Residential Ventilation

Energy Efficient Solutions for Improved Indoor Climate
Lindab in Brief

- Established in 1959
- More than 125 locations in 32 countries
- Over £600M Sales Revenue
- Good Thinking
- We simplify construction
Agenda

- Benefits of modern residential ventilation systems
- Heat recovery unit selection
- Energy efficiency demands of modern residential ventilation
- Selecting and sizing ductwork
- The radial ducting principle and components
- Sound performance options
- Fire protection requirements
- Design solutions
Residential Ventilation

**Traditional Systems**
- Passive Stack Ventilation
- Intermittent Extract Ventilation

**Modern Systems**
- Mechanical Extract Ventilation
- Mechanical Ventilation and Heat Recovery
Passive Stack Ventilation

- Uses the natural effect of warm air rising to extract from wet rooms through a roof ridge vent
- Ducting needs to be relatively large compared to mechanical systems
- Vertical configuration with limited design flexibility
- Can result in over-ventilation caused by movement and temperature of external air
Intermittent Extract Ventilation

- Uses fans placed in bathrooms and in cooker hoods
- Easy to install
- Can be very noisy
- Requires trickle vents to be open to bring fresh air into the home
- Need to be manually switched on and off
- Can cause condensation build up and mould if not consistently used
Mechanical Extract Ventilation

- Works at an efficient continuous low level
- Much quieter than intermittent fans
- Can be centralised with just one fan and one extract outlet which minimises cost.
- Doesn’t require manual operation
- Requires air bricks or trickle vents to bring in fresh air
Mechanical Ventilation and Heat Recovery

- Extracts stale air from wet rooms and supplies fresh air to habitable rooms
- Enables heat to be recovered back into the home
- Operates continuously at a low rate which offers efficiency
- Low noise levels
- Cost savings from a reduction in heating requirement
- Suitable for passive house installation
## Costs

<table>
<thead>
<tr>
<th></th>
<th>Passive Stack</th>
<th>Intermittent Extract</th>
<th>Mechanical Extract</th>
<th>Mechanical Ventilation and Heat Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Upfront System Cost</td>
<td>£500</td>
<td>£1,500</td>
<td>£3,500</td>
<td>£7,000</td>
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<tr>
<td>Typical Energy Consumption</td>
<td>-</td>
<td>0.04 kW/day</td>
<td>0.89 kW/day</td>
<td>1.8 kW/day</td>
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<tr>
<td>Typical Annual Running Costs</td>
<td>-</td>
<td>£6.40</td>
<td>£32.42</td>
<td>£65.71</td>
</tr>
</tbody>
</table>

Based on 1 x en-suite, 1 x family bathroom, 1 x wc, 1 x kitchen, 1 x utility
Heat Recovery Units

Provide continuous 24-hour whole house extract ventilation and heat recovery

- Stale, moist air is extracted from wet rooms
- A heat exchanger within the unit transfers up to 90% of the heat into fresh air
- The fresh air is then supplied into habitable rooms
- Summer bypass allows the fresh air to be supplied without heat recovery
MVHR Unit Selection

Units should be selected according to the airflow required for the size of the property and typical use taking into account the resistance of the system.

Resistance is effected by the type of ductwork, the number of bends and other obstructions and the length of the duct runs.

A unit should be selected so that the required airflow is 40 – 60% of the maximum capacity of the unit.

Good quality MVHR Units:
- Are ultra-quiet in operation
- Can fit in a kitchen cupboard or loft space
- Easy-access filters allow simplified maintenance
- Work with a range of controllers
Demands of Modern Residential Ventilation

Better insulated and more airtight houses makes energy efficient ventilation more important.

Specific Fan Power is the energy efficiency measure of a fan within a given ventilation system.

