Technical Specification

ISO/TS 16774-1

Second edition
2024-08

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

Part 1: Test method for thermal stability

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

Partie 1: Méthode d'essai de la stabilité thermique

Reference number
ISO/TS 16774-1:2024(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 www.iso.org/iso/foreword.html.

This document 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 16774-1:2017), which has been technically revised.

The main changes are as follows:

— in 6.1 a), a recommendation regarding the specification of the fine aggregate, as well as the necessary reference to the relevant standard, has been added;

— in 6.1 d), the text has been revised to provide clearer context;

— in Figure A.7, subfigure b) has been removed.

A list of all parts in the ISO/TS 16774 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is linked to ISO/TR 16475. ISO/TR 16475 outlines six basic properties and the required performance levels of water-leakage repair materials; The ISO/TS 16774 series proposes sample testing methods for evaluating the respective properties of the repair materials.

The test methods in this document are intended to serve as reference for nations that have not yet developed a test method for the six required performance properties of water-leakage repair materials. Many of the dependent variables outlined in the reference test methods of this 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.

In this document, 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 are used to control the usage of repair materials for each testing cycle and enable repetition of the same test methods under the same conditions.

The repair material injected into a test specimen with an artificial crack is thermally stressed under the applied temperature conditions outlined in different national testing parameters that reflect different environmental conditions. As such, the results are only intended to provide a comparative performance evaluation of the waterproofing repair materials between different products of the same type of repair material under the same environmental conditions.

NOTE 1 The test method in this document classifies and categorizes materials that are tested into families of similar properties for the purpose of making relative comparisons with the data results.

NOTE 2 Each individual repair material can be further tested in an actual construction site application for a complete assessment.

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

Part 1:
Test method for thermal stability

1 Scope

This document specifies a laboratory test method for evaluating the thermal stress resistance of water-leakage crack repair materials through permeability testing.

This document outlines general principles and procedures for the test method. This document does not specify specific variables that control the quantifiable parameters of the testing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO/TR 16475, *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
repair material
<water-leakage cracks> material used for preventing the escape of water at cracks in concrete

EXAMPLE Injection type grouts, such as synthetic rubberized asphalt, mastic, urethane, poly-urea.

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

4 Principle

Resistance to physical change, loss, or disintegration due to thermal stress is one of the fundamental properties that water leakage repair materials should possess. Changes of repair material property due to high or low temperature conditions can potentially cause the repair material's performance to deteriorate. To evaluate the repair material's thermal stability performance, this test method uses two separate procedures:

a) a thermal stress test method;

b) a permeability test method.

The test specimen with an artificial crack is injected with repair material, and the specimen goes through thermal stress testing for a specified number of cycles, between hot and cold temperature conditions. Test specimens with the repair materials are placed in temperature chambers where the temperature is repeatedly changed from maximum to minimum temperature conditions for a period of time (time and temperature variables are subject to change in accordance to different national test parameters). To evaluate whether the repair material loses its waterproofing property due to thermal stressing, the specimen goes through water permeability testing for the last stage of the test method.

5 Apparatus

5.1 Temperature chamber, which should be able to handle temperature precision values of 2 °C ranging from (–20 ± 2) °C to (60 ± 2) °C and maintain a constant temperature in the interior of the chamber apparatus. Apparatus should also be equipped with a compartment dryer and freezers with temperature precision of ±2 °C. The chamber should also be able to automatically alternate between high and low temperature conditions.

NOTE Temperature condition values are subject to change in accordance with different national testing parameters and requirements.

5.2 Air compressor, which should be able to handle a minimum air pressure value of 0,1 N/mm^2 to 0,3 N/mm^2.

5.3 Permeability test chamber, which should be able to handle a minimum water pressure value of 0,1 N/mm^2 to 0,3 N/mm^2 (output method).

NOTE Conditions outlined in 5.2 and 5.3 are subject to change in accordance with different national testing parameters and requirements.

6 Preparation

6.1 Test specimen and artificial crack conditions

a) Two separate concrete or mortar substrate parts should be cured to form a water-leakage crack test specimen. The parts consist of upper and bottom parts, and they should be flat and cylindrical in shape and should be made using concrete or mortar.

