European Organisation for Technical Approvals
Europäische Organisation für Technische Zulassungen
Organisation Européenne pour l'Agrément Technique

ETAG n° 002

Edition March 2002

GUIDELINE FOR EUROPEAN TECHNICAL APPROVAL OF

STRUCTURAL SEALANT

GLAZING SYSTEMS (SSGS)

Part 3 : Systems incorporating profiles with a thermal barrier

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Introductory notes

This part of the guideline deals with profiles with a thermal barrier which are used in certain structural sealant glazing systems (facade and roof).
The same paragraph numbering as in parts 1 and 2 applies. The paragraphs of the present document complement those of parts 1 and 2. When a paragraph is not mentioned in the present document, SSGS parts 1 and 2 apply without modification, when applicable.

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SECTION ONE : INTRODUCTION

2. Scope

2.1 Scope of part 3

This part 3 complements parts 1 and 2 and relates to Structural Sealant Glazing Systems (SSGS) Types I, II, III and IV for use as facades and roofs, or parts of them, when metal profiles with thermal barriers are used.

The document covers structural sealant support frames with thermal barriers whether or not they are the bearing structure of the facade or the roof.

Note : These support frames are usually the frames of prefabricated infill elements.

If the members of the structure of the facade (or roof) directly support the structural sealant, they are covered by this guideline. If these members of the structure do not directly support the structural sealant they may be part of the system, but they are normally not covered by this guide.

This Guideline does not cover profiles where the thermal barrier is in the form of screws, pins or other discontinuous metal elements connecting the two parts.

Systems where permanent tensile stresses (1) in the thermal barrier applied, are not covered by this guide.

3. Terminology

3.1 Particular terminology and abbreviations

(20) Profiles with a thermal barrier

Metal profiles, incorporating a continuous thermal barrier, used in SSGS kits.

These profiles comprise two parts formed from aluminium or steel. The two parts of the profile are connected together with one or more continuous synthetic materials, called a thermal barrier, held in place by bonding, clipping, injecting, pouring or a combination of these methods.

(21) Thermal barrier

Product incorporated in a profile which increases the thermal resistance of the profile in order to limit the heat transfer through the whole facade or roof and to reduce surface condensation on the interior face of the profiles themselves.

(1) In the direction of Q (see 5.1.4.1.1.1).

SECTION TWO : GUIDANCE FOR THE ASSESSMENT OF FITNESS FOR USE

4. Requirements

The requirements related to ER2 (safety in case of fire), ER3 (Hygiene, health and the environment), ER5 (protection against noise), ER6 (energy economy and heat retention) and Durability are identical to those expressed in part 1 - ER1 (mechanical resistance and stability) is not relevant to these products.

ER4 - Safety in use - is relevant as follows :

4.4.1 Gravity

The permanent load of the fixed glass may or may not induce permanent shear stresses in horizontal or non horizontal profiles, and if so shall be taken into account in the evaluation.

4.4.2 Effect of the wind and snow load

The action of the wind, considered perpendicular to the facade or to the roof (pressure and suction), may induce compression, tensile, torsion, shear and flexural stresses in the profiles with a thermal barrier with fatigue effect.

For roofs, the weight of snow may induce long-term, flexural, shear, compression and tensile stresses in the profiles.

All the considered stresses must be taken in account in the evaluation.

4.4.4.1 Effect of temperature

The hygrothermal stresses, mainly shear stresses during long periods with fatigue effect, due to thermal (or hygrothermal) gradient.

The extreme temperatures to be considered in the barrier are :

low temperature - 20 °C

high temperature + 70 °C for facades

+ 80 °C for roofs

For local climatic conditions temperatures outside these limits can be considered (e.g. in nordic countries a temperature of – 40 °C can be applicable).

4.4.5 Effect of water

The SSGS shall normally be designed to keep the thermal barrier free from stagnant water. Nevertheless, the thermal barrier shall not be sensitive to the action of water.

4.4.10 Effect of relative humidity

The thermal barrier shall not be sensitive to the continuous action of a high level of relative humidity.

The TABLE 2 is complemented as follows :

ER	ID	ID Clause for the works	Element involved (*)	Performance of the element (with reference to the ID)	Characteristics specified in the mandate	Corresponding characteristics in the WP	Test or evaluation method
4	4	3321 Impacts of falling objects forming part of the works, upon users	P	Mechanical resistance and stability	Wind and snow load resistance	Mechanical resistance and stability	– Tensile test – Shear test – Ageing test

(*) P = profile with a thermal barrier

5. Methods of verification

The following methods of verification have been used for more than 15 years to evaluate the behaviour of profiles with a thermal barriers made from polyamide strips, poured PUR and PVC based product strips. For polyphenylene oxide more than 5 hears of experience is available.

If other types of profiles are to be evaluated, additional tests may be needed, for instance : hygroscopic behaviour, freeze-thaw, durability tests etc.....The approval body must decide which tests are needed. The Technical Dossier of the ETA shall as far as possible refer to documents where such methods are described.

5.1 Verification methods related to the essential requirements

For ER 2, 3, 5 and 6 the methods are identical to those described in part 1 of the guide.

If a kit is presented including profiles with and without a thermal barrier, some characteristics behaviour in fire, watertightness...) may need to be checked for both types.

The mechanical requirements given in 4.4.1, 4.4.2, 4.4.4.1, 4.4.8 and 4.4.9 are normally covered by the verifications given in 5.1.4.11.1, 2 and 3 hereafter.

