BRITISH STANDARD

BS EN
13577:2007

Chemical attack on concrete — Determination of aggressive carbon dioxide content in water

The European Standard EN 13577:2007 has the status of a British Standard

ICS 13.060.50; 91.100.30

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 13577:2007.

The UK participation in its preparation was entrusted by Technical Committee B/517, Concrete, to Subcommittee B/517/1, Concrete production and testing.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Chemical attack on concrete - Determination of aggressive carbon dioxide content in water

Attaque chimique du béton - Détermination de la teneur en dioxyde de carbone agressif de l'eau

Chemischer Angriff an Beton - Bestimmung des Gehalts an angreifendem Kohlendioxid in Wasser

This European Standard was approved by CEN on 8 March 2007.

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Foreword

This document (EN 13577:2007) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2007, and conflicting national standards shall be withdrawn at the latest by October 2007.

This European Standard describes a method for testing water which may be aggressive to hardened concrete.

It is based on DIN 4030 "Assessment of water, soil and gases for their aggressiveness to concrete".

No existing European Standard is superseded.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies a reference method for the determination of carbon dioxide present in water and which has a capacity to dissolve in lime from concrete.

It is not applicable to the measurement of total carbon dioxide present in water.

If other methods are used, it needs to be shown, that they give results equivalent to those obtained by this reference method.

This test does not apply to water that has a pH less than 4,3.

In case of dispute, only the reference method is used.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following term and definition applies.

3.1
aggressive CO_2
quantity of carbon dioxide present in water which has a capacity to dissolve lime in concrete

4 Principle

Calcium carbonate powder is added to water.

After the reaction of aggressive CO_2 with calcium carbonate is complete, the water is titrated with acid.

The difference in titration with a second sample of the same water which has not been subjected to the reaction with calcium carbonate will give the aggressive CO_2 content of the water.

5 Apparatus

5.1 Laboratory equipment

5.1.1 balance reading up to 100 g accurate to 0,1 mg.

5.1.2 pH meter (in calibration) or a pH indicator (e.g. metylorange).

5.1.3 magnetic stirrer fitted with thermosstatic control.

5.1.4 thermometer with a measuring range from 0 to 30 °C and scale divisions of 0,2 °C.

5.1.5 25 ml burette accurate to 0,03 ml.

5.1.6 100 ml pipette accurate to 0,1 ml.

5.1.7 sample bottle of at least 1 litre.

5.1.8 bottle of 0,5 litre capacitiy with screw closure.

5.1.9 250 ml beaker.

5.1.10 thermally insulated transport boxes (when required).

5.2 Reagents

5.2.1 Precipitated calcium carbonate powder.

5.2.2 Hydrochloric acid (0,100 M).

WARNING — Hydrochloric acid is corrosive. Take precautions to avoid contact with the eyes or inhalation of vapour. Prevent skin contact by wearing gloves and suitable protective clothing. If acid enters the eye or touches the skin, wash it out thoroughly with clean water and seek medical treatment without delay.

6 Procedure

6.1 Preparations

Prior to sampling water 10 g of calcium carbonate powder shall be weighed and put into the 0,5 l bottle (5.1.8).

6.2 Sampling

Caution. Carbon dioxide is easily lost from water during sampling, transit and storage of samples. Consequently, the water sample shall be taken with care not to remove the dissolved gas and shall be tested as soon as possible after collection. Fill the sample bottle (5.1.7) with water to be tested. Then use this sample bottle (5.1.7) to fill slowly the 0,5 l bottle (5.1.8) containing the 10 g of calcium carbonate powder which shall be filled slowly, care being taken not to flush out the powder while filling. The bottle shall be completely filled, hermetically sealed after collecting the sample and distinctively and permanently marked by the sampler with the sample number, point of collection, sampling date and sampling time. The remaining water shall be kept in the sampler bottle for the second measurement.

The composition of water sample shall not alter while it is being transported, e.g. due to change in temperature. The change in temperature during transportation from the point of collection and testing in the laboratory shall not exceed 5 °C . The time between collection and determination of the aggressive CO_2 content, shall not exceed 48 h.

When appropriate, thermally insulated transport boxes shall be used.

6.3 Testing

After sampling and just prior to testing, the temperature of the water shall be measured to the nearest 0,2 °C and reported in the sampling record. The 0,5 l bottle (containing the 10 g of $CaCO_3$ powder) shall be vigorously shaken for not less than 2 h.

Care shall be taken to ensure that the temperature of water does not vary by more than 2 °C from the temperature measured during collection from the temperature measured after sampling. If necessary the magnetic thermo stated device shall be used.

The use of an automatic titrater is a permitted alternative procedure.

100 ml of the sample water shall be titrated with hydrochloric acid to a pH value of 4,3.

H_1 is the volume in ml of acid necessary for this titration.

After the excess calcium carbonate has settled, 100 ml of the clear supernatant solution shall be titrated with the hydrochloric acid to a pH value of 4,3.

H_2 is the volume in ml of acid necessary for this titration.

Repeat the measurement with a second sample of the clear supernatant solution taken from the remaining solution in the sample bottle (5.1.7).

7 Expression of results

7.1 Calculation

The lime dissolving capacity (LDC) of the sample is calculated from the equation:

$LDC = 28 (H_2 - H_1)$ expressed in mg of CaO/l

The aggressive CO_2 content of the sample is given by multiplying *LDC* by the ratio 44/56.

7.2 Result

The mean value of each determination from the two samples shall be taken as the aggressive CO_2 content of the water.

It shall be expressed in mg/l rounded to the nearest whole number.

8 Test report

The report shall include:

a) unambiguous identification of the test sample;

b) location of performance of test;

c) date and time of collection;

d) time of performance of test;

e) temperatures of sample (after sampling and just prior to testing);

f) calculated aggressive CO_2 contents and mean value;

g) identification of person carrying out the test;

h) deviations from the standard test method (if any);

i) declaration by the person carrying out the test that it was carried out in accordance with the standard except as noted in h).

A pro-forma for a test report is given in Annex A.

9 Precision

The standard deviation for repeatability is 0,3 mg/l.

Annex A
(informative)

Example of a test report - Determination of aggressive CO_2 content

Client

Test organisation

Test location

Test item

Sample identification:

Date and time of collection:

Type of water:

(ground water, surface water etc.)

Temperature of water after sampling:

Temperature of water just prior to testing:

Point of collection:

(borehole, pit etc.)

Depth of collection:

Test and test results

Time of performance of test:

pH meter reference number:

Any deviation from standard test method:

Aggressive CO_2 content:

Test 1: mg/l

Test 2: mg/l

Result: mg/l

Except as detailed above this test was carried out in accordance with EN 13577

Technical responsibility

Responsible person:

Name:

Position:

Signature:

Certificate identification:

Certificate No:

Date issued:

Bibliography

[1] EN 206-1, *Concrete — Part 1: Specification, performance, production and conformity*

[2] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

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