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**Air Infiltration and Ventilation
Glossary**

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Ventilation Centre***

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Preface

International Energy Agency

The International Energy Agency (IEA) was established in 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an International Energy Programme. A basic aim of the IEA is to foster co-operation among the twenty-one IEA Participating Countries to increase energy security through energy conservation, development of alternative energy sources and energy research development and demonstration (RD&D). This is achieved in part through a programme of collaborative RD&D consisting of forty-two Implementing Agreements, containing a total of over eighty separate energy RD&D projects. This publication forms one element of this programme.

Energy Conservation in Buildings and Community Systems

The IEA sponsors research and development in a number of areas related to energy. In one of these areas, energy conservation in buildings, the IEA is sponsoring various exercises to predict more accurately the energy use of buildings, including comparison of existing computer programs, building monitoring, comparison of calculation methods, as well as air quality and studies of occupancy. Seventeen countries have elected to participate in this area and have designated contracting parties to the Implementing Agreement covering collaborative research in this area. The designation by governments of a number of private organisations, as well as universities and government laboratories, as contracting parties, has provided a broader range of expertise to tackle the projects in the different technology areas than would have been the case if participation was restricted to governments. The importance of associating industry with government sponsored energy research and development is recognized in the IEA, and every effort is made to encourage this trend.

The Executive Committee

Overall control of the programme is maintained by an Executive Committee, which not only monitors existing projects but identifies new areas where collaborative effort may be beneficial. The Executive Committee ensures that all projects fit into a pre-determined strategy, without unnecessary overlap or duplication but with effective liaison and communication. The Executive Committee has initiated the following projects to date (completed projects are identified by *):

- I Load Energy Determination of Buildings*
- II Ekistics and Advanced Community Energy Systems*
- III Energy Conservation in Residential Buildings*
- IV Glasgow Commercial Building Monitoring*

- V Air Infiltration and Ventilation Centre
- VI Energy Systems and Design of Communities*
- VII Local Government Energy Planning*
- VIII Inhabitant Behaviour with Regard to Ventilation*
- IX Minimum Ventilation Rates*
- X Building HVAC Systems Simulation*
- XI Energy Auditing*
- XII Windows and Fenestration*
- XIII Energy Management in Hospitals*
- XIV Condensation*
- XV Energy Efficiency in Schools*
- XVI BEMS - 1: Energy Management Procedures
- XVII BEMS - 2: Evaluation and Emulation Techniques
- XVIII Demand Controlled Ventilating Systems
- XIX Low Slope Roof Systems
- XX Air Flow Patterns within Buildings
- XXI Thermal Modelling
- XXII Energy Efficient Communities
- XXIII Multizone Air Flow Modelling (COMIS)
- XXIV Heat Air and Moisture Transfer in Envelopes
- XXV Real Time HEVAC Simulation

Annex V Air Infiltration and Ventilation Centre

The IEA Executive Committee (Building and Community Systems) has highlighted areas where the level of knowledge is unsatisfactory and there was unanimous agreement that infiltration was the area about which least was known. An infiltration group was formed drawing experts from most progressive countries, their long term aim to encourage joint international research and increase the world pool of knowledge on infiltration and ventilation. Much valuable but sporadic and uncoordinated research was already taking place and after some initial groundwork the experts group recommended to their executive the formation of an Air Infiltration and Ventilation Centre. This recommendation was accepted and proposals for its establishment were invited internationally.

The aims of the Centre are the standardisation of techniques, the validation of models, the catalogue and transfer of information, and the encouragement of research. It is intended to be a review body for current world research, to ensure full dissemination of this research and based on a knowledge of work already done to give direction and firm basis for future research in the Participating Countries.

The Participants in this task are Belgium, Canada, Denmark, Germany, Finland, France, Italy, Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom and the United States of America.

Introduction

The Air Infiltration and Ventilation Centre's first glossary of ventilation terms was published in 1981 as AIVC Technical Note 5 and contained definitions of words relating to air infiltration and ventilation. Since then, many definitions have been updated and new terms have been added.

This technical note incorporates the changes that have been made since the first edition was published. It also includes the principle terms associated with ventilation technology.

The revised terms have been compiled from a variety of sources including those listed in the bibliography.

The intention of this document is to promote a more uniform use of terms in the area of ventilation.

User guide

The glossary consists of main terms with definitions followed by any subsidiary terms. The main terms are in alphabetical order.

The basic entry has the following format:

Minimum Ventilation Requirement

The minimum quantity of outdoor or conditioned air entering a building, which is needed to maintain acceptable indoor air quality.

(See Acceptable Air Quality)

Subsidiary terms are bracketed and appear below the definition in italics, as in the example above. Definitions for these subsidiary terms are given in their alphabetically correct place.

Acceptable Air Quality

Air in which there are no known contaminants at harmful concentrations as determined by specialist authorities and with which a substantial majority (80 % or more) of the people exposed do not express dissatisfaction. (ASHRAE 62-1989).

A

Absolute Ventilation Efficiency

A quantity which expresses the ability of a ventilation system to reduce a pollution concentration relative to the feasible theoretical maximum performance.

Acceptable Air Quality

Air in which there are no known contaminants at harmful concentrations as determined by specialist authorities and with which a substantial majority (80 % or more) of the people exposed do not express dissatisfaction. (ASHRAE 62-1989).

Acoustic Technique

A method of detecting cracks in a building where leakage may occur. A steady source of high pitched sound is placed within the building and a microphone is used outside the building as a detector. Leaks correspond to an increase in volume of the sound transmitted. This technique provides qualitative information only.

