
**Water quality — Determination of free
chlorine and total chlorine —**

**Part 2:
Colorimetric method using *N,N*-
dialkyl-1,4-phenylenediamine, for
routine control purposes**

Qualité de l'eau — Dosage du chlore libre et du chlore total —

*Partie 2: Méthode colorimétrique à la N,N-dialkylphénylène-1,4
diamine destinée aux contrôles de routine*



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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 2, *Physical, chemical and biochemical methods*.

This second edition cancels and replaces the first edition (ISO 7393-2:1985), which has been technically revised.

The main changes compared to the previous edition are as follows:

- a new [Annex C](#) has been included with the title: Disposable planar reagent-filled cuvettes using a mesofluidic channel pump/colorimeter.

A list of all parts in the ISO 7393 series can be found on the ISO website.

Water quality — Determination of free chlorine and total chlorine —

Part 2:

Colorimetric method using *N,N*-dialkyl-1,4-phenylenediamine, for routine control purposes

WARNING — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices.

IMPORTANT — It is essential that tests conducted in accordance with this document be carried out by suitably qualified staff.

1 Scope

This document specifies a method for the determination of free chlorine and total chlorine in water, readily applicable to lab- and field-testing. It is based on measurement of the absorption, the red DPD colour complex in a photometer or the colour intensity by visual comparison of the colour with a scale of standards that is regularly calibrated.

This method is appropriate for drinking water and other waters, where additional halogens like bromine, iodine and other oxidizing agents are present in almost negligible amounts. Seawater and waters containing bromides and iodides comprise a group for which special procedures are to be carried out.

This method is in practice applicable to concentrations, in terms of chlorine (Cl_2), from, for example, 0,000 4 mmol/l to 0,07 mmol/l (e.g. 0,03 mg/l to 5 mg/l) total chlorine. For higher concentrations, the test portion is diluted.

Commonly, the method is applied as a field method with mobile photometers and commercially available ready-for-use reagents (liquid reagents, powders and tablets). It is essential that those reagents comply with minimum requirements and contain the essential reagents and a buffer system suitable to adjust the measurement solution to a pH range of typically 6,2 to 6,5. If there is doubt that water samples have uncommon pH values and/or buffer capacities, the user has to check and, if necessary, to adjust the sample pH to the required range. The pH of the sample is within the range of pH 4 and 8. Adjust, if necessary, with sodium hydroxide solution or sulfuric acid before the test.

A procedure for the differentiation of combined chlorine of the monochloramine type, combined chlorine of the dichloramine type and combined chlorine in the form of nitrogen trichloride is presented in [Annex A](#). In [Annex C](#), a procedure is presented for the determination of free and total chlorine in drinking and other low polluted waters, for disposable planar reagent-filled cuvettes using a mesofluidic channel pump/colorimeter.

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

ISO 5667-3, *Water quality — Sampling — Part 3: Preservation and handling of water samples*

ISO 8466-1, *Water quality — Calibration and evaluation of analytical methods and estimation of performance characteristics — Part 1: Statistical evaluation of the linear calibration function*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1

free chlorine

chlorine present in the form of hypochlorous acid, hypochlorite ion or dissolved elemental chlorine

Note 1 to entry: See [Table 1](#).

3.2

combined chlorine

bound chlorine

fraction of *total chlorine* ([3.3](#)) present in the form of *chloramines* ([3.4](#)) and organic chloramines

Note 1 to entry: See [Table 1](#).

3.3

total chlorine

chlorine present in the form of *free chlorine* ([3.1](#)) and *combined chlorine* ([3.2](#))

Note 1 to entry: See [Table 1](#).

3.4

chloramines

derivatives of ammonia by substitution of one, two or three hydrogen atoms with chlorine atoms

Note 1 to entry: Derivatives are monochloramine NH_2Cl , dichloramine NHCl_2 , nitrogen trichloride NCl_3 and all chlorinated derivatives of organic nitrogen compounds as determined by the method specified in this document.

Table 1 — Terms and synonyms in relation to actual compounds in the solution

Term	Synonym		Compounds
Free chlorine	Free chlorine	Active free chlorine	Elemental chlorine, hypochlorous acid
		Potential free chlorine	Hypochlorite
Total chlorine	Total residual chlorine		Elemental chlorine, hypochlorous acid, hypochlorite, and chloramines
Bound chlorine	Combined chlorine		Difference of total and free chlorine

4 Principle

4.1 Determination of free chlorine

Free chlorine is determined by a direct reaction with *N,N*-dialkyl-1,4-phenylenediamine (DPD) in a pH range of 6,2 to 6,5. This leads to the formation of a red colour complex. Measure the colour intensity by photometry, or alternatively, by visual comparison of the colour with a scale of permanent glass, plastics standards or colour card comparators.