



SERIAL NUMBER: N-048
N-049 COOK DATE: 2/27

MOLD SIZE 5.03 (5.03) BY UA

ORDER DATE 20 FEB 18 SHIP DATE: 05 MAR 18 PO _____

FOR SLB SIZE 5.000 TYPE MZ-36S

THREAD 2 3/8 PAC OTHER .310 center cutter / 1/4" in front of center cutter

MATRIX (H) 1743 WEIGHT 5.50

MATRIX (S) 1786 WEIGHT 5.56

BINDER 23679 WEIGHT 7.20

BLANK 4" 8620 TJ 22165500

BILLET MM14106200 Sleeve 22085862
TUBE _____

WELD BY ALIAN MPI BY JM MPI PIC JM

THREAD GAGE _____ STAND OFF 625

NOTES _____

FINAL DIAMOND GRIND SIZE 5.00

LENGTH TO WELD _____ / _____

FINISHED PIC TAKEN BY ALIAN SHIPPED BY JM DATE: 3-7-18

SHORT BIT & TOOL CO
225 GOLD STREET
GARLAND TX 75042
972-205-1011
main@shortbits.com

Document Number:	F-Q-018
Revision:	Orig.
Date of Origin:	8/12/2012
Manual:	P-Q-001
Page:	PAGE 1 OF 1
Title:	MATERIAL PROPERTIES CERTIFICATION



CUSTOMER:	Short Bits
CUSTOMER PO#:	VICKIE E MAIL 12-08-17
ITEM ID:	PWMP010
ITEM DESCRIPTION	MP MATRIX POWDER H
ITEM LOT #	MPW1743
DATE	12/11/2017
WEIGHT	100 lb.

CHEMICAL COMPOSITION (Weight Percent)			
Element	Minimum	Maximum	RESULT
Total Carbon (Tc)	5.4	5.90	5.65
Free Carbon (Fc)	-	0.04	0.03
Iron (Fe)	-	1.00	0.02
Nickel (Ni)	1.5	2.50	2.01
Tungsten (T)			Balance

PRODUCT SIZING (Weight Percent)			
Sieve	Minimum	Maximum	RESULT
(U.S. Standard Mesh per ASTM B214)			
+80	4.0	8.0	5.8
-80 + 120	13.0	17.0	15.5
-120+ 170	13.0	17.0	14.7
-170 + 230	13.0	17.0	15.1
-230 + 325	13.0	17.0	15.7
-325	29.00	37.00	33.2

PHYSICAL PROPERTIES			
Testing Procedure	Minimum	Maximum	RESULT
Apparent Density ASTM B212 (g/cc)	7.2	8.1	7.2
Tap Density ASTM B527 (g/cc)	9.2	10.4	10.3
Hall Flow Rate ASTM B213 (sec/50g)		Must Flow	12.8

Document Number:	F-Q-018
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Page:	PAGE 1 OF 1
Title:	MATERIAL PROPERTIES CERTIFICATION



CUSTOMER:	Short Bits
CUSTOMER PO#:	VICKIE E MAIL 1-18-18
ITEM ID:	PWCTPM002
ITEM DESCRIPTION	CTPM CRYSTALLINE W 80 X 325 MESH
ITEM LOT #	MPW1786
DATE	1/22/2018
WEIGHT	100 lb.

CHEMICAL COMPOSITION (Weight Percent)			
Element	Minimum	Maximum	RESULT
Tungsten (W)	99.5	-	99.99

PRODUCT SIZING (Weight Percent)			
Sieve	Minimum	Maximum	RESULT
(U.S. Standard Mesh per ASTM B214)			
+80	-	5.0	0.3
-80 + 325	-	-	92.5
-325	-	10.00	7.2

PHYSICAL PROPERTIES			
Testing Procedure	Minimum	Maximum	RESULT
Apparent Density ASTM B212 (g/cc)	7.2	9.2	8.4
Tap Density ASTM B527 (g/cc)	9.0	10.5	9.8
Hall Flow Rate ASTM B213 (sec/50g)		Must Flow	9.2



330 Belmont Avenue, Brooklyn, NY 11207-4000 U.S.A
tel: +1.718.342.4900 fax: +1.718.342.0175

Certificate of Analysis

September 06, 2017

To: Short Bits & Tool
225 Gold Street
Garland, TX 750426648 USA

Customer Order No: Verbal/Vicki

Customer ID: SHORTC

Sales Order No: 28918

Material: 4483D

BELMONT *Virgin Grade Binder Alloy*

Shape: 1/2" x 1/2" x 3/4" Tumbled Sheared Pcs.

