Unofficial translation

Handbook for energy consultants

Energy Certification of Small Buildings

2004 version

Selected Parts

Final version

Danish Energy Authority / Concerted Actions EPBD

February 2006 / rev. June 2006

Handbook for Energy Consultants 2004

Publisher

The Danish Energy Authority

Prepared by

Dansk Energi Management A/S
for:
The Registration Committee for Energy Rating of Small Buildings under the Danish Energy Authority

Edited by

Uffe Groes, Tanja Louise Weis, Nils Jepsen, Rasmus Bohr and Kåre Groes – all from Dansk Energi Management A/S

Approved by

The Registration Committee for Energy Rating of Small Buildings, 15 September 2004
The Danish Energy Authority, 19 October 2004

Implementation

The handbook comes into force on 1 November 2004. The previous ”Handbook for Energy Consultants” is valid until 15 November 2004. During the transition period, consultants may freely choose which handbook to use.

Download

The handbook can be downloaded from the Registration Committee’s homepage:

http://www.emsekretariat.dk

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Foreword to the English translation

”Handbook for Energy Consultants – version 2004”, given by the Danish Energy Authority seeks to improve the framework for the energy labelling of small buildings. The Handbook for Energy Consultants is one of central parts of the Danish certification scheme for buildings.

The general rules of the certification are given in the Act given by the Parliament and the Executive Orders given by the Minister of Economy and Business Affairs. Other important guides are set by the Calculation Rules and by the form of the Energy Label and the Energy Plan & Documentation, which describe how to calculate the results and how to present the results of the labelling for the users of the scheme.

The Handbook sets up the more detailed rules for the certification of small buildings and tells in details how the consultant must act;

- by assessment and registration of the buildings and the technical installations,
- by the calculation procedure,
- by advising on possible energy savings,
- by filling in the forms used for the energy labelling,
- by all other details of the consultants contracting and work.

Hence the Handbook is the daily tool for the Energy Consultant and it is an essential background for the quality assessment of the scheme.

The Handbook is translated into English in November / December 2005 with support of the European Commission as a part of the project Concerted Action EPBD translation budget, since the steering group for this project and the CORE team members found, that this Handbook could be a valuable inspiration and tool for other countries who build up a certification scheme for the first time.

Some of the rules in Denmark will change with the implementation of the Directive on Energy Performance in Buildings from 2006 and the new Act to Promote Energy Savings in Buildings which was approved by the Danish Parliament 24th of June 2005. The forms for the certification will change too. For these reasons some parts of the handbook is not translated because those parts are not in line with the directive and will change in Denmark too from the 1st of January 2005. Other parts are left out because they are too specific Danish.

The way to asses the building parts, the technical installations and the systematic of the Handbook will remain the same after 1st of January 2006 so it is our hope that this Handbook can be of inspiration for other countries.

The Danish Energy Authority, February 2006.

[signature]
Jens H. Laustsen

Foreword

With its publication of ”Handbook for Energy Consultants – 2004”, the Danish Energy Authority seeks to improve the framework for the energy labelling of small buildings.

The Handbook is structured according to the energy labelling processes and should function as a tool to facilitate the energy labelling for the energy consultants. It is intended to contribute to ensuring uniformity in the Energy Labelling Certificates and increasing the quality for the consumers, and so the handbook is publicly available online at the Registration Committee’s homepage www.emsekretariat.dk

Also, the structure of the Handbook leads up to the implementation of the new energy labelling framework which is expected to take effect on 1 January 2006, and this regulation will adapt the existing Danish regulations to the requirements stated in EC directive 91 of 2002 concerning the energy capacity of buildings.

For a more detailed description of the structure of the Handbook, please see the General Section.

The Handbook takes effect on 1 November 2004. During the transition period up until 15 November 2004, the previous “Handbook for Energy Consultants” will continue to be in force, and during this transition period, energy consultants may carry out the energy labelling of small buildings according to either the old or the new rules.

We hope that the Handbook will help to further develop the framework and ensure the quality of the energy labels.

The Danish Energy Authority, 19 October 2004.

[signature]
Morten Palle Hansen

[signature]
Jens H. Laustsen

Table of contents

1 Background for energy labelling

1.1 Authorities

The Danish Energy Authority is under the Ministry of Economic and Business Affairs[1)], which is the top authority for the Energy Labelling Scheme. The Ministry has authorised the Energy Authority to manage the scheme. The Energy Authority has delegated the responsibility for the daily management of the regulations to the Registration Committee for Energy Rating of Small Buildings (henceforth referred to as the Registration Committee). The Registration Committee has engaged the Secretariat of Energy Labelling (henceforth referred to as the Secretariat) to carry out the daily management on its behalf. In addition, the Energy Authority and the Energy Board of Appeal act as appeal courts for decisions made by the Registration Committee concerning the quality of energy labelling and of the work of the energy consultants.

For a more detailed description of the qualifications and responsibilities of each authority and agency, see chapter 3 Organisation of the Energy Labelling Scheme.

1.2 Legal basis

The Handbook guidelines for energy labelling have the following legal basis:

- Act no. 485 of 12 June 1996 to Promote Energy and Water Savings in Buildings (”The Energy Labelling Act”) as amended by section 24 in Act no. 450 of 31 May 2000 to Promote Energy Savings
- Executive Order no. 789 of 19 September 2002 on Energy Labelling, etc., in Buildings (“The Energy Labelling Order”)
- Executive Order no. 718 of 14 September 1999 on Fees and Liability Insurance for Energy Labelling of Buildings (”The Fee Order”)
- Executive Order no. 323 of 10 May 2001 on the amendment of the Executive Order on Fees and Liability Insurance for Energy Labelling of Buildings
- Executive Order no. 875 of 20 August 2004 on Service Fees pursuant to the Act to Promote Energy and Water Savings in Buildings (“The Service Fee Order”)

Links to acts and executive orders are available on the Registration Committee’s homepage www.emsekretariat.dk and on the Danish Energy Authority’s homepage www.ens.dk

1.3 Purpose of energy labelling

1.3.1 Purpose of the scheme

The Energy Labelling Scheme for small buildings came into force on 1 January 1997. The purpose of the compulsory energy labelling of small buildings is to:

- promote energy and water conservation and increase the efficiency in energy and water consumption in buildings

and by doing so, to

- reduce energy and water consumption and CO2 emissions of small buildings, and
- provide potential buyers with information on the energy conditions of a building before the deal is closed

1.3.2 The Energy Certificate

The energy labelling consists of an ”Energy label” and an ”Energy plan & documentation”. Together these form the “Energy Certificate”.

Energy labelling refers to a standardised and documented statement of a building’s energy status compared to other buildings, also including water consumption, energy consumption in technical installations and appliances as well as proposals for improvements. The labelling serves as objective consumer information.

The building is given an energy label for heating, electricity and water as well as for the CO2 emission level.

The energy labelling is based on a systematic registration of the building’s energy conditions. The registration is based partly on inspection, partly on information from the owner, BBR information and blueprints of the building.

The energy label shows the calculated theoretical consumption of the building. The accompanying Energy plan & documentation gives the buyer of the building concrete proposals as to how the heating consumption and the electricity, water and CO2 consumption of the building may be reduced.

Consequently, it is important that the energy consultant draws up a correct energy label and – not least – a detailed energy plan, which clearly shows the buyer where he can make profitable savings.

In the drawing up of the Energy Certificate, the energy consultant should have in mind the buyer’s need for knowledge of the building’s energy consumption and possible energy improvements. The energy consultant must also use the commentary sections in the Energy plan & documentation to further explain to the buyer the energy conditions of the building and his proposals for improvements in accordance with the guidelines in chapter 19 Free text in the Concrete section of the Handbook.

The certificates are valid for 3 years to ensure that the information on the building is up-to-date and, in case the building is sold several times within a short time span, that there is no unnecessary ”double labelling. In that situation the seller can choose to have a voluntary energy labelling made if important energy improvements have been made to the building.[3)]

1.3.3 Energy labels on the Internet

In order to let both the seller and the buyer have access to information as to whether a building has an energy label, all submitted energy labels are available on the Registration Committee’s homepage.

Publicly available information on the Energy Certificates includes:

- the energy labelling number
- number, name and address of the energy consultant who drew up the Energy Certificate
- the address of the property
- label type by category A1 to C5 for heating and A to C for electricity, water and CO2

The energy consultant must submit the information on the energy labelling electronically to the Secretariat which, based on the submitted information, generates an Energy Certificate in PDF format. The claimant / buyer can look up the PDF version of the Energy Certificate by using a specific password, which the claimant is given by the energy consultant who drew up the certificate.

1.4 The Handbook

1.4.1 Guidelines from the Danish Energy Authority

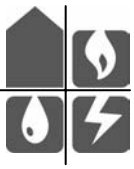
The Handbook for energy consultants (”The Handbook”) contains the Danish Energy Authority’s guidelines for energy labelling of small buildings less than 1,500 m^2. The energy consultant must follow the existing guidelines in the Handbook at all times when making an energy label. The Handbook comes in both a printed and an electronic version.

As regards the updating of changes to the guidelines, see chapter 1.4.7 Updating.

1.4.2 Reading guide

The Handbook is divided into four sections:

- General section
- Concrete section
- Calculation section [4)]
- Appendix section [5)]



The energy consultant must read the Handbook for energy consultants as follows:

To know and understand the guidelines of the General section as common background knowledge. To know and understand the guidelines in the Concrete section, so that the energy consultant can look them up while drawing up the energy label.

The General and Concrete sections of the Handbook contain the guidelines from the Danish Energy Authority. These are divided into:

- rules
- recommendations
- guides
- examples

The exact content of these terms is explained in chapter 1.5 Contents of the guidelines. The energy consultant must understand these terms and their importance. The terms are used throughout the Handbook to indicate the exact degree to which the energy consultant must follow them.

1.4.3 General section

The General section contains the overall guidelines for energy labelling:

- Background and definitions for energy labelling
- The qualifications and responsibilities of the energy consultant
- The organisation of the Energy Labelling Scheme

1.4.4 Concrete section

The Concrete section contains the guidelines for energy labelling:

- Basic data
- Thermal envelope
- Heating systems
- Electricity
- Water
- Calculation results
- Free text
- New buildings, blocks of flats, owner-occupied flats, other/mixed use

The Concrete section can be brought along for the actual inspection of the building and consequently, it is composed in accordance with the energy labelling procedure that the energy consultant must follow. Each subject in the energy labelling contains a general introduction to the subject with a description of what the

energy consultant must do. Following the introduction, there is a description of related subjects in the following order:

- Purpose
- Registration
- Data
- Text

Example ***Division of chapters in the Concrete section***

- (Subject) Thermal envelope in general – general description of registration of thermal envelope for Energy label and Energy plan & documentation
- (Related subject) Walls – concrete description of Purpose, Registration, Data and Text for walls

1.4.5 Calculation section

The calculation section shows how to calculate heating, electricity and water consumption of a building in accordance with the Energy Labelling Scheme for small buildings. This section contains:

- Formulas and tables
- Calculation examples

1.4.6 Appendix section

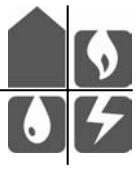
The appendix section contains additional material, which supplements the General section, the Concrete section and the Calculation section:

- Forms and diagrams
- Tables with in-data for calculation
- Dictionary

The electronic version of the Handbook contains direct links from the text in the General, Concrete and Calculation sections of the Handbook to the accompanying appendices.

1.4.7 Updating

The Secretariat updates the Handbook when changes or corrections are made to the guidelines. The changes and corrections are updated on the Registration Committee's homepage www.emsekretariat.dk and in the Handbook print files. Also, the Secretariat sends out an e-mail to the energy consultants informing them



of the change or correction with a direct link to the changed file for them to read or print out.

The energy consultant can then print out the changes and update his personal Handbook.

1.5 Contents of the guidelines

The Handbook guidelines are divided into

- rules
- recommendations
- guides

which may all be illustrated by means of examples. The terms are defined as follows:

1.5.1 Rules

Rules are guidelines which the energy consultant must follow without exception. If no choice is given, it is a rule. A rule can also be defined by the word ”must” in the text. By far, most of the guidelines in the Handbook are rules for how the energy consultant must carry out his job.

1.5.2 Recommendations

Recommendations are guidelines which leave a certain amount of judgement to the energy consultant. Recommendations are expressed by the word “should” in the Handbook and to a certain degree lets the energy consultant decide whether or not to follow the recommendations. If the energy consultant chooses not to follow a recommendation, he *must* state the reasons for his choice in the Energy Certificate, and at the request of the Secretariat, the energy consultant must be able to argue that his choice is at least as good as the recommendation.

1.5.3 Guides

Guides are guidelines which are meant as a help to the energy consultant, and he is free to follow or ignore them as he sees fit. Guides are expressed by the word ”may”. The energy consultant does not have to state the reasons for his choice not to follow a guide in the Energy Certificate.

1.5.4 Examples

In some cases, rules, recommendations and guides are explained by means of examples which illustrate how the individual rule, recommendation or guide is to be understood. The examples are a guide to understanding the guidelines behind them.

1.6 Terms and forms

1.6.1 Contents of the energy labelling

”The energy labelling” includes both the work that the energy consultant does in registering the building, performing calculations, drawing up the energy plan, submitting and registering the energy labelling and the end product (”The Energy Certificate”), which the energy consultant finally delivers to the claimant / buyer.

1.6.2 The Energy Certificate

”The Energy Certificate” is the term for the printed end product, which the energy consultant delivers to the claimant / buyer on the basis of the energy labelling.

The Energy Certificate includes the printed ”Energy label”, which functions as the front page and the printed ”Energy plan & documentation”. The number of pages in the ”Energy plan & documentation” will typically be between 1 and 8 pages, but may vary depending on the energy consultant’s registration and commentary volume.

Appendix 2 shows a marked Energy Certificate with references to the places in the Concrete section of the Handbook where the energy consultant can find explanations of the contents of the individual sections. The energy consultant must use this appendix as background material to understand the guidelines in the Concrete section of the Handbook.

1.6.3 Energy label

In accordance with article 7, paragraph 1, of the Energy Labelling Order, energy labels for small buildings are drawn up on a standardised form and contain information on the property’s calculated energy and water consumption and CO2 emission. “Energy label” includes basic data, conclusion and the final energy label from A1 to C5 for heating and from A to C for electricity, water and CO2. The contents of the basic data are described in chapter 1 Basic data in the Concrete section of the Handbook. The contents and the energy consultant’s use of the conclusion section are described in chapter 19.2 Conclusion in the Concrete section.

1.6.4 Energy plan

An energy plan for small buildings is drawn up in accordance with article 8, paragraph 1, of the Energy Labelling Order on a standardised form and contains a summary of savings in the property’s energy and water consumption, which it is recommended for the owner to execute. “The energy plan” contains the energy consultant’s re-commendations for energy and water-saving procedures. The recommendations are listed in the following sections on page 1 forward in the “Energy plan & documentation”:

- The energy consultant’s overall recommendation (page 1)
- Heating (proposals for improvements and investment) (page 6)

- Electricity (proposals for improvements and investments) (page 7)
- Water (proposals for improvements and investment) (page 8)
- Appendix with additional remarks on improvements (appendix B)
- Appendix on conversion (appendix C)

In chapter 19 Free Text in the Concrete section of the Handbook it is described how the energy consultant must fill out the free text sections in the ”Energy plan & documentation” as, for instance, the ”Conclusion section”.

1.6.5 Documentation

In accordance with article 7, paragraph 1, of the Energy Labelling Order, the energy label must be supplemented by documentation for information on insulation conditions, energy and water-consuming appliances and installations, etc. In the case of owner-occupied flats with individual energy labels, the energy plan and the accompanying documentation must contain an evaluation of the heating installations and insulation of the entire property in accordance with article 8, paragraph 3, of the Energy Labelling Order.

The energy consultant must be able to document his work. Consequently, the energy consultant must be able to produce paperwork which documents why the energy labelling is drawn up as it is and why the energy consultant has recommended the energy-saving procedures; cf. also chapter 2 The qualifications and responsibilities of the energy consultant.

Furthermore, the energy consultant must state the reasons for his decisions and considerations in the documentation sections of the Energy Certificate, which are found in the following sections on page 1 forward in the “Energy plan & documentation”:

- Heating (registered information) (page 3)
- Heating (registered information continued) (page 4)
- Heating (registered information continued) (page 5)
- Electricity (Electrical appliances) (page 7)
- Water (Water-consuming appliances and equipment) (page 8)
- Key to calculating the building’s total energy consumption (page 9)

Areas and installations not included in the energy labelling are listed in Appendix A.

The Concrete section of the Handbook describes how the energy consultant must register the building.

1.6.6 Forms

The Secretariat supplies the pre-printed forms, which the energy consultant must use to print out the Energy Certificate. Each form consists of one page; cf. Appendix 2:

- front page for the Energy Certificate for ”Small properties”
- front page for the Energy Certificate for ”Owner-occupied flats”
- pre-printed forms for the pages in ”Energy plan & documentation”
- appendices for owner-occupied flats

The energy consultant may order the pre-printed forms on the Registration Committee’s homepage www.emsekretariat.dk.

1.7 Requirements and validity

1.7.1 Energy labelling duty

In accordance with section 4 of the Energy Labelling Act, the seller of a property less than 1,500 m^2 or an owner-occupied flat is obligated to have it energy labelled in connection with selling, unless it has a valid Energy Certificate already.

The seller must ensure that the buyer is familiar with the energy labelling of the property before the agreement to sell is final. The label must be drawn up no more than 3 years prior to the agreement to sell.

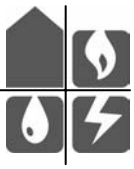
In case the seller has not provided the required Energy Certificate, the buyer has the right to carry out the energy labelling at the seller’s cost, provided that this is done within a “reasonable” period of time in accordance with section 16 of the Energy Labelling Act. The parties cannot waiver this right by agreement. A ”reasonable ” period of time has been estimated to 6-12 months in the explanatory notes to the Energy Labelling Act.

1.7.2 No energy labelling duty

Energy labelling is required by law in the sale of property, but transfer of ownership by inheritance, gift, forced sale, transfer of ownership from insolvent estate or transfer to spouse or cohabitant or transfer by co-ownership (see section 4 of the Energy Labelling Act) is not considered a sale. Also, no energy labelling is required in the sale of cooperative flats, limited holding or holiday homes (unless there is an unlimited, non-personal permission for year-round residence).

1.7.3 Voluntary energy labelling

In addition to the compulsory energy labelling, the owner of a building or flat can always choose to have the building labelled by an energy consultant in order to obtain a better idea of the building’s energy status and any possible energy efficient-saving measures. In these cases also, the energy consultant must label the building in accordance with the guidelines in the Handbook.



1.7.4 Duration of validity

The energy labelling is valid for 3 years from the date of the building inspection / drawing up of the energy label.

1.7.5 Rights to the Energy Certificate

The Energy Certificate as such is owned by the person who pays to have it drawn up, i.e. the seller or an insurance company. If an insurance company pays for the Energy Certificate, the company retains ownership of the certificate until the seller has reimbursed it for the energy consultant's fee.

