

CERTIFICATE OF ANALYSIS

13X 14933 (batch R)

Certified Reference Material Information

Type: MARAGING STEEL (CAST)
Form and Size: Disc 40mm Diameter x 15mm Thickness
Supplied by: MBH Analytical Limited
Produced by: Willan Metals Limited

Certified Analysis

Percentage element by weight

Element	C	Si	S	P	Mn	Ni
%	0.008	0.05	0.014	0.023	0.17	16.8

Element	Cr	Mo	Co	Al	Ti
%	0.022	3.83	11.4	<0.005	0.029

Usage

Intended use: With optical emission and X-ray fluorescence spectrometers.

Recommended method of use: Steels are generally prepared by finishing, milling, turning or polishing, avoiding contamination with abrasives or lubricants. However, users are recommended to follow the calibration and sample preparation procedures specified by the relevant instrument manufacturer.

Preparation should be the same for reference materials and the samples for test.

When using OE, a minimum of three consistent replicate analyses is recommended to optimise precision and accuracy. Users are advised to check against possible bias between reference materials and production samples due to differences in metallurgical history, and be aware of possible inter-element effects.

Certified by:

MBH ANALYTICAL LIMITED _____

on 14th September 1998



Method of Preparation

This reference material was produced from pure metals, ferro alloys and master alloys. The discs are the product of one melt poured into a single mould with a feeding system designed to ensure sound discs. Metal has been removed from the cast faces of the discs to minimise surface effects.

Sampling

Milled samples for chemical analysis, and discs for homogeneity checks, were taken from the top and bottom of the mould.

Homogeneity

Discs were checked for vertical uniformity using an optical emission spectrometer.

Multiple measurements were taken from each surface under test, and averaged.

The mean value of the material was then calculated from these averages.

For each of the surfaces checked, the differences between the averaged result and the overall mean value were evaluated to ensure that the homogeneity met the acceptance criteria defined in ISO guide 30 - 1992.

Chemical Analysis

Analysis was carried out on millings taken from samples representative of the cast product. For analysis purposes, the selected participating laboratories normally followed the requirements of ISO guide 25 - 1990. The individual values listed overpage are usually the average of each analyst's results:

Analytical Data

Sample	<u>Percentage element by weight</u>					
	C	Si	S	P	Mn	Ni
1	<0.010	-	0.013	0.024	0.17	-
2	0.007	-	0.016	0.02	0.16	16.8
3	0.010	0.065	0.014	0.026	0.16	16.85
4	0.006	0.04	0.013	0.022	0.18	16.91
5	-	0.05	0.014	-	0.17	16.8
6	-	0.04	-	-	0.18	16.80
7	0.010	-	0.015	-	-	-
Mean	0.008	0.049	0.014	0.023	0.170	16.832
Std Dev	0.002	0.012	0.001	0.003	0.009	0.049

Sample	Cr	Mo	Co	Al	Ti
1	0.02	3.87	11.30	-	0.03
2	-	3.80	-	<0.01	-
3	0.025	3.82	11.37	<0.005	0.025
4	0.021	3.85	11.52	0.002	0.030
5	0.02	3.83	-	<0.005	-
6	-	3.79	11.43	-	0.03
Mean	0.022	3.827	11.405	<0.005	0.029
Std Dev	0.002	0.030	0.093	-	0.003

Confidence Limits

These are the upper and lower values between which the actual measurements will fall, with the stated probabilities, assuming a Gaussian distribution.

68.3% of the results will fall within ± 1 x Standard Deviation of the mean.

95.4% of the results will fall within ± 2 x Standard Deviation of the mean.

99.7% of the results will fall within ± 3 x Standard Deviation of the mean.

Participating Laboratories

Metals Technology (Testing) Ltd	Sheffield, England	NAMAS Approval 0963
IncoTest Ltd	Hereford, England	NAMAS Approval 0281
AllVac SMP Ltd	Sheffield, England	NAMAS Approval 1385
Willan Metals Ltd	Rotherham, England	NAMAS Approval 0014
RoTech Laboratories	Wednesbury, England	NAMAS Approval 0366
University Metals Advisory Centre	Sheffield, England	NAMAS Approval 0411

Analytical Methods Used

Carbon:	Combustion (IRD)			
Silicon:	FAAS	XRF		gravimetric
Sulfur:	Combustion (IRD)			
Phosphorus:		ICP		photometric (molybdate)
Manganese:	FAAS	ICP	XRF	photometric (periodate)
Nickel:		ICP	XRF	volumetric (dimethyl glyoxime)
Chromium:	FAAS	ICP		
Molybdenum:	FAAS	ICP	XRF	photometric (thiocyanate)
Cobalt:	FAAS	ICP	XRF	photometric (2 β -naphthol)
Aluminium:	FAAS	ICP		
Titanium:	FAAS	ICP	XRF	photometric (peroxide)

Notes

This Certified Reference Material has been produced in accordance with the general principles of ISO Guide 34 - 1996. The certification conforms with the guidelines given in ISO Guide 31 - 1981.

To achieve NAMAS (National Measurement Accreditation Scheme) approval, test houses must demonstrate conformity to the general requirements of BS EN 45001, ISO Guide 25 and ISO9002.

Some cast materials may exhibit shrinkage cavities on the rear (engraved) surface of the disc. The above certification is applicable from the front face of the disc to a depth of 10mm.

Figures shown in brackets are not certified; they are provided for information only.

This material will remain stable provided adequate precautions are taken to protect it from cross-contamination, extremes of temperature and atmospheric moisture.

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