INTERNATIONAL STANDARD

ISO 19596

First edition
2017-09

Admixtures for concrete

Adjuvants pour béton

Reference number
ISO 19596:2017(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

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

Admixtures for concrete

1 Scope

This document specifies definitions and requirements for admixtures for use in concrete in accordance with ISO 22965.

This document does not specify provisions governing the practical application of admixtures in the production of concrete, i.e. requirements concerning composition, mixing, placing, curing, etc. of concrete containing admixtures.

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 680, *Cement — Test methods — Chemical analysis*

ISO 758, *Liquid chemical products for industrial use — Determination of density at 20 °C*

ISO 1158, *Plastics — Vinyl chloride homopolymers and copolymers — Determination of chlorine content*

ISO 1920-2, *Testing of concrete — Part 2: Properties of fresh concrete*

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

ISO 4316, *Surface active agents — Determination of pH of aqueous solutions — Potentiometric method*

ISO 12439, *Mixing water for concrete*

ISO 22965-1, *Concrete — Part 1: Methods of specifying and guidance for the specifier*

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

BS 8443, *Specification for establishing the suitability of special purpose concrete admixtures*

EN 480-1, *Admixtures for concrete, mortar and grout — Test methods — Part 1: Reference concrete and reference mortar for testing*

EN 480-2, *Admixtures for concrete, mortar and grout — Test methods — Part 2: Determination of setting time*

EN 480-4, *Admixtures for concrete, mortar and grout — Test methods — Part 4: Determination of bleeding of concrete*

EN 480-5, *Admixtures for concrete, mortar and grout — Test methods — Part 5: Determination of capillary absorption*

EN 480-6, *Admixtures for concrete, mortar and grout — Test methods — Part 6: Infrared analysis*

EN 480-8, *Admixtures for concrete, mortar and grout — Test methods — Part 8: Determination of the conventional dry material content*

EN 480-10, *Admixtures for concrete, mortar and grout — Test methods — Part 10: Determination of water soluble chloride content*

EN 480-11, *Admixtures for concrete, mortar and grout — Test methods — Part 11: Determination of air void characteristics in hardened concrete*

EN 480-12, *Admixtures for concrete, mortar and grout — Test methods — Part 12: Determination of the alkali content of admixtures*

EN 480-14, *Admixtures for concrete, mortar and grout — Test methods — Part 14: Determination of the effect on corrosion susceptibility of reinforcing steel by potentiostatic electro-chemical test*

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 http://www.iso.org/obp

3.1 General definitions

3.1.1
performance
ability of an admixture to be effective in its intended use without detrimental effects

3.1.2
compliance dosage
dosage of an admixture, expressed in % by mass of cement or binder, stated by the manufacturer which will meet the requirements of this document

Note 1 to entry: The compliance dosage is within the recommended range of dosage.

3.1.3
recommended range of dosage
dosages between limits expressed in % by mass of cement or binder which the manufacturer recommends for the product based on experience on site

Note 1 to entry: The use of the recommended dosage does not imply that compliance with this document will be met over the whole range. Trial tests should be carried out with the materials to be used on site to find the dosage necessary to achieve the required result.

3.1.4
maximum recommended dosage
upper limit of the recommended range of dosage

3.1.5
reference concrete and mortar
concrete and mortar as specified in Annex B for testing admixtures for conformity with this document

3.1.6
multifunction admixture
admixture which affects several properties of fresh and/or hardened concrete by performing more than one of the main functions defined in 3.2.2 to 3.2.9

3.1.7
primary function
single function of a multifunction admixture designated by the manufacturer

3.1.8
secondary function
function of a multifunction admixture which is additional to the primary function

3.1.9
binder
cement or combinations of cement and additions of type II

3.2 Specific definitions

3.2.1
admixtures for concrete
material added during the mixing process of concrete in a quantity not more than 5 % by mass of the cement content of the concrete, to modify the properties of the mix in the fresh and/or hardened state