   The mix proportion is (water : cement : fine aggregate = 1 : 2 : 6, mass ratio). The fine aggregate used should be specified. A different standard specification can apply.

   NOTE 1 The curing period for the mortar or concrete substrate parts is approximately 72 h, but can also be subject to change according to different national testing parameters and requirements.

b) The bottom substrate is drilled with evenly spaced holes (Ø2,5 mm) near the centre of the substrate. The pinholes shall be drilled all the way through from one surface of the substrate part to the other.

   NOTE 2 The purpose of these pinholes is to check for signs of leakage during repair material injection and during permeability testing.

c) Spacers are placed on one surface of the bottom substrate part without covering the pinholes; and the upper substrate part is placed on top of the spacers. The substrate parts, having formed the test specimen with the artificial crack, are held together with tape, silicone sealants or other applicable materials along the exterior side. The spacer height represents the width of the crack and can vary depending on the different national testing parameters and requirements.

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

d) The specimen surface should be cleaned before injecting the repair material to remove any debris. After placing the test specimen under water to ensure that the substrate surface is sufficiently wet for repair material injection, inject the repair material into the specimen.

The injection method varies according to different national testing parameters and requirements. The manufacturer's instructions should be followed if available. Debris and other substances, if present, should be removed prior to material application.

NOTE 3 For detailed explanation, refer to Annex A.

6.2 Ambient conditions

Keep the test room at a temperature of (22 ± 2) °C and a humidity of (55 ± 5) % (standard drying conditions of a drying shrinkage state conditions outlined in ISO 1920-8) during the experiment unless specifically required otherwise.

NOTE Temperature values are subject to change according to different national standards. For example, warmer countries have ranges that can reach up to (27 ± 2) °C and colder countries can have a range at (16 ± 3) °C. The same applies to humidity conditions.

7 Procedure

7.1 Thermal stress test

a) Place the test specimens in the temperature chamber.

NOTE 1 This is after the test specimens have been fully injected with the repair materials and taken out of the water after the specified duration.

b) Run the thermal stress testing.

NOTE 2 Thermal stress testing consists of alternating the interior temperature of the testing chamber between low and high temperatures for a set number of cycles within a set period of time. Temperature range, duration, and number of cycles are subject to change in accordance to different national testing parameters and requirements.

c) Take the test specimen out of the temperature chamber and record its conditions. Proceed to the permeability test.

Record sample conditions at different intervals of cycles during thermal cycling for changes on for mass change and visual descriptions of failure like cracking, disintegration, erosion, etc. if such data are required.

7.2 Permeability test

a) Place the specimen in the permeability test chamber.

NOTE 1 The procedure outlined follows the steps required for the output method of this permeability test. Other methods, if applicable, can be used for this step.

b) Fill the chamber with water. Connect the air compressor valves to the air compression chamber.

c) Run the permeability test.

NOTE 2 Water/air pressure values are subject to change in accordance with different national test parameter requirements.

d) Observe and record if there is leakage or not with the test specimen.

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

NOTE 3 For detailed explanation, refer to Annex A.

8 Presentation of results

The continually induced physical stress of the test cycles can affect the repair material's performance level. This test method evaluates the physical properties of the repair materials under the prescribed conditions of permeability testing through a qualitative evaluation of whether the repair material can maintain adequate waterproofing properties. These results can be used in the future as a database, which can provide guidance on selecting appropriate repair materials with the required properties of adhesion on leakage crack surfaces of underground concrete structures.

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 the repair material of the test target:

a) producer (name, address and phone number);

b) production date, time and place of the repair material;

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

d) manufacturer's product instructions and relevant repair material guidelines;

e) data on the 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) project of the test target;

b) application areas of the test specimen;

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

9.2 Information on the test

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

a) a reference to this document (including its year of publication);

b) test manager;

c) name/purpose of the test;

d) ambient condition of the laboratory (temperature, relative humidity, safety conditions etc.);

e) production time and place of the specimens;

f) shape and size of the specimens, and the number of replicates of the specimens for repeat test;

g) identification of the specimens (lot No. etc.);

h) curing and storage conditions;

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