

ECISS
EUROPEAN COMMITTEE FOR IRON AND STEEL STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION DU FER ET DE L'ACIER
EUROPÄISCHES KOMITEE FÜR EISEN-UND STAHLNORMUNG

EUROPEAN CERTIFIED REFERENCE MATERIAL (EURONORM – CRM)

CERTIFICATE OF CHEMICAL ANALYSIS
EURONORM – CRM No. 782-1 DOLOMITE

LABORATORY MEANS (4 Values), all results relate to the dried (105°C) sample
mass content in %

| Line No. | Si | Al | Ti | Fe | Mn | Ca | Mg | LOI | Cr | K | P | Pb | Zn | B | Ba | Ni | S |
|----------------|--------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | — | 0.0455 | 0.0019 | 0.2998 | 0.0548 | 21.4876 | 12.6161 | 46.9510 | 0.0003 | — | — | — | — | 0.0008 | 0.0004 | 0.0001 | 0.0118 |
| 2 | 0.1139 | 0.0472 | 0.0020 | 0.3005 | 0.0585 | 21.5988 | 12.6285 | 46.9728 | 0.0003 | 0.0183 | 0.0051 | 0.0022 | 0.0057 | 0.0010 | 0.0005 | 0.0001 | 0.0120 |
| 3 | 0.1156 | 0.0493 | 0.0021 | 0.3007 | 0.0602 | 21.6000 | 12.6639 | 47.0179 | 0.0003 | 0.0189 | 0.0051 | 0.0023 | 0.0058 | 0.0013 | 0.0006 | 0.0002 | 0.0127 |
| 4 | 0.1167 | 0.0544 | 0.0023 | 0.3067 | 0.0613 | 21.6150 | 12.6641 | 47.0732 | 0.0004 | 0.0190 | 0.0051 | 0.0025 | 0.0060 | 0.0013 | 0.0006 | 0.0003 | 0.0144 |
| 5 | 0.1207 | 0.0545 | 0.0024 | 0.3080 | 0.0613 | 21.6221 | 12.7256 | 47.1050 | 0.0004 | 0.0199 | 0.0051 | 0.0025 | 0.0061 | 0.0014 | — | 0.0003 | 0.0153 |
| 6 | 0.1218 | 0.0547 | 0.0025 | 0.3098 | 0.0625 | 21.6320 | 12.7281 | 47.1224 | 0.0005 | 0.0200 | 0.0052 | 0.0026 | 0.0065 | 0.0014 | 0.0007 | 0.0003 | — |
| 7 | 0.1224 | 0.0548 | 0.0025 | 0.3117 | 0.0625 | 21.6520 | 12.7498 | 47.1250 | 0.0006 | 0.0220 | 0.0054 | 0.0026 | 0.0066 | 0.0014 | 0.0007 | 0.0003 | 0.0169 |
| 8 | 0.1233 | 0.0548 | 0.0025 | 0.3140 | 0.0629 | 21.6675 | 12.8000 | 47.1625 | 0.0007 | 0.0221 | 0.0055 | 0.0026 | 0.0066 | — | 0.0007 | — | 0.0177 |
| 9 | 0.1233 | 0.0551 | 0.0026 | 0.3150 | 0.0629 | 21.7119 | 12.8108 | 47.1950 | 0.0007 | 0.0225 | 0.0057 | 0.0027 | 0.0067 | 0.0008 | 0.0007 | 0.0007 | 0.0185 |
| 10 | 0.1247 | 0.0562 | 0.0026 | 0.3160 | 0.0635 | 21.7300 | 12.9232 | 47.2321 | 0.0008 | 0.0228 | 0.0060 | 0.0027 | 0.0069 | 0.0010 | 0.0007 | 0.0007 | 0.0186 |
| 11 | 0.1254 | 0.0573 | 0.0027 | 0.3185 | 0.0637 | 21.7325 | 12.9768 | 47.2700 | 0.0008 | 0.0236 | 0.0060 | 0.0027 | 0.0070 | 0.0011 | 0.0008 | 0.0008 | 0.0210 |
| 12 | 0.1260 | 0.0578 | 0.0028 | 0.3188 | 0.0637 | 21.7433 | 12.9940 | 47.2900 | 0.0010 | 0.0236 | 0.0062 | 0.0030 | 0.0070 | — | — | — | — |
| 13 | 0.1287 | 0.0583 | 0.0029 | 0.3202 | 0.0655 | 21.7700 | 12.9973 | 47.3008 | — | 0.0236 | 0.0062 | 0.0031 | 0.0070 | — | — | — | — |
| 14 | 0.1325 | 0.0594 | 0.0029 | 0.3234 | 0.0661 | 21.7771 | 13.0000 | 47.4775 | — | 0.0243 | — | 0.0032 | 0.0073 | — | — | — | — |
| 15 | 0.1335 | 0.0595 | — | 0.3260 | 0.0672 | 21.7817 | 13.0325 | 47.5969 | — | — | — | — | 0.0074 | — | — | — | — |
| 16 | 0.1338 | 0.0623 | — | 0.3272 | 0.0675 | 21.7985 | — | 47.6875 | — | — | — | — | — | — | — | — | — |
| 17 | — | — | — | 0.3309 | 0.0692 | — | 13.1000 | 47.6875 | — | — | — | — | — | — | — | — | — |
| M _M | 0.1242 | 0.0551 | 0.0025 | 0.3145 | 0.0631 | 21.6825 | 12.8382 | 47.2510 | 0.0006 | 0.0216 | 0.0056 | 0.0027 | 0.0066 | 0.0012 | 0.0007 | 0.0004 | 0.0159 |
| s _M | 0.0062 | 0.0045 | 0.0003 | 0.0095 | 0.0035 | 0.0868 | 0.1628 | 0.2338 | 0.0002 | 0.0021 | 0.0005 | 0.0003 | 0.0005 | — | — | — | — |
| s _w | 0.0014 | 0.0024 | 0.0002 | 0.0056 | 0.0013 | 0.0516 | 0.0448 | 0.0499 | 0.0001 | 0.0011 | 0.0003 | 0.0002 | 0.0002 | — | — | — | — |

