BRITISH STANDARD

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13198:2003

Precast concrete products — Street furniture and garden products

The European Standard EN 13198:2003 has the status of a British Standard

ICS 91.100.30

National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/524, Precast concrete products, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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EUROPEAN STANDARD
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EN 13198

May 2003

ICS 91.100.30

English version

Precast concrete products - Street furniture and garden products

Produits préfabriqués en béton - Mobilier urbain et de jardin

Betonfertigteile - Straßenmöbel und Gartengestaltungselemente

This European Standard was approved by CEN on 10 March 2003.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 13198:2003) has been prepared by Technical Committee CEN/TC 229 “Precast concrete products”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by November 2003, and conflicting national standards shall be withdrawn at the latest by November 2003.

Annexes A and B are informative.

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

Introduction

This European Standard covers a vast range of products, which are widely used in our daily environment and have an important decorative function. Bearing in mind the great variety of these products, the standard sets minimum requirements for the various products and specific requirements for some particular products.

1 Scope

This European Standard specifies the requirements for street furniture and garden products in precast concrete.

This kind of prefabricated, non-structural products and accessories can be used in public and private areas such as gardens, parks, foot-paths, squares, essentially for the landscaping, without, however, being subject to loads resulting from vehicle traffic. They can also be used for internal applications.

Examples are : products for the furnishing of spaces such as benches, seats, tables, playshapes, step blocks, flower boxes, plant containers, fountains, billboards, street signs, traffic marking signposts, illuminated boards, barbecues, mailboxes, clothesline posts, litter bins, statues, decorative columns and bollards, copings; products for soil erosion control such as piled flower boxes, banks with vegetation with no superimposed load and not exceeding a total height of 1 m; floorscape products such as tree frames and grids, gratings, stepping stones.

This Standard does not cover paving units, flags, kerbs, fences, drainage channels, safety barriers, retaining walls nor sound barriers.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12620:2002, *Aggregates for concrete.*

EN 13369:2001, *Common rules for precast concrete products.*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply:

3.1
actual dimension
the dimension found by measurements

3.2
continuous use of elements
arrangement of elements each adjoining the preceding one, the position of each element depending on the key-dimension of the next identical element

3.3
corrosion protected reinforcement
steel which is inherently resistant to corrosion or has been coated with a protective material e.g. zinc-coated reinforcement, reinforcement of stainless steel, epoxy-coated

3.4
(concrete) cover
distance between the nearest concrete surface and the surface of reinforcement

3.5
design (nominal) cover
value of the cover thickness quoted in the project documentation and referred to the clear distance from the steel reinforcement to the concrete surface

3.6
lightweight concrete
concrete having an oven-dry density of not less than 800 kg/m and not more than 2000 kg/m^3. It is produced using lightweight aggregate for all or part of the total aggregate

3.7
minimum cover
minimum cover thickness given by the design cover reduced by the tolerance

3.8
normal weight concrete
concrete having an oven-dry density of not less than 2000 kg/m^3 but not exceeding 2600 kg/m^3

3.9
secondary processing
manufacturing process to texture the whole product or any surface, carried out after basic manufacture (i.e. washing or sand blasting)

3.10
work (design*)* dimension
the dimension targeted by the manufacturer and generally complying with the dimension indicated in the project or in the manufacturer documentation

4 Requirements

4.1 Material requirements

For material requirements, the clause 4.1 of EN 13369:2001 shall be applied.

4.2 Production requirements

For production requirements, the clause 4.2 of EN 13369:2001 shall be applied.

Additionally, the concrete shall meet one of the minimum strength requirements in Table 1. The minimum class to ensure durability is given in Table 1, in relation to the kind of concrete that is used.

The manufacturer may demonstrate compliance using alternative test methods to the compressive test (e.g. splitting or bending carried out on a test specimen or the unit).

Table 1 — Minimum compressive strength class

Type of concrete	Minimum compressive strength class (on cylinder/on cube) N/mm^2
normal weight concrete	C25/30
normal weight concrete with no upper sieve size coarse aggregates exceeding D = 5,6 mm	C20/25
lightweight concrete	LC12/13

4.3 Finished product requirements

4.3.1 Geometrical characteristics

Dimensional tolerances are only relevant for alignment and/or interlocking. The producer shall declare the key-dimension for which the dimensional tolerances shall then conform to Table 2 (see 5.2).

