

# CERTIFICATE OF ANALYSIS

## 82X PAg3.5R (batch D)

### Certified Reference Material Information

Type: LEAD/SILVER ALLOY (CAST)  
Form and Size: Disc 40mm Diameter x 15mm Thickness  
Produced by: MBH Analytical Limited  
Certified and supplied by: MBH Analytical Limited

### Certified Analysis

#### Percentage element by weight

Element	Sn	Sb	Bi	Cu	As	Ag
Value <sup>1</sup>	0.25	0.106	0.290	0.073	0.020	3.54
Uncertainty <sup>2</sup>	0.02	0.005	0.012	0.003	0.002	0.13

Element	Zn	Cd	Fe	Al	In
Value <sup>1</sup>	(0.0004)	0.0027	<0.001	0.0015	0.037
Uncertainty <sup>2</sup>	-	0.0004	-	0.0005	0.005

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 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 1st November 2000

## **Method of Preparation**

This reference material was produced from commercially-available lead and high-purity silver. The other minor and trace elements were added as single elements or as binary alloys. Individual discs were prepared by sequential transfer of aliquots from the melt holding pot, and each was cast into a steel mould. 2mm has been removed from the cast face to minimise any surface effects.

## **Sampling**

Discs taken from throughout the casting process were used to monitor homogeneity within the cast. Chemical analyses were carried out on turnings taken from the working faces of several discs.

## **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 usually the average of each analyst's results.

## **Usage**

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

Recommended method of use: Lead alloys are generally prepared by machining on a lathe. However, users are recommended to follow the calibration and sample preparation methods 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

### Percentage element by weight

Sample	Sn	Sb	Bi	Cu	As	Ag
1	0.23	0.10	0.28	0.069	0.0154	3.38
2	0.23	0.104	0.28	0.070	0.020	3.48
3	0.24	0.107	0.281	0.072	0.0200	3.52
4	0.25	0.107	0.290	0.072	0.02	3.58
5	0.25	0.110	0.29	0.073	0.020	3.60
6	0.27	0.11	0.301	0.073	0.020	3.67
7	0.286		0.31	0.075	0.021	
8				0.075	0.024	
9				0.076		
<b>Mean</b>	<b>0.251</b>	<b>0.106</b>	<b>0.290</b>	<b>0.073</b>	<b>0.020</b>	<b>3.54</b>
<b>Std Dev</b>	0.021	0.004	0.012	0.002	0.002	0.10
<b>C<sub>(95%)</sub></b>	0.019	0.004	0.011	0.002	0.002	0.11

Sample	Zn	Cd	Fe	Al	In
1	0.0002	0.0023	<0.0005	0.001	0.032
2	0.0002	0.0023	0.0006	0.001	0.032
3	0.0005	0.0026	0.0007	0.0011	0.035
4	0.0005	0.0027	0.001	0.0013	0.0365
5	<0.0005	0.0028	<0.001	0.0018	0.04
6	<0.001	0.0029		0.002	0.041
7	<0.001	0.0032		0.002	0.042
<b>Mean</b>	<b>(0.0004)</b>	<b>0.0027</b>	<b>&lt;0.001</b>	<b>0.0015</b>	<b>0.037</b>
<b>Std Dev</b>	-	0.0003	-	0.0005	0.004
<b>C<sub>(95%)</sub></b>	-	0.0003	-	0.0004	0.004

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	Wednesbury, England	UKAS approval 0366
Sheffield Assay Office	Sheffield, England	UKAS approval 0012
Bodycote Materials Testing Ltd	Middlesbrough, England	UKAS approval 0239
University Metals Advisory Centre	Sheffield, England	UKAS approval 0411
Birmingham Assay Office	Birmingham, England	UKAS approval 0667
Metals Technology Testing	Sheffield, England	UKAS approval 0963
Universal Scientific Laboratory Pty Ltd	Milperra, NSW, Australia	NATA approval 492
Laboratory Testing Inc	Hatfield, Pa, USA	A2LA approval 0117
Shiva Analyticals Ltd	Bangalore, India	

## Analytical Methods Used

Tin:	FAAS	ICP		
Antimony:	FAAS	ICP		
Bismuth:	FAAS	ICP		
Copper:	FAAS	ICP		
Arsenic:	FAAS	ICP	GF-AAS	
Silver:	FAAS	ICP	cupellation	volumetric (thiocyanate)
Zinc:	FAAS	ICP		
Cadmium:	FAAS	ICP		
Iron:	FAAS	ICP		
Aluminium:	FAAS	ICP	GF-AAS	
Indium:	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 to a depth of 10mm. Material to the rear of the disc, to a depth of 5mm, is not certified.

This material is liable to superficial corrosion; however, it will otherwise 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.