



Technical guides for owner/manager of an air conditioning system : volume 2

**Energy Auditing of Air Conditioning
Systems
and the Energy Performance in
Buildings Directive : what does the new
regulation say?**

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What does the Directive require?

The Energy Performance of Buildings Directive (abbreviated as EPBD) impacts on the energy auditing of air-conditioning systems in two ways:

- directly, by requiring mandatory inspection ("pre-audit" in the terminology of Auditac)
- indirectly, through a separate requirement to provide recommendations for improvements to energy efficiency.

The latter requirement implicitly calls for analysis that both mandatory pre-audits and more comprehensive energy audits can provide. The Directive itself does not demand detailed audits so these may be voluntary or - if Member States so decree - mandatory. Other outputs of the Auditac project support the effective implementation of these analyses.

Mandatory Inspection. Article 9 of the EPBD requires the introduction of “measures to establish a regular inspection of air conditioning systems of an effective rated output of more than 12 kW”. Article 10 says that this should be carried out ... "in an independent manner by qualified and/or accredited experts" However, the Directive does not define what comprises "inspection", how frequent it should be, or who qualifies as a suitable expert. These issues are left to Member States to define. Thus the detailed requirements will vary from country to country.

Recommendations. Article 7 requires that buildings should have valid energy performance certificates when they are constructed, sold or rented out. Some buildings have to display the certificate in a prominent place. Each certificate has to be accompanied by recommendations for the cost-effective improvement of energy performance. Clearly, some of these recommendations could result from the air-conditioning inspection process. Others may have an impact on the air-conditioning system - for example, improved solar shading will reduce cooling demands.

The relevant articles of the Directive are given at the end of this volume.

Compulsory inspection: why?

The compulsory inspection of air-conditioning systems is clearly targeted at improving the energy efficiency of systems. Its main impact is likely to be on those systems that are not already subject to effective operation and maintenance procedures. This does not mean that more detailed (and more expensive) energy audits may not be justified - indeed, inspection may identify situations where this seems likely to be worthwhile.

The underlying purpose of Article 9 is to initiate a continuous improvement process that will set up higher quality standards in air conditioning: either diagnosis and correction of existing systems operation (in the short term) or audits followed by investments and improvement works (in the longer term). It should provide a sound basis for the work of professionals: operators, auditors, and contractors.

Compulsory inspection: what does it cover?

The mandatory inspection is to include “an assessment of the air conditioning efficiency and the sizing compared to the cooling requirements of the building”. Advice is also to be provided to the users on “possible improvement or replacement of the air-conditioning system and on alternative solutions”. This does not demand a full audit of the air conditioning system but rather an initial assessment of its operation that can identify any immediately observable adverse impacts on energy consumption, and as a result to make recommendations for possible improvements. It might reasonably also point out issues that would justify more detailed examination.

Article 2 of the EPBD defines an “air conditioning system” as “a combination of all components required to provide a form of air treatment in which temperature is controlled or can be lowered, possibly in combination with the control of ventilation, humidity and air cleanliness.”

The inspection is therefore intended to include all types of comfort cooling and air conditioning systems that provide a total cooling output for the building above the specified 12 kW - in other words, the total rated cooling capacity of the refrigeration systems. The term “air conditioning system” covers a wide range of systems which may provide heating or ventilation as well as cooling. It includes the associated water and air distribution and exhaust systems where these form a necessary part of the system. It also includes the controls that are intended to regulate the use of the systems. The terms of the Directive exclude mechanical ventilation systems that provide no mechanical cooling, though some Member states may introduce similar requirements for such systems.

Compulsory inspection: how?

As already explained, Member States have freedom to define detailed ways of complying with the Directive, but work is in hand (including the Auditac project) to establish agreement on recommendations for essential minimum requirements, and on what constitutes good practice.

The CEN draft standard prEN 15240 is an important part of this effort. It was published in 2005 for “enquiry” - that is, for comments to be received from Member States' standardisation bodies. The draft has been revised in the light of comments received and is expected to be published for voting during 2006.

CEN Standard Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of air-conditioning systems (prEN 15240)

Scope. This draft standard gives details for inspection of air conditioning systems, and of the associated air distribution and exhaust systems. It comprises a “normative” (mandatory) standard plus several “informative” annexes that describe recommended procedures, checklists etc. (Like most other CEN standards, the normative element is only legally binding if legislation in a particular Member State so decrees. On the other hand, national legislation must be consistent with the normative part of the standard.)

Documentation. Before the inspection is carried out, it is necessary to examine the design and

system documentation. If the documentation is not available, then an additional part of the procedure is to locate the equipment and assemble a minimum portfolio of relevant documentation. Informative annexes provide examples of checklists. Before carrying out the inspection proper, visual checks should be made to ensure as far as possible that the equipment described is present and according to system specification.

