

# CERTIFICATE OF ANALYSIS

## 41X 2951Zn1 (batch A)

### Certified Reference Material Information

Type: LOW-ALLOY ZINC - ILZRO16-type (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>       | 0.0042 | 0.0029 | 0.029 | 0.0005 | 0.011 | (0.0007) |
| Uncertainty <sup>2</sup> | 0.0004 | 0.0003 | 0.002 | 0.0001 | 0.001 | -        |

| Element                  | Cu   | Ti    | Cr    | Mn     | Ni     |
|--------------------------|------|-------|-------|--------|--------|
| Value <sup>1</sup>       | 0.79 | 0.278 | 0.083 | 0.0013 | 0.0038 |
| Uncertainty <sup>2</sup> | 0.02 | 0.003 | 0.002 | 0.0001 | 0.0002 |

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 12th September 2001

## **Method of Preparation**

This reference material was produced from 99.999 high-purity zinc, commercial ILZRO16 alloy, and master alloys. 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 selected for homogeneity checks.

## **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

| Sample                   | <u>Percentage element by weight</u> |               |               |               |               |                 |
|--------------------------|-------------------------------------|---------------|---------------|---------------|---------------|-----------------|
|                          | Pb                                  | Mg            | Al            | Cd            | Fe            | Sn              |
| 1                        | 0.0037                              | 0.0025        | 0.0258        | 0.0004        | 0.0099        | 0.0005          |
| 2                        | 0.0039                              | 0.0025        | 0.0278        | 0.0004        | 0.010         | 0.0008          |
| 3                        | 0.0040                              | 0.0029        | 0.0284        | 0.0004        | 0.010         | <0.001          |
| 4                        | 0.0041                              | 0.0030        | 0.029         | 0.0004        | 0.010         | <0.001          |
| 5                        | 0.0042                              | 0.0030        | 0.030         | 0.0005        | 0.010         | <0.005          |
| 6                        | 0.0043                              | 0.0030        | 0.030         | 0.0005        | 0.0100        |                 |
| 7                        | 0.005                               | 0.0033        | 0.032         | 0.0007        | 0.012         |                 |
| 8                        |                                     |               | 0.0324        |               | 0.0136        |                 |
| <b>Mean</b>              | <b>0.0042</b>                       | <b>0.0029</b> | <b>0.0294</b> | <b>0.0005</b> | <b>0.0107</b> | <b>(0.0007)</b> |
| <b>Std Dev</b>           | 0.0004                              | 0.0003        | 0.0022        | 0.0001        | 0.0014        | -               |
| <b>C<sub>(95%)</sub></b> | 0.0004                              | 0.0003        | 0.0018        | 0.0001        | 0.0011        | -               |

| Sample                   | Cu           | Ti           | Cr            | Mn            | Ni            |
|--------------------------|--------------|--------------|---------------|---------------|---------------|
| 1                        | 0.768        | 0.273        | 0.0792        | 0.001         | 0.0032        |
| 2                        | 0.772        | 0.277        | 0.082         | 0.0012        | 0.0037        |
| 3                        | 0.772        | 0.279        | 0.082         | 0.0013        | 0.0038        |
| 4                        | 0.773        | 0.279        | 0.083         | 0.0013        | 0.0038        |
| 5                        | 0.795        | 0.280        | 0.084         | 0.0013        | 0.0039        |
| 6                        | 0.814        | 0.281        | 0.0846        | 0.0014        | 0.004         |
| 7                        | 0.819        |              | 0.085         | 0.0014        | 0.004         |
| 8                        |              |              |               | 0.0015        | 0.0040        |
| <b>Mean</b>              | <b>0.788</b> | <b>0.278</b> | <b>0.0828</b> | <b>0.0013</b> | <b>0.0038</b> |
| <b>Std Dev</b>           | 0.022        | 0.003        | 0.0020        | 0.0002        | 0.0003        |
| <b>C<sub>(95%)</sub></b> | 0.020        | 0.003        | 0.0018        | 0.0001        | 0.0002        |

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

|  |                          |                    |
|--|--------------------------|--------------------|
| 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  |
| Central Iron & Steel Research Inst                     | Beijing, China           | CNACL 0435         |
| Non-Ferrous Materials Technology<br>Development Centre | Hyderabad, India         |                    |
| Minton, Treharne and Davies Ltd                        | Cardiff, Wales           |                    |
| Birmingham Assay Office Ltd                            | Birmingham, England      |                    |
| Brock Metals Ltd                                       | Cannock, England         |                    |
| Coleshill Laboratories Ltd                             | Coleshill, England       |                    |

## Analytical Methods Used

|            |      |     |   |
|------------|------|-----|---|
| Lead:      | FAAS | ICP | polarographic                                     |
| Magnesium: | FAAS | ICP |   |
| Aluminium: | FAAS | ICP |   |
| Cadmium:   | FAAS | ICP |   |
| Iron:      | FAAS | ICP | photometric (sulfosalicylic acid)                 |
| Tin:       | FAAS | ICP |   |
| Copper:    | FAAS | ICP | photometric (bis-cyclohexanone oxalyldihydrazone) |
| Titanium:  | FAAS | ICP | photometric (di-antipyrylmethane)                 |
| Chromium:  | FAAS | ICP |   |
| Manganese: | FAAS | ICP |   |
| Nickel:    | 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 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 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 product is designed as part of a calibration series for alloy type ILZRO16. ILZRO is a trademark of the International Lead Zinc Research Organisation Inc, based in North Carolina, USA.

This product is also available in the form of chippings.

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.