International Standard

ISO 12439

Mixing water for concrete

Eau de gâchage pour béton

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Contents

Page

Foreword

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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 document 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).

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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 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 3, *Concrete production and execution of concrete structures*.

This second edition cancels and replaces the first edition (ISO 12439:2010), which has been technically revised.

The main changes are as follows:

— addition of some new normative references;

— addition of the definition of water types;

— inclusion of requirements regarding radioactive testing (subclause 4.3.4).

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.

Introduction

The quality of the mixing water for production of concrete can influence the setting time, the strength development of concrete and the protection of the reinforcement against corrosion.

When assessing the suitability of water of unknown quality for the production of concrete, both the composition of the water and the application of the concrete being produced must be considered.

Mixing water for concrete

1 Scope

This document specifies requirements for the treatment of water that is suitable for making concrete in accordance with ISO 22965 (all parts) and describes methods for assessing its suitability.

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 1920-3, *Testing of concrete — Part 3: Making and curing test specimens*

ISO 1920-4, *Testing of concrete — Part 4: Strength of hardened concrete*

ISO 23696-1, *Water quality — Determination of nitrate in water using small-scale sealed tubes — Part 1: Dimethylphenol colour reaction*

ISO 6878, *Water quality — Determination of phosphorus — Ammonium molybdate spectrometric method*

ISO 13163, *Water quality — Lead-210 — Test method using liquid scintillation counting*

ISO 29581-1, *Cement — Test methods — Part 1: Analysis by wet chemistry*

ISO 9597, *Cement — Test methods — Determination of setting time and soundness*

ISO 22965-2, *Concrete — Part 2: Specification of constituent materials, production of concrete and compliance of concrete*

ISO 10523, *Water quality — Determination of pH*

3 Terms and definitions

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

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/

3.1
potable water
water intended for human consumption

Note 1 to entry: This water is generally considered as suitable for use in concrete. The water shall not be further tested, if already tested and certified by concerned authorities. Otherwise, the water shall be tested and shall conform to the requirements specified in 4.3.

3.2
natural surface water
water which flows over, or rests on, the surface of a land mass

Note 1 to entry: This water can be suitable for use in concrete but shall be tested to determine whether it is suitable for use in concrete.

3.3
sewage water
wastewater conveyed in underground pipes

Note 1 to entry: This water is not suitable for use in concrete.

3.4
combined water
mixture of water recovered from processes in the concrete industry and water of some other origin.

Note 1 to entry: This water can be suitable for use in concrete but shall be tested to determine whether it is suitable for use in concrete.

4 Requirements

4.1 General

Water for use in concrete shall conform to 4.2, 4.3.1, 4.3.2 and 4.3.3. The water shall conform to either the chemical requirements in 4.3.4, or the requirements for setting time and compressive strength in 4.4.

NOTE When waters are mixed (see 3.4), the requirements apply to the combined water.

4.2 Preliminary assessment

The water shall be examined in accordance with the test procedures stated in Table 1. Water not in accordance with one or more of the requirements in Table 1 may be used only if it can be shown to be suitable for use in concrete in accordance with 4.4.

Table 1 — Requirements and test procedures for preliminary assessment of mixing water

Number	Parameter	Requirement	Test procedure
1	Oils and fats	Not more than visible traces.	6.1.1
2	Detergents	Foam shall disappear within 2 min except for small residues.	6.1.1
3	Colour	Water not from sources classified as potable: the colour shall be assessed qualitatively as pale yellow or paler.	6.1.1
4	Suspended matter	Water from sources classified as potable.	A.4.4
		Water from other sources: max. 4 ml of sediment.	6.1.1
5	Odour	Water from sources classified as potable: no smell, except the odour allowed for potable water and a slight smell of cement; where blast-furnace slag is present in the water, a slight smell of hydrogen sulfide.	6.1.1
		Water from other sources: no smell, except the odour allowed for potable water; no smell of hydrogen sulfide after addition of hydrochloric acid.	
6	pH value	pH ≥5	6.1.1
7	Humic matter	The colour shall be assessed qualitatively as yellowish brown or paler after addition of NaOH.	6.1.2

4.3 Chemical properties

4.3.1 Chlorides

The chloride content of the water, tested in accordance with 6.1.3 and expressed as Cl^-, shall not exceed the levels given in Table 2, unless it can be shown that the chloride content of the concrete does not exceed the maximum value permitted for the total chloride content specified in ISO 22965-2.

ISO 22965-2 recommends that limits for the total chloride content in concrete be given in a national annex to ISO 22965-2. The values may be different depending on the end use. It can be necessary to amend the recommended values in Table 2 to fit with the limits for the total chloride content.

