22.2 No.213-M1987 - Non-Incendive Electrical Equipment for Use in Class I, Division 2, Hazardous Locations (For Guidance)

MARKINGS

- Manufacturer's name;
- Motor type designation;
- Hazardous Locations Designation (Class I, Division 2, Groups A, B, C and D);
- Temperature Coded: T3C, T3B, T3A, T3, T2D or maximum operating temperature (160°C or T3C; 165°C or T3B; 180°C or T3A; 200°C or T3; 215°C or T2D; 230°C or T2C);
- Complete electrical ratings (e.g., volts, frequency, horsepower, revolutions per minute, FLA, SFA, etc.);
- Motors provided with space heaters shall be provided with a separate nameplate marked with heater's voltage and wattage ratings.
- Class of insulation;
- Service Factor 1.0 or 1.15;
- Number of poles;

- Serial number or date code;
- Enclosure type;
- Number of phases;
- Ambient temperature;
- CSA Monogram.

In addition to the marking above, inverter-duty machines shall be permanently marked with the following:

(a) machine application(eg, Inverter-duty motor);

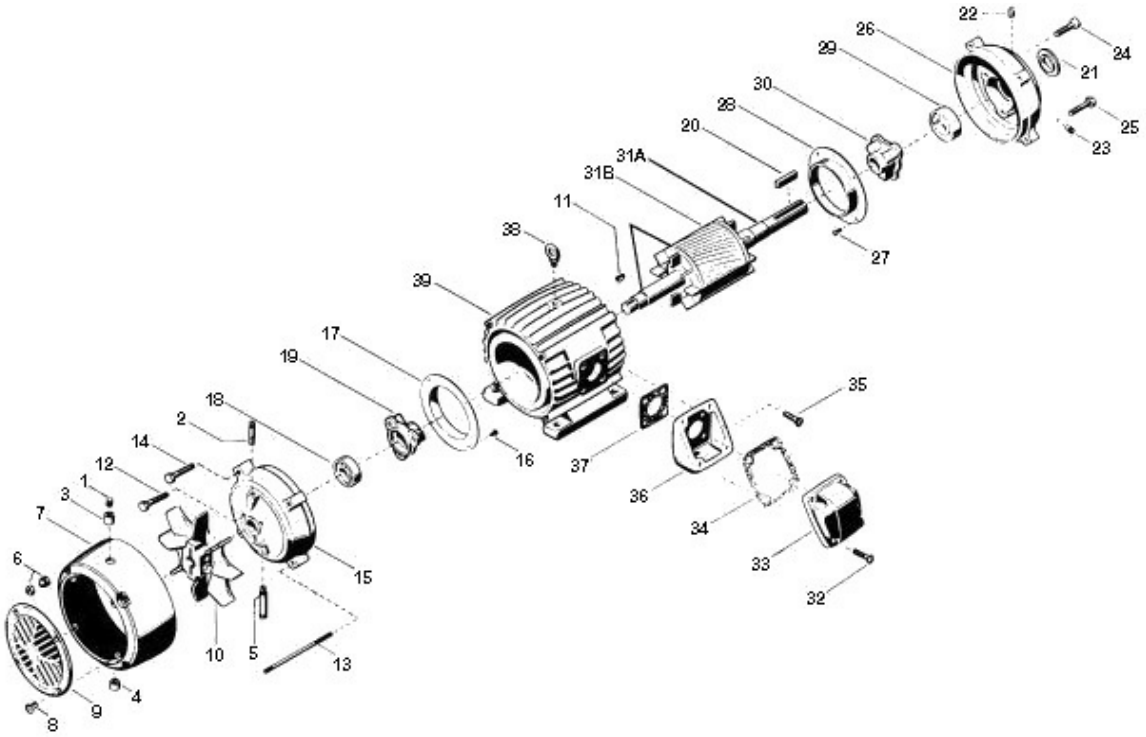
(b) speed range over which the machine is designed to operate;

(c) type(s) of torque application for which the machine is designed: VT(Variable Torque, 10:1); CT (Constant Torque, 4:1 or 3:1) or equivalent;

(d) type(s) of inverter with which the machine is intended to be used: PWM, VSI or CSI

RENEWAL PARTS

FRAMES 254T THRU 447T, 449T (WORLD MOTOR) - TOTALLY ENCLOSED AND EXPLOSIONPROOF MOTORS
TYPES: CE, CE1, CE4, CEF, CT, CT1, CT4, CTC, CTE, CTE1, CTE4, CTEF, CTEF1, CTEF4, CTEI, CTEN, CTF, CTF1, CTF4, CTFI, CTFI1, CTFI4, CTFN, CTI, CTI4, CTN, CTNI, EC, ECEI, FCT, FCTF, FCTF1, FCTN, FD, FDF, FDF1, FL, FLC, FLCA, FLCF, FLF, FN, FNC, FTC, FTCF, JAD, JDE, L, L1, L4, LC, LC1, LCA, LCAE, LCE, LCEF, LCEI, LCE1, , LCF, LCFI, LCI, LE, LE1, LE4, LEF, LF, LF1, LF4, LFC, LFI, LI, LN, N, NC, NCE, NCEF, NCF, NCFI, NCI, NE, NF, NN, T, T1, T4, TC, TC1, TC4, TCA, TCE, TCE1, TCE4, TCEF, TCEF4, TCEI, TCEN, TCEP, TCF, TCF1, TCFI, TCI, TCI1, TCN, TE, TEF, TEN, TF, TFC, TFN, TN



