



TECHNICAL REPORT

**Evaluation of plate  
stiffness from plastic  
anchors for fixing of  
external thermal insulation  
composite systems with  
rendering (ETICS)**

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## 1 Foreword

EOTA Technical Reports are developed as supporting reference documents to European Technical Approval Guidelines (ETAG) and can also be applicable to a Common Understanding of Assessment Procedures (CUAP), an EOTA Comprehension Document or an European Technical Approval, as far as reference is made therein.

EOTA Technical Reports go into detail in some aspects and express the common understanding of existing knowledge and experience of the EOTA Bodies at a particular point in time.

Where knowledge and experience is developing, especially through approval work, such reports can be amended and supplemented.

When this happens, the effect of the changes upon the European Technical Approval Guidelines will be laid down in the relevant Comprehension Documents, unless the European Technical Approval Guideline is revised.

## 2 General

The verification of fitness for the intended use for external thermal insulation composite systems with rendering (ETICS) is specified in ETAG 004 [1]. The fixing of the anchors in the substrate is specified in ETAG 014 [2]. The load resistance of the ETICS exclusively fixed by anchors is determined according to ETAG 004 and is particularly linked to the mechanical properties of the anchor plate and the insulation material. Up till now, neither in ETAG 004 nor in ETAG 014 requirements are specified for this characteristic.

To transfer test results of ETICS according to ETAG 004 using anchors tested according to ETAG 014 into other anchors (according to ETAG 014) specific mechanical properties shall be specified of the interface (of the anchor plate).

This includes

- the load resistance and
  - the stiffness (plate stiffness)
- of the anchor plate.

If the anchor plate fulfils the following criteria for the load resistance, the stiffness and the geometry, it can be assumed, that the failure of the ETICS can be transferred into ETICS with different anchors, with the same properties.

According to ETAG 014, section 2, c) it is said:

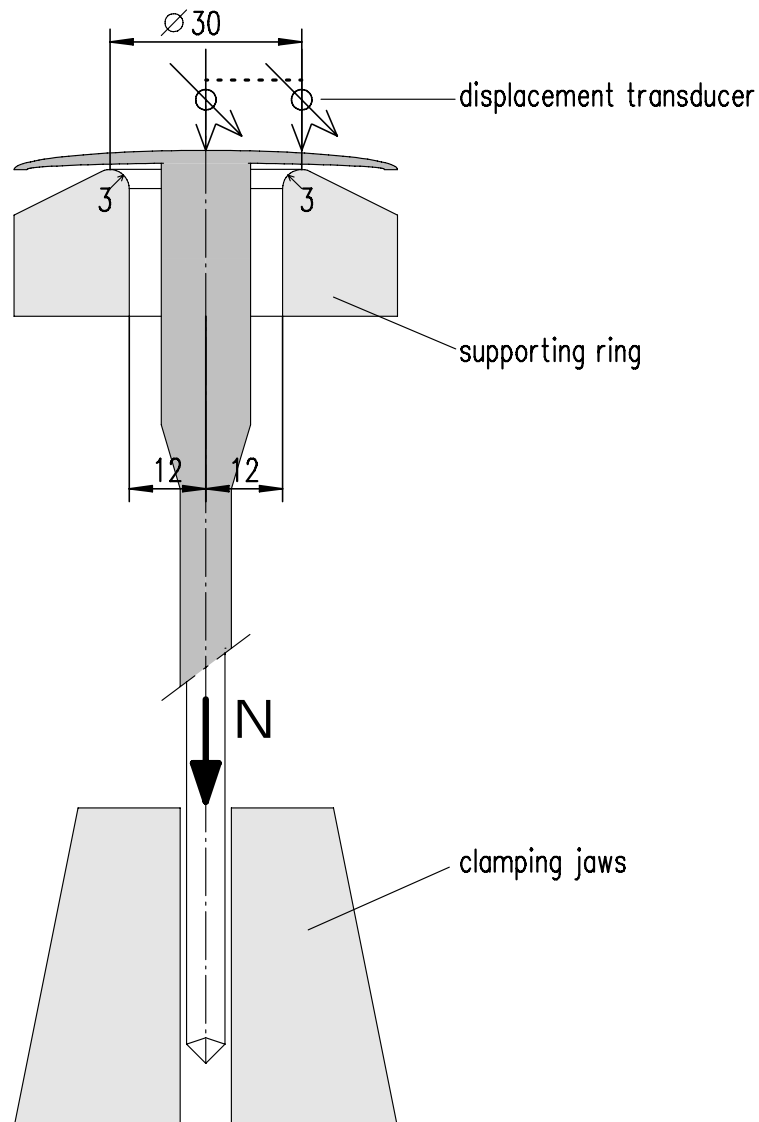
**The evaluation of the plate stiffness is optional.**

If the plate stiffness is not evaluated, it will be stated in the relevant part of the ETA for the plastic anchor "no performance determined".

### 3 Verification for the anchor plate

#### 3.1. Description of the tests

The failure load of the anchor plate shall be determined from at least 5 tests. During the tests the anchor plate shall rest on a solid support ring with a clear inside diameter of 30 mm. A preload can be applied for determination of the stiffness for curved anchor plates in a way, that the tension load is transmitted at the inside edge of the support ring. If the anchor plate is stiffened by ribs, recesses, which prevent a contact between the ribs and the supporting ring and the load transmission is not effected by the ribs, shall be designed in the steel ring. A principle test setup is shown in figure 1.



