EUROPEAN STANDARDISATION REGARDING HEATING SYSTEMS IN BUILDINGS

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ABSTRACT

Since the end of the 80's, intensive work on standardisation has been taken place in Europe. The goal is to establish uniform standards in Europe among the countries who are members of EFTA and the European Union. Inside the building and HVAC area, mainly standards for products have been published. Now design of systems and calculation methods are also being standardised. The present paper presents the standardisation work going on in Europe related to the design and operation of heating systems in buildings. Standards for calculation of building energy demand, heat load calculations, system design, installation and operation, sizing of heat emitter, and for calculation of yearly energy performance will be presented and discussed.

1. INTRODUCTION

During the last 10 years, intensive work on standardisation has been taken place in Europe. The goal is to establish uniform standards in Europe among the countries who are members of EFTA and the European Union. The standardisation under CEN (Centre European Standardisation) is however, made in close corporation with ISO (International Standards Organisation). According to the Vienna agreement, existing ISO-standards shall be used as CEN standards. And similar must new developments of ISO standards also use existing CEN standards as the basis. This means that ongoing European standardisation will also influence the development of ISO standards.

Many different kinds of standards exist or are being developed e.g. product standards, system standards, test standards, calculation standards etc. In Europe the standardisation has mainly been concentrated on products, so that a basis is established for a free trade of products among all the member states.

The present paper will only deal with a few product standards for heat emitters like radiators or floor heating, and mainly presents system standards for the whole heating system and standards for calculation of heat load and yearly energy requirements for heating

2. STANDARD DEVELOPMENT IN ISO AND CEN

Both in ISO and CEN standards are being developed in Working Groups (WG) by experts form various countries. In the working groups the members are appointed by the various countries. The members are working as experts and individuals and do not necessarily represent the opinion of the country. After the working group has finished a draft, a Technical Committee (TC) or Sub Committee (SC) gives national comments on the draft and decides if it is ready to go out for public comments in all the member countries. The members on a TC and SC represent a country. Then the document is accepted as a Draft International Standard inside ISO (ISO/DIS) and as a Pre-Standard inside CEN (prEN). The document will be out for vote and comments during a 6 months period in all member countries. After the review period the standard may be revised again before it will be send out for a final vote and then publication. After a new revision, based on the received comments during the enquiry period, the document will be circulate for formal vote during a two months period. It is then only possible to vote "yes" or "no" with editorial comments. On the CEN level the results are based on a weighted vote.

An ISO standard is a voluntary document , which may be adopted as national standard, used in national law, or used in contracts. A CEN standard must be adopted as national standard and the equivalent national standard must be withdrawn.

3. PRODUCT STANDARDS

The diagram in Figure 1 is showing some of the committees working on standards related to heating systems. Only a couple of the committees working on product standards are listed. There also exists committees working with circulation pumps, valves etc. In the present paper only the work on product standards from CEN TC 130 and CEN TC 247 will be presented.

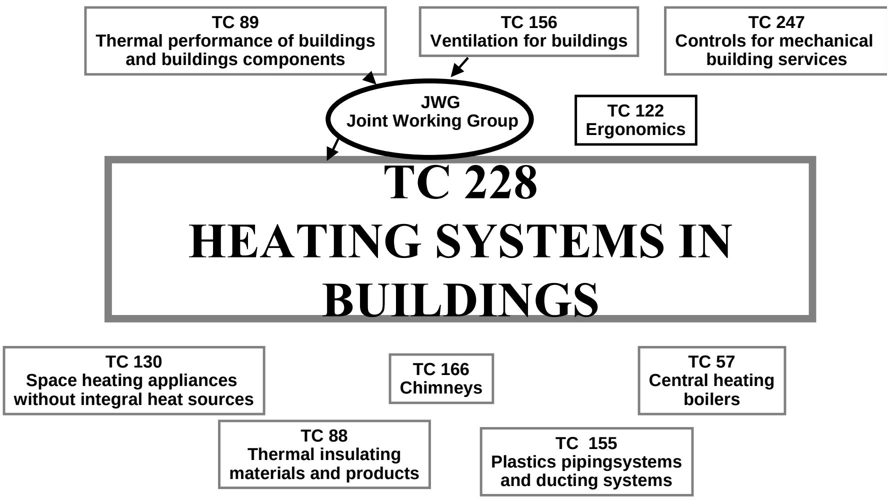


Figure 1: Diagram showing the interaction between CEN standard committee in the area of heating systems in buildings.