ITEM NO.	QTY	NAME OF PART
1	1	Slotted Headless Pipe Plug
2	1	Pipe Coupling
3	1	Pipe Nipple
4	1	Pipe Cap
5	1	Pipe Nipple
6	2	Cap and Jam Nut
7	1	Fan Cover Guard
8	3	Screw & Lockwasher
9	1	Grill
10	1	Vent Fan Assembly
11	1	Woodruff Key (Not used on frames 254T &256T
12	2	Screw
13	2	Stud & Nut
14	2	Screw (Qty 6 on frames 254T & 256T)
15	1	Bracket
16	4	Screw (Used only on frame 286T & 326T)
17	1	Air Deflector (Used only on frame 286T & 326T)
18	1	Ball Bearing
19	1	Bearing Cap
20	1	Key
21	1	Water Deflector

ITEM NO.	QTY	NAME OF PART
22	1	Slotted Headless Pipe Plug
23	1	Pipe Plug
24	2	Screw
25	4	Screw (Qty 8 on frames 286T & 326T)
26	1	Bracket (Not used on types TF)
27	4	Screw (Used only on frame 286T & 326T)
28	1	Air Deflector ((Used only on frame 286T & 326T)
29	1	Ball Bearing
30	1	Bearing Cap
31	1	Rotor Assembly (Includes items 31A & 31B)
31A	1	Motor Shaft
31B	1	Rotor Core
32	4	Screw
33	1	Outlet Box Cover
34	1	Gasket
35	4	Screw (Qty 2 on frames 254T & 256T)
36	1	Outlet Box Base
37	1	Gasket (Outlet Box Base)
38	1	Eyebolt
39	1	Wound Stator Assembly

WARNING:
Any disassembly or repair work on explosionproof motors will void the Underwriters Laboratories, Inc. label unless done by the manufacturer, or a facility approved by the Underwriters Laboratories, Inc. Refer to your nearest sales office for assistance.

BEARINGS:
Refer to motor nameplate for the bearing numbers.

PRICES:
Parts stocking distributors: refer to renewal parts numerical index. All Others: refer to your nearest parts distributor.

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IEEE 841 Plus® World Motor

Specifically designed for Severe Duty Oil & Gas, Petro Chemical, Pulp & Paper, Automotive, Mining and Waste Treatment Industries

Product Specifications

Horsepower:
350 HP with World motor (Stock)
Have capability to offer through 500 HP (ETO)

Frame SIzes: 143 – 447

Pole Designs: 2, 4, 6, 8

Design Voltages: 460 and 575 Volts at 60 Hz

Requirements: Meets or exceeds 2016 DOE NEMA Premium Efficiency rule;
Meets vibration requirements of GM7E-TA

Warranty: 5-year limited warranty

Product Overview and Options

Designed to exceed the industry's most stringent IEEE 841 standards, the U.S. MOTORS® brand 841 PLUS® motors are commonly used in severe duty environments for pumps, compressors, fans, blowers, and other material processing applications. These rugged motors are ideal for constant speed or inverter duty applications typically found in the petroleum, chemical, pulp and paper, wastewater, automotive and mining industries.

U.S. MOTORS brand 841 PLUS motors are rated NEMA Premium®† efficient. Low-loss silicon steel construction and streamlined design enables the motor to operate at lower temperatures resulting in lower energy costs. This motor is designed to operate in ambient temperatures of -30°C to 40°C, in altitudes of up to 1,000 meters above sea level and with NEMA Design B torque-current characteristics. Inertia load acceleration capabilities for the 841 Plus motor meet the stringent requirements of NEMA MG 1-2009, Section 12.54.

Product Features

- NEMA Premium®† efficient
- 1.15 Service Factor on sine wave power; 1.0 Service Factor on Inverter Duty
- Class B temperature rise at 1.0 Service Factor by resistance with sine wave power
- Class F insulation materials to increase motor life
- Exceeds NEMA MG1 Part 31 Inverter Duty
- Polyurea grease
- Stainless-steel nameplate
- Variable frequency drive or full voltage, across-the-line starting
- Ground on frame
- Division 2 suitable per NEC article 500 (NFPA 70)
- AFBMA bearing numbers on nameplate
- Protective coating on each rotor and shaft from bearing journal to bearing journal

Inverter Duty

Nidec Motor Corporation's patented inverter grade insulationsystem allows the U.S. MOTORS brand 841 PLUS motor to withstand spike and transient voltages induced by insulated bipolar gate transistor drives, making it fully compliant with NEMA MG-1, Part 31. This is made possible through:NEMA Premium®† efficient

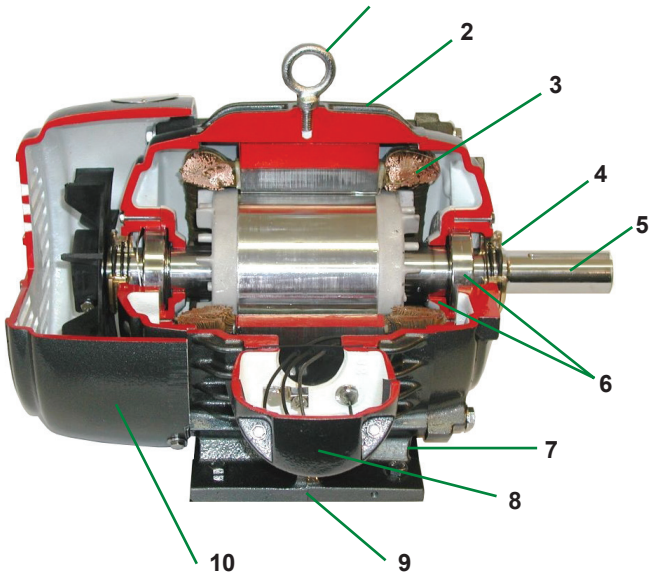
- Pulse-resistant magnetic wire that provides protection against high-voltage spikes
- Additional lacing on the end turns improve coil rigidity
- Multiple bake cycles to help prevent coil-to-coil circuits
- Phase paper to help prevent phase-to-phase arcs
- Adjustable frequency of 5:1 constant torque or 20:1 variable torque for the full product line.

