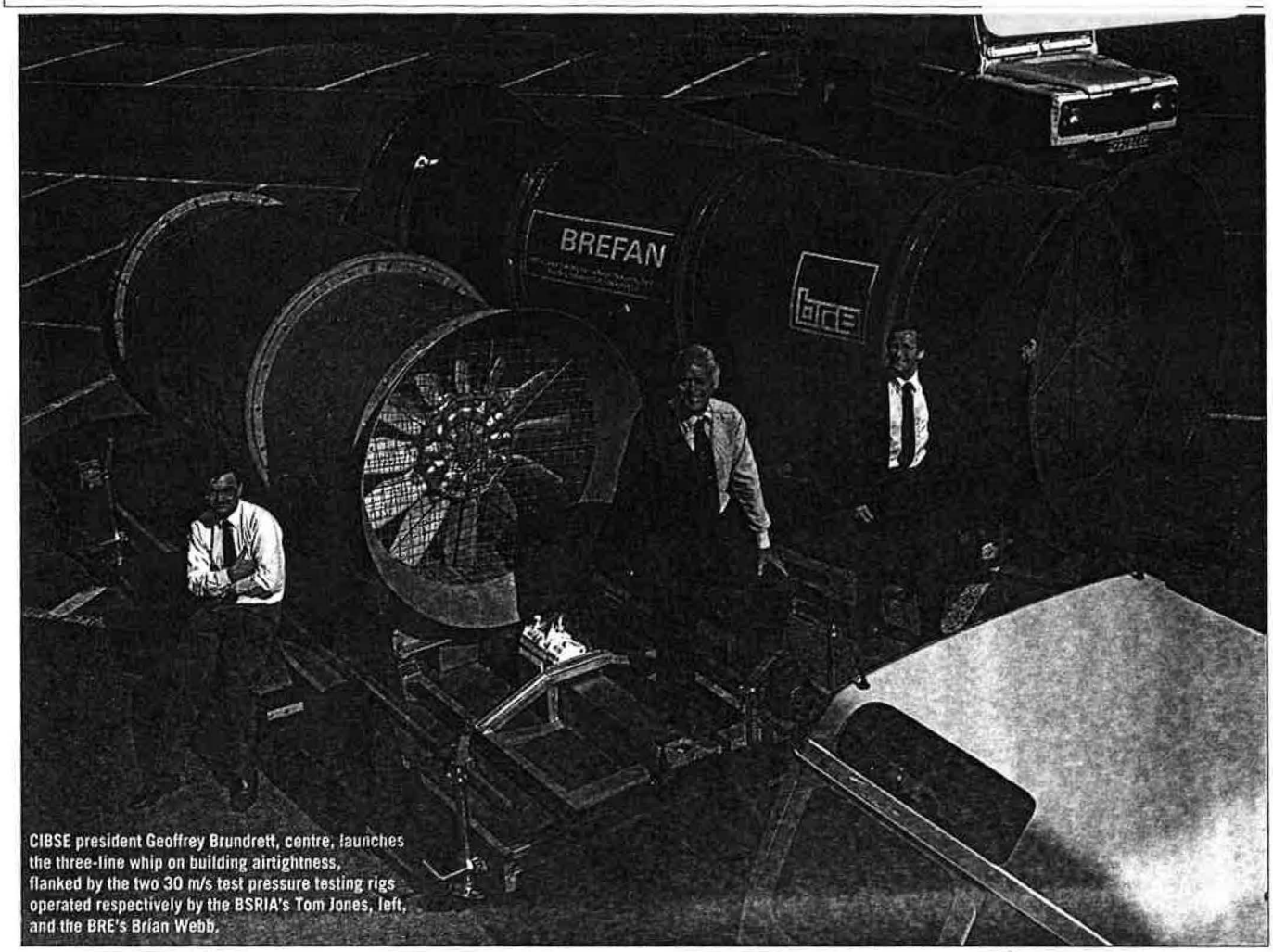


CIBSE president Geoffrey Brundrett, centre, launches the three-line whip on building airtightness, flanked by the two 30 m/s test pressure testing rigs operated respectively by the BSRIA's Tom Jones, left, and the BRE's Brian Webb.

benchmarks for better buildings airtightness campaign

Building

Uncontrolled air infiltration in buildings is compromising energy efficiency and wrecking attempts to reduce CO_2 emissions. The time is right to act. This month, *Building Services Journal* announces a joint initiative involving the CIBSE, BRE and the BSRIA, aimed at improving building airtightness. In an exclusive report, CIBSE president Geoffrey Brundrett launches the airtightness campaign.