Table 2 — Dimensional tolerances depending on the key-dimension and use

Key dimension	Continuous use	Discontinuous use
1 m	5 mm	15 mm
> 1 m	10 mm	15 mm

For interlocking units in particular, tolerances shall be declared by the manufacturer and shall be such as to permit interlocking.

4.3.2 Surface characteristics

If cracks are visible under the conditions specified in 5.3 the product is unacceptable.

The appearance is subjective. It is advisable that the acceptable limits can be determined by comparison with approved samples or documentation of the producer or with the CIB-scales (CIB report N. 24).

4.3.3 Concrete cover to reinforcement

Depending upon the type of concrete, the compressive strength class and the water absorption in mass of the concrete used, the minimum concrete cover (see 5.6*)* shall not be less than specified in Table 3.

Table 3 — Minimum concrete cover

Type of concrete	Minimum compressive strength class	Maximum water absorption %	Minimum concrete cover mm	Remarks
normalweight concrete	C 20/25	/	20	Only for normal weight concrete with no upper sieve size coarse aggregates exceeding D=5,6mm. When corrosion protected reinforcement is used, the min. concrete cover may be reduced by 5 mm
	C25/30	/	20	When corrosion protected reinforcement is used, the min. concrete cover may be reduced by 5 mm.
	C 30/37 C 35/45	6,5	15	
	C 40/50	6	10	Only for products with a maximum thickness of less than 80 mm.
lightweight concrete	LC 12/13	/	20	Only corrosion protected reinforcement should be used.
NOTE Moreover, the product should have a concrete cover of at least 1,25 times the upper sieve size (D) of coarse aggregate according to EN 12620.				

4.3.4 Safety in use

Requirements for safety in use shall be considered for the intended final use of the products.

The manufacturer shall indicate the limiting service conditions for products for soil erosion control such as piled flower boxes, banks with vegetation etc., such as a maximum height and, possibly, occasional load for access to or maintenance of the works.

Safety in use shall be checked by design or test loading. Moreover, for fixed products, the producer shall provide guidelines for erection, handling and intended usage.

4.3.5 Weathering resistance

4.3.5.1 Products for external use, not subjected to freeze/thaw conditions

For normal weight concrete, water absorption shall not exceed 7,5 % (see 5.4).

4.3.5.2 Products for external use, subjected to freeze/thaw conditions and not in contact with de-icing salt

Products for external use not in contact with de-icing salt are exempted from direct freeze/thaw tests (see 5.7) if they meet both of the following requirements:

a) for normal weight concrete, the water absorption shall be less than 7 % in mass; for lightweight concrete, the water absorption shall be less than 15 % in mass;

b) for normal weight concrete, the minimum strength class shall be C 30/37; for lightweight concrete, the minimum strength class shall be LC 12/13.

When the direct freeze/thaw test (see 5.7) is used and if appearance is important, after the test, no projections, depressions, flakes or crazes shall be visible on the product from a distance of 2 m in daylight and dry surface conditions.

4.3.5.3 Products for external use, subjected to freeze/thaw conditions and in contact with de-icing salt

Products for external use, subjected to freeze/thaw conditions and in contact with de-icing salt are exempted from direct freeze/thaw tests (see 5.8) with de-icing salt if they meet both of the following requirements:

a) the water absorption shall be less than 6,0 % in mass;

b) minimum strength class shall be C 35/45.

Additionally, frost resisting aggregates shall be used for products with secondary processing in accordance with clause 5 of EN 12620:2002.

When the direct freeze/thaw test with de-icing salt (see 5.8) is used, the maximum mass loss shall be 1,5 kg/m^2.

4.3.6 Other requirements

Some products have additional requirements linked to their specific use. These kinds of requirements shall only be considered when relevant. A product may have to meet several specific requirements.

The properties of the products which indicate the fitness-for-use shall be demonstrated by the manufacturer.

