How do we determine if we should we opt for round or rectangular section ventilation ducts in our MVHR system?

Round ductwork is generally the superior default choice because its circular shape provides the lowest air resistance, ensuring higher efficiency, lower energy use (SFP), and quieter operation, which complies with UK building regulations like Approved Documents F, L, and E. Rectangular ducts are a necessary compromise only when spatial constraints, such as shallow ceiling voids, prohibit round duct installation, despite their higher pressure drop and potential noise issues.

Round vs. Rectangular Duct for MVHR

Choosing the right duct shape for your Mechanical Ventilation with Heat Recovery (MVHR) system in the UK is far more critical than simply picking the one that fits. This decision represents a fundamental trade-off between **air delivery efficiency** (performance and running cost) and **spatial necessity**. For any professional designer, installer, or self-builder aiming for a compliant and high-performance system, a deep understanding of this dichotomy is essential.

Why Aerodynamics Favours the Circle

The primary function of MVHR ductwork is to move air with the absolute minimum of resistance. The round duct is the **undisputed champion of airflow efficiency**.

Imagine water flowing through a pipe. The smoother the flow, the less energy required to push it. This is precisely the principle at play. A round duct has a smaller internal surface area for a given volume compared to a rectangular duct, which minimises **frictional losses** (also known as pressure drop).

Key Performance Data

- **Specific Fan Power (SFP):** This metric, measured in $W/(l/s)$, is a key requirement of **Approved Document L (Conservation of Fuel and Power)** in the UK. It measures the fan power needed to move a volume of air. Lower is better. Round ducting inherently leads to a significantly lower SFP because the fan does not have to work as hard to overcome air resistance. This translates directly into lower electricity bills for the homeowner—a major selling point.

- **Air Turbulence:** Rectangular ducts introduce sharp corners. As air moves through these corners, it creates **turbulence** (eddies and vortices). This turbulence not only increases resistance but is a major source of airborne noise. Round ducts offer a continuous, smooth path, resulting in laminar flow and dramatically reduced turbulence and noise.

- **Airtightness: Approved Document F, Volume 1, Clause 1.81** emphasises the importance of airtight ductwork to prevent leakage, which wastes energy and compromises the system's effectiveness. Round ducts are typically fabricated with fewer longitudinal seams and use more reliable, easier-to-seal gasket fittings. Consequently, achieving the specified low leakage rates (often a maximum of 3% total leakage) is much simpler with a quality round system.

Characteristic	Round Ductwork	Rectangular Ductwork
Airflow Resistance	Lowest (Highest Efficiency)	Higher (Lower Efficiency)
Specific Fan Power (SFP)	Lower Running Costs	Higher Running Costs
Noise Generation	Quieter (Less Turbulence & Vibration)	Louder (More Turbulence & 'Drum Effect')
Airtightness	Excellent (Fewer Joints/Seams)	Moderate (More Joints, Harder to Seal)
Material Usage	Less Material for Equivalent Airflow	More Material for Equivalent Airflow

The Necessary Evil: When Rectangular Ducts Take Over

We must acknowledge that the British building stock, particularly in refurbishment and retrofit projects, often presents substantial **spatial constraints**. This is the single, overriding reason to opt for rectangular or flat channel ducts.

Dealing with Tight Spaces

- **Shallow Ceiling Voids:** In modern builds, particularly flats or properties with structural floor joists, the vertical space for services above a suspended ceiling is often severely limited. A rectangular duct, with its low-profile shape, can often fit where a round duct of equivalent capacity would not. This low-profile nature is the rectangular duct's main, and often only, functional advantage.

- **Aesthetic Integration:** Similarly, rectangular ducts are sometimes favoured for running within shallow wall cavities or chases, as they are easier to conceal and integrate seamlessly with the structure, thus impacting the architectural design less.

Mitigating Rectangular Duct Deficiencies

If the spatial issue dictates the use of rectangular ductwork, the designer must take proactive steps to minimise the resultant performance penalties. This process is about compromise, not parity.

Sizing and Velocity Control

Because rectangular ducts have higher resistance, maintaining an acceptable air velocity is paramount. High air velocity in any duct is a major source of noise. The Chartered Institution of Building Services Engineers (CIBSE) recommends air velocities in domestic ventilation systems should not exceed 3 m/s, and many acoustic experts suggest aiming for 2 m/s or less in sections supplying habitable rooms.

To compensate for the higher resistance of rectangular ducting, they must often be **oversized** compared to their round counterparts. For example, a rectangular duct with an **aspect ratio** (width-

to-height ratio) of $3:1$ has a hydraulic diameter considerably smaller than its dimensions suggest, leading to disproportionately high pressure loss. Therefore, specifying a wider, shallower duct, rather than a narrow, deep one, helps to reduce the aspect ratio and minimise the internal corners' impact.

Acoustic Management

The flat panels of rectangular ducts are much more susceptible to the "drum effect"—vibration and noise breakout—than the rigid cylindrical shape of round ducts. Consequently, a rectangular installation may require additional **acoustic consideration**, such as:

- **Thicker insulation** (acoustic lagging) to absorb breakout noise.
- **Specific, low-velocity design** (e.g., keeping velocity below 2 m/s in quiet areas).
- **Vibration isolators** at the MVHR unit and along duct runs to prevent structure-borne noise transmission.

The UK Regulatory Environment

It is important to remember that Approved Document F (Ventilation) does **not** mandate a specific duct shape. However, the performance requirements set out in the other documents effectively steer the market towards the most efficient solution:

- **AD L (Energy Efficiency):** Demands a low SFP, which is best achieved with low-resistance, round ductwork.
- **AD E (Acoustics):** Requires systems to operate quietly to prevent undue noise in habitable rooms, which is more readily achieved by the quieter operation of round ducts.

Ultimately, while rectangular ducts solve a pressing architectural problem, they create a demanding engineering challenge. They force the MVHR unit to work harder, increasing energy use and noise, thereby placing the system under greater scrutiny against the benchmarks set by the UK Building Regulations.

By prioritising high-quality, round ductwork wherever architecturally feasible, you ensure your MVHR system delivers maximum efficiency and comfort, resulting in lower running costs and a quieter home.