Packaging: 250 Lb. Drums

Lot: 23679

Copper (Cu)	47.68
Manganese (Mn)	23.60
Nickel (Ni)	20.06
Zinc (Zn)	8.18
Boron (B)	0.19
Iron (Fe)	0.07
Silicon (Si)	0.17
Lead (Pb)	< 0.05
Tin (Sn)	< 0.05

BELMONT METALS, INC.

Nasir Naseer

QC Administraot



Sold To: CMC DALLAS TRADING
 PO BOX 139094
 DALLAS, TX 75313-9094
 (214) 689-4300
 Fax: (214) 689-5886

Ship To: CMC TRADING WAREHOUSE
 GREENSPORT TERMINAL
 13609 INDUSTRIAL ROAD - GATE 5
 UP - PTR A SWITCH ROAD
 HOUSTON, TX 77015
 (214) 496-5584

Customer P.O.	69855	Sales Order	134724.1
Product Group	Special Bar Quality	Part Number	30004000240MTS0
Grade	8620HLA; 8620/8622H; MECH PROP REPORT	Lot #	MM1410620002
Size	4" (4.0000) Round	Heat #	MM14106200
Product	4" (4.0000) Round 20' 8620-C2R7	B.L. Number	G1-270911
Description	8620-C2R7	Load Number	G1-147295
Customer Spec		Customer Part #	8620

I hereby certify that the material described herein has been manufactured in accordance with the specifications and standards listed above and that it satisfies those requirements.

Roll Date: 11/26/2014 Melt Date: 11/6/2014

C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Al	B
0.21%	0.80%	0.011%	0.023%	0.23%	0.23%	0.41%	0.51%	0.19%	0.004%	0.025%	0.0003%
Sn	Ti	Cb	Co	Ca	Pb	As	Bi	Sb	H		
0.008%	0.0015%	0.004%	0.0301%	0.0008%	0.0000%	0.005%	0.0000%	0.0020%	1.0 ppm		

Austenitic fine grain by chemical analysis per the latest revision of ASTM A29

DI value: 2.00

Simulated Hardenability Band

J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J18	J20	J22	J24	J26	J28	J30	J32
45	44	42	35	29	25	24	23	22	21		19		18		18	17	16		15		14		14

Brinell Converted Mid-Radius: 170.0bhn

Brinell Converted Surface: 170.0bhn

Brinell: 170.000bhn

Tensile 1: 93,000psi

Yield 1: 61,400psi

Elongation: 20.4% in 2"(% in 50.8mm)

Reduction of Area: 40.49%

Grain Size per ASTM E112 = 7

Reduction Ratio 11.4 :1

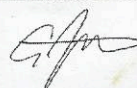
ASTM E381

Surface: 1 Mid Radius: 1 Center: 1

ASTM E45 Method A (Worst)

Sulfides: T: 1.5 H: 1.5 Alumina: T: 0.0 H: 0.0 Silicates: T: 0.0 H: 0.0 Globular: T: 1.0 H: 0.5

1. All manufacturing processes, including melting have been performed in the U.S.A.
2. No mercury, mercury compounds or mercury containing devices came into contact with this product.
3. Welding or weld repair was not performed on this material.
4. This material conforms to the specifications described on this document and may not be reproduced except in full, without written approval of Nucor Corporation.
5. This product is NAFTA certified under Paragraph "B" of the NAFTA rule of origin.
6. Material is Free of Radioactive Contamination.
7. This document is in compliance with EN 10204 "type 3.1"
8. Test procedures followed with asterisk(*) are outside of NSMEM - ISO17025 Accreditation scope
9. Results reported for ASTM E45 (Inclusion content) and ASTM E112 (Grain size) are provided as interpretation of ASTM procedures.
10. Reported results relate to the material samples subject to test, and are used to qualify material lot# indicated in within this report.
11. Export Country USA e-mail contact Memphis.Sales@nsmem.nucor.com



Cory Anthony
 Division Metallurgist

Sold To: CMC DALLAS TRADING
 PO BOX 139094
 DALLAS, TX 75313-9094
 (214) 689-4300
 Fax: (214) 689-5886

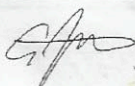
Ship To: CMC TRADING WAREHOUSE
 GREENSPORT TERMINAL
 13609 INDUSTRIAL ROAD - GATE 5
 UP - PTRS SWITCH ROAD
 HOUSTON, TX 77015
 (214) 496-5584