For example:

- bicycle stands shall have dimensions and dimensional tolerances so as to receive and to hold bicycles safely (e.g. bicycles in a row shall not touch each other's cables or steering);
- products intended to contain water shall be watertight under the appropriate condition;
- products with electrical connections shall be checked for conformity with applicable electrical safety regulations; they shall satisfy a variety of performance criteria including one or more of the following:
  - strength: the capacity of these to resist the forces to which they will be subjected during their lifetime including those caused by external loads, restraint or imposed deformations and those required to maintain stability;
  - ductility: strictly defined as the ability of these to accommodate relatively large inelastic deformations without a significant decrease in capacity; they should have capacity to sustain overloads without precipitous strength loss;
  - durability: the resistance of these to the adverse effects of variations in temperature and exposure to moisture or other corrosive agents, according to previous use.

5 Test methods

5.1 General

The tests described in this standard, or in the absence of these, the tests described in the corresponding EN(V) shall be reference tests.

The manufacturer may propose alternative methods to those described in this standard, providing a correlation with the reference method is established.

5.2 Dimensions

Measuring equipment shall be accurate to ± 0,5 mm taken in the area of use.

5.3 Appearance

An observer stands at a minimum distance of two metres from the products and/or the samples to be compared in daylight and dry surface condition.

5.4 Measuring of water absorption

The test method given in 5.1.2 of EN 13369:2001 shall be applied.

5.5 Compressive strength

The test method given in 5.1.1 of EN 13369:2001 shall be applied.

5.6 Concrete cover

The measurement of the concrete cover of the reinforcement may be destructive or non-destructive to an accuracy established by tests against known cover. For exposed-aggregate finishes, the result shall not take account of the outer non-coated part of the aggregate.

5.7 Freeze/thaw resistance without de-icing salt

The test method given in informative annex A should apply.

5.8 Freeze/thaw resistance with de-icing salt

The test method given in informative annex B should apply.

6 Evaluation of conformity

6.1 General

Clause 6.1 of EN 13369:2001 shall apply.

6.2 Type testing

Clause 6.2 of EN 13369:2001 shall apply.

6.3 Factory production control

It is recommended to apply clauses 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.5. and 6.3.6 of EN 13369:2001.

7 Marking and labelling

7.1 On the product

Each element or, where it is not practicable, each package of units, shall be labelled to show:

- identification of the manufacturer or the factory;
- identification of the date of production;
- reference to this European Standard.

7.2 On the delivery ticket, invoice or declaration of the manufacturer

The delivery ticket, the invoice or the manufacturers declaration shall contain the following accompanying information:

- identification of the manufacturer or the factory;
- identification of the date of production;
- products identity (commercial name);
- the address of the factory;
- the reference to technical standard(s) involved;
- identification of this standard by European Standard number.

Annex A
(informative)

Freeze/thaw resistance without de-icing salt

A.1 Test specimens

Test whole units at least 28 days old. If testing whole units is not possible the sampling method may be left to the choice of the manufacturer. The specimen shall incorporate an upper face area greater than 7 500 mm^2 but less than 25 000 mm^2, which shall be the test surface. If the specimen has to be cut from a unit to meet this requirement, it shall be sawn when it is at least 28 days old.

A.2 Apparatus

Freeze chamber with an air mixing device, capable of achieving the cycle characteristics given in A.4 and an immersion tank.

NOTE The test may be performed either with an automatic apparatus or by manual means.

A.3 Conditioning of the specimens

Place the specimens in the immersion tank containing water at 20 °C ± 5 °C for three days. Remove the specimens and wipe off excess surface water with a damp cloth.

A.4 Procedure

Immediately after conditioning the specimens, place them vertically in the freeze chamber. To provide free circulation of air, position the specimens such that:

¾ the distance between any two specimens is 40 mm;

¾ the distance between the vertical faces of the chamber and specimen faces is 100 mm;

¾ the distance between the bottom of the chamber and the lower end of the specimens is 30 mm;

¾ the distance between the top of the chamber and the upper end of the specimens is 100 mm.

When a frame is used to hold the specimens in position during the test, construct it in such a manner that the free circulation of air is not restricted.

One complete freeze/thaw cycle consists of a cooling phase, a freezing phase and a thawing phase.

To cool the specimens, reduce the air temperature in the freeze chamber from ambient room temperature to (- 20 ± 5) °C within 2 h ± 30 min.

