

05/27/2016

P.O.#: B105152

Item: 1 (1 PC) " X 4" DIA X 101" LONG

S.O.#: 546451

To: ENCORE METALS

AA PL#: 4.A131578

# A131578



8000 N. County Road 225 East  
Pittsboro, IN 46167  
Phone: (317) 892-7000  
Fax: (317) 892-7286

## Certified Material Test Report

Cert #: 156109	Mill Order: 1307888	Heat #: A131578	Issued: 8/27/2013 16:49:53
Work Order:	Sales Order: 118557-1	Customer:	PO #: 96012-1
Load #: 185026	Reference #:	Reference Desc:	End Use:
Size: 4"	Shape: Round	Grade: F22	Length: 28'
Grain Practice: Al Fine Grain (5-8) per ASTM A29		Reduction Ratio: 11.4 to 1	Disposition: 1

### Ladle Chemistry Analysis (ASTM A29)

C	Mn	P	S	Si	Al	Cu	Ni	Cr	Mo	Sn	N	V	Cb	B	Ca	W	Ti	DI
0.13	0.48	0.009	0.010	0.23	0.020	0.13	0.08	2.30	1.02	0.007	0.0100	0.007	0.004	0.0002	0.0015	0.001	0.001	0.001
Pb	Co	As	Sb	Zr	Bi	H	O	Ceq	J-Factor									
0.001	0.008	0.001	0.005	0.001	0.000	2.6		0.89										

### Product Check Analysis (ASTM A29)

Front	C	Mn	P	S	Si	Al	Cu	Ni	Cr	Mo	Sn	N	V	Cb	Ti	B	Ca	O
Back																		

### Jominy (ASTM A255)

Calc'd	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J12	J14	J16	J18	J20	J24	J28	J32
Front																		
Back																		

### Microcleanliness (ASTM E45)

Method A										Method C				Method E				Microcleanliness (DIN 50602)			
AT	AH	BT	BH	CT	CH	DT	DH	S	O	SAM "B"				SAM "D"				K	M		
														S	O	Tot	Tot				

Decarb		Grain Size				Macrostructure (ASTM E381)			Magnetic Particle Inspection			
Depth	% of Diameter	Austenitic		Ferritic		S	R	C	Frequency		Severity	
		8										

### Mechanical Properties (ASTM A370)

Tensile Properties					Hardness (BHN)	
Tensile Strength	0.2% Yield Strength	% Elong (2")	% ROA	0.35% EUL Yield Strength	(MR)	(Surf)
					319	
					315	

### Comments/Specs

Electric Arc Furnace Melted - Vacuum Tank Degassed ---- EN 10204:2004 3.1 ---- Normalize & Temper and Machine Straighten ---- Normalize & Temper and Machine Straighten ---- ASTM A182/182M-12b F22, Class 3 ---- ASME SA182-04 F22 CL3 ---- ASTM A739-90a (Reapproved 2006) B22 ---- AAS Spec 22, P. 0.025max, S 0.010-0.025, Sn 0.02 max

**MATERIAL CONFORMS TO**  
NACE MR0175  
BHN 315

SA-182-F22  
SA-739-B-22  
HH: A131578  
Silver  
Dew

Condition: Normalize, Temper, Straighten, Contact UT

UT: Passed Ultrasonic Inspection

I hereby certify that the content of this report is correct and accurate, and that all tests and operations performed on this material were in compliance with applicable material specifications and purchaser designated requirements.

Trevor Klipp - Rolling Mill Metallurgist

Any alteration to this report voids Steel Dynamic's warranting of results. No weld repair has been performed on this material. This material is not radioactive and has not been exposed to radioactivity while under the control of Steel Dynamics. This material has not been exposed to mercury while under the control of Steel Dynamics. Unless otherwise noted, this material was melted, continually cast, and rolled in the USA; w/ all testing performed by Steel Dynamics.

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### Certified Material Test Report Heat Treatment Addendum

Cert #: 156109  
Work Order: 149147  
Load #: 185026  
Size: 4"

Mill Order: 1307888  
Sales Order: 118557-1  
Reference #:  
Shape: Round

Heat #: A131578  
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Reference Desc:  
Grade: F22

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Length: 28'

Normalize		Austenitize		Quench Media		Temper		Stress Relieve		
Time	Temp	Time	Temp	Type	Time	Temp	Time	Temp	Time	Temp
1.6 hrs	1750 F	hrs	°F	Water	min	°F	4.75 hrs	1250°F	hrs	F

\* Furnaces are calibrated to API 6A Annex P, and use atmospheric thermocouples.  
\*\* QTC is 12" prolongation from longitudinal orientation .machined to a 0.505" buttonhead for tensile.

**Hardness (ASTM A370)**

Sample ID	Location	HB
92300	Mid-Radius Q1	181
92800	Mid-Radius Q1	173

**Surface Hardness (ASTM A370)**

Sample ID	Location	HB
92304	Surface Q1	173
92804	Surface Q1	166

**Tensile (ASTM A370)**

Sample ID	Orientation	Location	Tensile	0.2% Yield	%E (2")	%ROA
92300	Longitudinal	Mid-Radius Q1	84,900 psi	56,400 psi	26	73
92800	Longitudinal	Mid-Radius Q1	81,400 psi	51,500 psi	26	69

I hereby certify that the content of this report is correct and accurate, and that all tests and operations performed on this material were in compliance with applicable material specifications and purchaser designated requirements.

Garrett Bouyett - Bar Finishing Metallurgist

Any alteration to this report voids Steel Dynamic's warranting of results.