Provided payment for the energy labelling has been made, the Energy Certificate must be handed over to the buyer along with the transfer of ownership of the house or flat that he has bought. The buyer may use the Energy Certificate to carry out energy-saving measures, and he is obligated to hand it over to a new buyer if he sells the building before the validity of the energy labelling expires after the 3-year period.

When the energy consultant delivers the Energy Certificate to the claimant, he must also provide a password to the electronic version of the certificate on the Registration Committee's homepage, so that the claimant / buyer can print out a new copy, if needed.

The energy consultant retains copyright on the Energy Certificate in accordance with ABR89 item 4.1.

1.8 Properties and buildings

1.8.1 Properties less than 1,500 m^2

The Energy Labelling Scheme includes heated properties of less than 1,500 m^2 total floor area which are used for housing purposes, public purposes, private trade, service or administration. If a property consists of several buildings, the total floor area of the buildings must be less than 1,500 m^2. The BBR registration for the property states whether several buildings are registered under the same property number.

In certain cases, buildings which are located on several consecutive title numbers and which have the same owner or owners' association and share operation of the same heating system, may be regarded as one property in accordance with article 2, paragraph 2, of the Energy Labelling Order. If the total floor area of these joint properties exceeds or is equal to 1,500 m^2, the properties will fall under the Energy Management Scheme. In case of doubt, the energy consultant may contact the ELO Secretariat.

1.8.2 Energy labelling of buildings

In accordance with section 3 of the Energy Labelling Act, the energy labelling consists of "a standardised and documented summary of a building's energy

status, including the energy consumption of technical installations and appliances as well as water consumption."

Thus, the energy consultant must label the individual building or flat. As such, the energy labelling must be carried out for an entire property, i.e. the labelling must consist of an Energy Certificate including all heated buildings on the property. However, in certain cases, the energy labelling may be divided into several Energy Certificates. This is the case if there are several separate buildings for individual use with separate heating systems, payments and/or separate heating supply on the property.

Examples ***Buildings which typically fall under the scheme***

- villas
- single family houses
- owner-occupied flats
- small residential properties
- residential houses on farms

1.8.3 New buildings

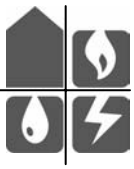
Generally, new buildings must be labelled in connection with sale. The seller's duty to have the building energy labelled may be annulled if the buyer is a building owner with influence on the building's energy consumption. If the buyer is a building owner to such a degree that he has a significant insight into and influence over the building's energy consumption, he is not protected by law. In these cases, therefore, the energy labelling of the building is not required by law.

Whether or not the seller is required to have the building energy labelled depends on a concrete assessment of the buyer's influence on the building's energy consumption. The final decision on this matter is made by the courts.

Examples of cases of compulsory energy labelling / exceptions from energy labelling:

Compulsory energy labelling

- if the buyer ("the building owner") purchases a completed "building shell" where only colour and kitchen appliances, etc., may be selected
- if a standard house construction company builds a house at its own cost and puts it up for sale, even if there are no appliances in the building
- if the buyer purchases a flat as a pre-emption right with a deposit without any (not even theoretical) possibility of influencing the construction process apart from the colour on the walls, etc.



No energy labelling

- if the buyer / building owner owns a property and engages a company to construct a single-family house as an all-inclusive contract, including design
- if the buyer / building owner purchases a lot from a standard house construction company and engages the company to construct a single-family house as an all-inclusive contract
- if the buyer / building owner purchases a building, which has not yet been constructed, i.e. a construction-included project

Individual interpretation

- if the buyer / building owner purchases a property and a house where construction has been initiated and which the buyer completes (15-50 % of the house will typically be constructed on purchase). It is essential that the buyer has a real possibility of influencing the future energy consumption by demanding additional insulation, etc. In these cases, the question of energy labelling must be decided on the basis of individual interpretation

1.8.4 Owner-occupied flats

The energy consultant must label owner-occupied flats according to the rules on energy labelling, etc., of small buildings with the addition of the special rules which apply to owner-occupied flats; see chapter 22 Owner-occupied flats in the Concrete section.

1.8.5 Buildings used for other purposes

A building of less than 1,500 m^2 which according to the BBR registration is used for any purpose other than residence and which is not exempted from energy labelling must be labelled, but for heating only; see chapter 23 Buildings used for other purposes in the Concrete section of the Handbook.

1.8.6 Buildings used for mixed purposes

Typically, a building of less than 1,500 m^2 which has been registered as a residence and is partly used for other purposes than residence must be labelled.

The contents and extent of the energy labelling depend on whether the other use purpose accounts for more or less than 20 % of the building's total heated floor area.

Properties consisting of several buildings where more than half of the total floor area is used for manufacturing business or production are exempt from energy labelling, see the Concrete section in the Handbook chapter 24 Buildings used for mixed purposes and article 1, paragraphs 2 and 3 of the Energy Labelling Order.

1.8.7 Buildings exempt from energy labelling

Certain buildings – regardless of size – are exempt from the compulsory energy labelling. In accordance with article 1 of the Energy Labelling Order, this applies to certain commercial buildings (BBR code for building purpose shown in parentheses):

- buildings for commercial production in agriculture, forestry, gardening, extraction of raw materials, etc. (210) or industry, crafts, etc. (220)
- electrical, gas or heating plants, incineration plants, etc. (230)
- other buildings for agriculture, industry (290)
- properties consisting of several buildings where more than half of the total floor area is used for the same type of industry, as mentioned in the preceding points

The following other buildings are also exempt from energy labelling (BBR code for building purpose shown in parentheses):

- summer cottages (510), unless there is a time unlimited, non-personal permission for year-round residence in accordance with the provisions contained in the act on planning
- Allotment sheds (540), holiday camps, youth hostels etc. (520) and other buildings for recreational purposes (590)
- carports (920) and detached, un-heated garages (910) and outbuildings (930)

Furthermore, the following categories of buildings are exempted regardless of their BBR registration:

- buildings used for church rooms
- buildings with a total floor area of less than 1,500 m^2 which the parties have agreed to sell for the purpose of demolition
- buildings which are entirely or partly used for storage and which have no or a very low level of water and energy consumption

It is the responsibility of the energy consultant to be familiar with the types of buildings and properties that are exempt from energy labelling and to be up-to-date on changes in article 1 of the Energy Labelling Order.

2 The qualifications and responsibilities of the energy consultant

2.1 Certification

2.1.1 "Training assistant arrangement" and data sheet

Energy consultant applicants cannot draw up energy labels until the formalities involved in the certification as energy consultant have been completed. This includes the applicant's submission of a data sheet and insurance papers and the completion of a "training assistant arrangement".

"Training assistant arrangement" is the name of the last part of the education to become an energy consultant. After the course has been passed and before the applicant can finally be certified as an energy consultant, the applicant must draw up three Energy Certificates as a "training assistant" under the supervision of a certified energy consultant. It is up to the applicant to find a certified energy consultant who can help the applicant through the "training assistant arrangement". The responsibility for the drawing up of the three Energy Certificates rests with the certified energy consultant.

The "training assistant arrangement" is only a way for the applicant to test his abilities as an energy consultant through practical exercises, and it is not a test of the applicant. Consequently, the Registration Committee cannot decline to certify the applicant on the basis of these exercises.

The energy consultant certification can be given to the applicant when the Secretariat has received documentation proving that all three exercises have been carried out and the applicant has submitted a data sheet and insurance papers.

2.1.2 Insurance coverage

In order to become a certified energy consultant, the applicant must document that he is covered by a professional liability insurance. The insurance must contain a continuous coverage, so that there is insurance coverage five years after the energy consultant's drawing up of an energy labelling in case of any faults in the labelling that he may be accountable for.

The specified requirements for the contents of the insurance and documentation can be found in the Fee Order and on the Registration Committee's homepage www.emsekretariat.dk.

2.1.3 Final certification

When the applicant has been certified as an energy consultant, the first three Energy Certificates that he makes as a certified energy consultant must be submitted to the Secretariat. The energy consultant should submit the certificates before they are sent to the clients to avoid being reported for any possible faults in the energy labelling.

The Secretariat examines the certificates and guides the energy consultant as to any corrections without further consequences. If, on the other hand, the energy consultant chooses to send the reports to the clients before the Secretariat has had the opportunity to comment on them, the Secretariat will note any faults committed by the energy consultant. Such Energy Certificates will be evaluated equally to any other certificates, which means that the energy consultant may be penalised for faults which could have been avoided by letting the Secretariat examine them before they were sent to the clients.

2.1.4 Continued certification

To uphold the energy consultant certification, the energy consultant has to live up to the requirements in the Energy Labelling Order and the Fee Order as well as the guidelines issued by the Danish Energy Authority or the Registration Committee. The energy consultant must participate in the courses which the system provides and which the Energy Authority or the Registration Committee have made obligatory.

The energy consultant must draw up the energy labels in accordance with the guidelines in the Handbook and may – after judging the cases individually – in case of repeated faults have his certification revoked; see chapter 3.8 Practice of the Registration Committee.

2.1.5 Impartiality

Considering the quality and credibility of the energy labelling, the energy consultant must be impartial in matters that may affect the energy labelling in a positive or negative way.

The energy consultant must not:

- be independent of any real estate agent or insurance company
- work under a "no cure - no pay" agreement
- be in any kind of family or job dependent relationship with the seller of the building or with the claimant of the energy labelling
- be in a dependent relationship which forces the energy consultant to recommend certain products or certain jobs in connection with the energy labelling; i.e. if the energy consultant works for a producer or supplier of certain building materials, energy units, etc., or if the energy consultant is going to engage in entrepreneur tasks, workmanship, etc., at a later time

The energy consultant's work is not, however, expected to be affected by the energy consultant potentially or actually giving advice on energy efficiency, including the design of systems or renovation at a later time. Nevertheless, the energy labelling agreement must not include conditions of design at a later date.

2.2 The responsibilities of the energy consultant

2.2.1 Advisor responsibility

The energy consultant is personally responsible for the drawing up of the energy labelling and carries out his work subject to common advisor responsibility. This means that the energy consultant is responsible if he, in carrying out his assignment, does not exhibit adequate professional competence or does not exercise due diligence (the culpa rule); i.e. if the energy consultant does not notice insufficient insulation in accessible loft spaces.

The energy consultant's advisor responsibility is based on the rules in ABR89; see article 26, paragraph 3, of the Energy Labelling Order. Pursuant to ABR89 item 6.2, the energy consultant may become liable under the general Danish legal regulations of damages for faults and neglect in carrying out a task.

Pursuant to ABR89 item 6.2.4 the advisor is not liable for any operating loss, profit loss or any other indirect loss in connection with his advisory task.

Claim for damages may be decided either by the (Danish) building and construction arbitration board or by the courts.

2.2.2 Period of indemnity

The energy labelling is valid for 3 years from the date of the building inspection / drawing up of the energy label.

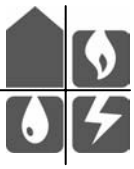
The energy consultant is liable for the Energy Certificate for 5 years from the date of the energy labelling. In order to document his work, should an Energy Certificate be selected for field control; see chapter 3.7.3 Field control, or a claimant takes legal action against the energy consultant, it is recommended that the energy consultant keeps a copy of the certificate until the expiration of the 5-year period. The same applies to any necessary information on the energy labelling; i.e. registration, owner information, photos, etc.

2.2.3 Personal registration

To calculate the energy consumption of the building and evaluate the energy-saving measures, it is a basic necessity that the energy consultant registers the building correctly. It is the responsibility of the energy consultant that all the building parts which are used in the calculations for the Energy Certificate are registered to the extent that is necessary in order to ensure a correct energy labelling and an adequate basis for evaluation of the energy-saving measures.

The energy consultant must personally inspect the building and register the individual building parts and the electricity and water-consuming appliances. The energy consultant is also personally responsible for the keyed in information in the Energy Certificate being correct.

All sub-stages of the energy labelling, with the exception of the simple entering of the energy consultant's information, must be carried out by the energy consultant personally. The Registration Committee has determined that building inspection,



calculations and self-supervision (the energy consultant's quality control) must be carried out by the certified energy consultant personally, and deviation from this rule may result in revocation of the energy consultant certification.

The building inspection covers the building's thermal envelope and heat-producing and heat distributing installations as well as the electricity and water-consuming appliances which are included in the sale of the property.

The energy consultant is free to choose the method of registering the building as long as the registration is correct.

The energy consultant must register the information on every building part which is necessary to calculate the building's insulating capacity and heat loss and assess whether proposals for profitable energy-saving measures can be made.

The Concrete section of the Handbook specifies what data the energy consultant must register for use in the Energy Certificate. To the extent that the energy consultant *must* follow concrete methods for registering parts of a property, these have been described specifically in the Concrete section.

2.3 Basis for the agreement

2.3.1 Note of agreement

Before the energy consultant registers a building, there should be an agreement signed by the energy consultant and the claimant or his attorney and which:

- specifies that the drawing up of the Energy Certificate is done in accordance with the conditions of the "General principles of technical advice and assistance ABR 89"
- clearly describes to which extent the energy consultant is allowed to make destructive inspections of the individual building parts

Case ***Agreement on and execution of destructive inspection***

The owner provides information that the building has cavity wall insulation. In the examination of the information on the building, the energy consultant finds that the property is from 1950 when cavity wall insulation was uncommon. The energy consultant ponders on this and decides to measure the thickness of the outer wall. The measurement shows that the wall is 30 cm thick, which indicates that it is a cavity wall. The energy consultant and the claimant agree on a destructive inspection for an additional fee (see the Fee Order), which must feature on the note of agreement.

The energy consultant should use appendix 3 as the note of agreement.

The note of agreement is the energy consultant's documentation for the basis of the energy labelling as agreed with the claimant. The note of agreement is an important basis for the handling of possible complaints at a later date. Without a written note of agreement, the energy consultant would risk not being able to document the basis for the energy labelling in case of any claims for damages against him or complaints regarding the energy labelling to the Registration Committee.

2.3.2 Owner information

The owner of the building can submit information on the building on a specific owner information form with information including:

- annual energy consumption for heating and electricity
- annual water consumption
- previous years' energy and water consumption
- hollow space and cavity wall insulation has been done
- insulation thickness in inaccessible constructions
- knowledge of re-insulation
- knowledge of insulation in hidden constructions
- age and type of small appliances, etc., which are included in the sale
- blueprints of the building

The energy consultant should use appendix 4 as the owner information form when the owner chooses to submit information on the building for the Energy Certificate.

The energy consultant may use the information on the owner information form as a basis for his energy labelling if the owner has signed the form. However, based on the experience and general advisor responsibility of the energy consultant, he must evaluate the information on the form in accordance with the rules governing registration of the building.

If the energy labelling is based on false information on the building, it may lead to the energy consultant drawing up a faulty Energy Certificate and providing inaccurate recommendations on energy-saving measures. This can further lead to increases expenses on energy-saving measures for the buyer compared to what he had expected when he purchased the building. The buyer may demand compensation for the additional expenses in accordance with the general Danish legal regulations of damages for faults. In case of a dispute, the buyer must institute legal proceedings at the (Danish) building and construction arbitration board or at a court.

Consequently, the energy consultant must assess whether the information given by the owner is correct. The energy consultant must base the evaluation on his professional knowledge, including concrete knowledge of buildings from different time periods.

If the consumption information is based on information from other sources than the owner, this should be made very clear in the Energy Certificate in case of any claims for damages. The owner of a building is by the way not obligated to supply information on energy consumption, etc., for the energy labelling to be drawn up.

If the energy consultant is in doubt, the supplied information should be verified. If the owner's information turns out to be incorrect, the energy consultant must note this in the Energy Certificate and use the correct information to draw up the energy label. The energy consultant must refer to the owner information form as documentation for the information.

If the owner information contains statements about insulation conditions or re-insulation of any constructions, the energy consultant should evaluate the probability of this information during his inspection of the building and, in case of discrepancies, note this in the Energy Certificate.

If the energy consultant cannot procure the information from the owner, he must note this in the Energy Certificate; see chapter 19 Free text in the Concrete section.

Case ***Quality control of owner information***

The owner provides information that the building has cavity wall insulation. The energy consultant finds in his examination of the information on the building that it was built in 1910 when cavity wall insulation was uncommon. He ponders on this and decides to measure the thickness of the outer wall. The measurement shows that the wall is 35 cm thick, which indicates a solid wall. The energy consultant knocks on the wall and determines from the sound that it has not been re-insulated on the inside with a light construction. The energy consultant examines the wall with an endoscope and registers that the wall is solid.

2.3.3 Fee

The energy consultant's fee must not exceed the maximum defined in the Fee Order. In accordance with appendix 1 to the Fee Order, the maximum fee is calculated from the building's total floor area excluding cellar and loft space. In buildings where the loft space is being used, or with more than one regular floor, the energy consultant may raise the fee by the extra charge specified in the Fee Order Appendix 1, 1), b).

Furthermore, the fee depends on the energy consultant's ability to register the building without any destructive inspections and availability of the necessary building information and blueprints. The energy consultant may charge an extra fee if:

- the necessary information is missing and the energy consultant offers to procure them
- the energy consultant must perform destructive inspections by agreement with the claimant

If the energy consultant performs a house check at the same time as the energy labelling, the maximum fee that the energy consultant may charge for the energy labelling is lowered with the amount that is stated in the Fee Order Appendix 1, 4), a) and b).

In accordance with Appendix 1, 5), a) to the Fee Order, the energy consultant may charge an extra fee if agreed to procure blueprints, but cannot charge anything for the time spent, or other expenses, in gathering data.

It is always the energy consultant's responsibility that the fee does not exceed the maximum prices for the drawing up of energy labels. The current maximum fees and prices are available on the Registration Committee's homepage www.emsekretariat.dk

It must be clearly stated in the note of agreement which fee has been agreed upon by the energy consultant and the claimant.

In accordance with article 4 of the Fee Order, the claimant may submit complaints about the fee to the Registration Committee. Within 4 weeks of receiving a decision from the Registration Committee, the claimant has the right to appeal the decision to the Energy Board of Appeal.

2.4 Submission

2.4.1 Purchase of energy rating numbers

The energy consultant purchases energy rating numbers (e-numbers) for submission of energy labels via his personal account on the Registration Committee's homepage.

The energy consultant may purchase any number of energy rating numbers which are valid until used. The Danish Energy Authority or the Registration Committee may choose to make energy rating numbers invalid provided a reasonable notice is given and if they compensate the energy consultant for the numbers. The current price on the energy rating numbers can be found on the Registration Committee's homepage www.emsekretariat.dk.

Companies who have several energy consultants employed may purchase energy rating numbers available to all the company's energy consultants as part of a special company agreement with the Secretariat. If agreed with the Secretariat, companies may also have their energy rating numbers automatically renewed when they are approaching zero.

The energy consultant pays the Secretariat via PBS for the energy rating numbers ordered and receives a printout each month showing how many numbers have been bought.

Energy consultants who do not register with PBS must pay an administrative fee to the Secretariat equal to invoicing and manual payment expenses as specified by the Registration Committee.

