

Article for BSJ: Dec

## **Air conditioning inspections will need quantitative validation to avoid disputes**

There will be some surprises – and potentially red faces - when the results start flowing from the new mandatory inspections of building efficiency under the Energy Performance of Buildings Directive (EPBD), suggests Mike Creamer

No one wants to occupy an inefficient building. It's expensive – in terms of both energy costs and reputation. For corporates and public bodies with sensitive profiles, the requirement to display an energy rating on their buildings under the EPBD will shine a potentially uncomfortable spotlight on a hitherto hidden aspect of their environmental credentials.

There will be no hiding place for those who find themselves not “walking the talk” in terms of the efficiency of the bricks and mortar they occupy.

The truth is that many - dare I say most - buildings operate well below optimum efficiency much of the time. A significant component of this relates to the buildings services in general, and air conditioning in particular.

We are already speaking to clients who have made firm public declarations of their intent to reduce the carbon footprint of their buildings and now seek an irrefutable means of proving both their ability to accurately measure plant performance and demonstrate the ultimate results.

The EPBD recognises the important role air conditioning plays in relation to the energy efficiency of buildings. Article Nine requires Member States to introduce a system of mandatory inspections for air conditioning, as part of the programme to assess and improve overall building energy efficiency.

The UK regulations implementing this are the Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007. Under these, all air conditioning system over 250kW must be inspected by January 2009; and all air conditioning systems between 12kW and 250kW must be inspected by January 2011. Air conditioning systems of more than 12kW will have to be re-inspected at least every five years.

The aims of the inspection are to:

- assess the efficiency and appropriateness of the sizing of air conditioning systems in relation to the cooling requirements of the building;
- advise building users/managers on possible improvements to, or replacement of air conditioning systems – and alternative solutions.

Carrying out these assessments in practice, however, is going to be a challenge for the new inspectors. In an ideal world, all relevant buildings would be fitted with energy sub-meters to the main air conditioning system components. There would also be a building log book, containing descriptions of the air conditioning system, the locations and specifications of components, and details of control systems.

Using this information, the inspector or building manager could relatively easily draw up a record of the energy consumed by the plant – and come up with an assessment of its effectiveness in relation to the building, provided he or she has a means of assessing the heat gain profile for the year, this involving a rather complex set of calculations or the use of dedicated software.

However, as the Chartered Institution of Building Services Engineers (CIBSE) acknowledges in its recently published *Technical Memorandum 44: Inspection of air conditioning systems*, most buildings simply won't have this information available. As a result, air conditioning inspectors will be left to piece together the picture from several techniques and non-quantitative approaches.

TM44 says: "Obtaining a good estimate of air conditioning efficiency can be a very complex process, involving a considerable involvement in time, equipment and expertise." Instead, it says, "inspection will primarily be based on visual observations and non-invasive measurements."

There are two immediate issues that arise in relation to this approach. First, because it is based on observation rather than quantitative assessment, it may be open to challenge. If the results of an inspection are unfavourable, and impact negatively on a building's overall energy rating, it could have consequences for the value of the building as a lettable commodity.

A building rated as having poor efficiency is clearly going to cost more to run, therefore the level of rent it can command in the market could be affected. Recent research in the US shows that green buildings are now commanding significantly higher rents, due to the kudos they bring to occupants – and, on a practical level, the lower cost of running them.

Given the financial implications, therefore, an unfavourable energy inspection based on subjective, non-quantitative criteria may well be contested – and subject to possible legal challenge due to the consequences in terms of the building's value.

The second problem with the suggested approach relates to consistency between inspections. If energy efficiency assessments of air conditioning are based on a mixture of several subjective methods, used to varying degrees and with varying emphases between buildings and between inspectors, then it may bring into question the comparability of results.

While it may be easy to determine the efficiency of a domestic fridge or kettle, this is a far cry from evaluating a complex air

conditioning system serving an entire building or larger development.

At least that has been the received wisdom until recently. A new approach, however, is emerging that enables the efficiency of operating air conditioning systems to be assessed quickly and accurately – without breaking into the system, a key requirement and crucial under F-Gas Regulation to ensure the containment of refrigerant.

It is based on a new approach developed by Swedish thermodynamics pioneer, Klas Berglof. Ten years in development, the ClimaCheck system makes it possible for the first time to provide a quantitative measure of the Coefficient of Performance (COP) of a working air conditioning system – that would otherwise take weeks and thousands of pounds and hundreds of man-hours to achieve.

It is being widely used by consultants and end users in Scandinavia to make reliable, comparable assessments of the performance of in situ, operational air conditioning and refrigeration plant. In the UK, major supermarket chains have recently started using the system to obtain quantitative measures of the efficiency and performance of cooling systems – never before possible in relation to operating plant in real world as opposed to laboratory conditions.

I started using ClimaCheck extensively over two years ago for use in trouble-shooting, arbitration and performance verification work.

A stark fact emerges from growing experience with ClimaCheck. Accumulating evidence suggests, as inventor Klas Berglof says: “Most plant operates well below optimum efficiency. And a significant proportion of installations are dramatically underperforming against design – whether due to poor maintenance, incorrect control, or mismanagement.”

Indeed, it is rare for ClimaCheck not to show up performance-related issues with plant. It can also highlight where component wear – say with the chiller or compressor – is affecting performance and likely to result in breakdown in the future. It therefore has a role in preventive maintenance, enabling problems to be caught and remedied before they result in serious underperformance or, in extreme conditions, plant failure.

Underling ClimaCheck is a series of complex mathematical algorithms that, from key operational data, dynamically calculate essential performance parameters. It can be used on any type and configuration of air conditioning, cooling-only or heat pump, running on any type of refrigerant. Even the COP (Coefficient of Performance), Cooling / Heating Capacity and Compressor Isentropic Efficiency can be determined. Faults and defects can be identified within minutes of attaching the system to a working plant.

As the first wave of inspections gets underway, those equipped with this technology for quantitatively assessing air conditioning performance will be much better placed to deliver what the EPBD requires. And, in the event of challenge, they will be in a position to

provide an objective, quantified measure of performance to underpin potentially controversial efficiency assessments.

- *The author, Mike Creamer, is managing director of Business Edge, UK distributor for ClimaCheck. The company can be contacted on 02392 230007.*

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### **How ClimaCheck works**

- The technology was developed by Swedish inventor, thermodynamycist and refrigeration pioneer Klas Berglof. He has worked for 20 years on the sophisticated mathematical algorithms on which the system is based.
- It is a so-called “non-invasive technology”, as it does not require large-scale intrusion into the refrigeration circuit.
- Instead, it uses simple measurements from working plant to calculate key parameters on system performance.
- With a few basic measurements, it can calculate: overall efficiency for both cooling and heating, system capacity, compressor efficiency – as a measure of wear, superheat in the evaporator, sub-cooling in the condenser, and flow in the condenser and evaporator.
- Armed with this information, engineers can then optimise plant performance – resulting in huge savings in power and carbon emissions.

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**What air conditioning inspections are required?**

Existing air conditioning systems greater than 250kW will need to have their first inspection by 4 January 2009.

Existing systems greater than 12kW will need to have their first inspection by 4 January 2011.

For further information about EPCs, Display Certificates, air conditioning inspections and Home Information Packs, visit:

Communities and Local Government –

*[www.communities.gov.uk/epbd](http://www.communities.gov.uk/epbd)*

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