

ICS 91.100.30

English Version

## Testing hardened concrete - Part 11: Determination of the chloride resistance of concrete, unidirectional diffusion

Essai sur béton durci - Partie 11: Détermination de la résistance du béton à la pénétration des chlorures, diffusion unidirectionnelle

Prüfung von Festbeton - Teil 11: Bestimmung des Chloridwiderstandes von Beton - Einseitig gerichtete Diffusion

This Technical Specification (CEN/TS) was approved by CEN on 20 June 2009 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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**Contents**

Page

Foreword.....	3
Introduction .....	4
1 Scope .....	5
2 Normative references .....	5
3 Terms and definitions .....	5
4 Principle.....	6
5 Reagents and apparatus .....	7
5.1 Reagents.....	7
5.2 Apparatus .....	7
6 Preparation of specimens .....	8
6.1 Preparing sub-specimens .....	8
6.2 Conditioning and preparation of profile specimen for chloride testing .....	9
6.2.1 Vacuum saturation of the profile specimens .....	9
6.2.2 Sealing surfaces other than the surface to be exposed .....	9
6.2.3 Profile specimen for immersion .....	10
6.2.4 Profile specimen for ponding .....	10
6.2.5 Profile specimen for inversion .....	11
7 Procedure .....	12
7.1 Exposure conditions .....	12
7.1.1 Chloride exposure solution .....	12
7.1.2 Exposure temperature.....	12
7.2 Exposure method.....	12
7.2.1 General.....	12
7.2.2 Immersion.....	12
7.2.3 Ponding.....	12
7.2.4 Inversion.....	13
7.3 Exposure period.....	13
7.4 Determination of initial chloride content ( $C_i$ ) .....	13
7.5 Profile grinding .....	13
7.6 Chloride Analysis.....	14
8 Regression procedure and expression of results.....	14
9 Test report .....	16
10 Precision .....	17
Annex A (informative) Diffusion Coefficients .....	18
Annex B (informative) Core test specimen .....	19
Annex C (informative) Typical equipment and procedure for vacuum saturation .....	20
C.1 Apparatus .....	20
C.2 Procedure .....	21
Annex D (normative) Immersion method for large specimens.....	22
Bibliography .....	23

## Foreword

This document (CEN/TS 12390-11:2010) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

The drafting of this Technical Specification was delegated to CEN/TC 51/WG 12/TG 5.

This test method is one of a series concerned with testing concrete. At the behest of CEN, RILEM reviewed chloride testing methods [1] and this Technical Specification is based on their recommendations. In addition, this Technical Specification draws on recommendations from the EU-project “Chloritest” 5<sup>th</sup> Framework Programme (GRD1-2002-71808/G6RD-CT-2002-00855) [2] immersion test recommendation as well as the Nordtest Method NT Build 443 Concrete hardened: Accelerated Chloride penetration [3].

EN 12390, *Testing hardened concrete*, consists of the following parts:

- *Part 1: Shape, dimensions and other requirements for specimens and moulds*
- *Part 2: Making and curing specimens for strength tests*
- *Part 3: Compressive strength of test specimens*
- *Part 4: Compressive strength — Specification for testing machines*
- *Part 5: Flexural strength of test specimens*
- *Part 6: Tensile splitting strength of test specimens*
- *Part 7: Density of hardened concrete*
- *Part 8: Depth of penetration of water under pressure*
- *Part 9: Freeze-thaw resistance — Scaling<sup>1)</sup>*
- *Part 10: Determination of the relative carbonation resistance of concrete<sup>1)</sup>*
- *Part 11: Determination of the chloride resistance of concrete, unidirectional diffusion<sup>1)</sup>*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, 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 the United Kingdom.

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1) For the time being, status of Technical Specification (CEN/TS).

## Introduction

Steel reinforced concrete structures exposed to the ingress of chloride, either from seawater or other sources, need to be durable for at least the intended working life. The possibility of reinforcement corrosion is significantly increased as the chloride level at the embedded reinforcement increases. For this reason, the chloride diffusivity or penetrability of the concrete is an important property to measure and this Technical Specification sets out a test method that may be applied to specimens cast to assess the potential chloride resistance properties of a concrete mix.

NOTE This test method takes a minimum of 119 days comprising a minimum age of the specimen prior to testing of 28 days, a minimum of one day to prepare and condition the specimen and then 90 days to expose the specimen to the chloride solution.

## 1 Scope

This Technical Specification is a method for determining the unidirectional non-steady state chloride penetration parameters of conditioned specimens of hardened concrete. The test method enables the determination of the chloride penetration at a specified age, e.g. for ranking of concrete quality by comparative testing. Since resistance to chloride penetration depends on the ageing, including the effects of continual hydration, then the ranking may also change with age.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

EN 12390-2, *Testing hardened concrete — Part 2: Making and curing specimens for strength tests*

EN 12504-1, *Testing concrete in structures — Part 1: Cored specimens — Taking, examining and testing in compression*

EN 14629, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of chloride content in hardened concrete*

## 3 Terms and definitions

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

### 3.1

#### **as-cast surface**

surface of a concrete element exposed in the construction works to a chloride environment

### 3.2

#### **chloride content**

amount of acid-soluble chloride expressed in percent by mass of concrete

### 3.3

#### **chloride penetration**

ingress of chlorides into concrete due to exposure to external chloride sources

### 3.4

#### **diffusion**

movement of molecules or ions under a concentration gradient, that is movement from a zone of high concentration to a zone with a lower concentration

### 3.5

#### **diffusion coefficient**

proportionality between the molecular flux (e.g. rate of flow of chloride ions) and the concentration gradient in the diffusion equation

NOTE 1 In this Technical Specification Fick's Law is adopted.

NOTE 2 See Annex A.