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**Ceramic tiles — Installation —**

Part 3:

**Installation of large format porcelain  
tiles and panels by mechanical means  
onto a supporting structure**

iTeh STANDARD PREVIEW

*Carreaux et dalles céramiques - Installation —*

*Partie 3: Installation des carreaux et panneaux céramiques grand  
format par des moyens mécaniques sur une structure de support*

ISO/TS 17870-3:2023

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Published in Switzerland

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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](http://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](http://www.iso.org/patents)).

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 189, *Ceramic tile*.

A list of all parts in the ISO 17870 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).



# Ceramic tiles — Installation —

## Part 3:

# Installation of large format porcelain tiles and panels by mechanical means onto a supporting structure

## 1 Scope

Classes A1a and B1a porcelain (as defined in ISO 13006) are now manufactured in much larger formats than previously available and are increasingly being used as an external cladding material for buildings.

Classes A1b, A11a, and A11b extruded ceramics (as defined in ISO 13006) are not covered by the scope of this document. These materials, when specifically developed for external façade applications, have been used extensively for many years and established methodologies already exist.

Large format porcelain tiles or panels are generally considered to be too large to be used externally on high buildings when installed by conventional adhesive fixing methods (ISO/TR 17870-1 and ISO/TR 17870-2); therefore, mechanical fixings are used.

As there are currently no published standards or guidelines for these products to be installed in this way, this document provides generic information on some typical types of mechanical fixing systems in use together with positive and negative wind load factors and typical testing procedures that can be used for evaluating anchor pull-out or edge fracture resistance. Also, because the current impact resistance test method for ceramics tiles (ISO 10545-5) relates only to traditional (bedded) installed tiling – which measures the coefficient of restitution – it is not an appropriate test for unbedded (unsupported) tiles, so alternative test methods (ISO 7892) are referred to for measuring hard-body and soft-body impact resistance.

Guidance is provided regarding typical impact zones of vulnerability to hard and soft body impact and reference is made to anti-shatter mesh backings, which are sometimes applied to porcelain cladding tiles and panels.

Installation systems which rely upon the chemical adhesion of metal brackets, straps or framing, etc. onto or into large format porcelain tiles or panels in conjunction with, or instead of, mechanical attachment, are not included in this document.

The detailed principles for the design and construction of the substructure of ventilated façades, also known as rain screens, used on the outside of buildings, are well documented in other national and international standards and are not therefore, included in this document, other than in general reference.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

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

#### **arris**

sharp edge formed by the intersection of two surfaces such as the corner of a masonry unit text of the definition

### 3.2

#### **porcelain**

ceramic with water absorption  $\leq 0,5\%$  (Class A1a or B1a according to ISO 13006)

### 3.3

#### **large format porcelain tile**

surface area  $>3\ 600\text{ cm}^2$  and no tile edge  $>1\ 200\text{ mm}$

### 3.4

#### **porcelain panel**

surface area  $>1\text{ m}^2$  and any tile edge  $>1\ 200\text{ mm}$

### 3.5

#### **ventilated façade**

system for cladding the exterior of a building that provides for the formation of a cavity between the building structure and the cladding to allow for the installation of a thermal/acoustic insulation layer and an air cavity between the *insulation layer* (3.8) and the *large format porcelain tiles* (3.3) or panel

Note 1 to entry: Air cavity has a minimum of a 20 mm wide continuous air flow cavity.

### 3.6

#### **drift**

unintended sideways movement of *large format porcelain tiles* (3.3) or panels across a support structure due to differential thermal expansion/contraction of components and/or gusting wind pressures

### 3.7

#### **primary support**

subframe or substructure, usually metal, onto which the *large format porcelain tiles* (3.3) or panels are mounted

### 3.8

#### **insulation layer**

layer included to obtain sound or thermal insulation

### 3.9

#### **movement joint**

*joint* (3.10) in *large format porcelain tiles* (3.3) or panels, backgrounds or substrates, designed to accommodate movement

### 3.10

#### **joint**

space between adjacent *large format porcelain tiles* (3.3) or panels

### 3.11

#### **undercut anchor**

special type of stress-free mechanical anchorage system used to secure brackets or straps onto *large format porcelain tiles* (3.3) or panels

### 3.12

#### **support system**

metal brackets and rails used to form the subframe



**3.13****vapour membrane**

impervious layer to resist the passage of water but which will allow vapour from the building structure to escape

