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International standards – Tools in efficient energy use in buildings

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The amount of energy needed depends on how efficiently the energy is used. The Bruntland Commission, the UN commission for development and the environment, has recommended a great effort on more efficient energy use, so drastic that the industrial countries would half their use of energy.

Already today, it is possible to reduce the energy use in buildings with the help of known and economical technology.

The technical committee ISO/TC 163, Thermal insulation, of the International Organization for Standardization, ISO, has produced some of the tools we need in order to determine the energy flows in buildings. TC 163 has produced standards on the determination and presentation of relevant material properties. The committee has also elaborated test methods and calculation methods by which the thermal properties of building components and building constructions can be quantified. Other standards give tools needed for the design and the evaluation of the thermal performance of a building. These standards and others under production give us a set of tools by which rational decisions on how to use energy more efficiently in buildings can be made.

What is ISO?

The International Organization for Standardization – ISO – is a world wide federation of national standards bodies from some 90 countries, one from each country. The mission of ISO is to promote standardization and related activities all over the world in order to facilitate the exchange of goods and services and to develop mutual cooperation in important spheres of human endeavour – intellectual, scientific, technological and economic activities.

The ISO work results in international agreements which are published as International Standards. The object of these International Standards is to contribute to making life simpler and to increase the reliability and effectiveness of the goods and services we use.

Why International Standards?

The International Standards are to be seen as a worldwide communications system. In international trade, internationally recognized standards form the basis for fair competition on the market. The standards also serve as a basis in the transfer of technical knowledge.

Different standards in different countries or regions could also contribute to so–called "technical barriers to trade". That is why export–minded industries support and participate in the standards making process. The resulting International Standards are consensus agreements among trading partners and serve as the language of trade.

How does ISO work?

The technical work of ISO is highly decentralized. It is carried out in some 2600 technical committees, sub-committees and working groups. Here qualified representatives of industry, research institutes, government authorities, consumer bodies and international organizations from all over the world come together as equal partners. The administration of a technical committee is accepted by one of the national standards bodies that make up the ISO membership. A committee chairman helps the secretariat and the committee members in reaching consensus. A consensus decision means that the views of all interests are taken into account: manufacturers, vendors and users, consumer groups, testing laboratories, governments, engineering professions and research organizations. Generally, a consensus will mean that a particular solution to the problem at hand is the best possible at that time. Although the greater part of the ISO technical work is done by correspondence, there are on average 12 ISO meetings taking place somewhere in the world every working day of the year.

There is of course a central body, the ISO Central Secretariat in Geneva that supports the committees and submits the result of the committee work to all the member bodies as Draft International Standards for voting. The Central Secretariat also prints and publishes the final approved International Standards.

However, without the national representatives on the committees and the experts who participate in the working groups there will not be any International Standards. Each member body interested in a subject has the right to be represented on a committee. International organizations, both governmental and non-governmental, that have established a liaison with ISO, also take part in the work. Some 30 000 experts from all parts of the world participate each year in the ISO technical work.

In what fields does ISO work?

The scope of ISO is not limited to any particular branch. ISO covers standardization in all fields except electrical and electronic engineering standards, which are the responsibility of IEC, the International Electrotechnical Commission. ISO and IEC collaborate closely on all matters of electrotechnical standardization. The work in the field of information technology is for example carried out in a joint ISO/IEC technical committee.

There are at present round ISO 180 technical committees working in different fields. One of these technical committees is ISO/TC 163, Thermal insulation, which I will tell you more about soon. A proposal to set up a new technical committee within ISO is submitted for consideration to all ISO member bodies. Since the resources are limited, priorities must be considered.

How are ISO standards developed?

In International Standard is the result of an agreement between the member bodies of ISO. Before such an agreement can be reached, several steps have to be passed. If a technical committee already exists, the first step is to agree on the new work item. If approved, usually a working group within the committee is asked to draft a proposal for a standard. The

working groups comprise technical experts from countries interested in the subject matter. Once the working group has reached agreement on the technical aspects to be covered by the standard, the consensus–building phase starts. Here the countries represented on the technical committee or sub–committee negotiate on the detailed contents and wording of the standard. When consensus has been reached in the committee, the formal approval of the standard remains. The draft International Standard is submitted to all the member bodies of ISO for voting. The required acceptance criteria is approval by two–thirds of the ISO members that have participated actively in the development of the standard, and approval by 75 % of all members that vote. If approved the agreed text is published as an International Standard.