Table 2 — Maximum recommended values for the chloride content of mixing water

End use	Chloride concentration max. mg/l	Test procedure
Pre-stressed concrete or grout	500	6.1.3
Concrete with reinforcement or embedded metal	1 000	
Concrete without reinforcement or embedded metal	4 500	

4.3.2 Sulfates

The sulfate content of the water, tested in accordance with 6.1.3 and expressed as SO_4^{2-} shall not exceed 2 000 mg/l.

4.3.3 Alkali

If it is expected to use alkali-reactive aggregates in the concrete and the exposure conditions of the concrete can promote deleterious alkali-related reactions to occur, the water shall be tested for its alkali content in accordance with 6.1.3. The equivalent sodium oxide content of the water shall not exceed 1 500 mg/l, unless it can be shown that the alkali content of the concrete does not exceed the maximum value recommended. If these limits are exceeded, the water may be used only if it can be shown that actions have been taken to prevent deleterious alkali-silica reactions.

NOTE Guidance can be found in technical literature, such as CEN CR 1901.

4.3.4 Harmful contamination

In the first instance, qualitative tests for sugars, phosphates, nitrates, lead and zinc may be carried out. If the qualitative tests show a positive result, tests for setting time and compressive strength shall be performed or chemical analysis shall be chosen.

If chemical analysis is chosen, the water shall conform to the limits given in Table 3.

When specified, the radioactivity of the water may be tested. See additional information in Annex D.

Table 3 — Requirements for harmful substances

Substance	Maximum concentration mg/l	Test procedure
Sugars	100	6.1.3
Phosphates; expressed as P_2O_5	100	
Nitrates; expressed as NO_3^-	500	
Lead; expressed as Pb^{2+}	100	
Zinc; expressed as Zn^{2+}	100	

4.4 Setting time and strength

When tested in accordance with 6.1.4, the initial setting time obtained on paste samples made with the water shall be not less than 1 h and not differ by more than 25 % from the initial setting time obtained on specimens made with distilled or de-ionized water. The final setting time shall not exceed 10 h and not differ by more than 25 % from the final setting time obtained on specimens made with distilled or de-ionized water. Potable water may be used, provided it has been demonstrated that it gives results similar to those obtained with distilled or de-ionized water.

The mean compressive strength at 7 days and 28 days of the concrete or mortar specimens prepared with the water shall be at least 90 % of the mean compressive strength of corresponding specimens prepared with distilled or de-ionized water.

5 Sampling

A sample of water of not less than 5 l shall be taken. The sample shall be correctly identified. It shall be representative of the water being used, with due regard being given to the possible effects of seasonal fluctuations.

Natural surface water shall be collected from the centre of the water area and below 100 mm from the water surface. The water from underground sources shall be collected after the pipeline is flushed with water, or be directly collected in containers, and shall not be collected from the groundwater accumulated on the surface. Water recovered from processed in the concrete industry shall be collected from the tank below 100 mm from the water surface after sedimentation.

The sample of combined water should be taken from its final combined form. If it is impractical, it is acceptable to sample, proportion and combine the individual sources of water to produce a test sample that is representative of the combined water.

The sample shall be stored in a clean and sealed container. The container shall be rinsed out with water from the source prior to filling to capacity with the water sample. The water shall be tested within two weeks of sampling.

6 Testing

6.1 Test methods

6.1.1 Preliminary assessment

A small subsample shall be assessed as soon as possible after sampling for density, oil and fats, detergents, colour, suspended matter, odour and humic matter.

Bring any material that has settled back into suspension by shaking the sample. Measure the density using the pycnometer method, hydrometer method or digital densimeter method. Pour 80 ml of the sample into a 100 ml measuring cylinder. Seal with a suitable stopper and shake the cylinder vigorously for 30 s. Smell the sample for any odours other than those of clean water. If in doubt about the odour, test the water for its odour level. The odour level of the water shall be lower than the maximum level accepted for potable water. Observe the surface for foam. Set the cylinder in a place free from vibration and allow to stand for 30 min. After 2 min, check the sample for the continuing presence of foam and signs of any oils or fats. After 30 min have elapsed, observe the apparent volume of the settled solids and the colour of the water. Measure the pH using indicator paper or a pH meter in accordance with ISO 10523. Then, add 0,5 ml hydrochloric acid, mix and then smell or test for the presence of hydrogen sulfide.

NOTE 1 Regional standards can apply when measuring the density using the pycnometer method, hydrometer method or digital densimeter method.

NOTE 2 When testing, national regulations for potable water can apply.