NOTE Where specimens are placed into a precooled chamber, it may be necessary to use ballast to achieve the specified rate of cooling.

To freeze the specimens, maintain the air at (-20 ± 5)°C for 1 h 15 min ± 5 min.

To thaw the specimens, immerse them in water for 1 h to 2 h immediately after the freezing phase. The final temperature of the water shall be (20 ± 5) °C.

Interruption of the cycles is only permitted at the end of the thawing phase and the specimens shall remain immersed. Each interruption shall not exceed 96 h. Record all interruptions that exceed 24 h.

On completion of 25 freeze-thaw cycles store the specimens for seven days at 15 °C to 30 °C and at a minimum of 40 % relative humidity.

Verify the number of projections, depressions, flakes or crazes visible on the specimen from a distance of 2 m in daylight and dry surface conditions.

A.5 Test report

The test report shall include the following information:

a) the number of visible projections, depressions, flakes or crazes;

b) the area of the test surface in square millimetres.

Annex B
(informative)

Freeze/thaw resistance with de-icing salt

B.1 Principle

The specimen is preconditioned and then subjected to 28 freeze-thaw cycles while the surface is covered with a 3 % NaCl solution. The material that has scaled off is collected and weighed and the result expressed in kg/m^2.

B.2 Specimen

The specimen shall incorporate an upper face area greater than 7 500 mm^2 but less than 25 000 mm^2, which shall be the test surface and shall have a maximum thickness of 103 mm. If the specimen has to be cut from a unit to meet this requirement, it shall be sawn when it is at least 20 days old.

B.3 Materials

B.3.1 Potable water.

B.3.2 Freezing medium, consisting of 97 % by weight of potable water and 3 % by weight of NaCl.

Adhesive for gluing the rubber sheet to the concrete specimen. The adhesive shall be resistant to the environment in question

NOTE Contact adhesive has proved to be suitable.

B.3.3 Silicon rubber or other sealant to provide a seal between the specimen and the rubber sheet and to fill in any chamfer around the perimeter of the specimen.

B.4 Apparatus

B.4.1 Saw for cutting concrete specimen.

B.4.2 Climate chamber with a temperature of (20 ± 2) °C and a relative humidity of (65 ± 10) %. In the climate chamber the evaporation from a free water surface shall be (200 ± 100) g/m^2 in (240 ± 5) min. The evaporation shall be measured from a bowl with a depth of approximately 40 mm and a cross section area of (22 500 ± 2 500) mm^2. The bowl shall be filled up to (10 ± 1) mm from the brim.

B.4.3 Rubber sheet (3 ± 0,5) mm thick which shall be resistant to the salt solution used and sufficiently elastic down to a temperature of -20 °C.

B.4.4 Thermal insulation, Polystyrene (20 ± 1) mm thick with a thermal conductivity between 0,035 W/m.K and 0,04 W/mK or equivalent other insulation.

B.4.5 Polyethylene sheet, 0,1 mm to 0,2 mm thick.

B.4.6 Freezing chamber with time controlled refrigerating and heating system with a capacity and air circulation such that the time-temperature curve presented in Figure B.3 can be followed.

B.4.7 Thermocouples, or an equivalent temperature measuring device, for measuring the temperature in the freezing medium on the test surface with an accuracy within ± 0,5 °C.

B.4.8 Vessel for collecting scaled material. The vessel shall be suitable for use up to 120 °C and shall withstand sodium chloride attack.

B.4.9 Paper filter for collecting scaled material.

B.4.10 Brush, 20 - 30 mm wide paint brush with the bristles cut down to about 20 mm long for brushing off material that has scaled.

B.4.11 Spray bottle containing potable water for washing off scaled material and washing salt out of scaled material.

B.4.12 Drying cabinet, for a temperature of (105 ± 5) °C.