3.2.2
water reducing/plasticizing admixture
admixture which without affecting the consistence, permits a reduction in the water content of a given concrete mix, or which, without affecting the water content increases the workability/consistency or produces both effects simultaneously

3.2.3
high range water reducing/super plasticizing admixture
admixture which, without affecting the consistence, permits a high reduction in the water content of a given concrete mix, or which, without affecting the water content increases the workability/consistency considerably, or produces both effects simultaneously

3.2.4
water retaining admixture
admixture which reduces the loss of water by a reduction of bleeding

3.2.5
air entraining admixture
admixture which allows a controlled quantity of small, uniformly distributed air bubbles to be incorporated during mixing which remain after hardening

3.2.6
set accelerating admixture
admixture which decreases the time to commencement of transition of the mix from the plastic to the rigid state

3.2.7
hardening accelerating admixture
admixture which increases the rate of development of early strength in the concrete, with or without affecting the setting time

3.2.8
set retarding admixture
admixture which extends the time to commencement of transition of the mix from the plastic to the rigid state

3.2.9
water resisting admixture
waterproof admixture
admixture which reduces the capillary absorption of hardened concrete

3.2.10
set retarding/water reducing/plasticizing admixture
admixture which produces the combined effects of a water reducing/plasticizing admixture (primary function) and a set retarding admixture (secondary function)

3.2.11
set retarding/high range water reducing/superplasticizing admixture
admixture which produces the combined effects of a high range water reducing/superplasticizing admixture (primary function) and a set retarding admixture (secondary function)

3.2.12
set accelerating/water reducing/plasticizing admixture
admixture which produces the combined effects of a water reducing/plasticizing admixture (primary function) and a set accelerating admixture (secondary function)

3.2.13
slump and air retentions/high range water reducing/air entraining admixture
admixture that enable reduction in the water content, while providing slump and air retentivity, without affecting the consistence

3.2.14
viscosity modifying admixture
admixture incorporated in concrete to limit segregation by improving cohesion

3.2.15
antiwashout admixture
admixture that significantly reduces the washout of cement during underwater placing and hardening of concrete

3.2.16
antifreezing admixture
admixture which allows concrete to set and develop compressive strength at temperatures below freezing

4 Requirements

4.1 General requirements

The requirements in this document assume that admixtures are uniformly dispersed in concrete; special attention shall be given to the dispersion of powder admixtures with retarding effects.

All admixtures defined in 3.2.2 to 3.2.16 shall conform the general requirements in Table 1, Clause 5 and Clause 6.

Table 1 — General requirements

	Property	Test method	Requirements
1	Homogeneity[a]	Visual	Homogeneous when used. Segregation shall not exceed the limit declared by the manufacturer.
2	Colour[a]	Visual	Uniform and similar to the description declared by the manufacturer. Distinctive (distinguished from water).
3	Effective component[a]	EN 480-6[b] or equivalent	Infrared spectra to show no significant change with respect to the effective component when compared to the reference spectrum provided by the manufacturer.
4	Absolute density[a] (for liquid admixtures only)	ISO 758[c]	D ± 0,03 if D > 1,10 kg/l, D ± 0,02 if D ≤ 1,10 kg/l, or within the manufacturer's declared range, where D is manufacturer's declared value of density.
5	Conventional dry material content[a]	EN 480-8[d] or equivalent	0,95T ≤ X ≤ 1,05T if T ≥ 20 %, 0,90T ≤ X ≤ 1,10T if T < 20 %, T is manufacturer's declared value % by mass; X is test result % by mass.
6	pH value[a] (for liquid admixtures only)	ISO 4316	Manufacturer's declared value ±1 or within manufacturer's declared range.
7	Total chlorine[a, f]	ISO 1158[g]	Either ≤0,10 % by mass[e] or not above the manufacturer's declared value.
8	Water soluble chloride[a]	EN 480-10 or equivalent	Either ≤0,10 % by mass[e] or not above the manufacturer's declared value.
9	Alkali content (Na_2O equivalent)[a]	EN 480-12 or equivalent	Not above the manufacturer's declared maximum value in % by mass.
10	Corrosion behaviour	EN 480-14 or equivalent	See 4.4.2.
11	Silicon dioxide SiO_2 content[a, h, i]	ISO 680	Not above the manufacturer's declared maximum value in % by mass.