3.1 TC 130 Space heating appliances without integral heat sources

The TC 130 committee is dealing with standard for rating and determining the heat output for heat emitters. The published standards are listed in Table 1. For radiators and convectors the heat output must be determined by a test in a certified test room and under standard conditions (EN 442). The heat output can then be corrected for other conditions (water temperatures, space temperatures etc.) by calculations.

This committee has also produced a standard (EN 1264) for floor heating which is almost identical with a German standard for floor heating (DIN 4725). A „floor system“ is not regarded as a product, but more like a „kit“, which is a system consisting of an assembly of products delivered by the same producer/supplier. EN 1264 is only applicable for warm water floor heating systems. The determination of thermal performance and conformity to the standard is carried out by calculation in accordance with type of floor system design. The calculation method is based on a finite element model. The calculation model is valid for standard type of floor systems. For other types of systems additional factors must be experimentally determined and introduced in the calculations.

Table 1: Published documents from CEN TC 130

Doc. Number	Title	Year
EN 442-1	Radiators and convectors Part 1: Technical specifications and requirements	1995
EN 442-2	Radiators and convectors - Part 2: Test methods and rating	1996
EN 442-3	Radiators and convectors - Part 3: Evaluation of conformity	1997
EN 1264-1	Floor heating – Systems and components – Part 1: Definitions and symbols	1997
EN 1264-2	Floor heating – Systems and components – Part 2: Determination of the thermal output	1997
EN 1264-3	Floor heating – Systems and components – Part 3: Dimensioning	1997

Table 2: Work Program CEN/TC130 – Space heating appliances without integral heat sources

Work item	Title	Expected as EN
00130 009	Floor heating – Systems and components – Part 4: Installation	2001
00130 010	Radiators and convectors – Annex to part 2	
00130 011	Ceiling mounted radiant panels supplied with water at temperature below 120 °C – Part 1: Technical specifications and requirements	2001
00130 012	Ceiling mounted radiant panels supplied with water at temperature below 20°C – Part 2: Test method for thermal output	2001
00130 013	Ceiling mounted radiant panels supplied with water at temperature below 120 °C – Part 3: Thermal conversion, rating methods and evaluation of the radiant thermal output	2002
00130 014	Ceiling mounted radiant panels supplied with water at temperature below 120 °C – Part 4: Evaluation of conformity	2002
00130 015	Ceiling mounted radiant panels supplied with water at temperature below 120 °C – Part 5: Methodology for the application of ceiling mounted panels	2003

TC 130 is now mainly working with testing standards for ceiling mounted radiant heating panels (Table 2).

3.2 TC247 Controls for mechanical building services

The committee are dealing with standardisation related to building automation and building management products and systems for heating, ventilating and air conditioning. Several published documents and ongoing work items are dealing with protocols for communication between components of a control system and for the control management level (EIB, BAC-net, LON-talk etc.). Another part of the work is dealing with the products of a control system like thermostats, mixing value, sensors etc. The main work items in this area are listed in Table 3.

Table 3: Work Program CENTC247 – Controls for mechanical building services

Work item No.	Reference document	Title	Expected formal vote
00247001	EN 12098-1 (1996)	Outside temperature compensated control equipment for hot water heating systems	
002470015	prEN 12098-2	Control for heating systems – Part 2: Optimum start-stop control equipment for hot water heating systems	2001
002470017	CEN/TC247 N 166	Individual zone control for HVAC - Part 1: Heating systems for hot water and electrical heating	2001
002470018	CEN/TC247 N 167	Individual zone control for HVAC - Part 2: Fan coil and induction systems	2001
002470019	CEN/TC247 N 168	Individual zone control for HVAC - Part 3: Heating and air conditioning systems	2001
002470022		Temperature control devices and temperature limits for heat generating systems (Central heating systems)	2001
002470024	New work	Terminology for Building Automation	
002470025	PrEN12098-3	Outside temperature compensated control equipment for electrical heating	2002
002470026	PrEN12098-4	Optimum start-stop control equipment for electrical heating	2002
	PrEN12098-5	Fixed time start-stop control equipment for HVAC systems	

4. SYSTEM STANDARDS

Even if the major focus of the CEN Standardisation at the moment is on product standards several activities are also going on related to heating systems and ventilation systems. These standard are not supposed to set requirements to products but on systems, i. e. assembly of products.

