



Azkoitia Plant

## MILL TEST CERTIFICATE

ISO 9001 - ISO/TS 16949



Product Made in Spain

CUSTOMER: ENERGY ALLOYS HOUSTON	WORKS REFERENCE: 1708892
REFERENCE: 1031455 OP	SALES ORDER: 268382-3
PRODUCT NR: 684	HEAT NUMBER: 628055
	ROLLED: 07.03.2014

## REQUIRED PRODUCT

9%Cr 1%Mo ROUND BARS AS ROLLED Q+T+STRESS RELIEVED 1.75" ASTM A-29 (")  
3.000/8.000 mm RANDOM

EXPEDITION DELIVERY: 0080459366 WEIGHT (KG): 2.085 BUNDLES: 1 UNITS: 25

## MADE ACCORDING TO

ASTM A29-A29M - ...2011 ; ASTM A370 11A 15.11.2011  
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

## CHEMICAL ANALYSIS OF HEAT

U:% HEAT NUMBER: 628055

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu
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	0,300
cer.	0,098	0,454	0,667	0,011	0,005	8,595	0,247	0,975	0,173

## MECHANICAL PROPERTIES AS SUPPLIED (CONDITIONS)

Specimen Test location: At 1/2 radius ; Temperature of: (1): Austenitizing 1.652 °F ; Time: (1): 78 Minutes  
Cooling: (1): Oil 84 °F ; Temperature of: (2): Tempering 1.310 °F ; Time: (2): 104 Minutes  
Cooling: (2): Air ; Temperature of: (3): STRESS RELIEVED 1.210 °F ; Time: (3): 180 Minutes

## MECHANICAL PROPERTIES AS SUPPLIED (TEST)

Standard (ASTM A370 11A 15.11.2011) ; Tensile Strength ( $\geq 100$  KSI): 115 KSI  
Yield Strength(1) (Rp(0,2%) 80/95 KSI): Rp(0,2%) 93 KSI  
Yield Strength(2) ((0,5%) 80/95 KSI): (0,5%) 95 KSI ; Elongation (2 "  $\geq 20$  %): 2 " 25,9 %  
Reduction of Area ( $\geq 40$  %): 70,05 % ; Observations: . ; Standard (ASTM E23-01AE12007)  
Notch impact sample direction (Longitudinal): Longitudinal  
Notch Impact sample type (CHARPY-V): CHARPY-V ; Notch Impact test Temperature (75 °F): 75 °F  
K(1): 125 Ft.Lb ; K(2): 125 Ft.Lb ; K(3): 128 Ft.Lb ; K (average) ( $\geq 40$  Ft.Lb): 126 Ft.Lb  
lateral expansion: 0,61-0,61-0,63 mm ; Brittle fracture: 21-21-22 % ; Standard (ASTM E18-2008B)  
Surface hardness (HB): 226/237 HB ; Hardness at 1/2 radius(1) (16/22 HRC): 19/21 HRC  
Hardness at 1/2 radius(2) (207/235 HB): 222/232 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): 119 Ft.Lb ; K(2): 123 Ft.Lb ; K(3): 123 Ft.Lb ; K (average) ( $\geq 29$  Ft.Lb): 121,67 Ft.Lb  
lateral expansion: 0,60-0,62-0,62 mm ; Brittle fracture: 20-22-22 %

## ADDITIONAL TESTS

Standard (ASTM E112-...2010) ; Grain size: Austenitic 7

## NON DESTRUCTIVE TESTS

Internal defects standard(1) (ASTM A388-A388M-...2011)  
Internal defects standard(2) (API SPEC 6A 20\*ED, +ER1&2+AD12.3 . .03.2013)  
Internal defects type/method (PSL3) ; ULTRASONIC INSPECTION 100% : O.K.

## ADDITIONAL INFORMATION

Reduction ratio: 141,6 ; 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 &amp; QUALITY CERTIFIES THAT THE PRODUCT FULL FILLS THE ORDER'S SPECIFICATION

APPROVED BY: ISABEL UZKIANO INURRATEGI

DATE: 25.03.2014

REF.: 2000715640000

SIGN:

Page 1 of 2

Analyst of Quality certificates



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REFERENCE: 1031455 OP	SALES ORDER: 268382-3	HEAT NUMBER: 628055
PRODUCT NR: 684	MASTER REFERENCE: 186859	ROLLED: 07.03.2014

TREATMENT OF THE MATERIAL IN CONVENTIONAL FURNACE ; "COUNTRY OF MELT AND MANUFACTURE: SPAIN"  
NO WELD REPAIR PERFORMED ; MATERIAL IS FREE OF MERCURY CONTAMINATION