Testing Rules
for Thermal Conductivity

October 2015

Normative references (to be inserted as additional chapter in the Testing Rules for Panels)

1. EN 14509 Self-supporting double skin metal faced insulating panels - Factory made products – Specifications

2. EN 13172 Thermal insulating products. Evaluation of conformity

3. EN ISO 10456 Building materials and products. Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values (replacing EN 12524)

4. Product standards for core materials:

   EN 13162 Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification

   EN 13163 Thermal insulation products for buildings – Factory made expanded polystyrene (EPS) products – Specification

   EN 13164 Thermal insulation products for buildings – Factory made extruded polystyrene foam (XPS) products – Specification

   EN 13165 Thermal insulation products for buildings – Factory made rigid polyurethane foam (PU) products – Specification

5. EN ISO 10211 Thermal bridges in building construction – Heat flows and surface temperatures – Part 1: Detailed calculations (ISO 10211)

6. ISO 9001 Quality management systems – Requirements

For all standards mentioned, the last version published in the Official Journal of the European Union (OJEU) is the basis of these Testing Rules.

Determination of the thermal conductivity based on EN 14509, 5.2.2 and A.10

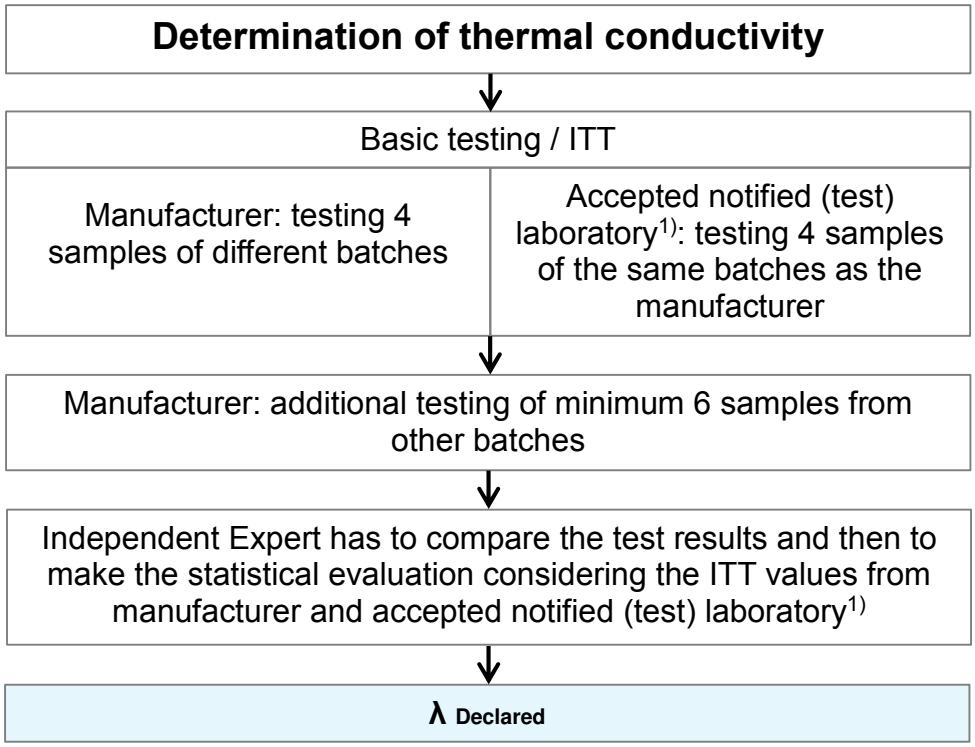
The declared thermal conductivity shall be determined in accordance with the procedures described in the appropriate product standard for the core material in the direction used for insulation in the sandwich panel. For preformed CE-marked mineral wool core materials, the values and the results from the manufacturer of the core material can be used without any further testing, if the manufacturer has a quality system that respects the requirements of EN 13172, the CE markings provide the λ values for the orientation used in the panel manufacturing process and these core material performances are controlled under responsibility of a third party, in AVCP system 1+ (EPAQ system A of PPA-Europe).

For other materials than core materials (e.g. metal sheets), tabulated values in accordance with EN 10456 shall be used.