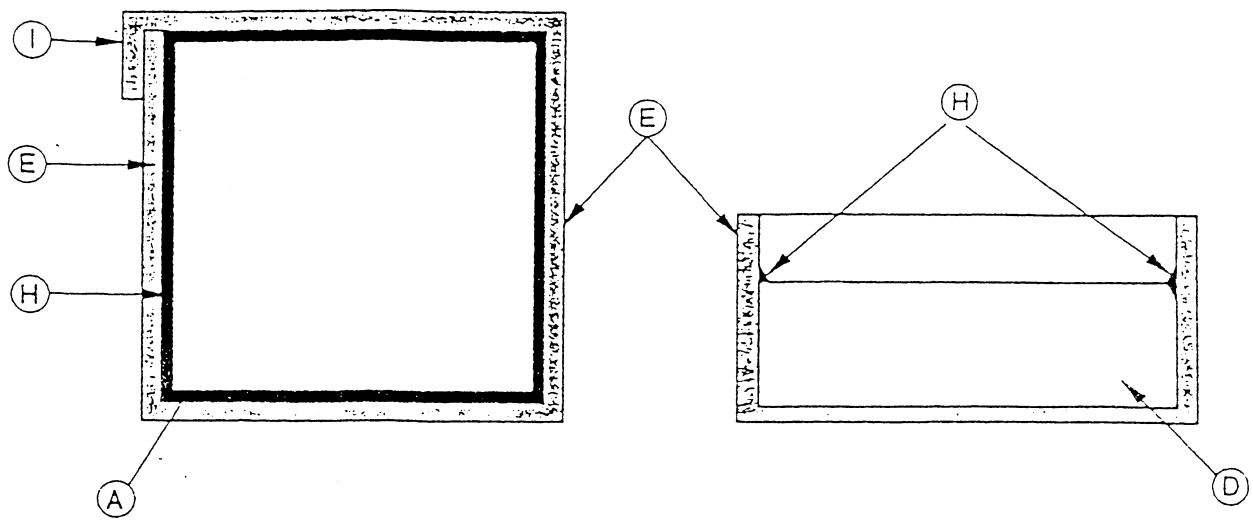
B.4.13 Balance, with an accuracy within ± 0,05 g.

B.4.14 Vernier callipers, with an accuracy within ± 0,1 mm.

B.5 Preparation of test specimens

When at least 28 and, except for receiving inspection, not more than 35 days old remove any flashings and loose material and then cure the samples for (168 ± 5) h in the climate chamber with a temperature of (20 ± 2) °C, relative humidity (65 ± 10) % and an evaporation rate in the first (240 ± 5) minutes of (200 ± 100) g/m^2 measured in accordance with B.4. There shall be a minimum 50 mm air space between the samples. During this time the rubber sheet is glued to all surfaces of the specimen except the test surface. Use the silicon rubber or other sealant to fill in the chamfer around the perimeter of the specimen and to provide a seal around the test surface in the corner between the concrete and the rubber sheet to prevent water penetration between the specimen and rubber. The edge of the rubber sheet shall reach (20 ± 2) mm above the test surface.

NOTE The adhesive is normally spread on the concrete surfaces as well as on the rubber surfaces. The manner of gluing the rubber sheet illustrated in Figure B.1 has proved suitable.



Key

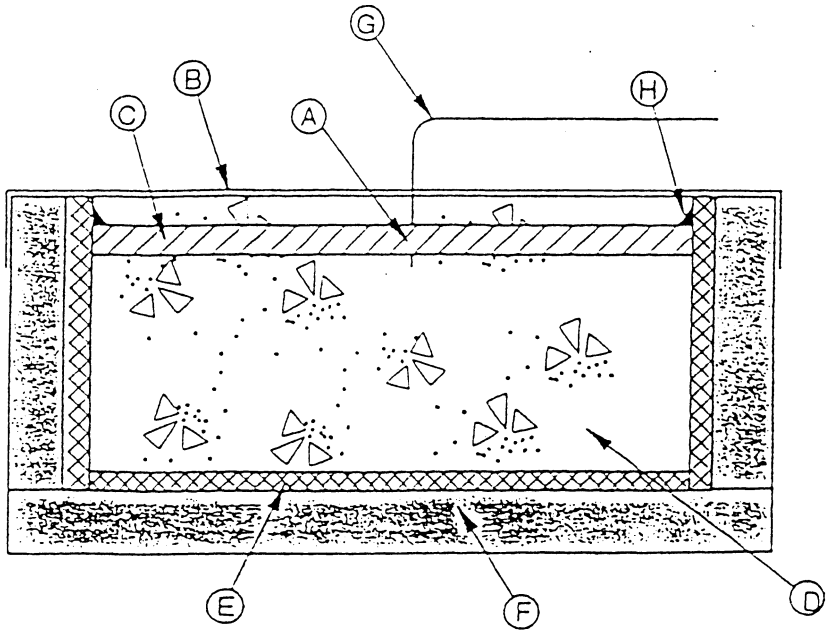
A Test surface
D Specimen
E Rubber sheet
H Sealant string
I Overlap