TABLE 3 - Verification of performance - is completed as follows :

	Reference	**Term (1)**	**Element involved (1)**
5.1.4 Safety in use			
5.1.4.11 Profiles with a thermal barrier			
5.1.4.11.1 Tensile resistance	UEAtc (4)	ST	SF
5.1.4.11.2 Shear resistance	UEAtc (4)	ST	SF
5.1.4.11.3 Ageing test	UEAtc (4)	LT	SF
5.1.4.11.4 Stability in hot humid atmosphere	UEAtc (4)	LT	SF
5.1.4.11.5 Performance after immersion in water	UEAtc (4)	LT	SF
5.1.4.11.6 Compatibility with oil and cleaning agents (optional)	ISO	LT	SF
5.2 Verification methods related to the identification of products	ISO	ST	SF

(1) ST : Short term or initial store
LT : long term or aged state
SF : structural seal support frame

5.1.4 ER4 Safety in use

5.1.4.11 Profiles with a thermal barrier

Test pieces and pre-conditioning

The test pieces shall be cut from representative profiles, including the surface treatment being in line with their final application.

Before testing the test piece shall be conditioned for at least 2 days at 23 ± 5 °C in normal laboratory conditions.

If hygroscopic products (e.g. polyamide) are used, the relative humidity must be 50 + 5 % and longer conditioning time is needed, to ensure hygroscopic equilibrium (at least 2 weeks).

Test temperature

The measurement of tensile and shear strength is made at three different temperatures :

- low test temperature (- 20 ± 2) °C
- room temperature (+ 23 ± 2) °C
- high test temperature (+ 80 ± 3) °C or (+ 70 ± 3) °C

A temperature of the test pieces (as a whole) shall be maintained for the duration of the test.

The temperature of 70 °C is sufficient for facades. A temperature of 80 °C may be needed for roof applications.

5.1.4.11.1 Transverse tensile strength (Q)

The preferred size for test pieces is a length of 100 mm. The size can be reduced to a minimum of 18 mm as long as the cutting is carried out taking great care to avoid damage to the connection between the thermal barrier and the metal.

Number of test piece : ten for each temperature.

For determining the transverse tensile strength each test piece is fixed to the clamps of a tensile test machine (accuracy ± 1 %), then loaded at a rate in the range of 1 to 5 mm/min, in the axis of the thermal barrier, at the intended temperature.

The tensile strength Q of each test piece is obtained from : $Q = \frac{F_{max}}{\ell}$ with :

F_{max} : maximum tensile force in N

ℓ : length of the test piece in mm.

$Q_{u,5}$ is the characteristic value according to 6.2

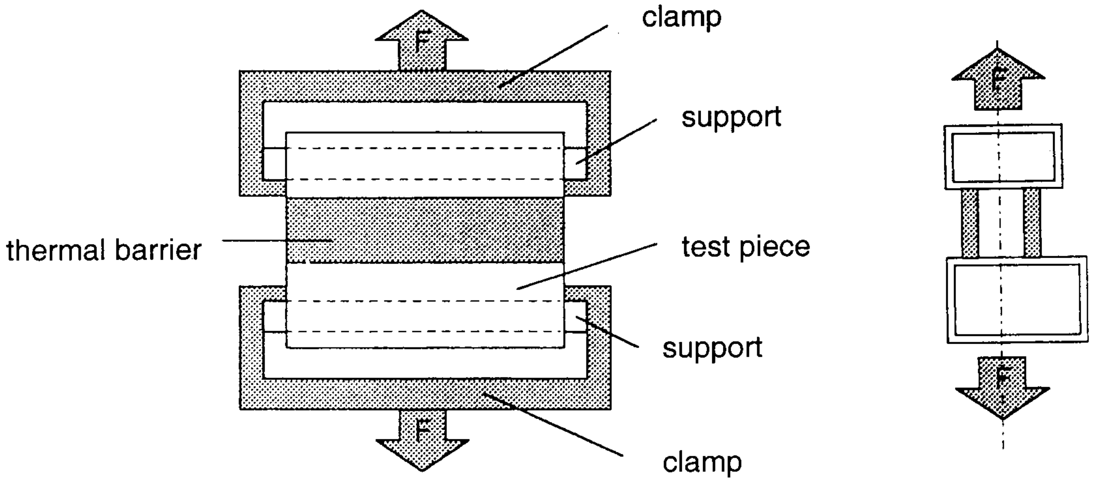

Figure 1 - Example of test assembly (side view and front view)

5.1.4.11.2 Shear strength and elasticity constant (T)

Test pieces

– ten test pieces for each temperature
– length : 100 ± 1 mm.

This size can be reduced to a minimum of 50 mm provided the barrier remains stable during the test.

For larger thermal barriers, inserts may be used to avoid possible buckling of the barrier during the test.

Test procedure

To determine the shear strength T and elasticity constant C each test piece is placed in a test device, according to figure 3. The test piece shall be guided laterally. The forces are transmitted to the profile by a rigid support in such a way as to ensure uniform distribution of the load but without any contact with the thermal barrier material.

The loading rate is 1 to 5 mm/min. The loads applied and the respective shear deformations shall be recorded up to the maximum load or at least 2 mm deformation if there is slip. Slip may need to be measured directly on the sample.

The value of the shear strength T for each test piece is obtained from the maximum shear load Fmax divided by the length ℓ of the test piece :

$$T = \frac{F_{max}}{\ell}$$

The elasticity constant C is obtained from the increase of the curve of deformation under load at the beginning of the deformation. The following rule shall apply :

$$C = \frac{F}{\delta \bullet \ell}$$

where δ is the displacement in mm in the case of the shear force F in N Newtons and ℓ is the length of the test piece in mm.