NIDEC MOTOR CORPORATION

Product Overview and Options

Typical 841 PLUS® Motor Construction:

1. Corrosion resistant zinc dichromate-plated hardware
2. Heavy duty cast-iron enclosure for long life and reduced vibration
3. Inverter grade insulation
4. Inpro/SealTM “VBXX” on both ends provides IP56 protection and prolongs motor life by shielding bearings from contaminants in even the harshest environments
5. Special shaft runouts for ball bearing motors of 0.0010 inches for shafts up to 1.625 inches and 0.0015 inches for larger shafts.
6. Same size oversized bearings on each end. Cast iron inner bearing caps
7. Brass breather drains
8. Oversized, double-gasketed and rotatable conduit box to protect against contaminants and correctly position non-braided, non-wicking motor leads
9. Foot flatness machined to within 0.005 inch tolerance ensures easy installation and proper alignment
10. Corrosion-resistant mill and chemical duty paint capable of withstanding a 500-hour salt spray test



Options and Accessories

Nidec Motor Corporation offers the following custom-design options on the U.S. MOTORS brand 841 PLUS motor:

- Cylindrical roller bearings where applicable
- Horizontal or vertical mounting
- Vibration detectors
- Sealed insulation treatments, available on form wound, medium voltage motors above 200 HP, to help shield motor windings
- Winding and bearing thermal protection for motors 50 HP and up
- Inpro/SealTM MGS grounding shaft rings
- API 661 Duty

841 Plus Stock Motors

- 1 – 200 HP
- 2, 4, 6 pole designs
- 460 and 575 Volts
- Constant or variable torque
- 1–10 HP C-Face Footless

Custom and Conversion Motors

- 1 – 500 HP
- 2, 4, 6, 8 pole designs
- 200, 230, 460, 575, 2300, 4000 Volts
- Constant or variable torque
- C & D flange kits available 140 – 440 frame

Testing and Inspection

Nidec Motor Corporation conducts extensive testing and inspections on each of its U.S. MOTORS brand 841 PLUS motors.

- No load current, power and speed
- High-potential test on stator windings
- Insulation resistance test by megohmeter and polarization index
- Precision balanced to typical vibration levels of less than 0.05 inches per second
- Optional complete test, including full load test

For additional information, please refer to our Full Line Standard Motor Catalog (FL600) or contact your Nidec Motor Corporation representative.

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NIDEC MOTOR CORPORATION

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Phone: 888-637-7333 | Fax: 866-422-7758

General Information for Integral Horsepower (IHP) Motors on Variable Frequency Drives (VFDs)

Variable Frequency Drives (VFD)

A VFD is a type of controller used to vary the speed of an electric motor. The VFD takes a fixed AC voltage and frequency and allows it to be adjusted in order to get different speeds from the motor. Motor speed can be varied by changing the frequency of the input power waveform. The equation below shows how the frequency affects the speed of a three phase induction motor.

$$\text{Speed} = \frac{120^* \text{ Fundamental Input Frequency}}{\text{Number of Motor Poles}}$$

How does a VFD work?

A VFD takes the fixed frequency and voltage sine wave from the power grid or power station and puts it through a few steps in order to allow the VFD user to vary the frequency and in turn control the motor speed. First it rectifies the AC power into DC Power. Because of this step, a term commonly used instead of VFD is inverter. This only describes one step of what the VFD does to the power waveform. Once rectified into a DC voltage the drive sends the power through a set of transistors or switches. These switches can take the DC waveform and by opening and closing at certain speeds and durations can create an output waveform that mimics the sine wave that is required to drive a three phase electric motor. The output wave form is known as a Pulse Width Modulation (PWM) waveform because the waveform is created by multiple pulses of the switches at short intervals.

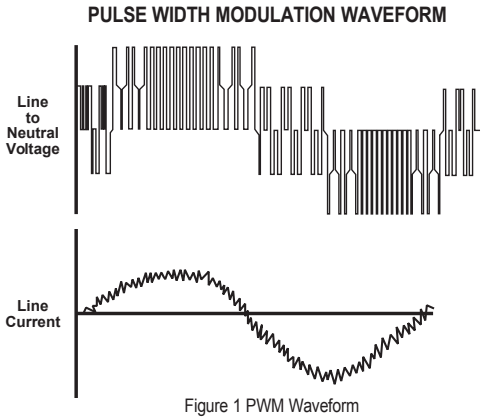


Figure 1 PWM Waveform

What variables should be considered when deciding whether to power a motor with a VFD?

VFD compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of a particular motor for use with a VFD. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line / System Voltage
- Cable length between the VFD and the motor
- Drive switching (carrier) frequency
- Motor construction
- VFD dv/dt - winding end turn differential in voltage versus differential in time
- High temperatures or high humidity
- Grouding system

Wider speed ranges, higher voltages, higher switching frequencies, insufficient grounding and increased cable lengths all add to the severity of the application and, therefore, the potential for premature motor failure.

How does a VFD affect the motor?

There are many things to consider when a motor is powered using a VFD or PWM power. When a motor is powered by a PWM waveform the motor windings very often see a large differential voltage, either from phase to phase or turn to turn. When the voltage differential becomes large enough it creates a reaction at the molecular level that converts available oxygen into O3. This phenomenon is called partial discharge or corona. This reaction creates energy in the form of light and heat. This energy has a corrosive effect on the varnish used to protect the motor windings. PWM waveforms can also magnify shaft voltages which lead to arcing across the bearing and causing premature bearing failure. Corrective action must be taken to mitigate these issues that arise when using an electric motor with a VFD.

How do I protect the motor?

