

INTERNATIONAL STANDARD

ISO
13898-1

First edition
1997-06-01

Steel and iron — Determination of nickel, copper and cobalt contents — Inductively coupled plasma atomic emission spectrometric method —

Part 1: General requirements and sample dissolution

*Aciers et fontes — Dosage du nickel, du cuivre et du cobalt — Méthode
par spectrométrie d'émission atomique avec plasma induit par haute
fréquence —*

Partie 1: Prescriptions générales et mise en solution de l'échantillon



Reference number
ISO 13898-1:1997(E)

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 13898-1 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 1, *Methods of determination of chemical composition*.

ISO 13898 consists of the following parts, under the general title *Steel and iron — Determination of nickel, copper and cobalt contents — Inductively coupled plasma atomic emission spectrometric method*.

- *Part 1: General requirements and sample dissolution*
- *Part 2: Determination of nickel content*
- *Part 3: Determination of copper content*
- *Part 4: Determination of cobalt content*

Annex A forms an integral part of this part of ISO 13898. Annexes B and C are for information only.

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Printed in Switzerland

Introduction

This part of ISO 13898 is to be used in conjunction with subsequent parts which specify methods for the determination of individual elements in steel and iron by inductively coupled plasma atomic emission spectrometric method (ICP-AES).

Although the analytical methods are specified as independent standards, more than one element in a single test solution can be determined.

ISO 13898 is optimized to give the highest accuracy for each individual element, which implies that the multi-element capability of the ICP technique is not utilized.

Steel and iron — Determination of nickel, copper and cobalt contents — Inductively coupled plasma atomic emission spectrometric method —

Part 1:

General requirements and sample dissolution

1 Scope

1.1 This part of ISO 13898 specifies a method for determination of nickel, copper and cobalt contents in unalloyed steel and unalloyed iron within the ranges specified in table 1 by means of inductively coupled plasma atomic emission spectrometric method.

Table 1 - Application ranges of the elements to be determined

Element	Application range %(m/m)
Nickel	0,001 to 0,30
Copper	0,001 to 0,40
Cobalt	0,001 to 0,10

1.2 This part of ISO 13898 specifies the general requirements for analyses by ICP-AES, preparation and dissolution of the test portion and method of calculation and the procedures used for the evaluation of the precision data of the individual methods specified in the subsequent parts.

1.3 The International Standard specifies two alternative methods of evaluating concentrations in test solutions. One is with, the other is without the use of an internal standard.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 13898. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 13898 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 385-1:1984, *Laboratory glassware - Burettes - Part 1 : General requirements.*

ISO 648:1977, *Laboratory glassware - One-mark pipettes.*

ISO 1042:1983, *Laboratory glassware - One-mark volumetric flasks.*

ISO 3696:1987, *Water for analytical laboratory use - Specification and test methods.*

ISO 13898-2:1997, *Steel and iron - Determination of nickel, cobalt and copper contents - Inductively coupled plasma atomic emission spectrometric method - Part 2: Determination of nickel content.*

ISO 13898-3:1997, *Steel and iron - Determination of nickel, cobalt and copper contents - Inductively coupled plasma atomic emission spectrometric method - Part 3: Determination of copper content.*

ISO 13898-4:1997, *Steel and iron - Determination of nickel, cobalt and copper contents - Inductively coupled plasma atomic emission spectrometric method - Part 4: Determination of cobalt content.*

ISO 14284:1996, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition.*

3 Principle

Dissolution of a test portion in a mixture of hydrochloric and nitric acids and dilution of the solution to known volume. If necessary, addition of scandium or yttrium as internal standard. Nebulization of the solution into an inductively coupled plasma atomic emission spectrometer and measurement of the intensity of the emitted light from each element, or with emitted light from scandium or yttrium, simultaneously. Examples of the analytical lines are given in table 2.

Table 2 - Examples of analytical lines of the elements to be determined

Element	Analytical lines nm
Nickel	231,60
Copper	324,75 or 327,40
Cobalt	228,62
Scandium	361,38 or 424,68 (internal standard)
Yttrium	371,03 (internal standard)

4 Reagents

During the analysis, unless otherwise stated, use only reagents of recognized analytical grade and only grade 2 water as specified in ISO 3696.

4.1 Pure iron, containing less than 0,000 1 % (m/m) of each element.

4.2 Hydrochloric acid, ρ approximately 1,19 g/ml, diluted 1+1.

4.3 Nitric acid, ρ approximately 1,40 g/ml, diluted 1+1.