



# Technical Specification

**ISO/TS 16774-6**

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

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

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

*Partie 6: Méthode d'essai de la réponse aux mouvements du  
substrat*

**Second edition  
2024-08**

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

[ISO/TS 16774-6:2024](https://standards.iteh.ai/catalog/standards/iso/37783f23-c96c-4fe2-a11d-78f1642ac7ac/iso-ts-16774-6-2024)

<https://standards.iteh.ai/catalog/standards/iso/37783f23-c96c-4fe2-a11d-78f1642ac7ac/iso-ts-16774-6-2024>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

Published in Switzerland

# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative reference</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Principle</b> .....	<b>1</b>
<b>5 Apparatus</b> .....	<b>2</b>
<b>6 Preparation</b> .....	<b>2</b>
6.1 Test specimen and artificial crack conditions.....	2
6.2 Ambient conditions.....	3
<b>7 Procedure</b> .....	<b>3</b>
7.1 Substrate behaviour stress test.....	3
7.2 Permeability test.....	3
<b>8 Presentation of results</b> .....	<b>3</b>
<b>9 Test report</b> .....	<b>4</b>
9.1 Information on the repair material of the test target.....	4
9.1.1 General.....	4
9.1.2 Other information.....	4
9.2 Information on the test.....	4
<b>Annex A (informative) Example test method</b> .....	<b>6</b>
<b>Bibliography</b> .....	<b>16</b>

## Document Preview

[ISO/TS 16774-6:2024](https://standards.iteh.ai/standards/iso/37783f23-c96c-4fe2-a11d-78f1642ac7ac/iso-ts-16774-6-2024)

<https://standards.iteh.ai/catalog/standards/iso/37783f23-c96c-4fe2-a11d-78f1642ac7ac/iso-ts-16774-6-2024>

## 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](http://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](http://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](http://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 16774-6:2017), 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.

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](http://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 16774-1 and ISO/TS 16774-5, 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 undergoes simulated movements normally caused by thermal expansion, settlement and vibrations in leakage cracks found in concrete structures 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.

## Document Preview

[ISO/TS 16774-6:2024](https://standards.iteh.ai/standards/iso/37783f23-c96c-4fe2-a11d-78f1642ac7ac/iso-ts-16774-6-2024)

<https://standards.iteh.ai/catalog/standards/iso/37783f23-c96c-4fe2-a11d-78f1642ac7ac/iso-ts-16774-6-2024>



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

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

### 1 Scope

This document specifies a laboratory test method for evaluating the substrate (crack) movement response of water-leakage crack repair materials through permeability testing.

This document outlines general principles and procedures for the test method. Specific variables that control the quantifiable parameters of the testing are filled in using relevant national standards or testing parameters, or both.

### 2 Normative reference

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:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 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

Response to loss, deterioration and other physical changes by the behavioral movement of leakage crack (such as crack movements caused by thermal shrinkage and expansions, differential settlement, and/or vibrations) is one of the fundamental properties that water leakage repair materials should possess. To evaluate the repair material's responsiveness to substrate movement, this test method uses two separate procedures:

- a) a substrate movement test method;
- a) a permeability test method.

The test specimen with an artificial crack is injected with repair material, and the specimen goes through an induced tensile/compressive stress test for a specified number of cycles using a substrate movement simulating apparatus, such as a universal testing machine (UTM). To evaluate whether the repair material loses its waterproofing property due to tensile/compressive stress (substrate/crack movement), the specimen goes through a water permeability test for the last stage of the test method.

## 5 Apparatus

**5.1 Substrate movement apparatus**, which must be able to exert a cycle of predetermined width of compressive and tensile force per one minute. A universal testing machine (UTM) should be used for this test method.

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

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

NOTE Conditions outlined in [5.2](#) and [5.3](#) are subject to change in accordance to 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 hours, 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 (Ø 2,5 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 should leave an inlet 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 for a specified amount of time 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 cleared prior to material injection.

NOTE 3 For detailed and clearer explanation, refer to [Annex A](#)



## 6.2 Ambient conditions

Keep the test room at a temperature  $(22 \pm 2) ^\circ\text{C}$  and a humidity at  $(55 \pm 5) \%$  (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  $(27 \pm 2) ^\circ\text{C}$  and can have a range at  $(16 \pm 3) ^\circ\text{C}$ . The same applies to humidity conditions.

## 7 Procedure

### 7.1 Substrate behaviour stress test

- a) Place the test specimen on the substrate movement apparatus.

NOTE 1 Once the test specimens have been injected with the repair materials and taken out of the water after the specified duration, attach the fixing bolt to the upper substrate that will connect to the jig on the substrate movement apparatus (universal testing machine).

- b) Run the substrate movement test.

NOTE 2 The substrate movement simulation test will consist of applying tensile and compressive stress on the test specimen through repeated cycles of induced motion. The apparatus jig will pull on the upper part of the specimen for a specified width and press down the same length. This procedure will repeat until sufficient amount of tensile/compressive stress has been applied on to the specimen. Duration, width and cycle number are subject to change according to different national test parameters and requirements.

- c) Remove the test specimen from the substrate movement apparatus and record its conditions. Proceed to the permeability test.

NOTE 3 For a detailed explanation, refer to [Annex A](#).

### 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 according to 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 must be taken at every stage possible during each and every test procedure for recording and information purposes.

NOTE 3 For a 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

for selecting appropriate repair materials with the required responsive properties against substrate/crack movement in 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 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 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) reference to this document (including its year of publication)
- b) test manager;
- c) name and purpose of the test;
- d) ambient condition of the lab (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.);
- j) test data (production, measurement, test period etc.);
- k) type of facilities, equipment, tools;
- l) status of test equipment, tools;
- m) test results prepared in accordance with [Clause 8](#);