
**Manganese ores and concentrates —
Determination of manganese content
— Potentiometric method**

*Minerais et concentrés de manganèse — Dosage du manganèse —
Méthode potentiométrique*



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Contents

Page

Foreword.....	iv
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Principle.....	1
5 Reagents.....	2
6 Apparatus.....	4
7 Sampling.....	4
8 Procedure.....	4
8.1 Test portion.....	4
8.2 Blank test.....	4
8.3 Determination of hygroscopic moisture content.....	4
8.4 Decomposition of test portion.....	5
8.5 Treatment of residue.....	5
8.6 Titration.....	5
9 Expression of results.....	5
9.1 Calculation of manganese content.....	5
9.2 General treatment of results.....	6
9.2.1 Expression of precision.....	6
9.2.2 Determination of analytical result.....	7
9.2.3 Between-laboratories precision.....	7
9.2.4 Check for trueness.....	7
9.2.5 Calculation of final result.....	8
10 Test report.....	8
Annex A (informative) Additional information on the international interlaboratory test.....	9
Annex B (normative) Flow chart for the acceptance procedure of test results.....	11
Bibliography.....	12

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 132, *Ferroalloys*.

This third edition cancels and replaces the second edition (ISO 4298:1984), which has been technically revised.

The main changes are as follows:

- in [Clause 4](#), the description of reaction has been reworded to better explain the method;
- in [5.12](#) (previously in 5.10), the detailed specification of “electrolytic manganese” has been added and described as “electrolytic manganese metal flakes”;
- in [5.13](#) (previously in 5.11), the commercially available standard solution has been added as an alternative, and variations in concentration shall be taken into account for the calculation of the results in [9.1](#);
- in [5.14](#) (previously 5.11.1), the amount of aliquot portion of the manganese standard reference solution and the saturated sodium pyrophosphate solution has been reduced, and the specification of the beaker has been changed;
- in [5.15](#) (previously 5.11.2), the amount of aliquot portion of the potassium permanganate solution and the saturated sodium pyrophosphate solution has been reduced, and the specification of the beaker has been changed;
- in [Clause 6](#), the description of pH meter has been replaced with a list of potentiometric titration apparatus in line with the current status of the development of the instrument, including the apparatus for potentiometric titration in [6.1](#), pH determination in [6.2](#) and titration assembly in [6.3](#);
- in [Clause 8](#), a new paragraph of the definition of test portion has been added in [8.1](#) and the amount of test portion in [8.1](#) (previously 8.2) has been reduced from 1,0 g to 0,50 g;
- in [Clause 8](#), a new paragraph of the definition and requirement of determination of hygroscopic moisture content has been added in [8.3](#);

- in [8.4](#) (previously 8.2), the amount of acids has been reduced, the times of washing have been changed, and the detailed usage of watch-glass and the provision of filter volume have been added;
- in [8.6](#) (previously 8.4), the amount of aliquot portion of the solution and the saturated sodium pyrophosphate solution has been reduced, and the specification of one-mark volumetric flask and the beaker have been changed;
- in [9.1](#), the formula of the manganese content has been replaced with three new calculating formulae which take into account the hygroscopic moisture content of the test portion;
- in [9.2](#), the paragraph of the “permissible tolerances on results” has been replaced with the “general treatment of results”;
- [Clause 10](#), the test report has been added;
- [Annex A](#), “Additional information on the international interlaboratory test” has been added;
- [Annex B](#), “Flow sheet of the procedure for the acceptance of test results” has been added.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Manganese ores and concentrates — Determination of manganese content — Potentiometric method

1 Scope

This document specifies a potentiometric method for the determination of the manganese content of manganese ores and concentrates with manganese content equal to or greater than a mass fraction of 15 %.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 310, *Manganese ores and concentrates — Determination of hygroscopic moisture content in analytical samples — Gravimetric method*

ISO 648, *Laboratory glassware — Single-volume pipettes*

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

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 4296-1, *Manganese ores — Sampling — Part 1: Increment sampling*

ISO 4296-2, *Manganese ores — Sampling — Part 2: Preparation of samples*

ISO 80000-1:2009, *Quantities and units — Part 1: General*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Principle

The method is based on the titration of manganous ion with permanganate ion in neutral pyrophosphate solution, the manganese(II) being oxidized, the permanganate ion reduced, to a pyrophosphate complex of the +3 state (the stoichiometry ratio of Mn^{2+} to MnO_4^- is 4:1).

Decomposition of a test portion by treatment with hydrochloric acid, nitric, perchloric and hydrofluoric acids. Separation of insoluble residue, and reservation of the filtrate as the main solution. Ignition of the residue, fusion with sodium carbonate, leaching of the melt with hydrochloric acid and combination with the main solution. Addition of an aliquot portion of the resulting solution to sodium pyrophosphate solution, adjustment of the pH to 7,0, and potentiometric titration with potassium permanganate standard volumetric solution.