

# CERTIFICATE OF ANALYSIS

## 41X 0336Zn5 (batch A)

### Certified Reference Material Information

Type:	RESIDUALS IN ZINC (CAST)
Form and Size:	Disc 50mm Diameter x 20mm Thickness
Manufactured by:	G Rhodes
Certified and Supplied by:	MBH Analytical Limited

### Certified Analysis

#### Percentage element by weight

Element	Pb	Mg	Al	Cd	Fe	Sn
Value <sup>1</sup>	0.91	<0.0005	0.035	0.056	0.016	0.21
Uncertainty <sup>2</sup>	0.01	-	0.002	0.002	0.002	0.015

Element	Cu	Mn	Ni	Sb	Bi
Value <sup>1</sup>	0.023	(0.0001)	(0.0005)	0.008	(0.001)
Uncertainty <sup>2</sup>	0.001	-	-	0.001	-

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 30th April 2001

## **Method of Preparation**

This reference material was produced from master alloys and commercial-purity zinc. The metal was cast into individual iron chill moulds. At least 1mm was machined from the upper and lower surfaces of each disc, to minimise surface effects.

## **Sampling**

Samples for chemical analysis were taken from throughout the casting process. In addition 10% of all discs, chosen at random from the complete cast, were checked for homogeneity.

## **Homogeneity**

Discs were checked for uniformity using an optical emission spectrometer. One additional disc was checked for vertical uniformity using the same method.

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 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: Zinc and zinc alloys are generally prepared by machining on a mill or 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.

For OES the sample should be of sufficient mass to prevent excess heating during sparking, and the discharge chamber should be regularly cleaned as directed by the instrument manufacturer.

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	Pb	Mg	Al	Cd	Fe	Sn
1	0.892	<0.0001	0.031	0.053	0.0149	0.19
2	0.909	<0.0001	0.0329	0.054	0.015	0.202
3	0.91	0.0003	0.0337	0.0545	0.015	0.203
4	0.911	<0.0005	0.0338	0.055	0.016	0.205
5	0.916	<0.0005	0.036	0.055	0.016	0.211
6	0.92	<0.0005	0.036	0.0550	0.0164	0.22
7		<0.0005	0.036	0.058		0.22
8			0.038	0.059		0.2378
9		-	0.0382	0.0609		
<b>Mean</b>	<b>0.910</b>	<b>&lt;0.0005</b>	<b>0.035</b>	<b>0.056</b>	<b>0.0156</b>	<b>0.211</b>
<b>Std Dev</b>	0.010	-	0.0024	0.003	0.0007	0.015
<b>C<sub>(95%)</sub></b>	0.010	-	0.0018	0.002	0.0007	0.012

Sample	Cu	Mn	Ni	Sb	Bi
1	0.021	0.0001	0.0002	0.0065	0.001
2	0.0216	0.0001	0.0003	0.007	0.0010
3	0.0222	0.0001	0.0005	0.0082	0.001
4	0.023	<0.0002	0.0007	0.009	0.0013
5	0.023	<0.0002	0.0009	0.0090	<0.001
6	0.0233	<0.0005	<0.001	0.0093	<0.001
7	0.024	<0.0005	<0.001	0.0097	<0.005
8	0.0242				
<b>Mean</b>	<b>0.0228</b>	<b>(0.0001)</b>	<b>(0.0005)</b>	<b>0.0084</b>	<b>(0.001)</b>
<b>Std Dev</b>	0.0011	-	-	0.0012	-
<b>C<sub>(95%)</sub></b>	0.0009	-	-	0.0011	-

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

Bodycote Materials Testing Ltd	Edinburgh, Scotland	UKAS approval 0172
Metals Technology Testing Ltd	Sheffield, England	UKAS approval 0963
London & Scandinavian Met Co Ltd	Rotherham, England	UKAS approval 1091
RoTech Laboratories	Wednesbury, England	UKAS approval 0366
Sheffield Assay Office	Sheffield, England	UKAS approval 0012
Universal Scientific Laboratory Pty Ltd	Milperra, NSW, Australia	NATA approval 492
Laboratory Testing Inc	Hatfield, Pa, USA	A2LA approval 0117
Central Iron & Steel Research Inst	Beijing, China	National reg. E0584
Coleshill Laboratories Ltd	Coleshill, England	
Shiva Analyticals Ltd	Bangalore, India	

## Analytical Methods Used

Lead:	FAAS	ICP	volumetric (via chromate precipitation)
Magnesium:	FAAS	ICP	
Aluminium:	FAAS	ICP	photometric (chromazurol-S)
Cadmium:	FAAS	ICP	square-wave polarography
Iron:	FAAS	ICP	photometric (sulfosalicylic acid)
Tin:	FAAS	ICP	photometric (phenylfluorone)
Copper:	FAAS	ICP	photometric (bis-cyclohexanone oxalyldihydrazone)
Manganese:	FAAS	ICP	photometric (periodate)
Nickel:	FAAS	ICP	
Antimony:	FAAS	ICP	photometric (malachite green)
Bismuth:	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, coupled with 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.

For OES the sample should be of sufficient mass to prevent excess heating during sparking, and the discharge chamber should be regularly cleaned as directed by the instrument manufacturer.

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.