**3.14****slotted edge system**

kerf edge system

slots formed into the edges of *large format porcelain tiles* (3.3) or panels to receive clips which are secured to the façade subframe

**3.15****overlapping clip**

visible clips which overlap the edges of *large format porcelain tiles* (3.3) or panels and secured to the façade subframe

**3.16****hard-body impact**

impact by hard projectiles that may be thrown, blown or otherwise caused to impact the façade

**3.17****soft-body impact**

impact from persons or other significantly heavy soft objects falling or pushing against the façade

**3.18****negative wind load**

negative load (suction) imposed onto the façade by strong or gusting wind

**3.19****positive wind load**

load imposed onto a façade by strong or gusting wind

**3.20****workshop drawing**

project-specific detailed installation drawing

**4 Exchange of information**

In order for the correct large format porcelain tiles or panels ventilated façade system to be installed in appropriate conditions, at the right time, etc., it is essential that all parties have a clear understanding of the requirements of the project. To ensure that this is achieved, it is essential that there is wide consultation between all the parties involved in the project, including client, façade installer and materials suppliers.

As each project will be unique, it is impossible to give a definitive list of the information to be exchanged, but the following are common examples:

- a) specification: the information required;
- b) special attendances: access, unloading, hoisting and storage facilities, heat, light and power, and any additional items considered necessary to expedite the work;
- c) large format porcelain tiles or panels mechanical fixing system: technical specification and instructions for transport, storage, use;
- d) backgrounds: type of façade subframe construction; location on the building and any need for movement joints;
- e) associated work: services in or passing through the façade substructure and junctions with other adjacent finishes;

- f) finishes: type, size, and colour of large format porcelain, tiles or panels and layout requirements;
- g) installation: type and technique;
- h) workshop drawing;
- i) wind load: engineering calculations;
- j) programme: a time schedule for the progress of the work.

## 5 Workmanship

The installation of large format porcelain tiles or panels requires efficient supervision and the employment of skilled operatives properly trained to install large format porcelain tiles or panels façade systems to an appropriate level of competence.

The large format porcelain tiles or panels façade installers should be properly trained to work safely from a scaffold or when using access equipment to work at height, including the use of a safety harness and other equipment where necessary.

## 6 Ventilated façades

### 6.1 General

Ventilated façade systems vary in design, depending upon the performance criteria required by the specifier, e.g. drained and ventilated, pressure equalised, compartmented.

The various requirements and recommendations contained in this document relate only to the installation of mechanically fixed large format porcelain tiles or panels onto an appropriately designed, drained and ventilated façade system subframe. <https://standards.iteh.ai/catalog/standards/sist/18069810-1856-4c26-9603->

Usually a ventilated façade subframe will consist of primary support brackets that attach a metallic subframe to the structure of the building, which may be masonry or concrete/steel frame, etc.

Primary support brackets, which are usually available in a range of sizes depending upon the façade cavity dimension required, are securely fixed to the building structure and normally provide for some adjustment of the subframe, which is appropriately attached to the primary support brackets after first aligning it to the required planarity and perpendicularity.

A thermal/acoustic insulation layer may be installed and covered by a waterproof vapour membrane if recommended by the façade designer or required in accordance with national regulations.

Purpose-designed horizontal rails are then attached to the subframe in accordance with the specification at the correct levels and spacing to suit the setting out module of the large format porcelain tiles or panels to be mechanically attached to them (see [Figure 1](#)).

Some ventilated façade primary support systems are suitable for the mechanical attachment of large format porcelain tiles or panels directly onto the vertical support rails (See [Figure 4](#), [Figure 5](#) and [Figure 6](#)).

In some countries ventilated façade systems are classified as 'construction kits' consisting of all the components necessary to construct the façade and tested to appropriate standards.

