



Tata Steel UK Limited
 Stockbridge
 Sheffield
 S36 2JA
 United Kingdom
 Telephone: +44 (0) 114 2882361
 Fax: +44 (0) 114 2882079
 Website: www.tatasteel.com

4 1/4" 9Cr1Mo

INSPECTION CERTIFICATE/TYPE 3.1 to BS EN10204

TATA STEEL INT (AMERICAS) INC.
 475 NORTH MARTINGALE DRIVE
 SUITE 400 SCHAUMBURG
 ILLINOIS 60173 - 2222
 USA

Cast No. A0725N

Works Order No. CB860754

Customer Order No. HOU-104960

Date of Issue 04-NOV-2013

Certificate No. 00461535/1

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SPECIFICATIONS ASSOCIATED WITH THIS ORDER -
 HG9CR BAR REV 3/HG 001 BAR REV 1

PRODUCT INFORMATION -

SIZE - 4.25"

QUANTITY/WEIGHT - 7 BARS 5.012 TONNES APPROX

PRODUCT DESCRIPTION - ALLOY ROUGH TURNED BAR

CONDITION OF MATERIAL - COLD STR, FINALLY HT, SM TURN, STR REL

STEELMAKING PROCESS/PROCESS OF MANUFACTURE - Electric VDG Ingot

HEAT TREATMENT OF MATERIAL - W22507

Continuous Harden at 960°C; for 01:00; time to 01:37; total time 02:37; Water Quenched from 31°C.

Temper at 685°C; for 01:00; time to 02:18; total time 03:18; Air Cooled.

Freedom from residual stress

Continuous Harden starting and ending water quench temperatures below 35°C

ANALYSIS -

| Cast No | C | Si | Mn | P | S | Cr | Mo | Ni | Cu | Sn |
|---------------|-----|-----|-----|------|-------|------|-----|-----|-----|------|
| Cast Analysis | | | | | | | | | | |
| A0725N | .13 | .31 | .53 | .008 | .0013 | 8.33 | .92 | .10 | .04 | .014 |

Mechanical Test - Tested to ASTM E8 - 11

| | Test No. | Ingot Id | Ingot Pos. | Sample Pos. | Orient | Temp. | 0.2% PS | U.T.S | Elong | R of A |
|--------|----------|----------|------------|-------------|--------|-------|---------|-------|-------|--------|
| Units | | | | | | C | kPSI | kPSI | % | % |
| Result | 2244417 | 42 | M | Mid-Radial | Lo | 20 | 85.1 | 109.9 | 25.4 | 70.0 |

Impact Test - Tested to ASTM E23 - 12c

| | Test No. | Ingot Id | Ingot Pos. | Sample Pos. | Geometry | Orient | Temp. | Imp Mean | Imp | Imp | Imp | Lat Exp | Lat Exp | Lat Exp |
|--------|----------|----------|------------|-------------|-----------|--------|-------|----------|-----|-----|-----|---------|---------|---------|
| Units | | | | | | | C | J | J | J | J | mm | mm | mm |
| Result | 2244418 | 42 | M | Mid-Radial | CH2MMV(8) | Lo | -10 | 134 | 132 | 136 | 133 | 1.62 | 1.60 | 1.69 |

| | Test No. | Ingot Id | Ingot Pos. | Sample Pos. | Geometry | Orient. | Temp. | % Shear | % Shear | % Shear |
|--------|----------|----------|------------|-------------|-----------|---------|-------|---------|---------|---------|
| Units | | | | | | | C | % | % | % |
| Result | 2244418 | 42 | M | Mid-Radial | CH2MMV(8) | Lo | -10 | 65.0 | 70.0 | 70.0 |





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MacQuaid Ehn Grain Size - Tested to ASTM E112 - 12
MacQuaid Ehn Grain Size - Carburised at 925 Deg C 8 Hours Furnace Cooled.

Tested at a magnification of X100

| Test No. | Ingot Id | Ingot Pos. | G.Size | G.Size | Etchant |
|----------------|----------|------------|--------|--------|-----------|
| Result 2230326 | 17 | M | 7 | 8 | 10% Nital |

Jernkontoret Inclusion Count - Tested to ASTM E45 -13

| Test No. | Ingot Pos. | A Thin | A Heavy | B Thin | B Heavy | C Thin | C Heavy | D Thin | D Heavy |
|----------------|------------|--------|---------|--------|---------|--------|---------|--------|---------|
| Result Average | | 0.00 | 0.00 | 0.92 | 0.00 | 0.00 | 0.00 | 0.57 | 0.08 |

Surface Hardness -

| Test No. | Ingot Id | Ingot Pos. | Hardness | Hardness |
|----------------|----------|------------|------------|------------|
| Units | | | HBW10/3000 | HBW10/3000 |
| Result 2244420 | | | 235 | 235 |

Delta Ferrite Count - Tested to AMS 2315 F 2008-01

| Test No. | Ingot Id | Ingot Pos. | Sample Pos. | Orient | % Ferrite | RelAccuracy | Mag | Etchant |
|----------------|----------|------------|-------------|--------|-----------|-------------|------|----------|
| Units | | | | | % | % | | |
| Result 2244419 | 42 | M | | Lo | 0.0 | 100.0 | X200 | VILLELAS |

Magnetic Particle Inspection Test - Tested to AMS 2301 Rev K 2010-08

| Test No. | Ingot Id | Ingot Pos. | Sev | Freq |
|----------------|----------|------------|------|------|
| Result 2230329 | 17 | T | 0.00 | 0.00 |
| 2242208 | 24 | T | 0.00 | 0.00 |
| 2244415 | 42 | T | 0.00 | 0.00 |
| 2230330 | 17 | B | 0.00 | 0.00 |
| 2242209 | 24 | B | 0.00 | 0.00 |
| 2244416 | 42 | B | 0.00 | 0.00 |

Ultrasonic Test - Tested to ASTM A388/A388M - 11
Satisfactory to 1/8in FBH
US SATISFACTORY TO API 6A PSL 3 + 4



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MISCELLANEOUS INFORMATION -

NO WELDING PERFORMED

FURNACE CALIBRATION TO AMS 2750

REDUCTION RATIO: 29.11:1

INGOT ROUTE

Material type tested satisfactorily

Method of Analysis

- Elemental Analysis (combustion/fusion) tested at our Rotherham laboratory C S

- Atomic Emission Spectroscopy (OES) tested at our Rotherham laboratory Si Mn P Cr Mo Ni Cu Sn

Radioactivity < 0.1Bq/g on ladle sample.

This product is mercury free.

No weld repair carried out on this product.

Our quality management system is accredited to the following standards : ISO9001 and AS/EN9100.

Our environmental management system is accredited to ISO14001.

AUTHORISED SIGNATURE -

Certified by our Stocksbridge Works that, unless otherwise stated above, the whole of the above mentioned materials have been manufactured, tested & inspected in accordance with the terms of the acknowledged contract/order applicable thereto and conform fully to the standards/specifications quoted hereon.

Approved Signatory - Lee Ibbitson - Certification and Accreditation Manager

Signed.....

For Tata Steel UK Limited

This inspection certificate shall not be reproduced except in full, without the written approval of Tata Steel UK Limited
End Of Certificate