M_M: Mean of the laboratory means s_M: Standard deviation of the laboratory means
s_w: Intralaboratory standard deviation s_b: Interlaboratory standard deviation

$$s_M = \sqrt{s_b^2 + s_w^2/4}$$

The laboratory mean values have been examined statistically to eliminate outstanding values. Where a "—" appears in the table it indicates that an outlying value has been omitted by either the Cochran or Grubbs Test.

CERTIFIED VALUES
mass content in %

| | Si | Al | Ti | Fe | Mn | Ca | Mg | LOI | Cr | K | P | Pb | Zn |
|----------------|-------|-------|--------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|
| M _M | 0.124 | 0.055 | 0.0025 | 0.314 | 0.063 | 21.68 | 12.84 | 47.25 | 0.0006 | 0.0216 | 0.0056 | 0.0027 | 0.0066 |
| C(95%) | 0.003 | 0.003 | 0.0002 | 0.005 | 0.002 | 0.05 | 0.09 | 0.12 | 0.0002 | 0.0013 | 0.0003 | 0.0002 | 0.0003 |

The half-width confidence interval C(95%) = $\frac{t \times s_M}{\sqrt{n}}$ where t is the appropriate Student's t value and n is the number of acceptable mean values

For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.



Certificate No. 94/3993

This reference material was prepared and issued by:

BUREAU OF ANALYSED SAMPLES LIMITED

Newham Hall, Middlesbrough, England

On behalf of:- The Iron and Steel Nomenclature Co-ordinating Committee (COCOR) of the ECISS, after approval by all the participating laboratories and all the producing organizations. (France-IRSID/CTIF Germany-Iron and Steel CRM Working Group, UK-BAS Ltd.)

