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INSULATING MATERIALS AND CERTIFICATION

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INTERNATIONAL ENERGY AGENCY

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INSULATING MATERIALS AND CERTIFICATION

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INSULATING MATERIALS AND CERTIFICATION

Definition of an insulating material

The definition of a thermal-insulation material intended for walls of buildings (either new or existing buildings) is given in the French standard NF P 75001, as follows:

« A thermal-insulation material is a material whose presence enables to reduce the thermal transfer through the wall on or in which it is fitted. A thermal-insulation material is characterized by its thermal resistance expressed in $m^2.K/W$. Conventionally, we consider that a material intended for building purposes can be defined as an insulating material if the ratio between its thickness and its thermal resistance (or in the case of bulk materials, the ratio between the effective thickness and its thermal resistance) does not exceed $0.065 W/m.K$, and if its thermal resistance is at least equal to $0.5 m^2.K/W$. »

Definition of thermal resistance

Insulating materials, provided that they are used under normal conditions, which means that they are fitted in a wall in compliance with the rules of good current practice, are sheltered from the rain and mass condensation.

Under these conditions, their thermal resistance is defined when dry at $10^{\circ}C$.

However, as regards materials which contain water, either originally or by hygroscopicity, and as regards materials which contain occluded gases other than air, the measured value is to be adjusted. This adjustment is given for each material in the relevant standards.

As regards rigid products, the thermal resistance is defined according to the nominal thickness indicated by the manufacturer. As regards flexible or semi-rigid materials, if the measured thickness is lower than the nominal thickness, the thermal resistance will be determined according to the measured thickness.

Metal or plated coverings are not regarded as thermal insulating materials as defined in the above-mentioned standard. They only have an effect when they constitute one side of a non-ventilated air space.

Main insulating materials used

The main insulating materials which are used in the building construction field in France are the following:

- mineral wool (glass wool and rock wool),
- expanded polystyrene,
- extruded polystyrene,
- polyurethane foam,

and to a lesser extent:

- phenolic foam board,
- cork board.

Thermal characteristics (apart from certification)

The values of the thermal conductivity are given in France in the form of indicated values in the following reference document:

« Th-K 77 Rules »

Rules for calculating practical thermal properties of structural components.

CERTIFICATION OF MANUFACTURED INSULATING MATERIALS USED IN BUILDING

The ACERMI Certification belongs to the group of product certifications and has therefore the characteristics common to all these certifications.

Product Certification is governed by a Law (Scrivener Law dated January 10, 1978) which defines the way it operates.

The main principles are the following:

Certificates can only be issued by organizations approved by the State, called: Certification Bodies.

1.2 Each Certification is defined by a technical rule which specifies the conditions for issuing certificates.

Each Certification has a label which the certified products shall bear.

For each Certification, the Certification Body is given assistance from an Issuing Committee in which the interests of both the manufacturers and the users are represented.

The main conditions of Certification are listed below:

- * setting up of internal control making it possible for the manufacturer to ensure regularity of product quality;
- * the results of this inspection are written down on registers;
- * inspection control (external control) performed by the Certification Body and designed to:
 - check that the external control is undertaken properly;
 - take down the results written out on the registers (for analysis by the Certification Body);
 - carry out cross-check tests on site,
 - possibly undertake sampling of products to be tested by the laboratory of the Inspection Body;
 - check for proper marking and labeling of the certified products.

- ACERMI CERTIFICATION

What does the ACERMI Certificate consist of ?

The ACERMI Certificate is issued by the « Association pour la Certification des Matériaux Isolants » (Association for the Certification of Insulating Materials used in the building sector) which includes the « Centre Scientifique et Technique du Bâtiment » (CSTB) (Scientific and Technical Centre for Building) and the « Laboratoire National d'Essais » (LNE) (French National Testing Laboratory).

This Association has drawn up the technical rule regarding the Certificate of insulating materials used in the building sector, and secured its approval.

What does the ACERMI Certificate cover ?

The ACERMI Certificate applies to any type of insulating material in conformity with the above-mentioned French standard NF P 75-101.

It covers the manufactured insulating materials (factory-made materials) whose constancy of characteristics complies with the criteria laid down in the technical regulation.

What does the ACERMI Certification aim at ?

The ACERMI Certification aims at:

- setting competition between products according to objective bases on a both national and international level;
- making it possible for the users to select products easily and under optimal saving conditions;

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- ensuring them, without their having to check, that the product delivered to them has the characteristics expected.

The ACERMI Certification is a certification of performances

The relevance of a Certification of performances depends, as is the case with insulating materials, on whether the field of application of a product is a function of the value of its functional characteristics (for instance, the thermal resistance of an insulating material).

The certified characteristics can be physical properties, for example thermal resistance. They are then generally expressed with the corresponding units.

When the fitness for use is more easily expressed thanks to a conventional scale (an easy understanding or the necessity of simplifying the presentation of complex performances), the certified characteristics may take the form of performance indices or quality levels. In that case, Certification is generally associated with a use rating.

Thus the Certificates of performances allow to choose among the materials on the market the one that is most fitted for the purpose.

The Certification applicable to Windows, called « AEV » is another well-known example in the field of building.

Performances certified by the ACERMI

First of all, thermal resistance (and not conductivity, since the purpose is to characterize products of a given thickness and not material).

Either of the two values may be certified:

R_p = the effective thermal resistance of the product, such as the manufacturing control and particularly the measurement of thermal properties of products at the end of the production line enables to determine it.

