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Test methods for repair materials for water-leakage cracks in underground concrete structures =
Part 4: Test method for adhesion on wet concrete surface

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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).

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For an explanation of 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.

Field Code Changed

~~The committee responsible for this~~ This document ~~is~~ was prepared by Technical Committee ISO/TC-71, Concrete, reinforced concrete and pre-stressed concrete, Subcommittee SC 7, Maintenance and repair of concrete structures.

~~This second edition cancels and replaces the first edition (ISO/TS 16774-4:2016) which has been technically revised.~~

The main changes are as follows:

- ambient conditions in 6.2 and A.3.3 have been modified;
- some clarifications have been made in 9.2;
- some editorial corrections have been made.

~~A list of the following~~ all parts, under in the general title *Test methods for repair materials for water leakage cracks in underground concrete structures*: ISO 16774 series can be found on the ISO website.

- *Part 1: Test method for thermal stability*
- *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*

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~~Part 5: Test method for watertightness~~

~~Part 6: Test method for response to the substrate movement~~

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A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

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

The test methods in this ~~Technical Specification document~~ are intended to serve as references for nations that have not yet developed a test method on the ~~six~~ proposed 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 document~~ are subject to change in accordance with 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.

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Test methods for repair materials for water-leakage ~~crack~~cracks in underground concrete structures — Part 4: Test method for adhesion on wet concrete surface

1 Scope

This ~~part of ISO/TS 16774 document~~ specifies a laboratory test method for indirectly measuring the adhesion performance of repair material to wet concrete crack surfaces by qualitatively, as a pass/fail at predetermined time, against predetermined amount of weight exerted on the repair material adhesion.

NOTE This ~~part of ISO/TS 16774 document~~ classifies and categorizes materials that are tested into families of similar properties for the purpose of making relative comparisons with the data results.

2 Normative references

The following documents, ~~are referred to in whole the text in such a way that some or in part, are normatively referenced in all of their content constitutes requirements of 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~~*General practices* 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.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <https://www.electropedia.org/>

3.1

~~water leakage repair material for water leakage cracks~~

grouting materials used ~~for~~to prevent water-leakage at crack leakages in concrete cracks

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

[SOURCE: ISO/TS 16774-2:—;20—1, 3.1]

¹ Under preparation.

4 Principle

A repair material's ability to adhere to a wet leakage crack surface is one of the fundamental properties that water-leakage repair materials should possess. Focus areas of repair material application are most often on concrete surfaces that are constantly wet and humid. During and after application, repair materials should be able to remain firm adhesion to concrete surface and should not fall off. This test method proposes that observing whether repair materials can retain adhesion on wet concrete surface against a constantly exerted weight can determine a repair material's adhesion performance on wet concrete surface. An example test method is provided in Annex A.

Repair materials are injected in an artificially produced wet crack space formed by two separate concrete (or mortar) specimens, a top part that serves as an anchor, and another that serves as the constant weight that pulls on the material adhesion surface. The concrete specimen is then lifted and held in mid-air by the clamp (anchor) of adhesion tester to see if the material can maintain adhesion past the failure margin time against the weight of the bottom concrete specimen.

5 Apparatus

5.1 Adhesion tester.

Adhesion tester should have **three** main parts: frame, clamp, and mobile support plate/mechanism.

5.1.1 Frame, used for levelling the specimen horizontally that can be set immobile during the progress of the test.

5.1.2 Clamp, can anchor the test specimen securely and hold it suspended in mid-air during the test.

5.1.3 Mobile support plate/mechanism, used to initially secure the specimen prior to the testing.

Once the testing starts, it shall be removable (left, right, top, down, in any direction) to allow the specimen to stay mid-air.

Any apparatus can be used, but it should allow the bottom concrete specimen that serves as the weight to pull against the material adhesion the wet surface during the testing.

5.2 Others.

5.2.1 Stop watch, used for testing the duration of adhesion of the material.

5.2.2 Injector, testing material injecting apparatus.

5.2.3 Water container.

6 Preparation

6.1 Test specimen assembly as artificial water-leakage crack

- a) A water-leakage crack test specimen is prepared using two separate concrete or mortar parts (upper and bottom part) placed horizontally parallel to one another. One part (upper) is placed over the other (bottom) with spacers in between, forming the test specimen with an artificial crack.

NOTE The space height between the two concrete parts represents the width of the concrete crack. The height can vary according to different national standards.

- b) The crack space along the side is covered with silicon sealants, tape or other applicable materials along the exterior side of the artificial crack space to prevent leakage during injection.

Any supplementary material can be used to hold the two parts together with a crack space in between, but should leave an inlet for material injection.

- c) The assembled specimen is placed underwater for a predetermined period (time variable ~~may~~ be subject to change according to the different national standards that are applied to this test method).
- d) After taking the specimen out of the water, the repair material is injected into the space while the surface is still wet.

Injection method varies according to different national standards. If manufacturer's instructions are available, employment of such method is recommended.

6.2 Ambient conditions

Keep the test room at temperature $(22 \pm 2)^\circ\text{C}$ and humidity at $(55 \pm 5)\%$ ~~(standard during the experiment unless specifically required otherwise. Standard~~ drying conditions of a drying shrinkage state conditions ~~should be as outlined in ISO 1920-8) 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 $(27 \pm 2)^\circ\text{C}$ and colder countries at $(16 \pm 3)^\circ\text{C}$, etc. The same applies to humidity conditions.

7 Procedure

- a) Place the test specimen on the support plate located at the adhesion tester.

Raise the support plate up to the clamp located at the top of the adhesion tester and fix the upper concrete part on to the clamp (refer to [the](#) procedure note).

- b) To begin testing, remove the support plate, letting the whole specimen suspend in mid-air and letting the weight of the bottom concrete part pull on the repair material adhesion on concrete surfaces.

NOTE One of the two concrete parts adhered together by the injected repair material is fixed onto the clamp of adhesion tester and the other concrete part alone acts as the weight to pull on the adhesion of the repair material.

- c) Observe the specimen to see if it maintains adhesion for a given period of time to pass the test method (adhesion maintenance time ~~is~~ subject to change ~~in accordance~~ according to different national standards) and record the adhesion time.
- d) If the material fails adhesion and falls off, end the test and record the results (the time at which material adhesion fails).

Photos of the specimen and equipment conditions shall be taken at every stage possible during each and every test procedure for recording and information purposes. For detailed and clearer explanation, refer to Annex A.