

CERTIFICATE OF ANALYSIS

31X B17 (batch F)

Certified Reference Material Information

Type: BRASS (CHILL CAST)
Form and Size: Disc 40mm Diameter x 15mm Thickness
Manufactured by: MBH Analytical Limited
Certified and Supplied by: MBH Analytical Limited

Certified Analysis

Percentage element by weight

Element	Sn	Pb	Zn	Fe	Ni	Al
Value ¹	0.010	(0.05)	(33.9)	(0.02)	(0.01)	6.05
Uncertainty ²	0.002	-	-	-	-	0.04

Element	Si	Mn	Cu	As	Bi	Sb
Value ¹	(0.007)	(<0.001)	60.0	(0.015)	(<0.001)	(<0.001)
Uncertainty ²	-	-	0.1	-	-	-

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 23rd October 2001



Method of Preparation

This reference material was produced from commercial-purity metals, and master alloys. The discs are the product of one melt poured into multiple chill moulds with feeding systems designed to ensure sound discs. Metal was 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 random positions within the moulds.

Homogeneity

Samples representative of the batch were checked for 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: Copper and its alloys are generally prepared by milling or turning. 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	Sn	Pb	Zn	Fe	Ni	Al
1	0.0068	0.044	33.68	0.014	0.009	6.00
2	0.009	0.052	33.8	0.022	0.015	6.02
3	0.01		34.09			6.02
4	0.01					6.06
5	0.011					6.08
6	0.012					6.09
Mean	0.010	(0.05)	33.86	(0.02)	(0.01)	6.05
Std Dev	0.002	-	0.21	-	-	0.04
C_(95%)	0.002	-	0.52	-	-	0.04

Sample	Si	Mn	Cu	As	Bi	Sb
1	0.003	<0.001	59.89	0.015	<0.001	<0.001
2	0.003	0.001	59.9			
3	0.004		60.0			
4	0.010		60.05			
5	0.01		60.10			
6	0.01		60.16			
7	<0.01					
Mean	(0.007)	(<0.001)	60.02	(0.015)	(<0.001)	(<0.001)
Std Dev	-	-	0.11	-	-	-
C_(95%)	-	-	0.11	-	-	-

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

Metals Technology (Testing) Ltd	Sheffield, England	UKAS accreditation 0963
Bodycote Materials Testing	Middlesbro', England	UKAS accreditation 0239
University Materials Advisory Centre	Sheffield, England	UKAS accreditation 0411
Sheffield Assay Office	Sheffield, England	UKAS accreditation 0012
RoTech Laboratories	Wednesbury, England	UKAS accreditation 0366
Zurich Certification	West Bromwich, England	UKAS accreditation 0584
Central Iron & Steel Res Inst	Beijing, China	CNACL accreditation 0435
Universal Scientific Laboratory Pty Ltd	Milperra, NSW, Australia	NATA accreditation 492
Minton, Treharne and Davies Ltd	Cardiff, Wales	

Analytical Methods Used

Tin:	FAAS		
Lead:	FAAS	XRF	
Zinc	FAAS	ICPvolumetric (EDTA)	XRF
Iron:	FAAS	ICPXRF	
Nickel:	FAAS	ICPphotometric (dimethyl glyoxime)	
Aluminium:	FAAS	ICPXRF	
Silicon:	FAAS		
Manganese:	FAAS	ICPphotometric (periodate)	
Copper:	FAAS	XRF	volumetric (thiosulfate) electrogravimetric
Arsenic:	FAAS		
Bismuth:	FAAS		
Antimony:	FAAS		

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 National Accreditation (eg UKAS, NATA, CNACL), test houses must demonstrate conformity to the general requirements of EN ISO/IEC 17025 and ISO9002.

The combination of alloying elements used in a 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 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 to a depth of 10mm. 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.