

CEN and ISO activities for heating and cooling systems standards



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The standardisation related to the energy efficiency of heating and cooling systems as part of the overall energy use of buildings and has to take into account innovative technologies. In Europe, The Energy Performance of Building Directive (EPBD) accelerated in Europe the standardisation activities in this field. Products are now no longer evaluated as products but as part of system. On the CEN level a coherent structure has been put in place between product TC's, providing the basis for individual testing, system TC's dedicated to specific uses as heating and cooling, and a "horizontal" TC responsible for the overall energy use in buildings. This standardisation has been organised in cooperation with the main stakeholders.

The CEN standards and structure should be brought on ISO level. Heating and cooling systems and services represent an important market sector worldwide.

After some information about the business environment, underlining the importance of harmonized market conditions, this article presents the ongoing activities in CEN and ISO related to heating and cooling systems.

Business environment

Heating systems in buildings represent an important market sector in Europe and worldwide. Heating systems constitute a key element in providing a comfortable and healthy environment in buildings. Heating of buildings in Europe is accounting for approx. 35% of the total energy use. The market share for heating systems in buildings is very difficult to evaluate. The yearly turnover is estimated as 20 billion Euro

(2010). Heating systems in buildings constitute a significant economical factor, not only on the construction costs of buildings but also on the running costs.

Heating systems includes:

- ▶ hardware products (like heat generators, pipes, pumps, fittings, controls, insulation, heat emitters);
- ▶ software products for design of systems and for calculation of heat load and annual energy requirements;
- ▶ services for design, installation, commissioning, operation and maintenance of heating systems.

CEN TC 228 "Heating systems in buildings" - a performance based system approach

Heating systems in buildings are the scope of CEN TC 228 "Heating systems in buildings". The standards developed by TC228 are system standards. They are based on performance requirements addressed to the system as a whole and not dealing with requirements to the products within the system.

Standardisation on single products used in heating systems is carried out by other product Technical Committees (TCs). These product TCs provide the basis for individual testing of products.

But product testing alone does not guarantee that a heating system composed of several different products will work safely and efficiently. The specific running conditions and the interactions between the different products in a system have to be taken into account. The system performance can be calculated. This work is realized mainly in

CEN/TC 228 WG4 “calculation methods, system performance and evaluation”.

The scope of CEN/TC 228 WG4 includes calculation methods for:

- ▶ Design heat loads, i.e. standards for calculation of design heat loads on heating systems,
- ▶ Heating system energy requirements and system efficiencies,
- ▶ Economic performance of heating systems,
- ▶ Environmental performance of heating systems.

The calculation methods may be used for:

- ▶ supporting or judging compliance with regulations, directives or labelling of product and heating systems,
- ▶ optimisation of the energy performance of a building,
- ▶ displaying conventional level of energy performance of existing buildings,
- ▶ predicting future energy resources needs on a national or international scale.

As indicated the system approach of the calculation method is based on normalized product characteristics. Liaisons are established with product TCs as:

- ▶ CEN/TC 57 - Central heating boilers
- ▶ CEN/TC 109 - Central heating boilers using gaseous fuels
- ▶ CEN/TC 113 - Heat pumps and air-conditioning units
- ▶ CEN/TC 130 - Space heating appliances without integral heat sources
- ▶ CEN/TC 180 - Non-domestic gas-fired overhead radiant heaters
- ▶ CEN/TC 197 - Pumps
- ▶ CEN/TC 312 - Thermal solar systems and components

CEN/TC 228 has also members in the horizontal CEN/TC 371 Project Committee EPBD in order to coordinate the standardisation work and the definitions, terms, parameters, etc. used in the standards for building, ventilation and heating systems related to the EPBD.

On the international level, calculation of heating systems for annual energy consumption is related to the Work program of ISO/TC 205 “Building environment design” and ISO/TC 163 “Thermal performance and energy use in the built environment”. For the energy performance of buildings using holistic approach, a Joint Working

Group “Energy performance of buildings using holistic approach” was established between ISO/TC 205 and ISO/TC 163.