JULY 1996

CERTIFIED VALUES EXPRESSED AS OXIDES (not necessarily actual compositions)

mass content in %

| | SiO ₂ | Al ₂ O ₃ | TiO ₂ | Fe ₂ O ₃ | MnO | CaO | MgO | Cr ₂ O ₃ | K ₂ O | P ₂ O ₅ | PbO | ZnO |
|----------------------|------------------|--------------------------------|------------------|--------------------------------|-------|-------|-------|--------------------------------|------------------|-------------------------------|--------|--------|
| M_M | 0.266 | 0.104 | 0.0042 | 0.450 | 0.081 | 30.34 | 21.29 | 0.0009 | 0.0260 | 0.0128 | 0.0029 | 0.0082 |
| C(95%) | 0.007 | 0.006 | 0.0004 | 0.007 | 0.003 | 0.07 | 0.15 | 0.0003 | 0.0016 | 0.0007 | 0.0002 | 0.0004 |

PARTICIPATING LABORATORIES

| | |
|--|--|
| Acerinox S.A., Algeciras (Spain) | Hoogovens Groep BV, IJmuiden (Netherlands) |
| Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany) | Luxcontrol S.A., Esch-sur-Alzette (Luxembourg) |
| British Ceramic Research Ltd, Stoke on Trent (UK) | Max-Planck-Institut für Eisenforschung GmbH., Düsseldorf (Germany) |
| Böhler Edelstahl GmbH, Kapfenberg (Austria) | Ridsdale & Co. Ltd., Middlesbrough (UK) |
| Centro Nacional de Investigaciones Metalúrgicas (CENIM), Madrid (Spain) | Sandberg, London (UK) |
| Cockerill Sambre S.A., Couillet (Belgium) | SOLLAC, Dunkerque (France) |
| Cookson Group plc., Oxford (UK) | SOLLAC, Florange (France) |
| Centre des Recherches Maidieres, Pont-à-Mousson (France) | Voest Alpine Linz Stahl GmbH., Linz (Austria) |
| Forschungsinstitut der Zementindustrie, Düsseldorf (Germany) | |

DESCRIPTION OF THE SAMPLE

This sample consists of material passing a 125µm sieve after passing over a magnetic separator. It is only supplied in bottles containing 100g.

METHODS USED
EURONORM – CRM No. 782-1

| Element | Line Number | Methods |
|------------|---|--|
| Si | 2-3-5-8-9 | Gravimetric, dehydration with perchloric acid |
| | 4 | ICP-MS |
| | 6-7-13-15 | XRF |
| | 10-11-12 | Photometric as molybdenum blue, without extraction |
| | 14 | Gravimetric, coagulation with polyethylene oxide |
| Al | 16 | PES |
| | 1-2-7-10-11 | PES |
| | 3-4-9-14-15 | XRF |
| | 5-6-8-13-16 | FAAS |
| | 12 | ICP-MS |
| Ti | 1-3-4-5-10-11-12-13-14 | PES |
| | 2-6 | XRF |
| | 7-9 | Photometric with diantipyrylmethane |
| | 8 | ICP-MS |
| Fe | 1-2-13-15 | PES |
| | 3-4-5-6-9-17 | XRF |
| | 7 | ICP-MS |
| | 8-14 | FAAS |
| | 10 | Photometric with 2,2' dipyridyl |
| | 11 | Photometric with 8-hydroxy-7-iodoquinoline-5-sulphonic acid (ferron) |
| | 12 | Photometric with 1-10 phenanthroline |
| Mn | 16 | Photometric with thioglycolic acid |
| | 1 | ICP-MS |
| | 2-5-9-11-12 | PES |
| | 3-4-10-13-14 | FAAS |
| | 6-8-15-16-17 | XRF |
| Ca | 7 | Photometric, oxidation with periodate |
| | 1-3 | PES |
| | 2-4-9-11-16 | XRF |
| | 5-6-10-13-14 | Complexometric titration, visual end-point |
| | 7-8-12 | FAAS |
| Mg | 15 | Gravimetric after precipitation as oxalate |
| | 1-10-13-15 | Complexometric titration, visual end point |
| | 2-6-7-8 | FAAS |
| | 3 | Gravimetric, magnesium ammonium phosphate |
| | 4-9-11-12-14-17 | XRF |
| LOI | 5 | PES |
| | 1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17 | Loss on ignition at 1025°C±25°C |