New buildings leak, and badly. One head office pressure-tested by the Building Services Research and Information Association (BSRIA) revealed an air leakage rate of 27 $m^3/h/m^2$ at 50 Pa, equivalent to a 9 m^2 hole in the building's envelope. Other data reveals that out of 39 buildings pressure-tested by the Building Research Establishment (BRE) and the BSRIA, only one actually met the BSRIA's good practice benchmark of 5 $m^3/h/m^2$.

So where does the problem lie, and what should we do about it? Thirty years ago, fabric heat loss was an imprecise calculation, largely because the thermal properties of components, such as bricks, were only vaguely understood. Calculating air change rates due to infiltration was similarly arbitrary, typically 25% of the fabric loss, to which would be added a working margin for peace of mind.

Such a rough-and-ready approach has no place in the design of today's buildings. Current *Building Regulations* require a high standard of thermal insulation, provided by quality-controlled, measured and predictable insulants.

This is the key to providing low energy buildings which are comfortable, but modern and often innovative construction techniques combined with complex architectural detailing is creating a situation where infiltration losses can vary between buildings, often by an order of magnitude. Recent studies also show that heating and comfort cooling systems are proving to be very sensitive to such uncontrolled infiltration.

Figure 1 reveals the severity of the problem. Shown here for the first time, data gathered by the BRE and the BSRIA shows that only a very small percentage of office buildings pressure tested came anywhere near the good practice benchmark of 5 $m^3/h/m^2$.

Most of these offices had not been designed for low air leakage, and so the figures

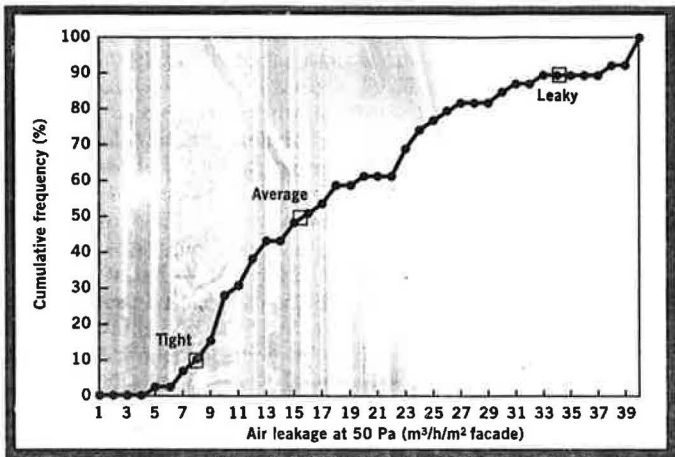


FIGURE 1: The true extent of the air leakage problem compiled from the BRE and BSRIA pressure testing data. Each square represents an actual building. 25 out of 39 buildings recorded leakage rates three times the recommended value, with seven others regarded as average performers.

