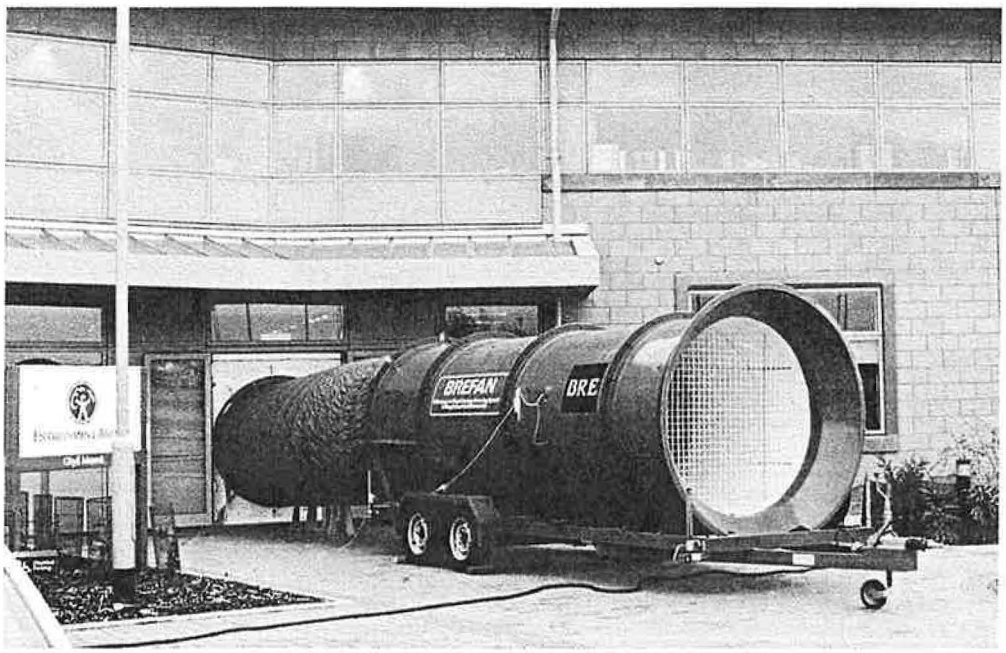


The government is set to crack down on leaky buildings in 2001. So what's likely to happen and what should the construction industry be doing?

BY BRIAN WEBB

Achieving airtight buildings

By definition, buildings that aren't airtight will leak. The consequences range from complaints of draughts and discomfort, to the inability of heating systems to provide a stable temperature level. Of course, these buildings also waste energy.

The issue of a lack of airtightness is impossible to dodge at a time when climate change is being blamed for everything from storms to melting permafrost. The reality is that government is taking energy wastage and associated CO_2 emissions seriously, with big implications for the construction industry.

The 1995 edition of the *Approved Document L* of the *Building Regulations* required air filtration in buildings to be "reasonably controlled". This is currently undergoing review and the DETR plans to announce new regulations in Summer 2001. For the first time legislation is expected to include mandatory standards and compliance air pressure testing for all non-domestic buildings.

Details of the proposals

The DETR's intention is that existing building stock will also be subject to tougher regulation. This can be achieved when building work is carried out or where there is a material change of use. As regards airtightness, the DETR's requirement to make improvements may be satisfied "when carrying out substantial alteration to the external envelope."

Their consultation paper also proposes: "that fan pressurisation tests should always be undertaken where buildings have a floor area greater than 1000 m^2". When tested, leakage should not exceed 10 $m^3/h/m^2$ of envelope area at a reference pressure of 50 Pa.

For dwellings (and buildings under 1000 m^2 floor area), there is recognition that testing of every new building would be impractical. For these, compliance may be through testing a representative sample or by a report signed by a 'competent person' confirming the adoption of 'robust design details'.

Future revisions propose tighter standards and also different values for different building types to reflect their purpose and requirements. Obligatory sample testing of dwellings is proposed for 2003.