[a] The manufacturer's declared values and characteristics shall be provided in writing to the user upon request.

[b] If the method in EN 480-6 is not suitable, the manufacturer shall specify a documented alternative test method.

[c] ISO 758 is the reference method. Another method may be used provided that it can show essentially the same results as the method in ISO 758.

[d] If the method in EN 480-8 is not suitable, the manufacturer shall specify a documented alternative test method.

[e] Where the chloride content is ≤0,10 % by mass the admixture may be described as "chloride free".

[f] If there is no significant difference between the total chlorine and the water soluble chloride content, only the water soluble chloride content should be determined in subsequent tests on the admixture involved.

[g] The procedure in ISO 1158 shall be modified as follows:

— Increase the sample size in method B to 0,1 g of dry admixture;

— Use silver nitrate and ammonium thiocyanate solutions at 0,01 N.

[h] The silicon dioxide content is only required when silica (see A.1) is a constituent intended to exceed 5 % by mass of the admixture.

[i] This requirement does not apply to natural sand.

4.2 Requirements for specific types of admixtures

The admixtures defined in 3.2.2 to 3.2.16 shall comply with the requirements listed in Table 2.

Table 2 — Performance requirements for specific types of admixture

Definition	Name of admixture	Performance requirements
3.2.2	Water reducing/plasticizing admixtures	Table 3
3.2.3	High range water reducing/super plasticizing admixtures	Tables 4 and 5
3.2.4	Water retaining admixtures	Table 6
3.2.5	Air entraining admixture	Table 7
3.2.6	Set accelerating admixtures	Table 8
3.2.7	Hardening accelerating admixtures	Table 9
3.2.8	Set retarding admixtures	Table 10
3.2.9	Water resisting admixtures	Table 11
3.2.10	Set retarding/water reducing/plasticizing admixtures	Table 12
3.2.11	Set retarding/high range water reducing/super plasticizing admixtures	Tables 13 and 14
3.2.12	Set accelerating/water reducing/plasticizing admixtures	Table 15
3.2.13	Slump and air retention/high range water reducing/air entraining admixtures	Table 16
3.2.14	Viscosity modifying admixture	Table 17
3.2.15	Antiwashout admixture	Table 18
3.2.16	Antifreezing admixture	Table 19

Where the manufacturer's declared values are required, these shall be provided in writing on request.

Reference concretes shall comply with Annex B. When testing at equal consistence or equal w/c ratio the requirements and tolerance limits apply.

Table 3 — Specific requirements for water reducing/plasticizing admixtures (at equal consistence)

No.	Property	Reference concrete	Test method	Requirements
1	Water reduction	Annex B reference concrete I	ISO 1920-2 slump or flow	In test mix ≥ 5 % compared with control mix
2	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 7 and 28 days: Test mix ≥ 110 % of control mix
3	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % by volume above control mix unless stated otherwise by the manufacturer
4	Setting time	Annex B mortar	EN 480-2 or equivalent	Initial: test mix ≤ control mix + 90 min Final: test mix ≤ control mix + 360 min

Table 4 — Specific requirements for high range water reducing/super plasticizing admixtures (at equal consistence)

No.	Property	Reference concrete	Test method	Requirements
1	Water reduction	Annex B reference concrete I	ISO 1920-2 slump or flow	In test mix ≥ 12 % compared with control mix
2	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 1 day: Test mix ≥ 140 % of control mix At 28 days: Test mix ≥ 115 % of control mix
3	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % by volume above control mix unless otherwise stated by the manufacturer

Table 5 — Specific requirements for high range water reducing/super plasticizing admixtures (at equal w/c ratio)[a]

