

CERTIFICATE OF ANALYSIS

54X G13H3 (batch M)

Certified Reference Material Information

Type: ALUMINIUM/SILICON (CAST)
Form and Size: Disc 40-50mm diameter x 13-17mm thick
Manufactured by: Coleshill Laboratories Limited
Certified and Supplied by: MBH Analytical Limited

Certified Analysis

Percentage element by weight

Element	Cu	Mg	Si	Fe	Mn	Ni	Zn
Value ¹	0.83	0.90	10.2	0.79	0.434	0.96	0.42
Uncertainty ²	0.02	0.02	0.15	0.015	0.010	0.015	0.015

Element	Pb	Sn	Ti	Cr	Co	Zr	Be
Value ¹	0.051	0.092	0.153	0.060	0.009	(0.004)	0.0076
Uncertainty ²	0.005	0.004	0.006	0.003	0.001	-	0.0009

Note: values given in parentheses are not certified - they are provided for information only.

Definitions

- ¹ The certified values are derived from the results of an interlaboratory testing programme, detailed on page 3.
- ² The uncertainty values are generated from the 95% confidence interval derived from the wet analysis results (page 3). When appropriate, these values have been modified to account for additional information from the material homogeneity checks.

Certified by:

MBH ANALYTICAL LIMITED _____

on 21st June 2001

Method of Preparation

This reference material was produced from commercial-purity aluminium, pure elements and master alloys. The melt was degassed using sodium-free degasser, and was cast into iron chill moulds. 2mm has been removed from the cast face to minimise any surface effects.

Sampling

Samples for chemical analysis, and discs for homogeneity checks, were taken from various positions within the casting process.

Homogeneity

Samples representative of the batch were checked for vertical uniformity using an optical emission spectrometer.

Multiple measurements were taken from each surface under test.

The mean value of the material was then calculated from the multiple measurement 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 of the material satisfied the acceptance criteria defined in ISO guide 30 - 1992, and fell within 95% probability limits.

Chemical Analysis

Analysis was carried out on millings taken from samples representative of the product. It was performed by participating laboratories mostly operating within the terms of EN ISO/IEC 17025 - 2000, using documented standard methods of analysis.

The individual values listed overpage are the average of each analyst's results.

Usage

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

Recommended method of use: Aluminium and aluminium alloys are generally prepared by machining on a lathe. 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.

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.

Analytical Data

Percentage element by weight

Sample	Cu	Mg	Si	Fe	Mn	Ni	Zn
1	0.81	0.865	9.98	0.779	0.423	0.942	0.39
2	0.81	0.88	10.05	0.78	0.43	0.95	0.40
3	0.816	0.892	10.16	0.78	0.43	0.95	0.41
4	0.82	0.895	10.2	0.789	0.43	0.951	0.414
5	0.83	0.910	10.23	0.79	0.432	0.96	0.415
6	0.832	0.91	10.28	0.79	0.433	0.96	0.421
7	0.842	0.91	10.3	0.790	0.44	0.966	0.43
8	0.85	0.91	10.37	0.80	0.44	0.97	0.43
9	0.864	0.92	10.41	0.804	0.45		0.447
Mean	0.830	0.899	10.22	0.789	0.434	0.956	0.417
Std Dev	0.019	0.018	0.14	0.009	0.008	0.009	0.017
C_(95%)	0.014	0.014	0.11	0.007	0.006	0.008	0.013

Sample	Pb	Sn	Ti	Cr	Co	Zr	Be
1	0.043	0.087	0.144	0.056	0.008	0.003	0.0062
2	0.044	0.0888	0.15	0.056	0.009	0.004	0.0065
3	0.05	0.09	0.15	0.056	0.009	0.004	0.0074
4	0.051	0.09	0.15	0.058	0.010	0.0048	0.0074
5	0.051	0.0935	0.152	0.06	0.010	0.006	0.0075
6	0.052	0.095	0.152	0.06	0.010	<0.010	0.0079
7	0.056	0.095	0.156	0.063	0.010		0.008
8	0.06	0.096	0.16	0.063			0.0083
9			0.165	0.066			0.009
Mean	0.051	0.092	0.153	0.060	0.0094	0.004	0.0076
Std Dev	0.006	0.003	0.006	0.004	0.0008	0.001	0.0009
C_(95%)	0.005	0.003	0.005	0.003	0.0007	0.001	0.0007

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

Bodycote Materials Testing Ltd	Middlesbrough, England	UKAS approval 0239
Sheffield Assay Office	Sheffield, England	UKAS approval 0012
London & Scandinavian Met Co Ltd	Rotherham, England	UKAS approval 1091
Rotech Laboratories Ltd	Wednesbury, England	UKAS approval 0366
IncoTest Ltd	Hereford, England	UKAS approval 0281
Coleshill Laboratories Ltd	Birmingham, England	UKAS approval 0121
Universal Scientific Laboratory Pty	Milperra, NSW, Australia	NATA approval 492
Central Iron & Steel Research Inst	Beijing, China	National reg. E0584
Birmingham Assay Office	Birmingham, England	
Dubai Aluminium Co (DUBAL)	Jebel Ali, Dubai, UAE	

Analytical Methods Used

Copper:	FAAS	ICP	photometric (oxalyl dihydrazone)
Magnesium:	FAAS	ICP	
Silicon:	FAAS	ICP	gravimetric (perchloric acid)
Iron:	FAAS	ICP	photometric (orthophenanthroline)
Manganese:	FAAS	ICP	photometric (periodate)
Nickel:	FAAS	ICP	photometric (dimethyl glyoxime)
Zinc:	FAAS	ICP	photometric (PAN)
Lead:	FAAS	ICP	square-wave polarography
Tin:	FAAS	ICP	photometric (phenylfluorone)
Titanium:	FAAS	ICP	photometric (di-antipyryl methane)
Chromium:	FAAS	ICP	
Cobalt:	FAAS	ICP	
Vanadium:	FAAS	ICP	
Zirconium:		ICP	
Beryllium:	FAAS	ICP	

Notes

This Certified Reference Material has been produced in accordance with the requirements of ISO Guide 34-2000, ISO Guide 31-2000, ISO Guide 35-1989, and ASTM Guides E1724 and E1831.

To achieve UKAS (UK Accreditation Scheme) approval, test houses must demonstrate conformity to the general requirements of EN ISO/IEC 17025 and ISO9002.

The combination of alloying elements used in a complex cast material of this type may produce a structure which exhibits micro-porosity on the rear (engraved) surface of the disc. In addition, the unidirectional solidification effects associated with semi-chill casting may lead to the formation of inhomogeneous segregates in the rear portion of the disc. The above certification is therefore only applicable from the front face of the disc. Material to the rear of the disc, to a depth of 5mm, is not certified.

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.