$T_{u,5}$ is the characteristic value according to 6.2.

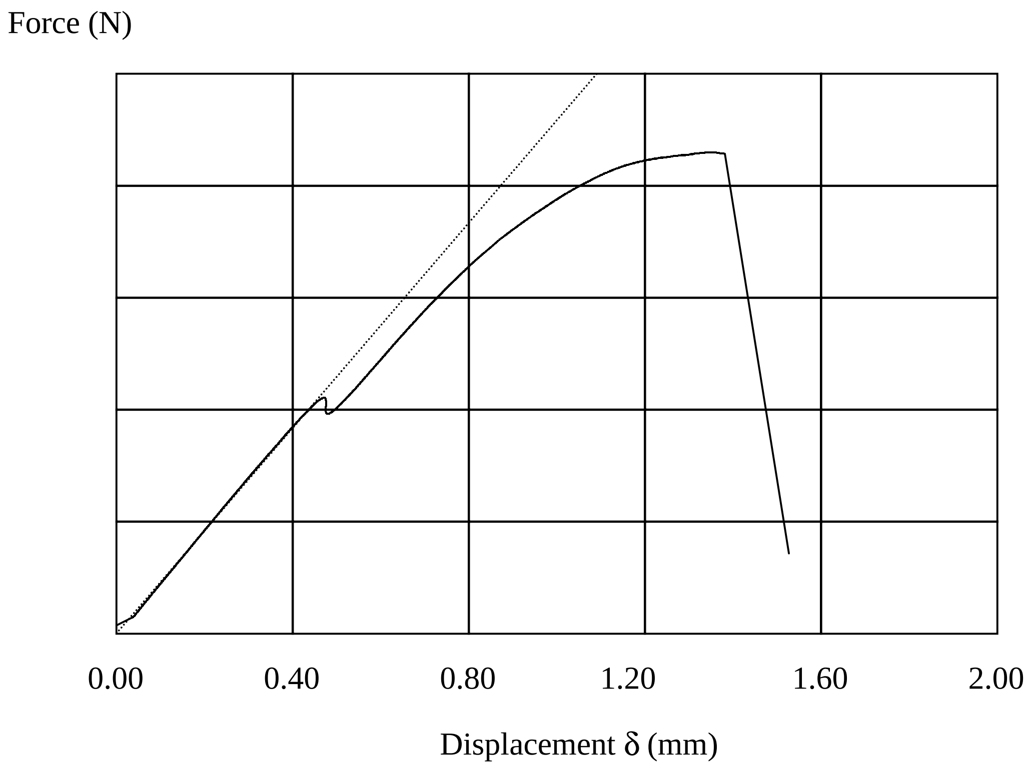

Figure 2 – Example of force / displacement curve

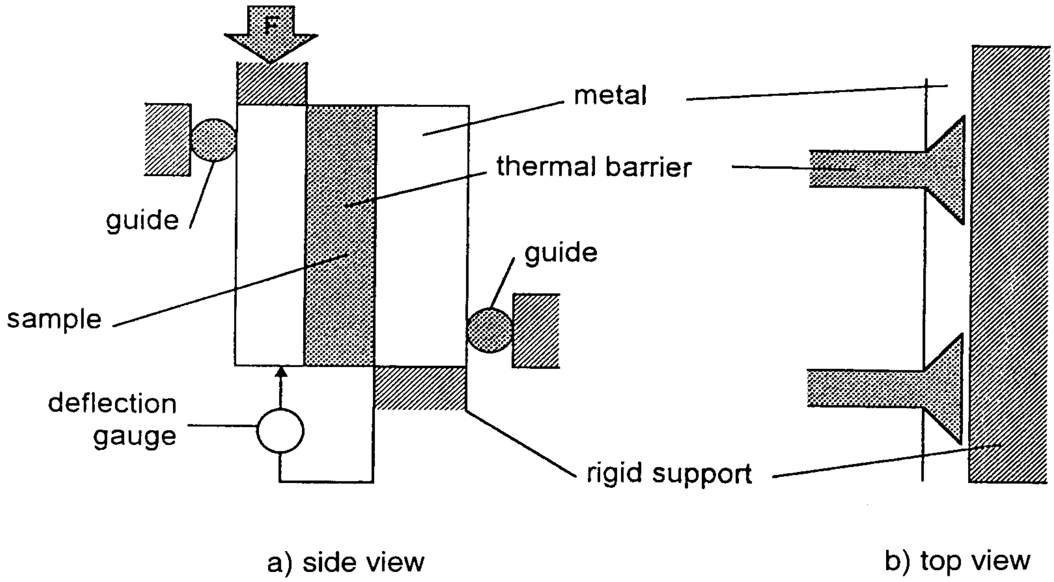

Figure 3 - Example of device

a) Side view of the test device (schematic) for determining the shear strength and the elasticity constant.

b) Top view section : The rigid support shall not restrain slip of the thermal barrier material.

5.1.4.11.3 Ageing

Depending on the application and the type of geometry of the profile an ageing procedure according to the following table shall be used :

	Frame of an infill element or opening part of a window (or door)	**Structural frame of the facade or roof**
Type 1	Method 1 or 2	Method 1 and method 3
Type 2	Method 2(1)	To be considered case by case (1)

The behaviour of the thermal barrier depends on the geometry of the profile section and the direction of the load. Two types of load situation are to be distinguished, see figure 4 for examples. In figure 4 the arrow corresponds to the application of the wind action.

(1) Method 4 is applicable in addition in specific cases described at the end of the paragraph.