## 7 Methods of mechanical fixing for porcelain

### 7.1 General

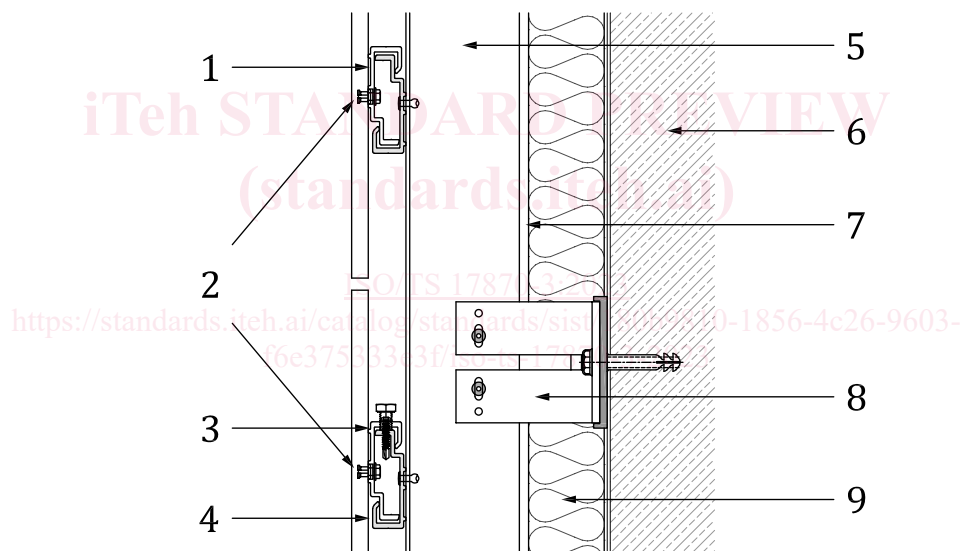
There are various methods of mechanically fixing large format porcelain tiles or panels. This clause sets out details of some of the most popular types of mechanical fixing systems currently in use. It is important that whichever mechanical fixing system is used, the fixing shall be able to sustain the specified design load, without causing stresses within the large format porcelain tiles or panels.

### 7.2 Anchored systems

#### 7.2.1 General

Whilst the precise design of undercut anchoring systems may vary between different manufacturers, the general intent is to achieve invisible and stress-free fixing of appropriately designed brackets or clips, to the rear sides of large format porcelain tiles or panels, for their attachment to a supporting façade framework.

Undercut anchor details provided in this clause are, therefore, for general information purposes rather than being design-specific.



#### Key

- 1 façade system brackets
- 2 undercut anchors
- 3 compression pads
- 4 façade system horizontal rail
- 5 subframe
- 6 building structure
- 7 vapour membrane
- 8 primary support bracket
- 9 insulation

**Figure 1 — Typical anchored support brackets**

The minimum thickness of large format porcelain tiles or panels to receive undercut anchors will be determined by the façade system designer according to the size of the panel and the spacings between the undercut anchors.

### 7.2.2 Bracket and strap attachment

Bracket or strap attachment to the backs of large format porcelain tiles or panels is usually by means of specially designed anchors which, when tightened, expand at their base into undercut recesses at the bottom of holes, drilled to precise depths into the porcelain using specially designed drilling apparatus (see [Figure 2](#) and [Figure 3](#)).

When the anchors are fully tightened to a predetermined torque value, they should not exert any pressure between the porcelain and the anchor but should fit precisely into the undercut hole in order to be able to satisfactorily secure the brackets or straps to the large format porcelain tiles or panels.

Some large format porcelain tiles or panels façade systems include compression pads which are fitted between the large format porcelain tiles or panels and the bracket or strap attachment.

Undercut anchors should be made of austenitic stainless steel.

The diameter and depth of the anchor will depend upon the thickness and weight of the large format porcelain tiles or panels, the anticipated wind loads and the frequency at which the anchor fixings are spaced.

Where large format porcelain tiles or panels façade systems employ brackets which attach to horizontal carrier rails, the top brackets should have adjustable bolts on them for final levelling adjustment.

One of the top brackets should be secured to the horizontal carrier rail by a suitable screw to prevent any lateral drift of the large format porcelain tiles or panels.

Small cut porcelain returns/reveals are sometimes bracketed and undercut anchored to large format porcelain tiles or panels. The large format porcelain tiles or panels and their fixings must be able to support the additional loads created by the attachment of the return, taking into consideration also that wind loads may increase at external corners of the building.

Undercut drilling, anchoring and fabrication of these units should only be carried out at quality-controlled and appropriately accredited facilities in strict accordance with the façade designer's recommendations.

Final anchor tightness checks should be carried out on site by the façade installer immediately prior to the installation of large format porcelain tiles or panels using a torque testing hand tool designed for the purpose