CEN TC228 "Heating Systems in Buildings" are developing a series of standards dealing with design, installation, commissioning, instructions for operation and maintenance design heat load calculation and yearly efficiency of heating systems.

The work program of TC 228 is listed in Table 4. Some of the documents EN 12828, 12831, 12170, 12171, have gone through the six months comments period, have been revised and will be issued for formal vote in 2001. A standard on commissioning and a standard for design of electrical heating systems will be issued for six months enquiry comment period also in 2001.

Table 4: Work Program CEN/TC228 – Heating Systems in Buildings

Working Group	Work item	Doc. No.	Title	Expected for formal vote or enquiry
WG1	0228002 0228004 0228011	EN12828 PrEN14337	Design of water based heating systems Design of direct electrical heated systems Design of thermodynamic heating systems	Published-2002 Enquiry-2002 Enquiry-2003
WG2	0228009	PrEN14336	Commissioning of water based heating systems	Enquiry-2002
WG3	0228010 0228011	EN12170 EN12171	Instructions for operation, maintenance and use – large systems Instructions for operation, maintenance and use – small systems	Published-2002 Published-2002
WG4	0228012 0228013-1 0228013-2	EN12831 PrEN14335-1 PrEN14335-2	Methods for calculation of the design loads Methods for calculation of design efficiency and design energy demand Methods for calculation of design efficiency and design energy demand Part 2: Space Heating Emission Systems.	Published-2002 Enquiry-2002 Enquiry-2002
WG5	0228015		Hydraulic surface heating and cooling systems	Enquiry-2003

Two of the standards deal with instruction for operation and maintenance (EN 12170, EN 12171). These standards are not telling how to operate or maintain heating systems but setting requirements for how to write instructions for operation and maintenance. One standard (12170) is for systems requiring a trained operator and the other standard (12171) for systems without. The standard for commissioning will also include a section on installation.

The two most important documents, which will be finished in 2001, are the standards EN 12828 „ Heating Systems in Buildings - Design of water based heating systems“ and EN 12831 „Heating Systems in Buildings - Method for calculation of the design heat load“.

4.1 Design of heating systems

The standard for design of water based heating systems, EN12828 includes design requirements for the design of the different parts of a heating system like heat supply (boiler, heat exchanger), heat distribution (pipes, valves, pumps), heat emission (radiator, convector, floor system, ceiling system) and controls (local control, central control, timing control) (Table 5). The standard specifies requirements for safety and the insulation of the system to avoid excessive heat loss, too high temperature drop and risk of too high surface temperatures. The requirements are performance type requirements which in several cases are divided in classes to allow for each country to select individual requirements.

The capacity of the heat supply system shall be calculated as follows:

$$\Phi_{SU} = f_{HL} \cdot \Phi_{HL} + f_{DHW} \cdot \Phi_{DHW} + f_{AS} \cdot \Phi_{AS}$$

where

Φ_{SU}	=	the capacity of the heat supply system in kW
f_{HL}	=	the design factor for the heat load
Φ_{HL}	=	the heat load capacity in kW
f_{DHW}	=	the design factor for domestic hot water systems
Φ_{DHW}	=	the domestic hot water capacity in kW
f_{AS}	=	the design factor for attached systems
Φ_{AS}	=	the capacity of attached systems in kW

The factors f_{HL} , f_{DHW} and f_{AS} should be determined on an individual basis subject to national limitations. It should be considered that the above heat load capacities may not be cumulative and the heat supply capacity should be determined based on agreed criteria for their ability demand.

Table 5: Contents of EN 12828 Heating Systems in Buildings - Design for water based heating systems.