A minimum energy efficiency level for all residential ventilation systems is set in The Domestic Building Services Compliance Guide.

\[
SFP \ (W/l/s) = \frac{\text{Fan Power Consumption (W)}}{\text{Airflow (l/s)}}
\]

Other than the fan, the ducting system is the only significant factor that can influence SFP. The better the airflow through the ducting system, the better the energy efficiency.
Ductwork

Poorly installed or designed ductwork can have a dramatic effect on the efficiency of a ventilation system, both in terms of SFP and recovered heat.

- Airflow rates may not be achieved and the system could fail building control inspection
- Noise will increase as the unit tries to achieve the desired airflow against significant back pressure or leakage
- Lack of airflow will result in poor indoor air quality, high moisture and high CO2 levels.

Type of ductwork:
- Spiral tube
- Flexible pipe
- Rigid plastic
- Semi-rigid plastic
**Rigid plastic ducting**

**Rigid plastic circular or flat ducting** is readily available in a range of colours and sizes. Low profile flat ducting is easily concealed above wall units of in ceiling voids. Rigid plastic ducting should be high grade flame retardant, self-extinguishing, and conform to UL94 V2 and DIN 4102 B1

**Insulated plastic ducting** is designed to retain heat. Insulated plastic ducting should be fully tested to meet the thermal conductivity requirements of EN13163 and is flame retardant to DIN 4102 B1

**Self-seal couplings** eliminate the need for sealant and tape, simplifying installation and ensuring that the air leakage is kept to a minimum. Joint integrity should exceed the requirements set out in DW/143 Class A Leakage Test and DW/154 ductwork standards.
Semi-Rigid Ducting

Semi-rigid ducting takes a naturally gentle swept bend form around corners which reduces turbulence, noise, pressure drops and potential leak points.

A smooth internal surface has reduced air resistance, further reducing pressure drops, minimises power consumption and is resistant to kinking which eliminates points of restriction.

Requires only the minimum of space and can be run in voids without interference to other services or structural members.

Should be made from odourless, antibacterial, sanitised polythene without recycled material to ensure no contaminates are present.

Should have antistatic additives to the internal surface and microbial properties according to EN ISO 846 A.
Standard Assessment Procedure for Energy Rating

Energy performance calculations are simplified by SAP Appendix Q listing. UK building energy performance assessments are produced using the National Calculation Methodologies for energy rating buildings. These methodologies include the Standard Assessment Procedure for Energy Rating of Dwellings (SAP).

Flexible ducting is less efficient than rigid ducting. If flexible ducts are used within a ventilation system, to compensate for system losses, an in-use factor of 1.7 must be applied to the Specific Fan Power when calculating energy consumption.

The SFP in-use factor can be greatly reduced by utilising a SAP Appendix Q listed semi-rigid ducting. SAP Appendix Q listing simplifies compliance calculations and enables energy efficient design. Independent testing by BRE found semi-rigid ducting to perform equally well or better than a rigid duct system.
Radial ducting is the smart solution to today’s ventilation needs

The radial principle involves individual ducting tubes from each extraction and supply point to plenum and distribution boxes connected to the mechanical unit.

- Significantly reduces system pressure drops and power loss which maximises fan power efficiency.
- Provides acoustic separation as recommended in building regulations and eliminating cross-talk sound transfer between rooms.
- Reduces cross-contamination and transfer of smells through the ventilation system.

The ventilation Compliance Guidelines State:

- Ducts should be sized to minimise pressure loss and noise generation.
- The routing of ducts should minimise the number of bends required.
- Bends should have a minimum radius equal to the diameter of the duct.
- The need for privacy (acoustic separation) between rooms should be considered.
# Sizing duct runs

The tables below can be used to establish the number of duct runs required for any given flow rate based on the associated pressure drop (Pa).

**Example** - A 5m run requiring 1 x 90° bend with a flow rate of 20l/s would have a pressure drop of 78.5Pa if one 63mm duct is used and 17.5Pa if two 63mm ducts are used.