AC Pressurization Technique

This technique allows building airtightness to be examined at small (Pa) pressure differentials with minimal interference from climatic forces. The air flow through the building envelope can be evaluated by using a piston assembly to vary the effective volume of the structure. Measuring the amplitude of the pressure response inside the building and phase relationship between this pressure and the velocity of the piston, enables the air flow through the building to be determined.

(See DC Pressurization)

Adventitious opening (Also known as Unintentional Opening & Fortuitous Leakage)

An opening within the building envelope which, in terms of ventilation, is unintentional, for example, cracks around doors and windows.

Air Barrier

(See Air Curtain)

Air Change

A quantity of fresh air equal to the volume of the room or building being ventilated.

(See Air Change Rate)

Air Change Efficiency

A measure of how quickly the air in the room is replaced. It represents, the ratio between the nominal time constant, and the air change time, for the room.

(See also Air Change Time; Coefficient of Air Change Performance; Local Air Change Index; Nominal Time Constant; Specific Flow)

Air Change Rate

The volumetric rate at which air enters (or leaves) a building or zone expressed in units of building or zone volume.

(See Specific Flow)

Air Change Time

This is the time for all of the air in a room to be changed, and is equal to twice the room mean age.

(See Air Change Efficiency; Coefficient of Air Change Performance; Local Air Change Index; Nominal Time Constant; Room Mean Age; Specific Flow)

Air Channel

(See Flow Path)

Air Conditioning (Also known as Environmental Control)

The artificial process of treating air to adjust its temperature, humidity, cleanliness, air quality, circulation and distribution as required by occupants, a process or a product in the space.

(See Cooling; Dehumidification; Heating; Humidification)

Air Curtain

A stream of high velocity, temperature controlled air which is directed downward across an opening. It is designed to exclude exterior draughts, and pollutants blown in from outside. It also prevents the transfer of heat across the boundary, and permits the air-conditioning of a space with an open entrance.

Air Distribution

The delivery of outdoor or conditioned air to various spaces in a building, usually by mechanical means.

Air Exchange Rate

(See Air Change Rate)

Air Exfiltration

The uncontrolled outward leakage of indoor air through cracks, interstices, and other unintentional openings of a building, caused by the pressure effects of the wind and/or stack effect.

Air Flow

The mass/volume of air moved between two points.

(See Laminar Flow; Turbulent Flow)

Air Flow Rate

The mass/volume of air moved per unit of time through a space opening or duct.
(SI units: mass flow rate - Kg/s ; volume flow rate - m³/s)

Air Infiltration

The uncontrolled inward leakage of outdoor air through cracks, interstices, and other unintentional openings of a building, caused by the pressure effects of the wind and/or the stack effect.

Air Inlet

A deliberate opening in a room or a duct wall for the provision of outdoor or conditioned air into the room.

Air Leakage

The leakage of air in or out of a building or space usually driven by artificially induced pressures.

(See Pressurization Test)

Air Leakage Characteristic

An expression that describes the air leakage rate of a building or component. This may be: a) The air leakage flow rate at a reference pressure difference across the component or building envelope, (Usually 50 Pa and expressed in terms of C (the Flow Coefficient) and n (the Flow Exponent). b) The relationship between the flow rate and the pressure difference across the building envelope or component. c) The equivalent leakage area (ELA) at a reference pressure difference across the component or building envelope.

(See Flow Equation; Equivalent Leakage Area)

Air Leakage Rate

The rate of air leakage in or out of a building or space.

Air Outlet

A deliberate opening in a building envelope or a duct through which air is expelled to the outside.

Air Pressure

The force per unit area that air exerts on any surface in contact with it. (SI Units, Pascal (Pa) 1 Pa is equivalent to 1 N/m²)

Air Quality

(See Acceptable Air Quality)

Air Speed

The speed of the air relative to its surroundings.

Airtightness

A general descriptive term for the leakage characteristics of a building. The smaller the air leakage rate at a given pressure difference across a building envelope, the greater the airtightness.

(See Air Leakage Characteristic)

Airtightness Standard

A standard value of building or component air leakage corresponding to a reference pressure difference across the building envelope or component. Standard values may be expressed in terms of air change rate, flow rate per unit area of opening, flow rate per unit length of crack, or equivalent leakage area.

Air Velocity

The rate and direction of air movement. (Important when considering cooling effects and comfort criteria).

Air Vent

A purpose provided air inlet or outlet.

Air Vapour Barrier

A moisture impervious layer applied to the surfaces enclosing a space to limit moisture migration.

Ambient Temperature

The temperature of the air within a room or zone.

(See Environmental Temperature)

Apartment

A separate room or suite of rooms in a building occupied by one party. Many of these apartments form apartment blocks, or blocks of flats.

Atrium

An open space in the middle or at the edge of a building, usually enclosed, but still allowing the penetration of light.

Attic

A low storey or structure above the main part of a dwelling. Alternatively known as a Loft or Roofspace.

Axial or Vaneaxial Fan

A fan in which the airflow, at all times, from entry to exit is predominately parallel to the axis of rotation.

B

Backdraughting

The reversed flow of polluted air (or flue gases) in a chimney, flue or other air outlet, back into the room or building.

Background Leakage

Unidentified openings or gaps in a building envelope through which infiltration can take place.

Bag sampling method

a) A method of measuring the air change rate using tracer gas and a two channel pump. One channel dispenses tracer gas from a bag of known volume, the other draws room air into a sample bag. The final concentration of tracer in the room air and the amount of tracer gas used, enables the calculation of the average inverse air change rate. b) A method of measuring the air change rate by which tracer is discharged into a sample volume and mixed. Sample bags are inflated with room air at intervals and the concentration of tracer measured.