Type 1 : Profiles where the load is symmetric or near to symmetry. The eccentricity a/b shall not exceed the value $\alpha = Q_{u,5}(23°)/Q_{req}$ where Q_{req} is the minimum required value of the transverse tensile strength (see chapter 6) and $Q_{u,5}$ (23°) is the characteristic value obtained at 23°C.

Type 2 : Profiles where the load is non-symmetric, for instance profiles where $\alpha \geq 1$ or profiles according to figure 4.

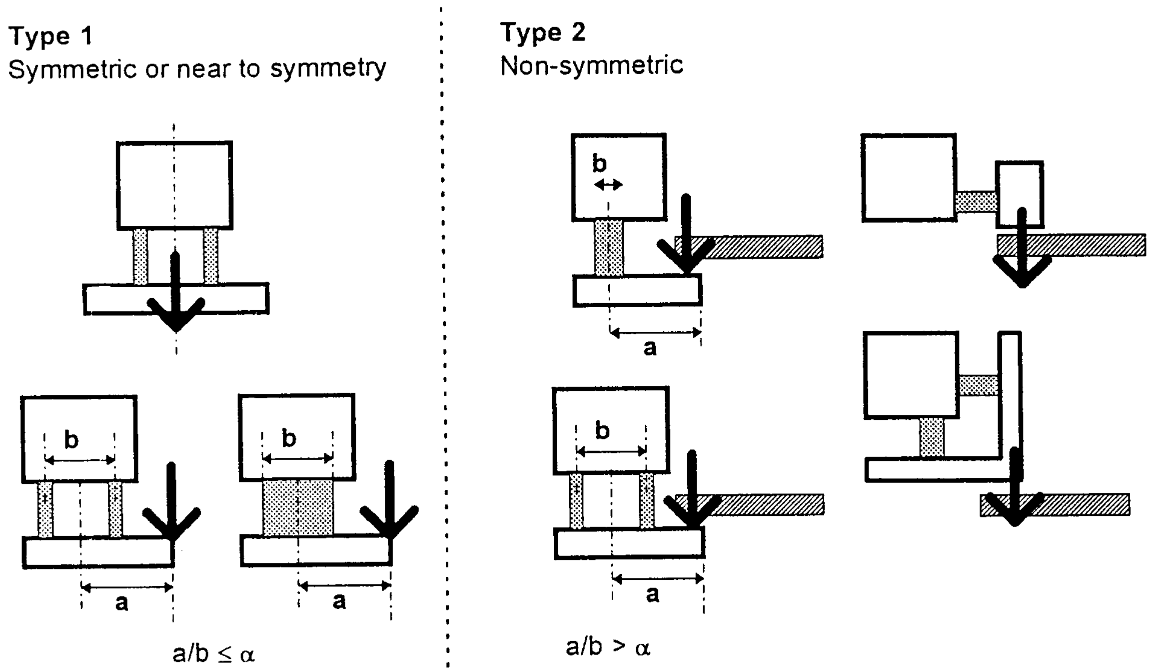

Figure 4 - Examples for symmetric or near symmetric loaded profiles (type 1) and non- symmetric profiles (type 2).

Method 1 - Permanent transverse tension at high temperature.

The length of the sample shall be (100 $\pm$1) mm.

The samples are exposed to a transverse tensile test applied for a period of 1000 h at a temperature of 80°C and a constant load of 10 N/mm. The residual elongation (deformation) Δh after ageing is determined.

After the ageing test the profile is cut into appropriate sample lengths and submitted to the tests defined in 5.1.4.11.1 and 2.

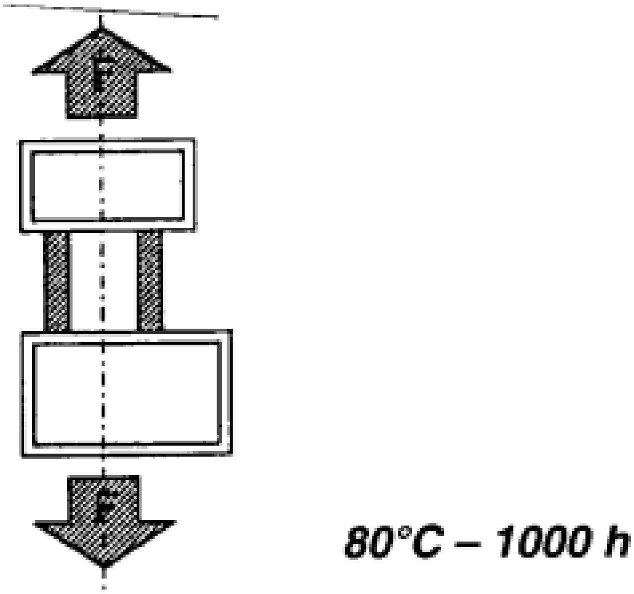

Figure 5

Note : This test may be undertaken after the shear test if the shear failure does not occur in the thermal barrier itself.

Method 2 - Variable load and temperature

A section of profile measuring at least 500 mm in length is placed in a climatic chamber, with air circulation, with its upper part fixed to a rigid support, see figure 6. The profile bar is simultaneously subjected to thermal cycles and mechanical stresses.

