# INTERNATIONAL STANDARD 3815

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

# Zinc and zinc alloys — Spectrographic analysis

*Zinc et alliages de zinc — Analyse spectrale d'émission*

**First edition — 1976-09-30**



**UDC 669.5 : 543.42**

**Ref. No. ISO 3815-1976 (E)**

**Descriptors** : zinc, zinc alloys, chemical analysis, emission spectrometry.

Price based on 5 pages

## FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3815 was drawn up by Technical Committee ISO/TC 18, *Zinc and zinc alloys*, and was circulated to the Member Bodies in June 1975.

It has been approved by the Member Bodies of the following countries :

| | | |
|---|---|---|
| Australia | Germany | South Africa, Rep. of |
| Austria | India | Spain |
| Belgium | Ireland | Turkey |
| Brazil | Italy | United Kingdom |
| Canada | Japan | U.S.S.R. |
| Czechoslovakia | Mexico | Yugoslavia |
| Egypt, Arab Rep. of | Norway | |
| France | Poland | |

No Member Body expressed disapproval of the document.





Printed in Switzerland

# Zinc and zinc alloys — Spectrographic analysis



## 0 INTRODUCTION

As spectrographic analysis methods are coming more and more into general use, it has become necessary to define their principles of application.

In the case of the present International Standard and after preliminary agreement between the interested parties, the determinations may be performed by emission spectroscopy, provided that samples with known composition are available for the element considered. In the absence of such an agreement, other standardized methods only are applicable.

## 1 SCOPE AND FIELD OF APPLICATION

**1.1** This International Standard specifies the objective criteria which make it possible to assess the value of the results obtained in each particular case. It is not intended to prescribe a type of apparatus or a procedure for converting the instrument response to concentration units because of the broad range of equipment available and the difficulty of completely specifying all working conditions in a spectrographic installation.

**1.2** Irrespective of the test procedure used, it is essential that it should refer to standard samples[1)] guaranteed by official bodies or to other standard samples accepted by the interested parties.

**1.3** This International Standard applies to the types of zinc and to the zinc alloys specified in ISO/R 301 and ISO/R 752 for the elements and the contents mentioned in those two documents, provided that standard samples are available.

**1.4** The spectrographic analysis, as described in this International Standard, shall be carried out on solid metallic samples.

## 2 REFERENCES

ISO/R 301, *Zinc alloy ingots.*

ISO/R 752, *Zinc ingots.*

## 3 APPARATUS

Any complete set of equipment for emission spectrographic analysis, either photographic or photoelectric, is acceptable, provided that it is sufficiently sensitive.

It is recommended that an arc discharge should be used for the determination of impurities and a spark discharge for the determination of alloying elements.

The wavelengths used should generally be between 200 and 520 nm.

## 4 SAMPLES

**4.1** The standard samples and the test samples shall have approximately the same structure, and shall have dimensions and shape as similar as possible. The surfaces shall be finished in the same manner.

**4.2** For plotting the calibration curve, standard samples with a composition corresponding to the composition of the test sample shall be used.

1) See the annex.

## 5 SELECTION OF ANALYTICAL LINES AND REFERENCE LINES

The use of lines with the following wavelengths is recommended. It is, however, possible to obtain correct results when using lines of other wavelengths inasmuch as these are sufficiently sensitive and do not show interfering lines.

In direct reading spectroscopy, the intensity of the analytical line may be compared either to that of a reference line or to the zero order beam reflected by the grating.

### 5.1 Determination of lead content in zinc and zinc alloys

Reference lines : 267,06 nm – 271,25 nm – 330,26 nm[1] – 334,50 nm[1] – 462,98 nm – 481,05 nm[1]

Analytical lines : 283,31 nm – 405,78 nm

Two lines recommended for the photographic method :

contents from 0,001 % to 0,04 % : Pb 405,78 nm – Zn 462,98 nm

### 5.2 Determination of cadmium content in zinc and zinc alloys

Reference lines : 256,99 nm – 267,06 nm – 301,84 nm – 330,26 nm[1] – 334,50 nm[1]

Analytical lines : 226,50 nm – 228,80 nm[2] – 326,10 nm – 346,62 nm[1]

Two lines recommended for the photographic method :

contents from 0,000 5 % to 0,01 % : Cd 228,80 nm[2] – Zn 256,99 nm

contents from 0,01 % to 0,3 % : Cd 326,10 nm – Zn 301,84 nm

### 5.3 Determination of copper content in zinc and zinc alloys

Reference lines : 267,06 nm – 271,25 nm – 301,84 nm – 330,26 nm[1] – 334,50 nm[1] – 462,98 nm[1] – 481,05 nm[1]

Analytical lines : 282,44 nm – 324,75 nm – 327,40 nm – 510,55 nm[1]

Two lines recommended for the photographic method :

contents from 0,000 5 % to 0,005 % : Cu 324,75 nm – Zn 301,84 nm

### 5.4 Determination of tin content in zinc and zinc alloys

Reference lines : 267,06 nm – 271,25 nm – 301,84 nm – 330,26 nm[1] – 334,50 nm[1]

Analytical lines : 266,12 nm – 284,00 nm – 286,33 nm – 317,50 nm[3]

Two lines recommended for the photographic method :

contents from 0,001 % to 0,01 % : Sn 284,00 nm – Zn 271,25 nm

### 5.5 Determination of iron content in zinc and zinc alloys

Reference lines : 267,06 nm – 301,84 nm – 330,26 nm[1] – 334,50 nm[1]