Balanced Fan Pressurization

A measurement technique using two or more blower doors to evaluate the leakage of individual internal partitions and external walls of multizone buildings. The technique involves using the fans to induce a zero pressure difference across certain building components, thus eliminating their leakage from the measurement.

(See AC Pressurization; DC Pressurization; Blower Door)

Balanced Supply/Extract Ventilation System

A ventilation system in which fans both supply and extract air from an enclosed space at equal rates.

Basement

(See Cellar)

Blower Door

A device that fits into a doorway of a building, containing a powerful fan, for supplying or extracting a measured rate of air flow. It is normally used for testing air leakage by pressurization or depressurization.

(See AC Pressurization; DC Pressurization; Balanced Fan Pressurization)

Body Odour

The odour originating from sweat and secretions from the skin, foul breath, and gases from the digestive tract. Odour emission is dependent upon diet, activity, and personal hygiene.

(See Olf, Decipol)

Building Envelope

The total area of the boundary surfaces of a building through which heat, light, air and moisture are transferred between the internal spaces and the outside environment.

Bungalow

A single storey building, which may be detached or semi-detached whose primary purpose is for living accommodation.

C

Caulking

Technique for making airtight joints by applying a sealing material. A form of weatherstripping.

(See Weatherstripping).

Cavity Barrier

A form of vapour barrier where a moisture impervious layer is introduced inside the "cavity" of a cavity wall, usually polythene sheeting.

(See Vapour Barrier; Cavity Wall)

Cavity Wall

A wall built of two leaves, separated usually by a continuous gap. The two leaves are connected by ties at intervals. The inner layer may be double for floor bearing.

Cellar

A storey in a building whose floor line is below ground level at any entrance or exit, the ceiling of which is not more than 5ft above ground level whose primary function can be accommodation or storage.

Centrifugal Fan

A fan in which the air is turned from parallel to the axis of rotation on entry to a direction tangential to the arc described by the tips of the rotating blades or vanes.

Coefficient of Air Change Performance

This is the ratio between the nominal time constant and the room mean age. The coefficient of air change performance equals twice the air change efficiency. This term is equivalent to the ventilation effectiveness definition of ASHRAE standard 62-1989, "Ventilation for Acceptable Indoor Air Quality".

(See also Air Change Time; Local Air Change Index; Nominal Time Constant; Specific Flow)

Collector Chamber

Sealed box or other enclosure used to isolate a building component when conducting pressurization tests.

Comfort Zone

The range of indoor conditions considered acceptable by a certain proportion (e.g. usually more than 80%) of the people working or living in the space.

Commercial Building

A building whose primary purpose is to provide space for commercial activity rather than domestic. This includes offices, storage, plant, farm, public and some factory classifications.

Component Leakage

The leakage of air through the building envelope which is directly attributable to flow through cracks around specific doors, windows or other components.

Condensation

The precipitation of liquid from its vapour phase resulting from the lowering of temperature at constant pressure: especially the deposition of water from moist, warm air onto a relatively cold surface or between two surfaces such as within a cavity wall.

Conduction

The transfer of heat from one part of a substance to another part of the same substance and then to another substance in physical contact with it, without appreciable displacement of the molecules forming the substance.

(See Convection; Radiation; Heat Transfer)

Conservation of Energy (Also known as Energy Conservation)

The principle that in any system energy cannot be created or destroyed, although it can be changed from one form to another, e.g. from potential to kinetic to heat, etc.

(See Energy Conservation)

Constant Concentration

A Tracer gas method for measuring ventilation rates, whereby an automated system injects tracer gas at a rate required to maintain the concentration of tracer gas within a room or zone at a fixed, pre-determined level. The ventilation rate is proportional to the rate at which the tracer gas must be injected.

(See Constant Flow/Emission; Decay Tracer Gas Method)

Constant Flow/Emission

A Tracer gas method for measuring ventilation rates whereby tracer gas is continually emitted at a uniform rate. The equilibrium concentration of tracer gas in air is then measured.

(See Constant Concentration; Decay Tracer Gas Method)

Contaminant

An unwanted airborne constituent that may reduce the acceptability of the air and may be detrimental to the health of building occupants.

Convection

Transference of heat through a liquid or gas by the actual movement of the fluid. Portions in contact with the source of heat become hotter, expand, become less dense, and rise: their place is then taken by colder portions, thus setting up convection currents.

(See Free Convection; Forced Convection; Conduction; Radiation; Heat Transfer)

Cooling

The transfer of energy from a body of solid liquid or gas by the existence of a temperature gradient from that body to its surroundings which are at a lower temperature, and may also be solid, liquid or gas. This process is the opposite of heating.

Crack / Crackage

Small gaps around doors, windows and other parts of a building envelope through which ventilation air may pass.

Crack Length

The total length of the narrow gaps found around doors and windows etc, through which ventilation air may pass.

(See Component Leakage)

Crawlspace

A shallow space in a building, usually under the floor, which provides access to pipes, wires and other equipment.

Cross Contamination (of air or masses)

The contamination of one stream of air by pollutants in another, due to air movement between the two streams (or masses).

Cross Ventilation

Air enters on one side of a room and leaves on a different side of the same room. Airflow between the entry and exit provides ventilation. Also used for flow between rooms, where the inlet is in one room and the outlet is in another.