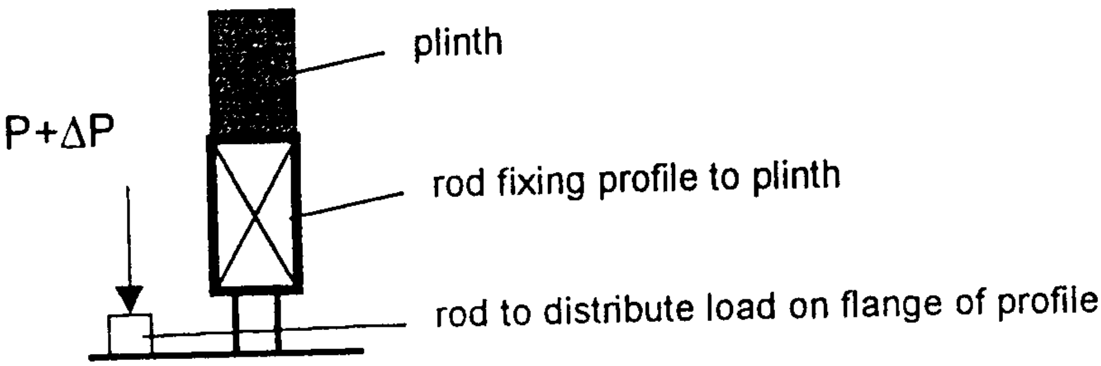

Figure 6 - Fixing of the test piece

Mechanical stresses

The load P to be applied is determined as a function of the length of the profile in such a way as to exert a constant linear force of (1,00 ± 0,01) N/mm on the flange of the profile. In addition to the constant load P, a cyclic force ΔP of ± (0,25 ± 0,01) N/mm is exerted. Loads are applied in a direction parallel to the bottom of the rebate for 10^6 cycles, see figure 7.

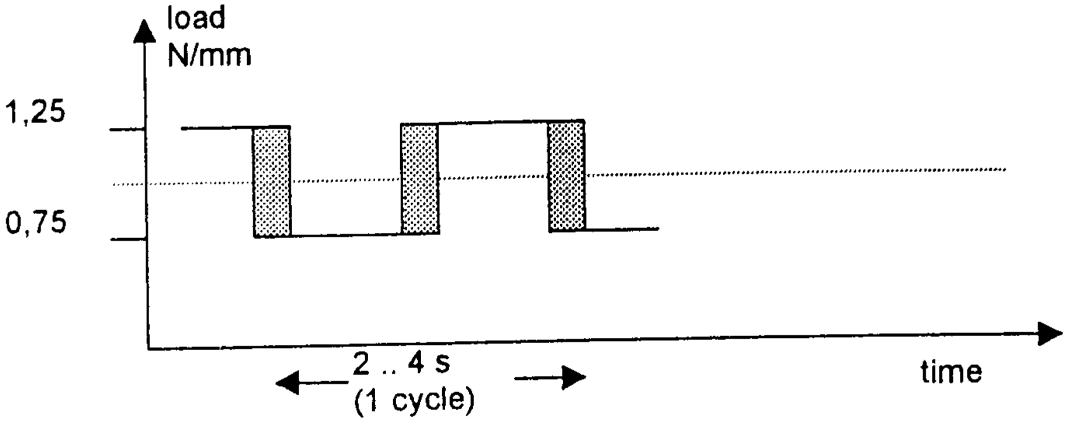

Figure 7 - Loading cycle

Thermal stresses

In parallel with the mechanical stresses, the temperature of the ambient air is varied between -10°C and +70°C according to the cycle shown in the diagram in figure 8.
Temperatures shall be maintained within ± 5°C.

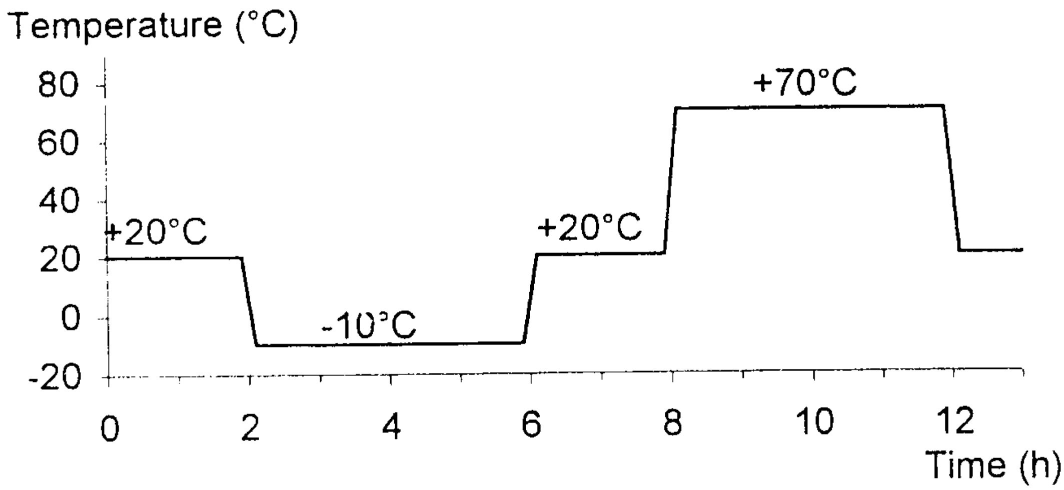

Figure 8 - Thermal cycle - 12 hours

Residual deformation f

Stability of the profile is assessed by the measurement of the residual deformation produced by the torsional load as shown in figure 9. This measurement is taken within 0,1 mm.

