MBH ANALYTICAL LTD

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CERTIFICATE OF ANALYSIS

18X D7 (batch A)

Certified Reference Material Information

Type:	Gases in Tool Steel
Form and Size:	Powder <200µ, 100g
Manufactured by:	Höganäs AB, UK
Certified and Supplied by:	MBH Analytical Ltd

Certified Analysis

Percentage element by weight

Element	C	S	N	O
Value [1]	**2.32**	**0.0111**	**0.0124**	**0.072**
Uncertainty [2]	0.02	0.0005	0.0009	0.006

Note: this sample also contains approximately 12% Cr, 4% V and 1% Mo.

Definitions

[1] The certified values are the present best estimates of the true content for each element. Each value is a panel consensus, based on the averaged results of an interlaboratory testing programme, detailed on page 3.

[2] The uncertainty values are the 95% confidence intervals derived from the interlaboratory testing results.

Certified by:

on 27th September 2005

MBH ANALYTICAL LIMITED _____

C Eveleigh

Method of Preparation

This reference material was produced by water atomisation of molten steel from a 1600kg induction furnace. The resultant powder was dried by vacuum annealing.

Sampling

Samples for analysis were taken from random positions within the batch.

Homogeneity

No formal homogeneity checks have been made. Instead, the homogeneity of the batch has been confirmed by the multiple analysis regime described herein.

Chemical Analysis

Analysis was performed by a panel of laboratories mostly operating within the terms of EN ISO/IEC 17025 - 2000, using documented standard reference methods and validated by appropriate reference materials. The individual values listed overpage are the average of each analyst's results.

Estimation of Uncertainties

Each element certified has been analysed by several laboratories, and 95% half-width confidence intervals ($C_{(95\%)}$) for the resultant mean values have been derived by the method shown on page 3.

Traceability

Most of the analytical work performed to assess this material has been carried out by laboratories with proven competence, as indicated by their accreditation to a national authority. It is part of the requirement for this accreditation that analytical work should be performed with due traceability, via an unbroken chain of comparisons, each with stated uncertainty, to primary standards such as the mole, or to nationally- or internationally-recognised primary reference materials.

Usage

Intended use:	Calibration or stability monitoring of combustion analysers.
Recommended method of use:	Users are recommended to follow the calibration and sample preparation procedures. specified by the relevant instrument manufacturer.
	A minimum of two consistent replicate analyses is recommended.

Analytical Data

Percentage element by weight

Sample	C	S	N	O
1	2.257	0.0099	0.0105	0.0621
2	2.284	0.0100	0.0114	0.0647
3	2.303	0.0104	0.0120	0.0656
4	2.31	0.0105	0.0122	0.067
5	2.312	0.0106	0.0123	0.0672
6	2.320	0.0108	0.0134	0.0748
7	2.32	0.0110	0.0135	0.0759
8	2.32	0.0110	0.0135	0.0772
9	2.330	0.0116		0.0817
10	2.336	0.0118		0.0848
11	2.357	0.0119		
12	2.36	0.0120		
13	2.368	0.0124		
14	2.369			
Mean	**2.324**	**0.0111**	**0.0124**	**0.072**
Std Dev	0.032	0.0008	0.0011	0.008
$C_{(95\%)}$	0.019	0.0005	0.0009	0.006

Note: $C_{(95\%)}$ is the 95% half-width confidence interval derived from the equation:

$$C_{(95\%)} = (t \times SD)/\sqrt{n}$$

where n is the number of available values, t is the Student's t value for n-1 degrees of freedom, and SD is the standard deviation of the test results.

Participating Laboratories

ATI Allvac Ltd	Sheffield, England	UKAS accreditation 0638
Bodycote Materials Testing Ltd	Middlesbrough, England	UKAS accreditation 0239
Special Testing Works Ltd	Sheffield, England	UKAS accreditation 0046
Central Iron & Steel Research Inst	Beijing, China	CNAL accreditation 0435
Institute of Iron & Steel Technology	Shanghai, China	CNAL accreditation 0783
Luo Yang Copper	Luo Yang, He Nan, China	CNAL accreditation 0173
Special Metals Corp	Huntington, WV, USA	A2LA accreditation 1098
Laboratory Testing Inc	Hatfield, PA, USA	A2LA accreditation 0117
Universal Scientific Laboratory Pty Ltd	Milperra, NSW, Australia	NATA accreditation 0492
TCR Engineering Services Ltd	Mumbai, India	NABL accreditation 0367
Powdrex Ltd	Tonbridge, UK	
Höganäs AB	Höganäs, Sweden	
Westmoreland Testing and Research	Youngstown, PA, USA	
LECO Corp	St Joseph, MI, USA	

Note: to achieve National Accreditation (eg UKAS, A2LA, NATA, CNAL, NABL), test houses must demonstrate conformity to the general requirements of EN ISO/IEC 17025.

Analytical Methods Used

ELEMENT	RESULT No. & METHOD
Carbon	All analysis was performed by a combustion method, with infra-red detection
Sulfur	All analysis was performed by a combustion method, with infra-red detection
Nitrogen	All analysis was performed by fusion in inert gas, with detection by thermal conductivity
Oxygen	All analysis was performed by fusion in inert gas, with detection by thermal conductivity

Stability Assessment

Although not audited, the manufacturer asserts that similar products, stored under appropriate metallurgical laboratory conditions, have given constancy of performance for the four certified elements over several years.

Notes

This Certified Reference Material has been produced and certified in accordance with the requirements of ISO Guide 34-2000, ISO Guide 31-2000 and ISO Guide 35-1989, taking into account the requirements of the ISO Guide to the Expression of Uncertainty in Measurement (GUM).

All production records will be retained for a period of 20 years from the date of this certificate. This certification will therefore expire in September 2025, although we reserve the right to make changes as issue revisions, in the intervening period.

The analysis and certification of this product were supervised by C Eveleigh, PhD, Technical Director, MBH Analytical Ltd.

The material to which this certificate of analysis refers is supplied subject to our general conditions of sale.