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National Standard of the People's Republic of China

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Replace GB/T 5237.6—2012

Wrought aluminum alloy extruded profiles for architecture—Part 6: Thermal barrier profiles

铝合金建筑型材 第6部分:隔热型材

(*English Translation*)

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Foreword

SAC/TC 243 is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

The GB/T 5237 *Wrought aluminium alloys extruded profiles for architecture* consists of the following six parts under the general title:

—*Part 1*: *Mill finish profiles*;

—*Part 2*: *Anodized profiles*;

—*Part 3*: *Electrodeposition coating profiles*;

—*Part 4*: *Powder coating profiles*;

—*Part 5*: *Paint coating profiles*;

—*Part 6*: *Thermal barrier profiles*.

This is the sixth part of GB/T 5237.

This part is drafted in accordance with rules given in the GB/T 1.1—2009.

This part replaces the GB/T 5237.6—2012 *Wrought aluminium alloys extruded profiles for architecture—Part 6*: *Thermal barrier profiles* in whole. In addition to a number of editorial changes, the following technical deviations have been made with respect to the GB/T 5237.6—2012.

—Deleted the statement in the foreword"In this part, article 4.5.1.2 and 4.5.2.2 are compulsory. Other contents are recommended"(See the foreword of 2012 edition);

—Added the normative reference GB/T 2411 (See clause 2 and subclause 6.5);

—Deleted the normative reference GB/T 6682 (See clause 2 and subclause A.3.1 of 2012 edition);

—Deleted the normative reference YS/T 436 (See clause 2 and subclause 4.1.3 of 2012 edition);

—Added the normative reference GB/T 34482 (See clause 2 and subclause 5.4);

—Added the stipulations of aluminum profile surface treatments categories, the coating appearance,

coating code, ranks of coating performance and application environment (See subclause 4.1.2);

—Modified the content of composite modes of thermal barrier profiles classification (See subclause 4.1.3 , subclause 4.1.2 of 2012 edition);

—Added the classification for the type of shear failure in product category (See subclause 4.1.4);

—Added the contents to the product classification including thermal transmittance of thermal barrier profiles and application environment, the height of polyamide profile, the model of poured and debridged thermal barrier profiles groove (See subclause 4.1.5);

—Modified the stipulation of cross-sectional dimensions of thermal barrier profiles (See subclause 4.1.6, subclause 4.1.3 of 2012 edition);

—Modified the stipulation of marking and examples (See subclause 4.1.7, subclause 4.1.4 of 2012 edition);

—Added the content of quality assurance (See subclause 4.2);

—Modified the requirement of aluminum alloy profile (See subclause 4.3, subclause 4.2 of 2012 edition);

—Modified the requirement of thermal barrier material (See subclause 4.4, subclause 4.3 of 2012 edition);

—Modified the stipulation of dimension tolerance of thermal barrier profiles (See subclause 4.5, subclause 4.4 of 2012 edition);

—Added the requirement of thermal transmittance of thermal barrier profiles (See subclause 4.6);

—Added the stipulation of "except for type O thermal barrier profiles" in the requirement for characteristic longitudinal shear strength of inserted profiles (See subclause 4.7.1.1, subclause 4.5.1 of 2012 edition);

—Modified the regulation for test temperature of inserted profiles property at low temperature (See subclause 4.7.1.1, 4.7.1.3, 5.5.1.1, 5.5.1.3, 5.5.1.4 and 5.5.1.6, subclause 4.5.1 of 2012 edition);

—Modified the requirement for elasticity constant of inserted profiles (See subclause 4.7.1.4, subclause 4.5.1.3 of 2012 edition);

—Modified the torsional performance to flexural performance, and the corresponding requirement of quality (See subclause 4.7.1.6 and 4.7.2.4, subclause 4.5.1.3 and 4.5.2.1 of 2012 edition);

—Added the requirement of thermal cycling fatigue performance(See subclause 4.7.1.7);

—Modified the stipulation of the characteristic transverse tensile strength at high temperature of poured and debridged thermal barrier profiles (See subclause 4.7.2.2, subclause 4.5.2.1 of 2012 edition);

—Modified the requirement of performance test of thermal barrier material (See subclause 5.2, subclause 5.2 of 2012 edition);

—Modified the requirement for measurement of the dimension tolerance of thermal barrier profiles (See subclause 5.3, subclause 5.3 of 2012 edition);

—Added the test method of thermal transmittance of thermal barrier profiles (See subclause 5.4);

—Modified the requirement of performance test of mechanical properties of thermal barrier profiles (See subclause 5.5, subclause 5.4 of 2012 edition);

—Modified the requirement of test method for appearance (See subclause 5.6, subclause 5.5 of 2012 edition);

—Modified the method of grouping (See subclause 6.2, subclause 6.2 of 2012 edition);

—Added the stipulation of inspection and category (See subclause 6.3);

—Modified the stipulation of inspection items (See subclause 6.4, subclause 6.3 of 2012 edition);

—Modified the stipulation of sampling (See subclause 6.5, subclause 6.4 of 2012 edition);

—Modified the judging requirement of inspection result (See subclause 6.6, subclause 6.5 of 2012 edition);

—Modified the stipulation of marking (See subclause 7.1, subclause 7.1 of 2012 edition);

—Modified the stipulation of packing (See subclause 7.2, subclause 7.2 of 2012 edition);

—Modified the stipulations of delivery and storage (See subclause 7.3, subclause 7.2 of 2012 edition);

—Modified the content requirement of quality certificate(See subclause 7.4, subclause 7.3 of 2012 edition);

—Modified the content requirement of order (or contract)(See clause 8, clause 8 of 2012 edition);

—Deleted Annex A (See 2012 edition Annex A);

—Added the informative Annex of quality assurance(See Annex A);

—Added six typical cavities and dimensions(FF、GG、HH、II、JJ、KK) to the contents of cavity design of thermal barrier profiles (See subclause C.2.1, subclause C.2 of 2012 edition);

—Added the content of the choice for single cavity and multi-cavities (See subclause C.2.2 and C.2.3);

—Added bibliography (See bibliography).

This part was proposed by China Nonferrous Metals Industry Association.

This part was prepared by SAC/TC 243 State Administration of China for Standardization of Nonferrous Metals.

The previous editions of GB/T 5237.6 are as follows:

—GB 5237.6—2004, GB/T 5237.6—2012.

Wrought aluminum alloy extruded profiles for architecture— Part 6: Thermal barrier profiles

1 Scope

This part of GB/T 5237 specifies content of thermal barrier profiles (also called thermal break profiles) the terms definitions requirements, test methods, conformity standards, marking, packaging, transporting, storing, quality certificate and order (or contract).

This part is applicable to thermal barrier architecture aluminum alloy profiles with insertion methodology (hereafter referred to as "inserted profiles") or thermal barrier architecture aluminum alloy profiles with poured and debridged methodology (hereafter referred to as "poured and debridged profiles").

The thermal barrier profiles for other industries may refer to this part.

2 Normative references

The following referenced documents are indispensable for the application 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.

GB/T 2411, *Plastics and ebonite—Measurement of indentation hardness by utilizing durometers (shore hardness)*

GB/T 3199, *Wrought aluminum and aluminum alloy products—Packing, marking, transporting and storing*

GB/T 5237.1, *Wrought aluminum alloy extruded profiles for architecture—Part 1: Mill finish profiles*

GB/T 5237.2, *Wrought aluminum alloy extruded profiles for architecture—Part 2: Anodized profiles*

GB/T 5237.3, *Wrought aluminum alloy extruded profiles for architecture—Part 3: Electrodeposition*

coating profiles

GB/T 5237.4, *Wrought aluminum alloy extruded profiles for architecture—Part 4: Powder coating profiles*

GB/T 5237.5, *Wrought aluminum alloy extruded profiles for architecture—Part 5: Paint coating profiles*

GB/T 23615.1, *Thermal barrier materials for architecture aluminum alloy extruded profiles—Part 1: Polyamide profiles*

GB/T 23615.2, *Thermal barrier materials for architecture aluminum alloy extruded profiles—Part 2: Thermal barrier polyurethane*

GB/T 28289, *Standard test method for mechanical properties of thermal barrier profiles*

GB/T 34482, *Determination of thermal transmittance for architecture aluminum alloy thermal barrier profiles*

YS/T 437, *Moment of inertia calculation methods and computing software requirements of aluminum profiles*

3 Terms and definitions

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

3.1

thermal barrier material

non-metallic materials with low thermal conductivity which used which connection between aluminum profiles

3.2

insertion methodology

the polyamide profiles are inserted into the groove of aluminum alloy profiles and mechanical locked by knurling, inserting and rolling [as shown in Figure 1a)]

3.3

poured and debridged methodology

Liquid thermal barrier is poured into the cavity of aluminium profiles. After curing, the aluminium bridge is debridged. The interior and the exterior aluminium sections are connected by thermal barrier [as shown in Figure 1b)].