By the end of each fiscal year, upon request, the energy consultant may receive a refund for any unused numbers which have been bought within that fiscal year. If the energy consultant retires as a consultant, the Secretariat refunds any unused numbers bought in that same fiscal year.

2.4.2 Procedure

The energy consultant must submit his Energy Certificates electronically to the Secretariat via a calculation program approved by the Danish Energy Authority no later than 30 days after the energy labels have been drawn up. Late submissions will result in the energy consultant being charged a fee to the Secretariat due to extra administration as specified by the Registration Committee.

Energy consultants using EK-Pro submit energy rating numbers via the calculation program. Energy consultants using TM-Energi submit energy rating numbers via the energy consultant's personal account on the homepage under the heading "TM-indberet".

From his personal account on the Registration Committee's homepage, the energy consultant can see the number of purchased, submitted and available energy rating numbers. The energy labels are shown with their energy rating number, submission date and address.

As soon as the Energy Certificate has been delivered to the claimant and/or data for the energy labelling has been submitted to the Secretariat, the energy consultant can no longer make corrections. If the energy consultant has made any errors in the energy labelling, he must draw up a new Energy Certificate; cf. chapter 2.5 Self-supervision.

2.5 Self-supervision

The guidelines in the Concrete section of the Handbook for energy consultants and the building inspection part in particular are intended to ensure a satisfactory and uniform quality of the energy consultants' work in energy labelling.

It is the responsibility of the energy consultant that all necessary information has been gathered and used and that the final Energy Certificates comply with the requirements of the scheme. Even typing errors from the draft to the Energy Certificate may result in faults for which the energy consultant is liable.

To ensure the quality of his work, the energy consultant must conform to the guidelines for consultant responsibility as described above. In addition, the energy consultant must ensure that the information in the Energy Certificate is correct

before the Energy Certificate is delivered to the claimant and the data is submitted to the Secretariat.

In particular, the energy consultant must make quality checks in the three areas described below, which are also specifically covered in the Registration Committee's quality control; cf. chapter 3.8 Practice of the Registration Committee.

Data and calculations

The energy consultant must ensure that all measurements, owner information and calculations, i.e. U values, temperature factor b and reduction in number of hours of heat loss for heating systems, etc., are correct.

Energy plan

The energy consultant must recommend profitable energy-saving measures, i.e. measures that have a profitability over 1.33; cf. the calculation factor in Appendix 14.

Free text sections

The energy consultant must fill out all the text sections which must be filled out in accordance with the guidelines in the Concrete part of the Handbook, and he must write his comments in an exact, concise and non-technical language.

If necessary, the energy consultant must be able to account for his calculations and the registration basis for the Energy Certificate. This applies if the energy consultant is asked for a statement in case of a complaint about an energy label and if the Secretariat selects one of the energy consultant's Energy Certificates for quality control (field control); cf. chapter 3.7.3 Field control.

If the Energy Certificate is faulty to such an extent that a new certificate has to be made, the energy consultant must make it at his own expense. It is not allowed to make a correction sheet and send it to the claimant. The energy consultant must draw up the new Energy Certificate with a new energy rating number, submit it to the Secretariat and send a copy of the new certificate to the claimant with a note in the Conclusion section stating that the new certificate replaces the old one.

3 Organisation of the Energy Labelling Scheme

3.1 Organisational chart (not translated)[6)]

3.2 The Secretariat (not translated)

3.3 The Registration Committee (not translated)

3.4 The Danish Energy Authority (not translated)

3.5 The Ministry of Economic and Business Affairs (not translated)[7)]

3.6 The Energy Board of Appeal (not translated)

3.7 Quality Control

The authorities' supervision of the energy consultants' work is carried out by the Registration Committee and prepared by the Secretariat.

The quality control includes the following parts:

3.7.1 Electronic screening

When the energy consultant submits the Energy Certificate to the Secretariat, an electronic check is made of the completed report on the Secretariat's server. The check includes a verification of the energy rating number and some of the submitted data.

In case of any faults, an e-mail is sent to the energy consultant describing the nature of the fault and a note stating that the Energy Certificate has not been submitted.

3.7.2 Visual control

The Secretariat makes a continuous visual check of the submitted Energy Certificates based on the information in the certificate itself. The Secretariat checks the entire certificate and the information contents in relation to the consumer. It is verified whether the contents of the commentary sections are informative and precise, and in particular whether the Conclusion section has been filled out and whether the recommendations are justified.

If the Secretariat finds it necessary, the visual control may lead to the Energy Certificate being subjected to a field control.

3.7.3 Field control

Field controls are the Registration Committee's sporadic testing of whether the energy consultants draw up the Energy Certificates in accordance with the Danish Energy Authority's guidelines. Field controls are handled by the Secretariat of Energy Labelling.

The Secretariat selects Energy Certificates for field control somewhat randomly by random sporadic tests and electronic screenings / visual control or from risk evaluations.

The energy consultant is asked to submit his documentation for the Energy Certificate to the Registration Committee examiner who checks everything at the property site.

The Secretariat's control is sent along with any comments to the original Energy Certificate to a hearing with the energy consultant within two weeks after the field control. The energy consultant also has two weeks to supply his comments. Any unanswered questions from the energy consultant are answered on a continuous basis by the Secretariat.

When the energy consultant has had a chance to present his comments, the Secretariat sends the case to the Registration Committee Chairmanship. The Chairmanship then informs the Registration Committee as to whether the energy labelling is faulty upon which the Registration Committee makes the final decision.

The overall review time for a field control is no less than two months, but may vary depending on the amount of correspondence in the case. The energy consultant may appeal the Registration Committee's decision in field control cases.

3.8 Practice of the Registration Committee (not translated)[8)]

3.9 Appeal cases

In accordance with article 30 of the Energy Labelling Order, the owner of a building, etc., may file a complaint about an energy label.

In accordance with article 4 of the Fee Order, a claimant or house owner may furthermore file a complaint about the fee if an agreement was made with the energy consultant for the energy labelling.

The Secretariat prepares the case for the Registration Committee Chairmanship, which sends the case for further review in the Registration Committee. The case preparation includes a hearing with the parties by the energy consultant and the complainant. Both the complainant and the energy consultant have the right to appeal the Registration Committee's decisions.

If the complaint about an energy labelling is found to be legitimate, the Registration Committee may have a different energy consultant draw up the new energy labelling for the building. The Registration Committee may demand compensation from the defendant for the expenses incurred in connection with drawing up the new energy labelling for the building.

Comments:

1)

As of 18 February 2005 the Ministry of Transportation and Energy.

2)

A new Act on Energy Savings in Buildings was adopted on 24 June 2005. The new legislation including new Executive Orders will come into force by 1 January 2006. Further information on the Danish Energy Agency's homepage www.ens.dk

3)

New certificates will be introduced by 2006 and the new certificates will remain valid for 5 years.

4)

Not translated.

5)

Partly translated.

6)

The organisation chart and the roles of the different actors – chapters 3.1-3.6 – has not been translated since this will change with the new legislation from 1 January 2006.

7)

As of 18 February 2005 the Ministry of Transportation and Energy.

8)

The Practice of the Registration Committee has not been translated, as the organisation of the scheme will be changed by January 2006 and the work of the Registration Committee will in the future be done by the Danish Energy Authority.

4 Basic data

4.1 Basic data in general

Basic data are the factual data on the building, which the energy consultant may procure either from the owner's information on the owner information form, from the BBR[1)] information or from personally gathered information.

Basic data may be divided into the following groups:

- data on the building, which are independent of the energy labelling; i.e. address, usage code, etc.
- data which may vary from one energy labelling of the building to a later energy labelling; i.e. energy rating number, use and size of the heated area
- type of energy supply and prices

It is the responsibility of the energy consultant that the correct basic data are used for the energy labelling.

Further explanation of the contents of the basic data sections is found below and in Appendix 2, which is a marked Energy Certificate. In Appendix 2 every section contains references to the place in the Concrete section of the Handbook where the section contents are described.

The section names below refer to the sections in the Energy Certificate, which contain basic data.

4.2 Concrete descriptions in basic data sections

4.2.1 Energy rating number

The serial number, which is assigned by the energy consultant to the Energy Certificate before delivering it to the claimant / submitting it to the Secretariat. The energy consultant uses an energy rating number, which has been bought from the Registration Committee on its homepage www.emsekretariat.dk.

4.2.2 The energy label is valid for 3 years from

The date of the energy consultant's inspection and registration of the building. The energy label is valid for 3 years from the date of the inspection of the property / drawing up of the energy label.

4.2.3 BBR number for the property

The BBR number of the building or owner-occupied flat; cf. below. The energy consultant may look up BBR numbers for the properties, buildings and owner-occupied flats on www.ois.dk.

Specifics

Basic data

The BBR number for the property for developed property is divided into three levels:

- information applying to the entire property
- information on the individual building
- information on the individual residences / industrial leases (termed ”units”)

BBR number for the property

The BBR number for the property is made up of a local authority code (three digits) and a property number (six digits). A property may comprise several buildings. Using the BBR number for the property, the energy consultant can obtain information as to whether the entire property is less than 1,500 m^2 and thereby falls under the Energy Labelling Scheme of small buildings.

Example ***BBR number for the property***

365 – 001812 where 365 is the local authority code and 001812 is the property number

BBR number of the building on the Energy Certificate

For the individual building, the registration of the BBR number of the building consists of the BBR number for the property with the addition of a building number (three digits). It is (regardless of the name of the section on the Energy Certificate) the BBR number of the building, which the energy consultant must note on the Energy Certificate. If the energy consultant assigns energy labels to several buildings on one Energy Certificate (cf. the General section of the Handbook, chapter 1.8.2 Energy labelling of buildings), the energy consultant must fill out the BBR number for the property using the number on the first building.

Example ***BBR number of the building on the Energy Certificate***

365 – 001812 – 001 where 365 is the local authority code, 001812 is the property number and the building number, 001, shows that it is building no. 1 on the property

BBR number for the owner-occupied flat on the Energy Certificate

Owner-occupied flats are the only types of flats, which have a unique owner-occupied flat number which, along with the local authority code and the building number, forms the BBR number for the owner-occupied flat. When the energy consultant assigns an energy label to an owner-occupied flat, the BBR number for the flat must be noted on the Energy Certificate, using a local authority code (three digits), an owner-occupied flat number (number of digits may vary) and a building number (three digits).

Example ***BBR number for the owner-occupied flat on the Energy Certificate***

101 - 178607 - 001 where 101 is the local authority code, 178607 is the owner-occupied flat number, and the building number 001 shows that it is building no. 1 on the property

Flats (owner-occupied flats, co-operative flats and rented flats) are generally registered in the BBR register with a local authority code (three digits), a street name (up to 40 characters) or street code (four digits), a street number including any letters (four digits) as well as floor information (two characters) and door number (up to four characters).

Example ***BBR number for the flat using street name***

101 Sorgenfrigade 7B 1 TV

Example ***BBR number for the flat using street code***

101 6732 7B 1 TV

4.2.4 Year of construction

The year of construction of the building. The energy consultant may obtain this information from the owner of the property or retrieve the year at www.ois.dk.

4.2.5 Use

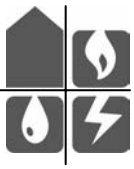
This section contains information on the use of the building in the form of a BBR usage code. The code consists of a three-digit number and a descriptive text. The energy consultant may obtain this information at www.ois.dk.

Example ***BBR usage code***

- 110 ”farmhouse”
- 120 ”single-family house”
- 140 ”flat”

4.2.6 The address of the property

The complete address of the building which is being labelled. The address consists of a street name, street number, letter, floor, left/right door, postal code and city.



4.2.7 Type of heating

The primary heat supply in the building; i.e. oil, natural gas, electricity or solid fuel (biomass or coal). If the primary heat supply is district heating or natural gas, the energy consultant must state the name of the supply company.

The energy consultant must state the correct type of heat and electricity supply. As to the water supply, the energy consultant may state the prices for water supply from the local authorities in case of very small water supply companies. If the water supply company is a small company, it may be difficult for the energy consultant to locate the correct waterworks. If the energy consultant is in doubt, it must be noted in the conclusion section on the front page of the Energy Certificate. In the conclusion section he may refer to further comments later on in the certificate (documentation) or to appendix B (savings).

Furthermore, the energy consultant must register the unit prices of energy with both fixed and current rates. The energy consultant must calculate the heat consumption of the fuel unit that the client settles with the heat supplier. The energy consultant must use the energy content per fuel unit as illustrated in Appendix 24.

As regards buildings heated by electricity, the heating costs are based solely on the calculated energy consumption, while the fixed rate is added to the electricity consumption of the household.

The heating costs for buildings heated by district heating are based on the calculated energy consumption plus any fixed costs covering a meter, rate per m^2 or per m^3, power rate, etc.

The energy consultant must use the current going rate for heat supply or the average quarterly price.

4.2.8 Total heated area

The building's heated and unheated areas, which must be stated on the Energy Certificate. The energy consultant must ensure that the areas noted on the certificate correspond to the areas measured in the building; see Appendix 6.

4.2.9 Current owner's stated energy consumption

The heat, electricity and water consumption, which the owner has stated on the owner information form. Consumption must be stated with the amount of energy, energy units, and costs incurred and settling period.

4.3 Building areas

In the energy labelling scheme the following definitions for areas are used. The definition of the areas is based on the BBR register and the building regulations.

The building areas are:

- floor area
- heated area

- transmission area
- area for calculation of ventilation loss
- window area
- area for fee calculation

The individual areas are described below and in Appendix 6.

The energy consultant must check that the areas used for the Energy Certificate are the same as the areas measured in the building according to the guidelines in Appendix 6.

In case of any inconsistencies between the areas in the calculations for the Energy Certificate and the areas under the BBR registration, the energy consultant should notify the claimant specifically in the conclusion section or in Appendix A.

4.3.1 Floor area

The energy consultant registers the floor area of the building by adding up the gross areas of all floors, including cellar and habitable loft spaces.

4.3.2 (Un)heated areas

Heated areas means the part of the floor area which is heated to at least 18° C. Unheated areas means the part of the floor area which is heated to less than 18° C. Both heated and unheated areas must appear on the Energy Certificate. If the energy consultant is in doubt as to how to register the (un)heated areas, he must follow the directions in the SBI-direction 184 regarding “Heated floor areas and developed areas”.

Examples ***Typically unheated areas are***

- cellar
- patio
- built-in garage

4.3.3 Cellars

Usually, the energy consultant must count cellars as unheated areas, unless they form a natural part of the heated living area with the same degree of heating as the heated floor area. In these cases, the cellar must figure in both the heated area and in the heat loss calculation.

In any case, the energy consultant must note which status (heated/unheated) the cellar has in the conclusion section on the front page of the Energy Certificate.

Examples ***Unheated cellar spaces***

- cellars which are partially heated (less than 18° C)
- cellars which are only expected to be heated occasionally; i.e. recreation rooms, drying rooms in un-insulated cellars, storage rooms, etc., regardless of whether radiators or other type of heating have been installed

Examples ***Heated cellar spaces***

- toilets, bathrooms, etc., which are used permanently
- habitable rooms fit for residence and which may lawfully be used as such
- parts of the cellar which necessarily must have the same temperature as the rest of the building due to the building's design; i.e. a part of a cellar with an open storey partition at the staircase to the ground floor and where the building's design calls for daily use of the cellar

4.3.4 Transmission area

Measuring of transmission areas is described in Appendix 6. The energy consultant must calculate the transmission areas according to the interior area measurements for roof slope walls and sloping walls, ceiling areas, outer walls or vertical walls adjoining unheated rooms, taking into consideration any partition walls. The energy consultant must add the current thickness of the ceiling insulation to the height of the outer walls for use in the calculations for the Energy Certificate.

4.3.5 Area for calculation of ventilation loss

The energy consultant must use the heated area to calculate ventilation loss.

4.3.6 Window area

The window area means the area of the wall opening in which the window is placed, including window clearance.

4.3.7 Area for fee calculation

Fee calculation includes the "Area excluding cellar and loft space". Area means the heated ground floor area.

5 Thermal envelope in general

5.1 Purpose

The purpose of registering the thermal envelope is to obtain data on building parts with heat loss. The data is used for calculating transmission and ventilation losses from all building parts in the thermal envelope and the contribution of heat from solar radiation through building parts with glass. The data is also used to calculate and evaluate any profitable, energy-saving measures in relation to the thermal envelope. Furthermore, the registration is used to describe the building parts and note proposals for improvements on the Energy Certificate.

5.2 Registration

It is the responsibility of the energy consultant to register the building parts of the thermal envelope correctly. The energy consultant must register all building parts with heat loss and / or heating gain. These include:

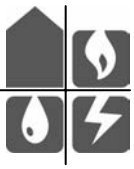
- outer walls towards the open
- walls adjoining unheated areas
- doors, windows, skylights and glass sections
- roof, loft space or unused upper floor
- floors adjoining unheated crawl space, ground supported floors, etc.
- outer cellar wall, cellar floor, etc., in heated or partially heated cellar
- joints
- ventilation systems

The energy consultant must generally use visual investigation methods to examine a building part to establish the data that is used for calculating the energy labels.

It is the responsibility of the energy consultant to ensure that the registration is sufficiently comprehensive to be used for establishing the data for calculation and description on the Energy Certificate.

It is the responsibility of the energy consultant to establish the U value for the building part. If the U value for the building part cannot be established by means of visual investigation, the energy consultant must:

- *either,* with the owner's permission, perform a destructive inspection of the building part to clarify the conditions for calculating the U value,
- *or* make an assessment of the U value for the building part based on the age of the building part, blueprints, etc.



- ***Case Assessment of the U value for a building part***

> The energy consultant has to register the ground-supported floors of a house from 1980 with wooden floors. The energy consultant decides to assess the U value and uses the highest U value allowed for ground supported floors in Building regulations 1977, which were in effect at the time of construction. As the building part is located against the ground, the value is multiplied by 1-b where b = 0.2, since the transmission loss is less against the ground than against outside air.

The energy consultant should inspect certain outer walls using an endoscope in accordance with the guidelines in chapter 6 Walls. Also, it is the responsibility of the energy consultant to assess to which extent it is necessary to carry out a destructive inspection. If the seller refuses to allow a destructive inspection, the energy consultant must perform a cautious evaluation of the construction's energy status and make a remark in the commentary section if the value is uncertain.

5.3 Data

The energy consultant must use the following data to calculate the heat loss for the building parts in the thermal envelope. To calculate the solar radiation, the energy consultant must use data from chapter 7 Windows.

5.3.1 U value

The energy consultant must state the transmission factor (the U value) in W/m²K. The energy consultant must use the U values for building parts indicated in the individual chapters on the building parts in the thermal envelope. If there is no adequate U value in the appendix, the energy consultant must calculate the U value on the basis of the rules in DS 418, 5th edition. However, calculation of the U value for windows is based on DS 418, 6th edition. cf. Appendices 8 and 9.

5.3.2 Thermal bridge

In determining the U values, the energy consultant must take into consideration any thermal bridges. The energy consultant may include the thermal bridges in the total U value or divide the building part into an insulated part and a solid part (the thermal bridge) and calculate each part separately with separate U values.