To date the ISO work has resulted in 8 400 International Standards, representing some 70 300 pages of technical text in one language. It should be kept in mind that all ISO standards are voluntary documents. International standardization is market–driven and therefore based on voluntary involvement of all interests in the market–place. The goal is to arrive at global solutions to satisfy industry and customers worldwide. The International Standard may be used as such, e g by reference in trade documents. However, in many cases the ISO standard is implemented through incorporation in national standards in different countries. It is also quite common that the authorities refer to standards. Even if the standard in itself is a voluntary document a reference may make the application of the standard mandatory. It all depends on whether the regulation refers to the standard in an exclusive way or as an example to a solution.

I should also mention that ISO has a rule to review all standards at intervals of not more than five years. This is to ensure that standards that are out of date are withdrawn or revised. The reasons for a revision could be a general technological evolution, new methods or materials, or e g new quality and safety regulations.

Financing!

No organization can work without money. The largest contribution to the ISO work is the voluntary contributions of the 30 000 experts that participate in the technical work. Their time, travel expenses etc are paid by their employers. With the exception of the revenues form sale of standards and other publications. The rest of the work is financed by the ISO member bodies. Either in the form of member body subscriptions or, which is the larger part, in the form of the expenditure necessary for the operation of the technical secretariats for which they are responsible.

ISO/TC 163 Thermal insulation

This committee was set up after the energy crisis in the early 1970s. The object was primarily to improve the thermal performance of buildings and other construction works by improved materials and design tools. ISO/TC 163 has produced some important test and calculation methods. A series of standards covering the terminology, symbols and units needed in the area has also been published.

Most of the standards produced by TC 163 are general performance standards. In spite of the sometimes somewhat misleading main title the application is not limited to thermal insulating

materials or products. The test and calculation standards, as well as the terminology standards, are all applicable to a wide range of materials, products and components and in some cases to complete buildings.

To give you an idea about the work of TC 163 in general and especially in relation to efficient energy use in buildings, I will comment on the draft and published International Standards produced by TC 163.

ISO/TC 163 - Terminology standards

In order to convey information we need a language in common. In order to avoid misinterpretations we need to agree on the terms to use and their definitions. To have a common set of symbols and units also makes the reading and understanding much easier. It is the terms, quantities, symbols and units to be used in other standards and technical documents you will find in this series of standards. These five standards give us the common language.

ISO/TC 163 - Methods of testing

In order to measure and report test data in a comparable way the procedure to be followed has to be defined. If we want to compare the thermal properties of different products they also have to be tested in a uniform way. That is why the TC 163 test methods as far as possible are material independent. The test methods so far produced by TC 163 cover the basic thermal properties of building materials and products as well as building components and elements. The basic test methods by which the thermal properties of building materials are tested are the guarded hot plate apparatus described in ISO 8302 and the heat flow meter apparatus in ISO 8301. There is also an International Standard for the hot box method covering both calibrated and guarded hot boxes. Another ISO standard gives the procedure to be used when determining the thermal properties of thermal insulation for circular pipes. There is also a Draft International Standard on how to determine the thermal properties of moist materials. It will hopefully soon be completed and published.

Some of the test methods are in-situ methods for use on site in completed buildings. That way the final performance of the building can be checked. They cover methods such as thermographic inspection of buildings, in-situ measurement of the thermal resistance and thermal transmittance and determination of the airtightness of buildings by pressurization.

ISO/TC 163 - Calculation methods

But what is the point to check afterwards if the design is poor. In addition to material data, we need tools to predict and to modify the design in order to ensure a good performance. The calculation methods prepared by TC 163 gives us some of the tools we need. Here you will find rules on how to arrive at declared and design thermal values for building materials and products. Other standards give the methods by which the U-value of building components and elements and the thermal bridges in building construction should be calculated. And last but not least a method by which the annual energy needed for space heating of residential buildings can be calculated.

