CASTINGS TECHNOLOGY INTERNATIONAL
and
BUREAU OF ANALYSED SAMPLES LTD.

CERTIFICATE OF ANALYSIS

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIAL
(formerly known as Spectroscopic Standard)

SCRM No. 660/9
LOW PHOSPHORUS ENGINEERING IRON

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

The material for this SCRM was prepared at the Castings Technology International Laboratories at Sheffield, U.K. (formerly BCIRA) using a special method of casting known to provide material of uniform composition in a form suitable for use as a calibration standard in optical emission spectroscopic analysis. Blocks from this cast have been shown, by statistically designed procedures, to provide reproducible results using optical emission spectroscopy.

The preparation of representative samples for chemical analysis and the certification by cooperative analysis was undertaken by Bureau of Analysed Samples Ltd.

CO-OPERATING ANALYSTS AND FIRMS

1. ROBINSON, C. (Mrs), *MChem,*	Bodycote Materials Testing Teesside, Middlesbrough.
2. CROCKER, F.,	Pattinson & Stead, Middlesbrough.
3. JONES, S. J., *BSc, CChem, MRSC*	Ridsdale & Co Ltd., Middlesbrough.
4. SCRIMSHIRE, P.,	IncoTest, Hereford.
5. WHITAKER, J. S.,	Keighley Laboratories Ltd, Keighley.

NOTE.

The samples of this SCRM are in the form of chill cast rectangular blocks, each approximately 50mm x 42mm x 12mm thick with a single chilled working face. Spectroscopic reproducibility has been shown to be reliable to a depth of 5mm below the original surface of this block. Sparking must be made on the fully ground surface only and the sample should be discarded when this face has been ground back as far as the small shoulder around the edge of the sample.

Using optical emission spectrometers it has been established that materials of similar composition from different sources may respond differently. This SCRM is primarily intended for the construction of basic response curves which should be related to the response curves obtained from an identical examination of the user's own material.

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ANALYSES

Mean of 4 values – mass content in %.

Analyst No.	C	Si	Mn	P	S
1	3.4618	1.7046	0.4065	0.1523	0.1062
2	3.4386	1.6964	0.4085	0.1520	0.1054
3	3.4830	1.6849	0.4054	0.1590	0.1021
4	3.4683	1.7235	0.4026	0.1516	0.1040
5	3.4555	1.6873	0.4076	0.1491	0.1059
M_M	**3.4614**	**1.6993**	**0.4061**	**0.1528**	**0.1047**
s_M	0.0164	0.0156	0.0023	0.0037	0.0017
s_W	0.0086	0.0065	0.0029	0.0018	0.0012

M_M: Mean of the intralaboratory means. s_M: standard deviation of the intralaboratory means. s_W: Intralaboratory standard deviation.

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	Mn	P	S
Cv	**3.461**	**1.699**	**0.406**	**0.153**	**0.105**
C(95%)	0.021	0.020	0.003	0.005	0.003

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.

NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 4 and 5 determined carbon using high frequency combustion and infrared absorption, No.5 following BS EN ISO 9556:2001. Nos. 2 and 3 used gravimetric methods, No. 3 according to BS EN 10036.

SILICON

Analysts Nos. 1 and 4 determined silicon using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). The remaining Analysts used gravimetric methods, dehydrating the silica using perchloric acid, according to BS 6200: 3.26.1: 1995.

MANGANESE

Analysts Nos. 1, 4 and 5 determined manganese using ICP-OES. Analyst No. 2 used flame atomic absorption spectrometry (FAAS) and No. 3 used the photometric method in BS 6200: 3.18.2: 1995.

PHOSPORUS

Analysts Nos. 1 and 4 determined phosphorus using ICP-OES. The other Analysts determined phosphorus photometrically after extraction of the phosphovanadomolybdate complex according to BS EN 10184:1992 (Method 1).

SULPHUR

Analysts Nos. 1, 4 and 5 determined sulphur using high frequency combustion and infrared absorption, No. 5 followed BS EN 24935:1991. Analyst No. 2 used an acidimetric titration following combustion, and Analyst No. 3 determined sulphur gravimetrically as barium sulphate.

INTENDED USE & STABILITY

This SCRM 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 linished 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) and is stored in a cool, dry, acid-free environment.

TRACEABILITY

The traceability of this CRM is ensured by the use of either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds.

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.

For CASTINGS TECHNOLGY INTERNATIONAL
Dr. M.C. ASHTON,
Chief Executive

For BUREAU OF ANALYSED SAMPLES LTD.
P. D. RIDSDALE
Chairman

Certificate No: Q3993

November 2005