Nidec Motor Corporation (NMC) has developed specific motor designs to decrease the harmful affects that a VFD can have on a motor. NMC's INVERTER GRADE® insulation system is the first line of defense against corona and phase to phase faults that can be common when a motor is powered using a PWM waveform. The INVERTER GRADE® insulation system is standard on all of NMC's Inverter Duty products. Along with the INVERTER GRADE® insulation, thermostats are installed as a minimum protection against over heating the motor. Special consideration must also be given to bearings in motors powered by VFD's. In order to create a low resistance path to ground for built up shaft voltages a shaft grounding device can be used. On larger horsepower motors an insulated bearing system should be used in conjunction with the shaft grounding device when installed, to force the stray shaft voltages to ground. The bearing failures are more prominent on motors with thrust handling bearings. NMC has created an Inverter Duty vertical motor line that not only uses the INVERTER GRADE® insulation system, but that also comes standard with a shaft grounding device. On motors that are 100 HP and greater the thrust bearing is also insulated for additional protection.

What does "Inverter Duty" mean?

An Inverter Duty motor should describe a motor that helps mitigate potential failure modes of a motor that is powered by a VFD. Inverter duty motor windings should be able to withstand the voltage spikes per NEMA MG1 Part 31.4.4.2 and protect against overheating when the motor is run at slow speeds. On thrust handling bearings it is apparent that the bearings require additional protection. Inverter Duty vertical motors should have a shaft grounding device to protect the motor bearings from fluting due to voltage discharge through the bearing. On larger motors (100HP and larger) the shaft should also be electrically isolated from the frame in order to aid the shaft grounding ring in discharging the shaft voltages to ground.

*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.

Motor / Inverter Compatibility

Thermal Overloads and Single Phase Motors

Motors with thermal overloads installed may not operate properly on a VFD. The current carrying thermal overload is designed for sine wave power. Operation on a VFD may cause nuisance tripping or potentially not protect the motor as would be expected on line power. Thermostats or thermistors installed in the motor and connected properly to the VFD may provide suitable thermal overload protection when operating on a VFD.
(consult codes for installation requirements)

Single phase motors and other fractional horsepower ratings are not designed to be operated on a VFD. Within Nidec Motor Corporation standard products, all motors NEMA®† 48 frame (5.5" diameter) and smaller are not suitable for VFD applications. Three phase 56 and 143/145 frame applications should be noted on the catalog price page; or if in doubt ask a Nidec Motor Corporation technical representative for recommendations on compatibility with a VFD.

Slow Speed Motors

Motors with a base design of slower than six poles require special consideration regarding VFD sizing and minimizing harmonic distortion created at the motor terminals due to cable installation characteristics. Additional external PWM waveform filters and shielded motor cables designed for PWM power may be required to provide acceptable motor life. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%) mismatch impedance.

690V Applications

Motors that are rated for 690VAC and that will be powered by 690VAC PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an INVERTER GRADE® motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

Low Voltage TITAN® Motors

When using 449 frame and larger motors on PWM type VFDs consider the use of an external filter and shielded motor cables designed for PWM power to minimize harmonic distortion and peak voltages at the motor terminals. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

Bearing Currents Related to PWM Waveforms

Protection of the motor bearings from shaft currents caused by common mode voltages is becoming a standard feature on Inverter Duty motor products. Some installations may be prone to a voltage discharge condition through the motor bearings called Electrical Discharge Machining (EDM) or fluting. Vertical HOLLOSHAFT and HOSTILE DUTY World Motor come with grounding devices installed as standard. EDM damage is related to characteristics of the PWM waveform, and the VFD programming, and installations factors.

Bearing Protection on Inverter Duty Vertical Motors
All U.S. MOTORS® brand "Inverter Duty" vertical products have a shaft grounding system that allows damaging shaft currents a low resistance path to ground. **Bearings on vertical motors fed by VFD power without this bearing protection are not covered under any warranty.** All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to EDM damage.

Guideline For Insulated Anti-Friction Bearings

Bearing insulation is required to prevent circulating shaft currents which can damage bearings. Circulating shaft current can be caused by use of improper power and/or ground cables, improper grounding systems and higher switching frequencies. Finding and correcting the external condition(s) is the responsibility of the system designer or specifying engineer. To prevent circulating shaft current in motors with anti-friction bearings, Nidec Motor Corporation's standard practice is to insulate the non-drive end bearing.

Adjustable Speed Drives produce a common mode voltage condition. To interrupt common mode voltage on induction motors of all sizes, NEMA MG1-2018 Part 31 recommends insulating both bearings. In cases where both anti-friction bearings are insulated, the system designer or specifying engineer should determine whether to apply one or more of the following options to prevent or reduce shaft currents: sinewave filters, line reactors or mechanical devices, such as shaft grounding or an insulated half coupling. Motors with shaft grounding devices are not suitable for installation in hazardous locations unless housed in an enclosure suitable for the specified Division (or Zone), Class and Group(s).

Multiple Motors on a Single VFD

Special considerations are required when multiple motors are powered from a single VFD unit. Most VFD manufacturers can provide guidelines for proper motor thermal considerations and starting/stopping of motors. Cable runs from the VFD and each motor can create conditions that will cause extra stress on the motor winding. Filters may be required at the motor to provide maximum motor life.

Grounding and Cable Installation Guidelines

Proper output winding and grounding practices can be instrumental in minimizing motor related failures caused by PWM waveform characteristics and installation factors. VFD manufacturers typically provide detailed guidelines on the proper grounding of the motor to the VFD and output cable routing. Cabling manufacturers provide recommended cable types for PWM installations and critical information concerning output wiring impedance and capacitance to ground.

Integrated Motor and Inverter

By integrating the motor and inverter at NMC's manufacturing facility, many of the motor compatibility problems are minimized or eliminated. During the manufacturing process, the motor is matched to the inverter characteristics which ensures the winding temperature and torque levels meet the design specification. Since the inverter output wiring to the motor is nearly eliminated, bearing currents are rarely experienced. When the unit is properly grounded, reducing the output cable lengths in conjunction with an inverter grade insulation system and low factory setting of the switching frequency of the inverter drive, results in low risk of voltage peaks produced by the PWM waveform.

