

# CERTIFICATE OF ANALYSIS

## 36X CBC5 (batch A)

### Certified Reference Material Information

Type: COPPER/BERYLLIUM/COBALT (WROUGHT)  
Form and Size: Disc 40mm Diameter x 15mm Thickness  
Produced by: Stock Bar  
Certified and supplied by: MBH Analytical Limited

### Certified Analysis

Element	Sn	Pb	Zn	Fe	Ni	Al
Value <sup>1</sup>	0.01	0.009	0.038	0.028	1.69	0.021
Uncertainty <sup>2</sup>	0.004	0.001	0.002	0.003	0.04	0.002

Element	Si	Mn	Cr	Be	Co	Cu
Value <sup>1</sup>	0.036	(0.001)	0.006	0.32	0.14	97.6(4)
Uncertainty <sup>2</sup>	0.004	-	0.001	0.015	0.005	0.12

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

### Definitions

- <sup>1</sup> The certified values are derived from the results of an interlaboratory testing programme, detailed on page 3.
- <sup>2</sup> 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 22nd June 2001



## **Method of Preparation**

This reference material was produced by slicing discs from stock wrought bar.

## **Sampling**

Samples for chemical analysis, and discs for homogeneity checks, were taken from random positions within the bar.

## **Homogeneity**

Samples 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 alloys are generally prepared by machining on a mill or 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 four 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

Sample	<u>Percentage element by weight</u>					
	Sn	Pb	Zn	Fe	Ni	Al
1	0.006	0.008	0.035	0.025	1.65	0.018
2	0.01	0.008	0.035	0.0253	1.65	0.0192
3	0.01	0.0086	0.0366	0.026	1.66	0.02
4	0.013	0.0090	0.037	0.026	1.66	0.02
5	0.013	0.010	0.037	0.03	1.67	0.021
6	0.016	0.01	0.040	0.03	1.70	0.022
7		<0.02	0.040	0.031	1.75	0.025
8			0.043		1.76	
<b>Mean</b>	<b>0.011</b>	<b>0.0090</b>	<b>0.038</b>	<b>0.028</b>	<b>1.69</b>	<b>0.021</b>
<b>Std Dev</b>	0.003	0.0009	0.003	0.003	0.045	0.002
<b>C<sub>(95%)</sub></b>	0.004	0.0010	0.002	0.002	0.037	0.002

Sample	Si	Mn	Cr	Be	Co	Cu
1	0.028	0.001	0.005	0.30	0.137	97.50
2	0.034	0.001	0.005	0.301	0.137	97.57
3	0.035	0.0012	0.005	0.306	0.14	97.66
4	0.036	0.0013	0.0055	0.31	0.14	97.70
5	0.036	<0.0012	0.006	0.328	0.14	97.75
6	0.037	<0.005	0.008	0.330	0.14	
7	0.04	<0.005		0.34	0.14	
8	0.0458	<0.02			0.154	
<b>Mean</b>	<b>0.036</b>	<b>0.001</b>	<b>0.006</b>	<b>0.316</b>	<b>0.141</b>	<b>97.64</b>
<b>Std Dev</b>	0.005	-	0.001	0.016	0.005	0.10
<b>C<sub>(95%)</sub></b>	0.004	-	0.001	0.015	0.005	0.12

Note: C<sub>(95%)</sub> 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**

Rotech Laboratories Ltd  
Metals Technology Testing Ltd  
Bodycote Materials Testing  
Sheffield Assay Office  
London & Scandinavian Met. Co Ltd  
Universal Scientific Laboratory Pty Ltd  
Laboratory Testing Inc  
Central Iron & Steel Research Inst  
Shiva Analyticals Ltd

Wednesbury, England  
Sheffield, England  
Middlesbrough, England  
Sheffield, England  
Rotherham, England  
Milperra, NSW, Australia  
Hatfield, Pa, USA  
Beijing, China  
Bangalore, India

UKAS approval 0366  
UKAS approval 0963  
UKAS approval 0239  
UKAS approval 0012  
UKAS approval 1091  
NATA accreditation 492  
A2LA accreditation 0117  
National reg. E0584

## **Analytical Methods Used**

Tin:	FAAS	ICP	gravimetric (hydrolysis)
Lead:	FAAS	ICP	
Zinc:	FAAS	ICP	
Iron:	FAAS	ICP	
Nickel:	FAAS	ICP	gravimetric (dimethyl glyoxime)
Aluminium:	FAAS	ICP	
Silicon:	FAAS	ICP	photometric (molybdenum blue)
Manganese:	FAAS	ICP	photometric (periodate)
Chromium:	FAAS	ICP	
Beryllium:	FAAS	ICP	
Cobalt:	FAAS	ICP	
Copper:	volumetric (thiosulfate)	electrogravimetric	

## **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.

This certification is applicable to the whole of the disc.

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.