Customer P.O.	69855	Sales Order	134724.1
Product Group	Special Bar Quality	Part Number	30004000240MTS0
Grade	8620HLA; 8620/8622H; MECH PROP REPORT	Lot #	MM1410620002
Size	4" (4.0000) Round	Heat #	MM14106200*
Product	4" (4.0000) Round 20' 8620-C2R7	B.L. Number	G1-270911
Description	8620-C2R7	Load Number	G1-147295
Customer Spec		Customer Part #	8620

I hereby certify that the material described herein has been manufactured in accordance with the specifications and standards listed above and that it satisfies those requirements.

Specification Comments: EAF, LMF, VACUUM DEGASSED, CONTINUOUSLY CAST MATERIAL IS IN CONFORMANCE TO EN 10204
 3.1 MATERIAL CONFORMS TO ASTM A29; ASTM A322 A304 FINE GRAIN OF 5 OR FINER TO BE MEASURED IN ACCORDANCE WITH
 ASTM E112

1. All manufacturing processes, including melting have been performed in the U.S.A.
2. No mercury, mercury compounds or mercury containing devices came into contact with this product.
3. Welding or weld repair was not performed on this material.
4. This material conforms to the specifications described on this document and may not be reproduced except in full, without written approval of Nucor Corporation.
5. This product is NAFTA certified under Paragraph "B" of the NAFTA rule of origin.
6. Material is Free of Radioactive Contamination.
7. This document is in compliance with EN 10204 "type 3.1"
8. Test procedures followed with asterisk(*) are outside of NSMEM - ISO17025 Accreditation scope
9. Results reported for ASTM E45 (Inclusion content) and ASTM E112 (Grain size) are provided as interpretation of ASTM procedures.
10. Reported results relate to the material samples subject to test, and are used to qualify material lot# indicated in within this report.
11. Export Country USA e-mail contact Memphis.Sales@nsmem.nucor.com



Cory Anthony
 Division Metallurgist



ISO 9001:2008
Certificate number: 30993



ISO/TS 16949:2009
Certificate number: 20164



ISO 14001:2004
Certificate number: 10638

CERTIFICADO DE QUALIDADE
QUALITY CERTIFICATE
MILL'S TEST CERTIFICATE
CERTIFICADO DE CALIDAD

Nº 574693

OUR MANAGEMENT SYSTEM IS CERTIFIED TO ISO9001 / TS16949 / ISO14001

NOTA FISCAL/INVOICE 055741	PESO/WEIGHT (Kg) 69862,00	PEO CLIENTE/CUST ORDER CSI 209134	ORD FORNEC/ORD-SUPPLY 16445557 - 812508050	QUALIDADE/GRADE AISI 4140	PRODUTO/PRODUCT BARRA LAMINADA REDONDA	LOTE/BATCH 90217050																
					SEM TOTO BRUTO	CORRIDA/HEAT 22.165.500																
CLIENTE/CUSTOMER CHICAGO STEEL AND IRON - BAR DIVISI			MATERIAL/MATERIAL 899658	BITOLA/SIZE (mm) 88,900 mm	NORMA/SPECIFICATION CSI - 4140 (CHICAGO STEEL)-Rev.01 de 06.03.2011	REDUÇÃO/REDUCTION 42,40 :1																
ANALISE QUIMICA/CHEMICAL COMPOSITION																						
C	Mn	Si	P	S	Cr	Ni	Mo	V	Cu	Sn	Al	Ti	Nb	N	B	Pb	Ca	H				
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%				
0.42	0.93	0.28	0.011	0.006	1.02	0.16	0.22	0.004	0.15	0.009	0.026	0.0020	0.005	0.0093	0.0003	0.001	0.0008	0.00020				
ENSAIOS MECÂNICOS/MECHANICAL PROP																						
Elongation																						
Hardness																						
% 10.5																						
HB 302																						
ENSAIOS METALOGRAFICOS/METALLOGRAPHIC TESTS																						
Austenitic																						
Grain Size																						
7																						
MICROINCLUSÕES/INCLUSION RATING NUMBERS																						
AT	AH	BT	BH	CT	CH	DT	DH															
1.00	1.00	0.00	0.00	0.00	0.00	0.50	0.50															
MACROGRAFIA/MACROGRAPHY																						
S	R	C																				
1	2	1																				
TEMPERABILIDADE/HARDENABILITY																						
DI	DI	1/16	2/16	3/16	4/16	5/16	6/16	7/16	8/16	9/16	10/16	11/16	12/16	13/16	14/16	15/16	16/16	18/16	20/16	22/16	24/16	26/16
in	mm	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC	HRC
0.39	162.38	59.0	59.0	58.0	58.0	58.0	58.0	58.0	58.0	57.0	57.0	57.0	57.0	57.0	56.0	56.0	56.0	55.0	55.0	53.0	52.0	50.0
TEMPERABILIDADE/HARDENABILITY																						
28/16	30/16	32/16																				
HRC	HRC	HRC																				
49.0	48.0	48.0																				