5.3.3 Transmission area

The energy consultant must state the transmission area of the building part in m².

5.3.4 Temperature factor b

The energy consultant must state the temperature factor b with one decimal using Appendix 7.

5.3.5 Heating capacity

Depending on the program used, the energy consultant must state the heating capacity for the entire building or for the individual building part; cf. Appendix 13. The heating capacity is indicated in Wh/K m².

5.3.6 Investment

The investment cost is included in the energy consultant's proposals for energy-saving measures. The energy consultant must use prices from approved price books, electronic price lists or prices based on the local price levels for materials and labour costs.

5.3.7 Life time

In the energy consultant's proposals for energy-saving measures is also included the lifetime of the measures; cf. Appendix 14. The energy consultant must use the life times in the appendix in the calculation of the energy savings.

5.4 Text

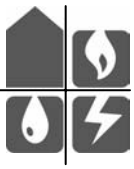
In his documentation for the building parts, the energy consultant must describe these in a precise, concise and non-technical language. Furthermore, the energy consultant must state the information, which appears in the section headline of each building part and the type of building part.

Example Description in the documentation for "building part, insulation type and thickness" for heated or partially heated cellar, outer cellar wall, cellar floor, etc.

> Outer cellar walls in heated cellar rooms are made of concrete, approximately 30 cm thick (wide) and the inside is covered with a soft board of approximately 1.5 cm.

If the energy consultant decides to perform a destructive inspection with the owner's permission, the documentation for the building part must show the type and extent of this inspection. A destructive inspection typically consists of an inspection of closed building parts using an endoscope; i.e. an outer wall or storey partition.

Example Description in the documentation for destructive inspection



> The outer wall is a 30 cm cavity wall, which has been re-insulated with granulated mineral wool. The insulation of the cavity wall has been inspected using an endoscope in the garden front by the kitchen window, the gable at the corner and driveway front between the main door and bath-room window.

If the energy consultant decides to make an assessment of a building part, he must state the background for the assessment in the commentary section for the individual building part.

Example ***Description in the documentation for the contents of the assessment***

> I have assessed the amount of floor insulation based on the building regulations for 1977 (BR77) which were in effect in 1980 when the house was built. The floor construction can be constructed as a wooden floor on joists on concrete with loose leca underneath the concrete.

In the energy plan, the energy consultant must make proposals for the energy-saving measures, which are profitable for the individual building parts or parts of composite building parts. The energy consultant must also propose energy-saving measures that would result in a profitable reduction of the ventilation loss.

The energy consultant must make proposals for energy-saving measures, which are not profitable, if it is probable that the building parts will be renovated by a new owner. This may be relevant in the case of an unused upper floor, old floors, etc.

In the energy plan, the energy consultant must describe the proposed energy-saving measures in a precise, concise and non-technical language.

Example ***Description of energy-saving measures in the energy plan***

> I suggest that the outer cellar walls are re-insulated with 100 mm of insulation and finished off with i.e. a gypsum board. For further details, see appendix B.

6 Walls

6.1 Purpose

In drawing up the Energy Certificate, the energy consultant must:

- calculate the transmission loss from outer walls, outer cellar walls and walls adjoining unheated rooms. The building's U value, temperature factor b, transmission area and any thermal bridge plus heating capacity are included in the heat loss.

Examples ***Typical wall types***

- outer wall
- outer wall adjoining unheated room
- cellar outer wall against open air
- cellar outer wall against ground
- cellar wall adjoining unheated room
- gable triangles

6.2 Registration

The energy consultant must register all walls in accordance with the guidelines in chapter 5 Thermal envelope in general and chapter 6 Walls. Furthermore, the energy consultant must:

- register the construction of all walls with any loss, including the thickness of the individual layers, amount of insulation and whether the wall is facing open air. The energy consultant must compare the obtained information with any blueprints
- register all types of outer walls which are part of the building and be aware that outer walls may vary in their construction both on the same floor and between floors
- register any possibility of carrying out profitable energy-saving measures for the entire wall or for parts of the wall. The energy consultant may only propose energy-saving measures which do not cause humidity problems in the new total wall construction
- perform a destructive inspection of the outer walls, which have been insulated with polystyrene foam to evaluate the condition of the insulation. Usually, the inspection should be performed using an endoscope. The energy consultant may obtain information on the insulation in the cavity wall from the owner information form.

The energy consultant should perform an endoscopic inspection of any outer walls constructed before the Building regulations 1977 came into force to establish the insulation type used in the cavity, insulation thickness and condition. The energy consultant should make at least 2 inspections, one of which should be in

the gable and the other in a front wall. Samples should not be collected from under windows as cavity walls may be re-insulated in connection with window relocation. If there is an insulation certificate, the energy consultant does not have to perform the inspection.

Furthermore, the energy consultant must be aware that the heat transmission requirements in the Building regulations 1961, Building regulations 1966 and Building regulations 1977 could be met by alternative constructions other than those indicated on any blueprints available to the energy consultant. Particularly cavity walls with an insulating back wall and no cavity wall insulation constructed after Building regulations 1966 and Building regulations 1972 have given rise to incorrect information on insulated cavity walls; i.e. information on an insulated cavity wall in a house from the 1970's does not necessarily mean that the cavity wall is insulated, but that the cavity wall met the requirements in the building regulations at the time of construction, which would be the case if the inner wall was made from moler brick.

6.3 Data

The energy consultant must use the data which appears in chapter 5 Thermal envelope in general for the calculations on the Energy Certificate.

6.4 Text

The documentation for walls includes the following sections on the Energy Certificate:

- outer walls and walls adjoining unheated rooms
- heated or partially heated cellar – outer cellar wall, cellar floor, etc.

In the left column of the Energy Certificate, the energy consultant must state the type of wall in question; i.e. whether it is an outer wall or an outer cellar wall and whether the wall is facing open air or an unheated room/ground.

In the second column (the text column), the energy consultant must state the type of wall, wall thickness, insulation type and insulation thickness as well as documentation for the registration.

Examples	***Documentation text (for outer walls)***
	30 cm cavity wall with 7.5 cm mineral wool insulation. I have checked the insulation with an endoscope in two places; the gable (facing the road) and the front by the bedroom towards the garden.
	30 cm cavity wall with 7.5 cm mineral wool insulation. Information on re-insulation of the cavity wall appear in a

cavity wall certificate from Rockwool, dated January 12th 2004, according to the owner information.
36 cm solid brick outer wall facing west (the garden).
24 cm solid outer wall in radiator niches.
20 cm light outer wall with 100 mm insulation. Information on the outer wall appears on the received blueprints; cf. contract.
24 cm solid wall adjoining unheated room (garage).
24 cm solid wall in gables, 1st floor, covered on the inside with wooden fibre board.
27 cm outer wall, brick on the outside, elements on the inside. The outer wall is estimated to be insulated with 7.5 cm insulation. I have assessed the amount of insulation in the outer walls based on the Building regulations 1977, which were in force at the time of construction.

The energy consultant may provide further documentation in the text section ”Any remarks on evaluation of insulation and heating systems”.

The energy consultant must tick off the section in the 3rd column whether there are any proposals for energy-saving measures.

Examples ***Text for proposals for energy-saving measures in Energy plan***

Injection of granulated mineral wool in the cavity of the outer wall, which is approximately 7.5 cm; see appendix B.
100 mm interior re-insulation of the outer wall in the bedroom. Insulation finished with board covering; see appendix B.

In case of cavity wall insulation and composite several-layer re-insulation, i.e. interior insulation of walls, the energy consultant should specify the proposals in appendix B, "The energy consultant’s additional remarks on proposed improvements”.

Examples insulation ***Text for additional information in appendix B with cavity wall***

When injecting insulation into the outer wall, it is recommended to use an isolator who is a member of *Dansk Isoleringskontrol* www.dk-isolering.dk, which has a warranty scheme and as well as a board of appeal.

Examples ***Text for additional information in appendix B with interior reinsulation of outer wall***

The price of 100 mm interior re-insulation of the outer wall includes wood or steel lathes, 100 mm insulation batts, vapour barrier, gypsum board and paint. Furthermore, the price includes moving of radiators and electrical switches, covering of windows and outer doors, new window boards and moving/relocation of foot panels and sweep guards. Location of vapour guard should be done by a professional to avoid any humidity problems in the construction.

7 Windows

7.1 Purpose

In drawing up the Energy Certificate, the energy consultant must:

- calculate the heat loss from building parts with transparent parts

The following factors limit the solar radiation through windows/glass doors:

- the frame fraction of the total window area
- number of glass layers
- whether the glass is coated as in energy windows
- shadow factors; i.e. shadows from roof eaves, trees or neighbouring buildings

7.2 Registration

The energy consultant must register all building parts with glass / other transparent material in accordance with the guidelines in chapter 5 Thermal envelope in general. The registration of each building part with glass must also include:

- window transmission area defined as the area of wall opening in which the window is placed
- glass areas with solar radiation
- location in relation to 8 compass points
- slope in degrees (90 for vertical windows, 45 for skylights in heated loft spaces and 0 for skylights in flat roofs)
- the reduction in percentage of the solar radiation due to shadow factors. Standard reduction is 15 %
- number of glass layers and the glass type, i.e. coated glass as in low-energy windows
- window type, i.e. farmhouse window with coupled frames
- the building part's suitability for inclusion in the energy plan with proposals for saving energy, i.e. whether the double-glazed window can be replaced by a low-energy window or whether a removable window with low-energy glazing may be put up, etc.

In his suggestions for relocations of windows and outer doors, etc., the energy consultant must also take into consideration the building's architectural value when pricing the new windows. The energy consultant must be aware that removable, low-energy glazed windows may be the best financial and architectural solution rather than replacing the windows. The energy consultant must register the

condition of the window clearance and tightness of the frame; cf. chapter 10 Ventilation.

7.3 Data

The energy consultant must use the data below for calculating heat loss and heat gain from transparent building parts.

The calculation of heat loss from windows and doors with glass includes heat loss from panes, frames and edges and loss from the edge of the individual pane. Consequently, the energy consultant must use the calculation premises in DS 418, 6th edition or the U values in Appendix 9, which have been calculated on the basis of DS 418, 6th edition.

The energy consultant must use the data registered for windows, etc., when calculating the heat gain from solar radiation.

When calculating the heat gain from windows, the energy consultant starts with the solar radiation on the window area (wall opening). When calculating the actual solar radiation, the energy consultant makes a reduction in:

- the window clearance area and frame area using the area factor F_a
- the solar radiation due to shade on the glass area using the shadow factor F_s
- the solar radiation due to the transparency of the glass type using the glass factor F_g

If the building has a heated patio, the building parts adjoining the patio will have a temperature factor b of 0.2 for the heat loss; cf. Appendix 7. The glass constant for windows will also change depending on the number of glass levels in the patio ceiling; i.e. the glass constant changes from a 2-layer window to a 3-layer window if the glass patio ceiling has one glass layer. If the patio is covered in something less transparent than glass, i.e. plastic, the energy consultant must use the shadow factor from Appendix 10.

7.4 Text

In the documentation, the energy consultant must state the types of windows, i.e. if it is a four-pane window with a secondary window, and also the number of glasses and glass type, i.e. if it is a 2-layer low-energy glazed window, location and wall opening area.

Examples ***Documentation descriptions***

Windows have coupled frames on the ground floor and two-layer double-glazing on the first floor.

Window in scullery has one glass layer.

Windows in living room facing garden have low-energy glazing.

In the energy plan, the energy consultant must state whether the windows are new or improvements have been made. Also, the energy consultant must state which and how many windows he recommends are improved or replaced as well as where the windows are located (i.e. if it is a kitchen window).

Examples ***Text in the energy plan***

Two windows in gable room towards the garden to be replaced with low-energy glazed windows.

New secondary windows with one layer of energy glazing on the three windows in the bedroom and first floor room.

8 Roof

8.1 Purpose

In drawing up the Energy Certificate, the energy consultant must:

- calculate the heat loss from building parts adjoining loft spaces. The heat loss includes the U value, heating capacity and transmission area of the building.
- assess whether there is sufficient ventilation in the loft space to avoid rot and fungus

Examples ***Loft constructions***

- collar beam lofts and loft hatches
- sloping walls
- vertical space under roof slope and hatches
- horizontal space under roof slope (storey partition adjoining heated room)
- vertical wall adjoining unheated room
- storey partition adjoining unheated loft space
- flat roofs and sloping roofs
- dormer slides

8.2 Registration

The energy consultant must register all types of building parts adjoining loft spaces in accordance with the guidelines in chapter 5 Thermal envelope in general. Furthermore, the energy consultant must register:

- the construction of the building parts
- insulation thickness and condition
- whether the vapour barrier is located on the wrong side of the insulation
- whether there is a duckboard and whether it stabilises the construction of the building
- loft hatches and hatches to space under roof slope
- the tightness of the building part

When the energy consultant registers the loft space, it would make sense to register building parts and parts of the heating system at the same time, i.e.:

- insulation conditions in the outer walls
- insulation status of chimneys in the loft space

- installations significant for the heating system, i.e. heat pipes, hot-water tank, expansion tank, etc.

8.3 Data

The energy consultant must use the data found in chapter 5 Thermal envelope in general when calculating the Energy label and Energy plan.

If the loft and roof space hatches are tight and insulated in the same way as the rest of the construction, the energy consultant may include the hatch areas in the area of that building part.

If the loft and roof space hatches are re-insulated with the rest of the building part, the energy consultant may include the re-insulation cost in the general re-insulation cost, but he must note that the re-insulation of the hatches is included in the cost.

If the loft and roof space hatches need to be re-insulated and/or tightened without re-insulating the rest of the building part, the hatches must be registered and calculated separately.

The temperature factor b for building parts adjoining the roof is 0; see Appendix 7.

8.4 Text

On the Energy Certificate in the section ”Roof, loft or unused loft space”, the energy consultant must describe all building parts adjoining the roof, loft, etc., indicating insulation type and thickness.

Examples	*Documentation text*
	Collar beam loft: 100 mm insulation between collar beams.
	The storey partition facing the ground floor in the horizontal space under the roof slope is an un-insulated beam layer. I have inspected the storey partition cavity using an endoscope in two places, one at each front of the house.
	It is my assessment that the horizontal roof has been insulated with 50 mm insulation. My assessment is based on received cross-section blueprint no. 6 of 20.3.1970.
	It is my assessment that the sloping wall has been insulated with 50 mm insulation. My assessment is based on registration of insulation in the space under the roof slope.

The energy consultant must tick off the 3rd column in the Energy plan & documentation whether a building part is part of the energy plan.

Examples Text in the energy plan

Re-insulation of the collar beam loft with 100 mm insulation, including the loft hatch. See note in appendix B.
Sloping wall insulation replaced with 100 mm new insulation. See note in appendix B.
Injection of granulated insulation material in horizontal storey partition of space under the roof slope. See note in appendix B.

In appendix B, the energy consultant must consider loft hatch insulation, duckboard, ventilation, etc.

9 Floors

9.1 Purpose

In drawing up the Energy Certificate, the energy consultant must:

- calculate the heat loss from floors, ground supported floors, etc. The heat loss includes the U value, heating capacity, area and temperature factor b of the floor

Examples ***Typical floor constructions***

- ground supported floor
- floor adjoining crawl space
- storey partition above open air; i.e. gateways
- storey partition above unheated space; i.e. cellar space
- heated floors
- cellar floors

9.2 Registration

The energy consultant must register all floor constructions in accordance with the guidelines in chapter 5 Thermal envelope in general. Insulation conditions and nature of floor constructions will usually be based on an assessment.

The floor constructions of a building may be different; i.e. the scullery floor, bathroom floor, etc., may have a different construction than the living room floors. The energy consultant is not required to register floors, which account for less than 10 % of the floor area as an independent floor with data, etc. Instead, it must be included in the calculation of the total U value for the floors. However, the energy consultant must register the different floor types in the documentation for the Energy Certificate.

The energy consultant must register the different floor types as follows:

9.2.1 Ground supported floors

The energy consultant must always calculate ground supported floors as interior slabs on ground area, located near (1 meter) the outer walls and not distinguish between inner and outer slabs; cf., however, the guidelines for heated floors in chapter 9.2.5 Heated floors. The energy consultant must set the temperature factor b at 0.2. The U value for the ground supported floor must be assessed on the basis of the date of construction or renovation or on information from blueprints, etc.

9.2.2 Crawl space

A crawl space is a floor construction with access to outside air on the underside of the construction regardless of its height. If the crawl space is accessible, the en-

ergy consultant must inspect its insulation condition. If it is inaccessible, the energy consultant must assess the U value for the floor in the same way as with ground supported floors. The energy consultant must be aware that there may be different temperature factors b before and after re-insulation of the crawl space.

9.2.3 Storey partitions

Storey partitions adjoining open air or unheated cellars may be open or closed constructions. A construction is open if there are beam layers with visible beams. If the floor construction has a closed beam layer fit for re-insulation, the energy consultant should inspect the construction using an endoscope to assess whether re-insulation is possible and to register whether the beam layer has had clay inserted. If there is no clay, the energy consultant must register the beam layer as a ground supported floor. The storey partition may have different temperature factors b before and after re-insulation.

9.2.4 Cellar floors

The energy consultant must register cellar floors in the same way as ground supported floors. The U value for cellar floors is equal to the U value for cellar floors 2 meters under ground, unless there is actually a significant difference.

9.2.5 Heated floors

Heated floors have a negative temperature factor b; cf. Appendix 7. The energy consultant must register the heated floors separately if the heated floor area either accounts for more than 10 % of the total gross floor area or is exceeds 10 m^2. Regardless of the area of heated floors, the energy consultant must make a note of any heated floors in bathrooms when registering the other floors.

9.3 Data

The energy consultant must use the data found in chapter 5 Thermal envelope in general for the calculations on the Energy Certificate. U values for typical floor constructions are found in Appendix 8 and Appendix 12.

9.4 Text

The energy consultant must describe all floor constructions in the building that have a heat loss on the Energy Certificate in the section ”Floors – adjoining unheated crawl space, ground supported floors, etc.” For each type of floor construction, the energy consultant must note the type and thickness of the insulation. If the U value for a floor construction is based on an assessment, the energy consultant must use this section to describe what the basis for the assessment is.

Examples ***Documentation text***

Un-insulated concrete floor in hallway; cf. information from blueprint no. 3 of 5 May 1943.

Un-insulated wooden floor. My assessment of the floor construction is based partly on common building practice at the time of construction and partly on the ventilation grates in the foundation. There is no access to the crawl space. There is a tiled floor with 50 mm insulation and heating in the scullery and bathroom; cf. information from the owner.

Un-insulated beam layer with approximately 15 cm beams, wooden floor and plastered ceiling in the cellar. The cavity has been inspected in one place using an endoscope.

The energy consultant must tick off the 3rd column in the section indicating whether a building part is included with proposals for savings in the energy plan.

Example ***Text in the energy plan***

Injection of 150 mm granulated insulation material in the storey partition adjoining the cellar. Injection to be made from the cellar; see also appendix B.

Re-insulation of crawl space with 100 mm insulation batts between beams. See also appendix B.