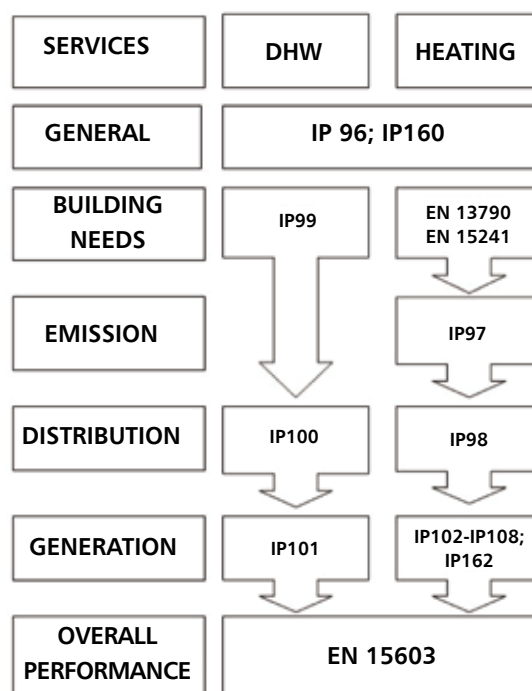
CEN/TC 228 WG4 work items linked to EPBD

In some countries there has been pressure from the national regulators on the national standardisation bodies to establish relevant national standards on calculation methods for the annual energy use. This has led to increased activities on the national level, which has made it more difficult to progress the work on the European level. The mandate (M/343 as issued in 2004) of the EU-commission to CEN, asking CEN to develop standards related to the EU Directive on Energy Performance of Buildings, was the firm basis for the increased level of activities to develop European Standards in this field. This mandate was given to support the implementation of the EPBD in the EU Member States, and involved 18 mandated work items of CEN/TC 228.

The EN 15316-x set of CEN standards covers all aspects of the energy performance of heating systems in buildings: calculations of the energy performance for space heating and domestic hot water.

Both are split up in different sections:

- ▶ building needs;
- ▶ emission;
- ▶ distribution;
- ▶ generation;
- ▶ overall performance.



Domestic hot water

The energy consumption for domestic hot water (DHW) is calculated using a step by step approach.

Building needs (domestic hot water):

The DHW needs are characterized by volumes linked to temperatures throughout the year (hot water needs) and tapping patterns. Tapping patterns are needed for the calculation of distribution and generation losses. Also the estimation of the contribution of each heat generator (e.g. thermal solar) depends on the tapping patterns (see information paper).

Emission:

In the case of DHW emission is not taken into consideration yet. Emission systems consist of tapping points and showerheads.

Distribution:

Heat losses and auxiliary energy are considered (see IP100). The distribution losses can be higher than the domestic hot water needs.

Generation:

There are several types of generators available which are also used to provide space heating. Space heating and domestic hot water have some distinctively different properties, so there are separate standards on DHW and space heat generation (see IP101).

Space heating

The energy consumption for space heating is calculated using a four step approach.

Emission:

Factors like non-uniform temperature stratification in a room, control strategy, heat losses and auxiliary consumption are taken into account in calculation (see IP97).

Distribution:

A part of the heating system which is often underestimated is distribution. The electrical consumption of a pump can represent about 10% of the primary energy consumption of a low energy house (see IP98).

Generation:

Combustion systems like gas boilers, heat pumps are taken into account. Other generators are thermal solar, combined heat and power, photovoltaic and biomass combustion systems.

District heating and other large volume systems have some distinctive properties. They are treated as separate subjects in the generation standards.

An important aspect when considering improvements of a building installation is the economic benefit (see IP160).

Extension of the scope of CEN TC 228 from heating to cooling systems

The extension to cooling purposes in the scope of CEN TC 228 is discussed. Cooling is more and more important. The system approach of cooling systems is not yet explicitly covered by a Technical Committee in CEN.

If heating and cooling is needed, both are supplied very often by reversible systems (e.g. generators like heat pumps, emitters). In modern buildings, the use of heating and cooling will increase. The stakeholders, the design engineers have, or will have, to deal with heating and cooling. The methods should be comparable and coordinated.

For the coordination of the system approach of heating and cooling within CEN, it would be beneficial if both activities are within the same TC and WG's. The same applies also for design, inspection and maintenance. Some aspects of cooling systems as hydraulic surface heating and cooling systems (including the TABS) are already treated by CEN TC 228.