R_c = the thermal resistance which is being referred in a presumptive way to the rating to which, as indicated by the manufacturing control, the certified product belongs.

Then, the characteristics of fitness for use in building, symbolized by the following letters: ISOLE, which lead to a parallel rating of products and use (see below).

The contents of the ACERMI Certificate

There are three types of ACERMI Certificates designed to assess the insulating capacity and the fitness for use properties of insulating materials used in the building sector.

A Certificate = Certification of the effective thermal resistance « R » (called R_p as indicated above) as a function of the nominal thickness of the product (R is expressed in $m^2 \cdot ^\circ C/W$).

B Certificate = Certification of the « ISOLE » characteristics and of a presumptive value of the thermal resistance (called R_c as indicated above), also expressed in $m^2 \cdot ^\circ C/W$.

C Certificate = Certification of the effective thermal resistance as a function of both the thickness of the product and the « ISOLE » characteristics.

These three types of certificates comply with certification requirements as different as they may be. There is no hierarchy whatever between them.

The meaning of the ISOLE characteristics and their scope

I (Incompressibilité) (Incompressibility) = mechanical properties in compression with 5 levels: I1 to I5.

S (Stabilité dimensionnelle) (Dimensional stability): behaviour in differential motion with 4 levels: S1 to S4.

O (comportement à l'EAU) (Behaviour in water): behaviour in water with 3 levels: O1 to O3.

L (Limite des performances mécaniques en traction) (Limit of mechanical performances under tensile stress): effective mechanical properties under cohesion and bending stress with 4 levels: L1 to L4.

E (comportement aux transferts de vapeur d'Eau) (Behaviour in water vapour transfer): with 5 categories of permeability: E1 to E5.

These characteristics have been chosen because they are a true representation of what we expect from insulating materials as far as their common use in the building sector is concerned.

Thus the five levels of ISOLE rating constitute a true profile regarding the insulating material fitness for different purposes. Since these are defined by the ISOLE levels they require, it is an easy and effective way of checking whether an insulating material is fitted for a given purpose.

Where can one find the characteristics certified by the ACERMI ?

One can find them:

- of course on the labels applied to the products,
- in manufacturers' catalogues,
- by referring to the ACERMI data base which is one of the CSTB data bases. Access to it is by Minitel 3616 code ACERMI.

Comparison with European Certification

The table below provides us with a comparison of certifications in different European countries.

The main research work carried out at the present time

At the present time, our research work is orientated by both the present economic situation and the evolution of the products.

The two main lines are the following:

- thermal characterization of very thick products;
- thermal characterization of foams made of CFC substitutes.

a) very thick products

Nowadays, products are very often 250 mm if not 300 mm thick (especially products whose density is very low ($< 15 \text{ kg/m}^3$)).

As regards these products, the difficulties are of the following two types:

- * accuracy limit of the measuring devices (the heating plate being kept and the fluxmeter);
- * phenomena of radiation with a short wave length.

b) products made of CFC substitutes

The necessity of replacing the CFC expansion gas of certain products to comply with the International decisions now leads to study the expanded products with substitutes:

- * CO_2 ,
- * pentane,
- * HCFC,
- * 141 B,
- * etc.,

the problems being of the following two natures:

- keeping or non-keeping of the performances,
- estimation of the value to be indicated as regards aged products.

CONCLUSION

This brief summary shows that the quality certification provides:

- * the user and the contractor with:

information which is:

- easy to understand,
- reliable,
- comparative,

regarding characteristics which they cannot verify and which are decisive as regards fitness for use;

- * the manufacturer with:

means of optimizing the quality of his products and of improving his mastering of the control and manufacturing processes;

- * the designers and other partners with:

- a simple and reliable tool to select the products most fitted for the purpose.

In addition, this Certification requires constant studies so as to maintain the state of knowledge in relation to the needs of professionals.

Not forgetting the contribution made to be by the ACERMI to the enhancing of the certified products on the future European Market.

CERTIFICATION SYSTEMS FOR BUILDING INSULATING PRODUCTS

	A	B	D	DK	F	GB	I	N	NL	S	SP
ALL OR SELECTED PRODUCTS	SEL(1)	SEL	ALL	ALL	ALL	SEL	SEL	ALL	SEL	ALL	SEL
LAMBDA	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y
THERMAL RESISTANCE	N	Y	N	N	Y	Y	N	N	N	N	N
THICKNESS	Y	Y	Y	Y	N	N	Y	N	Y	N	Y
OTHER DIMENSIONS	Y	Y	Y	Y(1)	N	Y	Y	Y(1)	Y	Y(1)	Y
INTERNAL Q CONTROL	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
EXTERNAL Q CONTROL	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREQ OF EXT.CONTROL	1/Y	4/Y	1-2/Y	1/Y	2/Y	2-4/Y	2/Y	1/Y	4-6/Y	1/Y	2/Y
FIRE PROPERTIES	Y	N	Y	Y(2)	N(1)	Y(2)	Y	Y(2)	N	Y(2)	Y
MECHANICAL PROPERTIES	Y	N	Y(2)	N	Y	N	Y	N	Y(2)	N	Y
DIMENSIONAL STABILITY	N	N	Y(2)	N	Y	Y(2)	Y	N	N	N	Y
WATER VAPOUR DIFF.	N	N	N	N	Y	Y(2)	Y	N	N	N	Y
WATER UPTAKE/REPEL.	N	Y	Y	N	Y	Y(2)	Y	N	Y	N	N

(1) BEEING IMPLEMENTED OR TO BE DONE AT THE MOMENT

(2) ACCORDING TO APPLICATION