TECHNICAL SPECIFICATION

ISO/TS 16774-3

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Test methods for repair materials for water-leakage cracks in underground concrete structures —

Part 3: Test method for water (wash out) resistance

Méthodes d'essai pour matériaux de réparation pour fissures dues à l'eau dans les structures en béton souterraines —

Partie 3: Méthode d'essai de la résistance à l'eau (de lixiviation)

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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).

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For an explanation on 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.

The committee responsible for this document is ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 7, *Maintenance and repair of concrete structures*.

ISO/TS 16774 consists of the following parts, under the general title *Test methods for repair materials for water-leakage cracks in concrete structures*:

— *Part 2: Test method for chemical resistance*

— *Part 3: Test method for water (wash out) resistance*

— *Part 4: Test method for adhesion on wet concrete surface*

The following parts are under preparation:

— *Part 1: Test method for thermal stability*

— *Part 5: Test method for watertightness*

— *Part 6: Test method for response to the substrate movement*

Introduction

This Technical Specification is linked to ISO/TR 16475. ISO/TR 16475 outlines 6 basic properties and the required performance levels of water-leakage repair materials, and ISO/TS 16774 proposes a tentative, sample test methods that are capable of evaluating the respective properties of the repair materials.

The test methods in this Technical Specification are intended to serve as references for nations that have not yet developed a test method on the 6 required performance properties of water-leakage repair materials. If other forms of test methods that are simpler, more accurate or more organized are available, such methods are recommended for use instead. Many of the dependent variables outlined in the reference test methods of this Technical Specification are subject to change in accordance to the environmental conditions (temperature and humidity, chemical solution and concentration, width of movement activity, water pressure or water flow velocity, etc.) outlined in the standards used in respective countries.

For ISO/TS 16774-1, ISO/TS 16774-5 and ISO/TS 16774-6, for the purpose of objectively comparing the performance of injected repair materials, artificial cracks of same width, height, and volume were used to control the usage of repair materials for each testing cycle and enable repetition of the same test methods under the same conditions.

Test methods for repair materials for water-leakage cracks in underground concrete structures —

Part 3:
Test method for water (wash out) resistance

1 Scope

This part of ISO/TS 16774 specifies a laboratory test method on the quantitative determination of repair material's performance and resistance against erosion and wash out due to underground water flow.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TR 16475, *Guidelines for the repair of water-leakage cracks in concrete structures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 16475 and the following apply.

3.1
repair material for water-leakage cracks
grouting materials used to prevent water-leakages in concrete cracks

Note 1 to entry: In this Technical Specification, target ingredients are limited to injection materials outlined in ISO/TR 16475.

[SOURCE: ISO/TS 16774-2:—, 3.1]

4 Principle

Resistance to water flow is one of the fundamental properties that water-leakage repair materials should possess. Repair materials are, in most cases, under constant pressure due to water flow, meaning there are risks of erosion, and/or washout and eventual reopening of leakage paths. This test method evaluates the performance of repair material for water-leakage crack by observing how closely the materials can maintain their original state after being exposed to long term water flow. This is done by comparing the mass difference of water-leakage repair materials before and after flow testing in order to determine the repair material's wash out resistance. An example test method is provided in Annex A.

Test repair material is placed in a Petri dish container, which is then placed under exposure to water flow for predetermined duration in a water flow chamber apparatus (flow velocity, duration of flow testing, and other relevant conditions are subject to change in accordance regulated values and figures outlined in different national standards). The mass of the test specimen prior to and after the exposure to water flow is measured using an electronic scale and the data is recorded. For the purpose of this test, specimens should try to retain its original mass as closely as possible as an indicator of strong physical resistance against water flow.

5 Apparatus

5.1 Water flow chamber, shall be able to maintain and control a constant velocity of water flow.

Water flow velocity can be set in accordance to the relevant environmental condition of the appropriate national standard.

5.2 Others.

5.2.1 Glass Petri dish for repair material placement and water flow chamber testing.

5.2.2 Electronic scale (able to measure up to two decimal places in grams).

5.2.3 Stirring rod and **trowel** used for material placement in the Petri dish.

5.2.4 Injector, (injection method has to be as close as possible to manufacturer instructions if provided).

5.2.5 Non-woven fabric cloth, (filters eroded particulates that are washed out during flow testing).

6 Preparation

6.1 Test specimens

a) Completely fill the glass Petri dish with repair material.

   Make the surface flat with a trowel or other surface treating tools in order to prevent overflow (tolerance for uneven surface allowed). Should there be a specific instruction provided by the manufacturer's end on how to prepare/inject material, such method should be used instead.

b) Cure the test specimens in the test room for predetermined number of hours or days until it dries to constant mass with +/- tolerance.

c) Prepare a set number of specimens for test repetition.

6.2 Ambient conditions

Keep the test room at temperature (20 ± 3) °C and humidity at (65 ± 5) % during the experiment unless specifically required otherwise.

NOTE Temperature values are subject to change according to different national standards.

Examples may include warmer countries with ranges that can reach up to (27 ± 2) °C and colder countries at (16 ± 3) °C, etc. The same applied to humidity conditions.

7 Procedure

a) Record the condition of specimen surface placed in the Petri dish. Measure and record the mass (Mb, Mass of specimen before water flow exposure) of the test specimens (up to two decimal places in grams). Cover the surface with non-woven fabric to act as a filter for eroded particulates. Note: When covering the specimen with the non-woven fabric cloth, the cloth should not be directly touching the exposed surface of the test material.

b) Place the Petri dish specimens on the chamber bottom and fill the chamber with water.