3.4

thermal barrier profiles

composite profiles composed of aluminium profiles connected by thermal barrier material, which have thermal insulation performance

3.5

characteristic value

characteristic value has a 95% chance of being exceed based on logarithmic normal distribution with 75% confidence

4 Requirements

4.1 Classification

4.1.1 Alloy, temper and dimension

Alloy, temper and dimension of aluminium profiles shall be in accordance with GB/T 5237.1.

4.1.2 Aluminum profiles surface treatment categories, coating appearance, coating code, coating performance classes and recommended application environment

Aluminum profiles surface treatment categories, coating appearance, coating code, coating performance classes and recommended application environment are shown in Table 1.

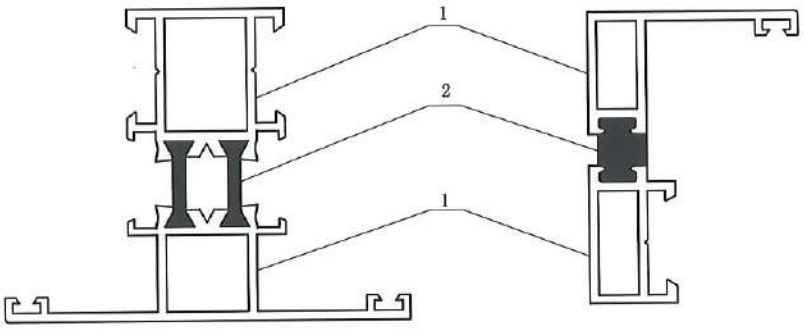
Table 1—Aluminum profiles surface treatment categories, coating appearance, coating code, coating performance classes and recommended application environment

aluminum profile surface treatment categories	coating appearance		coating code	coating performance classes[a]	recommended application environment
anodizing	mill finish surface, matt surface, polished surface, brushing surface		AA10,AA15,AA20,AA25	—	Anodic oxide coating is applicable to strong ultraviolet radiation environment. In environment with heavier pollution or humidity, AA20 or AA25 anodic oxide coating should be chosen. In marine environment, the coating should be chosen and used with cautious
electrode position coating	gloss or matt clear paint		EA21,EB16	Ⅳ、Ⅲ、Ⅱ	Combined coating is applicable to most situations, but class Ⅲ or Ⅳ combined coating should be more suitable for tropical marine environment
	gloss or matt colored paint		ES21		
powder coating	flat effect		GA40,GU40,GF40,GO40	Ⅲ、Ⅱ、Ⅰ	Powder coating is applicable to most situations, but class Ⅱ or Ⅲ powder coating should be more suitable for the humid tropical marine environment
	texture effect	sand texture, wood grain, marble effect, structured colour carving, metallic effect			
paint coating	solid color or mica pearlescent effect		LF2-25	—	PVDF coating is applicable for most environments with stronger solar radiation and stronger atmospheric corrosion, especially the tropical ocean environment near the coast
	metallic effect		LF3-34, LF4-55		

[a] Electrodeposition coating performance classes shall be in accordance with GB/T 5237.3; Powder coating performance classes shall be in accordance GB/T 5237.4.

4.1.3 Composite methods for thermal barrier profiles

The composite methods for thermal barrier profiles include insertion methodology[Figure 1a)] and poured and debridged methodology[Figure 1b)], according to composite methods, as shown in Table 2.



a) insertion methodology b) poured and debridged methodology

Key

1 Aluminum profiles;

2 Thermal barrier material.

Figure 1—The diagram of thermal barrier profiles composite methods

Table 2—Composite methods and characteristic of thermal barrier profiles

composite method[a]	characteristic of thermal barrier profiles[b,c]
insertion methodology	The linear expansion coefficient of polyamide profile used in the inserted profiles is close to that of aluminum alloy profile, which will not cause major stress, slip dislocation and falling off in the composite part due to thermal expansion and contraction. The inserted profiles have good high-temperature performance and many selective section types, and no special environmental requirements for production process of the inserted profiles. But if the production process, including knurling, rolling, is not controlled properly, it will seriously affect the product performance(e.g. polyamide profiles and aluminum profiles may separate during use). Non-I-type complex shape of polyamide profiles may be used to reduce thermal transmittance of the inserted profiles, and enhance the thermal insulation of the inserted profiles. However, the transverse tensile property of non-I-shaped polyamide profiles of the inserted profiles is not as good as I-type polyamide profiles of the inserted profiles, if neither mechanical reliability check nor simulated load test assessment is adopted, accidental cracking may occur during use. For single polyamide profile of inserted profiles, the composite properties may not meet the requirements of this specification. For structural parts with inserted profiles, double polyamide profiles should be adopted

Table 2 (*continued*)

composite method[a]	characteristic of thermal barrier profiles[b,c]
poured and debridged methodology	Although the linear expansion coefficient of thermal barrier material used in poured and debridged profiles is not the same as that of aluminum profiles, its effective adhesion of coating surface could ensure that the composite part will not cause slip dislocation, falling off ,etc.Poured and debridged profiles have good resistance and ductility.But if the production environment of the pouring process is not controlled properly, it will cause serious impact on product performance (e.g. the barrier material crack at low-temperature). When poured and debridged profiles with the class I thermal barrier polyurethane are used above 70 ℃, the composite performance declines, resulting in reduced load bearing capacity. When the surface treatment of aluminum profiles causes thermal barrier polyurethane ineffectively bonded with the surface of the coating, it is not appropriate to use poured composite method to make thermal barrier profiles

[a] If insertion methodology and poured and debridged methodology co-exist on one thermal barrier profiles, the performance shall meet the performance requirements for both inserted profiles and poured and debridged profiles at the same time.

[b] When the thermal barrier profiles are used in some structural parts, it may bear the effects of gravity , wind, earthquake, temperature, etc. Based on the environment and design requirements of thermal barrier profiles, the purchaser should take worst effect combination as the load combination.In order to select appropriate thermal insulation profiles, the possible bending deformation, bending strength, longitudinal shear strength, transverse tensile strength and other stress indicators of thermal barrier profiles under this load combination need to be calculated or analyzed.

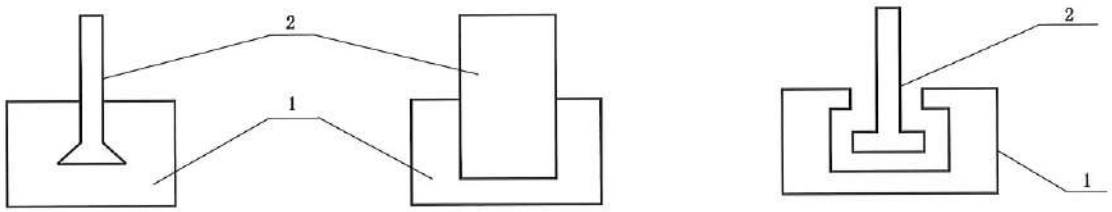
[c] The equivalent inertia moment calculation method of thermal barrier profile shall be in accordance with YS/T 437.

4.1.4 Shear failure type of thermal barrier profile

Thermal barrier profiles are classified into A、B、O three types according to the shear failure types, as shown in Table 3.

Table 3—Shear failure types of thermal barrier profiles

shear failure type	notes
A	The thermal barrier profiles, that the shear failure of composite parts may not affect the transverse tensile property, such as inserted profiles, as shown in Figure 2a)
B	The thermal barrier profiles, that shear failure of composite parts may cause transverse tensile failure, such as poured and debridged profiles, as shown in Figure 2b)
O	Due to special requirements (e.g.solving the thermal bow phenomenon of the door leaf), it is intentional to design the inserted profiles without longitudinal shear or lower longitudinal shear performance.as shown in Figure 2c)



a) Type A b) Type B c) Type O

Key

1 Aluminum profiles;

2 Thermal barrier material.

Figure 2—Shear failure types of thermal barrier profiles

4.1.5 Thermal transmittance classes of thermal barrier profiles and recommended application environment, the height of polyamide profile and the model of poured and debridged profiles cavity

The thermal transmittance of thermal barrier profiles are divided into class Ⅰ, class Ⅱ, class Ⅲ and class Ⅳ according to thermal insulation effect.Recommended application environment, the height of polyamide profiles, and the model of poured and debridged profiles cavity are shown in Table 4.