10 Ventilation

10.1 Purpose

In drawing up the Energy Certificate, the energy consultant must:

- calculate the heat loss from the natural air change rate in the building
- calculate the heat loss from the mechanical ventilation in the building

The natural air change rate is air change caused by leaks in the building, ventilation through ventilation shafts and ventilation valves and ventilation when opening and closing doors. The natural air change rate also comprises ventilation through cooker hood and bathroom ventilators.

Mechanical ventilation is electrical ventilation in the building or parts of the building through mechanical injection and suction or through mechanical suction and supply of outside air through openings in the thermal envelope. Mechanical ventilation may be combined with heat recovery.

10.2 Registration

The energy consultant must evaluate the degree of natural air change for the entire building by registering:

- the tightness of clearances in windows and doors
- the tightness of joints between sill and frame
- the tightness of joints in connections between building parts; i.e. between wall and ceiling
- location and number of ventilation grids and whether these provide the necessary ventilation
- whether hatches to loft and space under the roof slope are tight to the frame
- number and location of cooking hood and bathroom ventilators

As regards the mechanical ventilation, the energy consultant must register:

- whether the building has a ventilation system as well as the location and age of the system
- whether there is any heat recovery
- whether injected air is heated and if so how the heating occurs (electric / central heating)

Furthermore, the energy consultant must assess whether there are any humidity problems in the building.

10.3 Data

The energy consultant must use the data found in chapter 5 Thermal envelope in general for his calculations on the Energy Certificate. The energy consultant must state the air change rate in the building as:

- air change rate per hour or
- air change rate in litres per second per m² (l/s m²)

See Appendices 15 and 16.

In buildings of normal tightness, an air change rate of 0.3 l/s m^2 is expected, equal to an air change rate of 0.5 per hour at a ceiling height of 2.3-2.5 m.

The energy consultant must use one of the following categories in his calculation of the air change rate:

- normal tightness (air change rate 0.5 times/hour)
- partial leak (0.6 times/hour)
- leak (0.7 times/hour)

The energy consultant must include the effect of small suction ventilators in bathrooms and cooking hoods in kitchens in the natural air change rate.

The energy consultant must evaluate the air change rate based on Appendix 15.

If it is required that the energy consultant compares the values of ”the number of natural air changes per hour” to the air change rate in ”l/s m ²”, these may be looked up in Appendix 16.

In buildings with mechanical heat recovery, the energy consultant must evaluate the infiltration and temperature effect in natural ventilation and then add the heat recovery percentage as the reduction in percentage of heat loss through ventilation.

In the case of ventilation systems with heat recovery, the energy consultant must note that the heating coil which heats up the injected air may be electrically heated. This means that a significant proportion of the heating is done by electricity, and so the energy consultant must be aware of the stated electricity consumption. The energy consultant should not calculate electricity used for the operation of the ventilation system, but add the system as and an “extra appliance” under electrical appliances; cf. chapter 18 Electricity.

10.4 Text

The energy consultant must fill out the sections ”Joints” and ”Ventilation”.

In the section ”Joints”, the energy consultant must note whether there are tight/leaky joints and their location. In the case of window clearances, the energy consultant must note whether they are sealed with mortar, plastic joints, etc., and

their condition. In the case of other joints with significance to the natural air change rate, the energy consultant must describe their condition and tightness.

Examples ***Explanations in the ”Joints” section***

Outside joints between windows/doors and wall have been sealed with plastic joint filler. The joints are generally tight.

Outside joints between windows/doors and wall have been sealed with mortar. The mortar is partially decomposed, and the joints are partially leaky.

In the ”Ventilation” section, the energy consultant must add an explanation if a different value than “normally tight” is given.

Examples ***Explanations in the ”Ventilation” section***

The building is partially leaky, since certain window frames are not tight to the window sills.

The building is very tight. It is recommended that possible ventilation is established in every room either as valves in the outer wall or as valves in the window/door frames.

The building is tight and there is a mechanical ventilation system with heat recovery. The heat recovery has been assessed to reduce the ventilation loss by 50 %.

If the air change rate is higher than 0.5 times/hour, the energy consultant must evaluate the possibilities of reducing it. If the energy consultant recommends joint relocation of joints under ”Ventilation”, the recommendation must also appear under ”Joints”.

Examples ***Text for energy-saving measures***

Approximately 1/3 of the mortar joints between windows/doors and wall are to be replaced with new mortar joints.

For the 4 windows in the living room I suggest sealing with sealing strips between window frame and sill. If there are no ventilation valves or if the current valves are defect, the

residents should be made aware of the advantages of ventilation.

11 Heating system in general

11.1 Purpose

The purpose of registration of the heating system is to obtain data on the heat producing and heat distributing system and any accompanying automatic control devices. The data is used to calculate the efficiency of the heating system and the loss that is required for the net energy requirement for heating and hot water. The data is also used to calculate and evaluate any possible profitable energy-saving measures.

11.2 Registration

It is the responsibility of the energy consultant to register the heating system correctly. The energy consultant must register all parts of the heating system which have a loss or affect the efficiency of the heating system.

The heating system consists of:

- the heat producing appliance, primarily boilers, district heating units, electrical radiators, ovens and hot-water tanks
- the heat distributing system, primarily heat pipes, hot water pipes and radiators
- automatic control devices, primarily thermostatic valves, automatic temperature reduction (including boiler/shunt circuit and clock) and temperature regulators on hot-water tanks

11.3 Data

11.3.1 Chimney losses

Chimney losses are indicated as a percentage of the supplied effect. The energy consultant must state the chimney loss for oil furnaces based on his reading on the OR certificate. In the case of gas boilers, the values in appendix 21 must be used.

11.3.2 Gate losses

The energy consultant must state the gate losses (heat loss from non-cooled surfaces on boilers) as a percentage of the supplied effect; cf. Appendices 20 and 21.

11.3.3 Stand-by losses

The energy consultant must state the stand-by loss for the boiler (heat loss from surfaces and draught) in kW based on Appendices 20 to 23. Losses occur in 8,760 hours/year; cf. Appendix 19.

11.3.4 Hot-water tank losses

The energy consultant must state any loss from the hot-water tank including connection pipes in W/K, cf. Appendix 26. The losses are included with a temperature difference of 35ºC and entered into the computer programs with losses in W. Losses occur in 8,760 hours; cf. Appendices 19 and 27.

11.3.5 Pipe losses

The energy consultant must register losses from heat pipes in W/mK, cf. Appendix 28. Heat losses from pipes in W/m with a temperature difference of 35°C are found in Appendix 29. The number of hours with losses is found in Appendix 19.

11.3.6 Temperature factor b

The energy consultant must reduce the loss by the factor (1-b), where b is shown in Appendix 17, if the heating system or parts of the heating system are placed in heated rooms or cellars.

11.3.7 Automatic control devices

The energy consultant must register any automatic control devices installed.

11.4 Text

In the energy plan, the energy consultant must propose any profitable energy-saving measures for the heating system or parts of the heating system. The investment in DKK and the life time of the measures are included in the proposals for energy-saving measures. The energy consultant must use the life times in Appendix 14.

12 Heat producing systems

12.1 Purpose

The purpose of registration and calculation of the heat producing system is to identify energy losses from fuels (oil, gas, electricity, and district heating) for heat in the building. The registration of the heat producing system must include:

- oil furnaces and oil burners
- gas boilers and gas burners
- solid fuel boilers
- ovens for main heating, including gas ovens, petroleum ovens, etc.
- district heating units
- electrical panels
- electrical hot-water tanks; see chapter 15 Hot-water Tanks
- solar heating

12.2 Registration

The energy consultant must register the heat producing system with the losses shown in chapter 11.3 Data. The energy consultant must register the system with:

- type
- name
- age
- losses
- improvement possibilities

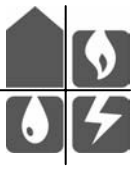
12.2.1 Oil furnaces and oil burners

The oil boiler must be registered with:

- type, unit/single boiler, cast iron/plate iron, condensing/non-condensing
- name on the boiler
- age according to the mark
- chimney losses from the OR certificate
- improvement possibilities

The energy consultant must register oil burners separately stating age if the burner has a different age from the boiler.

The energy consultant may find inspiration for evaluating existing oil furnaces on http://www.sparolie.dk/ under the ‘status list’. Appendix 20 shows which losses



the energy consultant must include in the calculations for the boilers in the status list.

New energy labelled boilers are found on http://www.sparolie.dk/ under the 'positive list'. Appendix 20 shows the losses found in new boilers in categories A-E.

If the oil furnace is more than 15 years old, the energy consultant must calculate whether it is profitable to replace the boiler with an A-B labelled boiler. Before making any recommendations for a new boiler, the energy consultant must evaluate whether the interaction between a new boiler, burner, chimney, hot-water tank and radiator system will result in the desired savings.

12.2.2 Gas boilers

The energy consultant must register gas boilers following the same guidelines as with oil furnaces. In the case of gas boilers, the energy consultant must also register whether the boiler is wall mounted or is placed on the floor. Additionally, these types are registered:

- gas boiler with gas burner
- gas boiler with open burn chamber
- gas boiler with closed burn chamber
- condensing gas boiler

If in doubt as to which type of gas boiler is installed, the energy consultant should consult the gas Distribution Company. The energy supply companies are obligated to have in their records the name and type of boiler. If the energy consultant cannot obtain the necessary information, this must be stated clearly on the Energy Certificate.

Gas boilers with closed burn chambers may also be modulating; i.e. the effect of the burner can be adjusted as needed.

The different types of gas boilers are found in Appendix 21.

If the gas boiler is more than 15 years old, the energy consultant must calculate whether it would be profitable to replace it with a new condensing gas boiler.

Before any recommendations for a new boiler are made, the energy consultant must evaluate whether the interaction between a new condensing boiler, chimney, hot-water tank and radiator system will result in the desired savings.

12.2.3 Solid fuel boilers

Solid fuel boilers are boilers which provide heat for central heating systems and which are fired with solid fuel. Solid fuel boilers are divided into types depending on the kind of primary fuel used. The most common types of boilers are:

- wood burning boilers with manual feed
- biomass boilers with manual or automatic feed
- other fuels such as coal, coke, grain, etc.

- straw-fired boilers
- woodchip-fired boilers

12.2.4 Ovens

Ovens for main heating are separate ovens which are not part of a central heating system. Ovens must be registered stating type and age. Ovens must be divided into types according to the fuel used:

- petroleum oven
- oil fireplace
- gas radiator

Electrical panels, etc., are not registered as ovens.

12.2.5 District heating

As regards district heating, the energy consultant must register:

- whether it is direct district heating or indirect heating, where the district heating water is exchanged with the central heating water in a heat exchanger
- type, age and losses for the district heating unit
- control of the district heating supply; i.e. with a central return thermostatic valve
- type of heat gauge and the unit used for measuring heat consumption; i.e. MWh

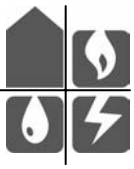
12.2.6 Heat pumps

A heat pump is characterised by the type of heat source and the heating supply system. Different types of heat pumps exist:

- in an earth/water system, the heat source is the earth and the heat emission system is a water based system in the house, a hot-water tank, radiators or a radiant floor heating system
- in an air/water system, the heat source is the outside air or ventilation air and the heat emission system is a water based system, usually a hot-water tank
- in an air/air heat pump, the heat source is the outside air and the receiving system is the inside air

The heat pump efficiency is the relation between the energy supplied to the house through the heat pump and the auxiliary energy fed to the heat. The average annual efficiency is usually between 2.2 and 3.2.

The energy consultant must register the heat pump stating:



- type (earth/water, air/water, etc.)
- function; i.e. heating, domestic hot water, partial heating, etc.
- name and age
- location
- any possible improvements
- interaction between the heat source and the heat emission system; i.e. earth/water heat pump with radiant floor heating
- information on the heat pump capacity and performance coefficient
- heat source, including heating and hot water peak load when it is cold

12.2.7 Additional heating

The energy consultant must register all additional heat sources. Additional heat sources are heat sources which are not defined as the main heat source. Additional heat sources must not be included in the heat consumption calculations. Additional heat sources may be divided into:

- wood burning stoves
- coal burning stoves
- electrical panels
- separate petroleum ovens and gas ovens

12.3 Data

12.3.1 Boilers

Depending on the computer program, the data for calculation of losses in boilers must include:

- chimney losses in percentage of supplied effect
- gate losses from non-water cooling areas in percentage of supplied effect
- stand-by losses (heat losses from surfaces and draught losses) in kW
- temperature factor b for the location of the boiler

The losses are found in Appendix 20 and Appendix 21.

12.3.2 Ovens

The energy consultant must calculate oven losses based on Appendix 23.

12.3.3 District heating

The energy consultant must calculate losses in district heating units as losses from hot-water tanks.

12.3.4 Heat pumps

The heat pump only figures in the calculations for the Energy Certificate if the heat pump is the primary heat source.

If the heat pump is used only for heating domestic hot water or as additional heating to electrical heating, the heat pump is not included in the calculations, but only in the text for the Energy Certificate.

If the heat pump is the primary heat source, there will usually be an additional heat source, since heat pumps are generally dimensioned to cover 95 % of the heat requirements.

In the evaluation of the energy consumption of the heat pump system, an average approximated annual efficiency factor is used. The heat pump efficiency factors below may be used:

- earth/water 2.4 – 3.2
- air/water 2.2 – 2.7
- air/hot water 1.6 – 2.0
- air/air 2.2 – 2.5

The efficiency factors are shown with an interval because there may be variations in the individual system types and heat emission systems. In new buildings where the system may be dimensioned perfectly from the outset, the top values will usually be the relevant ones.

The air/hot water system usually only has an efficiency factor of 1.6 – 2.0 because the heat pump, in addition to supplying energy for the hot water, also has to cover the system's stand-by losses.

The energy consultant calculates the gross heat requirements according to standard procedure. When calculating the gross energy requirement, the heat pump efficiency factor is added. The result is a gross energy requirement that is approximately 50 % lower than the gross heat requirements.

In the case of heating with heat pumps, the calculation of the energy label for heating is based on the net heat requirements. The energy label for CO2 is based on the gross energy requirement. The heating cost is based on the gross energy requirement.

12.3.5 Additional heating

Heat sources registered as additional heating do not figure in the calculation of heat consumption. Only one heat source figures in the calculation for heat consumption.

12.3.6 Hot water

The net energy requirement for water heating is calculated on the basis of standard figures and the heated area; cf. Appendix 6.

12.4 Text

12.4.1 Heat pumps

The first column must read ”heat pump” under heating system.

The type, name, age and location of the heat pump must be noted in the second column. In the same column, the energy consultant should state the estimated efficiency factor or refer to a more detailed text further down on the Energy Certificate.

If the heat pump produces hot water, it must appear in the hot-water tank section that the hot water is produced by heat pump, and a reference to further comments further down on the Energy Certificate should be made.

If the heat pump heats the house only partially, for example with an air/air heat pump, this must be described in additional heat sources with a more detailed comment on how the heat pump affects the total heating costs.

13 Conversion

13.1 In general

The energy consultant must register whether it is possible to convert from individual heating supply to collective heating supply (district heating and natural gas). If this is possible, the energy consultant must state it in the conclusion section on the front page of the Energy Certificate and note whether he would recommend it.

The energy consultant must always calculate whether a conversion is profitable. If so, it must be stated in appendix A or appendix C depending on the program used.

13.2 Order of calculation

When the effect of the conversion is calculated, the energy consultant has already calculated the effect of the improvements in the energy plan; i.e. re-insulation of roof and outer walls.

The order of calculation is:

- calculation of heat consumption in Energy label
- calculation of heat consumption after implementation of Energy plan
- calculation of heat consumption after savings in Energy plan and conversion

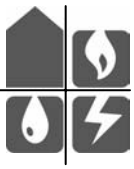
The conversion is the 3rd calculation where only the losses of the heat producing system are recalculated based on the new heat producing system, and possibly heat distributing system (in converting from electrical to district or gas heating).

This means that the net heat requirements in kWh are the same in this 3rd calculation (conversion) as in the 2nd calculation (the energy plan).

13.3 Investment

The investment in the conversion procedure is defined as all the work and installation charges that the client must pay. The investments may include:

- connection fee from the district heating company or natural gas supplier
- service pipes
- removal of existing installation
- chimney modification/setting-up of new vent for condensing boilers
- new heat producing system
- new oil tank and supply line of oil from the tank (from electrical to oil heating)
- new central heating system including automatic control devices



13.4 Savings

The conversion savings are not always a reduction of the gross energy requirement, but a reduction of fuel costs per kWh.

The savings figure as heating costs in DKK in Energy plan less the heating costs after the conversion in DKK.

13.5 Profitability

The profitability factor is the annual savings in DKK/year multiplied by the life time of the system (20 years) divided by the investment.

14 Solar heating for hot water

14.1 Purpose

The purpose of registering solar heating systems for water heating is to calculate the reduction in the energy consumption that would otherwise have been used for hot water production.

The Handbook only contains guidelines for calculation of solar heating for water heating. If the energy consultant must label a solar heating system that is used for partial heating of the building, the Secretariat of Energy Labelling must be consulted for further guidance.

If installation of solar heating is physically possible, the energy consultant must state this under heating and in the energy plan.

14.2 Registration

The energy consultant must register:

- net energy requirement for heating of hot water for the entire year
- m² collector area (solar panels)
- the actual slope of the collector area. In the calculations, the slope is divided into the following intervals: 15º, 30/70º and 90º
- orientation of the collector areas; south, SE/SW and east/west

14.3 Data

The effect of the solar heating system is partly a reduction in the net energy requirement for hot water and partly a saved stand-by loss in the heat producing system over the summer months during which the heat producing system is presumed to be shut off.

The total reduction in net energy requirement is calculated on the basis of the collector area, the slope and the orientation; cf. Appendices 31 and 32. The energy consultant first calculates the net energy contribution from the collector area. Then the energy consultant calculates any reduction in net energy contribution. A reduction will occur if the collector area is oriented a different way than south and/or if it has a slope less than 30º or greater than 70º.

Example ***Calculation of the solar heating system's net energy contribution***

Solar panel area: 6 m². Orientation: South, 45º. Net hot water requirements: 2,500 kWh/year.
The net energy contribution is 1,800 kWh/year. There is no slope or orientation reduction.

Savings from the boiler's stand-by losses are a reduction of the heat losses from the heat producing system (the boiler) from 8,760 hours/year to 6,000 hours/year. The loss from the hot-water tank remains unchanged; 8,760 hours/year.

14.4 Text

The energy consultant must state the solar heating system's collector area size under "Additional heat sources" and note that the solar heating is included as a reduction of the hot water consumption even though additional heat sources are not included in the calculated heat consumption.

15 Hot-water Tanks

15.1 Purpose

In drawing up the Energy Certificate, the energy consultant must:

- register hot-water tanks
- calculate heat losses from hot-water tanks

If the hot-water tank is an integrated part of the boiler unit, the energy consultant must not register it, since the losses from the boiler unit include the heat losses from the hot-water tank.