Figure B.1 — An example of the cross-section of a specimen with the rubber sheet and a sealant string (right) and a specimen seen from above (left)

The tested area A is established from the mean of three measurements of its length and width to the nearest millimetre. After curing in the climate chamber, potable water with a temperature of (20 2) °C shall be poured on the test surface to a depth of (5 ± 2) mm. This shall be maintained for (72 ± 2) h at (20 ± 2) °C and can be used to assess the effectiveness of the seal between the specimen and the rubber sheet.

Before the freeze/thaw cycling all surfaces of the specimen except the test surface shall be thermally insulated. This may be carried out during curing. The insulation shall be as described in B.4.

15 min to 30 min before the specimens are placed in the freezing chamber, the water on the test surface shall be replaced with a (5 ± 2) mm layer, measured from the top surface of the specimen of 3 % NaCl in potable water. This shall be prevented from evaporating by applying a horizontal polyethylene sheet as shown in Figure B.2. The polyethylene sheet shall remain as flat as possible throughout the test and not come into contact with the freezing medium.



Key

A Test surface
B Polyethylene sheet
C Freezing medium
D Specimen
E Rubber sheet
F Thermal insulation
G Temperature measuring device
H Sealant string

Figure B.2 — Example of set-up used for the freeze/thaw test

B.6 Procedure

Place the specimens in the freezing chamber in such a way that the test surface does not deviate from a horizontal plane by more the 3 mm/m in any direction and they are subjected to repeated freezing and thawing. During the test the time-temperature cycle in the freezing medium at the centre of the surface of all specimens shall fall within the shaded area in Figure B.3. Furthermore, the temperature shall exceed 0 °C during each cycle for at least 7 but not more than 9 h. Record the temperature continually in the freezing medium at the centre of the test surface for at least one specimen which shall be located in a representative position in the freezing chamber. Record the air temperature in the freezer during the test. Start the timing of the first cycle of the test on a specimen within (0 ± 30) min of being placed in the freezing chamber. If a cycle has to be interrupted keep the specimen in the frozen state between –16 °C and –20 °C. If this interruption is for more than three days, the test shall be abandoned.