Table 4—Thermal transmittance classes and recommended application environment, the height of polyamide profiles and the model of poured and debridged profiles cavity

thermal transmittance class	recommended application environment	recommended height of polyamide profiles mm	recommended model of poured and debridged profiles cavity[a]
Ⅰ	temperate regions or environment with low requirements for thermal insulation property of product (eg.Kunming)	≤12	AA
Ⅱ	hot summer and warm winter regions (eg. Guangzhou, Xiamen)	>12—14.8	BB
Ⅲ	hot summer and cold winter regions (eg. Shanghai, Chongqing)	>14.8—24	CC
Ⅳ	severe cold and cold regions(eg.Harbin, Beijing)	>24	>CC 以上

[a] The model of poured and debridged profiles cavity sees Table C.1.

4.1.6 Cross-sectional drawings of thermal barrier profiles

Cross-sectional drawings of thermal barrier profiles shall be agreed by purchaser and supplier. The shape of groove and size are crucial to the quality of thermal barrier profiles, and their designs see Annex C.

4.1.7 Marking and example

Thermal barrier profiles are marked in the order of product name or composite methods type, number of this part, alloy and temper, coating code and property class of aluminum alloy profiles(when the codes of inside and outside coating are different from property class , marked by inside/outside respectively); the shear failure type, the class of thermal transmittance(marked when indicated in the contract), cross-sectional code and length of thermal barrier profiles, height, material code and property class of thermal barrier material. Examples of marking are shown as follows:

EXAMPLE 1

Thermal barrier profiles, made of alloy 6063, temper T5, the code of inside coating is EA21, the coating property is class Ⅲ, the code of outside coating is GA40, the coating property is class Ⅲ of aluminum alloy profiles, shear failure type A, thermal transmittance class Ⅰ, reference No. 561001, length 6 000 mm, height 14.8 mm, material code PA66GF25, are marked as follow:

Inserted profiles GB/T 5237.6-6063T5EA21Ⅲ/GA40Ⅲ-A(Ⅰ)561001×6000-14.8PA66GF25

EXAMPLE 2

Thermal barrier profiles, made of alloy 6063, temper T5, the code of inside and outside coating is AA20, shear failure type B, thermal transmittance class Ⅱ, reference No. 561001, length 6 000 mm, height 9.53 mm, material code PU, property class Ⅰ, are marked as follow:

Poured and debridged profiles GB/T 5237.6-6063T5AA20-B(Ⅱ)561001×6000-9.53PUI

4.2 Quality assurance

4.2.1 Process

The process assurance sees A.1.

4.2.2 Aluminium alloy profiles

The quality assurance of aluminium profiles shall be in accordance with GB/T 5237.1 to GB/T 5237.5.

4.2.3 Thermal barrier material

The quality assurance of thermal barrier material sees A.2.2.

4.3 Aluminum alloy profiles

The chemical composition and mechanical properties of aluminium alloy profiles shall be in accordance with GB/T 5237.1.The coating property of aluminium alloy profiles shall be in accordance with the provisions of GB/T 5237.2 to GB/T 5237.5.

4.4 Thermal barrier material

The polyamide profiles of the inserted profiles shall be in accordance with GB/T 23615.1.The thermal barrier polyurethane of poured and debridged profiles shall be in accordance with GB/T 23615.2.

4.5 Dimension tolerance of thermal barrier profiles

The dimension tolerance of thermal barrier profiles (except for the wall thickness of the thermal barrier material and the cavity size) shall be in accordance with GB/T 5237.1, The thermal barrier materials are deemed as metal substance.

4.6 Thermal transmittance of thermal barrier profiles

The purchaser and supplier shall consult the class of thermal transmittance in accordance with Table 5, and indicate it in the order (or contract), when the purchaser has requirements on the thermal transmittance of thermal barrier profiles.

Table 5—Thermal transmittance requirements

classes of thermal transmittance	thermal transmittance $W/(m^2 \cdot K)$
Ⅰ	>4.0
Ⅱ	>3.2—4.0
Ⅲ	2.5—3.2
Ⅳ	<2.5

4.7 Mechanical properties of thermal barrier profiles

4.7.1 Inserted profiles

4.7.1.1 Characteristic value of longitudinal shear strength

The characteristic value of longitudinal shear strength shall be in accordance with Table 6(except for tpye O thermal barrier profiles).

Table 6—Characteristic longitudinal shear strength

item	test temperature ℃	result of longitudinal shear test[a] N/mm
characteristic value of longitudinal shear strength at room temperature	23±2	≥24
characteristic value of longitudinal shear strength at low temperature	−30±2	
characteristic value of longitudinal shear strength at high temperature	80±2	

[a] It is allowed that similar thermal barrier profiles can be adopted to test longitudinal shear strength, and deduce the characteristic value of longitudinal shear strength (See Annex B) with agreement between supplier and purchaser, but the result of longitudinal shear strength test of the similar profiles shall be in conformity with this table.

4.7.1.2 Characteristic value of transverse tensile strength at room temperature

The characteristic value of transverse tensile strength at room temperature shall be in conformity with Table 7.

Table 7—Characteristic value of transverse tensile strength at room temperature

item	test temperature ℃	result of transverse tensile test[a] N/mm
characteristic value of transverse tensile strength at room temperature	23±2	≥24

[a] It is allowed that similar thermal barrier profiles can be adopted to test transverse tensile, and deduce the characteristic value of transverse tensile strength at room temperature(See Annex B) with agreement between supplier and purchaser, but the test result shall be in conformity with this table.

4.7.1.3 Performance at high temperature sustained load

The performance at high temperature sustained load shall be in accordance with Table 8.

Table 8—The performance at high temperature sustained load

test result of transverse tensile in high temperature sustained load[a]		
mean value of the deformation of thermal barrier profiles mm	characteristic value of transverse tensile strength N/mm	
	low temperature (−30 ℃ ±2 ℃)	high temperature (80 ℃ ±2 ℃)
≤0.6	≥24	

[a] It is allowed that similar thermal barrier profiles are adopted to test transverse tensile at high temperature sustained load, and deduce the performance at high temperature sustained load (See Annex B) with agreement between supplier and purchaser, but the result of transverse tensile test in high temperature sustained load of the similar profiles shall be in conformity with this table.

4.7.1.4 Elasticity constant

If the purchaser has any special requirements for the elasticity constant, this requirements shall be agreed by both purchaser and supplier, and also indcated in the order (or contract). The supplier shall provide the test result.

4.7.1.5 Creep factor

If the purchaser has any special requirments for the creep factor (A_2), this requirements shall be agreed by both purchaser and supplier, and also indcated in the order(or contract).

4.7.1.6 Flexural performance

If the purchaser has any special requirments for the flexueal performance, this requirements shall be agreed by both purchaser and supplier, and also indcated in the order(or contract). The supplier shall provide the test result.

NOTE The flexural performance of inserted profiles decline as the height of polyamade profiles increase.

4.7.1.7 Thermal cycling fatigue performance

If the purchaser has any special requirements for the thermal cycling fatigue performance, this requirment shall be agreed by both purchaser and supplier, and also indicated in the order(or contract).

4.7.2 Poured and debridged profiles

4.7.2.1 Characteristic value of longitudinal shear strength

The characteristic value of longitudinal shear strength shall be in conformity with Table 9.

Table 9—Characteristic value of longitudinal shear strength

item	test temperature ℃	result of longitudinal shear test[a] N/mm
characteristic value of longitudinal shear strength at room temperature	23±2	≥24
characteristic value of longitudinal shear strength at low temperature	−30±2	
characteristic value of longitudinal shear strength at high temperature	70±2	
[a] It is allowed that similar thermal barrier profiles can be adopted to test longitudinal shear strength, and deduce the characteristic longitudinal shear strength (See Annex B) with agreement between supplier and purchaser, but the result of longitudinal shear strength test of the similar profiles shall be in conformity with this table.		

4.7.2.2 Characteristic value of transverse tensile strength

The characteristic value of transverse tensile strength shall be in conformity with Table 10.

Table 10—Characteristic value of transverse tensile strength

item	test temperature ℃	result of transverse tensile test[a] N/mm
characteristic value of transverse tensile strength at room temperature	23±2	≥24
characteristic value of transverse tensile strength at low temperature	−30±2	
characteristic value of transverse tensile strength at high temperature	70±2	
[a] It is allowed that similar thermal barrier profiles can be adopted to test transverse tensile strength, and deduce the characteristic transverse tensile strength(See Annex B) with agreement between supplier and purchaser, but the result of transverse tensile test of the similar profiles shall be in conformity with this table.		

4.7.2.3 Dry shrinkage performance after thermal cycling

The dry shrinkage performance after thermal cycling shall be in conformity with Table 11.

Table 11—Dry shrinkage performance after thermal cycling

result of thermal cycling test[a,b]	
mean value of dry shrinkage of the thermal barrier material mm	characteristic value of longitudinal shear strength at room temperature(23 ℃ ± 2 ℃) N/mm
≤0.6	≥24

[a] It is allowed that similar thermal barrier profiles can be adopted to do the thermal cycling test, and deduce the dry shrinkage performance after thermal cycling (See Annex B) with agreement between supplier and purchaser, but the result of thermal cycling test of the similar profiles shall be in conformity with this table.