ISO 9001:2008
Certificate number: 30010



ISO/TS 16949:2009
Certificate number: 30554



ISO 14001:2004
Certificate number: 70026

CERTIFICADO DE QUALIDADE
QUALITY CERTIFICATE
MILL'S TEST CERTIFICATE
CERTIFICADO DE CALIDAD

Nº 574693

OUR MANAGEMENT SYSTEM IS CERTIFIED TO ISO9001 / TS16949 / ISO14001

NOTA FISCAL/INVOICE 055741	PESO/WEIGHT (Kg) 69862,00	PEÇ./CLIENTE/CUST ORDER CSI 209134	ORD.FORNEC/ORD SUPPLY 16445557 - 812508050	QUALIDADE/GRADE AISI 4140	SEM TOTO BRUTO	CORRIDA/HEAT 22.165.500
CLIENTE/CUSTOMER CHICAGO STEEL AND IRON - BAR DIVISI			MATERIAL/MATERIAL 899658	BITOLA/SIZE (mm) 88,900 mm	NORMA/SPECIFICATION CSI - 4140 (CHICAGO STEEL)-Rev.01 de 06.03.2011	REDUÇÃO/REDUCTION 42,40 : 1

OBSERVAÇÕES/OBSERVATIONS

Made in Brazil - Size 3.50 in - Color Code: Black - Round Bars As Rolled, Untreated - UT 100% approved as ASTM A388 with criterium FBH max 2,00mm - EF, LF, VD and Ingot Casting - Inspected by magnetic particles - Free of Mercury, Welding and Radioactivity - ASTMs: E112, E45[A], A29, A322, E381, A370 and A711[max. 20%], EN 10204_3.1. All standards refer to the 2010

DEPARTAMENTO DA QUALIDADE/QUALITY DEPARTMENT

PINDAMONHANGABA, 30.04.2012

Ildo Jânio Souza de Oliveira - CREA 117203

C E R T I F I C A T E O F H E A T T R E A T M E N T

LONE STAR HEAT TREATING CORPORATION
3939 BLAFFER
HOUSTON, TX 77026

CUSTOMER: BAR SOURCE INTERNATIONAL
PURCHASE ORDER NO.: 31725

DESCRIPTION: 3 1/2"OD X 357"RL HN 22165500
TAG# 55453 (10) 55452 (10) 55455 (10) 55456 (10)
55454 (3) 55580 (10) 55660 (10) 55658 (10)
55457 (10)

NUMBER OF PARTS: 83

TYPE OF MATERIAL: 4140

SHIPPED ON OUR WO #: 535479

DATE OF ORDER: 12/22/14

HEAT TREATING SPECIFICATIONS:

Q&T & TEST TO BSI SPEC BSI-002 REV 4 UT PER ASTM
A388 PER SPEC S/C EXTRA BRINELL TEST TENSILE
CHARPY MAINTAIN TRACEABILITY CERT W/MATL

PROCESS AS FOLLOWS:

HEATED IN A CONTINUOUS FURNACE TO 1601F IN 48.8 MINUTES

WATER SPRAY QUENCHED

HEATED IN A CONTINUOUS FURNACE TO 1154F IN 39.5 MINUTES

INSPECTED 83 PIECES CHECKED 293-311 HBW SURFACE
CHECKED 302-311 HBW 1" BELOW
CHECKED 311-311 HBW MID RADIUS

FIVE TEST PIECES PROLONGATION 3 1/2"OD X 14"LG

S/N 535479-03 HN 22165500 MID RADIUS
MECHANICALS REFERENCED FROM ACCU TEST REPORT 705666.00 REV A
ATTACHED

S/N 535479-20 HN 22165500 MID RADIUS
MECHANICALS REFERENCED FROM ACCU TETS REPORT 705667.00 REV A
ATTACHED

S/N 535479-40 HN 22165500 MID RADIUS
MECHANICALS REFERENCED FROM ACCU TEST REPORT 705668.00 REV A
ATTACHED

C E R T I F I C A T E O F H E A T T R E A T M E N T

SHIPPED ON OUR WO #: 535479

DATE OF ORDER: 12/22/14

S/N 535479-60 HN 22165500 MID RADIUS
MECHANICALS REFERENCED FROM ACCU TEST REPORT 705669.00 REV A
ATTACHED

S/N 535479-80 HN 22165500 MID RADIUS
MECHANICALS REFERENCED FROM ACCU TEST REPORT 705670.00 REV A
ATTACHED

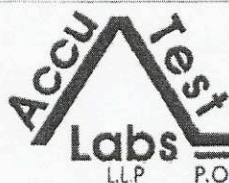
SEE ULTRASONIC TEST REPORT ATTACHED

Furnaces and instruments are calibrated to AMS 2750E. Reported Heat treat times and temperatures are taken from the furnace chart recorder. Our quality system is certified in accordance with AS9100 Cert # 47512. Mechanical testing conforms to the requirements of ASTM A370 and only applies to the sample tested or inspected. Frequency of all testing is dictated by Specification, customer purchase order and our quality manual QM-01 Rev 13. While at Lone Star Heat Treating this material did not come in contact with Mercury nor was it subject to any weld repairs.

LONE STAR HEAT TREATING CORPORATION

 Todd Pritchard

Prod. Mgr.



LLP P.O. Box 802404 ♦ Houston, TX 77280-2404 ♦ Telephone (713) 460-3655 ♦ FAX (713) 460-3695

Report Date: 01/12/15
Report No: **705666.00**
Rev.: A
Cust Acct: LON220

To: Lone Star Heat Treat
P. O. Box 15621
Houston, TX 77220-5621

Ordered By: Todd
Material: 4140 3-1/2"OD x 14"LG test pc
ID/Heat: 22165500
Job Info: LSHT Hardness 302-311 HBW

PO#: 535479-03

Tensile Test Results

No./Location	Size (in.)	Area (in ²)	Ult. Load (lbs.)	Yield (psi)	Tensile (psi)	Elong. (%)	R. of A. (%)	Hardness
1	.506			126,500	144,400	19.0	58.7	32.2 HRC
	.6% EUL			126,500				

Unless otherwise stated, yield stress is 0.2% offset, gauge length is 2 in. for 1/2 in. bars or 1 in. for 1/4 in. bars.

Charpy Test Results

No.	Temp	Location	Foot-Pounds	% Shear	Mils Lat Exp
1	-20°F	LCVN	64-60-61	100-100-100	32-29-30
2	-20°F	TCVN	31-28-28	70-65-65	22-20-20
3	-4°F	LCVN	71-69-68	100-100-100	28-27-27
4	-4°F	TCVN	31-32-31	65-65-65	20-22-21
5	+50°F	LCVN	70-75-71	100-100-100	45-47-46
6	+50°F	TCVN	45-48-42	90-100-90	26-29-23
7	+72°F	LCVN	71-70-80	100-100-100	43-42-45
8	+72°F	TCVN	46-48-45	100-100-100	37-39-37

Unless otherwise stated, Charpy impact specimens are V-notch 10 x 10 mm.

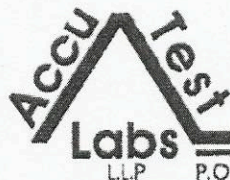
Mechanical testing performed at mid-radius.

Document

Reviewed By:

Yvonne Barajas
Yvonne Barajas
Documentation Specialist

Our reports are for the exclusive use of our customer and our name may be used only with prior written approval. Our reports apply only to the sample tested or inspected and do not necessarily represent the quality of other apparently similar or identical materials. All test specimens and testing conforms to ASTM A-370 requirements unless otherwise stated. This test report shall not be reproduced, except in full, without the written approval of Accu-Test Labs LLP.