Analytical lines : 302,06 nm – 358,12 nm – 371,95 nm

Two lines recommended for the photographic method :

contents from 0,001 % to 0,2 % : Fe 302,06 nm – Zn 301,84 nm

### 5.6 Determination of aluminium content in zinc alloys

Reference lines : 256,99 nm – 303,58 nm – 330,26 nm[1] – 334,50 nm[1]

Analytical lines – 256,80 nm – 396,15 nm[4]

### 5.7 Determination of magnesium in zinc alloys

Reference lines : 267,06 nm – 271,25 nm – 303,58 nm – 330,26 nm[1] – 334,50 nm[1]

Analytical lines : 277,98 nm – 279,55 nm – 285,21 nm – 383,83 nm

Two lines recommended for the photographic method :

contents from 0,01 % to 0,1 % : Mg 277,98 nm – Zn 267,06 nm

## 6 PLOTTING OF THE CALIBRATION CURVE

Submit the test sample as well as at least three standard samples to a suitable kind of discharge at least twice under the same conditions.

Choose the standard samples so that as far as possible the contents of two of them bracket those of the test sample.



1) Direct reading only.

2) The line 228,80 shows a coincidence with the persistent line As 228,8 and may not be used when arsenic is present.

3) The line 317,50 shows a coincidence with a line of iron.

4) Only to be used in direct reading with a Feusner-type high-voltage spark.

Plot the ratio between the intensity of the line for the element to be determined and the reference intensity (for another suitable expression of their relationship) determined for each standard sample as a function of the content of the element to be determined. Whatever the method used for plotting, it must result in the obtaining of a straight line. This straight line shall be determined by means of experimental points using the mean square method or any other method of linear regression. No experimental point shall be located at more than 10 % of the corresponding value from the straight line which has been so defined. The allowable variation shall be reduced to 2,5 % of the content in the case of aluminium in alloys and 5 % of the content in the case of copper in alloy Zn Al4 Cu1.

If these basic criteria are not fully respected under practical operating conditions, either of the interested parties shall be entitled to reject the results obtained and to request the use of other standardized methods.

ANNEX

## STANDARD SAMPLES

NOTE — This list is given for information only and is not exhaustive. All standard samples should be supplied with a certificate of analysis.

**A.1 STANDARD SAMPLES FOR SPECTROGRAPHIC ANALYSIS OF PURE ZINC,** guaranteed by G.A.M.S. (Groupement pour l'avancement des méthodes spectrographiques) and distributed by : Zinc et alliages, à Levallois-Perret (Hauts-de-Seine), France.

| Lots | Pb | Cd | Fe | Sn | Cu |
|---|---|---|---|---|---|
| 1 | 0,001 4 | 0,000 2 | 0,000 6 | 0,000 | 0,000 2 |
| 2 | 0,002 6 | 0,001 | 0,002 | 0,001 1 | 0,001 |
| 3 | 0,005 7 | 0,003 | 0,003 5 | 0,003 0 | 0,003 |
| 4 | 0,012 | 0,006 4 | 0,007 1 | 0,006 4 | 0,006 8 |
| 5 | 0,029 | 0,010 5 | 0,018 5 | 0,011 | 0,011 |

**A.2 STANDARD SAMPLES FOR SPECTROGRAPHIC ANALYSIS OF ZINC ALLOYS,** guaranteed by G.A.M.S. (Groupement pour l'avancement des méthodes spectrographiques) and distributed by : Zinc et alliages, à Levallois-Perret (Hauts-de-Seine), France.

**Zinc alloys without copper**

| Lots | Al | Cu | Mg | Pb | Cd | Sn |
|---|---|---|---|---|---|---|
| 1 | 4,59 | 0,011 | 0,013 | 0,001 1 | 0,001 1 | 0,001 4 |
| 2 | 4,30 | 0,030 | 0,023 | 0,003 | 0,003 | 0,003 |
| 3 | 3,94 | 0,11 | 0,048 | 0,005 | 0,005 | 0,005 |
| 4 | 3,61 | 0,30 | 0,067 | 0,01 | 0,010 | 0,010 |

**Zinc alloys containing copper**

| Lots | Al | Cu | Mg | Pb | Cd | Sn | Ni |
|---|---|---|---|---|---|---|---|
| 1 | 4,56 | 0,59 | 0,014 | 0,001 2 | 0,001 | 0,001 4 | — |
| 2 | 4,02 | 1,00 | 0,048 | 0,002 9 | 0,002 9 | 0,002 7 | — |
| 3 | 3,40 | 1,44 | 0,087 | 0,009 | 0,01 | 0,008 6 | — |
| 4 | 3,97 | 0,052 | 0,004 | 0,002 | 0,002 1 | 0,001 3 | 0,027 |

**A.3 STANDARD SAMPLES FOR SPECTROGRAPHIC ANALYSIS OF PURE ZINC** distributed by : Bundesanstalt für Materialprüfung, 1 Berlin 45, Unter den Eichen 87 (Germany).

| Lots | Sn | Pb | Cd |
|---|---|---|---|
| D | 0,000 5 | 0,004 2 | 0,001 0 |
| E | 0,000 9 | 0,007 6 | 0,001 4 |
| F | 0,002 1 | 0,012 | 0,003 1 |
| G | 0,004 0 | 0,016 | 0,006 5 |
| H | 0,006 6 | 0,028 | 0,010 |