No.	Property	Reference concrete	Test method	Requirements
1	Increase in consistence	Annex B reference concrete II	ISO 1920-2 slump or flow	Increase in slump ≥ 120 mm from initial (30 ± 10) mm Increase in flow ≥ 160 mm from initial (350 ± 20) mm
2	Retention of consistence	Annex B reference concrete II	ISO 1920-2 slump or flow	30 min after the addition the consistence of the test mix shall not fall below the value of the initial consistence of the control mix
3	Compressive strength	Annex B reference concrete II	ISO 1920-4	At 28 days: test mix ≥90 % of control mix
4	Air content in fresh concrete	Annex B reference concrete II	ISO 1920-2	Test mix ≤2 % by volume above control mix unless otherwise stated by the manufacturer

[a] The compliance dosage for admixtures used to meet the requirements of Table 5 does not have to be the same as that used to meet the requirements of Table 4.

Table 6 — Specific requirements for water retaining admixtures (at equal consistence)

No.	Property	Reference concrete	Test method	Requirements
1	Bleeding	Annex B reference concrete III	EN 480-4 or equivalent	Test mix ≤50 % of control mix
2	Compressive strength	Annex B reference concrete III	ISO 1920-4	At 28 days: Test mix ≥80 % of control mix
3	Air content in fresh concrete	Annex B reference concrete III	ISO 1920-2	Test mix ≤2 % by volume above control mix unless stated otherwise by the manufacturer

Table 7 — Specific requirements for air entraining admixtures (at equal consistence)

No.	Property	Reference concrete	Test method	Requirements[a]
1	Air content in fresh concrete (entrained air)	Annex B reference concrete I	ISO 1920-2	Test mix ≥2,5 % by volume above control mix Total air content 4 % to 6 % by volume
2	Air void characteristics in hardened concrete	Annex B reference concrete I	EN 480-11 or equivalent	Spacing factor in test mix ≤0,200 mm[b]
3	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 28 days: test mix ≥ 75 % of control mix

[a] All the requirements apply to the same test mix.

[b] Conformity of test mix may be judged by relative dynamic modulus of elasticity instead of spacing factor, provided a freezing and thawing test method for concrete is specified in regional or national standards.

Table 8 — Specific requirements for set accelerating admixtures (at equal consistence)

No.	Property	Reference mortar/ concrete	Test method	Requirements
1	Initial setting time	Annex B mortar	EN 480-2 or equivalent	At 20 °C - 27 °C: test mix ≥ 30 min At 5 °C: test mix ≤ 60 % of control mix
2	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 28 days: Test mix ≥80 % control mix At 90 days: Test mix ≥test mix at 28 days
3	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤2 % by volume above control mix unless stated otherwise by the manufacturer

Table 9 — Specific requirements for hardening accelerating admixtures (at equal consistence)

No.	Property	Reference concrete	Test method	Requirements
1	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 20 °C - 27 °C and 24 h: test mix ≥ 120 % of control mix At 20 °C - 27 °C and 28 days: test mix ≥ 90 % of control mix At 5° C and 48 h: test mix ≥ 130 % of control mix
2	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % by volume above control mix unless otherwise stated by the manufacturer

Table 10 — Specific requirements for set retarding admixtures (at equal consistence)

No.	Property	Reference mortar/ concrete	Test method	Requirements
1	Setting time	Annex B mortar	EN 480-2 or equivalent	Initial: test mix ≥ control mix + 90 min Final: test mix ≤ control mix + 360 min
2	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 7 days: Test mix ≥ 80 % control mix At 28 days: Test mix ≥ 90 % of control mix
3	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % by volume above control mix unless otherwise stated by the manufacturer

Table 11 — Specific requirements for water resisting admixtures (at equal consistence or equal w/c ratio[a])

No.	Property	Reference mortar/ concrete	Test method	Requirements
1	Capillary absorption	Annex B mortar	EN 480-5 or equivalent	Tested for 7 days after 7 days curing: test mix ≤ 50 % by mass of control mix Tested for 28 days after 90 days curing: test mix ≤ 60 % by mass of control mix
2	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 28 days: test mix ≥ 85 % of control mix
3	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % by volume above control mix unless otherwise stated by the manufacturer

[a] All tests shall be performed either at equal consistence or equal w/c ratio.