D

DC pressurization

Building airtightness levels can be measured by using a fan, temporarily installed in the building envelope (a blower door) to pressurize the building. Air flow through the fan creates an internal, uniform, static pressure within the building. The aim of this type of measurement is to relate the pressure differential across the envelope to the air flow rate required to produce it. Generally the higher the flow rate required to produce a given pressure difference, the less airtight the building.

(See Blower Door; Internal Fan Pressurization; External Fan Pressurization)

Decay Method (Tracer Gas)

A tracer gas method for measuring the ventilation rate whereby a quantity of tracer gas is released and the decrease in concentration is measured as a function of time.

(See Constant Concentration; Constant Flow/Emission)

Decipol

The decipol attempts to quantify the concentration of odour as perceived by humans. The decipol represents the perception of odour measured by the "pol" unit. To obtain a usable unit it has been suggested that one tenth of the pol unit is used, the "decipol". The perceived air pollution is defined as that concentration of human bioeffluents that would cause the same dissatisfaction as the actual air pollution concentration.

(See Olf)

Degree Day

The number of degrees of temperature difference on any one day between a given base temperature and the 24-hour mean outside air temperature for the particular location. The average number of degree days for a given period (For example during the heating season) is the sum of these degree days, divided by the given period.

Dehumidification

The process of reducing the moisture content of the air; serves to increase the cooling power of the air and can contribute to occupant comfort.

(See Air Conditioning; Humidification; Cooling; Heating)

Demand-Controlled Ventilation (DCV)

A ventilation strategy where the airflow rate is governed by a chosen pollutant concentration level. This level is measured by air quality sensors located within the room or zone. When the pollutant concentration level rises above a preset

level, the sensors activate the ventilation system. As the occupants leave the room the pollutant concentration levels are reduced and ventilation is also reduced. Common pollutants are usually occupant dependent, such as, carbon dioxide, humidity or temperature.

Depressurization

A measurement technique used to evaluate the airtightness of a building or component. The air inside the room or building is extracted by the use of a fan, creating a lower pressure inside, than outside the room or building.

(See Blower Door; DC Pressurization; Pressurization)

Discharge Coefficient

A dimensionless coefficient relating the mean flow rate through an opening to an area and the corresponding pressure difference across the opening.

Displacement Flow

The displacement of internal room by incoming outdoor or conditioned air without appreciable mixing of the two masses. Very precise temperature and control conditions are required.

(See Piston Flow).

Downdraught

An airstream with a significant downward directional component of velocity. Often occurs adjacent to cold surfaces. It may be generated artificially by air curtains, air doors etc.

Draught

Excessive air movement in an occupied enclosure causing discomfort.

Draughtproofing

The action of filling the gaps around doors and windows, in order to prevent outside cold air leaking into the building, causing draughts.

(See Weatherstripping; Caulking).

Dry Bulb Temperature

The temperature indicated by a dry temperature sensing element (such as the bulb of a mercury in glass thermometer) shielded from the effects of radiation.

(See Wet Bulb Temperature)

E

Energy Balance

The arithmetic balancing of energy inputs versus outputs of an object or processing equipment; it is positive if energy is released, and negative if energy is absorbed.

Energy Conservation

The deliberate design of a building or process to reduce its energy usage, or to increase its energy efficiency.

(See Conservation of Energy)

Energy Efficiency

The efficient use of energy with minimum waste.

Environmental Chamber

(See Testing Chamber)

Environmental Control

(See Air Conditioning)

Environmental Temperature

The temperature of the air outside a room or zone.

(See Ambient Temperature)

Equivalent Leakage Area (ELA)

The equivalent amount of orifice area that would pass the same quantity of air as would pass collectively through a building envelope or component at a specified reference pressure difference.

Exhaust Air

Air removed from a space and not reused therein.

Extract air

Air that is removed from a building or space. A proportion is often used for recirculation and added to incoming air. Alternatively it is all exhausted to the outdoors, sometimes via an air to air heat exchanger or a heat pump.

Extract Ventilation

A mechanical ventilation system in which air is extracted from a space or spaces, so creating an internal negative pressure. Supply air is drawn through adventitious or intentional openings. Such a system allows heat to be recovered, using an exhaust air heat pump.

External Fan Pressurization

A blower door is fitted to a building, induced air flow through the fan creates an artificial, uniform static pressure within the building. Internal and external pressure taps are made and a manometer is used to measure the air flow required to produce a given pressure difference. The higher the flow rate required to produce a given pressure difference, the less airtight the building.

(See Blower Door; DC Fan Pressurization; Internal Fan Pressurization)

F

Fabric Leakage

(See Background Leakage)

Fan

A mechanical device employing rotating aerofoil blades or vanes to continuously move air from one place to another.

(See Axial or Vaneaxial Fan; Centrifugal Fan)

Fan Pressurization/Depressurization

(See DC Pressurization)

Flat

(See Apartment)

Flow Coefficient (C)

Parameter used in conjunction with the "flow exponent" in a flow equation.

(See Flow Exponent; Flow Equation)

Flow Equation

Equation describing the airflow rate through a building (or component) in response to the pressure difference across the building (or component). This equation takes the form of $Q = C \Delta P^n$; Where C is the flow Coefficient, ΔP is the change in pressure over the component or envelope, and n is the flow exponent. Q represents the resulting volume flow rate expressed in m³/h.

(See Flow Coefficient, Flow Exponent)

Flow Exponent (n)

Parameter which characterises the type of flow through a building (or component) and is used in conjunction with 'flow coefficient' in a 'flow equation'.

(When n = 1 flow is laminar, and when n = 0.5 flow is assumed turbulent). For most openings, n takes a value between these two extremes.