The consultation paper also expresses the view that the proposed airtightness specification is not too onerous to achieve for those already skilled in designing and constructing buildings to an airtightness specification.

The non-domestic sector is beginning to incorporate airtightness into building specifications. In September last year, *Building Services Journal* hosted a summit to debate the changes to *Part L*. Industry participants, largely representing the non-domestic sector, commented that they thought that the airtightness values were appropriate.

Concern focused on the ability of building control to cope with the implications of the proposals. The DETR is aware of this and also notes the potential increased demand for testing facilities.

The retail sector has proved it is possible to significantly reduce air infiltration. Leading players, notably Tesco, Asda, Sainsbury and Safeway have taken this route in their desire to attract their customers with an 'open door' frontage, while still maintaining a comfortable environment.

The domestic sector does not have any significant parallels in terms of client-led pull, but that's not to say that tighter houses aren't being built. Some major housebuilders are building better sealed properties. One such company is Wilcon Homes; its spokesperson Giles Connolly said, "We have been looking at Canadian examples of airtightness and energy efficiency in their housing. We believe that it's the way to go." He added, "we will increasingly be using factory solutions to avoid site defects".

CIBSE support the proposals for testing buildings and the standards – so long as they guarantee a healthy environment. RIBA have expressed a rather different view.

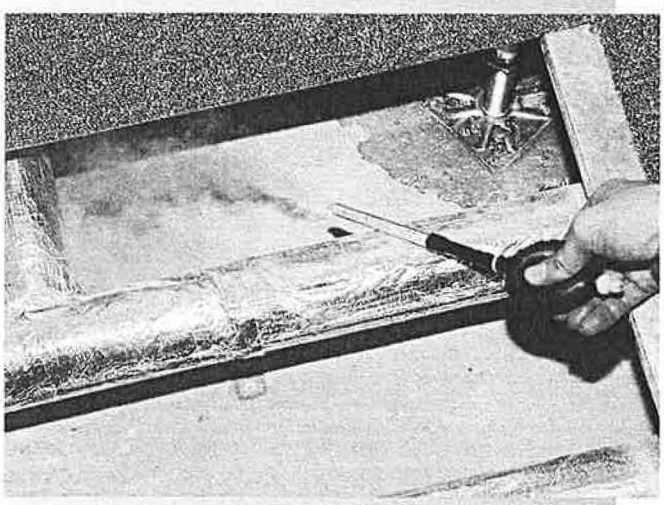
Keith Snook, the RIBA's director of practice says, "Our main concerns are that the potential impact of higher insulation and airtightness on the build-up of temperature in conditions of fire should be taken into account."

To achieve an airtight building three essential steps must be followed: design for airtightness, build for airtightness and test for airtightness. Until expertise is built up, allow for one extra step: pre-plan for risk of failure.