Table 12 — Specific requirements for set retarding/water reducing/plasticizing admixtures (at equal consistence)

No.	Property	Reference concrete/ mortar	Test method	Requirements
1	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 28 days: test mix ≥ 100 % of control mix
2	Setting time	Annex B mortar	EN 480-2 or equivalent	Initial: test mix ≥ control mix + 90 min Final: test mix ≤ control mix + 360 min
3	Water reduction	Annex B reference concrete I	ISO 1920-2 slump or flow	In test mix ≥ 5 % compared with control mix
4	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % (by volume) above control mix unless stated otherwise by the manufacturer

Table 13 — Specific requirements for set retarding/high range water reducing/super plasticizing admixtures (at equal consistence)

No.	Property	Reference concrete/ mortar	Test method	Requirements
1	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 7 days: test mix ≥ 100 % of control mix At 28 days: test mix ≥ 115 % of control mix
2	Setting time	Annex B mortar	EN 480-2 or equivalent	Initial: test mix ≥ control mix + 90 min Final: test mix ≤ control mix + 360 min
3	Water reduction	Annex B reference concrete I	ISO 1920-2 slump or flow	In test mix ≥ 12 % compared with control mix
4	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % (by volume) above control mix unless stated otherwise by the manufacturer

Table 14 — Specific requirements for set retarding/high range water reducing/ super plasticizing admixtures (at equal w/c ratio[a])

No.	Property	Reference concrete/ mortar	Test method	Requirements
1	Retention of consistence	Annex B reference concrete II	ISO 1920-2 slump or flow	60 min after the addition the consistence of the test mix shall not fall below the value of the consistence of the control mix
2	Compressive strength	Annex B reference concrete II	ISO 1920-4	At 28 days: test mix ≥ 90 % of control mix
3	Air content in fresh concrete	Annex B reference concrete II	ISO 1920-2	Test mix ≤ 2 % (by volume) above control mix unless stated otherwise by the manufacturer

[a] The compliance dosage for admixtures used to meet the requirements of Table 14 does not have to be the same as that used to meet the requirements of Table 13.

Table 15 — Specific requirements for set accelerating/water reducing/plasticizing admixtures (at equal consistence)

No.	Property	Reference concrete/ mortar	Test method	Requirements
1	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 28 days: test mix ≥ 100 % of control mix
2	Initial setting time	Annex B mortar	EN 480-2 or equivalent	At 20 °C test mix ≥ 30 min At 5 °C test mix ≤ 60 % of control mix
3	Water reduction	Annex B reference concrete I	ISO 1920-2 slump or flow	In test mix ≥ 5 % compared with control mix
4	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % (by volume) above control mix unless stated otherwise by the manufacturer

Table 16 — Specific requirement for slump and air retention/high range water reducing/air entraining admixtures (at equal consistence)

No.	Property	Reference concrete/ mortar	Test method	Requirements
1	Water-reducing property	Annex B reference concrete III	ISO 1920-2 slump	Water reduction of not less than 18 % with respect to the control mix
2	Air content in fresh concrete	Annex B reference concrete III	ISO 1920-2	The air content of a test mix shall be within ±0,5 percentage point of a ratio 3 percentage points higher than that of the control mix
3	Compressive strength	Annex B reference concrete III	ISO 1920-4	Not less than 115 % of the strength of the control mix at 28 days
4	Change in slump over time	Annex B reference concrete III	Annex C and ISO 1920-2 slump	The difference between the initial consistence and that 60 min. from the beginning of mixing shall be not more than 60 mm
5	Change in air content over time	Annex B reference concrete III	Annex C and ISO 1920-2 slump	The difference between the initial air content and that 60 min. from the beginning of mixing shall be within ±1,5 percentage points