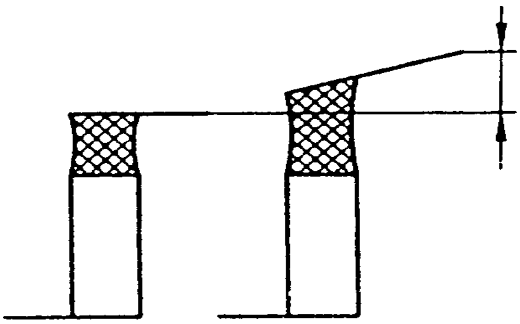

Figure 9 - Measurement of the residual deformation produced under torsional stress

Q and T tests after ageing test

After the ageing test the profile is cut into appropriate sample lengths and submitted to the tests defined in 5.1.4.11.1 and 2.

Method 3 - Permanent longitudinal shear tension and high temperature

This test serves for determination of the reduction factor A_2.

In order to test for shear-creep deformation, a load corresponding to 1/3 of the characteristic value of short-time shear strength $T_{u,5}$ at high temperature (70°C or 80°C) is applied to ten test pieces for a period of 1000 h at a temperature of 80°.

$$A_2 = \frac{T_{u,5}\,(23)\,N}{T_{u,5}\,(23)\,C}$$

$T_{u,5}$ (23) N is obtained with non-aged test pieces

$T_{u,5}$ (23) C is obtained with aged test pieces.

Method 4 - Permanent transverse shear tension and high temperature

This test is applicable for profiles which, in use, must support a permanent transverse shear load, such as transoms of roof frames (without mechanical fixing of the external profiles at the corners by means of e.g. a corner bracket) submitted to the permanent load of glass and snow.

A creep test similar to method 1 can be used as follows.

The length of the sample shall be (100 ± 1) mm.

The samples are exposed to a transverse shear load applied for a period of 1000 h at a temperature of 80 °C and a constant load F of 3N/mm (figure 10). The residual deformation $\Delta h'$ after ageing is determined.

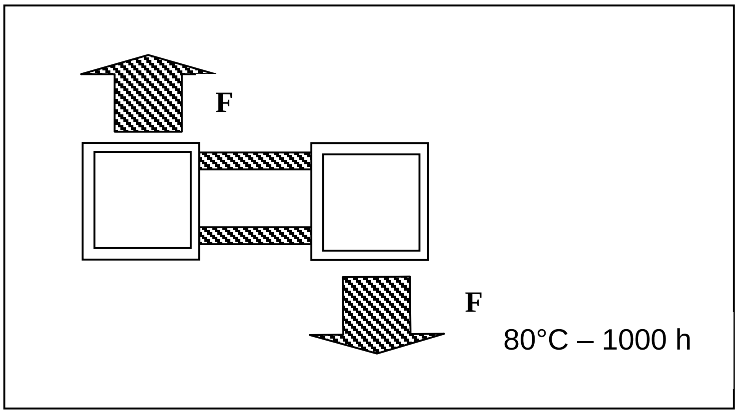

Figure 10

5.1.4.11.4 Stability in a hot humid atmosphere

The transverse tensile strength Q of ten test pieces is determined, at 23 °C according to the tensile test (see description in 5.1.4.11.1) after storage for a period of 96 hours in a hot, saturated atmosphere (85 ± 5 °C, 95 to 100 % relative humidity).

5.1.4.11.5 Performance after immersion in water

Ten test pieces as defined for the measurement of Q, are immersed in water at a temperature of 23 ± 2 °C for a period of 1000 hours. After having stored each test piece for a period of 24 hours at 23 ± 2 °C the transverse tensile strength Q shall be measured at room temperature according to 5.1.4.11.1.

5.1.4.11.6 Compatibility with oil and cleaning agents (optional)

To demonstrate the compatibility of a cleaning agent with the material of the thermal barrier the following test procedure shall be executed.

The material of the thermal barrier is immersed for 21 days in the cleaning product (see 5.1.4.2.4. Facade cleaning products), and is then subjected to a tensile test (ISO 527) after 24 h conditioning at 23 °C 50 % RH. The same procedure can be applied with drilling and cutting oils.

5.1.4.11.7 Brittleness (optional test)

Impact test to be detailed or tensile test as follows : The transverse tensile strength of ten test pieces is determined according to the tensile test (see description in 5.1.4.11.1) executed at a temperature of –10 °C and at a loading rate of 200 mm/min.

5.2 Verification methods related to the identification of the products

The thermal barrier profiles are to be identified by a description of the materials used and of the technology used to connect the different materials. The thermal barrier material shall be identified by a series of characteristics specific to each material (examples listed below), trade name and the name of firm producing the thermal barrier itself and/or the raw material.

Methods as « IR spectrography» or a « thermogravimetry » can be used for thermal barrier materials.

5.2.6.2.1 Polyurethane (with or without glass fibre filling)

5.2.6.2.1.1 Density - ISO 1183

5.2.6.2.1.2 Tensile strength - ISO 527

5.2.6.2.1.3 Elongation at rupture - ISO 527

5.2.6.2.1.4 Tensile modulus - ISO 527

5.2.6.2.1.5 Resistance to heat under flexural load - ISO 75

5.2.6.2.1.6 Percentage of glass fibres - ISO 3451.

5.2.6.2.2 Glass-filled polyamide, polyphenylene oxide, or polypropylene

Measurements must be made in well defined conditions of the material, for instance for polyamide the moisture content must be determined prior to testing.