Flow Network

A network of zones or cells of differing pressure connected by a series of flow paths.

Flow Path

(See Leakage Path)

Flue

A passage/duct for smoke and fumes from a boiler/fire etc.

Forced Convection

Heat transmission by mechanically induced movement of a fluid.

Fortuitous leakage (Also known as Adventitious Leakage)

(See Air Infiltration)

Free Convection

Heat transmission by movement of a fluid caused by density differences.

(See Convection; Forced Convection)

Fresh Air

(See Outdoor Air)

G

Gap Leakage

(See Component Leakage)

Gas Chromatography

A process by which gases can be separated from one another. This technique is used to separate tracer gases from each other and from the constituents of air, thus allowing individual quantitative analysis to be performed.

H

Heating

The transfer of energy to a space or to the air by the existence of a temperature gradient between the source and the space or air. This process may take different forms, ie, conduction, convection or radiation.

(See Conduction; Convection; Heat Transfer; Radiation)

Heat Exchanger (Air-to-Air)

A device designed to transfer heat from two physically separated fluid streams. In buildings, it is generally used to transfer heat from exhaust warm air to incoming cooler outdoor air.

Heat Balance

A statement of the heat input to, and heat loss from, an appliance, plant or structure, intended to account for all sources of heat and equivalent energy.

Heat Pump (Air-to-Air)

A device operating on a refrigeration cycle in which both evaporator and condenser are refrigerant/air heat exchangers. As a heating season heat recovery device, the evaporator transfers heat from the exhaust warm air to the refrigerant and the condenser transfers heat from the refrigerant to the incoming air. Arrangements are often made to allow the refrigerant flow to be reversed making the condenser the evaporator and vice versa - thus energy may be recovered in the cooling season.

Heat Pump (Air-to-Water)

A device operating on a refrigeration cycle in which the evaporator is a water/refrigerant heat exchanger and the condenser a refrigerant/air heat exchanger. The circuit normally includes an arrangement which allows the refrigerant flow to be reversed thus allowing heat to be transferred in either direction. In one system, a number of small air/water heat pumps installed in various zones around a building are used to transfer heat into or from a common water circuit. Thus heat unwanted in one zone may be transferred to another where it is needed.

Heat Recovery

(See Heat Exchanger (Air-to-Air); Heat Recovery Effectiveness)

Heat Recovery Effectiveness (Often referred to as Heat Recovery Efficiency)

The proportion of heat recovered from otherwise waste heat passing through a heat recovery system. Normally expressed as a percentage.

Heat Transfer

The movement of heat energy from one body to another (gas, liquid or solid or combinations thereof) by means of radiation, convection or conduction.

(See heating; Sensible Heat Transfer; Latent Heat Transfer)

Humidification

The process of transferring a mass of water to the atmospheric air.

(See Latent Heat Transfer)

I

Imperfect Mixing

The combination of two or more substances such that the parts of one are unevenly distributed among the parts of another.

Indoor Air Pollution

Pollution occurring indoors from any source, indoors or outdoors.

Indoor Climate

The synthesis of day-to-day values of physical variables in a building e.g. temperature, humidity, air movement and air quality, etc, which affect the health and/or comfort of the occupants.

Indoor Environment

(See Indoor Climate)

Industrial Building

A building in which the main purpose is to provide space for manufacturing and assembly processes. These are characterised by high levels of activity both mechanical and human, and often by the generation of internal pollution and heat.

Infiltration

(See Air Infiltration)

Infiltration Heat Loss/or Gains

Heat lost from a building which is directly attributable to the effects of the cooler outside air leaking into a building and of warm indoor air leaking out.

Infiltration Rate

The rate at which outside air infiltrates a room or building. Equivalent to the fresh air change rate, usually expressed in air changes per hour (ach) or litres per second (l/s).

(See Air Change Rate)

Infra-Red Gas Analyser

An instrument used to determine tracer gas concentrations by determining the transmission of infra-red radiation at a specific absorption frequency through a fixed path length.

Institutional Building

A building with mixed occupational activities where special requirements arising from those activities may be needed; such buildings include hospitals, prisons etc.

Intentional Opening

(See Purpose Provided Opening)

Intentional Ventilation

Ventilation provided through the use of purpose provided openings, such as through windows or airbricks.

Internal Fan Pressurization

The building's own mechanical ventilation system can be used to provide the required pressure differential from within. The supply fans are operated while all return and exhaust fans are turned off, and all return dampers are closed, so that air can only leave through the doors, windows and other leakage sites.

(See Blower Door; DC Fan Pressurization; External Fan Pressurization)

Internal Pressure

The pressure inside a building envelope or space. Usually expressed with respect to outside or atmospheric pressure.

Internal Pressure Distribution

The pattern of static pressure variation at various points inside a building due to variations in air density and air flow into and out of the building.

Interzonal Air Flow

The process of air exchange between internal zones of a building.

L

Laminar Flow

Flow in which fluid moves smoothly. In this flow form cross stream momentum transfer takes place by viscous action alone and mixing between flow strata does not occur.

(See Transition Flow; Turbulent Flow)

Latent heat transfer

Heat added or removed during a change of state of a substance ie solid, to a liquid to a gas or vice versa, the temperature remaining constant.

(See Sensible Heat Transfer)

Large Opening

Hole or gap in a building envelope which is generally purpose made, for example, a door window or vent.

Leakage Area

The actual open area of a hole or gap.

Leakage Component

(See Component Leakage)

Leakage Distribution

The apportionment of leakage openings (flow paths) comprising a flow network.

