

| | | | | |
|-----------------------------|-------------------------------|------------------------------|-------------------------|-------------------|
| Sample Result Name | Type | Measure Date Time | Recalculation Date Time | Origin |
| 9917 (DIA-70 MM) HNO-166583 | Unknown | Thursday, September 11, 2014 | 12:38:18 PM | Measured |
| Method Name | Method Version | Operator Name | Check Type | Check Status |
| Fe-30-MO | | SARA SAE | None | Not Used |
| Grade Verification Name | Grade Verification Similarity | Correction Type | Type Corr Sample Name | Grade Search Name |
| | 0 | None | | |
| Grade Search Similarity | Type | Status | Outlier Removal | |
| 0 | None | Not Used | | |

Sample Name Grade
9917 (DIA-70 MM) HNO-166583

| | C Conc % | Si Conc % | Mn Conc % | P Conc % | S Conc % | Cr Conc % | Mo Conc % | Ni Conc % | Al Conc % | Co Conc % | Cu Conc % | Nb Conc % | Ti Conc % | V Conc % | W Conc % | Pb Conc % | Sn Conc % | As Conc % | Zr Conc % |
|---------|-----------------|-----------------|-----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 0.046 | 0.30 | 0.67 | 0.017 | 0.017 | 21.51 | 2.65 | 39.65 | 0.090 | 0.061 | 1.59 | 0.056 | 0.62 | 0.049 | 0.047 | 0.012 | 0.013 | <0.005 | <0.003 |
| 2 | 0.045 | 0.32 | 0.68 | 0.018 | 0.015 | 21.67 | 2.57 | 39.54 | 0.085 | 0.061 | 1.59 | 0.060 | 0.61 | 0.047 | 0.046 | 0.011 | 0.010 | <0.005 | <0.003 |
| 3 | 0.043 | 0.33 | 0.67 | 0.017 | 0.016 | 21.78 | 2.59 | 39.33 | 0.094 | 0.064 | 1.61 | 0.060 | 0.62 | 0.046 | 0.052 | 0.013 | 0.013 | <0.005 | <0.003 |
| Rep | 0.045 | 0.32 | 0.67 | 0.017 | 0.016 | 21.65 | 2.60 | 39.51 | 0.090 | 0.062 | 1.60 | 0.059 | 0.62 | 0.047 | 0.048 | 0.012 | 0.012 | <0.005 | 0.003 |
| Min Cal | 0.006 | 0.005 | 0.004 | 0.003 | 0.002 | 0.005 | 0.003 | 0.005 | 0.003 | 0.005 | 0.002 | 0.005 | 0.0010 | 0.002 | 0.040 | 0.010 | 0.002 | 0.005 | 0.003 |
| Mean | 0.045 | 0.32 | 0.67 | 0.017 | 0.016 | 21.65 | 2.60 | 39.51 | 0.090 | 0.062 | 1.60 | 0.059 | 0.62 | 0.047 | 0.048 | 0.012 | 0.012 | <0.002 | <0.002 |
| Max Cal | 3.00 | 5.04 | 18.12 | 0.18 | 0.30 | 36.00 | 10.20 | 55.2 | 6.24 | 21.60 | 7.44 | 3.60 | 3.60 | 12.00 | 7.32 | 0.13 | 0.27 | 0.13 | 0.19 |
| | Ca Conc % | B Conc % | Fe Conc % | | | | | | | | | | | | | | | | |
| 1 | 0.002 | 0.002 | 32.60 | | | | | | | | | | | | | | | | |
| 2 | 0.002 | 0.002 | 32.61 | | | | | | | | | | | | | | | | |
| 3 | 0.002 | 0.002 | 32.65 | | | | | | | | | | | | | | | | |
| Rep | 0.002 | 0.002 | 32.62 | | | | | | | | | | | | | | | | |
| Min Cal | 0.0005 | 0.0005 | | | | | | | | | | | | | | | | | |
| Mean | 0.002 | 0.002 | 32.62 | | | | | | | | | | | | | | | | |
| Max Cal | 0.016 | 0.025 | | | | | | | | | | | | | | | | | |

Qualify in JN-825 as per
SES 26-724A
Qapali

certificate 124455/0
DIN EN 10204/01.05 3.1

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printed: 13. MAY 2014

Order No. 440426 Delivery No. 41485 Purchase Order No. OK/092/12

Sara Sae Private Limited

7/1, Pritam Road
IND - 248001 (Uttarakhand) India

Trademark
VDM® Alloy 825
NICROFER 4221
2.4858

EN ISO 9001, AS 9100
LRQA Approval
KLN 4000941/E
ASME QSC-671, expiration date:
March 16, 2015

Product
Bar, round, hot rolled, annealed, machined

Specification

FMC M40116 Rev. C

Material

UNS N08825

Mechanical properties from prolongation of the bar; Hardness max. 210 HB

| Item | Pcs | Wht [kg] | Dimension [mm] | Cast | Lot |
|------|-----|----------|---------------------|--------|-----------|
| 1 | 9 | 417 | 40,00 Ø x 3000-6000 | 166583 | 104080005 |

Analysis (weight %)

LE=combustion analysis

RF=XRF

FMC M40116 Rev. C

| Cast | Melting Pr. | C | S | Cr | Ni | Mn | Si | Mo | Ti | Cu | Fe | Al |
|--------|-------------|------------|--------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-------|-----------|
| 166583 | EF/VD | 0,01 LE | <0,002 LE | 22,7 RF | 39,3 RF | 0,8 RF | 0,3 RF | 3,1 RF | 0,7 RF | 2,0 RF | R30,6 | 0,1 RF |

Sample Condition
annealed

Tensile Test

1 ASTM E8/E8M - 13a / longitudinal specimen

Temp Yield0.2% Yield1.0% Tensile Elongation

[°C] [MPa] [MPa] [MPa] A [%] A [%] RoA [%]

Hardness Test

1 ASTM E10 - 12

HBW 10/3000

| | | | | | | | | | |
|-----|------------|---|----|-----|-----|----|----|---|-------------|
| Lot | Sample No. | 1 | RT | 278 | 674 | 4D | 48 | 1 | 190 surface |
|-----|------------|---|----|-----|-----|----|----|---|-------------|

Heat Treatment

Lot

950°C/01:05h/Water 104080005

Spectrographic analytical mixup test/PMI check: without objection

Dimensional and visual inspection performed: without objection

No mercury contamination; no Radium, Luminous or Alpha source materials were used in the manufacture or testing of the items furnished.

No weld repairs performed.

Since March 01, 2014, Outokumpu VDM GmbH is again a part of ThyssenKrupp enterprise. Due to this change in ownership, we are trading under VDM Metals GmbH instead of Outokumpu VDM GmbH.

The change in ownership does not lead to further changes in organization and production location. In Inspection Certificates of VDM Metals GmbH attachments, ThyssenKrupp VDM GmbH or Outokumpu VDM GmbH attachments shall be deemed to be equivalent.

We herewith certify, that the material is in conformance with the above mentioned specifications

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E-Mail thomas.gymnich@outokumpu.com

Mark of the
Inspector

Q

Thomas Gymnich, authorized inspection representative

Date of release: 13.05.2014

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