INTERNATIONAL STANDARD

ISO 7027

Third edition
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Water quality — Determination of turbidity

Qualité de l'eau — Détermination de la turbidité

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 7027 was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 2, *Physical, chemical, biochemical methods*.

This third edition cancels and replaces the second edition (ISO 7027:1990), which has been technically revised.

Annex A of this International Standard is for information only.

Introduction

Measurements of turbidity can be affected by the presence of dissolved light-absorbing substances (substances imparting colour). Such effects can be minimized, however, by performing measurements at wavelengths greater than 800 nm. Only a blue colour, which can be found in certain polluted waters, slightly affects measurements of turbidity in this region of the spectrum. Air bubbles can also interfere with measurements, but such interference can be minimized by careful handling of the samples.

It should be investigated whether, and to what extent, particular problems will require the specification of additional marginal conditions.

Water quality — Determination of turbidity

1 Scope

This International Standard specifies four methods for the determination of turbidity of water.

Two semiquantitative methods, employed for example in field work, are specified:

a) measurement of turbidity using the transparency testing tube (applicable to pure and lightly polluted water);

b) measurement of turbidity using the transparency testing disk (especially applicable to surface water).

Two quantitative methods, using optical turbidimeters, are specified:

c) measurement of diffuse radiation, applicable to water of low turbidity (for example drinking water);

Turbidity measured by this method is expressed in formazin nephelometric units (FNU); results typically range between 0 FNU and 40 FNU. Depending on the instrument design, it may also be applicable to waters of higher turbidity.

d) measurement of the attenuation of a radiant flux, more applicable to highly turbid waters (for example waste or polluted waters).

Turbidity measured by this method is expressed in formazin attenuation units (FAU); results typically range between 40 FAU and 4000 FAU.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3864:1984, *Safety colours and safety signs.*

ISO 5667-3:1994, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of samples.*

CIE Publication No. 17:1987, *International Lighting Vocabulary.*

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in CIE Publication No. 17 and the following apply.

3.1
turbidity
reduction of transparency of a liquid caused by the presence of undissolved matter

4 Sampling and samples

Maintain all containers that come into contact with the sample in a scrupulously clean condition. Wash with hydrochloric acid or surfactant cleaning solution.

Collect samples in glass or plastics bottles, and carry out the determinations as soon as possible after collection. If storage is unavoidable, store the samples in a cool, dark room but for not longer than 24 h. If the samples have been stored cool, allow them to come to room temperature before measurement. Prevent contact between the sample and air, and avoid unnecessary changes in the temperature of the sample.

5 Semiquantitative methods of turbidity measurement

5.1 Measurement using the transparency testing tube

5.1.1 Apparatus

5.1.1.1 **Transparency testing tube**, consisting of a colourless glass tube 600 mm ± 10 mm long and of internal diameter 25 mm ± 1 mm, graduated in divisions of 10 mm.

5.1.1.2 **Shield**, close-fitting, to protect the transparency testing tube from lateral light.

5.1.1.3 **Print sample** to place under the tube (5.1.1.1), consisting of black print on a white background (height of characters 3,5 mm; line width 0,35 mm) or a **test mark** (for example, a black cross on white paper), provided with the apparatus.

5.1.1.4 **Constant light source**, 3 W low voltage tungsten lamp, to illuminate the print sample or test mark (5.1.1.3).

5.1.2 Procedure

It is absolutely essential that tests conducted according to this International Standard be carried out by suitably qualified staff.

Thoroughly mix the sample and transfer it to the transparency testing tube (5.1.1.1). Steadily lower the sample level until the print sample or test mark (5.1.1.3) is clearly recognizable as viewed from above. Read the liquid height from the graduations on the tube.

5.1.3 Expression of results

Report the measured liquid height, to the nearest 10 mm, together with the apparatus used (name of the manufacturer).

5.2 Measurement using the transparency testing disk

NOTE This method is intended primarily for testing bodies of water *in situ.*

5.2.1 Apparatus

5.2.1.1 **Transparency testing disk** made of cast bronze and coated with white (see ISO 3864) plastics, attached to a chain or rod.

NOTE A typical design comprises a disk of diameter 200 mm with six holes, each of diameter 55 mm, on a circle of diameter 120 mm.

5.2.2 Procedure

It is absolutely essential that tests conducted according to this standard be carried out by suitably qualified staff.

Lower the disk, on its chain or rod, into the water until the disk is barely visible when viewed from above. Measure the length of immersed chain or rod. Repeat the test several times.

Ensure that no interference arises from reflection at the water surface.

5.2.3 Expression of results

Report the depth of immersion.

For values less than 1 m, report the result to the nearest 10 mm. For values greater than 1 m, report the result to the nearest 0,1 m.

6 Quantitative methods of turbidity measurement using optical turbidimeters

6.1 General principles

It is absolutely essential that tests conducted according to this International Standard be carried out by suitably qualified staff.

A water sample coloured by dissolved substances is a homogeneous system that only attenuates radiation passing through the sample. A water sample containing undissolved substances attenuates the incident radiation, and in addition the insoluble particles which are present diffuse the radiation unequally in all directions. The forward diffusion of radiation by the particles affects the attenuation so that the common spectral attenuation coefficient $\mu(\lambda)$ is the sum of the spectral diffusion coefficient $s(\lambda)$ and the spectral absorption coefficient $\alpha(\lambda)$:

$$\mu(\lambda) = s(\lambda) + \alpha(\lambda) \quad (1)$$

To obtain the spectral diffusion coefficient $s(\lambda)$ alone, the spectral absorption coefficient $\alpha(\lambda)$ needs to be known. In order to determine the spectral absorption coefficient of the dissolved substance, the undissolved substances can, in some cases, be removed by filtration, but this may cause interferences. Therefore, it is necessary to report the results of the determination of turbidity in comparison to a calibration standard.

The intensity of the diffuse radiation depends upon the wavelength of the incident radiation, the measurement angle, and the shape, optical characteristics and particle size distribution of the particles suspended in the water.

In measurements of the attenuation of transmitted radiation, the measured value depends upon the aperture angle Ω_o of the radiant efficiency arriving at the receiver.

When measuring the diffuse radiation, the measured values depend upon the angle θ and the aperture angle Ω_θ. The angle θ is that enclosed by the direction of the incident radiation and the direction of the measured diffuse radiation (see Figure 1).