**Figure 1:** Principle description of the test for determination of the plate stiffness

For plastic anchor plates, which change their mechanical properties under influence of humidity, the tests shall be carried out using air-humid conditioned anchors but always in ambient temperature ("standard" conditions according to ETAG 014, § 5.4.5). The tension load is transmitted over the anchor shaft with a loading rate of  $1 \text{ kN/min} \pm 20 \%$ .

## 3.2. Evaluation of the tests

### 3.2.1. Load resistance

The characteristic resistance has to be determined from the 5%-quantile of the ultimate loads for a confidence level of 90 %. This value has to be stated in the ETA (for the plastic anchor according to ETAG 014). The characteristic resistance shall at least comply with the characteristic resistance in the ETICS according to ETAG 004 [2]. If the characteristic resistance amounts at least 1,0 kN, the universal application mentioned above can be ensured. The reduction of the resistance of the anchor plate caused by increased temperature is included in this value.

### 3.2.2. Plate stiffness

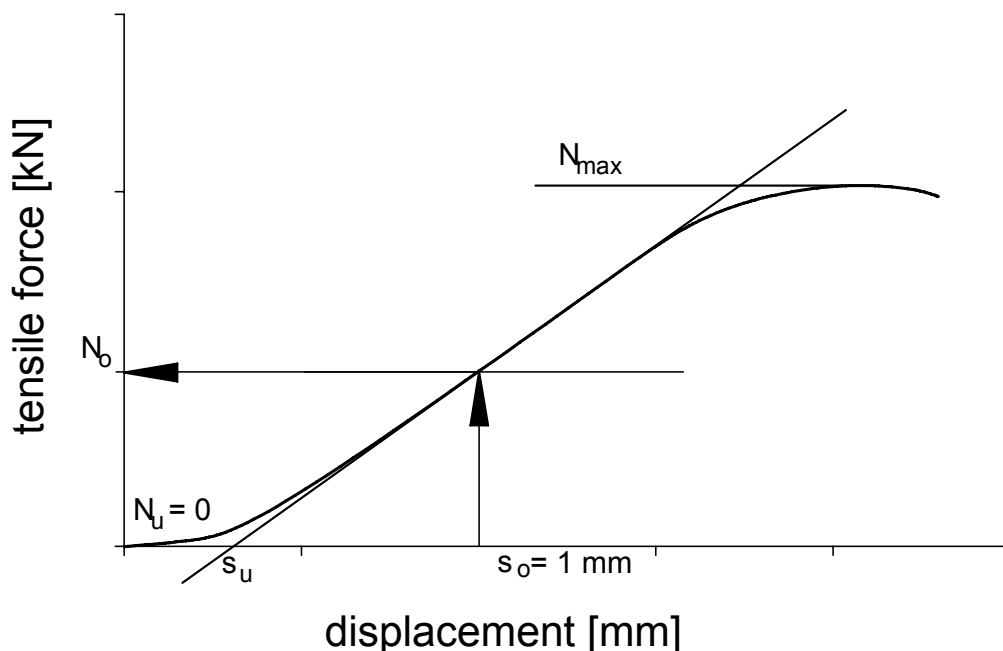
For getting a comparable dimension for the plate stiffness, the tangent stiffness has to be determined for every test. This tangent stiffness states the gradient of an idealised straight line between the points  $s_u$  with the appropriate tension force  $N_u = 0$  kN and  $s_o = 1$  mm with the appropriate tension force  $N_o$  in the load-displacement-diagram (see figure 2).

The plate stiffness and the diameter of the anchor plate shall be stated in the ETA (for the anchor according ETAG 014).

Tangents stiffness: 
$$c = \frac{N_o - N_u}{s_o - s_u} = \frac{N_o}{1 \text{ mm} - s_u} \quad (1)$$
with  $s_u \leq 0,3 s_o$ .

The evaluated values should be rounded expediently to  $\frac{1}{10}$  kN and be stated related to 1 mm deformation (e.g. 0,3 kN/mm / 0,4 kN/mm / 0,5 kN/mm / 0,6 kN/mm / 0,7 kN/mm).

For characterising the plate stiffness the mean value has to be stated. The coefficient of variation shall not exceed 20 %.



**Figure 2:** Load-displacement-diagram with the idealised straight line

## 4 Summary

This Technical Report specifies the pull-through test required for the evaluation of the plate stiffness from plastic anchors according to ETAG 014 for fixing of external thermal insulation composite systems with rendering according to ETAG 004.

The evaluation of the plate stiffness is optional.

If the plate stiffness is evaluated, the following has to be stated in the ETA for the plastic anchor:

- the load resistance of the anchor plate
- the diameter of the anchor plate and
- the plate stiffness

## 5 Literature

[1] **ETAG 004:** Guideline for European Technical Approval of EXTERNAL THERMAL INSULATION COMPOSITE SYSTEMS WITH RENDERING, Edition March 2000

[2] **ETAG 014:** Guideline for European Technical Approval of PLASTIC ANCHORS FOR FIXING OF EXTERNAL THERMAL INSULATION COMPOSITE SYSTEMS WITH RENDERING, Edition January 2002