AIRTIGHTNESS IN COMMERCIAL AND PUBLIC BUILDINGS

THIRD EDITION

Michael Jaggs and Chris Scivyer

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GLOSSARY

This glossary has been developed to be as consistent as possible with those defined in Technical Note AIVC TN 36 *Air infiltration and ventilation glossary*[1].

Air barrier
An air barrier comprises materials and/or components, which are air impervious or virtually so, separating conditioned spaces (heated), from unconditioned spaces (unheated).

Air change rate
The rate at which outside air enters a space divided by the volume of that space. This is expressed as ach (air changes per hour).

Air curtain
A stream of high velocity, temperature-controlled air which is directed across an opening. It enables control of conditions in a space that has an open entrance.

Air exfiltration
The uncontrolled outward leakage of indoor air through cracks, discontinuities and other unintentional openings in the building envelope.

Air infiltration
The uncontrolled inward leakage of outdoor air through cracks, discontinuities and other unintentional openings in the building envelope.

Air leakage audit
The inspection of materials and components, between conditioned and unconditioned spaces to try to establish where major discontinuities in an air barrier system might exist.

Air leakage index
The leakage of air (m^3.h-1) in or out of a building space, per unit area (m^2) of envelope (excluding ground floor area, except for non-ground supported lower floors) at a reference pressure of 50 Pa between inside and outside the building.

Air permeability
The leakage of air (m^3.h-1) in or out of a building space, per unit area (m^2) of envelope (including ground floor area) at a reference pressure of 50 Pa between inside and outside the building.

Air leakage rate
The leakage of air (m^3.h-1) in or out of a building space, per unit volume (m^3) at a reference pressure of 50 Pa between inside and outside the building.

Air leakage path
A route by which air enters or leaves a building or flows through a component.

Airtightness
A term describing the tightness of a building. The smaller the air leakage for a given pressure difference across a building, the tighter the building envelope.

Airtightness layer
A layer built in to the external envelope to minimise air infiltration/exfiltration. It may consist of a wide range of materials (eg, sealants, gaskets, glazing or membranes) and should be continuous to be effective.

Breather membrane
A water-resistant sheet which allows transmission of water vapour, but which provides resistance to airflow.

Conditioned zone
The occupied zone in a building requiring heating or cooling and normally bounded by an airtightness layer.

Draught
Excessive air movement within the conditioned zone, which may cause discomfort.

Draughtproofing
Filling gaps between opening parts of components and their frames.

Envelope area
The boundary or barrier (m^2) separating the interior volume of the building from the outside environment. This includes the area of the external walls, roof and, depending upon the air leakage parameter specified, the area of the ground supported floor.

Fan pressurisation test
A method of testing air leakage of a building. It allows airflow and pressure difference across the envelope to be measured and an estimate of leakage to be obtained.

Infiltration rate
The rate at which outside air infiltrates a building or a room under natural meteorological conditions (normally expressed in air changes per hour (ach) or litres per second).

Infrared camera
A camera sensitive to the infrared part of the spectrum, which can be used to "see" locally cooled areas on the internal surfaces or heated areas on internal and external surfaces of the envelope of a building.

Minimum ventilation requirement
The minimum quantity of outdoor or conditioned air which must enter a building to maintain an acceptable indoor air environment for occupants.

Natural ventilation
The movement (caused by wind and outside temperature) of outdoor air into a room or space through intentionally provided openings, such as windows and doors and non-powered ventilators.

Smoke test
A building (or parts of it) is filled with smoke using smoke machines and then pressurised to force the smoke through gaps in the building envelope.

Smoke tube/pencil
These are hand-held devices, which produce smoke in small quantities for more specific identification of leakage paths within a building under pressurisation or depressurisation, or under natural infiltration.

Stack effect
Air movement through a building caused by differences in the density of air due to temperature differences between the air inside and outside of the building.

Thermography
The use of cameras sensitive to infrared radiation to identify thermal weak spots in the envelope of the building and to help identify air leakage paths through gaps and cracks in the building.

Vapour control layer
A layer impervious to water vapour and usually enclosing an occupied space.

Ventilation
Supplying or removing air, by natural or mechanical means, to or from a space.


NEIGHBOURHOOD WATCH
WARNING
CCTV
WARNING

PREFACE

First published in 1994 and updated in 2002, this guide has been further revised to assist the construction industry in providing airtightness in commercial and public buildings. It supports the requirements on airtightness as specified in Approved Document L2A (2010 edition)[2] which supports the Building Regulations (England and Wales), and the equivalent building regulations in Northern Ireland and Scotland.

This publication is intended as an outline guide to design, setting out the principles of providing an effective airtightness layer and advising on some common pitfalls which can reduce the performance of this layer. The figures in the guide are not intended to highlight the airtightness performance of specific components, but to draw attention to airtightness issues and to identify some typical details that need to be addressed. For clarity, insulation has been omitted from some figures.

This is the third edition of this guide, as such the authors would like to recognise the work of former BRE employees who contributed to the earlier editions: Earle Perera and Roger Stephen in 1994, and Brian Webb and Richard Barton in 2002.

INTRODUCTION

Airtightness is all about minimising air infiltration in buildings. Air infiltration is the uncontrolled flow of air through gaps and cracks in the fabric of buildings. It is driven by pressure and temperature differences between the inside and outside of the building and is highly variable in response to changes in the weather. Infiltration is not a reliable substitute for properly designed ventilation of the interior. It may significantly increase heat losses to the outside and can depress comfort levels by allowing unwanted draughts and cold spots.

For commercial and public buildings, good design should separate the mechanisms that provide a good supply of fresh air to occupants from the adverse and unpredictable effects of air infiltration. This demands good ventilation design, coupled with a clear, workable specification for an effective and maintainable airtightness layer. In short: build tight, ventilate right. For many years BRE has been promoting this approach to considering ventilation as well as airtightness. Now with the current trend towards making buildings even more airtight than in the past, effective ventilation becomes essential.

Buildings where thermal comfort is not a primary design factor, eg those used for storage where close control of temperature and humidity and the exclusion of pollutants are necessary, will also benefit from careful airtightness design in the finished building.

This guide is aimed at those involved in the design, specification, building and commissioning of new or refurbished buildings; it is in three main sections:

1: Background principles: an introduction to the mechanisms causing air infiltration to occur and the benefits which result from increasing the airtightness of a building.

2: Design principles: designing and specifying for airtightness in buildings.

3: Achieving airtightness: undertaking airtight construction on site and testing that it meets the required standard specified.

The design of an airtight building depends on an understanding of the mechanisms which cause infiltration and identifying where they are likely to occur, either in the external building envelope or between conditioned (heated or cooled spaces) and non-conditioned spaces.

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This guide provides generic examples of frequently occurring air leakage paths and practical guidance on methods and materials suitable for sealing common construction detailing.

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