1.	Scope
2.	Normative references
3.	Terms and definitions
4.	System design requirements
4.1	Requirements for preliminary design information
4.2	Heat supply
4.3	Heat distribution
4.4	Heat emission
4.5	Controls
4.6	Safety arrangements
4.7	Operational requirements
4.8	Thermal insulation
5.	Instruction for operation, maintenance and use
6.	Installation and commissioning
Annex A	Control system classification (Informative)
Annex B	Thermal environment (Informative)
Annex C	Thermal insulation (Informative)
Annex D	Guidance for dimensioning diaphragm expansion vessels (sealed systems) (informative)

The heat emitters shall be selected on the basis of the design heat load (EN12831). Consideration shall be given to: thermal comfort and noise, safety (surface temperature), damage of building and maintenance. Size of the emitter, temperature of emitter and water flow rates shall be determined on the basis of manufacturers data sheets according to EN442 and EN1264. In rooms with high ceilings a high vertical temperature difference may occur, rather than the uniform temperatures normally assumed in the heat loss calculations. In such cases the heat loss through upper part of the heated space is larger and an additional allowance on emitter output may be desired. If desired by the user calculation of the criteria for thermal environment (operative temperature, radiant temperature asymmetry and draught) shall be fulfilled in accordance with EN ISO 7730.

Control of the heating system shall enable the specified designed indoor temperatures to be achieved under the specified variation of internal loads and external climate and, if specified, protect buildings and equipment against frost and moisture damages when normal comfort temperature level is not required.

An automatic control is not required in the standard; but in several countries automatic control is required in national building codes. The control system shall be classified according to Table 6. The requirements in the German law are indicated in the table.

Table 6: Control system combination table

	Control system performance modes			
Heating Control System	Manual	Automatic	Timing function	Optimisation of timing control
Local		x		
Zone		(x)		
Central		x	x	

As the last example from EN12828 is the requirement to thermal insulation of the heating system described. The components of the distribution system, including pipework throughout its entire length, shall be insulated to minimise heat losses, avoid harmful effects of too high surface temperatures to ensure the safety of the occupants and avoid damage to the heating system installation caused by frost. Parts of the heating system located in non-heated spaces shall be insulated to reduce unwanted heat losses. Insulation classes are given in Table 7.

Table 7: Thermal transmittance classes

Insulation class	Maximum thermal transmittance	
	Pipes [1]) (W/m² K)	Plane surfaces [2]) (W/m²K)
0	0	0
1	$3,3\ d_l + 0,22$	1,17
2	$2,6\ d_l + 0,20$	0,88
3	$2,0\ d_l + 0,18$	0,66
4	$1,5\ d_l + 0,16$	0,49
5	$1,1\ d_l + 0,14$	0.35
6	$0,8\ d_l + 0,12$	0,22

[1]) includes pipes with circular cross section up to an external diameter of $d_l = 0,4$ m.
[2]) includes tanks and other installation unites with plane or curved surfaces, circular pipes with diameter exceeding 0,4 m and large pipes with non-circular cross section d_l in m.

Radiator supply pipes are usually not insulated when placed in the same zone as the radiator. In well insulated buildings, however, the part of the piping system that is not part of the heat emission system, should be insulated to avoid undesirable increases of internal air temperature. An increase of more than 2 K in room temperature at design conditions should be avoided.

Similar as for water based heating system a draft standard has been made for electrical heating systems and a new work has started regarding design of thermodynamic heating systems (heat pumps). The standards will not deal with the design of or requirements to the components but set up general design criteria for systems.

4.2 Design heat load

The content of EN 12831 for calculation of design heat load is shown in Table 8. The basis for the sizing of the heat supply (boiler, heat pump) is the design heat load according to EN12831 for a building entity or a whole building. The basis for the sizing of the heat emitter is the heat load calculated space by space in EN12831. The method for calculation of the design heat load are based on general known equations for calculation of transmission and ventilation heat loss. The aim is to get a standard calculation method, which can be used by all designers in Europe. Country specific requirements for the design outdoor temperature and design indoor temperature shall be used. This means for a house in Germany a designer in Denmark, France or Belgium shall calculate the same heat load. While for the same house in Germany, Austria and Switzerland the same designer may calculate different heat load values even if the houses are geographical very close to each other. The calculation are referring to

Table 8: Contents of prEN 12831 Heating Systems in Buildings – Method for Calculation of the Design Heat Load