Vertical Motors on VFDs

Vertical motors operated on VFD power present unique conditions that may require consideration by the user or installation engineer:

- Locked rotor and drive tripping caused by non-reversing-ratchet operation at low motor speeds. It is not recommended to operate motors at less than 1/4 of synchronous speed. If slow speeds are required contact NMC engineering.
- Unexpected / unacceptable system vibration and or noise levels caused by the torque pulsation characteristics of the PWM waveform, a system critical frequency falling inside the variable speed range of the process or the added harmonic content of the PWM waveform exciting a system component
- Application related problems related to the controlled acceleration/deceleration and torque of the motor on VFD power and the building of system pressure/ load.
- The impact the reduction of pump speed has on the down thrust reflected to the pump motor and any minimum thrust requirements of the motor bearings
- Water hammer during shutdown damaging the non-reversing ratchet

Humidity and Non-operational Conditions

The possible build-up of condensation inside the motor due to storage in an uncontrolled environment or non-operational periods in an installation, can lead to an increased rate of premature winding or bearing failures when combined with the stresses associated with PWM waveform characteristics. Moisture and condensation in and on the motor winding over time can provide tracking paths to ground, lower the resistance of the motor winding to ground, and lower the Corona Inception Voltage (CIV) level of the winding.

Proper storage and maintenance guidelines are important to minimize the potential of premature failures. Space heaters or trickle voltage heating methods are the common methods for drying out a winding that has low resistance readings. **Damage caused by these factors are not covered by the limited warranty provided for the motor unless appropriate heating methods are properly utilized during non-operational periods and prior to motor start-up.**

NEMA®† Application Guide for AC Adjustable Speed Drive Systems: http://www.nema.org/stds/acadjustable.cfm#download

* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.

Warranty Guidelines for Integral Horsepower (IHP)* Motors on Variable Frequency Drives

Warranty Guidelines

The information in the following section refers to the motor and drive application guidelines and limitations for warranty.

Hazardous Location Motors

Use of a variable frequency drive with the motors in this catalog, intended for use in hazardous locations, is only approved for Division1, Class I, Group D hazardous location motors with a T2B temperature code, with a limitation of 2:1 constant torque or 10:1 variable torque output. **No other stock hazardous location motors are inherently suitable for operation with a variable frequency drive.** If other requirements are needed, including non-listed Division 2, please contact your Nidec Motor Corporation territory manager to conduct an engineering inquiry.

575 Volt Motors

575 volt motors can be applied on Inverters when output filters are used. Contact the drive manufacturer for filter selection and installation requirements.

Applying INVERTER GRADE® Insulated Motors on Variable Frequency Drives (2, 4, 6 pole)

The products within this catalog labeled "Inverter Duty" or "Vector Duty" are considered INVERTER GRADE® insulated motors. INVERTER GRADE® motors exceed the NEMA®† MG-1 Part 31 standard. Nidec Motor Corporation provides a three-year limited warranty on all NEMA®† frame INVERTER GRADE® insulated motors and allows long cable runs between the motor and the VFD (limited to 400 feet without output filters). Cable distance can be further limited by hot and humid environments and VFD manufacturers cable limits. These motors may be appropriate for certain severe inverter applications or when the factors relating to the end use application are undefined (such as spares).

Nidec Motor Corporation's U.S. Motors® brand is available in the following INVERTER GRADE® insulated motors:

- Inverter Duty NEMA®† frame motors good for 20:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI (10:1 V.T.)
- Inverter Duty motors rated for 20:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed or 5000:1
- 841 Plus® NEMA®† Frame Motors

Applying Premium Efficient motors (that do not have INVERTER GRADE® insulation) on Variable Frequency Drives (2, 4, 6 pole)

Premium efficient motors without INVERTER GRADE insulation meet minimum NEMA®† MG-1, Section IV, Part 31.4.4.2. These motors can be used with Variable Frequency Drives (with a reduced warranty period) under the following parameters:

- On NEMA®† frame 447 and smaller motors, 20:1 speed rating on variable torque loads & 4:1 speed range on constant torque loads.
- On TITAN® 449 and larger frame motors, 10:1 speed rating on variable torque loads.
- On TITAN® frame motors, inquiry required for suitability on constant torque loads.

Cable distances are for reference only and can be further limited by hot and humid environments (refer to Table 1). Refer to specific VFD manufacturers cable limits. Refer to the Motor/ Inverter Compatibility page for special consideration of vertical motor bearings.

Table 1 - Cable Distances			
Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	380 Volt
3 Khz	127 ft	400 ft	218 ft
6 Khz	90 ft	307 ft	154 ft
9 Khz	73 ft	251 ft	126 ft
12 Khz	64 ft	217 ft	109 ft
15 Khz	57 ft	194 ft	98 ft
20 Khz	49 ft	168 ft	85 ft

Warranty Period Clarifications and Exceptions

Standard Energy Efficient Exclusion

Applying Standard & Energy Efficient Motors on Variable Frequency Drives is not recommended. VFD related failures on standard and energy efficient motors will not be covered under warranty.

Vertical Motor Windings

Premium efficient vertical motors without INVERTER GRADE® insulation that are installed using the criteria described in this document and applied in the correct applications shall have a warranty while powered by a VFD for 12 months from date of installation or 18 months from date of manufacturing whichever comes first. See limited warranty page for horizontal motor warranty periods.

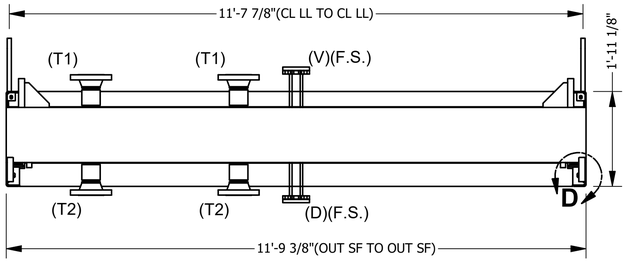
Bearing Exclusion for Thrust Handling Bearings

Bearings used in premium efficienct vertical motors, and all thrust handling bearings, that are powered by VFDs without shaft grounding devices or insulated bearings (when required) will not be covered under any warranty for damages caused from being powered by a VFD. All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to Electrical Discharge Machining.