15.2 Registration

The energy consultant must register the following data on hot-water tanks:

- volume in litres
- age according to information on the hot-water tank or estimated age
- type and insulation thickness and insulation condition
- location in the building

The volume of the hot-water tank is usually stated on the tank labelling. If this is not the case, the energy consultant must measure the volume of the hot-water tank.

If the age of the hot-water tank does not appear on the label, the energy consultant must assess its age based on the type of tank or the time of construction of the building.

The energy consultant must divide hot-water tanks into one of the following types:

- pre-insulated tanks; such as ”Metro”, which has been finished on the outside with a metal sheath and where the insulation between sheath and tank is foam
- conventionally insulated hot-water tanks; such as ”AJVA” which is a sheathed hot-water tank where the insulation may be measured with a thin awl and which is usually horizontally positioned

15.3 Data

The hot-water tank must be calculated with loss for the entire year, i.e. 8,760 hours/year. In the heating season, the loss may be reduced, since part of the loss from the hot-water tank is considered beneficial for the building. The extent of the loss, which may be beneficial for the building, depends on the location of the tank. The energy consultant must state the reduction of the heat loss as the tank’s temperature factor b; cf. Appendix 17.

Data for calculation *must* include:

- loss from hot-water tank including 2 m of pipe in W, cf. Appendix 26. The energy consultant may calculate the loss from the hot-water tank himself based on the surface area of the tank with a temperature difference of 35ºC
- temperature factor b; cf. Appendix 17.

15.3.1 Temperature factor b

The energy consultant must register all hot-water tanks and state which temperature factor b they should have. If the temperature factor b is higher than 0, the heat loss is reduced in the 6,000 hours of the heating season. In the 2,760 hours of the summer period, there is a 100 % loss from the hot-water tank.

15.4 Text

In the second column of the section ”Hot-water tanks and heat pipes”, the energy consultant must describe the hot-water tank with the information found in chapter 15.2 Registration.

Examples ***Documentation text***

Hot-water tank in the scullery is a 110 litre pre-insulated tank from 1989 of the brand ”Metro”.

The hot-water tank in the cellar is a 100 litre tank with 20 mm mineral wool insulation. It is my assessment that the hot-water tank is 25 years old, presuming that the tank is the same age as the building.

Hot-water tank from 1995 in the scullery next to the natural gas boiler is pre-insulated and has a 60 litre tank.

Example ***Text in the energy plan***

Existing insulation is to be removed and the entire tank is to be re-insulated with 40 mm insulation. See appendix B.

Example ***Text in Appendix B***

The hot-water tank is a sheathed hot-water tank of the ”AJVA” type. It is my assessment that there is a thick layer of lime deposits on the inside of the tank due to the relatively calcareous water in the area. Due to the lime, the heat loss from the tank is considerable and I recommend to have

the tank replaced with a pre-insulated vertical hot-water tank.

16 Heat pipes

16.1 Purpose

In drawing up the Energy Certificate, the energy consultant must register:

- heat pipes from central heating systems
- hot-air ducts from central heating systems with air heating
- hot-water pipes with pump circulation

Hot-water pipes are only included in registrations and calculations if there is forced hot water circulation on the pipes. In these cases, the energy consultant must register and calculate them using the same method as for heat pipes.

16.2 Registration

The energy consultant must only register heat pipes with heat loss and not heat pipes which, for calculation purposes, have no heat loss.

16.2.1 Pipes with no heat loss

Pipes with no heat loss relevant for calculation purposes, are pipes which are located in heated rooms. There is a calculational benefit to the building of heat loss from these pipes in the same way as if the heat came from the radiators. Consequently, the energy consultant must *not* register these heat pipes which are:

- heat pipes in heated rooms
- heat pipes in ground supported floors on joists, which have been constructed in accordance with Building regulations 1977 (which came into force on 1 February 1979) or later, and which are estimated to be on the heated side of the insulation

16.2.2 Pipes with heat loss

All other heat pipes than the above-mentioned have heat losses. The energy consultant must register these heat pipes with:

- length in m
- outer pipe diameter
- insulation thickness in mm
- insulation type and condition
- location in the building
- temperature factor b

If necessary, the energy consultant must carry out an inspection using an awl to determine the thickness of the insulation.

The energy consultant may determine the length of the heat pipes in one of the following ways:

- in a double-pipe system, the pipe length may be calculated to 4 x the length of the house + 2 x the width of the house; both outside measurements
- in a single-pipe system, the pipe length may be calculated as the circumference of the building; outside measurement

The energy consultant may choose to measure the exact visible pipe length instead of using the method above. This should be done if the pipes differ significantly from the above mentioned.

The degree of insulation on the pipes may vary and some parts may be un-insulated. Where it is not profitable to re-insulate the heat pipes, the energy consultant may use an average insulation degree. However, the energy consultant must always register un-insulated heat pipes and include them in the energy plan.

The energy consultant must not register un-insulated valves, etc., since these are included in the heat loss from the pipes.

16.2.3 Temperature factor b

The energy consultant must register all pipes with heat losses with a temperature factor b. The temperature factor b is a reduction factor for the heat losses from the heat pipes, seeing that part of the heat loss is considered beneficial to the building.

Example ***Temperature factor b***

> The temperature factor b 0.8 means that 80 % of the heat loss is beneficial to the building and that 20 % may be included as a loss.

The energy consultant must use the temperature factors b from Appendix 17.

16.3 Data

The following data is included in the calculations of heat loss from heat pipes:

- pipe length in m
- heat losses in W/m based on Appendix 29 or on the calculation of the heat loss where delta T is 35 degrees as a standard; see Appendix 30
- temperature factor b in accordance with Appendix 17
- hours with heat loss per year

Heat loss in W/m based on Appendix 29 applies to all types of intact insulation.

The energy consultant must include number of hours per year with heat losses based on Appendix 19.

Losses from hot-water pipes with pump circulation must be calculated as hot-water pipes with a temperature difference of 35ºC in all hours with losses.

The energy consultant must calculate losses from hot-air vents as losses from 1-inch heat pipes.

16.4 Text

In the second column of the section ”hot-water tank and heat pipes”, the energy consultant must describe:

- where the heat pipes are located
- insulation type and insulation condition if it is not intact
- insulation thickness

Example ***Documentation text***

Heat pipes in the space under the roof slope are insulated with 20 mm insulation.

Heat pipes in the space under the roof slope are insulated with 10 mm insulation, which is loose or missing in several places.

2 meter heat pipes in the cellar are un-insulated.

It is my assessment that the heat pipes under the wooden floor are insulated with 10 mm insulation. I base my assessment on the building code in place at the time of construction.

Pipes between the boiler and hot-water tank for heating the hot-water tank are un-insulated.

Example ***Text in the energy plan***

The existing defective insulation of the heat pipes in the cellar is to be removed and the heat pipes are to be insulated with 30 mm pipe bowls.

Heating pipes

Un-insulated heat pipes in the scullery are to be insulated with 30 mm pipe bowls.

Heat pipes in the loft space are to be insulated with 30 mm pipe bowls and the existing insulation is to be removed.

17 Automatic control devices

17.1 Purpose

The purpose of registering and calculating automatic control devices is to highlight the energy-related consequences of automatic heat control or lack thereof. Consequently, the energy consultant must first and foremost survey to what extent and where the building lacks automatic control devices.

There are two types of automatic control devices: Thermostatic valves and lowering of temperature by night. Additional consumption or savings due to lack of existing automatic control appear when the indoor temperature is regulated from +1 degree to -1 degree in relation to the standard indoor temperature of 20°C.

17.2 Registration

In drawing up the Energy Certificate, the energy consultant must register:

- to what extent the building has thermostatic valves on radiators in case of central heating and thermostats in case of electric heating
- the total number of manual valves or faucets on the radiators
- to what extent there are return thermostats on radiators with water-borne central heating and if there are flow thermostatic valves at the same time
- to what extent there is lowering of temperature by night and how to regulate this timer control of the room temperature; i.e. by clock, room sensor or timer via the thermostatic valves
- if only rooms with no windows lack thermostatic valves

If the radiators have manual radiator valves or regulators, the energy consultant must register where these are located.

Furthermore, the energy consultant must register possibilities for temperature lowering by night and mounting the required thermostatic valves.

17.3 Data

When calculating the heat requirements, the energy consultant must use an indoor temperature of 20ºC around the clock. The 20ºC is used under the presumption that there is automatic room temperature control by means of thermostatic valves or automatic central control.

Otherwise the energy consultant must correct the indoor temperature as follows:

- in case of automatic control devices for temperature lowering by night (automatic control devices for central room temperature control) by –1ºC

- with lack of thermostatic valves (required automatic control devices for automatic room temperature control) by +1ºC

If any rooms lack individual room temperature control, the energy consultant must set the room temperature in the entire building according to the number of lacking devices; i.e. if thermostatic valves are missing in half the rooms of the living area (usually bedrooms and living rooms), the energy consultant must use a 0.5ºC increase in room temperature for his calculations.

If installing thermostatic valves in rooms with no windows results in savings, the energy consultant must recommend this in the energy plan. If installing thermostatic valves in rooms with no windows does not result in savings, the energy consultant must make a note in his registration referring to appendix B. In appendix B, the energy consultant must then state that there may not be any major savings from installation of thermostatic valves in the secondary rooms, but that it may lead to improved system efficiency.

In buildings with electrical heating and with oil or natural gas supply, the energy consultant may suggest thermostatic valves and lowering of temperature by night – regardless of whether the profitability is more or less than 1.33 – in the energy plan if these have not been set up already.

In case of district heating, the energy consultant must assess whether lowering of temperature by night is profitable in relation to the form of settlement. The energy consultant must always suggest thermostatic valves if these have not been installed.

In case of district heating with return thermostatic valves, the energy consultant must assess whether it would be profitable to also install flow thermostatic valves on the radiators. The energy consultant must be aware that the profitability of automatic control devices is calculated after the energy consultant has calculated the savings of the thermal envelope and the heating system.

The energy consultant must not suggest automatic control devices which may cause the heat pipes to freeze.

Example ***Calculation of savings on automatic control devices***

A building has an oil consumption of 3,000 litres of oil. Energy savings in the thermal envelope amount to 1,000 litres of oil/year and the energy savings in the heating system amount to 500 litres of oil/year. The gross energy requirement will then be 1,500 litres of oil/year. Lowering of temperature by night saves 5 % of the gross energy requirement, equal to 5 % of 1,500 litres, or 75 litres, of oil/year.

17.4 Text

In the first column of the section ”Automatic heat control” on the Energy Certificate, the energy consultant must state whether he is registering thermostatic valves or lowering of temperature by night and describe in column two the type of automatic control devices or lack hereof.

Example ***Text in documentation***

Thermostatic valves on most radiators. There are 4 manual radiator valves, which are located in hallway and 3 rooms on the first floor. There are return thermostatic valves on all radiators.

There is no automatic control for room temperature reduction at times when it is not necessary to have room temperature of 20ºC in the building; for example at night.

Outside sensors ensure automatic room temperature control on the boiler. The timer control may be used to lower the room temperature, for example at night.

Example ***Text in the energy plan***

Replacement of 4 manual radiator valves with thermostatic valves in the hallway and 3 rooms on the first floor.

The electrical panels have been set up for automatic timer control of heating. It is recommended that a clock in the fuse box is installed and that the reduced temperature is adjusted on the individual electrical panels.

The boiler has been prepared for automatic timer control of room temperature. It is recommended that automatic control of the boiler is set up and that a room thermostat is installed in the living room.

18 Electricity (not translated) [2)]

18.1 Purpose

18.2 Registration

18.3 Data

18.4 Text

19 Water (not translated) [3)]

19.1 Purpose

19.2 Registration

19.3 Data

19.4 Text

20 CO2 emission (not translated)

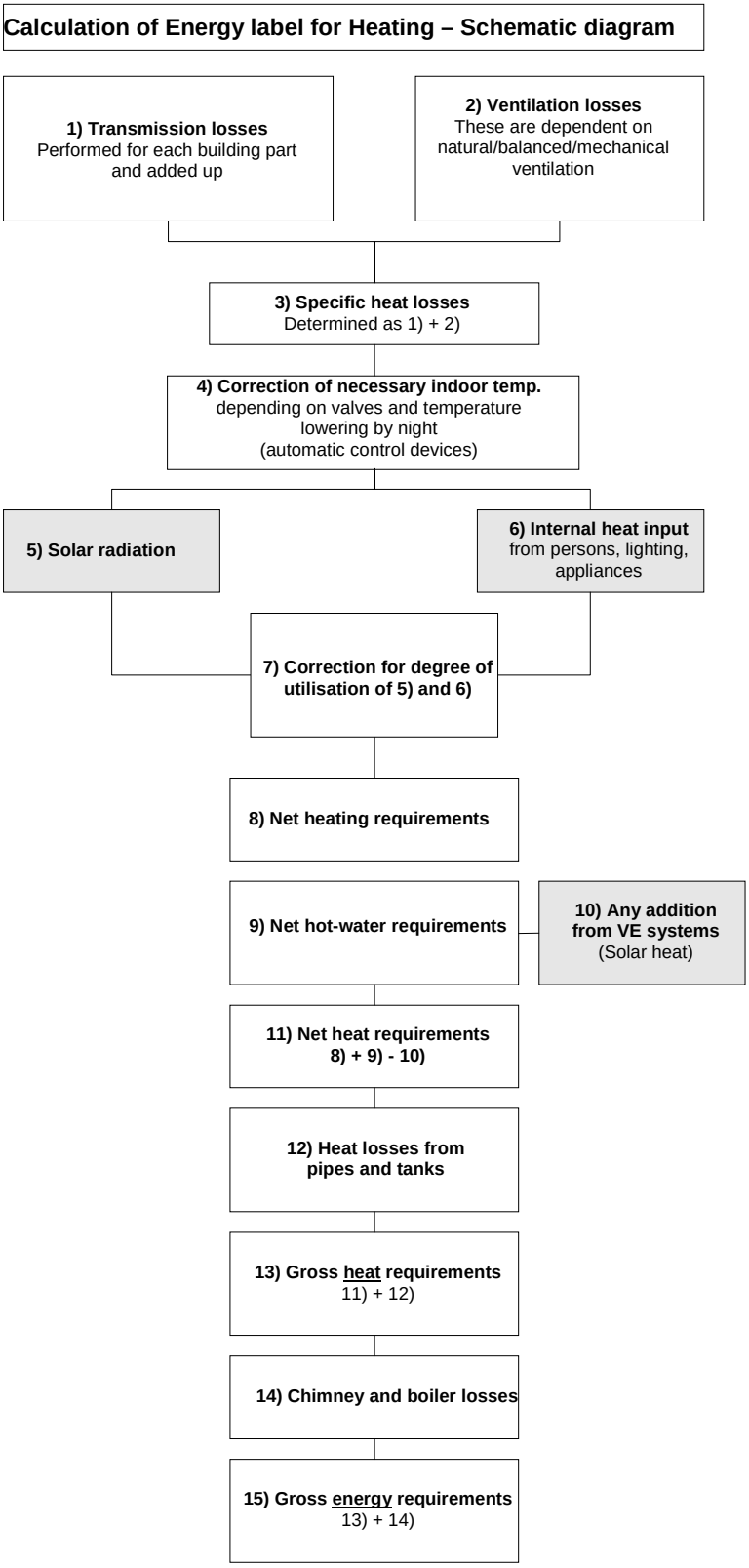
20.1 Calculation of total emission

21 Calculation results (partly translated)

In the preceding chapters on thermal envelope, heating systems, electricity and water, the data basis for calculating heating (…) consumption have been defined. This chapter explains how this data is used in the calculations for Energy label and Energy plan & documentation. Furthermore, it is explained how the energy consultant must calculate the energy labels for heating (…). The chapter includes explanations of the figures on the Energy Certificate, which are calculated using the energy consultant's computer program. The formulas behind the calculations appear in the Calculation section.

21.1 Gross energy consumption

The diagram below shows the calculation flow in the calculation of the gross energy consumption for heating and hot water. Net heating demands, net heat demands, gross heat demands and gross energy requirement are calculated in kWh/year. These intermediary calculations will appear from the calculation programs used by the energy consultants.



Note to diagram:	"Boxes" with grey backgrounds indicate a positive contribution to the heating calculation.

21.2 Electricity and water consumption

21.3 Calculated data in Energy label (front page)

21.4 Calculated data in Energy plan (page 1)

21.5 Calculated data in Energy plan (page 5)

The page contains any proposals for energy-saving measures in the thermal envelope and heating systems made by the energy consultant. Proposals above the dotted line are profitable. Proposals below the dotted line are not profitable.

The term profitability means that the calculation ”savings (in DKK) x life time (in years) / investment (in DKK)” must be higher or equal to 1.33.

The energy savings are calculated in the following order:

1. total savings for thermal envelope with existing heating system. The savings are distributed equally on the individual building parts/ventilation
2. savings in the heat producing and heat distributing system with re-insulated thermal envelope
3. effect of investment in automatic control devices in the energy plan based on re-insulated thermal envelope and improved heating system
4. effect of investment in conversion to a different supply form based on the energy plan and automatic control devices
5. effect of investment in automatic control devices after conversion

Field	Explanation
Proposals for improvements	Text field with description of proposal for energy saving. The proposal must be described in a concise and non-technical language, so that non-specialists will understand what is invested in and where.
Price including VAT	Price including VAT of the investment in the proposed saving. The price must be an average market price for the measure, such as prices from recognised price books, price surveys in electronic form or prices based on the local price level for materials and labour costs.
Annual heat saving	Annual heat saving in fuel units, i.e. the heating charge on a continuous basis.
Annual saving	Annual saving in DKK including VAT upon implementation of the proposed improvement.
Estimated lifetime	The lifetime of the proposed energy saving in years (disclosure field).
Annual reduction in tons of CO2	Reduction of CO2 in tons per year as a result of the implementation of all the proposed energy savings above and below the dotted line.
Energy label heating	Energy label for heating upon implementation of all energy savings above and below the dotted line.

21.6 Calculated data in Energy plan – Electricity (page 6)

21.7 Calculated data in Energy plan – Water (page 7)

22 Open text (not translated)

22.1 Purpose

22.2 Conclusion

22.3 Overall recommendations

22.4 Comments related to heat

22.5 Comments related to electrical appliances

22.6 Comments related to water

22.7 Stated consumption

22.8 Appendix A

22.9 Appendix B

22.10 Appendix C

23 New buildings (not translated)

23.1 Current building regulations governing construction permits

23.2 Energy labelling based on blueprints, etc.

23.3 Data

23.4 Proposals for energy-saving measures

24 Blocks of flats (not translated)

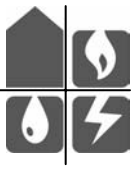
24.1 Energy label for heating

24.2 Energy label for electricity, water and CO2

24.3 Hot-water consumption

25 Owner-occupied flats (not translated)

25.1 In general



25.2 Individual energy labelling of owner-occupied flats in blocks with more than 6 flats

25.3 Individual energy labelling of owner-occupied flats in blocks with 6 or fewer flats

25.4 Energy labelling in accordance with the guidelines for small buildings

25.5 Additional energy labelling

25.6 Examples of calculation of heating for owner-occupied flats

26 Buildings used for other purposes (not translated)

26.1 Energy labelling for heating only

26.2 Electricity and water consumption

26.3 Comments and conclusion

27 Buildings used for mixed purposes (not translated)

27.1 Buildings used for mixed purposes in general

27.2 Other use less than or equal to 20 %

27.3 Other use exceeding 20 %

27.4 Mixed use exempt from energy labelling

Comments:

1)

National Buildings and Dwellings Register.