[b] 60 times thermal cycling test is undertaken for thermal barrier profiles with Class Ⅰ chemical resin and isocyanate; 90 times thermal cycling test is undertaken for thermal barrier profiles with Class Ⅱ chemical resin and isocyanate.

4.7.2.4 Flexural performance

If the purchaser has any special requests for the flexural performance, these requests shall be agreed by purchaser and supplier, and stated in the order(or contract).The supplier shall offer the result of actual measurement.

NOTE The flexural performance of poured and debridged profiles declines as the height of polyamade profiles increases.

4.8 Appearance

4.8.1 The appearance of aluminium alloy profiles shall be in accordance with GB/T 5237.1 to GB/T 5237.5.

4.8.2 It is allowed to have minor cracks in the coating of composite parts for the inserted profiles. But it is not allowed to have cracks in the mill finish aluminium alloy profiles.

4.8.3 The thermal barrier material surface of poured and debridged profiles shall be smooth and uniform.The cuts of aluminium connecting bridge shall be regular and smooth.

5 Test methods

5.1 Aluminum profiles

5.1.1 Chemical composition

The analysis method of chemical components shall be in accordance with GB/T 5237.1.The coating of

surface treatment shall be removed before test.

5.1.2 Mechanical properties

The test method of mechanical properties shall be in accordance with GB/T 5237.1. The powder coating profiles and paint coating profiles shall be removed before test.

5.1.3 Coating performance

The test method of the coating performance shall be in accordance with GB/T 5237.2 to GB/T 5237.5.

5.2 Performance of thermal barrier material

The test method of polyamide profiles performance shall be in accordance with GB/T 23615.1. The test method of the thermal barrier polyurethane performance shall be in accordance with GB/T 23615.2.

5.3 Dimension tolerance of thermal barrier profiles

The test method of dimension tolerance shall be in accordance with GB/T 5237.1. During the test, dimensions of anodized profiles and electrodeposition coating profiles shall include the coating thickness. The powder coatings profiles and paint coating profiles shall be removed before test.

5.4 Thermal transmittance of thermal barrier profiles

The test method of thermal transmittance shall be in accordance with GB/T 34482.

5.5 Mechanical properties of thermal barrier profiles

5.5.1 Inserted profiles

5.5.1.1 Characteristic value of longitudinal shear strength

The test method of longitudinal shear shall be in accordance with GB/T 28289. The low temperature of longitudinal shear test is $-30\ ℃ \pm 2\ ℃$.

5.5.1.2 Characteristic value of transverse tensile strength at room temperature

The test method of transverse tensile at room temperature shall be in accordance with GB/T 28289.

5.5.1.3 Sustained load performance at high temperature

The test method of transverse tensile of sustained load at high temperature shall be in accordance

with GB/T 28289.The low temperature of transverse tensile test after transverse tensile of sustained load test at high temperature is −30 ℃ ±2 ℃.

5.5.1.4 Elasticity constant

The test method of elasticity constant shall be in accordance with GB/T 28289.The low temperature of elasticity constant test is −30 ℃ ±2 ℃.

5.5.1.5 Creep factor

The test method of creep factor(A_2) shall be in accordance with GB/T 28289.

5.5.1.6 Flexural performance

The test method of flexural performance (also called torsional performance) shall be in accordance with GB/T 28289.The low temperature of flexural performance test is −30 ℃ ±2 ℃。

5.5.1.7 Thermal cycling fatigue performance

Thermal cycling fatigue performance test of inserted profiles shall be in accordance with GB/T 28289 or the method agreed by both purchaser and supplier.

5.5.2 Poured and debridged thermal barrier profiles

5.5.2.1 Characteristic value of longitudinal shear strength

The test method of longitudinal shear shall be in accordance with GB/T 28289.

5.5.2.2 Characteristic value of transverse tensile strength

The test method of transverse tensile shall be in accordance with GB/T 28289.

5.5.2.3 Thermal cycling deformation performance

The test method for the thermal cycling shall be in accordance with GB/T 28289.

5.5.2.4 Flexural performance

The test method of flexural performance (also called torsional property) shall be in accordance with GB/T 28289.

5.6 Appearance

The quality inspection for the appearance of aluminum profiles shall be in accordance with GB/T 5237.1 to GB/T 5237.5. Inspection of appearance of composite parts shall be carried out visually in diffuse sunlight.

6 Conformity with standard

6.1 Inspection and acceptance

6.1.1 The thermal barrier profiles shall be inspected by the supplier, ensuring the product quality in accordance with the specification of this part or the order (or contract), and filling in the product quality assurance certificate.

6.1.2 The purchaser may re-check the received products according to this part. If the re-check result is not in accordance with the specification of this part or order (or contract), purchaser may inform supplier in written form, and the problem may be solved through consultation by both sides. The disapproval of the appearance quality and tolerance on dimensions shall be informed within 1 month after products are received. The disapproval of other properties may be informed within 6 months after products are received. If arbitration is required, the arbitration specimens will be supplied by purchaser and the arbitration will be preceded between supplier and purchaser.

6.2 Batch

The thermal barrier profiles shall be inspected for acceptance in batches, and each batch shall be consisted of thermal barrier profiles and the same type thermal barrier materials. Thermal barrier profiles are required to have same alloy, temper and surface treatment (the type and component of the same side coating -forming material, surface treatment, coating code and the class of coating performance are the same). While thermal barrier materials (the same composition and size of polyamide profiles and the same composition of polyurethane) are all made through the same kind of compound craft and composed by the thermal barrier profiles with the same shear failure type and the same specifications of cross section. There is no limit for batch weight.

6.3 Inspection classification

The inspection for product includes the delivery inspection and routine inspection.

6.4 Inspection items and process assurance item

6.4.1 Delivery inspection items, routine inspection items and process assurance items shall be in accordance with Table 12.

Table 12—Inspection items and process assurance item

inspection item				delivery inspection item	routine inspection item	process assurance item
chemical composition of aluminium alloy profiles				√	—	—
mechanical properties of aluminium alloy profiles				√	—	—
coating performance of aluminium alloy profiles				in accordance with the rule of GB/T 5237.2 to GB/T 5237.5		
performance of thermal barrier material	polyamide profiles	characteristic transverse tensile strength at high temperature		√	—	—
		glass fiber content		√	—	—
		ash content		√	—	—
		microstructure		[a]	√	√
		DSC melting peak temperature		[a]	√	√
		composite adaptability of aluminum profiles-the test of immersion in water		[a]	√	√
		other		—	—	√
	thermal barrier polyurethane	water content for chemical resin and isocyanate		√	—	—
		viscosity for chemical resin and isocyanate		[a]	√	√
		notched Izod impact strength at low temperature		[a]	√	√
		heat deflection temperature		[a]	√	√
		shore hardness		[a]	√	√
		other		—	—	√
dimension tolerance of thermal barrier profiles				√	—	—
thermal transmittance of thermal barrier profiles				[a]	√	√
mechanical properties of thermal barrier profiles	inserted profiles	characteristic longitudinal shear strength	room temperature	[a]	√	√
			low temperature	[a]	√	√
			high temperature	√	—	—
		characteristic transverse tensile strength at room temperature		[a]	√	√
		sustained load performance at high temperature		[a]	√	√
		elasticity constant		[a]	√	√
		creep factor		[a]	√	√
		flexural performance		[a]	√	√
		thermal cycling fatigue performance		[a]	—	—

Table 12 (*continued*)

inspection item				delivery inspection item	routine inspection item	process assurance item
mechanical properties of thermal barrier profiles	poured and debridged profiles	characteristic value of longitudinal shear strength	room temperature	[a]	√	√
			low temperature	[a]	√	√
			high temperature	√	—	—
		characteristic value of transverse tensile strength	room temperature	[a]	√	√
			low temperature	[a]	√	√
			high temperature	[a]	√	√
		thermal cycling deformation performance		[a]	√	√
		flexural performance		[a]	√	√
appearance				√	—	—
NOTE "√" means indispensable inspection item or technology assurance item, "—" means no inspection item or non-technology assurance item.						
[a] The project is listed as indispensable inspection items when the purchase order or contract indicated.						

6.4.2 The supplier shall carry out routine inspection once every three years.

6.5 Sampling

The sampling of thermal barrier profiles (including thermal barrier material) shall be in accordance with Table 13.