Leakage Path

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

Local Air Change Index

An index that characterises conditions at a particular point within the room and may be largely due to the position of the measurement point. (Equation 40 Sutcliffe)

(See Air Change Efficiency; Air Change Time; Coefficient of Air Change Performance; Nominal Time Constant; Specific Flow)

Local Mean Age of Air

The average time it takes for air to travel from the inlet to any point P in a room or enclosure. The mean age of the air at the point P can be found from the centroid of the frequency curve, by taking moments about the vertical axis. (See Sutcliffe (1990).

Loft

(See Attic)

M

Makeup Air

Outdoor air supplied to replace exhausted air.

Mechanical Ventilation

Ventilation by means of one or more fans.

Mechanical Ventilation System

A ventilation system in which the motive force needed to introduce air in a space, or to extract air from a space, is provided by one or more fans.

Mechanical Extract Ventilation System

A ventilation system in which air is extracted from a space so creating an internal negative pressure. Supply air is drawn through adventitious or purpose provided openings.

Mechanical Supply Ventilation System

A ventilation system in which air is supplied to a space so creating an internal positive pressure. Air leaves the building through adventitious or purpose provided openings.

Minimum Ventilation Requirement

The minimum quantity of outdoor or conditioned air entering a building, which is needed to maintain acceptable indoor air quality.

(See Acceptable Air Quality)

Mixing Fan

Small fan used to aid the mixing of room air and tracer gas before and/or during ventilation rate measurements.

Multiple Tracer Gas Technique

A Measurement method using two or more tracer gases. This method is often used to evaluate interzonal airflows.

Multizone

A building or part of a building that comprises a number of zones or cells.

N

Natural Ventilation

The movement of outdoor air into a space through intentionally provided openings, such as windows and doors, or through non powered ventilators or by infiltration.

Neutral Pressure Level

Level at which the air pressure difference, derived from the stack effect between inside and outside a building is zero.

Network Technique

Theoretical method for estimating the magnitude of air infiltration ventilation and interzonal air movement using a model which considers a building to comprise a number of enclosed spaces each at its own internal pressure and linked by flow paths.

Normalised Leakage Area

Equivalent leakage area expressed per unit area of building envelope.
(See *Equivalent Leakage Area*)

Nominal Time Constant

The inverse of specific flow. Under piston conditions the nominal time constant is the time it will take to exchange all of the air in a room or zone with fresh air.
(See also *Air Change Efficiency; Air Change Time; Coefficient of Air Change Performance; Local Air Change Index; Specific Flow*)

O

Occupancy

The time during which people are in a building (generally expressed in hours per day)

Occupant behaviour

The pattern of activity of occupants in a building, including the number of occupants, their distribution, activities and time spent within the building, and how they interact with the buildings facilities, such as ventilation systems, window opening etc.

Olf

The olf unit attempts to quantify odorous pollution sources. One olf is the emission rate of odours (bioeffluents) from a standard person. Any other odour source is then expressed by the equivalent source strength, defined by the number of standard persons (olfs) required to cause the same dissatisfaction as the actual pollution source. The olf is a relative unit expressing the pollution source by a comparable known reference source.

(See Decipol)

Outdoor Air

Air taken from the external surroundings and therefore not previously circulated through the system.

Overpressure

An induced pressure above ambient atmospheric pressure or other given reference pressure.

P

Particulate tracer

Solid particles of aerosol or bubbles used as a tracer for measuring the rate of air movement. These particles usually have diameters of 2 to 3 microns, and can be detected by using either a) a fluorescent light scattering detector; b) a photomultiplier (P-M) detector, or c) a phosphorescence with a P-M detector.

Passive Adsorption

A process by which a gas or vapour is condensed (out of the air) and held on the surface of a piece of solid material by natural forces only.

Passive sampling

A method of sampling tracer gas in a building by the process of passive adsorption.

Passive Smoker

A non smoker who shares the same room, building, or space as a smoker, and thus is exposed to the products of tobacco combustion.

Perfect Mixing

(See Uniform Mixing)

Piston flow

Also known as plug flow, and displacement flow, and is regarded as the most efficient form of ventilation. The ventilation air acts as a piston, which pushes the "old" air in the room in front of it without actually mixing. Therefore all of the air that reaches an arbitrary point from a small packet of fresh air at the inlet does so at the same time; this time is by definition, the local mean age of air at this point.
(See Local Mean Age of Air)

Plenum chamber

A chamber, at higher/lower pressure than surrounding air, that receives air before/after delivery to a conditioned space or combustion system.

Plug Flow

(See Piston Flow)

Pollutant

(See Contaminant)

Pollutant Concentration

The concentration within a given portion of air of harmful or unpleasant contaminants such as noxious gases or dust particles. Concentrations are often

expressed as time weighted values over 24 hours, a working day or a working week.

Pollutant Migration

The movement of indoor air pollutants throughout the building between rooms or zones.

Pollutant Removal Effectiveness

A measure of how effectively pollutant from an internal contaminant source is diluted and removed from an enclosure.

(See also Ventilation Efficiency)

Pollution Source

Any object, usually within the building, which produces a substance which will contaminate the internal environment, for example, human bioeffluents caused by man, or pollutants outgassed from carpets or furniture.

Pressure Attenuation Technique

A method of estimating the leakage of a building by releasing air inside the building causing instant pressurization, the pressure returning to normal as the air leaks out. The rate of reduction of the pressure is proportional to the leakage.

Pressure Coefficient

A dimensionless coefficient relating the velocity pressure on the outer surface of the building to the velocity pressure derived from the mean wind velocity at a reference point.