METHODS USED
EURONORM – CRM No. 782-1

| Element | Line Number | Methods |
|---------|----------------------|---|
| Cr | 1 | Photometric with diphenylcarbazide |
| | 2-3-4-6-8-9-12 | PES |
| | 5-10 | GFAAS |
| | 7 | FAAS |
| | 11 | ICP-MS |
| K | 2-4-5-6-7-9-12-13-14 | FAAS |
| | 3-10 | PES |
| | 8 | XRF |
| | 11 | FES |
| P | 2-9-13 | XRF |
| | 3-8-12 | PES |
| | 4-6-7 | Photometric as phosphovanadomolybdate |
| | 5-10 | Photometric as molybdenum blue, without extraction |
| Pb | 11 | ICP-MS |
| | 2-5-7-12 | PES |
| | 3-6-10-11-13 | GFAAS |
| | 4-8-9 | FAAS |
| | 14 | ICP-MS |
| Zn | 2-3-5-8-12-15 | PES |
| | 4-6-9-10-11-13 | FAAS |
| | 7 | XRF |
| | 14 | ICP-MS |
| B | 1-4-5-6 | PES |
| | 2 | ICP-MS |
| | 3 | Photometric, methylene blue fluoroborate, extraction, ion-exchange separation |
| | 7 | Photometric with curcumin |
| Ba | 1-2-3-4-6-7-8-9-11 | PES |
| | 10 | ICP-MS |
| Ni | 1-4-5-7-10 | PES |
| | 2-12 | FAAS |
| | 3-6-11 | GFAAS |
| | 9 | ICP-MS |
| S | 1-3-4 | Combustion, infrared absorption |
| | 2 | XRF |
| | 5-7-11 | PES |
| | 8 | Gravimetric as barium sulphate, without separation |
| | 9 | Combustion, oxidation-reduction titration |
| | 10 | Photometric as molybdenum blue, separation as sulphide |

Abbreviations:

FAAS: Flame Atomic Absorption Spectrometry
FES: Flame Emission Spectrometry
GFAAS: Graphite-Furnace Atomic Absorption Spectrometry
ICP-MS: Inductively Coupled Plasma - Mass Spectrometry
PES: Plasma Emission Spectrometry
XRF: X-Ray Fluorescence Spectrometry Fused Bead Technique

FURTHER INFORMATION

For information regarding the preparation, certification and supply of these European Certified Reference Materials (EURONORM-CRMs) and the use of the statistical information given on this certificate, please refer to Information Circulars No. 1 (ECISS) and No. 5 (ECSC), both of which are available from the national standards body in your country. (In the UK this is the BSI, 389 Chiswick High Road, London W4 4AL).

Des informations complémentaires sur la fabrication, la certification et la distribution des Matériaux de Référence Certifiés Européens (EURONORM-MRC) ainsi que sur l'utilisation des informations statistiques données sur le certificat se trouvent dans les circulaires d'information No. 1 (ECISS) et No. 5 (CECA). On peut se procurer ces deux circulaires auprès des organismes nationaux de normalisation. (Pour la France: AFNOR, Tour Europe - Cedex 7, 92080 Paris La Défense).

Angaben über Herstellung, Zertifizierung und Bezugsmöglichkeiten dieser Zertifizierten Europäischen Referenzmaterialien (EURONORM-ZRM) sowie über die Anwendung der in diesem Zertifikat enthaltenen statistischen Daten finden sich in den Mitteilungen Nr. 1 (ECISS) und Nr. 5 (EGKS), beide zu beziehen durch die nationalen Normenorganisationen. (In Deutschland bei der Vertriebsstelle des DIN: Beuth-Verlag GmbH, Burggrafenstrasse 4-10, 10787 Berlin 30).