Table 17 — Specific requirement for viscosity modifying admixture

No.	Property	Reference concrete	Test method	Requirements
1	Segregated portion SR	Annex B reference concrete I	EN 480-15	Control mix SR ≥ 15 % and ≤30 % Test mix SR ≤ 70 % of the value obtained with the control mix
2	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 28 days: Test mix ≥ 80 % of control mix
3	Air content in fresh concrete	Annex B reference concrete I	ISO 1920-2	Test mix ≤ 2 % by volume above control mix unless stated otherwise by the manufacturer

Table 18 — Specific requirement for antiwashout admixture (at equal w/c ratio)

No.	Property	Reference concrete	Test method	Requirements
1	Consistence	Annex B reference concrete I	ISO 1920-2 slump	Test mix ≥ 200 % of control mix
2	Loss of mass (washout)	Annex B reference concrete I	BS 8443 or equivalent	Loss of mass < 15 %
3	Compressive strength	Annex B reference concrete I	ISO 1920-4	At 7 and 28 days: Test mix ≥ 75 % of control mix
4	Fresh density	Annex B reference concrete I	ISO 1920-2	Test mix = control mix ± 150 kg/m^3

Table 19 — Specific requirement for antifreezing admixture (at equal consistence or w/c ratio[a])

No.	Property	Reference concrete	Test method	Requirements
1	Initial setting time	Annex B mortar	EN 480-2 or equivalent	At 20 °C: test mix ≤ 200 % of control mix
2	Retention of consistence	Annex B reference concrete III	ISO 1920-2 slump or flow	60 min after the addition the consistence of the test mix shall not fall below 75 % of the value of the consistence of the control mix
3	Compressive strength	Annex B reference concrete I	ISO 1920-4	7 days at –10 °C (within 40 min after mixing) and 28 days at 20 °C for test mix, 28 days at 20 °C for control mix: test mix ≥ 85 % of control mix

[a] Initial setting time and compressive strength shall be performed at equal consistence. Retention of consistence shall be performed at equal w/c ratio.

4.3 Release of harmful substances

Admixtures for concrete shall not contain or release from hardened concrete substances that are harmful to health, hygiene and environment.

4.4 Corrosion behaviour

4.4.1 Testing and labelling

No testing for corrosion behaviour is required for admixtures containing only substances on the approved list A.1 and declared list A.2.

Admixtures containing any substances not on the approved list A.1 or declared list A.2 shall be tested and documented to have no harmful effect.

Admixtures containing substances on the declared list A.2 shall have the names of the substances declared on the label.

NOTE For admixtures containing chloride and chlorine the requirements of Table 1, rows 7 and 8 apply.

4.4.2 Test requirement

When tested in accordance with EN 480-14 the calculated current density of each of three test mix specimens shall not exceed 10 µA/cm^2 at any time between 1 h and 24 h. In addition, there shall be a similar trend in the progression of the current density vs. time curves for the control mix and the test mix.

5 Sampling

Sampling of admixtures shall be carried out in such a way that the resulting sample is representative of the batch to be inspected.

If required, sampling shall be carried out in the presence of representatives from all parties involved.

6 Conformity control and evaluation of conformity

Guidance on conformity control and evaluation of conformity are given in Annex D.

7 Marking and labelling

7.1 General

When admixtures for concrete are supplied in containers they shall be clearly marked with the relevant information.

When the material is supplied into a bulk container at the point of delivery, the same information shall be provided in writing at the time of delivery.

7.2 Designation of admixtures

Admixtures for concrete shall be designated by:

a) name of type of admixture in the language of one member country;

b) code, to identify the type of the admixture, consisting of the number of this document and the number of the table which gives the additional performance requirements for the particular type of admixture. Where the performance requirements are included in two tables, both table numbers shall be included.

EXAMPLE High range water reducing/super plasticizing admixture for concrete; ISO 19596: T4/T5.

7.3 Additional information

a) Batch number and production plant;

b) summary of storage requirements including any special requirements on storage life which shall be clearly marked, e.g.: This admixture shall not be taken to comply with ISO 19596 after “date“;

c) instructions for homogenization before use, when necessary;

d) instructions for use and any necessary safety precautions, e.g. if caustic, toxic or corrosive;

e) manufacturer's recommended range of dosage.

