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. 285-2 MARAGING STEEL

LABORATORY MEANS (4 Values)

mass content in %

Line No.	C	Si	Mn	P	S	Cr	Mo	Ni	Total Al	B	Co	Cu	N	Ti	Zr	*Sn*
1	0.0012	0.0082	—	0.0040	0.0021	0.0178	4.8758	17.8841	0.1003	0.0006	7.5890	0.0076	0.0005	—	0.0047	*0.0004*
2	0.0013	0.0090	0.0156	0.0040	0.0022	0.0203	4.9123	17.9188	0.1015	0.0006	7.6500	0.0085	0.0005	0.5051	0.0047	*0.0005*
3	0.0014	0.0103	0.0158	0.0041	0.0022	0.0210	4.9293	17.9600	0.1021	0.0007	7.6780	0.0088	0.0005	0.5065	0.0049	*0.0005*
4	0.0016	0.0106	0.0158	0.0048	0.0023	0.0212	4.9355	17.9620	0.1025	0.0007	7.6850	0.0089	0.0006	0.5087	0.0050	*0.0006*
5	—	0.0107	0.0161	0.0048	0.0023	0.0214	4.9491	17.9746	0.1032	0.0007	7.6996	0.0089	0.0006	0.5113	0.00050	*0.0006*
6	0.0017	0.0110	0.0162	0.0049	0.0023	0.0215	4.9580	18.0478	0.1042	0.0008	7.7067	0.0090	0.0006	0.5133	0.0050	*0.0008*
7	0.0017	0.0116	0.0162	0.0049	0.0023	0.0219	4.9613	18.0588	0.1044	0.0008	7.7300	0.0090	0.0007	0.5168	0.0051	*0.0009*
8	0.0017	0.0117	0.0164	0.0050	0.0023	—	4.9725	18.0600	0.1051	0.0008	7.7425	0.0090	0.0007	0.5182	0.0051	*0.0012*
9	0.0018	0.0119	0.0165	0.0050	0.0023	0.0234	4.9800	18.0618	0.1055	0.0008	7.7477	0.0090	0.0008	0.5189	0.0051	*0.0013*
10	0.0018	0.0120	0.0165	0.0052	0.0024	0.0241	4.9887	18.0700	0.1061	0.0008	7.7700	0.0092	0.0008	0.5200	0.0051	*0.0014*
11	0.0019	0.0121	—	0.0052	0.0024	0.0242	4.9941	18.0843	0.1070	0.0008	7.7707	0.0092	0.0008	0.5228	0.0051	*0.0018*
12	0.0019	0.0125	0.0165	0.0052	0.0025	0.0244	4.9946	18.0911	0.1078	0.0009	7.7800	0.0093	0.0009	0.5230	0.0051	*0.0020*
13	0.0020	0.0130	0.0168	0.0058	0.0025	0.0244	4.9968	18.1000	0.1083	—	7.7813	0.0093	0.0009	0.5233	0.0052	—
14	0.0021	0.0135	0.0168	0.0058	0.0025	0.0245	5.0000	18.1050	0.1087	0.0010	7.7824	0.0093	0.0009	0.5239	0.0054	*0.0022*
15	0.0021	0.0140	0.0170	0.0060	0.0025	0.0246	5.0030	18.1100	0.1088	0.0010	7.7961	0.0095	0.0009	0.5239	—	
16	0.0023	—	0.0171	0.0060	0.0026	0.0250	5.0038	18.1198	0.1106	0.0011	7.8020	0.0098	0.0009	0.5242		
17		0.0148	0.0171	0.0069	0.0026	0.0250	5.0277	18.1359	0.1108	0.0012	7.8103	0.0101		0.5268		
18			0.0174	0.0069	0.0027	0.0250	5.0458	18.1525	0.1119	0.0012	7.8163	0.0101		0.5278		
19			0.0174	0.0073	0.0029	0.0259	5.0607	18.1531	0.1121		7.8325	0.0102		—		
20			0.0178		0.0030	0.0265	5.0656	18.1863	0.1125		7.8498	0.0102		0.5329		
21			0.0178		0.0031	0.0269	5.0750	18.2080			7.8725	0.0110		0.5335		
22			0.0186			0.0271					7.9105	0.0111				
M_M	**0.0018**	**0.0117**	**0.0168**	**0.0053**	**0.0025**	**0.0236**	**4.9869**	**18.0688**	**0.1067**	**0.0009**	**7.7638**	**0.0094**	**0.0007**	**0.5202**	**0.0050**	*0.0011*
s_M	0.0003	0.0017	0.0008	0.0010	0.0003	0.0024	0.0514	0.0862	0.0038	0.0002	0.0757	0.0008	0.0002	0.0084	0.0002	
s_W	0.0002	0.0008	0.0004	0.0002	0.0002	0.0005	0.0232	0.0453	0.0014	0.0001	0.0314	0.0003	0.0001	0.0003	0.0001	

M_M: Mean of the intralaboratory means, s_M: Standard deviation of the intralaboratory 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 outlying 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 %

	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu	N	Ti	Zr
M_M	**0.0018**	**0.0117**	**0.0168**	**0.0053**	**0.0025**	**0.0236**	**4.99**	**18.07**	**0.1067**	**0.0009**	**7.76**	**0.0094**	**0.0007**	**0.520**	**0.0050**
C(95%)	0.0002	0.0008	0.0004	0.0005	0.0002	0.0011	0.02	0.04	0.0018	0.0001	0.04	0.0004	0.0001	0.004	0.0001

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

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.)