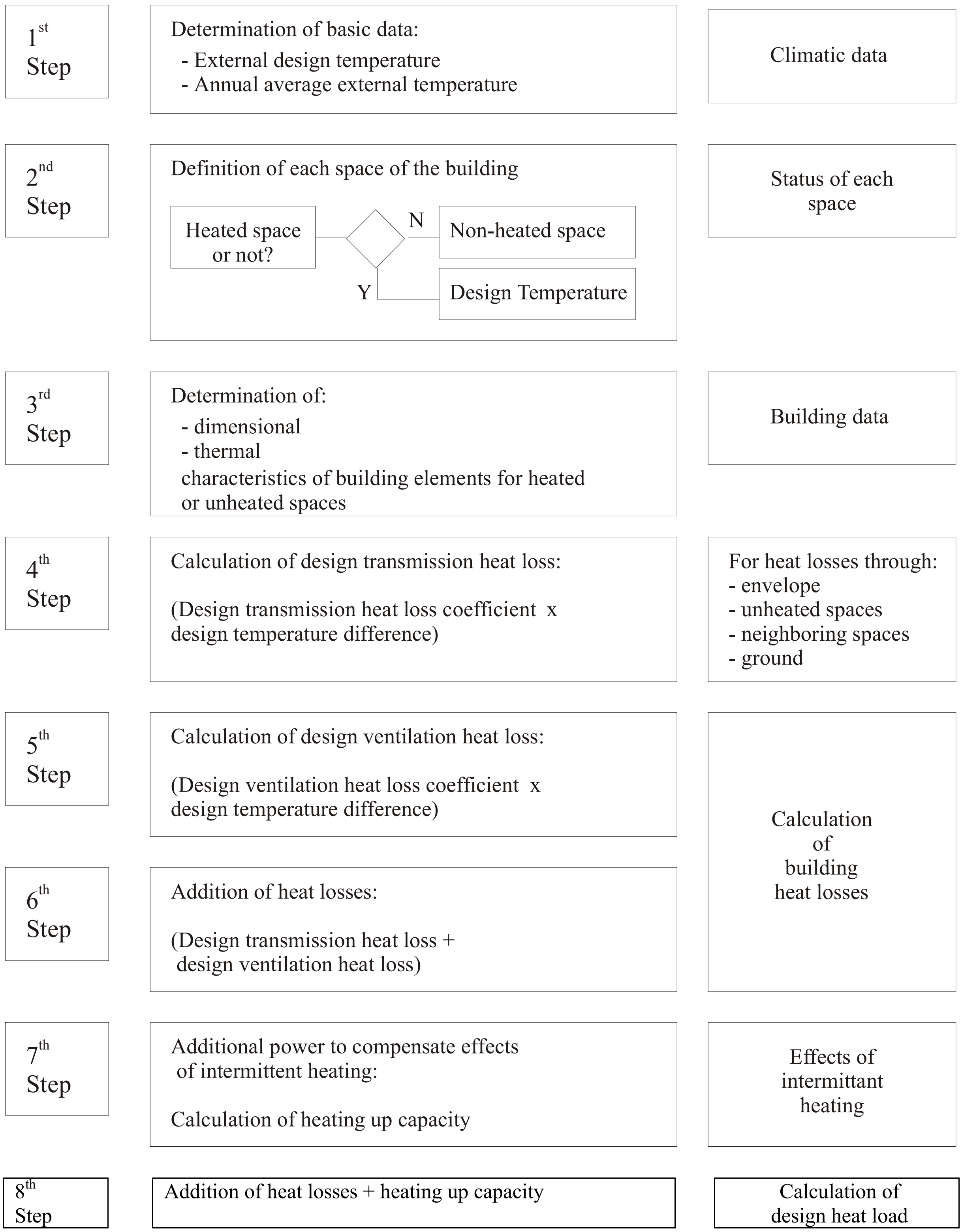
1.	Scope
2.	Normative references
3.	Definitions and Symbols
4.	Principle of the Method
5.	General Considerations
6.	Data Required
7.	Total Design Heat Loss for a Heated Space – Basic Cases
7.1.	Design Transmission Heat Loss
7.2	Design Ventilation Heat Loss
7.3	Intermittently heated Spaces
8.	Design Heat Load
8.1	Design Heat Load for a Heated Space
8.2	Design Heat Load for a Building Entity or a Building
9.	Simplified Calculation Method
Annex A	Basic Parameters on Human Comfort in Interior Thermal Environments. Significance of Operative Temperature in Heat Load Calculation (informative)
Annex B	Instructions for Design Heat Loss Calculation in Special Cases (informative)
Annex C	Example of a Design Heat Load Calculation (informative)
Annex D	Default values for the calculation in clauses 6 to 9 (normative)
Annex E	Bibliography (informative)

other CEN-Standards from TC 89 for calculation of thermal transmission values for building components (U-value).