2)

Not translated because registration was not in line with the directive and will change according to the energy performance calculation.

3)

No longer included in the calculations but only in the proposes for improvements.

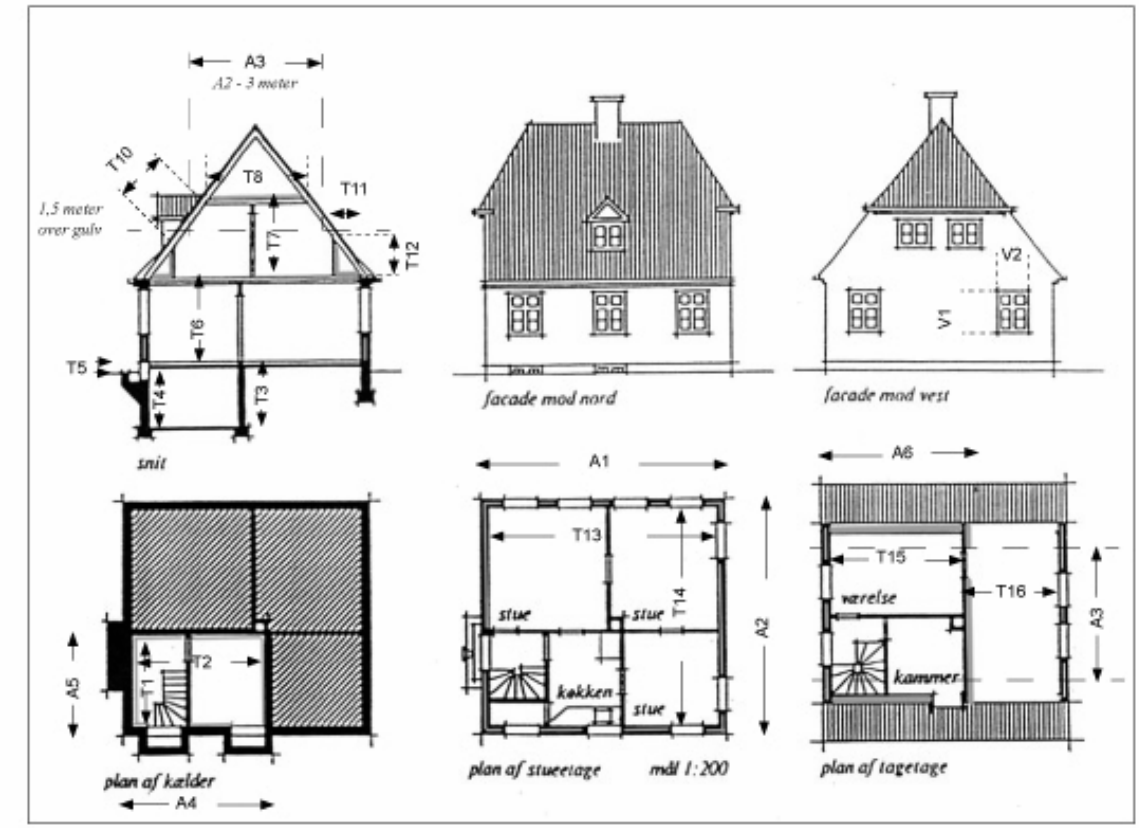
Contents

- INDHOLDSFORTEGNELSE -

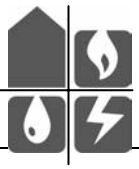
28

Annexes

Appendix 6 Measuring of areas



A = for heated area T = for transmission area	
Measuring of areas	
Heated areas Basement, external measurement……A4 * A5 Ground floor, external measurement…...A1 * A2 Top storey, fully utilised…….A3 * A1 Top storey, partly utilised (as drawing) external wall – insulation towards loft space...A3 * A6 **Transmission areas** Basement floor, external measurement...T1 * T2 Crawl space floor……(T13*T14) - (T1 * T2) No heat loss in the storey partition T1 * T2, since the basement is heated **Basement wall towards ground** Outer wall, OK, floor OK - ground…T1+T2 * T4 Facing building, OK floor, OK foundation…T1+T2 * T3 Windows/outer doors, wall opening…V1 * V2	**Outer wall** Ground floor, from OK floor to OK insulation Roof insulation less windows/outer doors…T13/T14 * T6 Gable, from OK insulation in ground floor to OK insulation collar beam and otherwise delimited by vertical roof slope and sloping wall measured inside. Height T7 **Loft** Collar beam loft is measured inside…T8 * T15 Sloping wall is measured inside …T10 * T15 Vertical roof slope is measured inside …T12*T15 Vertical wall towards unheated space is measured *inside from the heated room.* Horizontal roof slope is measured from vertical roof slope to inside wall on ground floor.....T11 * T15 ***Storey partition towards unheated loft…T16 * T14***



Appendix 8 – U values, building parts

Appendix 8.1 U values for solid outer walls

Serial number	Description	u-value	Note
1.0	Timber frame construction	2.80	Timber frame construction ½ bricks with 15% timber
1.1	½ bricks	3,20	12 cm masonry outer wall, (½-bricks wall)
1.2	½ bricks +50 mm	0,62	12 cm masonry wall, re-insulated on inside with about 50 mm insulation, with plate finish
1.3	½ bricks + 100 mm mm	0,34	12 cm masonry wall, re-insulated on inside with about 100 mm insulation, with plate finish
1.4	1/1 bricks	2,10	24 cm masonry outer wall, (1/1-bricks wall)
1.5	1/1 bricks + 50 mm	0,60	24 cm masonry wall, re-insulated on inside with about 50 mm insulation, with plate finish
1.6	1/1 bricks +100 mm	0.36	24 cm masonry wall, re-insulated on inside with about 100 mm insulation, with plate finish
1.7	1½ bricks	1,50	35 cm masonry wall, T1800 outside wall and T1600 inside wall
1.8	1½ bricks + 50 mm	0,49	35 cm masonry wall, re-insulated on inside with about 50 mm insulation, with plate finish
1.9	1½ bricks + 100 mm	0,30	35 cm masonry wall, re-insulated on inside with about 100 mm insulation, with plate finish
1.10	2 bricks	1,20	47 cm masonry outer wall
1.11	2 bricks + 50 mm	0,46	48 cm masonry wall, re-insulated on inside with about 50 mm insulation, with plate finish
1.12	2 bricks + 100 mm	0,27	49 cm masonry wall, re-insulated on inside with about 50 mm insulation, with plate finish
1.13	19 cm lightweight concrete	1.10	19 cm lightweight concrete outer wall
1.14	19 cm lightweight concrete + 50 mm	0,46	20 cm lightweight concrete outer wall, re-insulated on inside with about 50 mm insulation, with plate finish
1.15	19 cm lightweight concrete + 100 mm	0,28	21 cm lightweight concrete outer wall, re-insulated on inside with about 100 mm insulation, with plate finish
1.16	29 cm lightweight concrete	0,70	29 cm lightweight concrete outer wall
1.17	29 cm lightweight concrete + 50 mm	0,39	29 cm lightweight concrete outer wall, re-insulated on inside with about 50 mm insulation, with plate finish.
1.18	29 cm lightweight concrete + 100 mm	0,25	29 cm lightweight concrete outer wall, re-insulated on inside with about 50 mm insulation, with plate finish.
1.19	30 cm loncrete above ground	3,60	30 cm lightweight concrete outer wall
1.20	30 cm concrete above ground + 100 mm	0,35	30 cm lightweight concrete outer wall, re-insulated on inside with about 50 mm insulation, with plate finish
1.21	30 cm lightweight concrete above ground	0,95	30 cm lightweight concrete outer wall
1.22	30 cm lightweight conrete brick above ground + 100 mm	0.30	30 lightweight conrete brick wall, re-insulated on inside with 100 mm insulation, with plate finish
1.23	30 cm massiv tegl	1,50	30 cm masonry wall T1800 in outer and inner wall (used with 30 cm cavity wall as massive parts)

Appendix 8.2 U values for cavity walls / heavy outer walls

Serial number	Description	u-value	Note
2.1	30 cm cavity, uninsulated	1.60	30 cm masonry cavity wall with 7.5 cm cavity and 10% brickwork. Outer leaf T1800, inner leaf T1800.
2.2	30 cm cavity, reinsulated granulate	0,67	30 cm masonry cavity wall with 7.5 cm space between outer and inner wall. 10 % massive wall. Wall is reinsulated with mineral wool lambda-class 45
2.3	30 cm cavity, reinsulated leca nutts	1,00	30 cm masonry cavity wall with 7.5 cm space between outer and inner wall. 10 % massive wall. Wall is reinsulated with leca nutts lambda-class 80.
2.4	30 cm cavity, insulated	0.60	30 cm masonry cavity wall, insulated at the time of construction. 10% thermal bridge. Insulation lambda 34 (A-wall batts)
2.5	30 cm Heavy BR61 - BR72	1,00	30 cm outer wall that meets the building regulations up to 1979. For instance bricks and 12-13 cm lightweight concrete Pb600 or 12 cm molerstone 700 as inner wall. NB these walls might not be insulated.
2.6	30 cm solid BR61-72 + granulate	0.42	30 cm outer wall that meets the building regulations up to 1979 without cavity insulation. Has been re-insulated with granulate lambda 45. For example, masonry outer wall 75 mm granulate and 12-13 cm air-entrained concrete Pb600 or 12 cm moler brick 700 in outer leaf.
2.7	36 cm cavity, uninsulated	1,60	36 cm masonry cavity wall uninsulated with 10% massive parts.
2.8	36 cm cavity, reinsulated granulate	0,49	36 cm masonry cavity wall uninsulated with 10% massive parts. Reinsulated with mineral wool granulate, lamda 45
2.9	ca 35 cm 10% stonework insulated	0,48	35 cm masonry cavity wall with 10% massive parts, insulated with approximately 130 mm mineral wool, A-batts lambda class 34
2.10	350 masonry lightweight concrete	0.30	36 cm cavity wall insulated with about 130 mm insulation. Outer wall masonry, 125 mm A-batts and 110 mm lightweight conrete brick inner leaf. The outer wall insulation has been assessed to correspond to the demands in the building regulations in effect at the time of construction

Appendix 8.3 U values for light outer walls and dormer slides

Serial number	Description	u-value	Note
3.1	Light un-insulated	1.90	10 cm light wall with inner and outer facing, un-insulated
3.2	Light 50 mm	0,70	5 cm light wall with inner and outer facing, un-insulated
3.3	Light BR 61 - 72 (70 mm)	0.60	Outer wall with about 100 mm pillar framework and about 75 mm insulation
3.4	Light 1.2.79 - 15.98	0,30	Light wall with inner and outer facing and 120-145 mm iinsulation. Estimated because of the time of construction and insulation standard according to the building code on the time for construction.
3.5	Curtain wall-200 mm + facing	0.20	Curtain wall with 2x95 mm insulation, covered inside with gypsym board

Appendix 8.4 U values for outer basement walls towards ground, where the basement floor is about 2 m below ground

Serial number	Description	u-value	Note
4.1	30 cm concrete	0,92	30 cm concrete outer basement walls. All wall against grown
4.2	30 cm concrete + 50 mm	0.48	30 cm concrete outer basement walls re-insulated with 50 mm insulation, with plate finish
4.3	30 cm concrete + 100 mm	0,33	30 cm concrete outer basement walls reinsulated with 100 mm insulation with plate finish.
4.4	30 cm weight concrete	0,52	30 cm light weight concrete outer basement walls
4.5	30 cm weight concrete + 50 mm	0,34	30 cm light weight concrete outer basement walls insulated on the inside with 50 mm and with plate finish.
4.6	30 cm lightweight concrete brick + 100 mm	0.25	30 cm lightweight concrete brick outer basement walls, re-insulated on inside with 100 mm insulation, with plate finish
4.7	35 cm lightweight concrete	0,44	35 cm light weight concrete outer basement walls
4.8	35 cm lightweight concrete + 50 mm	0,30	35 cm lightweight concrete brick outer basement walls, re-insulated on inside with 50 mm insulation, with plate finish
4.9	35 cm lightweight concrete + 100 mm	0,20	35 cm lightweight concrete brick outer basement walls, re-insulated on inside with 100 mm insulation, with plate finish
4.10	39 cm lightweight concrete	0,40	39 cm light weight concrete outer basement walls
4.11	39 cm lightweight concrete n + 50 mm	0,27	39 cm lightweight concrete brick outer basement walls, re-insulated on inside with 50 mm insulation, with plate finish

Appendix 8.5 U values for walls between heated and non-heated rooms

Serial number	Description	u-value	Note
5.1	½ bricks	2,10	12 cm masonry outer wall, (½-bricks wall)
5.2	½ bricks +50 mm	0,56	12 cm masonry wall, re-insulated on inside with about 50 mm insulation, with plate finish
5.3	1/1 bricks	1,50	24 cm masonry outer wall, (1/1 bricks wall)
5.4	1/1 bricks + 50 mm	0,51	24 cm masonry wall, re-insulated on inside with about 50 mm insulation, with plate finish
5.5	10 cm lightweight concrete	1,50	10 cm lightweight concrete outer wall
5.6	10 cm lightweight concrete + 50 mm	0,52	10 cm lightweight concrete (gas concrete), re-insulated on inside with 50 mm, with plate finish
5.7	19 cm lightweight concrete	0,95	19 cm lightweight concrete outer wall
5.8	19 cm lightweight concrete + 50 mm	0.44	19 cm lightweight concrete (gas concrete), re-insulated on inside with 50 mm, with plate finish
5.9	29 cm lightweight concrete	0,66	29 cm lightweight concrete outer wall
5.10	29 cm lightweight concrete + 50 mm	0,26	29 cm lightweight concrete (gas concrete), re-insulated on inside with 50 mm, with plate finish.
5.11	10 cm concrete	3,10	10 cm concrete outer wall
5.12	10 cm concrete + 50 mm	0,69	10 cm concrete outer wall insulated on inside with 50 mm, with plate finish
5.13	19 cm concrete	2,60	19 cm concrete outer wall
5.14	19 cm concrete + 50 mm	0,66	19 cm concrete outer wall insulated on inside with 50 mm, with plate finish
5.15	30 cm concrete	2,30	30 cm concrete outer wall
5.16	30 cm concrete + 50 mm	0,57	30 cm concrete outer wall re-insulated on inside with 50 mm, with plate finish
5.17	30 cm massive brick wall	1,30	24 cm masonry outer wall, (1/1 bricks wall)
5.18	30 cm cavity wall, uninsulated	1,30	30 cm cavity wall with outside masonry and multiple cavity bricks/moler bricks inside. 75 mm un-insulated cavity. The wall must be examined with endoscope
5.19	30 cm cavity wall re-insulated	0,42	36 cm cavity wall with outside masonry and multiple cavity bricks/moler bricks inside. 75 mm insulated cavity. The wall must be examined with en-doscope
5.20	30 cm cavity wall insulated	0,40	30 cm cavity wall with outside masonry and multiple cavity bricks/moler bricks inside. 75 mm insulated cavity. Insulated by construction. Wall must be examined with endoscope
5.21	36 cm cavity wall un/insulated	1,30	30 cm cavity wall with outside masonry and multiple cavity bricks/moler bricks inside. 120 mm un-insulated cavity. The wall must be examined with endoscope
5.22	36 cm cavity wall, re-insulated	0.28	36 cm cavity wall with outside masonry and multiple cavity bricks/moler bricks inside. 120 mm insulated cavity. The wall must be examined with endoscope
5.23	light uininsulated	1,90	Pillar construction with one side covered without insulation
5.24	50 mm insulation	0,65	Pillar construction with one side covered with 50 mm insulation
5.25	75 mm insulation	0,48	Pillar construction with one side covered with 75 mm insulation
5.26	100 mm insulation	0,38	Pillar construction with one side covered with 100 mm insulation
5.27	150 mm insulation	0,24	Pillar construction with one side covered with 150 mm insulation
5.28	200 mm insulation	0,18	Pillar construction with one side covered with 200 mm insulation
5.29	250 mm insulation	0.14	Pillar construction with one side covered with 250 mm insulation
5.30	300 mm insulation	0,12	Pillar construction with one side covered with 300 mm insulation

Appendix 8.6 U values for timber beams facing basement, crawl space, loft space. U value for flat roof

Serial number	Description	u-value	Note
6.1	Timber on beams	1,90	Boards on beams without insulation
6.2	Timber on beams with (clay filling)	1.50	Boards on beams with clay filling without insulation
6.3	Timber on beams with carpet and clay	1,30	Boards on beams with clay filling, with carpet but without insulation
6.4	Timber on beams - 50 mm	0,60	Boards on beams with 50 mm insulation.
6.5	Timber on beams - 100 mm	0,38	Boards on beams with 100 mm insulation.
6.6	Timber on beams - 150 mm	0.30	Boards on beams with 150 mm insulation.
6.7	Timber on beams - 200 mm	0,20	Boards on beams with 200 mm insulation.
6.8	Timber on beams - 225 mm	0,18	Boards on beams with 225 mm insulation.
6.9	Tier of beams – un-insulated	1,20	Uisoleret bjælkelag med brædder, bjælker og beklædt underside
6.10	Tier of beams - 50 mm	0,52	Tier of beams, approximately 15 x 15 cm, with 50 mm insulation between beams
6.11	Tier of beams - 100 mm	0,37	Tier of beams, approximately 15 x 15 cm, with 50 mm insulation between beams
6.12	Tier of beams - 150 mm	0.25	Tier of beams with 150 mm insulation. The insulation thickness is assessed on the basis of the current requirements in the building regulations at the time of construction
6.13	Tier of beams - 200 mm	0,20	Tier of beams with 200 mm insulation. The insulation thickness is assessed on the basis of the current requirements in the building regulations at the time of construction
6.14	Tier of beams - 250 mm	0,15	Tier of beams with 250 mm insulation. The insulation thickness is assessed on the basis of the current requirements in the building regulations at the time of construction

Appendix 8.7 U values for solid storey partitions towards basement, crawl space, loft space. U value for flat roof

Serial number	Description	u-value	Note
7.1	Timber/carpet - 10-20 cm concrete	2,30	Carpet on concrete storey partition, 10-20 cm thick
7.2	Wood - 10-20 cm concrete	1,40	Timber/ joists on concrete storey partition, 10-20 cm thick
7.3	Timber/carpet - 10-20 cm concrete + 50 mm	0.54	Timber/ joists on concrete storey partition, 10-20 cm thick with 50 mm insulation
7.4	Timber/carpet - 10-20 cm concrete + 100 mm	0,33	Timber/ joists on concrete storey partition, 10-20 cm thick with 100 mm insulation
7.5	Carpet - 20 cm lightweight con-crete	1,30	Carpets on lightweight concrete storey partition, 20 cm thick
7.6	Wood -20 cm lightweight concrete	1,00	Timber/joists on lightweight concrete storey partition, 20 cm thick
7.7	Timber/carpet 20 cm lightweight concrete + 50 mm	0.47	Timber/joists with 50 mm insulation on lightweight concrete storey partition, 20 cm thick

