

# INTERNATIONAL STANDARD

**ISO**  
**9684**

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## **Iron ores — Determination of vanadium content — Flame atomic absorption spectrometric methods**

*Minerais de fer — Dosage du vanadium — Méthodes par spectrométrie  
d'absorption atomique dans la flamme*



Reference number  
ISO 9684:1991(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 9684 was prepared by Technical Committee ISO/TC 102, *Iron ores*, Sub-Committee SC 2, *Chemical analysis*.

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

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# Iron ores — Determination of vanadium content — Flame atomic absorption spectrometric methods

## 1 Scope

This International Standard specifies two flame atomic absorption spectrometric methods for the determination of the vanadium content of iron ores.

Method 1 is applicable to vanadium contents between 0,005 % (*m/m*) and 0,05 % (*m/m*), and Method 2 to vanadium contents between 0,05 % (*m/m*) and 0,5 % (*m/m*) in natural iron ores, iron ore concentrates and agglomerates, including sinter products.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 648:1977, *Laboratory glassware — One-mark pipettes*.

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

ISO 3081:1986, *Iron ores — Increment sampling — Manual method*.

ISO 3082:1987, *Iron ores — Increment sampling and sample preparation — Mechanical method*.

ISO 3083:1986, *Iron ores — Preparation of samples — Manual method*.

ISO 7764:1985, *Iron ores — Preparation of predried test samples for chemical analysis*.

## 3 Principle

### 3.1 Dissolution

Decomposition of the test portion by digestion with hydrochloric acid in a polytetrafluoroethylene (PTFE) beaker, addition of hydrofluoric and nitric acids and evaporation to dryness. Addition of hydrochloric and boric acids and evaporation to dryness. Dissolution of the salts in hydrochloric and nitric acids (Method 1), or hydrochloric acid (Method 2), and filtration. Ignition and fusion of the residue with sodium carbonate and dissolution of the cooled melt in the test solution.

### 3.2 Determination

#### 3.2.1 Extraction (Method 1 only)

Oxidation with cerium(IV) solution and addition of orthophosphoric acid and sodium tungstate solution. Extraction of the vanadium complex with a 1 + 1 mixture of 1-pentanol and methyl isobutyl ketone. Treatment of the solvent phase with water and then ascorbic acid solution to return the vanadium to an aqueous phase.

#### 3.2.2 Measurement (Methods 1 and 2)

Addition of aluminium solution to the test solution and dilution to volume. Aspiration into a dinitrogen oxide-acetylene flame in an atomic absorption spectrometer and measurement of the absorbance at a wavelength of approximately 318,5 nm.

## 4 Reagents

During the analysis, use only reagents of recognized analytical grade, and only distilled water or water of equivalent purity.

### 4.1 Hydrochloric acid, $\rho$ 1,16 g/ml to 1,19 g/ml.