## Single 63mm duct

**Pressure Drop (Pa): Straight Run Single Duct**

<table>
<thead>
<tr>
<th>Flow rate l/s</th>
<th>2.5m</th>
<th>5m</th>
<th>10m</th>
<th>15m</th>
<th>20m</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>8.8</td>
<td>17.5</td>
<td>35.1</td>
<td>52.6</td>
<td>70.1</td>
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<tr>
<td>20</td>
<td>37.5</td>
<td>75.0</td>
<td>150.1</td>
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<td>30</td>
<td>87.8</td>
<td>175.7</td>
<td>–</td>
<td>–</td>
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</table>

**Pressure Drop (Pa): 1 x 90° Bend Single Duct**

<table>
<thead>
<tr>
<th>Flow rate l/s</th>
<th>2.5m</th>
<th>5m</th>
<th>10m</th>
<th>15m</th>
<th>20m</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>9.3</td>
<td>18.0</td>
<td>35.6</td>
<td>53.1</td>
<td>70.6</td>
</tr>
<tr>
<td>20</td>
<td>41.0</td>
<td>78.5</td>
<td>153.5</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>30</td>
<td>97.9</td>
<td>185.8</td>
<td>–</td>
<td>–</td>
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</tbody>
</table>

## Pair of 63mm ducts

**Pressure Drop (Pa): Straight Run 2 x Ducts**

<table>
<thead>
<tr>
<th>Flow rate l/s</th>
<th>2.5m</th>
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<th>10m</th>
<th>15m</th>
<th>20m</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2.1</td>
<td>4.1</td>
<td>8.2</td>
<td>12.3</td>
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<td>20</td>
<td>8.8</td>
<td>17.5</td>
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<td>52.6</td>
<td>70.1</td>
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<tr>
<td>30</td>
<td>20.6</td>
<td>41.0</td>
<td>82.1</td>
<td>123.1</td>
<td>164.2</td>
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<tr>
<td>40</td>
<td>37.5</td>
<td>75.0</td>
<td>150.1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>60</td>
<td>87.8</td>
<td>175.7</td>
<td>–</td>
<td>–</td>
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</tr>
</tbody>
</table>

**Pressure Drop (Pa): 1 x 90° Bend 2 x Ducts**

<table>
<thead>
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<th>Flow rate l/s</th>
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<td>40</td>
<td>41.0</td>
<td>78.6</td>
<td>153.5</td>
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<td>–</td>
</tr>
<tr>
<td>60</td>
<td>97.9</td>
<td>185.8</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

## Trio of 63mm ducts

**Pressure Drop (Pa): Straight Run 3 x Ducts**

<table>
<thead>
<tr>
<th>Flow rate l/s</th>
<th>2.5m</th>
<th>5m</th>
<th>10m</th>
<th>15m</th>
<th>20m</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.9</td>
<td>1.8</td>
<td>3.5</td>
<td>5.3</td>
<td>7.0</td>
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<tr>
<td>40</td>
<td>16.0</td>
<td>32.1</td>
<td>64.1</td>
<td>96.2</td>
<td>129.2</td>
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<td>60</td>
<td>37.5</td>
<td>75.0</td>
<td>150.1</td>
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<td>–</td>
</tr>
<tr>
<td>90</td>
<td>87.8</td>
<td>175.7</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

**Pressure Drop (Pa): 1 x 90° Bend 3 x Ducts**

<table>
<thead>
<tr>
<th>Flow rate l/s</th>
<th>2.5m</th>
<th>5m</th>
<th>10m</th>
<th>15m</th>
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</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.9</td>
<td>1.8</td>
<td>3.5</td>
<td>5.3</td>
<td>7.0</td>
</tr>
<tr>
<td>40</td>
<td>17.2</td>
<td>33.2</td>
<td>65.3</td>
<td>97.3</td>
<td>129.4</td>
</tr>
<tr>
<td>60</td>
<td>41.0</td>
<td>78.5</td>
<td>153.5</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>90</td>
<td>97.9</td>
<td>185.8</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Flexible Applications

A comprehensive range of manifolds and plenums allow radial ducting systems to be designed to fulfil any residential ventilation requirement from single flats, multiple occupancy dwellings and large luxury homes. Push and click hassle free installation enables installation time to be reduced by up to 66% compared to traditional ducting methods.