The standards include a calculation procedure for a heated space, a calculation method for a building entity (apartment) or building and a simplified calculation method.. The calculation procedure for a heated space is shown in Figure 3.

The method for the basic cases is based on the hypotheses that the temperature distribution (air and design) is assumed to be uniform, the heat losses are calculated in steady state conditions assuming constant properties, such as values for temperature, characteristics of building elements etc..

Figure 2 - CALCULATION PROCEDURE FOR A HEATED SPACE



The procedure for basic cases can be used for the majority of buildings with a ceiling height not exceeding five metres, heated or assumed to be heated at a specified steady state temperature and where the air temperature and operative temperature are assumed to be of the same value.

In poorly insulated buildings and/or during heating-up periods with emission systems with a high convection heat transfer (e.g. air heating); or large heating surfaces with significant radiation components (e.g. floor or ceiling heaters); there may be significant differences between the air and operative temperatures, as well as a deviation of the uniform temperature distribution over the room, which can lead to a substantial deviation from the basic case and shall be considered as a special case (information is given in Annex B of the standard).
Initially the design heat loss is calculated. These results are then used to determine the design heat load.

For the calculation of the design heat loss of a heated space, the following components shall be considered:

- the design transmission heat loss, which is the heat lost to the exterior as a result of thermal conduction through the surrounding surfaces, as well as heat transfer between heated spaces due to the fact that adjacent heated spaces may be heated or conventionally assumed to be heated at a different temperature. For example, adjacent rooms belonging to another apartment can be assumed to be heated at a fixed temperature corresponding to an unoccupied apartment;

- the design ventilation heat loss, which is the heat lost to the exterior by ventilation or by infiltration through the building envelope and the heat transferred by ventilation from one heated space (i) to a heated space (j) inside the building.

The total design heat loss for a heated space (i) is calculated according to the equation below,

$$\Phi_i = \Phi_{T,i} + \Phi_{V,i} \qquad [W]$$

where:

$\Phi_{T,i}$ = design transmission heat loss
$\Phi_{V,i}$ = design ventilation heat loss

The design transmission heat loss $\Phi_{T,i}$ for a heated space i is calculated as follows:

$$\Phi_{T,i} = (H_{T,ie} + H_{T,iue} + H_{T,ig} + H_{T,ij}) \bullet (\theta_{int,i} - \theta_e) \qquad [W]$$

where:

$H_{T,ie}$ = heat loss coefficient between the heated space (i) and the exterior (e) through the building envelope in Watt per Kelvin (W/K);
$H_{T,iue}$ = transmission heat loss coefficient from heated space (i) to the

		exterior(e) through the unheated space (u) in Watt per Kelvin (W/K);
$H_{T,ig}$	=	steady state ground heat loss coefficient from heated space (i) to the ground (g) in Watt per Kelvin (W/K);
$H_{T,ij}$	=	corrected heat loss coefficient from a heated space (i) to a neighbouring heated space (j) heated at a significant different temperature in Watt per Kelvin (W/K). This can be an adjacent heated space within one building entity or a heated space of an adjacent building entity;
$\theta_{int,i}$	=	internal design temperature in heated space i in degree Celcius (°C),
θ_e	=	external design temperature in degree Celsius (°C).

The design ventilation heat loss, $\Phi_{V,i}$, for a heated space (i) is calculated by

$$\Phi_{V,i} = H_{V,i} \cdot (\theta_{int,i} - \theta_e) \qquad [W]$$

where:

$H_{V,i}$	=	design ventilation heat loss coefficient in Watt per Kelvin (W/K);
$\theta_{int,i}$	=	internal design temperature of heated space (i) in degree Celsius (°C);
θ_e	=	external design temperature in degree Celsius (°C).