Table 13—Sampling requirements

inspection item	sampling specification	clause of requirement	clause of test method
chemical composition of aluminium alloy profiles	According to GB/T 5237.1	4.3	5.1.1
mechanical properties of aluminum profiles	According to GB/T 5237.1	4.3	5.1.2
coating performance of aluminium profiles	According to GB/T 5237.1 to GB/T 5237.5	4.3	5.1.3

Table 13 (*continued*)

inspection item			sampling specification	clause of requirement	clause of test method
performance of thermal barrier material	polyamide profiles	characteristic value of transverse tensile strength at high temperature	Two piece of polyamide profiles are taken from each batch. On each polyamide profile, one end is cut in three test samples and the other end is cut in two samples. The length of the specimen shall be 35 mm ± 1 mm	4.4	5.2
		glass fiber content	One polyamide profile or thermal barrier profile is taken from each batch. The aluminum component of thermal barrier profile shall be removed. One polyamide profile is randomly cut in three test samples. The length of the specimen shall be 35 mm ± 1 mm		
		ash content			
		microstructure			
		DSC melting peak temperature	One polyamide profile or thermal barrier profile is taken from each batch. The aluminum component of thermal barrier profile shall be removed. Each selected profile is randomly cut in one test sample. The length of the specimen shall be not less than 30 mm		
		composite adaptability of aluminum profiles-the test of immersion in water	Two thermal barrier profiles are taken from each batch. On every thermal barrier profile, each end is cut in seven test samples and the middle is cut in six test samples (40 test samples in total). All test samples should be marked. Then the test samples are divided into four parts (each part includes at least three middle specimens), The length of the specimen shall be 100 mm ± 2 mm. The shortest length of the specimen is allowed to reduce to 18 mm (the length of the specimen shall be 100 mm ± 2 mm in the case of arbitration)		

Table 13 (*continued*)

inspection item			sampling specification	clause of requirement	clause of test method
performance of thermal barrier material	thermal barrier polyurethane	water content of chemical resin and isocyanate	Take specimens from the barrel of chemical resin and isocyanate and the specimens shall be in accordance with GB/T 23615.2	4.4	5.2
		viscosity for chemical resin and isocyanate			
		notched Izod impact strength at low temperature	Take specimens from the plaques of polyurethane and the specimens shall be in accordance with the provision of GB/T 23615.2		
		heat deflection temperature			
		shore hardness	One specimen is taken from plaques of polyurethane or thermal barrier profiles each batch. The aluminum component of thermal barrier profile shall be removed. The specimen shall be in accordance with the provisions of GB/T 2411		
dimension tolerance of thermal barrier profiles			According to the provisions of mill finish profiles in GB/T 5237.1	4.5	5.3
thermal transmittance of thermal barrier profiles			Both supplier and the purchaser agreed and noted in the order(or contract)	4.6	5.4
mechanical properties of thermal barrier profiles	inserted profiles	characteristic value of longitudinal shear strength	Two thermal barrier profiles are taken from each batch. Each end and the middle must be cut in five test samples on each thermal barrier profile taken (30 test samples in total). All test samples should be marked. Then the test samples are divided into three parts (each part includes at least three middle specimens), which are used at low temperature, room temperature and high temperature respectively. The length of the specimen shall be 100 mm ± 2 mm	4.7.1.1	5.5.1.1

Table 13 (*continued*)

inspection item			sampling specification	clause of requirement	clause of test method
mechanical properties of thermal barrier profiles	inserted profiles	characteristic value of transverse tensile strength at room temperature[a]	Two thermal barrier profiles are taken from each batch. On each thermal barrier profile, the middle is cut in one test sample and each end is cut in two test samples. The length of the specimen shall be 100 mm ± 2 mm. The shortest length of the specimen is allowed to reduce to 18 mm (the length of the specimen shall be 100 mm ± 2 mm in the case of arbitration)	4.7.1.2	5.5.1.2
		sustained load performance at high temperature[a]	Two thermal barrier profiles are taken from each batch. On each thermal barrier profile, the middle is cut in two test samples and each end is cut in four test samples (20 test samples in total). Then the test samples are divided into two parts (each part includes at least two middle specimens), which are used at low temperature test and high temperature transverse tensile test respectively after the high temperature sustained load. The length of the specimen shall be 100 mm ± 2 mm. The shortest length of the specimen is allowed to reduced to 18 mm (the length of the specimen shall be 100 mm ± 2 mm in the case of arbitration)	4.7.1.3	5.5.1.3
		elasticity constant	Two thermal barrier profiles are taken from each batch. Each end and the middle must be cut in five test samples on each thermal barrier profile taken (30 test samples in total). All test samples should be marked. Then the test samples are divided into three parts (each part includes at least three middle specimens), which are used for low temperature, room temperature and high temperature respectively. The length of the specimen shall be 100 mm ± 2 mm	4.7.1.4	5.5.1.4

Table 13 (*continued*)

inspection item			sampling specification	clause of requirement	clause of test method
mechanical properties of thermal barrier profiles	inserted profiles	creep factor	Two thermal barrier profiles are taken from each batch. Each end and the middle must be cut in five test samples on each thermal barrier profile taken (30 test samples in total). All test samples should be marked. Then the test samples are divided into three parts (each part includes at least three middle specimens). Two are used at room temperature and high temperature longitudinal shear test respectively before the creep test; the third one is used at room temperature after the high temperature sustained load longitudinal shear test. The length of the specimen shall be 100 mm ±2 mm	4.7.1.5	5.5.1.5
		flexural performance	Two thermal barrier profiles are taken from each batch. Each end and the middle must be cut in five test samples on each thermal barrier profile taken (30 test samples in total). All test samples should be marked. Then the test samples are divided into three parts (each part includes at least three middle specimens), which are used for low temperature, room temperature and high temperature respectively. The length of the specimen shall be 100 mm ± 2 mm	4.7.1.6	5.5.1.6
		thermal cycling fatigue performance	According to the provisions of GB/T 28289 or agreed by both supplier and purchaser	4.7.1.7	5.5.1.7

Table 13 (*continued*)

inspection item			sampling specification	clause of requirement	clause of test method
mechanical properties of thermal barrier profiles	the poured and debridged profiles	characteristic value of longitudinal shear strength	Two thermal barrier profiles are taken from each batch. Five test samples were cut at the middle and both ends of each thermal barrier profile taken (50 test samples in total) and marked. Then the test samples were divided into three parts (each part includes at least three middle specimens), which are used for low temperature, room temperature and high temperature respectively. The length of the specimen shall be 100 mm ± 2 mm	4.7.2.1	5.5.2.1
		characteristic value of transverse tensile strength	Two thermal barrier profiles are taken from each batch. Each end and the middle must be cut in five test samples on each thermal barrier profile taken (30 test samples in total). All test samples should be marked. Then the test samples are divided into three parts (each part includes at least three middle specimens), which are used at low temperature, room temperature and high temperature respectively. The length of the specimen shall be 100 mm ± 2 mm. The shortest length of the specimen is allowed to reduce to 18 mm (the length of the specimen shall be 100 mm ± 2 mm in the case of arbitration)	4.7.2.2	5.5.2.2
		thermal cyclic deformation performance	Two thermal barrier profiles are taken from each batch. The middle is cut in one test sample and each end is cut in two test samples. (10 test samples in total) All test samples should be marked. The length of the specimen shall be 305 mm ± 2 mm	4.7.2.3	5.5.2.3

Table 13 (*continued*)

inspection item			sampling specification	clause of requirement	clause of test method
mechanical properties of thermal barrier profiles	the poured and debridged profiles	flexural performance	Two thermal barrier profiles are taken from each batch. Each end and the middle must be cut in five test samples on each thermal barrier profile taken (30 test samples in total). All test samples should be marked. Then the test samples are divided into three parts (each part includes at least three middle specimens), which are used at low temperature, room temperature and high temperature respectively. The length of the specimen shall be 100 mm ± 2 mm	4.7.2.4	5.5.2.4
apperance			Inspecting piece by piece	4.8	5.6
[a] Test samples failing to longitudinal shear strength test at room temperature can be used.					

6.6 Rejection and retest

6.6.1 When any specimen of aluminium profiles fails in terms of chemical composition and the casting batch can be distinguished, the casting batch represented by the specimen is unquatified, the other casting batch should be checked piece by piece, and only the qualified ones shall be delivered. The whole batch fails when the casting batch cannot be distinguished.

6.6.2 When any specimen of aluminium profiles fails in terms of mechanical property, specimens in double quantity shall be taken from the same batch and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch fails. The supplier is allowed to check piece by piece if it is agreed by the supplier and the purchaser, and deliver the qualified ones.

6.6.3 The judgement for test result of coating performance shall be carried out in accordance with provisions of GB/T 5237.2 to GB/T 5237.5.

6.6.4 When any specimen of polyamide profiles fails in terms of characteristic value of transverse tensile strength at high temperature, specimens in double quantity shall be taken from the same batch and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch fails.

6.6.5 When any specimen of polyamide profiles fails in terms of glass fiber content, specimens in

double quantity shall be taken from the same batch and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch fails.

