

# MILL TEST CERTIFICATE

Azkaitia Plant

ISO 9001 - ISO/TS 16949

1.906 W-LOCK MANDREL 9CR



Product Made in Spain

CUSTOMER: <b>ENERGY ALLOYS HOUSTON</b>	WORKS REFERENCE: <b>1735449</b>
REFERENCE: <b>1031473 OP</b>	SALES ORDER: <b>268380-3</b>
PRODUCT NR: <b>959</b>	HEAT NUMBER: <b>628324</b>
	ROLLED: <b>06.06.2014</b>

<b>REQUIRED PRODUCT</b>			
9%Cr 1%Mo ROUND BARS AS ROLLED Q+T+STRESS RELIEVED 2.25" ASTM A-29 (")			
3.000/8.000 mm RANDOM			
<b>EXPEDITION</b>	<b>DELIVERY: 0080472882</b>	<b>WEIGHT (KG): 2.060</b>	<b>BUNDLES: 1</b>
			<b>UNITS: 15</b>

<b>MADE ACCORDING TO</b>	
ASTM A370 2012A 15.10.2012 ; ASTM A29-A29M E1 . . .2012	
ENERGY ALLOYS EAGL-600 05 06.04.2013 ; API SPEC 6A 20*ED.+ER1&2+AD12.3 . .03.2013	
NACE MR0175/ISO 15156-2 2*EDICION 15.10.2009	
NACE MR0175/ISO 15156-1 2*EDICION 15.10.2009 ; EN 10204 :2004 OCT. 2004 3.1	

<b>CHEMICAL ANALYSIS OF HEAT</b>								
U: % HEAT NUMBER: <b>628324</b>								
	<b>C</b>	<b>Mn</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cr</b>	<b>Ni</b>	<b>Mo</b>
Min.	0,090	0,300	0,250			8,000		0,900
Max.	0,150	0,600	1,000	0,020	0,010	10,000	0,500	1,100
Cer.	0,090	0,418	0,647	0,010	0,003	8,612	0,230	0,967


<b>MECHANICAL PROPERTIES AS SUPPLIED (CONDITIONS)</b>	
Specimen Test location: At 1/2 radius ; Temperature of: (1): Austenitizing 1.652 °F ; Time: (1): 101 Minutes	
Cooling: (1): Oil 82/99 °F ; Temperature of: (2): Tempering 1.328 °F ; Time: (2): 135 Minutes	
Cooling: (2): Air ; Temperature of: (3): STRESS RELIEVED 1.228 °F ; Time: (3): 200 Minutes	

<b>MECHANICAL PROPERTIES AS SUPPLIED (TEST)</b>	
Standard (ASTM A370-15.10.2012) ; Tensile Strength (>= 100 KSI): 103 KSI	
Yield Strength(1) (Rp(0,2%) 80/95 KSI): Rp(0,2%) 83 KSI	
Yield Strength(2) ((0,5%) 80/95 KSI): (0,5%) 84 KSI ; Elongation (2 " >= 20 %) : 2 " 27,1 %	
Reduction of Area (>= 40 %) : 74,4 % ; Observations: . ; Standard (ASTM E23-01AEL2007)	
Notch impact sample direction (Longitudinal): Longitudinal	
Notch Impact sample type (CHARPY-V): CHARPY-V ; Notch Impact test Temperature (75 °F): 75 °F	
K(1): 152 Ft.Lb ; K(2): 160 Ft.Lb ; K(3): 171 Ft.Lb ; K (average) (>= 40 Ft.Lb): 161 Ft.Lb	
lateral expansion: 0,62-0,65-0,69 mm ; Brittle fracture: 22-25-26 % ; Standard (ASTM E18-2008B)	
Surface hardness (HB): 218/230 HB ; Hardness at 1/2 radius (1) (16/22 HRC): 18/20 HRC	
Hardness at 1/2 radius (2) (207/235 HB): 215/223 HB	
Notch impact sample direction (Longitudinal): Longitudinal	
Notch Impact sample type (CHARPY-V): CHARPY-V ; Notch Impact test Temperature (14 °F): 14 °F	
K(1): 118 Ft.Lb ; K(2): 125 Ft.Lb ; K(3): 132 Ft.Lb ; K (average) (>= 29 Ft.Lb): 125 Ft.Lb	
lateral expansion: 0,60-0,630,66 mm ; Brittle fracture: 20-21-22 %	

<b>ADDITIONAL TESTS</b>
Standard (ASTM E112- . . .2010) ; Grain size: Austenitic 7

<b>NON DESTRUCTIVE TESTS</b>
Internal defects standard(1) (ASTM A388-A388M- . . .2011)
Internal defects standard(2) (API SPEC 6A20*ED.+ER1&2+AD12.3 . .03.2013)
Internal defects type/method (PSL3) ; ULTRASONIC INSPECTION 100% : O.K.

<b>ADDITIONAL INFORMATION</b>
Reduction ratio: 82,9 ; MADE IN ELECTRIC FURNACE AND VACUUM DEGASSED. ; Energy Alloys EAGL-600 REV5
"Cold rotary straightening" ; FURNACE CALIBRATION ACCORDING TO AMS-MIL-H-6875, AMS-2750

TECHNOLOGY & QUALITY CERTIFIES THAT THE PRODUCT FULL FILLS THE ORDER'S SPECIFICATION	
APPROVED BY: ISABEL UZKIANO INURRATEGI	SIGN: 
DATE: 25.06.2014	Analyst of Quality certificates
REF.: 2000756160000	



# MILL TEST CERTIFICATE

Azkoitia Plant

ISO 9001 - ISO/TS 16949



Product Made in Spain

CUSTOMER:ENERGY ALLOYS HOUSTON		WORKS REFERENCE:1735449
REFERENCE:1031473 OP	SALES ORDER:268380-3	HEAT NUMBER:628324
PRODUCT NR:959	MASTER REFERENCE:186858	ROLLED:06.06.2014
TREATMENT OF THE MATERIAL IN CONVENTIONAL FURNACE		

TECHNOLOGY & QUALITY CERTIFIES THAT THE PRODUCT FULL FILLS THE ORDER'S SPECIFICATION

APPROVED BY:ISABEL UZKIANO INURRATEGI

DATE:25.06.2014

REF.:2000756160000

SIGN:

Page 2 of 2

Analyst of Quality certificates