Annex A
(normative)

Approved and declared lists for corrosion behaviour

A.1 Approved list

No testing of corrosion behaviour is required for admixtures containing only the following approved substances

— Acetates;

— Alkanolamine;

— Anionic and cationic lattices;

— Aluminates;

— Aluminium powder;

— Benzoates;

— Borates;

— Carbonates;

— Citrates;

— Cellulose and cellulose ethers;

— Ethoxylated amines;

— Fatty acids and fatty acid salts/esters;

— Fillers (additions, cement and its main constituents in accordance with ISO 22965-2);

— Formaldehyde;

— Gluconates;

— Glycols and derivatives;

— Hydroxides;

— Hydroxycarboxilic acids and hydroxycarboxilic;

— acid salts;

— Lactates;

— Lignosulfonate;

— Malic acid;

— Maltodextrins;

— Melamine formaldehyde sulfonate;

— Natural resins and salts thereof;

— Naphthalene formaldehyde sulfonate;

— Phosphonic acid and salts thereof;

— Phosphates;

— Poly acrylate (acrylic ester polymers);

— Poly carboxylate polymers;

— Poly carboxylate ethers;

— Polysaccharides;

— Poly ethers;

— Polyvinyls and their derivatives;

— Saccharose;

— Silica;

— Synthetic silica (Colloidal silica, nanometric silica);

— Silica fume;

— Silicates;

— Starch and starch ether;

— Sugar;

— Sulfates;

— Surfactants;

— Tartrates;

— Waterglass.

Minor organic constituents, e.g. preservatives or defoamers, may be added in individual amounts ≤0,50 % by mass of constituent in the final admixture.

A.2 Declared list

No testing of corrosion behaviour is required for admixtures containing only the following declared substances:

— Formates;

— Nitrates;

— Nitrites;

— Sulfides;

— Thiocyanates.

NOTE 1 See Table 1, row 7 regarding the declaration of water soluble chloride.

NOTE 2 Limits on chloride content of concrete and mortar in the presence of embedded metals are contained in standards covering the use of admixtures.

NOTE 3 Where the use of substances on the declared list is regulated this normally relates to use in post-tensioned concrete.

Annex B
(normative)

Reference concretes

B.1 Constituent materials

B.1.1 Cement

The reference concrete and mortar shadll be made with an ordinary Standard Portland cement, according to ISO 22965-1 and ISO 22965-2, specified in regional or national standards.

B.1.2 Aggregate

B.1.2.1 Aggregate for reference concrete

A natural normal weight aggregate conforming to ISO 19595 with low water absorption (less than 2 % by mass) shall be used. The size fractions of the aggregate used in the production of reference concretes shall lie within the limits given in Table B.1.

Table B.1 — Aggregate for reference concrete

Aperture size[c] mm	**Percentage by mass passing the test sieve**[a, b, c]
31,5 (25)	100 (100)
- (20)	- (90 ~ 100)
16,0 (15)	75 to 95 (70 ~ 90)
8,0 (10)	45 to 70 (55 ~ 75)
4,0 (5)	35 to 50 (40 ~ 55)
2,0 (2,5)	25 to 40 (30 ~ 50)
1,0 (1,2)	20 to 35 (20 ~ 40)
0,5 (0,6)	10 to 25 (10 ~ 25)
0,25 (0,3)	4 to 12 (4 ~ 15)
0,125 (0,15)	1 to 8 (0 ~ 8)

NOTE Aperture sizes are rounded for simplified descriptions.

[a] The range is selected to accommodate both crushed and uncrushed aggregate.

[b] The variation in quantity passing each sieve of the chosen grading for both mixes (control and test mix) shall not exceed ±2,0 % by mass.

[c] When applying an aperture size in parenthesis, the corresponding percentage passing in parenthesis shall apply.