The declared thermal conductivity ($\lambda_{Declared}$) and the design value of the thermal conductivity (λ_{Design}) shall be determined. In case of aged values, $\lambda_{Declared}$ is equal to λ_{Design} (if not stated otherwise). Afterwards, the thermal transmittance value (U_{dS}) for the panel system excluding the transversal joints, but taking into account the effects of the longitudinal joints, shall be calculated according to EN 14509.

Above note that λ_{Design} is a national choice.

General procedure (process chart)



1) Accepted by PPA-Europe for thermal conductivity testing. As there are no notified bodies for thermal characteristics in case of EN 14509, the tests can be performed by notified bodies for testing the thermal conductivity of PU according to EN 13165, of MW according to EN 13162, of EPS according to EN 13163 or of XPS according to EN 13164, from the list of third parties accepted by PPA-Europe for thermal conductivity testing.

The declared thermal conductivity ($\lambda_{Declared}$) shall be determined in accordance with the procedures described in the appropriate product standard for the core material.

A. Test procedure for panels with PU core:

The method according to "Fixed increment procedure" shall be used (for core material with CO_2 as propellant, additional requirements have to be respected).

1. Basic Testing / ITT:

   a. Initial λ-test: 4 samples 20 mm thick or a variety of different thicknesses by agreement with the accepted notified (test) laboratory, cut out of the center of panels from different productions and thicknesses, without cover sheets, have to be tested in the same time by the manufacturer and by an accepted notified (test) laboratory from the list of third parties accepted by PPA-Europe for thermal conductivity testing. The manufacturer has to manage the coordination of the parallel testing.

   b. Normality-test: the same 4 samples have to be tested by an accepted notified (test) laboratory, after aging 21 days at 70°C.

2. Additional Testing:

   The manufacturer has to perform 6 more λ-tests on different batches.

3. Comparing of the test results by an Independent Expert:

   a. The difference between the λ-values of the manufacturer and the accepted notified (test) laboratory shall be within the tolerances given in Table 1.

   b. If the difference of all 4 single λ-values after aging 21 days at 70°C is lower than 6mW/(m*K), the "fixed increment" can be used.

   Evaluation of the test results by an Independent Expert:

   a. Fixed increment procedure: λ_{ini} + fixed increment

   b. Statistical evaluation delivers $\lambda_{90/90}$

   c. Rounding rules $\lambda_{Declared}$

Number of tests:

4 samples of different batches have to be tested by the manufacturer. Simultaneously another 4 samples of the same 4 batches have to be tested by a European accepted notified (test) laboratory from the list of third parties accepted by PPA-Europe for thermal conductivity testing. The manufacturer has to test another 6 samples from different batches to complete the 10 results for the ITT test. The Independent Expert has to control that the results of the manufacturer and the results of the accepted notified (test) laboratory are equal. Otherwise, the reason for the different results has to be eliminated and the tests may have to be repeated. The EPAQ Independent Expert has also to control

if the test results of the normality test fulfill the requirements for the normality test. Following, the Independent Expert has to determine the declared thermal conductivity ($\lambda_{Declared}$) and the design value (λ_{Design}).

These values have to be used by the Independent Expert to calculate the U-values (U_{ds}) for the Certification Document and the threshold values for the FPC.

Further running production:

The manufacturer has to collect and document all results from his FPC (minimum once a month with possibility to test more). The single test results with the fixed increment have to be below the declared value. Furthermore, the results have to be added in the statistical evaluation to control that the newly calculated values of the thermal conductivity ($\lambda_{Declared\_new}$) and the design value (λ_{Design_new}) are below or equal to the values of the initial type testing that are used for declaration on the CE-mark and for calculating the U-values (U_{ds}).

During each external third party control according to the Quality Regulations, a panel has to be taken out of the production and the thermal conductivity has to be tested in the laboratory of third party accepted by PPA-Europe. The single test results with the fixed increment have to be below or equal to the declared value, otherwise, the reason for the deviation has to be cleared and the tests have to be repeated or the declared values have to be changed. Furthermore the results have to be added in the statistical evaluation to control that the newly calculated values of the thermal conductivity ($\lambda_{Declared\_new}$) and the design value (λ_{Design_new}) are below or equal to the values of the initial type testing that are used for declaration on the CE-mark and for calculating the U-values (U_{ds}).

