

Technical Guide TG2010.25

Plenum Duct Design and Installation Instructions

Introduction

Many Invisible.AC installers are using both Fibreboard and metal duct successfully for the main trunk line (plenum). This Technical Guide describes the best methods for using both rectangular and round types of duct.

Duct Size

Round metal duct is used for some systems and is effective because its stiffness make it an effective attenuator of low-frequency breakout noise.

Equally, stiff fibreboard rectangular duct is effective against breakout noise. If metal rectangular duct is used, it is recommended that it be of the heaviest practical gauge in order to avoid 'drumming' resonances. Invisible.AC provides plenum adapters for both fibreboard and metal ducts.

The recommended cross-section of the plenum duct depends on its length and of course on the airflow requirement. In most cases, where the plenum duct length is less than 40m, the plenum will be between 160 mm and 200mm diameter, or, if rectangular, at least 160mm x 160mm. Rectangular fibreboard of internal dimensions 250mm x 100mm is a popular choice.

In certain instances a larger duct cross-sectional area will be needed. Specifically, a larger duct is necessary for air handlers rated at 14kW or over before any splitting of the flow or if the plenum length is more than 40m.

Table 1 lists the maximum recommended airflow for various round and rectangular duct sizes. For rectangular duct sizes, the duct is sized for equivalent flow resistance. Where flow is split, it is acceptable to reduce the duct size immediately after the tee. Invisible.AC has available appropriate reducer tees.

Note: In terms of pressure drop, an elbow is equivalent to 5m and a tee equivalent to 9m of straight duct.

Installation

The duct must be designed for 1000Pa internal pressure. It can be fibreboard, spiral metal, seamless, or snap lock metal. Fibreboard duct is normally of 25mm wall thickness. In the case of sheet metal a thickness of at least 0.5mm is commended in order to retain sufficient strength after the branch mini-duct holes are cut.

Table 1. Recommended Plenum Duct Sizes

Round Diameter mm	Rectangular Equivalent mm	Maximum Airflow l/s
180	250 x 100 170 x 170	300
200	400 x 100 190 x 190	400
250	600 x 100 240 x 240	550
315	350 x 200 280 x 280	700
400	600 x 200 350 x 350	850

Sealing

It is extremely important to seal all duct seams and joints, including any longitudinal snap-lock seams. The method of sealing should follow the ASHRAE Handbook-HVAC Systems and Equipment.

Insulation

The Invisible.AC systems are designed to produce a greater temperature drop across the heat exchanger than a conventional system. To prevent condensation or excessive duct losses to the surrounding air, wrap the duct with at least 40mm of fibreglass blanket insulation or insulation sleeve. The insulation must include an outer vapour seal.

When building regulations are specific about insulation R-factor, it may be necessary to use thicker insulation. All vapour seal joints must be effectively sealed with aluminium tape. If the duct is hung with straps, use a rigid insulation material under the duct where it is supported. This will avoid 'short circuits' in thermal conductivity and ensure that the duct is fully insulated.

Use of Metal or Fibreboard Return Air Duct

If the return air duct is made of metal or fibreboard, always add an acoustically absorbent lining of at least 50mm thickness to the inside of the duct. Allow for the lining thickness when calculating the effective duct cross-section. This acoustical lining is in addition to, not instead of, the outer wrapped insulation. The return air duct should be sealed at the seams and be designed for a negative static pressure of at least 125Pa.

High frequency noise emission from the return air grille is improved by approximately 6dB if a 90 degree bend can be introduced into the return air duct.

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