

From: ESP Specialty Steel Products Date: 1/26/2016 To: COPPER & BRASS SALES CANADA SO#: S085846 Ln#: 1 PO#: 5400290898-R05 Part: 11416005 Qty: 7482
 Heat#: CD25451A Tag: 149919



CARRS STAINLESS STEELS
 A Division of ELG Haniel Metals Ltd.
 Wadsley Bridge, Sheffield, S6 1LL, England

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Tomas Sanchez

Purchaser - Besteller - Acheteur ESP Specialty Steel Products 7404 Railroad Lane Houston TX 77088 USA	Inspection Certificate, Abnahmeprotokoll Certificat de reception DIN 50049 3.1 EN 10204	Cert No Zertifikat Nr. Cert No 144502	Date, Datum Date: 06/10/15
	Customer Order No Kundenbestellnummer No. de Commande Client P04054	Product Description - Beschreibung des Erzeugnisses - Description du Produit 16.125in Dia. x 9000lbs Electric Melt & Vacuum Degassed Stainless Steel 8543 LB 3875 Kgs.	
	Our Order No Unsere Auftr-Nr notre Comm. No. 54428 W147100/01	Solution Annealed Forged SS1 REV 6 316/316L/F316/F316L ASTM A276-13a, A479-14, A182-14b, A484-14a, A193-14 B8M CL1 ASME SA182, ASME SA479, ASME SA193 B8M CL1, SAE AMS-QQ-S-763B AMS 5853, AMS 5848, NACE MR0175, ISO 15156-3, NACE MR0103	

Chemical Analysis - Chemische Analyse - Analyse Chimique													
Cast No Schmelznummer No. de Cousse	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	N	Co		
CD25451 A	.029	.39	1.38	0.08	.023	16.62	2.10	10.21	.38	0.05	20		

Heat Treatment - Wärmebehandlung - Traitement Thermique
 Solution annealed @ 1940 F for 4 hours & Water Quenched

Mechanical Properties - Mechanische Eigenschaften - Caractéristiques Mécaniques									
Test No Probe Nr No. d'Essai	Test Dimension Probendimension Dimension	Proof Stress Streckgrenze Limite d'Elasticité 0.2%	Rp 1.0%	Tensile strength Zugfestigkeit Résistance à la traction	Elong % A Bruchdehnung % Allongement % L ₅₀ 4D	Mod of Arso % 7 Bruchverschiebung % Striction %	Impact Kerbschlagenergie Résistance	Hardness Härte Dureté	
MR0533	16.125" L	294 MPa	321 MPa	569 MPa	58 %	62 %	71 %	143 HB	1

Remarks - Bemerkungen - Remarques

Ultrasonically tested to ASTM A388 and found satisfactory
 Intergranular corrosion test to ASTM A262E satisfactory
 Intergranular corrosion test to ASTM A262A satisfactory
 Grain size to ASTM E112 - 00+
 Microstructure and macrostructure see attached sheet.
 No welding performed
 No contact with Mercury or radioactive elements
 Nominal Size = 16" dia
 Material produced by ELG Carrs Stainless Steels in the United Kingdom
 Hot Working Reduction - 3.2:1



This report is a copy of original mill certificate and verifies that the product meets the requirements as originally ordered by Energy Steel Products.

DATE: 1/26/15 VERIFIED BY: aps

The material detailed has been manufactured and tested in accordance with the Quality Assurance system ISO 9001:2008 and the requirements of the specification/order.

Signed: *[Signature]*
 Chris Ryall - Quality Manager
 Approved signatory for ELG Carrs Stainless Steels

Del.: 2404435698
 Cstor BOZO
 Date 03/23/2016
 From: TK Materials CA, Ltd.
 Cust. ATLANTIS INDUSTRIES
 CstAR
 Wgt.: 1,900 LB

	<p align="center">TECHNICAL REPORT No. 192337</p>	
<p>Metals Technology (Testing) Ltd 6 Finchwell Close Handsworth Sheffield S13 9DF</p>	<p>Tel: 0114 243 7271 Fax: 0114 243 7288 office@metals technology.co.uk</p>	<p>0963 Page 1 of 2 Our Ref: CB/KK Date 29/09/2015</p>
<p align="center"><u>METALLURGICAL ASSESSMENT OF 316L MATERIAL</u></p>		
<p><u>Introduction</u></p>		
<p>A sample of a 16.125" Diameter Segment, 316L material, was received for metallurgical assessment. The sample was identified as cast number CD25451A and supplied under covering order 032937 W147100/01</p>		
<p><u>Work Carried Out</u></p>		
<ol style="list-style-type: none"> 1. Microexamination 2. Microexamination in accordance with ASTM A262-13 Practice A 3. Grain Size Assessment to ASTM E112-12 (Comparison Method) 4. Macroexamination 		
<p><u>Results</u></p>		
<ol style="list-style-type: none"> 1. <u>Microexamination</u> 		
<p>A longitudinal sample was prepared to a 1µm finish using standard metallographic techniques and then etched in Kalling's No. 2 and examined at a magnification of X500.</p>		
<p>The sample exhibited a structure of twinned equiaxed austenite grains with occasional evidence of delta ferrite stringers. There was no evidence of any grain boundary carbides or intermetallic phases.</p>		
<ol style="list-style-type: none"> 2. <u>Microexamination in accordance with ASTM A262-13 Practice A</u> 		
<p>Prior to testing, a longitudinal sample was heat treated to 675°C for 1 hour then air cooled.</p>		
<p>The sample was prepared to a 1µm finish using standard metallographic techniques and then etched electrolytically in 10% oxalic acid and examined at a magnification of X500.</p>		
<p>The sample exhibited a step structure (step between grains, no ditches at grain boundaries) similar to fig. 1 of ASTM A262-13 Practice A.</p>		
<p align="center">Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.</p>		
Circulation:	Mr. D. Greaves & M.T.T. Archive	
Address:	Carrs Stainless Steels, Wadsley Bridge, SHEFFIELD, S6 1LL	
Steel Grade:	316L	
	P:\Documents\Test Reports\Microexaminations\192337 Carrs Sept 2015.doc QCD8/1	

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TECHNICAL REPORT
No. 192337



0963

Page 2 of 2

Results Contd...

3. Grain Size Assessment to ASTM E112-12 (Comparison Method)

The specimen prepared in the microexamination section was examined at a magnification of X100.

The average grain size was determined in accordance with ASTM E112-12. The result is shown below:-

Grain Size - ASTM No. 00+

4. Macroexamination

A transverse full cross section slice was prepared to 60 grit finish and was then hot etched in HCl/H₂O₂ solution.

The sample examined appeared homogenous and defect free.

Reported By:-

Mr. G Tinker

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