5.2.6.2.2.1 Density - ISO 1183

5.2.6.2.2.2 Tensile strength - ISO 527

5.2.6.2.2.3 Elongation at rupture - ISO 527

5.2.6.2.2.4 Tensile modulus - ISO 527

5.2.6.2.2.5 Melting point - ISO 3146

5.2.6.2.2.6 Percentage of glass fibres - ISO 3451

5.2.6.2.3 PVC base product

5.2.6.2.3.1 Density - ISO 1183

5.2.6.2.3.2 Tensile strength - ISO 527

5.2.6.2.3.3 Elongation at rupture - ISO 527

5.2.6.2.3.4 Tensile modulus - ISO 527

5.2.6.2.3.5 Vicat softening point – ISO 306

5.2.6.2.3.6 Ash content – ISO 3451-5

5.2.6.2.3.7 Dehydrochlorination (DHC) – ISO 182/2.

The Approval body shall insure that suitable tolerances are applied to the above characteristics, taking into account the effect of there variability on the performances of the profiles.

5.3 Verification necessary in case of interchange of components or suppliers.

The table 6 is complemented as follows :

See Annex 4 for extrapolation of the mechanical resistance

TABLE 6 - Components interchange

Component	Test for characteristics	Identification tests
Profile with a thermal barrier	5.1.4.1.1.	5.2

Interchange of two thermal barriers is possible, if the profiles have :

- The same geometry.
- The same material (origin, generic type and identification) is used for the thermal barrier.
- The same technique is used to assemble the complete profile and the same reference of metal is used.

If the eccentricity of a second profile is less than the first, one may consider that certain characteristics may decrease (e.g. impact resistance of the full frame...).

6. Assessing and judging the fitness of products for an intended use

6.1. Preamble

It is absolutely impossible to define in general all the criteria and test methods applicable for all systems using profiles with a thermal barriers, considering :

- the different possible natures of barriers
- the different geometries of profiles and frames
- the different actions

Consequently, an analysis case by case is needed for each ETA.

Nevertheless, experience of a number of years in service, of profiles and frames incorporating thermal barriers of poured PUR, glass filled polyamide, polypropylene and modified PVC, has shown that the use of the following assessment criteria gives a satisfactory performance.

For unknown thermal barriers other tests and investigations (durability, fatigue...) may be needed.

6.2 General - test result statistical interpretation

The formulation given in part 1 is applicable (except the type of rupture) to :

– tensile resistance : Q

– shear resistance : T

The statistical interpretation of these tests which lead to a characteristic value shall be made in accordance with table 7 in para 6.1 of part 1 of this guideline. For a test series with 10 test pieces $\tau = 2{,}10$.

$$Q_{u,5} = Q_{mean} - \tau \times S$$

$$T_{u,5} = T_{mean} - \tau \times S$$

6.3 Criteria

The different criteria of acceptance are defined in the table 8-3 “ER4 – Complementary table” which complements table 8-3 of Part 1 and Part 2.

with $\Delta Q_{mean} = \dfrac{Q_{mean,c}}{Q_{mean,n}}$

and $\Delta T_{mean} = \dfrac{T_{mean,c}}{T_{mean,n}}$

c means that the results are obtained after an ageing procedure : method 1, method 2, dry hot atmosphere, immersion….

TABLE 8-3 - ER4 complementary table

Reference	Verification methods	Reference	Treatment of results and requirements - Criteria
ER4 safety in use			
5.1.4.11.1	Tensile strength (Q)	6.1.4.11.1	$Q_{u,5} \geq Q_{req}$ at normal, low and high temperature. Infill element : Q_{req} = 12 N/mm Profile used for the structure of the facade/ roof : Q_{req} = 20 N/mm $(Q_{req} = Q_{required})$
5.1.4.11.2	Shear strength (T)	6.1.4.11.2	$T_{u,5}$ ≥ 24 N/mm at normal, low and high temperature
5.1.4.11.3	Deformation, tensile and shear strength after ageing (mechanical and conditioning procedure method 1 or 2).	6.1.4.11.3	$Q_{u,5}$ ≥ 12 N/mm and ΔQ_{mean} ≥ 0,6 $T_{u,5}$ ≥ 24 N/mm and ΔT_{mean} ≥ 0,6 and deformation limits : – method 1 : Δh ≤ 1 mm – method 2 : f ≤ 2 mm
5.1.4.11.3	Longitudinal shear Resistance (creep test according to method 3)	6.1.4.11.3	$T_{u,5}$ (23°) after ageing method 3 ≥ $\frac{T_{u,5}\ (23°C)}{A_2}$ A_2 = reduction factor
5.1.4.11.3	Transverse shear resistance (creep test according to method 4)	6.1.4.11.3	$\Delta h'$ ≤ 2 mm $Q_{u,5}$ ≥ 12 N/mm $T_{u,5}$ ≥ 24 N/mm
	Tensile strength after conditioning :		
5.1.4.11.4	– humid hot atmosphere (85°C - 100 % RH)	6.1.4.11.4	$Q_{u,5}$ (23°) ≥ 12 N/mm and ΔQ_{mean} ≥ 0,7
5.1.4.11.5	– immersion in water (1000 h)	6.1.4.11.5	$Q_{u,5}$ (23°) ≥ 12 N/mm and ΔQ_{mean} ≥ 0,7
5.1.4.11.6	– Compatibility with cleaning agents and/or drilling and cutting oils	6.1.4.11.6	$Q_{u,5}$ (23°) ≥ 12 N/mm and ΔQ_{mean} ≥ 0,7
5.1.4.11.7	Brittleness (option)	6.1.4.11.7	$Q_{u,5}$ (-10°C) ≥ 12 N/mm