6.6.6 The batch of thermal barrier profiles is unqualified when any specimen of polyamide profiles failed in ash content.

6.6.7 The batch of thermal barrier profiles is unqualified when any specimen of polyamide profiles failed in microstructure.

6.6.8 When any specimen of polyamide profiles is unqualified in terms of DSC melting peak temperature, specimens in double quantity shall be taken from the same batch of polyamide profiles or thermal barrier profiles and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch of thermal barrier profiles fails.

6.6.9 The batch of polyamide profiles is unqualified when any specimen of aluminium profiles failed in composite suitablitity.

6.6.10 When any specimen of chemical resin and isocyanate is unqualified in term of water content, specimens in double quantity shall be taken from the same batch of chemical resin and isocyanate and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch of thermal barrier profiles fails.

6.6.11 When any specimen of chemical resin and isocyanate are unqualified in term of viscosity, specimens in double quantity shall be taken from the same batch of chemical resin and isocyanate and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch of thermal barrier profiles fails.

6.6.12 When any specimen of thermal barrier polyurethan is unqualified in term of notched Izod impact strength at low temperature, specimens in double quantity shall be taken from the same batch of plaques of polyurethane and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch of thermal barrier profiles fails.

6.6.13 When any specimen of thermal barrier polyurethan is unqualified in term of the heat deflection temperature, specimens in double quantity shall be taken from the same batch of plaques of polyurethane and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch of thermal barrier profiles fails.

6.6.14 When any specimen of thermal barrier polyurethan is unqualified in term of shore hardness, specimens in double quantity shall be taken from the same batch of plaques of polyurethane and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch of thermal barrier profiles fails.

6.6.15 The whole batch is failed when the specimen of thermal barrier profiles is unqualified in terms of dimension tolerance. The supplier is allowed to check piece by piece if it is agreed by the supplier and the purchaser, and deliver the qualified ones.

6.6.16 The batch of thermal barrier profiles failed when any specimen of polyamide profiles failed in thermal transmittance.

6.6.17 When any specimen of thermal barrier profiles is unqualified in terms of characteristic value of longitudinal shear strength, specimens in double quantity shall be taken from the same batch and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch fails.

6.6.18 When any specimen of thermal barrier profiles is unqualified in terms of characteristic value of transverse tensile strength, specimens in double quantity shall be taken from the same batch and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch fails.

6.6.19 The batch of thermal barrier profiles is unqualified when any specimen failed in performance at high temperature sustained load.

6.6.20 When any specimen of thermal barrier profiles is unqualified in terms of elasticity constant, specimens in double quantity shall be taken from the same batch and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch fails.

6.6.21 The batch of thermal barrier profiles is unqualified when any specimen failed in creep factor.

6.6.22 The batch of thermal barrier profiles is unqualified when any specimen failed in hermal cycling fatigue performance.

6.6.23 When any specimen of thermal barrier profiles is unqualified in terms of flexural performance, specimens in double quantity shall be taken from the same batch and be tested again. If the retest result is qualified, then the whole batch is qualified. If any specimen fails in the second test, then the whole batch fails.

6.6.24 When the deformation performance after thermal cycling of any group of samples is not up to standard, the batch of thermal barrier profiles is determined to be unqualified. The batch of thermal barrier profiles failed when any specimen failed in deformation performance after thermal cycling.

6.6.25 The piece is unqualified when any specimen failed in appearance.

7 Marking, packaging, transporting, storing and quality certificate

7.1 Marking

7.1.1 Product marking

7.1.1.1 The qualified thermal barrier profiles shall be marked with the following contents (or certificate of conformity):

a) name and address of the supplier;

b) product name and specification (or the cross-sectional code of thermal barrier section)

c) inspection stamp of supplier's quality control department(or signature or seal of the quality inspection personnel);

d) alloy and temper;

e) symbol of thermal barrier profiles, class of chemical resin and isocyanate;

f) color(or color code), appearance, coating code and the class of coating performance of aluminum profiles;

g) production date or lot number;

h) the standard number of this part;

i) product license number.

7.1.1.2 Marking of polyamide profiles for inserted profiles shall be in accordance with provisions of GB/T 23615.1. The polyamide profiles should be marked the logo of manufacturing company producing thermal barrier profiles. Marking of poured and debridged profiles shall be in accordance with provisions of GB/T 23615.2.

7.1.2 Marking of package

Marking of package of thermal barrier profiles shall be in accordance with GB/T 3199.

7.2 Packaging

The exposed surface of the thermal barrier profiles shall be protected by paper, plastic foam and other materials. Other packagings shall be in accrodance with GB/T 3199.

7.3 Transporting and storing

Transporting and storing of thermal barrier profiles shall be in accordance with GB/T 3199. The protective measures of profiles in delivery and employment see GB/T 5237.2.

7.4 Quality certificate

Every batch of profiles shall be attached with a quality certificate with following contents:

a) name and address of the supplier;

b) product name;

c) alloy, temper, specification (or the cross-sectional code of thermal barrier section);

d) symbol of thermal barrier profiles, class of chemical resin and isocyanate;

e) color, appearance, coating code and the class of coating performance of aluminum profiles;

f) production date or lot's number;

g) weight or pieces;

h) this standard number of this part;

i) test results and stamp from the supplier's quality inspection department;

j) produce license number.

8 Order (or contract) content

Order (or contract) of buying the profiles covered in this part shall include the following contents:

a) the supplier name;

b) product name;

c) product category;

d) alloy, temper, specification (or the cross-sectional code of thermal barrier section);

e) dimension tolerance, accuracy class;

f) symbol of thermal barrier profiles, class of chemical resin and isocyanate;

g) color, appearance, coating code and the class of coating performance of aluminum profiles;

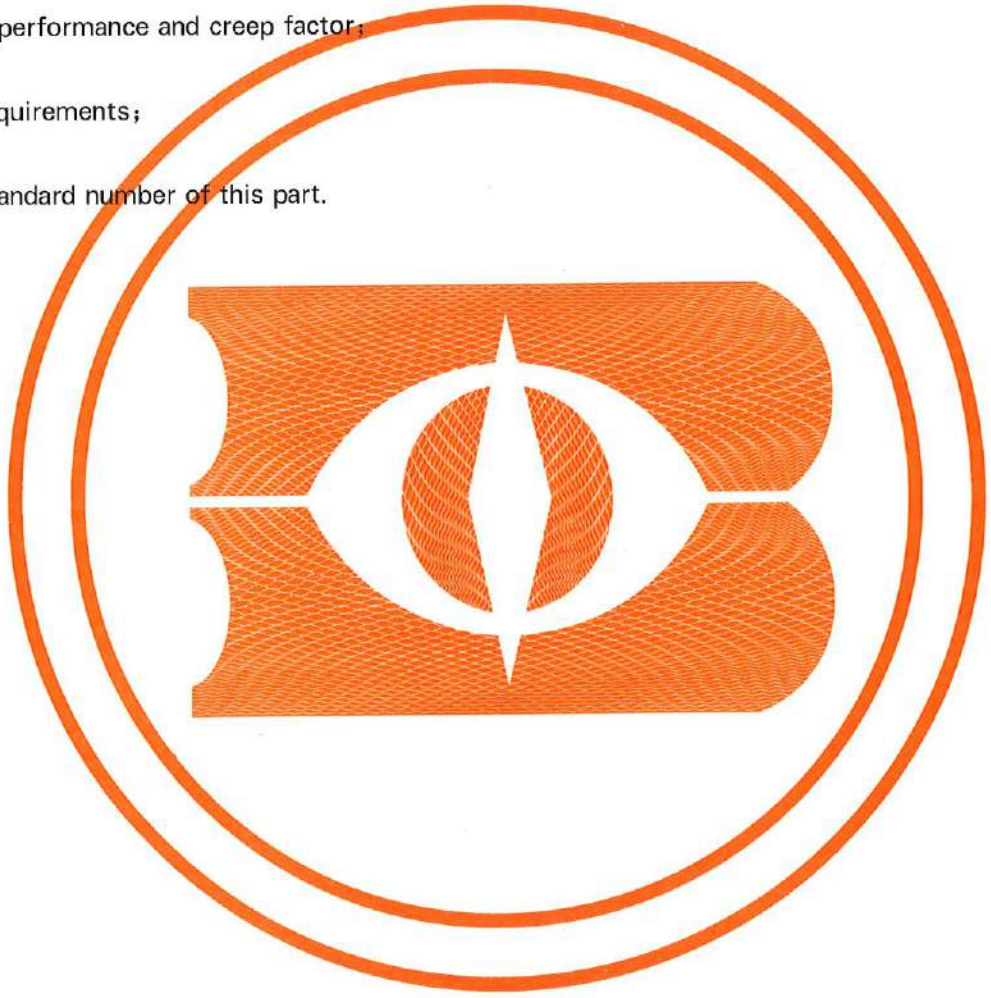
h) weight or pieces;

i) special requirements of the purchaser:

—requirements for the classes of thermal transmittance and sampling method, elasticity constant, flexural performance and creep factor;

—other requirements;

j) this standard number of this part.