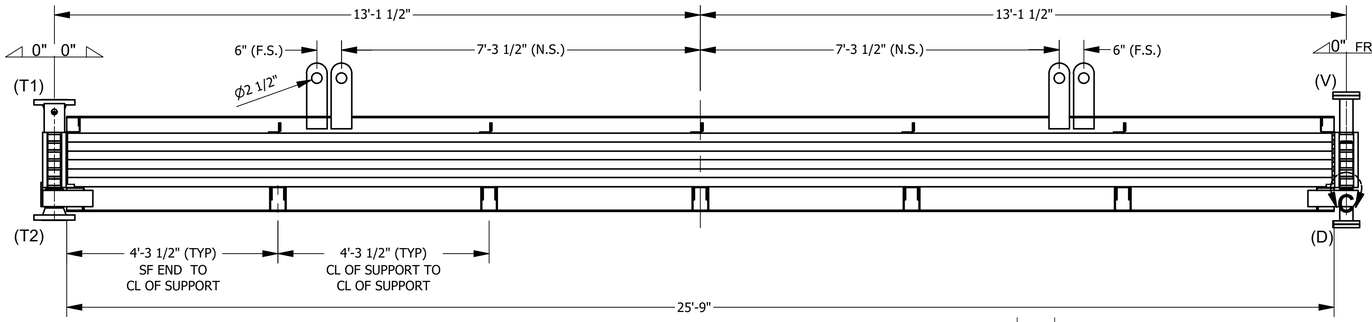
Medium Voltage and Slow Speed Considerations

Motors that are rated above 700 VAC or that are eight pole and slower require special consideration and installation and are not covered under the warranty guidelines in this document. Motors that are rated above 700VAC have special cable length and voltage differential issues that are specific to the VFD type and manufacture. The motor construction and cost may vary dramatically depending on the VFD topology and construction. Contact your NMC representative with VFD manufacturer name and model type for application and motor construction considerations. Motors that are designed eight pole and slower also require special installation and filters per the drive manufacturer.

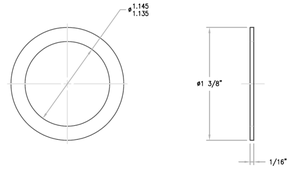
* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.



FRONT VIEW

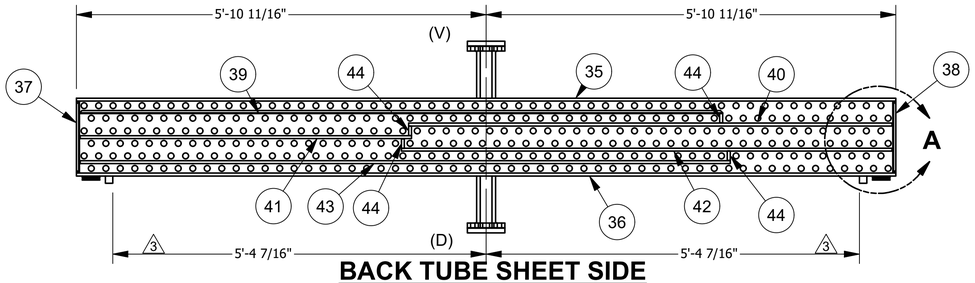


SIDE VIEW

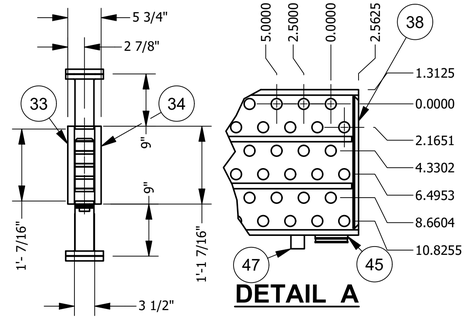


GASKET DETAIL

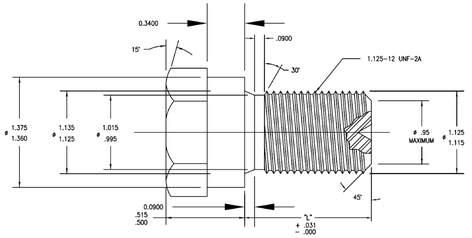
ALL HEADS FREE LATERAL 3/4" IN EITHER DIRECTION



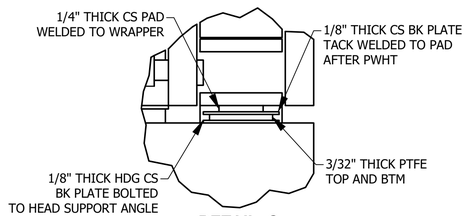
BACK TUBE SHEET SIDE



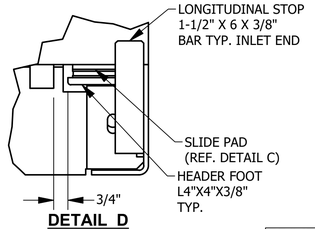
DETAIL A



PLUG DETAIL
L = T/P SHEET THICK.