MAY 1997

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DESCRIPTION OF SAMPLE

This sample is available in the form of chips passing a 1700µm aperture sieve from which the dust passing a 250µm aperture sieve has been removed. It is supplied in bottles containing 100g.... ref 285-2 (C). It is also supplied in the form of 38mm dia. discs… 285-2-(D).

METHODS USED

EURONORM – CRM NO. 285-2

Element	Line Number	Methods
C	1-2-3-4-7-8-9-10-11-12-13-15-16	Combustion, infrared absorption
	6	Combustion, conductimetry
	14	Combustion, non-aqueous titration
		NOTE: All results for carbon were obtained after pretreatment of Sample (by preheating or acid etching) to remove any surface contamination
Si	1-2-5-8-15-17	PES
	3	ICP-MS
	4-6-7-10-13-14	Photometric as molybdenum blue, without extraction
	9-11	Photometric as molybdenum blue, with extraction
	12	Gravimetric, dehydration with perchloric acid
Mn	2-3-6-9-10-12-13-15-17-22	PES
	4-5-7-8-14-16-18-20-21	FAAS
	19	Photometric, periodate oxidation
P	1-7-8-9-10-15-16-19	Photometric as phosphovanadomolybdate, extraction
	2-3-12-18	Photometric as molybdenum blue, without extraction
	4-5	Photometric as molybdenum blue, with extraction
	6-11-13-14	PES
	17	Acidimetric titration of ammonium phosphomolybdate
S	1-2-3-5-7-9-10-11-12-13-14-15-16-17-19-20-21	Combustion, infrared absorption
	4	Combustion, coulometric titration
	6-18	Combustion, conductimetry
	8	Photometric as molybdenum blue, separation as sulphide
Cr	1-2-5-6-10-11-14-19-20-22	FAAS
	3-4-7-9-12-13-15-16-17-18-21	PES
Mo	1-3-5-7-8-9-10-11-12-14-15-16-17-21	PES
	2	Gravimetric with benzoinoxime
	4-6-18-19-20	Photometric with thiocyanate in presence of Sn(II), extraction
	13	FAAS
Ni	1-7-10-14-16	PES
	2-5-6-8-13-18	Gravimetric, dimethylglyoxime
	3-19	Complexometric titration, visual end point
	4-17-21	Photometric with dimethylglyoxime, with extraction
	9-15-20	Photometric, dimethylglyoxime, without extraction
	11	Titration with dichromate after separation with dimethylglyoxime
	12	Cyanometric titration
Al	1-2-3-4-5-6-9-10-13	PES
	7-8-11-12-14-15-16-18-19-20	FAAS
	17	Photometric with eriochrome cyanine, NaOH separation of iron
B	1-3-6-7-10-11-12-14-15	Photometric with curcumin
	2	ICP-MS
	4-5-8-9-16-17-18	PES

METHODS USED
EURONORM – CRM NO. 285-2

Element	Line Number	Methods
Co	1-2-9-10-12-14-16-18-19-20	PES
	3-8-15-22	Titration with ferricyanide, potentiometric end point
	4-5-6-11-13	FAAS
	7	Photometric with thiocyanate
	17-21	Photometric with nitroso-R-salt
Cu	1-3-4-5-9-10-13-15-18-19-20	FAAS
	2-6-7-8-11-12-14-16-17-22	PES
	21	Photometric with diethyldithioformamide, extraction
N	1-2-3-4-5-6-7-8-9-10-11-13-15-16	Thermal conductivity, decomposition in graphite crucible
	12	Gas volumetry, oxidising fusion, CO_2 carrier gas
	14	Photometric with indophenol blue after distillation
Ti	2-3-6-9-10-11-12-16-17-18-20-21	PES
	4-5-8	FAAS
	7	Photometric with hydrogen peroxide, after separation
	13-14-15	Photometric with diantipyrylmethane
Zr	1-2-3-4-5-6-9-10-11-12-13-14	PES
	7	ICP-MS
	8	Photometric with arsenazo III
Sn	*1-2-3-4-5-12*	*GF-AAS*
	6-8-11-14	*FAAS*
	7	*ICP-MS*
	9-10	*PES*

Abbreviations:

FAAS:	Flame Atomic Absorption Spectrometry
GF-AAS:	Graphite Furnace-Atomic Absorption Spectrometry
ICP-MS:	Inductively Coupled Plasma – Mass Spectrometry
PES:	Plasma Emission Spectrometry

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 normalisations. (Pour la France: AFNOR, Tour Europe – Cedex 7, 92080 Paris La Défense).

Angaben über Herstellung, Zertifizierung und Bezugsmöglichkeiten dieser Europäischen Zertifizierten Referenzmaterialien (EURONORM -ZRM) sowie über die Anwendungen der in diesem Zertifikat enthaltenen statistischen Daten finden sich in den Mittellungen 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).