LLP P.O. Box 802404 ♦ Houston, TX 77280-2404 ♦ Telephone (713) 460-3655 ♦ FAX (713) 460-3695

Report Date: 01/12/15
Report No: 705667.00
Rev.: A
Cust Acct: LON220

To: Lone Star Heat Treat
P. O. Box 15621
Houston, TX 77220-5621

Ordered By: Todd PO#: 535479-20
Material: 4140 3-1/2"OD x 14"LG test pc
ID/Heat: 22165500
Job Info: LSHT Hardness 302-311 HBW

Tensile Test Results

No./Location	Size (in.)	Area (in ²)	Ult. Load (lbs.)	Yield (psi)	Tensile (psi)	Elong. (%)	R. of A. (%)	Hardness
1	.506			130,800	148,800	18.4	59.5	32.5 HRC
	.6% EUL			130,100				

Unless otherwise stated, yield stress is 0.2% offset, gauge length is 2 in. for 1/2 in. bars or 1 in. for 1/4 in. bars.

Charpy Test Results

No.	Temp	Location	Foot-Pounds	% Shear	Mils Lat Exp
1	-20°F	LCVN	60-65-63	85-100-100	40-43-41
2	-20°F	TCVN	30-27-27	75-75-75	21-17-18
3	-4°F	LCVN	67-69-67	100-100-100	47-48-47
4	-4°F	TCVN	32-33-35	70-70-70	22-23-25
5	+50°F	LCVN	71-77-71	100-100-100	45-47-44
6	+50°F	TCVN	39-43-40	100-100-100	22-27-26
7	+72°F	LCVN	71-71-71	100-100-100	43-44-44
8	+72°F	TCVN	37-36-39	100-100-100	27-26-28

Unless otherwise stated, Charpy Impact specimens are V-notch 10 x 10 mm.

Mechanical testing performed at mid-radius.

Document

Reviewed By:

Yvonne Barajas
Yvonne Barajas
Documentation Specialist

Our reports are for the exclusive use of our customer and our name may be used only with prior written approval. Our reports apply only to the sample tested or inspected and do not necessarily represent the quality of other apparently similar or identical materials. All test specimens and testing conforms to ASTM A-370 requirements unless otherwise stated. This test report shall not be reproduced, except in full, without the written approval of Accu-Test Labs LLP.



LLP P.O. Box 802404 ♦ Houston, TX 77280-2404 ♦ Telephone (713) 460-3655 ♦ FAX (713) 460-3695

Report Date: 01/12/15

Report No: 705666.00

Rev.: A

Cust Acct: LON220

To: Lone Star Heat Treat
P. O. Box 15621
Houston, TX 77220-5621

Ordered By: Todd

PO#: 535479-03

Material: 4140 3-1/2"OD x 14"LG test pc

ID/Heat: 22165500

Job Info: LSHT Hardness 302-311 HBW

Tensile Test Results

No./Location	Size (in.)	Area (in ²)	Ult. Load (lbs.)	Yield (psi)	Tensile (psi)	Elong. (%)	R. of A. (%)	Hardness
1	.506			126,500	144,400	19.0	58.7	32.2 HRC
	.6% EUL			126,500				

Unless otherwise stated, yield stress is 0.2% offset, gauge length is 2 in. for 1/2 in. bars or 1 in. for 1/4 in. bars.

Charpy Test Results

No.	Temp	Location	Foot-Pounds	% Shear	Mils Lat Exp
1	-20°F	LCVN	64-60-61	100-100-100	32-29-30
2	-20°F	TCVN	31-28-28	70-65-65	22-20-20
3	-4°F	LCVN	71-69-68	100-100-100	28-27-27
4	-4°F	TCVN	31-32-31	65-65-65	20-22-21
5	+50°F	LCVN	70-75-71	100-100-100	45-47-46
6	+50°F	TCVN	45-48-42	90-100-90	26-29-23
7	+72°F	LCVN	71-70-80	100-100-100	43-42-45
8	+72°F	TCVN	46-48-45	100-100-100	37-39-37

Unless otherwise stated, Charpy impact specimens are V-notch 10 x 10 mm.

Mechanical testing performed at mid-radius.

Document

Reviewed By:

Yvonne Barajas
Yvonne Barajas
Documentation Specialist

Our reports are for the exclusive use of our customer and our name may be used only with prior written approval. Our reports apply only to the sample tested or inspected and do not necessarily represent the quality of other apparently similar or identical materials. All test specimens and testing conforms to ASTM A-370 requirements unless otherwise stated. This test report shall not be reproduced, except in full, without the written approval of Accu-Test Labs LLP.