If the test results of the manufacturer and/or the accepted notified (test) laboratory show permanent deviation from the declared thermal conductivity, the declared and design values as well as the U-values (U_{ds}) have to be adjusted in the Certification Document by an Independent Expert.

B. Test procedure for panels with MINERAL WOOL or EPS core:

1. Basic Testing / ITT:

   Initial λ-test: 4 samples 50 mm thick or thicker (20 mm thick in case 50 mm is not applicable for the manufacturer), cut out of the center of panels from different productions and thicknesses, without cover sheets or lamellas taken out before bonding with the steel sheets, have to be tested in the same time by the manufacturer and by an accepted notified (test) laboratory from the list of third parties accepted by PPA-Europe for thermal conductivity testing. The manufacturer has to manage the coordination of the parallel testing. Samples from MW slabs must be cut in such way so that they correspond to lamellas; the cutting direction (line direction or transversal direction) has to be noticed, because thermal conductivity is different.

2. Additional Testing:

   The manufacturer has to perform 6 more λ-tests on different batches.

3. Comparing of the test results by an Independent Expert:

   The difference between the λ-values of the manufacturer and the accepted notified (test) laboratory shall be within the tolerances given in Table 1.

Evaluation of the test results by an Independent Expert:

a. Statistical evaluation delivers $\lambda_{90/90}$
b. Rounding rules $\lambda_{Declared}$

Number of tests:

4 samples of different batches have to be tested by the manufacturer. Simultaneously another 4 samples of the same 4 batches have to be tested by a European accepted notified (test) laboratory from the list of third parties accepted by PPA-Europe for thermal conductivity testing. The manufacturer has to test another 6 samples from different batches to complete the 10 results for the ITT test. The Independent Expert has to control that the results of the manufacturer and the results of the accepted notified (test) laboratory are equal. Otherwise, the reason for the different results has to be eliminated and the tests may have to be repeated. Following, the Independent Expert has to determine the declared thermal conductivity ($\lambda_{Declared}$) and the design value (λ_{Design}).

These values have to be used by the Independent Expert to calculate the U-values (U_{ds}) for the Certification Document and the threshold values for the FPC.

In case the tests for thermal conductivity are performed by the manufacturer of the mineral wool, the manufacturer of the mineral wool has to be involved in the basic tests and has to test also 4 samples of the same batch as the accepted notified (test) laboratory and as or instead of the manufacturer of the panel. The manufacturer of the mineral wool has to follow the regulation of the EN 13172.

Further running production:

The manufacturer has to collect and document all results from his FPC (minimum once a month with possibility to test more). The single test results have to be below the declared value. Furthermore, the results have to be added in the statistical evaluation to control that the newly calculated values of the thermal conductivity ($\lambda_{Declared\_new}$) and the design value (λ_{Design_new}) are below or equal to the values of the initial type testing that are used for declaration on the CE-mark and for calculating the U-values (U_{ds}). Otherwise, the reason for the deviation has to be cleared and the tests have to be repeated or the declared values have to be changed.

During each external third party control according to the Quality Regulations, a panel has to be taken out of the production and the thermal conductivity has to be tested in the laboratory of a third party accepted by PPA-Europe. The single test results have to be

below the declared value. Furthermore, the results have to be added in the statistical evaluation to control that the newly calculated values of the thermal conductivity ($\lambda_{Declared\_new}$) and the design value (λ_{Design_new}) are below or equal to the values of the initial type testing that are used for declaration on the CE-mark and for calculating the U-values (U_{ds}).

If the test results of the manufacturer and/or the accepted notified (test) laboratory show permanent deviation from the declared thermal conductivity, the declared and design values as well as the U-values (U_{ds}) have to be adjusted in the Certification Document by an Independent Expert.

Core material	**Type of production**	**Single- / Mean-λ-values**	**Maximum deviation allowed (%)**
Mineral Wool	continuous	s	7,5
		m	5
PUR / PIR	continuous	s	5
		m	3
	discontinuous	s	7,5
		m	5
Others	discontinuous	s	5
		m	3

Table 1. Maximum deviation allowed between λ-values obtained by manufacturer and by the accepted notified (test) laboratory