Good quality manifolds and plenums are:

- Used for supply and exhaust air
- Flexible and adaptable mounting applications
- Effortless but secure spigot connection
- Eurovent certified to fulfil air tightness class D
Supply and exhaust air

- Simple mounting clamps for semi-rigid duct can be colour coded for simple identification of supply and exhaust air
- Keeper straps provide added security for ceiling installations
- Can be linked together for mounting two or more ducts side by side

Supply or exhaust valves are required in habitable rooms and wet rooms.

**Good quality air valves are:**
- Easy to install to wall or ceiling
- Sound performance to ensure optimum sound levels
- Can be easily cleaned and maintained
- Adjustable for air flow balance
- Can be equipped with a blanking-off sector plate for 2 or 3 way airflow.
Design and function in perfect harmony

High performance air valves are available with an enhanced aesthetic to offer improved appearance for harmonised integration with interior design.

Shape, colour and finish of face plates can be customised to suit any design style.
A Quiet Solution

All elements of a residential ventilation system should be selected with noise levels in mind.

- Plenum chambers and distribution boxes assist in the attenuation and limit the distribution of mechanical noise.
- Low profile and easy to install silencers can be added to a design where extra attenuation is required.
- Semi-rigid ducting can have the equivalent or better noise break-out characteristics as industrial standard spiral ducting.

Full sound calculations are available.

<table>
<thead>
<tr>
<th>Reference</th>
<th>63Hz</th>
<th>125Hz</th>
<th>250Hz</th>
<th>500Hz</th>
<th>1KHz</th>
<th>2KHz</th>
<th>4KHz</th>
<th>8KHz</th>
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<tr>
<td>LFPE 63 1000</td>
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<td>LFPE 63 2000</td>
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<tr>
<td>LFPE 76 1000</td>
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<td>1</td>
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<td>0</td>
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<tr>
<td>LFPE 76 2000</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>
Fire Protection

Building regulations impose fire-stopping requirements on all services passing through fire compartment walls and floors.

**Intumescent fire sleeves and collars**
- Provide up to 2 hours resistance where ducts penetrate fire compartment walls and up to 4 hours resistance where ducts penetrate floors.
- Integral intumescent material rapidly expands in a fire situation to seal off the duct and limit the risk of fire spreading.
- Satisfy the requirements of Approval Document B of the Building Regulations.
- Tested to BSEN 1366-3: 2009.
- Tested to Type X durability – unaffected by weathering.

**Fire rated ceiling valves**
- Offer a fire rated solution where recessed ceiling valves are to be installed in fire-rated ceilings.
- Required in many residential properties including apartments, hotels and multiple occupancy buildings.
- Integral intumescent material rapidly expands in a fire situation to seal off the air valve and limit the risk of fire spreading.
- The intumescent material does not restrict airflow of the air valves in normal use.
- Satisfy the requirements of Approval Document B of the Building Regulations.
- Tested for 60 minutes of integrity according to BS EN 1365-2:1999 & BS476: Part 20: 1987.
Design Solutions

Typical design for 4 bedroom house
A complete ventilation partner

- Solutions for new and existing homes from energy-efficient luxury homes to cost-effective student accommodation or low-maintenance social housing developments.
- Independent fan specification
- Legislation and SAP advice
- Compliance with building regulations and planning conditions
- Selection software, system performance calculations and airflow and sound data
Outcomes

- Understand the benefits of MVHR
- Know requirements of a good heat recovery unit
- Appreciate how air flow impacts on SFP and energy efficiency
- Shown how to select and size ductwork
- Demonstrated how radial ducting simplifies building regulation compliance
- Discussed sound performance options
- Considered fire protection requirements
- Seen example design solutions
For more information contact Air Craft on 0800 0016123 or Email sales@acsouthern.com
www.acsouthern.com