DETAIL C
SLIDE PAD DETAIL

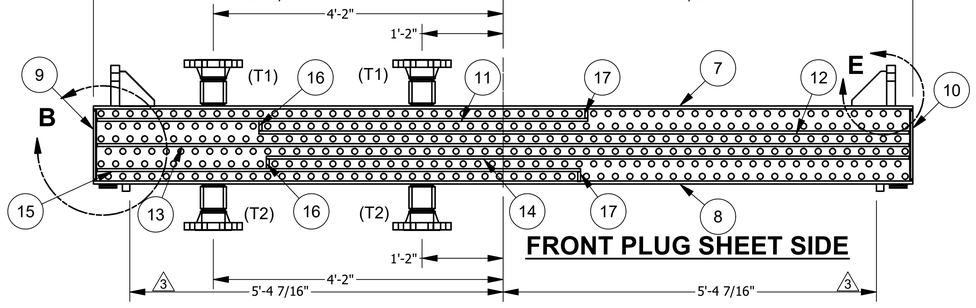


DETAIL D
HEADER SUPPORT
TYP. BOTH ENDS

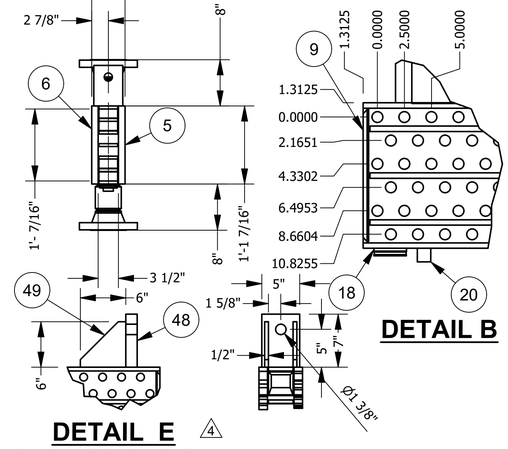
DESIGN INFORMATION	
DESIGN PRESS. PSIG:	135 / FV
DESIGN TEMP. DEG F:	300 / 300
MDMT DEG F:	32
CORROSION ALLOW. IN.:	0.125
EFFECTIVE SURFACE AREA:	BARE: 9148.3 FT^2
	EXTENDED: 192412 FT^2
WET H2S	
SPOT RT	
HYDROTEST PSIG:	176
DESIGN & STAMP:	ASME
API 661, 7TH ED.	
ASME SECT. VIII, DIV. 1 ED. 2021	
CHARPY EXEMPT UG20(f) AND/OR UCS 66	

PLUG HOLE INFORMATION	
PREDRILL DIAMETER	0.9688
TUBE REAM	1.01
TAP REAM	1.0469
TPI	12
SPOTFACE OD	1.5
SPOTFACE DEPTH	0.01
GROOVES/HOLE	FRONT (2) / BACK (2)
PLUG DIAM	1.125

ROLL TOOL INFO	
FRONT ROLLER	1249C / R18
FRONT MANDREL	M63C
BACK ROLLER	1249C / R18
BACK MANDREL	M63C

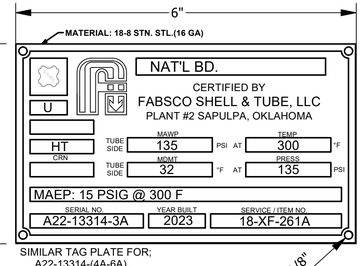


FRONT PLUG SHEET SIDE



DETAIL B

DETAIL E
THRUST BLOCK 4



REV:	DATE	COMMENT	BY
0	04-04-2022	FOR APPROVAL	BMH
1	9/2/2022	CUST. COMM.	BMH
2	11/4/2022	FIXED INLET HEAD IN LONG. DIR.	BMH
3	2/9/2023	LAT. STOP SIZE	BMH
4	10/18/2023	THRUST BLOCKS	BMH

		THICK	LENGTH	WIDTH	BEVELS
5 6	FRONT T/P SHEET	1.1250	141.3750	13.4375	30 LONG
7 8	FRONT WRAPPER	0.5000	141.3750	3.2500	30 LONG
9 10	FRONT END	0.5000	12.1875	3.2500	45 ALL
11	FRONT PASS	0.5000	84.6750	3.2500	45 2L,1S
12	FRONT PASS	0.5000	112.1875	3.2500	45 2L,1S
13	FRONT PASS	0.5000	140.1250	3.2500	45 2L,1S
14	FRONT PASS	0.5000	110.9375	3.2500	45 2L,1S
15	FRONT PASS	0.5000	83.4375	3.2500	45 2L,1S
16	FRONT PASS	0.5000	2.1250	3.2500	45 2L,1S
17	FRONT PASS	0.5000	1.6250	3.2500	45 2L,1S
4 48	THRUST PLATE	1.500	7.000	5.000	NONE
49	THRUST GUSSETS	0.500	6.000	6.000	NONE
18	HEADER PAD	0.2500	5.000	3.500	NONE
19	HEADER WING	0.2500 /3	13.4375	0.7500 /3	NONE
20	FLOAT BARS	1.2500	5.000	1.2500	NONE
33 34	BACK T/P SHEET	1.1250	141.3750	13.4375	30 LONG
35 36	BACK WRAPPER	0.5000	141.3750	3.2500	30 LONG
37 38	BACK END	0.5000	12.1875	3.2500	45 ALL
39	BACK PASS	0.5000	110.9375	3.2500	45 2L,1S
40	BACK PASS	0.5000	83.4375	3.2500	45 2L,1S
41	BACK PASS	0.5000	57.1875	3.2500	45 2L,1S
42	BACK PASS	0.5000	84.6875	3.2500	45 2L,1S
43	BACK PASS	0.5000	112.1875	3.2500	NONE
44	BACK PASS	0.5000	1.6875	3.2500	
45	HEADER PAD	0.2500	4.000	3.500	NONE
46	HEADER WING	0.2500	13.4375	0.7500	NONE
47	FLOAT BARS	1.2500 /3	5.000	1.2500 /3	NONE

NOZZLE:		CONNECTIONS:
(T1)	(INLET)	(2) 4 300# - SCH 160 - RFWN
		4 PIPE - SCH 160 - 4.375" LG - BBE
(T2)	(OUTLET)	(2) 4 300# - SCH 160 - RFWN
		4 PIPE - SCH 160 - 4.375" LG - BBE
(V)	(VENT)	(1) 2" 300# RFLWN W/BLIND
(D)	(DRAIN)	(1) 2" 300# RFLWN W/BLIND