Bringing CEN standards heating and cooling standards on ISO level – ISO/TC 205 WG9 "Heating and cooling system"

To structure the responsibilities for a uniform evaluation method of the energy performance of buildings significant reorganizations were made in ISO during the last years.

Climate change and energy efficiency are priority standardization topics all over the world but Europeans were the motor for this reorganization, linked to the mandate 343 and the "Energy performance of Buildings Directive" (EPBD). The European experts wanted to bring their standardization work on ISO level to enable countries such as China, India and the USA to take part on the work.

To assure that technical building systems and services of building energy engineering are considered in appropriate way in the standardization work, it is important that

the heating industry and service companies cooperates actively in the reorganization of the international standardization committees. As in 2008 the decision was made to bring the CEN EPBD standards, as produced under the mandate 343 EPBD, to the ISO level, the working group 9 "Heating and cooling systems" was established within ISO TC 205 "Building environment design" under the chair of Johann Zirngibl / France.

In ISO TC 205 several working groups were already dedicated to technical building systems, like WG3- "Building control systems design" (with a very successful cooperation with CEN TC247) and WG8- "Radiant heating and cooling systems". ISO TC 205 is also dealing with indoor environment which is related to the performance of heating and cooling systems.

Initially it was proposed to limit the scope of ISO/TC 205 WG9 to heating systems, but as in countries with air based systems (Japan, USA) heating and cooling are closely linked, it was decided to expand the scope to heating and cooling systems.

The first two new work topics are:

- ▶ NWI_N262 - Heating and cooling systems in buildings - Method for calculation of the system performance and system design - Heat pump systems (Leader: AFNOR – B. Ziegler);
- ▶ NWI_N265 - Heating and cooling systems in buildings - Method for calculation of the system performance and system design - Combustion systems –boilers (Leader: DIN – J. Schilling)

These two topics are based on two CEN EPBD standards (under mandate 343).

Conclusions

The standardization structure for heating and cooling systems related to the overall energy use of buildings (system approach) is now in place. The main characteristics of this structure are:

- ▶ the link between the product TC (TC 57, TC 113, TC 180, TC 312, etc) and the system TC (TC 228);
- ▶ the link between the system TC (TC 228) and TC 371 in charge of the overall energy use of buildings.

As the recast EPBD (2010) requires more specified energy performance declarations for heating, cooling and ventilation systems, it is expected that the EN or EN-ISO standards to be developed to

support this, will satisfy the legislation need on national level. This expectation will, with support of a second mandate from the EU commission to CEN, enable the EU experts to work on these issues on the European level and at the same time contribute to the ISO level.

The organization structure in place in CEN (the horizontal CENTC371) and in ISO, the ISO Joint working group of ISO/TC163 and ISO/TC205, taking care of the overall energy use and the ISO/TC205 WG9 dedicated to heating and cooling systems will support this. Having comparable structures in CEN and ISO will help to avoid duplication of efforts and inconsistencies.

The position of the heating and cooling systems within the system standardization has now well been established, especially on ISO level. The standardization of heating and cooling systems has an important position in the overall energy efficiency evaluation of the building and standardization work on ISO level is progressing.

References

- ▶ *Business plan CEN/TC 228 Heating systems in buildings.*
- ▶ *CENSE Information Papers available at: www.iee-cense.eu*
- IP96: Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies. Part 1: General*
- IP160: Economic evaluation procedure for energy systems in buildings.*
- IP99: Domestic Hot Water systems – Characterisation of Needs (tapping requirements)*
- IP100: Domestic Hot Water systems – Distribution*
- IP101: Domestic Hot Water systems – Generation*
- IP97: Heating systems in buildings – Space heating emission systems*
- IP98: Heating systems in buildings – Space heating distribution systems*
- IP102: Space heating generation systems – Combustion systems*
- IP103: Space heating generation systems – Heat pump systems*
- IP104: Space heating generation systems – Thermal solar*
- IP105: Space heating generation systems – Combined heat and power systems*
- IP106: The performance and quality of district heating and large volume systems*
- IP107: Space heating generation systems – Photovoltaic systems*
- IP108: Space heating generation systems – Biomass Combustion systems*