   NOTE Petri dish specimens have to be fixed so that they are not displaced due to the water flow.

c) Let the water flow over the test specimens for a specified duration and flow velocity (time and velocity subject to change according to the different national standards applied in this test method)

d) Take the test specimens out of the water flow chamber, and remove the fabric filters from the specimens. Dry the test specimens to constant mass with +/- tolerance.

e) Measure and record the mass (Ma, Mass of specimen after water flow exposure) of the test specimen (up to two decimal places in grams).

f) Calculate the mass change (Mc = Mb - Ma, Mc: Mass change) of the test specimens.

g) Record the change in mass (up to two decimal places in grams).

Photos of the specimen and equipment conditions shall be taken at every stage possible during the each and every test procedure for recording and information purposes.

8 Expression of results

In this test method, the tested repair material's resistance to erosion due to exposure to water flow is measured via the changes in the mass. In this case, results of the tested repair material evaluation shall be based on how much mass was lost after the flow testing in the water flow chamber as this information can be used to determine that materials with higher loss of mass have relatively weaker resistance to water flow erosion. These results (Mb – Ma = Mc) can be used as a data base for an evaluation guideline in future cases of selecting appropriate repair materials with the required properties against water flow erosion.

9 Test report

9.1 Information on the repair material of the test target

9.1.1 General

The test report should record the following information on repair material of the test target:

a) manufactured date, time, place of the repair material;

b) manufacturer (name, address, phone number);

c) type, storage method and authentication of the repair material;

d) guideline and manual on how to use and apply the repair material;

e) data on chemical composition of repair material as indicated in manufacturer's data sheet.

9.1.2 Other information

The following information is recorded on demand if required:

a) objective of the testing and related project;

b) applicable areas in construction sites using the test specimen;

c) result of some eco-toxicological performance tests to account for the release of hazardous substance and the subsequent effects on health and safety.

9.2 Information on the test

The test report should record the following information on the test:

a) test manager;

b) name, purpose of the test;

c) ambient condition of the lab (temperature, humidity, safety conditions, etc.);

d) production time and place of the specimens;

e) shape and size of the specimens;

f) identification of the specimens (Lot No., etc);

g) curing and storage conditions;

h) information on the test repair material (name, producer, validity, etc.);

i) test data (production, measurement, test period, etc.);

j) type of facilities, equipment, tools;

k) status of test equipment, tools;

l) test results;

m) details on other test programs and procedures.

Annex A
(informative)

Example test method

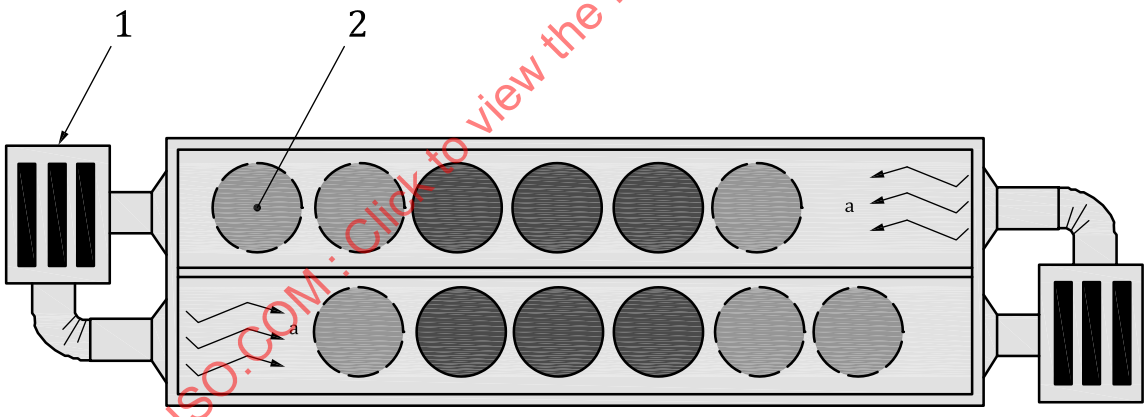
A.1 Principle

This example test method evaluates the washout resistance of the repair material against water flow erosion. Repair material once injected into water-leakage cracks should be able to maintain its repair material performance under constant physical pressure provided by continuous underground water flow. Under these conditions, test specimens injected with water-leakage repair material is placed in a water flow chamber for approximately 48 h at a flow velocity of 2,0 m/s. Information on the mass changes of the test specimen can be used to determine how resistant they are against water flow erosion and washout.

A.2 Apparatus

A.2.1 Water flow chamber (Refer to Figures A.1 and A.2)

Chamber should have specimen slots at the bottom floor to for placement of specimens.



Key

1 pump
2 specimen slots
a Water flow.

Figure A.1 — Placement of specimens and water flow direction

Figure A.2 — Test condition

A.2.2 Others.

A.2.2.1 Glass Petri dish (⌀ 100 mm × 10 mm × 6EA) for repair material placement and water flow testing.

A.2.2.2 Non-woven fabric (180 g/m^2) for filtering eroded particulates during flow testing.

A.2.2.3 Electronic scale (is able to measure up to two decimal places in grams).

A.2.2.4 Stirring rod and **trowels** used to make the material surface even and flat.

A.2.2.5 Injector (injecting methods have to be as close to manufacturer instructions if provided).

A.3 Preparation

A.3.1 Test specimens

a) Completely fill the glass Petri dish with repair material. Prepare 6 separate specimens for 1 test cycle.

   Repair material surface should be treated with a trowel or other surface treating tools to make certain the surface of the material is flat (tolerance for uneven surface allowed). Should there be a specific instruction provided by the manufacturer's end on how to prepare/inject material, such method should be employed.

b) Cure the test specimens in the test room for 72 h.

A.3.2 Ambient condition

Keep the test room at temperature (20 ± 3) °C and humidity at (65 ± 5) % during the experiment unless specifically required otherwise (example values for temperature and humidity conditions).

A.4 Procedure

