



BUREAU OF ANALYSED SAMPLES LTD

Directors:-

R. P. MEERES, *BA (Oxon), MRSC* (Managing)G. C. FLINTOFT, *ACMA*

J. C. MEERES

M. S. TAYLOR, *PhD, CChem, MRSC*

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCS[†]/SS[‡]-CRM No. 463/1

AUSTENITIC STAINLESS STEEL

Prepared under rigorous laboratory conditions and, AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN,
issued by the Bureau of Analysed Samples Ltd.

CO-OPERATING ANALYSTS

INDEPENDENT ANALYST

- 1 GELDER, Mrs. J. E., *BSc*, MTS Midlands Ltd., Brierley Hill.
- 2 HASTINGS, J., Sheffield Testing Laboratories Ltd., Sheffield.
- 3 HEYWOOD, D. G., *AMet*, Pattinson & Stead, Middlesbrough.
- 4 KATZ, A.M., Alfred H. Knight International Ltd., St. Helens.
- 5 PAGE-GIBSON, J. E., *BSc, CChem, MRSC*, Ridsdale & Co. Ltd., Middlesbrough.

GOVERNMENT DEPARTMENT

- 6 FRYER, R. E. J., *BSc, PhD, CChem, MRSC*, Directorate of Quality Assurance/Technical Support, M.O.D., Woolwich.

ANALYSTS representing MANUFACTURERS and USERS

- 7 HANCOCK, R., *BMet, CEng, MIM*, Stocksbridge Engineering Steels, Sheffield.
- 8 HIRST, R., British Steel Technical, Swindon Laboratories, Rotherham.
- 9 DAY, R., Rotherham Engineering Steels, Rotherham.
- 10 JOWITT, R., British Steel Technical, Teesside Laboratories, Middlesbrough.

ANALYSES

Mean of 4 values - mass content in %.

Analyst No.	C	Si	Mn	P	S	Cr	Mo	Ni	B	Co	Cu	N	Ti
1	0.018	0.262	1.385	0.024	0.018	...	0.268	...	0.0019	0.113	0.275	0.063	0.002
2	0.021	0.285	1.393	0.024	0.018	18.49	0.270	10.29	...	0.106	0.271	...	<0.001
3	0.020	0.275	1.398	0.024	0.019	18.44	0.257	10.10	0.0018	0.116	0.283	0.064	0.003
4	0.018	0.272	1.410	0.028	0.022	18.37	0.257	10.22	...	0.115	0.277	...	0.002
5	0.018	0.265	1.421	0.024	0.020	18.44	0.264	10.22	0.0022	0.119	0.271	0.062	<0.002
6	0.021	0.265	1.406	0.026	0.020	18.53	0.277	10.15	...	0.124	0.282	0.061	0.002
7	0.018	0.264	1.396	0.025	0.019	18.45	0.262	10.23	0.0023	0.116	0.278	0.064	0.002
8	0.020	...	1.393	...	0.017	18.44	0.257	10.18	...	0.117	0.275	0.064	<0.002
9	0.019	0.268	1.400	0.025	0.019	18.48	0.270	10.25	0.0024	0.118	0.271	0.062	<0.002
10	...	...	...	...	...	...	...	...	0.0023	...	...	...	...
M_M	0.019	0.270	1.400	0.025	0.019	18.46	0.265	10.20	0.0022	0.116	0.276	0.063	...
<i>s_M</i>	0.002	0.008	0.011	0.002	0.002	0.05	0.008	0.06	0.0003	0.005	0.005	0.002	...

The above figures are those which each Analyst has decided upon after careful verification.

Figures in bold type certified, figures in small italic type only approximate.

The following additional information was supplied by Analyst No. 5:- V 0.04%

M_M: Mean of the intralaboratory means. *s_M*: standard deviation of the intralaboratory means.

CERTIFIED VALUES (C_v)

mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	B	Co	Cu	N
C_v	0.019	0.270	1.400	0.025	0.019	18.46	0.265	10.20	0.0022	0.116	0.276	0.063
C(95%)	0.002	0.007	0.009	0.002	0.002	0.04	0.006	0.05	0.0003	0.004	0.004	0.002

The half width confidence interval $C(95\%) = \frac{t \times s_M}{\sqrt{n}}$ where "t" is the appropriate two sided Student's t value at the 95% confidence level for "n" acceptable mean values.

For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 sections 6.1 and 10.5.2.

N.B. Due to slight segregation of certain elements an area 6mm in diameter in the centre of the disc samples should be avoided for emission spectroscopy.

BCS/SS-CRM No. 463/1 AUSTENITIC STAINLESS STEEL

NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 2, 4, 6, 7, 8 and 9 determined carbon by high frequency combustion/infrared absorption. Nos. 3 and 5 used non-aqueous titration according to the British Standard Carbon Method 4*.

SILICON

All analysts determined silicon gravimetrically after dehydration with perchloric acid, according to the British Standard Silicon Method 1*.

MANGANESE

Analyst No. 1 determined manganese using FAAS. Nos. 2, 3, 4, 5, 6, 8 and 9 used photometric methods, all, except No. 9, oxidised manganese with periodate, Nos. 2, 4, 6 and 8 according to the British Standard Manganese Method 2*, Nos. 3 and 5 according to BS 6200: 3.18.2[§]. No. 9 oxidised with ammonium persulphate. No. 7 used ICP-OES.