P.O. Box 802404 ♦ Houston, TX 77280-2404 ♦ Telephone (713) 460-3655 ♦ FAX (713) 460-3695

Report Date: 01/12/15

Report No: 705670.00

Rev.: A

Cust Acct: LON220

To: Lone Star Heat Treat
P. O. Box 15621
Houston, TX 77220-5621

Ordered By: Todd

PO#: 535479-80

Material: 4140 3-1/2"OD x 14"LG test pc

ID/Heat: 22165500

Job Info: LSHT Hardness 302-311 HBW

Tensile Test Results

No./Location	Size (in.)	Area (in ²)	Ult. Load (lbs.)	Yield (psi)	Tensile (psi)	Elong. (%)	R. of A. (%)	Hardness
1	.504 .6% EUL			128,800 128,700	146,200	19.3	61.2	32.2 HRC

Unless otherwise stated, yield stress is 0.2% offset, gauge length is 2 in. for 1/2 in. bars or 1 in. for 1/4 in. bars.

Charpy Test Results

No.	Temp	Location	Foot-Pounds	% Shear	Mils Lat Exp
1	-20°F	LCVN	56-66-59	75-100-75	34-40-37
2	-20°F	TCVN	25-27-26	45-45-45	16-16-17
3	-4°F	LCVN	73-60-71	100-80-85	44-28-40
4	-4°F	TCVN	27-31-29	55-55-55	21-23-22
5	+50°F	LCVN	83-71-84	100-100-100	56-47-57
6	+50°F	TCVN	42-40-43	85-85-85	27-27-28
7	+72°F	LCVN	79-81-87	100-100-100	52-53-54
8	+72°F	TCVN	42-44-46	90-90-90	31-32-35

Unless otherwise stated, Charpy Impact specimens are V-notch 10 x 10 mm.

Mechanical testing performed at mid-radius.

Document
Reviewed By:

Yvonne Barajas
Yvonne Barajas
Documentation Specialist

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3939 Blaffer, Houston, Texas. 77026

731 672 6616 www.lshtr.com

Ultrasonic Certification Report

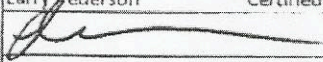
Report Number:	535479	Po #:	031725 REV02	Date:	03/31/2015
Company:	Bar Source International				
Specification:	BSI-002 Rev 4				
Acceptance Criteria:	ASTM-A388/API 6A				

Ultrasonic Inspection

Equipment:	Sonatest 250	Calibration Date:	12/02/2015	S/N #:	1005128
Longitudinal:	Size: 1" od	MHZ:	2.25	SN#:	45000
Shear Wave:	Size:	Deg:		MHZ:	
Part Condition:	clean	RMS:	250	Couplant:	cellulose
Longitudinal Standardization:	80%fsh 1/8" Flat Bottom Hole			Ref DB:	6.4 DB: 70
Shear Standardization:				Ref DB:	

Material:	4140
Heat #:	22165500
Size:	3 1/2" od x 35.7"-35.8" R/L
Total Pcs:	83
Acceptable:	83
Rejectable:	0

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Technician:	Larry Pederson	Certified 3-21-2008	SNT-TC- LEVEL II
			

Rev:		Date:	
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This report represents the results obtained from the test and is not to be construed as a guarantee or warranty of the materials listed. Lone Star Heat Treating Corp shall not be held liable for misinterpretation of Conditions, Loss, damage, or Death rising from or attributable to performance of a test. This report applies only to the material tested and or inspected and does not represent the quality of apparently similar or identical material.