ISO/TC 163 – Product standards

There are also some published product standards. Within sub–committees 3 and 4 of TC 163 some more are under preparation. In the product standards the important properties of the material or product are specified. Reference is made to different verification methods, primarily test methods. The thermal properties are determined with the help of the test methods mentioned above. For other properties reference is made to general methods, if available. Specific methods of test might also be included in the product standard itself.

Future work of ISO/TC 163 Thermal insulation

Considering the environmental effects, the need for international standards in this area has increased over the years but unfortunately the input from member bodies and other organizations has been greatly reduced. One reason is the general economic situation which has greatly affected the construction industry and thus also organizations related to it. Another reason is that many European companies and organizations have decided to give priority to the harmonization activities within CEN. Regarding the latter we have worked hard in order to establish good working relations with two CEN technical committees; CEN/TC 89, Thermal performance of buildings and building components, and also CEN/TC 88, Thermal insulating materials and products. Through a closer cooperation we hope to make use of each others results and thereby increase the output of standards.

However, more activity on the international arena is needed. One of the most important objects with of energy efficient standards is to limit or reduce energy and fuel consumption and to provide better control of energy needs in order to reduce the effects on the environment. One of the important areas is the reduction of energy use in buildings by improving the energy performance of residential and other buildings. Much of the work already completed or near completion within TC 163 meets some of these demands. However, additional standards are needed in order to get a complete set of tools by which rational decisions on how to use energy more efficiently in buildings can be made.

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ISO/TC 163 Thermal insulation

International Standards and Draft International Standards

Terminology

ISO 7345:1987	Thermal insulation – Physical quantities and definitions
ISO 9229:1991	Thermal insulation – Materials, products and systems – Vocabulary
ISO 9251:1987	Thermal insulation – Heat transfer conditions and properties of materials – Vocabulary
ISO 9288:1989	Thermal insulation – Heat transfer by radiation – Physical quantities and definitions
ISO 9346:1987	Thermal insulation – Mass transfer – Physical quantities and definitions

Methods of testing

ISO 8301:1991	Thermal insulation – Determination of steady-state thermal resistance and related properties – Heat flow meter apparatus
ISO 8302:1991	Thermal insulation – Determination of steady-state thermal resistance and related properties – Guarded hot plate apparatus
DIS 8497	Thermal insulation – Determination of steady-state thermal transmission properties of thermal insulation for circular pipes
DIS 8990	Thermal insulation – Determination of steady-state thermal transmission properties –Calibrated and guarded hot box
DIS 10051	Thermal insulation – Moisture effects on heat transfer – Determination of thermal transmissivity of a moist material

In situ test methods

ISO 6781:1983	Thermal insulation – Qualitative detection of thermal irregularities in building envelopes – Infrared method

DIS 9869.2	Thermal insulation – Building elements – *In–situ* measurement of the thermal resistance and thermal transmittance
DIS 9972	Thermal insulation – Determination of building airtightness – Fan pressurization method

Calculation methods

ISO 6946–1:1986	Thermal insulation – Calculation methods – Part 1: Steady state thermal properties of building components and building elements
ISO 6946–2:1986	Thermal insulation – Calculation methods – Part 2: Thermal bridges of rectangular sections in plane structures
ISO 9164:1989	Thermal insulation – Calculation of space heating requirements for residential buildings
DIS 10456	Methods for determining declared and design thermal values for building materials and products
DIS 12573	Thermal bridges in building construction – Heat flows and surface temperatures – General calculation methods
DIS 12241	Calculation rules for thermal insulation of pipes, ducts and equipment

Product specifications

ISO 8142–1990	Thermal insulation – Bonded preformed man–made mineral wool pipe sections – Specification
DIS 8143	Thermal insulation – Calcium silicate insulation –Specification
DIS 8144.2	Thermal insulation – Mineral wool mats for ventilated roof spaces – Specification
DIS 8145.2	Thermal insulation – Mineral wool board for overdeck insulation of roofs – Specification

NOTE: The above list does not include Committee Drafts and other work on hand.