TUBES: (336) 1" OD 0.083" MW 312"
FIN: 5/8" HI 0.016" THK. 10/FPI, L TENSION
PLUGS: (672) 1.125" OD 1.125" UH SHOULDER

MATERIALS:	
PLATE:	SA-516-70N
PIPE:	SA-106-B
FLANGE:	SA-350-LF2
PLUG:	SA-350-LF2
GASKET:	A1008 CS (ZP)
SIDE FRAME:	A36
TUBE:	SA-179 (SMLS)
FIN:	ALUMINUM
STAY PLATE:	SA-516-70N

STRUCTURAL:	
SIDEFRAME:	C 0.25" 23.125" 309"
SUPPORT:	(5) - 4" X 6" X 0.1875" RT
BINDER:	(5) - L 2 X 2 X .25
TP AIRSEAL:	Z SHAPE
BTM AIRSEAL:	Z SHAPE
LUG:	604 WELDED
HDR FINISH:	SSPC-SP10
	SYSTEM 1 BEFORE HYDRO
	REFERENCE: A8KM-PP-000-500520-A
SFR FINISH:	HAND TOOL CLEAN
	Galvanized
	REFERENCE: A8KM-PP-000-500540-A

TUBE SPACERS:	
TUBE SPACERS REQD.:	118
SCALLOPED CHANNELS:	
1" X 2.5" PITCH	
ALUMINUM	
TOLERANCES:	
LENGTH:	± 0.125
WIDTH:	± 0.125
TUBE PROJECTION:	0.25 ± 0.125
DRY WEIGHT LBS:	24604
HYDRO WEIGHT LBS:	27098

HEAT TREATMENT
A) HEAT FROM 800°F TO 1150°F @ 400°F PER HOUR.
B) HOLD @ 1150°F ± 25°F FOR (60 MIN.).
C) COOL FROM 1150°F TO 800°F @ 500°F PER HOUR.
D) FURTHER COOLING MAY BE IN STILL AIR.

CERTIFIED
BY:_____ DATE: _____

PROJECT NAME:	World Energy Renewables Project
PROJECT NO./UNIT:	EN-20-7121 / Amine
CUSTOMER/CLIENT:	World Energy Paramount
EQUIPMENT OWNER:	Air Products Manufacturing LLC
ITEM NO.:	18-XF-261A
SERVICE:	LEAN AMINE COOLER
LOCATION:	World Energy, Paramount, CA, USA
PO NO.:	4505606038 / A8KM-4-406-PO-3
FABSCO JOB NO.:	A22-13314-3A-6A

DRAWING PROPRIETARY TO FABSCO FIN-AIR, LLC AND IS NOT TO BE RELEASED TO ANY THIRD PARTY, EXCEPT WITH NOTIFICATION AND APPROVAL IN WRITING OF FABSCO FIN-AIR, LLC OFFICER.

DRAWN BY: BMH
DATE: 04-04-2022
CHECKED BY:

FABSCO Fin-Air, LLC.

BUNDLE ARRANEGMENT DRAWING - 18-XF-261

DRAWING NO: A22-13314-3A-6A-300

REV: 4

WORLD ENERGY RENEWABLE FUELS CONVERSION PROJECT
Project No: A8KM
Vendor Input to PCMS
Doc number: A8KM-PCMS-001, Rev. 0

Vendor Doc Number: EN207121-FAB-9V3-00085
PCMS_PO Number 4505606038/A8km-4-406-PO-3
Rev: 0

Identification					
1: Tag No.	18-XF-261 A	18-XF-261 B	18-XF-261 C	18-XF-261 D	
2: Model No.					
3: Serial No.	A22-13314-3A	A22-13314-4A	A22-13314-5A	A22-13314-6A	
4: Registration No.	TBA	TBA	TBA	TBA	Code Vessels Only
5: Code Stamped	yes	yes	yes	yes	Drop Down
General Design					
15: Build Date	2023	2023	2023	2023	
17: Manufacturer	FABSCO FIN AIR, LLC.	FABSCO FIN AIR, LLC.	FABSCO FIN AIR, LLC.	FABSCO FIN AIR, LLC.	
19: General Material	CS	CS			
20: Insulation Type	None	None	None	None	Drop Down
21: Support Type	Baseplate	Baseplate	Baseplate	Baseplate	Drop Down
22: External Coating	Galvanized	Galvanized	Galvanized	Galvanized	Drop Down
23: MAWP (psig)	135	135	135	135	
24: MAWT (F)	300	300	300	300	
25: Design Pressure (psig)	135	135	135	135	
26: Full Vacuum	yes	yes	yes	yes	Drop Down
27: Design Temp (F)	300	300	300	300	
28: MDMT (F)	32	32	32	32	
29: Weight Empty (lbs)	39548	39548	39548	39548	
30: Weight Full (lbs)	42042	42042	42042	42042	
31: Equipment Length (inches)	26' 10 7/8"	26' 10 7/8"	26' 10 7/8"	26' 10 7/8"	
32: Orientation	Horizontal	Horizontal	Horizontal	Horizontal	Drop Down
33: Equipment Width (inches)	12' 4 15/16"	12' 4 15/16"	12' 4 15/16"	12' 4 15/16"	
34: Equipment Height (inches)	10' 2 3/4"	10' 2 3/4"	10' 2 3/4"	10' 2 3/4"	
35: Storage Volume (bbls)	6.8	6.8	6.8	6.8	Vessels Only
36: Outer Diameter (inches)	NA	NA	NA	NA	
37: PWHT	yes	yes	yes	yes	
38: Fire Proofing	no	no	no	no	
39: Heat Tracing	None	None	None	None	
40: Test Medium	Water	Water	Water	Water	Pressure Testing