AS 1050.29—1989
Reconfirmed 2016

Australian Standard®

Methods for the analysis of iron and steel

Part 29: Determination of cobalt content—Flame atomic absorption spectrometric method

This Australian Standard was prepared by Committee CH/10, Analysis of Metals. It was approved on behalf of the Council of Standards Australia on 30 September 1988 and published on 19 June 1989.

The following interests are represented on Committee CH/10:

Aluminium Development Council
Australasian Institute of Mining and Metallurgy
Australian Lead Development Association
Australian Mineral Development Laboratories
Australian Tin Information Centre
Australian Zinc Development Association
Bureau of Steel Manufacturers of Australia
Confederation of Australian Industry
Copper Technical Data Centre
Department of Defence
Electricity Supply Association of Australia
Metal Trades Industry Association of Australia
National Association of Testing Authorities
Railways of Australia Committee
Royal Australian Chemical Institute

This Standard was issued in draft form for comment as DR 87152.

STANDARDS AUSTRALIA

RECONFIRMATION

OF
AS 1050.29—1989
Methods for the analysis of iron and steel
Part 29: Determination of cobalt content—Flame atomic absorption spectrometric method

RECONFIRMATION NOTICE

Technical Committee CH-010 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 31 July 2016.

The following are represented on Technical Committee CH-010:

Australian Aluminium Council
Bureau of Steel Manufacturers of Australia
International Copper Association Australia
International Precious Metals Institute
National Association of Testing Authorities Australia

NOTES

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PREFACE

This Standard was prepared by Standards Australia's Committee on the Analysis of Metals under the direction of the Chemical Standards Board to supersede AS 1050 1975, *Methods for the analysis of iron and steel, Part 29: The determination of cobalt in iron and steel (atomic absorption spectrometric method).*

The Committee organized an interlaboratory test program to obtain information on the repeatability and reproducibility of the method. Laboratories from the following organizations participated in the test program to provide the data given in Table 2:

BHP Steel International—Long Products Division (Whyalla).
BHP Steel International—Slab and Plate Division (Port Kembla).
BHP Steel International—Rod and Bar Division (Newcastle).
Department of Defence—Materials Testing Laboratory.
Commonwealth Aircraft Corporation.

STANDARDS AUSTRALIA

Australian Standard

Methods for the analysis of iron and steel

Part 29: Determination of cobalt content—Flame atomic absorption spectrometric method

1 SCOPE. This Standard sets out a method for the determination of cobalt in all types of iron and steel.

2 APPLICATION. The method is applicable to the determination of cobalt contents in the range 0.003% to 0.400% (*m*/*m*).

3 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS 1213 Iron and steel—Methods of sampling

2134 Recommended practice for chemical analysis by atomic absorption spectrometry

2134.1 Part 1: Flame atomic absorption spectrometry

2164 One-mark volumetric flasks

2850 Chemical analysis—Interlaboratory test programs—For determining precision of analytical methods—Guide to the planning and conduct

4 PRINCIPLE. The sample is dissolved in hydrochloric, phosphoric and nitric acids and fumed with perchloric acid. If tungsten is present, an addition of hydrofluoric acid is made. The cobalt content is determined by flame atomic absorption spectrometry.

5 REAGENTS.

5.1 General requirements. During the analysis only reagents of recognized analytical reagent grade and only distilled water, or water of equivalent purity, shall be used.

5.2 High purity iron. Iron containing greater than or equal to 99.5% Fe and less than 2 μg/g Co.

5.3 Solutions.

5.3.1 *Hydrochloric acid* (ϱ_{20} 1.16 g/mL).

5.3.2 *Phosphoric acid (1 + 9).* Add 50 mL of orthophosphoric acid (ϱ_{20} 1.75 g/mL) to 450 mL of water and mix well.

5.3.3 *Nitric acid* (ϱ_{20} 1.42 g/mL).

5.3.4 *Hydrofluoric acid* (ϱ_{20} 1.13 g/mL). Nominal 40% (*m*/*m*) solution.

WARNING: Even when diluted, hydrofluoric acid is extremely dangerous and harmful to the eyes and skin; rubber gloves and goggles should be worn when using this acid. Hydrofluoric acid attacks glassware. Care should be taken to minimize the time of acid contact with glassware.

5.3.5 *Perchloric acid* (ϱ_{20} 1.67 g/mL). 70% (*m*/*m*) solution.

5.4 Standard solutions.

5.4.1 *Standard cobalt solution* (1 mL ≡ 1 mg Co). Dissolve 1.000 g of high purity cobalt metal by heating in 30 mL of hydrochloric acid (5.3.1). Add 5 mL of nitric acid (5.3.3) and heat to expel oxides of nitrogen fumes. Cool, dilute to 1 L with water in a volumetric flask and mix.

5.4.2 *Standard cobalt solution* (1 mL ≡ 0.1 mg Co). Dilute 20 mL of standard cobalt solution (5.4.1) to 200 mL with water in a volumetric flask, and mix.

6 APPARATUS.

6.1 Glassware. Grade A volumetric glassware complying with AS 2164 shall be used throughout.

6.2 Atomic absorption spectrometer.

6.2.1 *General.* The instrument and practice shall comply with AS 2134.1.

6.2.2 *Operating parameters.* Suitable operating parameters for this test are as follows:

(a) Wavelength . . . . . 240.7 nm.

(b) Flame type . . . . . Nitrous oxide/acetylene.

6.2.3 *Performance criteria.* Immediately before the test, the following performance criteria shall be met:

(a) *Minimum sensitivity.* The absorbance of the calibration solution of highest cobalt content (see Table 1) shall be not less than 0.5.

(b) *Curve linearity.* The slope of the calibration curve covering the top 20% concentration range (expressed as a change in absorbance) shall be not less than 0.7 times the value of the slope of the bottom 20% concentration range, when determined in the same way.

(c) *Minimum stability.* The standard deviation of the absorbance of the most concentrated calibration solution and that of the least concentrated calibration solution (excluding the zero calibration solution), each calculated from at least 10 repetitive measurements, shall be less than 1.5% and 0.5% respectively of the mean value of the absorbance of the most concentrated solution.

7 SAMPLING. The sample shall be taken in accordance with AS 1213.

8 PROCEDURE.

8.1 Number of determinations. This method is written for a single determination only and may be used in that form. Where replicate determinations are required, procedures for acceptance of the results so obtained are given in Clause 12.