Pressure Differential

The difference in pressure across a building envelope or component whether caused by natural or artificial means.

Pressure Distribution

(See Internal Pressure Distribution; Surface Pressure Distribution)

Pressurization

A method of testing air leakage of a building or component by installing a fan in the building envelope, for example through a door or window, and creating a static pressure excess inside the building. The airflow rate through the fan and the pressure difference across the envelope are measured from which the air leakage is assessed.

(See AC Pressurization; DC Pressurization)

Purpose Provided Opening

An opening in the building envelope for the specific purpose of supplying or extracting ventilation air, ie, air bricks, vents, extractor fans, intake and exhaust for HVAC systems, etc.

Purpose Provided Ventilation

Ventilation provided to a space as the result of specific action to ensure its introduction. Such ventilation may be provided by natural means through purpose provided openings of the required size and position, or by mechanical means.

Public Building

A building which is open to the public, such as museums, clubs, public houses, exhibition halls etc.

R

Radiation

The transmission of heat through space by the propagation of infra red energy; the passage of heat from one object to another without necessarily warming the space between.

(See Conduction; Convection; Heat Transfer)

Recirculated Air

Extracted air which is re-supplied to a space. Recirculated air is normally blended with outside air and is reconditioned

Reductive Sealing Method

A method of determining the leakage of specific building components by pressurizing the building and recording the leakage changes as the components are successively sealed.

Relative Ventilation Efficiency

A quantity describing how the ventilation ability of a system varies between different parts of a room.

Residential Building

A building whose main purpose is to provide living space for the occupants. Activities within them are limited to those of a domestic nature. Such buildings includes single-family; multi-family, communal, institutional and intermittent use building classifications.

Retrofit

The action of improving a buildings performance by increasing various aspects for its design. For axample improving the energy efficiency of existing buildings, by enhancing its thermal performance and by systematically sealing infiltration flow paths.

(See Weatherization)

Roofspace

(See Attic)

Room Mean Age

The average value of the Local Mean Ages of air flow for all points in a room. The Room Mean Age cannot therefore be measured easily. It is necessary to express the Room Mean Age in terms of a measurable quantity, such as a tracer gas concentration in the exhaust duct. This requires a mass balance equation to be constructed for the room. *(See Air Change Rate; Local Mean Age)*

S

Sensible heat transfer

The heat absorbed or evolved by a substance during a change of temperature that is not accompanied by a change of state.

(See Latent Heat Transfer)

Shaft-Type Buildings

A building with large vertical connecting openings.

Shelter Belt

A natural or planned barrier of trees or shrubs used to reduce wind velocity, giving shelter.

Shielding

The degree of protection from wind offered to a building by upstream obstacles. These may be windbreaks, shelter belts, or other buildings.

Shielding Coefficient

The ratio of average total exterior wind pressure to the stagnation pressure at ceiling height.

Sick Building Syndrome (SBS)

Collective term for symptoms exhibited by occupants of some buildings. These include headaches, eye/skin irritation, shortness of breath and nausea.

Single Tracer Gas Technique

A method for determining the air change rate within a room or zone using only one tracer gas.

Single Zone

A building or part of a building comprising of one zone of uniform pressure.

Smoke Visualisation

A method of detecting leaks in the building fabric, by pressurizing the building and using smoke to trace the paths followed by the escaping air.

Specific Flow (a)

Defined as the total volumetric supply airflow rate per unit volume of the room. Specific flow is expressed by the equation; $a = Q/V$, where Q is the ventilation air flow rate (m^3/s) and V is the total volume of the room (m^3). Specific flow is often called the Air Change Rate (NOTE: Specific flow is usually expressed by the letter "n", but "a" is used here as not to confuse with the Flow exponent "n".)

(See also Air Change Rate; Air Change Time; Coefficient of Air Change Performance; Local Air Change Index; Nominal Time Constant)

Specific Leakage Area

Leakage area, expressed per unit floor or wall area.

Stack

A single chimney/flue or a cluster of chimneys/flues. That part of a flue above roof level.

Stack Effect

The pressure differential across a building caused by the differences in the density of the air due to an indoor-outdoor temperature difference.

(See Pressure Level, Neutral).

Stack Pressure

(See Stack Effect)

Stagnation Pressure

The pressure of air if it were brought to rest.

Storey-Type Buildings

A building comprising of floors separated by impermeable layers.

Stratified Air

The formation of layers of different densities, in a body of fluid that is not mixed well. The variation in densities may be due to difference in temperatures. The term "Thermal Stratification" is often ascribed for this condition.

Supply Air

Air delivered to a space and for the purpose of ventilation, heating, cooling humidification or dehumidification.

Supply Ventilation

A system in which air is supplied to a space, so creating an internal positive pressure. Air leaves the building through adventitious or purpose provided openings.

(See Adventitious Opening; Fortuitous Leakage Purpose Provided Opening)

Surface Pressure Distribution

The pattern of positive (or negative) pressure relative to the static pressure of the prevailing free wind, at various points on the external surface of a building, caused by the flow of the wind onto or around the building.

T

Temperature

A property of an object which determines the direction of heat flow. When the object is placed in thermal contact with another object, heat flows from the higher temperature object to the lower temperature one. It is measured either by an empirical temperature scale based on some convenient property of a material or instrument, such as the Celcius scale, or by a scale of absolute temperature, such as the Kelvin scale.

Terrain Roughness

The character of the terrain over which wind passes upstream of a building, causing the wind velocity to be modified. It is common practice to characterise terrain according to roughness and express the variation in terms of roughness constants.