Evidence of Inspection and Maintenance. Report whether there is evidence of a regular inspection and maintenance regime carried out by recognised competent organisations. Comments on the frequencies and scope of maintenance of the air conditioning systems shall be covered in relation to national requirements and good practice, e.g. industry guidelines. This, and the dates of most recent maintenance may be referred to during the 'physical' inspection. Where there is clear evidence that a good practice program of maintenance is being carried out, then certain aspects of the inspections described in this standard could be simplified or reduced.

Measurements and Assessments . The draft lists the elements of the system that should be inspected, and provides examples of checklists. It requires that instruments shall be properly calibrated and used, and recommends that the measured values be recorded for subsequent comparison with later observations. System sizes are to be compared with likely loads. An annex of the draft contains simple procedures for assessing whether refrigeration systems and air supply systems are likely to be oversized. The specific fan power of the air movement systems is to be checked using the installed fan capacities and the flow rates noted in the commissioning records.

Certification of the energy performance of a building : why?

Prospective purchasers of buildings, whether for their own use or for rental, can only include energy efficiency in their comparison between existing buildings or designs for new ones if they have a readily-understandable scale for energy efficiency. This is what energy performance certificates aim to provide. Although it is not explicitly required by the Directive, the certification procedures in many countries are based on an integrated calculation that is also used to set minimum standards for new buildings. Some countries will base energy performance certification of existing buildings on measured consumptions, while others are likely to use measured consumptions to identify those poorly-performing buildings that justify further assessment.

In the case of existing buildings, it is also important to know whether the efficiency can be improved at reasonable cost. This is the reason for accompanying the certificate with recommended improvements.

A significant market imperfection for investment in energy efficiency in the rental market is the fact that the owner and renter of a building, dwelling or office have different interests. As the renter normally pays the energy bill, the incentive for the owner to invest in energy efficiency is weak. If renters and owners have clear and visible information about the energy efficiency of the buildings that they rent or own, they can negotiate rents that reflect this. This in turn should encourage investment in energy-saving measures where this is beneficial.

In the case of public authority buildings and certain privately owned or occupied buildings frequented by the public, energy certificates must be prominently and permanently displayed for the public. Many of these buildings are rarely sold or rented, and so may not need certificates

under the "sale or rent" rule. Another reason for them to have visible performance certificates is that public authority buildings and buildings frequented by the general public can be used to demonstrate efficient technology and to set examples by incorporating energy efficiency measures into renovations.

Certification for new buildings is at present mandatory in DK, D and UK. For existing buildings, only Denmark has a mandatory scheme but several Member States have voluntary programs. In Denmark, a calculation on the basis of the database of 3.5 years of certification of 160,000 houses showed a total cost of the certification of ca 25 M€ and identified potential savings measures of ca 125 M€. These measures reduced the costs for energy for the consumers by 20 M€ each year. In this particular case, certification, together with the implementation of identified measures, provided a more than 13 % return on investments.

The legal frame

DIRECTIVE 2002/91/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2002 on the energy performance of buildings

Article 7

Energy performance certificate

1. Member States shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant, as the case might be. The validity of the certificate shall not exceed 10 years. Certification for apartments or units designed for separate use in blocks may be based:

- on a common certification of the whole building for blocks with a common heating system, or*
- on the assessment of another representative apartment in the same block.*

Member States may exclude the categories referred to in Article 4(3) from the application of this paragraph.

2. The energy performance certificate for buildings shall include reference values such as current legal standards and benchmarks in order to make it possible for consumers to compare and assess the energy performance of the building. The certificate shall be accompanied by recommendations for the cost-effective improvement of the energy performance. The objective of the certificates shall be limited to the provision of information and any effects of these certificates in terms of legal proceedings or otherwise shall be decided in accordance with national rules. 3. Member States shall take measures to ensure that for buildings with a total useful floor area over 1 000 m² occupied by public authorities and by institutions providing public services to a large number of persons and therefore frequently visited by these persons an energy certificate, not older than 10 years, is placed in a prominent place clearly visible to the public.

The range of recommended and current indoor temperatures and, when appropriate, other relevant climatic factors may also be clearly displayed.

Article 9

Inspection of air-conditioning systems

With regard to reducing energy consumption and limiting carbon dioxide emissions, Member States shall lay down the necessary measures to establish a regular inspection of air conditioning systems of an effective rated output of more than 12 kW.

This inspection shall include an assessment of the air-conditioning efficiency and the sizing compared to the cooling requirements of the building. Appropriate advice shall be provided to the users on possible improvement or replacement of the air-conditioning system and on alternative solutions.