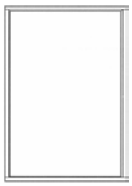
Appendix 8.8 U values for ground supported floors

Serial number	Description	u-value	Note
8.1	Floor against ground	1.00	Wooden floor on joists/tier of beams on ground
8.2	Linoleum-concrete	0,70	Linoleum or Vinyl floor on concrete direct on ground.
8.3	Linoleum-concrete-20 cm Leca	0.44	Linoleum/vinyl on concrete, with about 20 cm lightweight concrete bricks under concrete plate.
8.4	Wood-concrete-20 cm Leca	0,34	Wooden floor on joists/tier of beams on concrete, with approximately 20 cm Leca under concrete ground
8.5	Wood/vinyl with 50 mm insulation	0,20	Wooden floor on joists/tier of beams on concrete, with approximately 50 mm insulation
8.6	Wood/vinyl with 75 mm insulation	0,18	Wooden floor on joists/tier of beams on concrete, with approximately 75 mm insulation

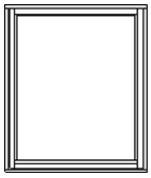
Appendix 8.9 U values for basement floors

Serial number	Description	u-value	Note
9.1	Concrete on grown	0,48	Concrete cellar floor direct on grown
9.2	Wood Concrete Grown	0,41	Wood floor on concrete cellar floor direct on grown
9.3	Timber/carpet concrete-20 cm Leca	0.24	Wooden floor on concrete cellar floor with about 20 cm lightweight concrete brick under concrete plate.
9.4	Wood/vinyl with 50 mm insulation	0,18	Wooden floor on joists/tier of beams on concrete, with approximately505 mm insulation

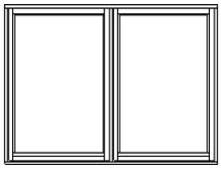
Appendix 9 – U values for windows, including frame and window clearance



Fast vindue 1 rude h x b i meter	1 layer of glass	1 + 1 layer of glass	Double-glazed window	Triple-glazed window	1 + 1 layer of low-energy glazing	Low-eergy glazing - double glazed window
1,2 * 0,6	4,8	2,6	2,9	2,3	1,8	1,8
1,2 * 1,2	5,1	2,6	2,9	2,2	1,8	1,6
1,4 * 1,6	5,2	2,7	2,8	2,1	1,8	1,5

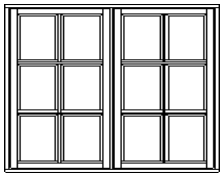


Fixed window 1 rude h x b i meter	1 layer of glass	1 + 1 layer of glass	Double-glazed window	Triple-glazed window	1 + 1 layer of low-energy glazing	Low-eergy glazing - double glazed window
1,2 * 0,6	4,2	2,3	2,7	2,3	1,7	1,9
1,2 * 1,2	4,7	2,4	2,8	2,2	1,8	1,7
1,4 * 1,6	4,9	2,5	2,8	2,1	1,8	1,6

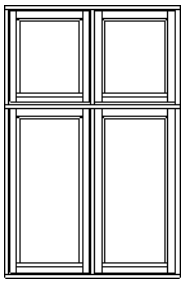


Bondehus window h x b i meter	1 layer of glass	1 + 1 layer of glass	Double-glazed window	Triple-glazed window	1 + 1 layer of low-energy glazing	Low-eergy glazing - double glazed window
1,2 * 0,6 One frame windows	4,2	2,3	2,70	2,3	1,7	1,9
1,2 * 1,2	4,3	2,3	2,70	2,3	1,7	1,9

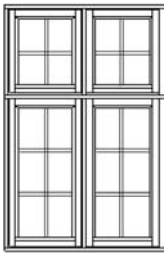
Two frames windows						
1,4 * 1,6 Three frames windows	4,3	2,3	2,70	2,3	1,7	1,9



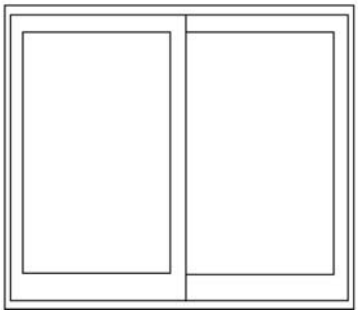
Bondehus window h x b i meter	**1 layer of glass**	**1 + 1 layer of glass**	**Double-glazed window**	**Triple-glazed window**	**1 + 1 layer of low-energy glazing**	**Low-eergy glazing - double glazed window**
1,2 * 0,6 One-bay 6 frame windows	3,7	2,1	2,9	2,7	1,7	2,4
1,2 * 1,2 Two-bay 12 frame windows	3,9	2,2	2,8	2,5	1,7	2,2
1,4 * 1,6 Three-bay 18 frame windows	3,8	2,1	2,7	2,4	1,7	2,1



Danebrog window h x b in meters	**1 layer of glass**	**1 + 1 layer of glass**	**Double-glazed window**	**Triple-glazed window**	**1 + 1 layer of low-energy glazing**	**Low-eergy glazing - double glazed window**
1.8 * 0.6 One-bay 2 windows	4.1	2.2	2.7	2.3	1.7	1.9
1.8 * 1.2 Two-bay, 4 frame windows	4.2	2.3	2.7	2.3	1.7	1.9
1.6 * 1.1 Two-bay, 4 frame windows	4.1	2.2	2.7	2.3	1.7	2.0
1.8 * 1.6 Three-bay, 6 frame windows	4.2	2.3	2.7	2.3	1.7	2.0



Danebrog window h x b i meter	1 layer of glass	1 + 1 layer of glass	Double-glazed window	Triple-glazed window	1 + 1 layer of low-energy glazing	Low-eergy glazing - double glazed window
1,8 * 0,6 One-bay 10 frame windows	3,7	2,30	2,9	2,7	1,7	2,4
1,8 * 1,2 Two-bay 20 frame windows	3,8	2,30	3,0	2,7	1,7	2,4
1,6 * 1,1 Two-bay 20 frame windows	3,7	2,30	2,9	2,7	1,7	2,5
1,8 * 1,6 Three-bay 30 frame window	3,7	2,30	3,0	2,7	1,7	2,5



Terrasse door h x b i meter	1 layer of glass	1 + 1 layer of glass	Double-glazed window	Triple-glazed window	1 + 1 layer of low-energy glazing	Low-eergy glazing - double glazed window
2,1 * 0,6 Side for terrasse door	3,2	2,2	2,5	2,2	1,9	2,00
2,1 * 0,9 Single terrasse door, one frame	4,0	2,4	2,6	2,1		1,8
2,1 * 1,9 Double terrasse door, two frames	4,3	2,5	2,6	2,1		1,7

Conditions

U value for glass in W/m²K:
1 layer 5.80 - 1+1 as coupled windows 2.80 - 2 layers of double-glazed windows 2.80 – triple-glazed window 1.90 - 1 + 1 low-energy window as coupled windows 1.90 – low-energy window as double-glazed window 1.20.

U value for frame/sill/bar in W/m²K:
1.90 as the average for windows with one layer of glass and double-glazed windows
1.5 as the average for windows with storm frames 1+1

The line loss for the distance profile of the window (psi) ψ_g in W/mK:

Double-glazed window 0.07,
For triple-glazed windows 0.09
For two-layer low-energy double-glazed windows 0.1
For 1+1 solutions with coupled windows 0

The U values are calculated in accordance with DS 418, 6th edition.

Appendix 12 – Typical constructions in "Danish houses"

The serial number to the right refers to the U values in Appendix 8

Houses from the 1900s – The small town house and the building society house

Building part	Building regulations, provisions and rules	Construction	Original insulation	Serial no. Appendix 8
Outer walls	The Copenhagen Building Act of 1856: Load-bearing constructions with a thickness of 1½, 2, 2½ or 3 bricks. At around 1900, cavity walls became more popular in construction. No building regulation requirements	Solid walls.	Timber frame construction: 11 cm wall, 15% timber	1.0
			Solid 1-brick wall (about 24 cm)	1,4
			Solid 1½-brick wall (about 36 cm)	1.7
			Solid 2-brick wall (about 48 cm)	1.10
			Solid 2½-brick wall (about 60 cm)	-
			Solid 3-brick wall (about 72 cm)	-
		Cavity walls. Possibly channel walls with fixed tie beams.	1½-brick cavity wall (36 cm) of multiple cavity bricks, 1800 kg/m^3 for the masonry mass, with fixed tie beams columns, pointed outside and plastered inside.	1.7
			30 cm cavity wall of heavy solid tiles, 1800 kg/m^3 pointed outside and plastered inside.	2.1
Lofts and storey partitions	None	High building. 1½ floors	Beamed ceiling with 6" beams and 28 mm ceiling boards without insulation	6.1
			Tier of beams with floorboards, clay filling and ceiling formwork, pipes and plaster (no insulation)	6.9
			Ceiling wall formwork, pipes and plaster without insulation	5.23
Floors and deck	Builder houses built in accordance with local traditions	Floor against the ground: 5/4"floor boards on tier of beams.	No insulation in floor against ground (ground supported floors)	8.1
			As above, but with 7 mm carpet, for example	8.1
		Floor against low crawlway: 5/4"floor boards on tier of beams with clay filling. (Ventilation gratings should be present)	No insulation in tier of beams against low crawl space	6.1
			As above, but with 7 mm carpet, for example	6.1

Houses from the 1940s – Government- subsidised houses, etc.

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Building part	Building regulations, provisions and rules	Construction	Original insulation	Serial no. Appendix 8
Outer walls	Government subsidies for single-family houses (□110 m^2) required heating insulation of ceilings. Houses of 2 floors or 1 floor with utilisation of basement. No building regulation requirements	Solid walls.	Full 1/1-brick masonry wall, 1800 kg/m^3 pointed outside and plastered inside.	1.4
			Full 1½-brick solid masonry wall (36 cm), 1800 kg/m^3, pointed outside and plastered inside.	1,7
			Full 2-brick solid masonry wall (48 cm), 1800 kg/m^3, pointed outside and plastered inside	1.10
		Cavity walls.	1½-brick cavity wall (36 cm) with multiple cavity bricks, 1800 kg/m^3 for the masonry mass with fixed tie beams columns, pointed outside and plastered inside.	1.10
			30 cm cavity wall of heavy solid masonry, 1800 kg/m^3 pointed outside and plastered inside.	2.1
Ceilings and floors	Roof of masonry or wave eternite. Requires ceiling insulation	Detached houses of 1 or 2 floors with pitch. Often ½ basement. Collar beam rafter or lattice truss.	Tier of beams with floorboards + inserted insulation and dispersed formwork with plaster. Requires at least 2 cm insulation against cold rooms.	6.10
Floors and deck	Government loan scheme for construction of single-family houses up to 110 m^2 The constructional quality is generally high. Required insulation of ceiling and normally, the floors were also most often insulated with at least 20 mm of mineral wool	Floor against crawl space: 5/4"floor boards on tier of beams	Insulation: at least 20 mm of mineral wool	6.10
		Floor against basement: Most often as tier of beams	Most often un-insulated	6.9

Houses from the 1970s – Prefabricated-standard houses

Building part	Building regulations, provisions and rules	Construction	Original insulation	Serial no. Appendix 8
Outer walls	Building regulations 1966 and Building regulations 1972 until 1979. Building regulations 1977 with current requirements 1 February 1979: U value requirement of 0.4 for outer walls weighing above 100 kg/m^3 and of 0.3 for outer walls weighing under 100 kg/m^3.	Cavity wall: Bricks – bricks. Building: - 108 mm tile T1800 - Mineral wool - 108 mm or 170 mm masonry Ma 1200 - plaster	Insulation thickness: 75 mm Brickwork: 0%	2.6
			Insulation thickness: 125 mm Brickwork: 0%	2.10
			Insulation thickness: 125 mm Brickwork: 3%	2.10
			Insulation thickness: 125 mm Brickwork: 8%	2.10
		Cavity wall: Bricks + lighweight outer leaf.	Bricks + outer leaf of insulated pillar construction	3.4
Ceilings and floors	Houses after the 1973 energy crisis (and especially after 1977) are dense and well insulated. Tightening og insulation requirements. Roofs with low slope and big eaves. Roofs of masonry, eternite or concrete tile.	Insulation required in accordance with Building regulations 1972:	Storey partitions above the open (gateway etc.)	6.4-6.5
			Ceiling and roof constructions that delimit heated rooms (including roof slope walls)	6.4-6.5
			Storey partitions against partly heated rooms.	6.4
		Insulation required in accordance with Building regulations 1977:	Storey partitions above the open (gateway etc.)	6.7
			Ceiling and roof constructions that delimit heated rooms (including roof slope walls)	6.7
			Storey partitions against partly heated rooms.	6.7
Floors and deck	Single-family houses of about 150 m^2 in 1 floor. Wall-to-wall and chain houses. After the 1973 energy crisis (and especially after 1977), the houses are well insulated. Requirements in accor-	Ground supported floor, e.g. wooden floors on concrete or beam deck above basements Insulation required in accordance with Building regulations 1972:	Floor constructions directly on ground	8.3
			Floors above ventilated crawl spaces	6.4
			Floors above basements with insulated heat pipes	6.4

		Ground supported floor, e.g. wooden floors on concrete or beam deck above basements. Insulation required in accordance with Building regulations 1977:	Floor constructions directly on ground	8.4
			Floors above ventilated crawl spaces	6.4
			Floors above basements with insulated heat pipes.	6.4

Houses from the 1990s –Well-insulated houses

Building part	Building regulations, provisions and rules	Construction	Original insulation	Serial no. Appendix 8
Outer walls	Building regulations 1995 (Effective from force 1 April 1995) Building regulations S-1998 Tightening of energy frame requirements. U value requirement of 0.3 for outer walls weighing over 100 kg/m^3 and of 0.2 for outer walls weighing under 100 kg/m^3	Heavy outer walls	Masonry cavity wall, 350 mm Mineral wool, 125 mm Ribbed percentage max 4 10 mm thermal bridge insulation	2.10
			As above, but with 70 mm thermal bridge insulation	2.10
			Masonry and concrete cavity wall 390 mm Ribbed percentage max 8, 50 mm thermal bridge insulation	2.10
			Masonry cavity wall and lightweight conrete brick , 340 mm Ribbed percentage max 8, thermal bridge insulation 30 mm	2.10
			Masonry cavity wall and air-entrained concrete, 340 mm Ribbed percentage max 8, thermal bridge insulation 30 mm	2.10
		Lightweight outer walls	Wooden frame wall with curtain wall Mineral wool 95+95 mm, inside covering	3.5
			Wooden frame wall with board covering Mineral wool 45+95+45 mm, internal covering	3.5
			Steel frame wall with curtain wall Mineral wool 150 + 50 mm, gypsum board 13 mm	3.5
			Steel frame wall with sectional metal plates Mineral wool 150 + 75 mm, gypsum board 13 mm	3.5
			Air-entrained concrete wall with board covering Mineral wool 95 + 95 mm, air-entrained concrete element 100 mm	3.5
			Concrete outer leaf with concrete based corrugated sheets Mineral wool 145 mm, concrete element 120 mm	3.5
			Lightweight concrete brick outer leaf with plane covering sheets Mineral wool 150 mm, lightweight concrete brick element 100 mm	3.5
			Lightweight concrete brick outer leaf with mineral wool slats Mineral wool 150 mm, lightweight concrete brick element 100 mm	3.5
Ceilings and floors	Insulation required in accordance with Building regulations 1995, Building regulations S-98		Storey partitions against rooms that are not heated or heated to a temperature which is more than 8□C lower than the temperature of the given room	6.6
			Ceiling and roof constructions that delimit heated rooms (including roof slope walls)	6.14
			Flat roofs and sloping walls directly against the roof	6.13

Floors and deck	Building regulations 1982 and Building regulations S-1985	Ground supported floor, e.g. wooden floors on concrete, or beam deck above basements Insulation required in accordance with Building regulations 1995 and Building regulations S-1998:	Ground supported floor, basement floors against the ground and storey partitions above the open or ventilated crawl spaces	8.5
			Storey partitions against rooms that are heated to a temperature which is more than 8□ C lower than the temperature of the given room	8.5
			Ground supported floor, basement floors against the ground and storey partitions above the open or ventilated crawl spaces with or without heated floors	8.6

Complete list of Annexes in Danish version:

Appendix 01 – Organisation of the energy labelling framework

Appendix 02 – Marked energy labelling report

Appendix 03 – Contract

Appendix 04 – Owner information form

Appendix 05 – BBR codes

Appendix 06 – Measuring of areas

Appendix 07 – Temperature factor b, thermal envelope

Appendix 08 – U values, building parts

Appendix 09 – U values for windows including frame and window clearance

Appendix 10 – Reduction factors for solar effect (Fs, Fa and Fg)

Appendix 11 – Building regulation minimum requirements for U values

Appendix 12 – Typical constructions in "Danish houses"

Appendix 13 – Building heating capacity

Appendix 14 – Life times for energy and water-saving suggestions

Appendix 15 – Air change rate for small buildings

Appendix 16 – Air change rate values at different room heights

Appendix 17 – b factors, pipes and heating systems

Appendix 18 – Distribution of heating use by percentages on a monthly basis

Appendix 19 – Hours with a loss

Appendix 20 – Average loss for oil furnaces

Appendix 21 – Average loss for gas boilers

Appendix 22 – Average loss for district heating units

Appendix 23 – Average loss for ovens

Appendix 24 – Burn values and CO2 emission for different fuels

Appendix 25 – CO2 emission from district heating plants

Appendix 26 – Specified heating loss from hot-water tanks

Appendix 27 – Loss from hot-water tank at a temperature difference of 35 degrees Celsius

Appendix 28 – Specified heating loss from pipes in W/(m*K) and average temperature difference

Appendix 29 – Loss from heating pipes

Appendix 30 – Correction of calculated average temperature

Appendix 31 – Solar panel net output

Appendix 32 – Reduction factor, F0, for solar panel direction and angle

Appendix 33 – Corrections for appliances in accordance with average electricity consumption

Appendix 34 – "Common electrical appliances" in households

Appendix 35 – Corrections for appliances in accordance with average water consumption

Appendix 36 – Definitions of water consumption for water consuming appliances and installations

Appendix 37 – Calculated number of persons at different building sizes

Appendix 38 – Tables for determining energy label for heat, electricity, water and CO2

Appendix 39 – Calculating heat, electricity and water costs

Appendix 40 – Statistics for reported energy labels, by label

Appendix 41 – Statistics for reported energy labels, by year of construction

Appendix 42 – Constants for position

Appendix 43 – Conversion between ELO and EM grades

Appendix 44 – Conversion between energy units

Appendix 45 – Connection between Dt, CO2 content and chimney loss – oil furnaces in villas

Appendix 46 – Connection between Dt, CO2 content and chimney loss – gas boilers in villas