ISO 9001:2008
Certificate Number: 50010



ISO/TS 16949:2009
Certificate Number: 38554



ISO 14001:2004
Certificate Number: 70638

CERTIFICADO DE QUALIDADE

QUALITY CERTIFICATE

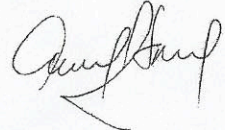
CERTIFICADO DE CALIDAD

Page 1/2

OUR MANAGEMENT SYSTEM IS CERTIFIED TO ISO9001 / TS16949 / ISO14001

PART NUMBER	PESO/WEIGHT (KG) 22.402,000	MATERIAL/MATERIAL 705009664	PRODUTO/PRODUCT HOT ROLLED ROUND BAR NO HEAT TREATMENT AS ROLLED	Cert. N° 0000012623 CORRIDA/HEAT 22085862												
CLIENTE/CLIENT MAGELLAN CORPORATION	QUALIDADE/GRADE AISI 8620/8620H	BITOLA/SIZE 5.0000 "														
NORMA/SPECIFICATION MIC 13016 ADDENDUM 9 AUG. 2016 31.08.2016																
Nota Fiscal/Invoice 0000007760	Pedido/Cust.Order 211139	Ord-Fornec/Ord-Supply 4337314 - 8106902574	Lote/Batch 2208586206	Peso/Weight (Kg) 22.402,000												
ANÁLISE QUÍMICA/CHEMICAL COMPOSITION																
C %	Mn %	Si %	P %	S %	Cr %	Ni %	Mo %	V %	Cu %	Sn %	Al %	Ti %	Nb %	N %	B %	Pb %
0,210	0,87	0,33	0,012	0,026	0,52	0,49	0,17	0,0030	0,170	0,0110	0,0250	0,0012	0,0040	0,0096	0,0005	0,0020
H %	Ca %	W %	Co %	As %	Zr %	Sb %	Zn %	Al+Nb %	Cu+10Sn %	DI "						
0,00011	0,0012	0,0020	0,0070	0,0040	0,0010	0,0004	0,0010	0,0290	0,2800	2,1949						
ENSAIOS MECÂNICOS/MECHANICAL PROP																
Mid Radius Hardness HB 183		Surface Hardness HB 183														
ENSAIOS METALOGRAFICOS/METALLOGRAPHIC TESTS																
Austenitic Grain Size 6																
MICROINCLUSÕES/INCLUSION RATING NUMBER																
ASTM/SAE																
A - TS 2,0	A - HS 1,5	B - TS 0,0	B - HS 0,0	C - TS 0,0	C - HS 0,0	D - TS 0,5	D - HS 0,5									
MACROGRAFIA/MACROGRAPHY																
Macro S 1	Macro R 1	Macro C 1														
TEMPERABILIDADE/HARDENABILITY																
1/16"	2/16"	3/16"	4/16"	5/16"	6/16"	7/16"	8/16"	9/16"	10/16"	11/16"	12/16"	13/16"	14/16"	15/16"	16/16"	18/16"
HRC 46,2	HRC 45,7	HRC 42,2	HRC 38,4	HRC 34,9	HRC 31,9	HRC 29,9	HRC 28,2	HRC 27,0	HRC 26,2	HRC 25,2	HRC 24,4	HRC 23,8	HRC 23,2	HRC 22,8	HRC 22,4	HRC 21,7
20/16"	22/16"	24/16"	26/16"	28/16"	30/16"	32/16"										
HRC 21,3	HRC 21,0	HRC 20,9	HRC 20,8	HRC 20,8	HRC 20,7	HRC 20,6										

OUR MANAGEMENT SYSTEM IS CERTIFIED TO ISO9001 / TS16949 / ISO14001

PART NUMBER	PESO/WEIGHT (KG) 22.402,000	MATERIAL/MATERIAL 705009664	PRODUTO/PRODUCT HOT ROLLED ROUND BAR NO HEAT TREATMENT AS ROLLED	Cert. N° 0000012623 CORRIDA/HEAT 22085862
CLIENTE/CLIENT MAGELLAN CORPORATION	QUALIDADE/GRADE AISI 8620/8620H		BITOLA/SIZE 5.0000 "	
GRAU DE REDUÇÃO/REDUCTION RATE 26,2000 : 1				
OBSERVAÇÕES/OBSERVATIONS Color code: Orange and Green. Ca-Al Treated Material according A29/A29M, John Deere JDM AO QL-2 and CAT 1E02743 US test 100% approved as ASTM A388/A388M-11 EF, LF, VD and Ingot Casting No Weld Repair, Mercury and Radioactivity Free. EN 10204_3.1 - ASTMs: E112-13, E45[A]-13, E381-01, A322-13, A304-11, A751-11, A370-12a, A255-10, A711/A711M-07 and E10-12. All standards refers to the 2013 volume. Made in Brazil. Rod. Luiz Dumont Villares, km 2 Pindamonhangaba SP - Brazil			DEPARTAMENTO DA QUALIDADE / QUALITY DEPARTMENT PINDAMONHANGABA. 25.02.2017  ANDRÉ L. SILVA FAGUNDES CREA 0682601000	
ENVIRONMENTAL RECOMENDATIONS RELATED TO PRODUTCS: In order to contribute with the environment and sustainable development of our productive chain, we recommend to our clients to dispose accordingly the waste related to our products, according to the environmental legislation of your region, state or country.				