Testing Chamber (Also known as Environmental Chamber)

A specially designed room, to enable experimenters to vary all of the environmental parameters. Thus given conditions can be tested. It is used mainly for the reconstruction of environmental conditions that represent extreme cases, and to simulate conditions which are difficult to measure in the field.

Thermal Comfort

A condition of satisfaction expressed by occupants within a building to their thermal environment. The thermal comfort condition is a subjective feeling of satisfaction, building designers attempt to satisfy as many of the occupants as possible (usually 80 % or more).

Thermal Stratification

(See Stratified Air)

Thermal Transmittance ("U"-Value)

The heat flow transmitted through a unit area of a given structure, divided by the difference between the effective ambient temperature on either side of the structure, under steady state conditions. Expressed as a "U"-value.

Thermography

The process of converting the heat emitted from an object into visible pictures. It is used to indicate the temperature distribution over part of a building envelope and is useful for locating infiltration flow paths.

Threshold Limit Value (TLV)

The limit of an environmental condition to which any person may be exposed repeatedly without adverse effect.

Tracer Gas

A detectable, non toxic, non reactable gas used to determine the rate of air interchange between a space and its surroundings.

Tracer Gas Analyser

Any instrument used to evaluate the concentration of tracer gas in a sample of air over time.

Tracer Gas Technique

A method employing tracer gases to determine air infiltration and ventilation rates.

(See Constant Concentration, Constant Emission; Decay Tracer Gas Method)

Transfer Index Method

A method of measuring ventilation rates, by determining the transfer index between two points. The time integral of tracer gas concentrations is determined at one point, following the liberation of a fixed volume of tracer to another. Several sample points are usually employed. The reciprocal of the transfer index has dimensions of ventilation rate.

Transition Flow

The unstable region of flow that occurs when there is a change from a laminar to a turbulent flow regime.

(See Laminar Flow; Turbulent Flow)

Turbulent Flow

Motion of fluids in which local velocities and pressures fluctuate irregularly.

(See Laminar Flow; Transition Flow)

UJ

Unintentional opening

(See Adventitious opening; Fortuitous Opening)

"U"- Value

(See Thermal Transmittance)

Uniform Mixing

The combining of two or more substances such that the parts of one are wholly distributed throughout the parts of another.

V

Vapour Barrier

A moisture impervious layer applied to the surfaces enclosing a space or to the surface of thermal insulation to limit moisture migration through the surface.

Variable Air Volume (VAV)

A ventilation system that controls the dry bulb temperature within a space by varying the volume of supply air, rather than the supply air temperature.

Velocity Profile (for a room)

The relationship between the height above a surface and the mean velocity of a fluid (air) at that point.

Ventilation

The process of supplying or removing air, by natural or mechanical means to and from a space.

Ventilation Air

That portion of supply air that is outdoor air plus any recirculated air that has been treated for the purpose of maintaining acceptable indoor air quality.

Ventilation Effectiveness

An expression describing the ability of a mechanical (or natural) ventilation system to remove pollution originating in a space, either of a steady state or transient nature.

(See Pollutant Removal Effectiveness)

Ventilation Efficiency

A series of indices which indicate the mixing characteristics of incoming outdoor air with the air already present in an enclosure and which characterise the pollutant distribution within that enclosure resulting from the interaction of air flow with internal pollutant sources.

(See Air Change Efficiency; Pollutant Removal Effectiveness; Absolute Ventilation Efficiency; Relative Ventilation Efficiency)

Ventilation Heat Loss/or Gains

The heat lost or gained by virtue of warm and/or humid air flowing into or leaking from a space.

Ventilation Rate

The rate at which outside air is intentionally supplied to a building or zone. Sometimes ventilation is used to describe the total mechanical air change in a room or building. This rate may then frequently comprise a considerable

proportion of recirculated rather than outdoor air. Hence when apparently very large ventilation rates are quoted, it is important to establish the proportion of flow representing outside supply air. The remainder will be recirculated air.

Ventilation Strategy

A plan by which ventilation air is purposefully provided to a space. When such a strategy is employed, it is normal to take action to minimise background leakage.

Ventilation System

(See Mechanical Ventilation System; Mechanical Extract Ventilation System; Mechanical Supply Ventilation System; Balanced Supply/Extract Ventilation System)

Viscous Flow

(See Laminar Flow)

Vitiated Air

Spoiled, impure or polluted air.

Vortex

Airflow with rotary, rather than translatory motion. It occurs in the wakes of buildings etc. and also in the presence of strong updraughts. A standing eddy or stationary vortex may be formed in the lee of a building arising from the airflow around it.

W

Weatherization

(See Retrofit)

Weathersealing

(See Weatherstripping)

Weatherstripping

a) The fitting of a strip of flexible material to seal a joint between a movable component and its seating or the application of mastic sealants to seal infiltration openings. The strip is attached to one edge and excludes air by pressing tightly against the other. b) Fixing a piece of material to stop a draught passing through the joints of a closed component (such as a door or window).

(See Caulking)

Wet Bulb Temperature

Air temperature indicated by a sensing element kept wet (usually by a wick), the indicated temperature thus being related to the rate of evaporation from the wetted bulb. This Wet Bulb Temperature is used by psychrometers to measure the relative humidity.

(See Dry Bulb Temperature)

Wind Barrier

(See Windbreak)

Windbreak

A barrier designed to obstruct wind flow and intended for protection against excessive wind pressure.

(See Shelterbelt)

Wind Pressure (on a facade)

The difference between the local pressure on the exterior of a building induced by the action of the wind and static outdoor pressure far away from any building or shield.

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