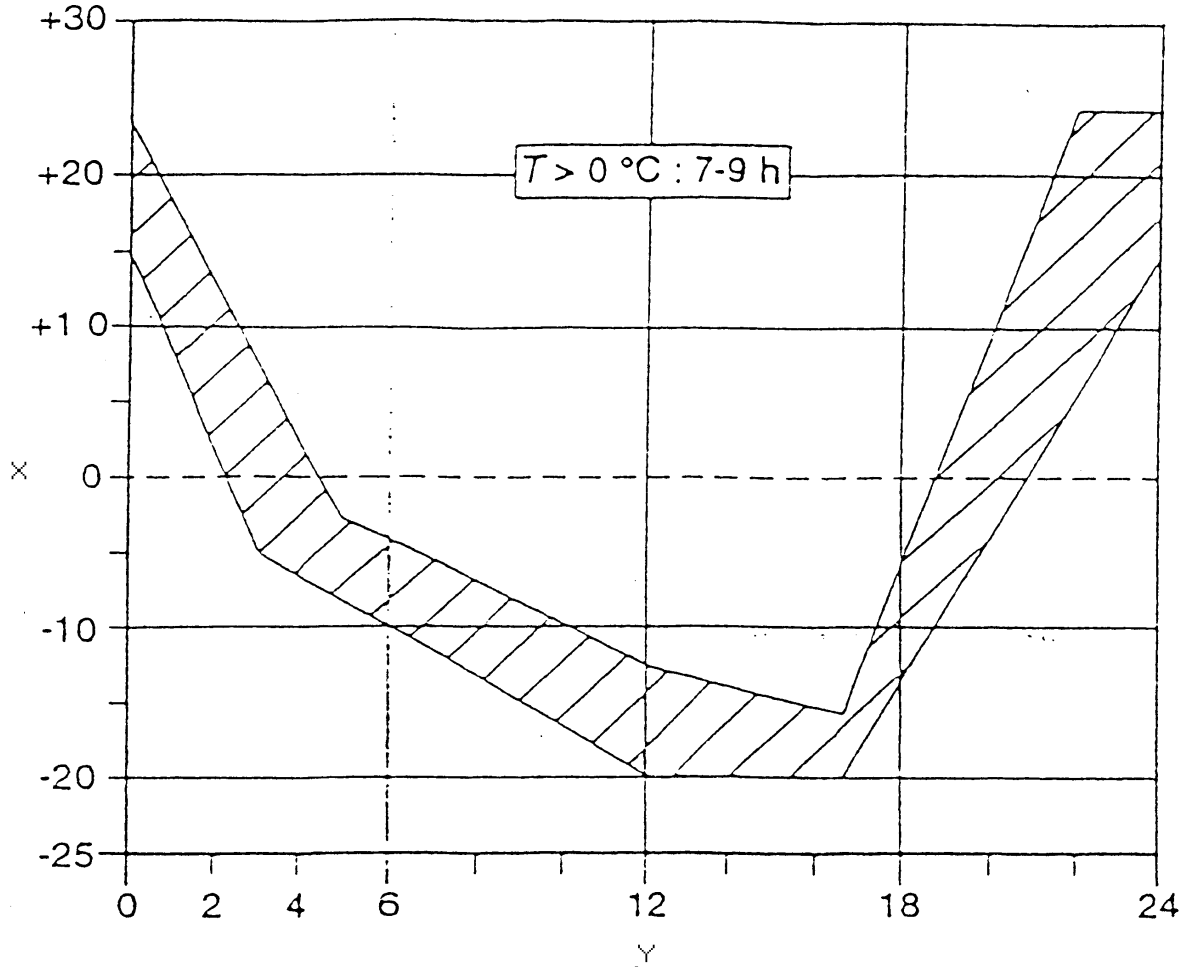


Figure B.3 — Time-temperature cycle

Key
X Temperature (°C)
Y Time (hours)

The break points specifying the shaded area are given in Table B.1.

Table B.1 — Co-ordinates of break points

Upper limit		Lower limit	
Time (h)	**Temperature** (°C)	**Time** (h)	**Temperature** (°C)
0	24	0	16
5	-2	3	-4
12	-14	12	-20
16	-16	16	-20
18	0	20	0
22	24	24	16

To obtain the correct temperature cycle for all the specimens ensure good air circulation in the freezing chamber. If only a few specimens are to be tested, fill the empty places in the freezer with dummies, unless it has been shown that the correct temperature cycle is achieved without them.

After 7 cycles and 14 cycles, during the thaw period add further 3 % NaCl in potable water if necessary in order to keep a (5 ± 2) mm layer on the surface of the samples.

After 28 cycles, the following procedure shall be carried out for each specimen:

a) Collect material which has been scaled from the test surface by rincing into the vessel using the spray bottle and brushing into the vessel until no further scaled material is removed;

b) Pour the liquid and scaled material in the vessel carefully through a filter paper. Wash the material collected in the filter paper with a minimum of one litre of potable water to remove any remaining NaCl. Dry the filter paper and collected material at least 24 h at (105 ± 5) °C. Determine to ± 0,2 g the dry mass of the scaled material, making due allowance for the filter paper.

B.7 Expression of test results

Calculate the mass loss per unit area of the specimen in kg/m^2 from the equation:

$$L = M/A \qquad (1)$$

where

M is the mass of the total quantity of material scaled after 28 cycles, in kilograms;

A is the area of the test surface, in square metres.

B.8 Test report

The test report shall include the following information:

a) the mass loss per unit area of the specimen;

b) the mass of total quantity of material scaled after 28 cycles, in milligrams;

c) the area of the test surface in square millimetres.

Bibliography

CIB Report No. 24 "*Tolerances on Blemishes of Concrete*" (based on a report by Dr. Rolf Schjodt, of the Norwegian Building Institute, Oslo, Norway)

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