The equation for calculating the design ventilation heat loss coefficient in a space (i), $H_{V,i}$, is:

$$H_{V,i} = \dot{V}_i \, \rho \, c_p \qquad [W/K]$$

where:

$\dot{V}_i$	=	air flow rate of a space (i) in cubic metres per second (m^3/s)
ρ	=	density of the air at $\theta_{int,i}$ in kilogram per cubic metre (kg/m^3)
c_p	=	specific heat capacity of air at $\theta_{int,i}$ in kilo Joule per kilogram (kJ/kg K)

Assuming ρ and c_p = const., the equation can be reduced to:

$$H_{V,i} = 0{,}34 \cdot \dot{V}_i \qquad [W/K]$$

where:

$\dot{V}_i$ is now expressed in m^3/h.

The calculation procedure for determining the relevant air flow rate $\dot{V}_{v,i}$ depends upon the system considered.
Calculation of the design heat load for a building entity or a building, shall not taken into account (e.g. heat losses between apartments) the heat transfer within the envelope of the building entity by transmission and ventilation.
The heat load for a building entity or a building is expressed by:

$$\Phi_{HL} = \Sigma\, \Phi_{T,i} + \Sigma\, \Phi_{V,i} + \Sigma\, \Phi_{RH,i}$$

where

$\Sigma\, \Phi_{T,i}$ = sum of transmission heat loss of all heated spaces without the heat transferred inside the building entity or the building;

$\Sigma \Phi_{V,i}$ = ventilation heat loss off all heated spaces without the heat transferred inside the building entity or the building (with one heat generator).

The equation implies an overall building air flow rate. Since the zone based air flow rate is based on the worst case, it is not appropriate to summarise the zone values, because the worst case only occurs in part of the zones simultaneously. The building air flow rates are calculated as follows :

<u>without ventilation system :</u>

$$\Sigma \dot{V}_i = \max (0.5\Sigma \dot{V}_{inf,i}\ ,\ \Sigma \dot{V}_{min,i})$$

<u>with ventilation system :</u>

$$\dot{V}_i = 0.5\Sigma \dot{V}_{inf,i} + (1-\eta_v)\,\Sigma\dot{V}_{su,i} + \Sigma \dot{V}_{mech,inf,i}$$

where:

η_v = efficiency of the heat recovery system on exhaust air;

if no heat recovery then $\eta_v = 0$

For sizing the heat generator a 24 hour average is used. If the supply air is heated by an adjacent system, the heat load is taken into account there.

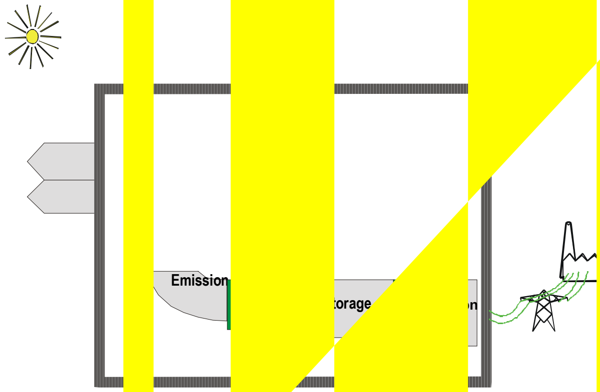
$\Sigma \Phi_{RH,i}$ = sum of additional power required to compensate for the effects of intermittent heating off all heated spaces

4.3 Method for calculation of system energy requirements and system efficiencies

In several countries (Italy, Netherlands, England, France) the efficiency of the heating system must be taken into account, when determining the energy requirements for heated buildings and verification that the building will met the maximum values given in the building energy codes. Germany and Austria are also proposing to include the performance of the heating system in their national laws for energy use in heated buildings. TC228 has for some years worked on an European method for calculation of the system energy requirements for heating and system efficiencies. This work has been somewhat delayed do to intensive activities at the national level in several countries. The first document from TC228 is, however, being issued for public enquiry. This document present the structure for the calculation of the energy requirements of a space heating and domestic hot water production system in a building. The document will be followed with several other parts given the calculation methods for the individual parts of a heating system (emission, distribution, generation, control).