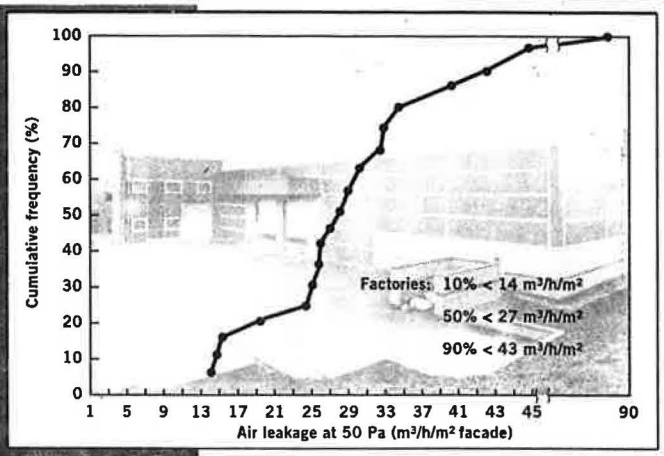
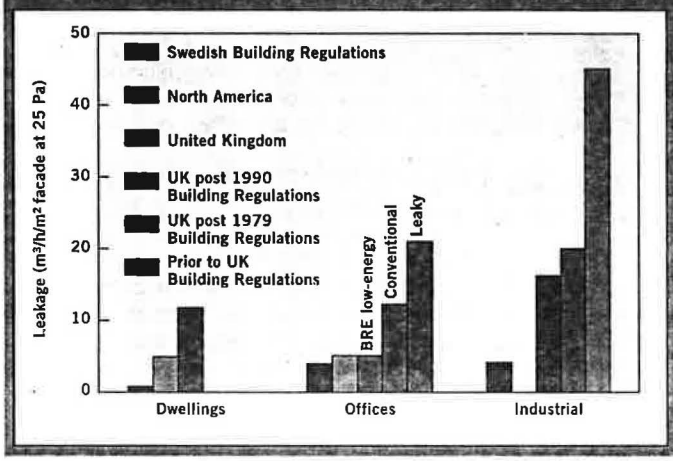


FIGURE 2: Air leakage in 19 factories studied by the University of Wales and the BSRIA. Factories are twice as leaky as offices.



Comparison of leakage rates for different building types in different countries.

pressure

"Factories appear to be twice as leaky as offices, and UK offices appear to be about four times worse than those in North America"

can be considered indicative of the extent of the problem. Considerable remedial action is needed in existing buildings to reach acceptable levels. That said, other tests conducted under commercial confidentiality show that 5 $m^3/h/m^2$ at 50 Pa can be achieved, and even bettered, in many new buildings.

The problem is not confined to office buildings. Industrial buildings are also leaky, as revealed by assessments carried out by both the University of Wales and the BSRIA (figure 2)[1]. Factories appear to be twice as leaky as offices, and UK offices appear to be about four times worse than those in North America.

Uncontrolled air leakage of this magnitude has three main implications. First, high energy costs will result from more air being driven through a building than was planned. The BRE studies show that infiltration losses in a medium-sized office with a leaky construction can be three times that of an equivalent building with a tighter envelope.

In terms of space heating requirements during the heating season, uncontrolled infiltration represents an energy loss of something over 61 000 kWh, which is one third of the total space heating. A tight building would have a loss of under 20 000 kWh.

Second, leaky buildings place a considerable strain on the heating system, particularly in windy, winter conditions. Not only can heating systems prove inadequate in providing full comfort, but local draughts can lead to occupant dissatisfaction[2].

Litigation by clients is the third danger, more and more of whom are turning to the courts to solve their building problems.

The Energy Efficiency Office has long recognised the importance of infiltration, campaigning under the slogan "build tight, ventilate right". This crusade has elicited a good response from clients with large building programmes, but the vast majority of new and refurbished buildings are still not airtight.

The CIBSE has decided that the time is right to accelerate the campaign with a new initiative. In partnership with the BRE and the BSRIA, the CIBSE is proposing a plan to improve building airtightness and produce guidance on recommended test procedures and test standards, to work with the DETR's *Building Regulations* department to seek compulsory pressure tests for new buildings, set a maximum air leakage standard for new buildings and collaborate with other countries in working towards an international standard.

The partnership will also be promoting a discussion forum between building professionals to share understanding as information and knowledge develops. This will start with a collaborative technical paper summarising the state of current knowledge, based on research work carried out at the Air Infiltration and Ventilation Centre, the BSRIA, the BRE and the University of Wales.

To support the airtightness campaign, *Building Services Journal* is planning to carry out pressure tests on all the buildings studied under the forthcoming PROBE 2 project, the second series of post-occupancy surveys. These tests will be carried out by the BRE, and the data used to inform designers, occupiers and developers of the nature of building leakiness, and the steps that can be taken to improve airtightness. All those involved in the initiative welcome your views.

References

[1]BSRIA Technical Report, *Ventilation heat loss in factories and warehouses*, BSRIA, 1992.
[2]Perera M D A E S, Gilham A V and Clements-Croome T D J, 'Natural ventilation in the UK: design issues for commercial and public buildings', *BSER&T*, Volume 17 No 1, 1996.