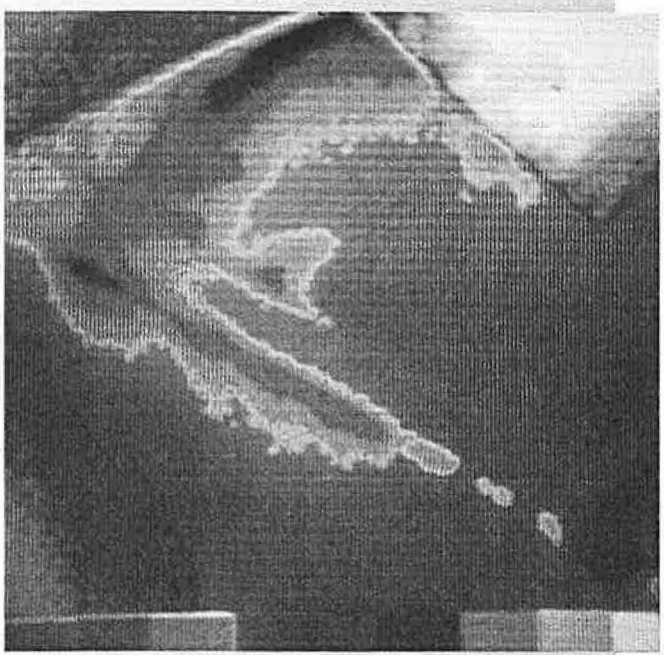
Design for airtightness

Designing the building with airtightness in mind is the obvious first step. It is not practicable to construct a building by traditional methods and try to make it airtight later. It usually results in inadequate airtightness and does not provide for long-term performance.

Remedial sealing can be difficult and costly. Only by designing



If a building fails under the pressurisation test the air leakage path can be traced using a smoke pencil.



Alternatively, infrared thermography can be employed. The blue area highlights the area of heat loss from the floor in the previous photograph.

in airtightness at the drawing-up stage can you adequately deal with the concept of air barrier continuity. Also, pay attention to sealing details at critical elements by specifying the right seal or sealant.

The main air leakage problems in buildings occur typically at the junctions of the wall/window/door interfaces or wall/roof and any service penetrations. The wall/roof interface can be a large source of air infiltration. Co-ordination of trades and the needs of specialists have to be tackled during specification. Designers should identify all the problem areas and spell out responsibility for finishing off in the contract documents.

It takes practice to learn how to spot the potential problems and specify appropriate details. BRE has worked alongside architects to review drawings and suggest problem areas and solutions. Based on its experience, BRE has recently published a guidance booklet, *Airtightness in commercial and public buildings* (replacing *BR 265*). The booklet sets out the principles of providing an effective airtightness layer and presents examples of relevant details.

Building and testing

Once the building has been designed with airtightness in mind and there are adequately detailed drawings available, the job of constructing it to the airtightness specification is down to the main contractor and sub-contractors. For this to be successful all of the workforce need to be aware of the issue from the outset. Any subcontractors arriving on the site also need to be aware of airtightness in the same way they would deal with safety issues.

Inspection during construction is essential. BRE has found that talking to and working with contractors is the only way to ensure that the construction team understands airtightness and how it can be incorporated. Currently the only real way to be confident that the building meets an airtightness specification is to carry out a pressure test.

If on first testing the building fails, the proposal states: "The major sources of air leakage should be identified using the techniques described in *CIBSE TM23*." In effect, an air leakage audit will be needed to identify the problem air leakage paths.

This is carried out while running the pressurisation fans and using either smoke tracers or infrared thermography. It is wise to plan ahead for this, as time and money will be saved by carrying it out while the equipment is still on-site. After that, any leaks can be identified and remediation and sealing techniques can be implemented before the test is repeated.

The *Part L* proposal continues: "A reasonable provision will be taken to include remedial action and re-testing until the leakage standard is achieved." An interim measure proposed for the first 18 months after full implementation of the *Part L* will allow either 75% improvement in the test shortfall, or to within 15% of the standard.

However, the improvement to the 75% option was criticised by the industry participants at the *BSJ* summit for potentially encouraging under-performance at the first test.

Contractual responsibilities

What do you need to do as a client or procurer of a building, an architect, or a contractor? A new BRE leaflet provides example specifications and responses. Nevertheless, when a building has an airtightness specification written into the contract, it has implications for all concerned.

Services engineers, for instance, know that they can size their heating/cooling systems to cater for the fact that the building should be airtight, but if the building doesn't measure up, the lack of heating capacity will be blamed upon the m&e engineers.

The contractor has the responsibility of constructing the building and for it to be pressure tested on completion. More contractors are becoming aware of the responsibility put on them by such contracts, and some are declining them.

When a building fails to meet its airtightness specification after several attempts, it becomes a major contractual problem to identify who is at fault. This does not arise when you have a design and build contract. A shared responsibility of the designers, main and subcontractors can be the only logical solution.

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