Annex A
(informative)
Quality assurance

A.1 Process Assurance

A.1.1 The composite technology of thermal barrier profiles has great influence on their mechanical properties. To ensure the quality of thermal barrier profiles, the manufacture technique should be carried out in accordance with YS/T 844.

A.1.2 To ensure that the thermal barrier materials are all qualified, the manufacturing company of thermal barrier profiles shall request the supplier of thermal barrier material to provide the inspection reports of all items, and all tests should be carried out according to Table 12.

A.1.3 The cryogenic property of thermal barrier profiles shall be examined before using at the temperature below −30 ℃. The test result of cryogenic property should be in accordance with this part.

A.1.4 When choosing thermal barrier polyurethane, the manufacturing company of poured and debridged profiles shall examine wheather thermal barrier polyurethane is applicable to the mode of surface treatment. If uncertainty of the application, adaptability test on aluminium profile surface treatment shall be in accordance with GB/T 23615.2. Make sure that characteristic longitudinal shear strength complies with the regulations of Table 9.

A.1.5 During production process of poured and debridged profiles, it is necessary to guarantee the environmental temperature of factory and the temperature of the profiles. The lower temperature may lead to the incomplete cure and embrittlement of thermal barrier polyurethane materials.

A.1.6 To make sure the Inserted profiles conform to the rules of this part, the inserted profiles compound with single polyamide profile shall adopt the polyamide profile with cavity structure; the groove design of aluminum alloy profiles shall match with the end socket of polyamide profiles, and the width of tooth peak should be within 0.15 mm.

A.2 The quality assurance of raw material

A.2.1 Aluminum profile

The quality of aluminum profile shall be in accordance with GB/T 5237.1 to GB/T 5237.5.

A.2.2 Thermal barrier material

A.2.2.1 The property of thermal barrier material

Thermal barrier material is the major raw material of the thermal barrier profiles. Its property has major effect on thermal barrier profiles. The thermal barrier material shall be in accordance with GB/T 23615.1 or GB/T 23615.2.

A.2.2.2 The component and character of thermal barrier material

The component and character of thermal barrier material see Table A.1

Table A.1—The component and character of thermal barrier material

main component		character	control requirement
polyamide profiles	polyamide 66	Polyamide 66 is the major raw material of polyamide profiles and determines DSC fusion peak temperature, characteristic transverse tensile strength, characteristic longitudinal tensile strength and other property of polyamide profiles. Polyamide 66 has a reliable stability	New raw material should be adopted in producing polyamide 66. Recycle material, polyamide 6, pvc, ABS and other material are not allowed to use
	glass fiber	Glass fiber is the enhancer of polyamide profile and affects the characteristic value of transverse tensile strength, the characteristic value of longitudinal tensile strength, coefficient of linear expansion and other property of polyamide profiles	Alkali-free glass fiber shall be used. The alkali glass fiber is not allowed
	additive	Polyamide profiles contain pigments, thermal stabilizer, toughening agent, extrusion auxiliary and other additives which mainly improve shocking, aging, thermal aging resistance, water aging and other properties of the polyamide profiles	The additives used should be in favor of every property of polyamide profiles. Water solubility additive, calcium carbonate additive, talcum powder additive and other additives are not allowed
thermal barrier polyurethane	isocyanate composite material (I glue)	I glue is the hard end part of the polyurethane molecular chain, and it directly affects the strength and hardness of polyurethane	Diphenylmethane diisocyanate (MDI) shall be adopted. Toluene diisocyanate (TDI) is not allowed

Table A.1 (*continued*)

main component		character	control requirement
thermal barrier polyurethane	polyhydric alcohols composite material (P glue)	P glue is the soft end part of the polyurethane molecular chain, and it directly affects the property of toughness and resistance of polyurethane	The polyhydric alcohols shall adopt Polyether polyol. Polyester polyol is not allowed
	additive	Polyurethane contains catalyst, inhibitor, pigment and other additives which are generally mixed in P glue. Its functions include controlling the chemical reaction speed of I glue and P glue, and enhancing weather ability and decorative of polyurethane	Environmentally friendly amine catalyst and metal catalyst shall be used in catalyst. No catalyst with heavy metals allowed. The pigments should contain organic color paste instead of inorganic one

A.2.2.3 The key index and control requirement of thermal barrier material

The key index and control requirement of thermal barrier material see Table A.2.

Table A.2—The key index and control requirement of thermal barrier material

thermal barrier material	key index	control requirement
polyamide profile	characteristic transverse tensile strength at high temperature	Transverse tensile strength is the most important mechanics index of the polyamide profile.If polyamide 66, recycled material or bad materials such as PVC, ABS are used, these materials will directly affect the transverse tensile strength, especially under high temperature. If the characteristic transverse tensile strength at high temperature of I14.8 polyamide profiles is more than 60 Mpa, the use of bad materials as above can be eliminated. The characteristic transverse tensile strength at high temperature will decline slightly as width of polyamide profile increases. When the characteristic transverse tensile strength at high temperature is less than 60 Mpa, recycled materials might be used during the production process, but further verification is required
	glass fiber content and appearance	The glass fiber content shall be controlled within 22.5% to 27.5%. The burning residual of polyamide profiles after calcine shall be transparent, thin and long glass fiber, whose length diameter ratio shall be about 40. Defects such as inclusions, short and break are not allowed in burning residual, otherwise it will seriously affect the various properties of polyamide profiles

Table A.2 (*continued*)

thermal barrier material	key index	control requirement
polyamide profile	microstructure	As for the internal organization of polyamide profiles, the internal structure of the glass fiber shall be three-dimensional network structure, arranging homogeneously on three directions of polyamide profiles. Defects such as bubbles and inclusions are not allowed, otherwise they will seriously affect the various properties of polyamide profiles
	DSC fusion peak temperature	DSC melting peak temperature is used to describe the fusion point of polyamide profiles. It is a convenient method to identify whether new polyamide 66 is used or not. It is difficult to identify when the small amount of added recycled materials or less processed recycle materials are used. With the selection of polyamide profiles with DSC melting peak temperature no less than 258 ℃, the use of polyamide 6, PVC, ABS or other bad materials can be eliminated
thermal barrier polyurethane	water content for chemical resin and isocyanate	The water content for chemical resin and isocyanate has a significant impact on the performance of thermal barrier polyurethane, especially P glue. Water content should be controlled under 0.05%, otherwise the thermal barrier polyurethane will produce bubbles reducing the strength of thermal barrier polyurethane and adhesive strength, directly affecting the tensile strength and the shear strength of poured and debridged thermal barrier profiles
	viscosity for chemical resin and isocyanate	Viscosity for chemical resin and isocyanate can reflect its stability of the production process. Waving in a smaller range, viscosiy has relatively more stable molecular weight. The viscosity of chemical resin and isocyanate in each batch shall be well controlled in a certain range before accepting, P glue should be controlled between 700 mPa · s± 100 mPa · s
	heat deflection temperature	The heat deflection temperature reflects the resistance to high temperature performance of thermal barrier polyurethane, where class Ⅰ thermal barrier polyurethane with the heat deflection temperature no less than 70 ℃ and the class Ⅱ thermal barrier polyurethane with the heat deflection temperature no less than 85 ℃ should be chosen. As the class Ⅱ thermal barrier polyurethane contains more polyols of rigid segment structure, it improves rigidity of the thermal barrier polyurethane and heat deflection temperature, so it can also identify the class of the insulation adhesive
	notched Izod impact strength at low temperature	Thermal barrier polyurethane is easily embrittled and ruptured at low temperature. Notched izod test at low temperature can reflect the brittleness at low temperature of the material properties, it is one of the important performance parameters of the thermal barrier polyurethane, the thermal barrier polyurethane notched Izod impact strength at low temperature less than 65 J/m should be adopted

A.2.2.4 Hazardous substance

The limit of hazardous substance sees Table A.3.

Table A.3—The limit of hazardous substance

hazardous substance	mass fraction
polybrominated biphenyls(PBB)	≤0.1%
polybrominated diphenyl Ethers(PBDE)	≤0.1%
dioctyl phthalate(DEHP)	≤0.1%
butyl benzyl phthalate(BBP)	≤0.1%
dibutyl-*O*-phthalate(DBP)	≤0.1%
phthalic acid diisobutyl ester(DIBP)	≤0.1%
dissoluble lead(Pb)	≤90 mg/kg
dissoluble cadmium(Cd)	≤75 mg/kg
dssoluble chromium(Cr)	≤60 mg/kg
dissoluble mercury(Hg)	≤60 mg/kg

A.2.2.5 Material safety data sheet

The supplier of thermal barrier polyurethane shall provide material safety data sheet(MSDS).