NOTE For materials for which there are no International Standards, the standards cited in the national annex apply.

To obtain good workability, the grading of aggregate in a test mix may differ from that of aggregate in the control mix, provided that the grading is within the range of Table B.1.

B.1.3 Mixing water

Water according to ISO 12439 shall be used as mixing water.

Distilled or de-ionised water may be used in special cases.

It is not allowed to use wash water from concrete production.

B.2 Reference concrete

B.2.1 General

Unless otherwise specified, tests on reference concrete are performed as comparative tests. That is, the performance of admixtures is determined by comparing the reference concrete containing an admixture (test mix) with the reference concrete made without an admixture (control mix) but otherwise with the same aggregate/cement ratio and constituent materials from the same delivery. Equal consistence of control mix and test mix is achieved if the deviation in consistence is within ±10 %.

The requirements of reference concretes shall be as given in Table B.2. The fresh concrete shall be fully compacted. The air content in the control mix shall not exceed 2 % by volume.

Table B.2 — Reference concretes[a]

Reference concrete	Cement content[c, e] kg/m^3	Consistence at required test temperature	
		Slump[b, e] mm	Flow[d] mm
I	300 ~ 350 ± 5	70 ~ 80 ± 10	400 ± 20
II	320 ~ 350 ± 5	30 ~ 80 ± 10	350 ± 20
III	350 ± 5	180 ± 10	—

[a] When testing at equal w/c ratio the requirements for consistence shall only apply to the control mix.

[b] These tests are alternatives and have to be chosen before starting the test. Slump and flow shall be determined in accordance with ISO 1920-2.

[c] Control mix only: The resulting cement content of the test mix may change as a result of volume change to concrete caused by water reducing or air entraining effects of the admixture under test.

[d] For high range water reducing/super plasticising admixture the consistence of the test mix shall be not less the consistence of the control mix with no upper limit on consistence of the test mix.

[e] Values out of the specified ranges may be accepted, provided that they are permitted by the national or regional standards.

B.2.2 Mix proportion

The cement content shall be in accordance with Table B.2.

Aggregate shall be used in an oven dry condition (≥105 °C) to remove doubts on moisture content variation. If the aggregate is not oven dry, its moisture content shall be determined and the specific gravity shall be corrected accordingly. In case of dispute, oven dry aggregate shall be used.

The test mix shall have the same aggregate/cement ratio as the control mix but the water content shall be adjusted to give a consistence within the limits given in Table 2 for the control mix. However, the volume percentage of fine aggregate to total aggregate of reference concrete III shall be 40 % to 50 %. The water content of the mix shall be calculated from the moisture content of the aggregate, the mixing water and the water content of the admixture. In the case of the plasticised or super plasticised flowing concrete mix and when testing water resisting admixtures at equal w/c ratio no water reduction shall be made.

The use of aggregate adjusted to a saturated surface-dry or similar condition is permitted. In this case, however, the amount of mixing water shall be corrected based on the measurement of the surface moisture content of aggregate to minimize fluctuation of the water content.

The grading of a test mix may be adjusted if necessary.

B.3 Reference mortar

B.3.1 Composition of mortar

B.3.1.1 General

The proportions by mass shall be one part of the cement, three parts of sand, and one half part of water (water/cement ratio 0,50).

Each batch for three test specimens shall consist of (450 ± 2) g of cement, (1 350 ± 5) g of sand and (225 ± 1) g of water.

Wet-screened samples of control mix or test mix may be used as mortar for setting tests.

B.3.1.2 Reference sand

The properties of the sand is vital, it is recommended to use a natural, siliceous sand consisting of rounded particles and which has a silica content of at least 98 %.

The particle size distribution should consistent and preferably lie within the limits given in Table B.3.

Table B.3 — Particle size distribution of the ISO reference sand

	Square mesh size mm					
	2,00	**1,60**	**1,00**	**0,50**	**0,16**	**0,08**
Cumulative sieve residue (%)	0	7 ± 5	33 ± 5	67 ± 5	87 ± 5	99 ± 1