The principle for calculation the system heating energy requirement is illustrated in Figure 3.The method is based on an analysis of the following parts of the space heating and domestic hot water system including control: emission system, distribution system, storage system and generation system. The building energy demand is calculated from EN13790 (or EN832), where an ideal heating system without additional losses is assumed. For each part of the heating system the additional losses from emission (non-uniform temperature distribution in the space and space temperature control), distribution and storage system (losses to unheated space) and generation system (stand still losses, boiler efficiency, control) are calculated.

As shown in Figure 4 also the auxiliary energy for pumps, valves etc are calculated for each part of the system. Finally the calculated energy requirements are converted to primary energy.



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solar). This factor shall be given on a national basis. Default values are listed in an Annex.

W_h = auxiliary energy needed for space heating

$Q_{f,w}$ = energy required by the domestic hot water system

$W_{w,}$ = auxiliary energy needed for domestic hot water production

The energy required for space heating is given by

$$Q_{f,h} = (Q_h - Q_{rhh} - Q_{rwh}) + Q_{th} \qquad \text{(kWh/period)}$$

where:

Q_h = building heating demand according to EN832 or ISO EN 13790

Q_{rhh} = heat recovered from the space heating system (thermal and auxiliary) where not directly taken into account as losses reduction in Q_{th},

Q_{rwh} = heat recovered for the space heat use from the domestic hot water system

Q_{th} = total of the heat losses due to the space heating system. The total space heating system loss includes the recovered space heat loss (see Figure 4).

The content of the first document is shown in Table 9.

Table 9: Contents of TC228WG4 N242 Heating Systems in Buildings - Method for calculation of system energy requirements and system efficiencies

1.	Scope
2.	Normative references
3.	Terms and definitions
4.	Principle of the method
4.1	Primary energy
4.2	Energy required for space heating
4.3	Energy required for domestic hot water system
4.4	Auxiliary energy
4.5	Recoverable and recovered heat losses
4.6	Heat demand for the building
4.7	Heat demand for hot water preparation
4.8	Heat losses due to the space heating system
4.9	Heat losses due to the domestic hot water system
4.10	Time periods
4.11	Spatial division
4.12	Space heating and domestic hot water system performance
5.	Space heating and domestic hot water subsystem energy calculation
5.1	Energy losses from the space heating system
5.2	Energy losses from the domestic hot water system
5.3	Splitting and/or branching of the heating system
5.4	Simplified and detailed methods for the calculation of the total system loss and within sub-systems
Annex A	Sample of subsystem (informative)
Annex B	Primary energy conversion factors (informative)
Annex C	Sample of space heating and electrical domestic hot water system (informative)

5. SUPPORTING STANDARDS

Several standards are dealing with calculation methods which do not direct take into account the heating system, but which give input to the calculation methods used in the standards for heating systems. Most of the calculation methods for energy transmission in buildings are done by CENTC89 "Thermal Performance of Buildings and Building Components". A small excerpt of the work program related to energy use for heating is listed in Table 9. The basis for the annual energy use for heating in buildings is EN 832, which will be substituted by another document covering all types of buildings, EN13190. These calculations are only dealing with the building. The calculations do also take into account the dynamics of the building.

Table 10: Selected work items from the program of CEN/TC 89 Thermal Performance of Buildings and Building Components

WI No.	Document No.	Title	Expected formal vote
7	EN ISO 8497	Thermal insulation – Determination of steady-state thermal transmission properties of thermal insulation for circular pipes	1994
22	EN ISO 13370	Thermal performance of buildings – Heat transfer via the ground – Calculation method.	1998
36	EN 832	Thermal performance of buildings – Calculation of energy use for heating – Residential buildings	1998
37	prEN ISO 13790	Thermal performance of buildings – Calculation of energy use for heating (all type of buildings)	2001
46.4	ISO DIS 6398	Part 4 : Winter external design temperature (ISO/DIS 6398)	2000-03

6. CONCLUSION

The standardisation in Europe under CEN are being done in close corporation with ISO. The procedures have been briefly presented in this paper. The design and dimensioning of a heating system (heat emitter, distribution system, generation system) are influenced by standards for the indoor environment, standards for heat load calculations, building standards and product standards.

Standardisation for buildings and HVAC systems must not result in requirements, which standardise a product and then stop for further developments. The standards should be performance standard, where the requirements may be met by existing or future products. To establish international standards for products and design of systems will promote the international trade and make it easier for designers to work internationally.