A.2.2.6 Quality certificate of thermal barrier material

A.2.2.6.1 Polyamide profile

The quality of polyamide profiles plays a key role in the performance of inserted profiles, so the content of quality certificate shall be agreed by the manufacturer of the inserted profiles and supplier of polyamide profiles, the content of quality certificate at least includes:

a) the content of hazarodous substance of polyamide profiles;

b) the main component and structure of polyamide profiles;

c) density of polyamide profiles;

d) DSC fusion peak temperature of polyamide profiles;

e) the characteristic value of longitudinal tensile strength at room temperature and elastic modulus of polyamide profiles;

f) the characteristic value of transverse tensile strength at high temperature and low temperature

of polyamide profiles;

g) the test result of heat aging of polyamide profiles;

h) the date of quality guarantee.

A.2.2.6.2 Thermal barrier polyurethane

The quality of thermal barrier polyurethane plays a key role in the performance of inserted profiles, so the content of quality certificate shall be agreed by the manufacturer of the poured and debridged profiles and suppliers of thermal barrier polyurethane, the content of quality certificate at least includes:

a) the performance class of thermal barrier polyurethane;

b) the content of hazardous substance of thermal barrier polyurethane;

c) water content and viscosity of chemical resin and isocyanate;

d) the manual operation setting time of thermal barrier polyurethane;

e) density of thermal barrier polyurethane;

f) the heat deflection temperature of thermal barrier polyurethane;

g) the notched Izod impact strength test, tensile strength in low temperature and high temperature of thermal barrier polyurethane;

h) the date of quality guarantee.

Annex B
(informative)
Extrapolation of characteristic data for thermal barrier profiles

The performance (the characteristic value of shear strength, the characteristic value of tensile strength, the characteristic value of elasticity constant and the creep coefficient) of thermal barrier profiles are allowed to be extrapolated from profiles which have similar performances and meet the following characteristics:

—The material and the mechanical properties of the thermal barrier material shall be similar, and in accordance with GB/T 23615.1 and GB/T 23615.2;

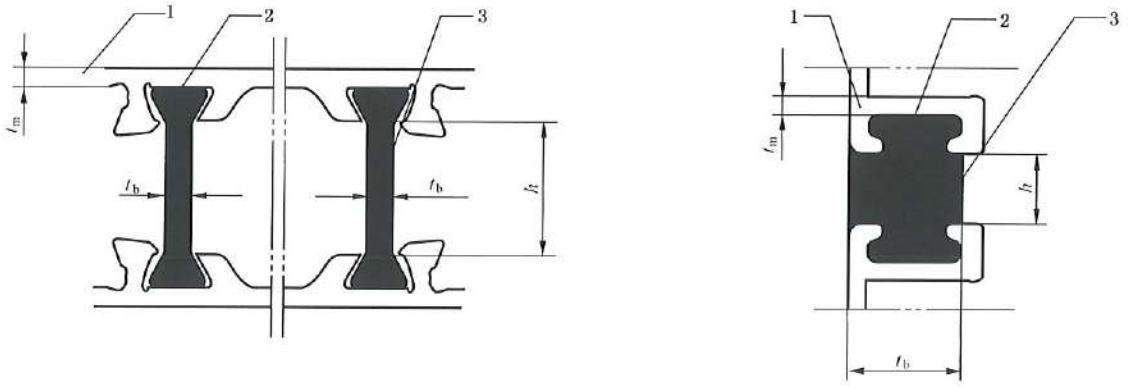
—The alloy, temper and the mechanical properties of the aluminum profiles shall be in accordance with GB/T 5237.1, and shall have the same surface treatment;

—The same composite mode;

—The geometrical characteristics of the aluminum part and thermal barrier at the connected interface shall be the same;

—The thickness(t_m)of the aluminum wall and the thickness(t_b)of the thermal at the connection site shall be the same(as shown in Figure B.1);

—Height(h) of the thermal barrier material should be the same(as shown in Figure B.1).



Key
1 Aluminum profiles;
2 Joint surface;
3 Thermal barrier materials.

Figure B.1—The connection diagram of aluminium profiles and thermal barrier material

Annex C
(informative)
The groove design of thermal barrier profile

C.1 Inserted profiles

The groove design shall consider the effect of the cooperative relationship between groove and polyamide profiles end, the composite technology and other factors. The groove design of inserted profiles sees Figure C.1.

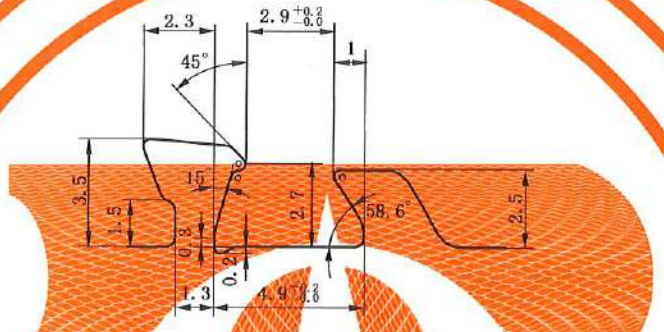


Figure C.1—The groove diagram of inserted profiles

C.2 Poured and debridged profiles

C.2.1 Typical cavity and dimension

The cavity design of the poured and debridged profiles shall consider the effect of the type of load-bearing (tensile, shear, bending and so on), the performance of thermal barrier, the variation range of temperature in using environment and other factors. The typical cavity of the poured and debridged profiles sees Figure C.2, and the typical size sees Table C.1.

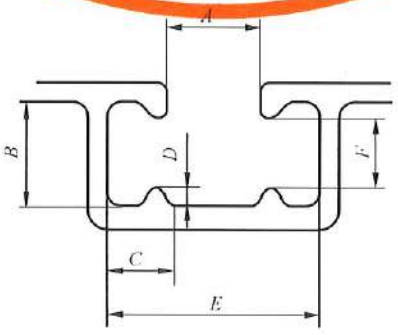


Figure C.2—The cavity diagram of poured and debridged profiles

Table C.1—The typical dimension of poured and debridged profiles cavity

type of cavity	*A* mm	*B* mm	*C* mm	*D* mm	*E* mm	*F* mm	area mm^2	volume mm^3/m
AA	5.18	6.86	2.79	1.02	10.77	4.83	71.0	71 000.0
BB	6.35	7.14	4.06	1.14	14.48	4.85	100.7	100 700.0
CC	6.35	7.92	4.78	1.27	15.90	5.38	123.3	123 300.0
DD	7.92	8.89	5.49	1.57	18.90	5.74	165.9	165 900.0
EE	9.53	9.53	5.74	1.57	21.01	6.38	199.4	199 400.0
FF	11.10	11.10	6.68	1.85	24.49	7.39	279.35	279 350.0
GG	11.54	11.54	6.93	1.91	25.40	7.67	299.35	299 350.0
HH	12.70	9.53	5.74	1.57	24.18	6.35	240.00	240 000.0
II	12.70	12.70	7.65	2.11	28.00	8.48	364.51	364 510.0
JJ	19.05	19.05	11.48	3.18	41.99	12.70	820.64	820 640.0
KK	25.40	25.40	15.29	4.24	56.00	16.94	1 458.71	1 458 710.0

C.2.2 The choice for single cavity

The choice for single cavity and typical application sees Table C.2.

Table C.2—The choice for single cavity and typical application

model of cavity	width of the poured and debridged profiles mm	wall thickness of the poured and debridged profiles mm	typical application
AA	45—50	1.4	frame, sash, stick of window
BB	55—65	1.4—2.0	
CC	80—90	2.0—2.5	frame, sash of the ground casement window(2.5 m to 3.0 m)
DD	—	2.5—3.0	frame, sash and others of curtain wall
EE	—	3.0—3.5	
FF、GG、HH、II、JJ 和 KK	—	>3.5	thermal barrier rod piece of curtain wall

C.2.3 The choice for multi-cavities

Compare to the single cavity design, the multi-cavities design can improve the thermal barrier effect of the poured and debridged profiles, for example, the thermal barrier effect of dual-cavities is about 20% to 30% higher than single cavity design. The cost of the dual-cavities design that meets the same thermal barrier performance is lower than that of the single-cavity design, but the bending strength of multi-cavities design of the poured and debridged profiles will be reduced.

Bibliography

[1] YS/T 844, *Technical specification for assembling process of architecture aluminum alloy profiles with thermal barrier strip*

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Publisher:Standards Press of China

A2,Hepinglixijie,Beijing,China,100029

Sanlihe,Fuxingmenwai,Beijing,China,100045

Tel: (+ 86 10)68533533 51780238 68523946

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