PHOSPHORUS

All analysts, except No. 2, determined phosphorus photometrically as phosphovanadomolybdate, according to BS 6200: 3.24.1[§]. No. 2 used a titrimetric method after separation as phosphomolybdate.

SULPHUR

Nos. 1, 2, 4, 6, 7, 8 and 9 determined sulphur using high frequency combustion/infrared absorption. No. 3 determined sulphur gravimetrically according to BS 6200: 3.28.1[§] and No. 5 according to the British Standard Sulphur Method 1*.

CHROMIUM

All analysts determined chromium titrimetrically after oxidation with ammonium persulphate, Nos. 2, 4, 6, 7, 8 and 9 according to the British Standard Chromium Method 1*, Nos. 3 and 5 according to BS 6200: 3.10.1[§].

MOLYBDENUM

Analysts Nos. 1, 2, 4 and 8 determined molybdenum using FAAS. Nos. 3, 5, 6 and 9 determined molybdenum photometrically as oxythiocyanate, Nos. 3 and 5 according to BS 6200: 3.19.1[§], Nos. 6 and 9 according to the British Standard Molybdenum Method 1*. No. 7 used ICP-OES.

NICKEL

Analyst No. 2 determined nickel cyanometrically according to the British Standard Nickel Method 1*. Nos. 3, 5, 6, 7, 8 and 9 determined nickel titrimetrically after separation with dimethylglyoxime. All, except No. 5, titrated with EDTA, according to BS 6200: 3.20.1[§]. No. 5 dissolved the precipitate in dilute sulphuric acid, boiled with excess ferric sulphate, and titrated with dichromate (Analoid Method No. 62). No. 4 determined nickel gravimetrically.

BORON

All analysts determined boron photometrically with curcumin, Nos. 1 and 3 according to the British Standard Boron Method 1*, Nos. 5, 7, 9 and 10 according to method EN 10200.

COBALT

Analysts Nos. 1, 3, 4, 5, 8 and 9 determined cobalt using FAAS. Nos. 2 and 6 determined cobalt photometrically with Nitroso-R-Salt according to the British Standard Cobalt Method 1*, No. 7 used ICP-OES.

COPPER

Analysts Nos. 1, 2, 3, 4, 5, 8 and 9 determined copper using FAAS. No. 6 determined copper photometrically with bis-cyclohexanone oxalyldihydrazone. No. 7 used ICP-OES.

NITROGEN

Analysts Nos. 1, 5, 7 and 8 determined nitrogen using thermal conductivity after fusion in graphite crucibles. Nos. 3 and 9 used acidimetric titration after conversion to ammonia and steam distillation according to the British Standard Nitrogen Method 1*.

TITANIUM

Analyst Nos. 1, 2 and 8 determined titanium using FAAS. Nos. 3, 5, 6 and 9 also determined titanium photometrically with diantipyryl methane according to BS 6200: 3.32.1[§]. Nos. 4 and 7 used ICP-OES.

Analyst No. 6 also used ICP-MS and obtained a mean value of 0.001 %.

*Methods for Sampling and Analysis of Iron, Steel and Other Ferrous Metals, B.S. Handbook No. 19, first published in 1970 by the BSI, 389 Chiswick High Road, London. W4 4AL.

[§]BS 6200: Sampling and Analysis of Iron, Steel and Other Ferrous Metals: Part 3, Method of Analysis, published by the BSI, 389 Chiswick High Road, London. W4 4AL.

Abbreviations

FAAS: Flame Atomic Absorption Spectrometry.

ICP-OES: Inductively Coupled Plasma - Optical Emission Spectrometry.

ICP-MS: Inductively Coupled Plasma - Mass Spectrometry.

DESCRIPTION OF SAMPLE

† British Chemical Standard – bottles of 100g chips graded 1700 - 250µm (10 - 60 mesh) for chemical analysis.

‡ Spectroscopic Standard – 38 mm diameter x 19 mm thick discs for spectroscopic analysis.

INTENDED USE & STABILITY

The chip sample, BCS-CRM 463/1, is intended for the verification of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments in cases where the calibration with primary substances (pure metals or stoichiometric compounds) is not possible and for establishing values for secondary reference materials.

It will remain stable provided that the bottle remains sealed and is stored in a cool, dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the contents should become discoloured (e.g. oxidised) by atmospheric contamination they should be discarded.

The disc sample, SS-CRM 463/1, is intended for establishing and checking the calibration of Optical Emission and X-Ray Spectrometers for the analysis of similar materials. The “as received” working surface of the sample should be finished before use to remove any protective coating. It will remain stable provided that it is not subject to excessive heat (e.g., during preparation of the working surface). An area 6mm in diameter in the centre of the disc should be avoided for optical emission spectrometry.

This Certified Reference Material has been prepared in accordance with the recommendations specified in ISO Guides 30 to 35, available from the International Standards Organisation in Geneva.

NEWHAM HALL, NEWBY,
MIDDLESBROUGH, ENGLAND, TS8 9EA
Email: enquiries@basrid.co.uk
Website: www.basrid.co.uk

For BUREAU OF ANALYSED SAMPLES LTD

R.P. MEERES,
Managing Director

Preliminary Edition December 1991
Main Edition July 1993
Main Edition (revised with a C(95%) value for each element) June 2010