TABLE 8-6 - Verification methods related to the identification of the products

Reference	Verification methods	Reference	Treatment of results and requirements - Criteria
Verification methods related to the identification of the products			
5.2.6 Profiles with a thermal barrier			
5.2.6.1	Metallic alloy	6.2.6.1	Identification conforming to 5.2.2.1 or 5.2.4 as a function of the metal used
5.2.6.2	Thermal barrier material		
5.2.6.2.1	*Polyurethane*		
5.2.6.2.1.1	Density	6.2.6.2.1.1	ISO 1183 $V_{mean,}S$
5.2.6.2.1.2	Tensile strength	6.2.6.2.1.2	ISO 527 $V_{mean,}S$
5.2.6.2.1.3	Elongation at rupture	6.2.6.2.1.3	ISO 527 $V_{mean,}S$
5.2.6.2.1.4	Tensile modulus	6.2.6.2.1.4	ISO 527 $V_{mean,}S$
5.2.6.2.1.5	Resistance to heat under flexural load	6.2.6.2.1.5	ISO 75 $V_{mean,}S$
5.2.6.2.1.6	Glass fibre %	6.2.6.2.1.6	ISO 3451 $V_{mean,}S$
5.2.6.2.2	*Polyamide glass-filled or polypropylene*		
5.2.6.2.2.1	Density	6.2.6.2.2.1	ISO 1183 $V_{mean,}S$
5.2.6.2.2.2	Tensile strength	6.2.6.2.2.2	ISO 527 $V_{mean,}S$
5.2.6.2.2.3	Elongation at rupture	6.2.6.2.2.3	ISO 527 $V_{mean,}S$
5.2.6.2.2.4	Tensile modulus	6.2.6.2.2.4	ISO 527 $V_{mean,}S$
5.2.6.2.2.5	Melting point	6.2.6.2.2.5	ISO 3146 $V_{mean,}S$
5.2.6.2.2.6	Glass fibre %	6.2.6.2.2.6	ISO 3451 $V_{mean,}S$
5.2.6.2.3	*Modified PVC*		
5.2.6.2.3.1	Density	6.2.6.2.2.1	ISO 1183 $V_{mean,}S$
5.2.6.2.3.2	Tensile strength	6.2.6.2.2.2	ISO 527 $V_{mean,}S$
5.2.6.2.3.3	Elongation at rupture	6.2.6.2.2.3	ISO 527 $V_{mean,}S$
5.2.6.2.3.4	Tensile modulus	6.2.2.6.2.4	ISO 527 $V_{mean,}S$
5.2.6.2.3.5	VICAT point	6.2.6.2.2.5	ISO 306 $V_{mean,}S$
5.2.6.2.3.6	Ash-content	6.2.6.2.2.6	ISO 3451-5 $V_{mean,}S$
5.2.6.2.3.7	Dehydrochlorination (DHC)	6.2.6.2.2.7	ISO 182-2 $V_{mean,}S$

SECTION THREE - ATTESTATION AND EVALUATION OF CONFORMITY

8. Attestation and Evaluation of conformity

8.3 Documentation

8.3.2.4 Test plan as part of FPC

Checks on incoming material

(V i i i) On each batch of profiles with a thermal barrier.

No specific test by the ETA holder is required.

However he shall communicate the declaration provided by the producer of profiles with a thermal barrier which establishes that the profiles supplied for the project are identical to the product described in the ETA.

The technical file accompanying the declaration for the profile delivery shall include a summary of the test record collected during the factory production control of the profiles, containing at least the following results :

– dimensions and cross sections,

– T beginning and end of batch, and every 200 bars,

– Q for each new profile,

– shrinkage (100°C - 1 h) if PU poured, once a week.

When profiles are non-anodised and non coated (coating after assembly of the profile) test piece for T and Q are conditioned prior to test during 20 minutes at 200°C.

Annex 3 - Reference documents

UEAtc (4) - Guidelines for the assessment of thermal break metal windows August 1990.

ISO 75 - Plastics - Determination of temperature of deflection under load.

ISO 306 - Plastics - Thermoplastic materials – Détermination of Vicat Softening Temperature (VST).

ISO 527 - Plastics – Determination of tensile properties.

ISO 1183 - Plastics - Methods for determining the density and relative density of non-cellular plastics

ISO 3146 - Plastics – Determination of melting behaviour (melting temperature of melting range) of semi-crystalline polymers.

ISO 3451-5 - Plastics – Determination of ash.

ISO 182-2 - Dehydrochlorination

Annex 4 - Extrapolation rules

The **T, c, Q** mechanical characteristics performed on e typical profiles of a particular set can be extrapolated to other sets of profiles of the same type of geometry (see 5.1.4.11.3), provided the respect of the following rules :

T and Q : in order the T, Q values to be extrapolated from a set of profile to another one, both sets have to be equal to the point of view of the following characteristics :

- the mechanical characteristics of the materials of the thermal barrier (PA, PUR resin, PUR foam, PPO, …) and the metal part (aluminium, stainless steel,…),

- the technology used to connect the 2 materials, methodology of this technology,

  e.g. 1 – technology : unrolling of PA thermal barrier profile in a aluminium groove, methodology : notching of the groove, insertion of the thermal barrier profile of the groove, setting (pressing) of the aluminium on the TB, …

  e.g. 2 – technology : PUR resin poured in an aluminium section, methodology : notching of the groove, pouring of the resin, removing of the aluminium bridge in order to have 2 aluminium sections connected by the thermal barrier,…

- to the geometrical characteristics of the metallic part and thermal barrier at their connected interface,

- to the thickness (t_b) of the thermal barrier and to the thickness of the metal wall (t_m) at connection place.

c : in order the c value to be extrapolated from a set of profiles to another one, additionally to the points mentioned for T and Q here above, both sets have to present the same height (h) of the thermal barrier. Extrapolation in nevertheless permitted from higher height to smaller one.