

## Basic Installation Guide November 2016

This instruction is a summary of the basic rules and applies to most Invisible.AC applications.

The Invisible.AC System is a pressure-duct based technology and operates on a design airflow of 36l/s per kW [UK applications assume a 27/19.5C (50% RH) air-on temperature] using our proprietary 66mm diameter acoustic mini-duct.

**Jet Outlets** – the allowable airflow range per outlet is 15l/s to 30l/s. Target design airflow per outlet is 22.5l/s – giving an air-rush noise for an average room type of NR30 [much quieter designs are possible using more outlets with a lower air-jet velocity]. Example – say to achieve say 30l/s airflow at the outlet the measured figure [using a Davies Turbo-meter hard against the universal connector] is 9m/s [or this device 17.5 knots]. This equates to say a reading of 4.5m/s on a foam slotted outlet and 3.8m/s with the Turbo-meter held hard against the centre of the 25mm slot.

**Mini-duct** – this comes in standard 3.5m lengths. Older North American technology generally had all outlets with the same standard length of duct to provide similar outlet velocity at each outlet. With the Invisible.AC 1m silencer /damper component the velocity [air-flow] can be adjusted – so mini-ducts can be much shorter in length [e.g. damper adjusted 35deg off of fully open makes this 1m duct equivalent to a 3.5m standard mini-duct].

**10% Rule** – for mini-ducts longer than 3.5 meters the air is reduced in that run by 10% for every 1.5 meter over the 3.5 meters. For example, an 9.5 meter mini-duct run is equivalent to 60% of a standard outlet that is 3.5meters long - yielding a reduction of 40% in air-flow ( $9.5 - 3.5 = 6.0$ ,  $6.0 \div 1.5 = 4$ ,  $4 \times 10 = 40\%$ ). *Example:* if you required 3kW total cooling in one particular room; you would normally need  $3 \times 36 = 108$ l/s of air delivered into the room. If 3.5m standard mini-duct lengths are used you need  $108/22.5 = 4.8$ [5] outlets. If the room was some distance away and had 9.5 meter duct runs you would need 40% more outlets,  $5/0.6 = 8$  outlets to deliver that same 3kW duty!

**Consider Traffic Patterns** – locate outlets out of traffic pattern. A corner, 130 mm from each wall is a good location as are ceilings along walls avoiding open doorways. With say the 30l/s airflow the outlet normally pulls-in air from a 4 meter radius. Consider round floor outlets [with screens] for systems located in basements. Our 25mm slotted outlets can be used in walls, ceilings and floors – 130mm off – these fit in smaller voids [no mini-duct bending is needed].

**Allow for Aspiration** – locate outlets so the air stream does not impinge on any objects or people – at least 1m away. Our standard outlets have a directional nozzle as standard – that can be useful.

**Minimize Length, Minimize Restriction** – generally keep the mini-duct length as standard close to 3.5m or use the 1 meter silencer /damper as a minimum. Use the fewest number of bends as possible. Maximize the radius of any bends making sure the bend in the mini-duct near the outlet is at least 150mm. If not possible use slotted outlets.

## Plenum

### Maximize Length, Minimize Restriction

– run plenum duct as long as possible; it is better to lengthen the plenum if you can shorten even two outlet runs. Use full-flow tees and full flow elbows. The maximum total plenum length is nominally 45 meters; consider the first tee equal to 9 meters and elbows equal to 4.5 meters.

**60/40 Rule** – when using a tee split the flow as close to 50/50 as possible – no more than 60/40. Always use a full-flow – in metal spiral or fibreboard [see Tech Guide TG2010.25].

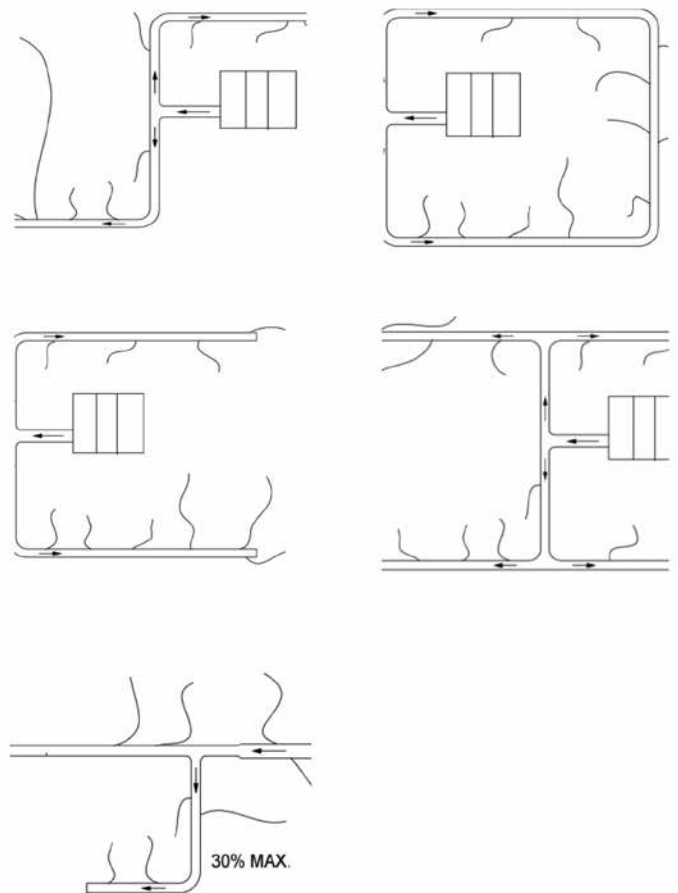
**70/30 Rule** – turn the tee 90° to make a side branch with no more than 30 percent of the air. A guide is 70% of the air will go straight on!

**600mm Rule** – use at least 600mm of straight plenum before any fitting, such as an elbow, tee, or takeoff. Keep outlets 600mm away from any elbow or 'T', etc.

**Space Takeoffs Evenly** – maintain distance between takeoffs as evenly as possible. Space the takeoffs at least 300mm apart and 600mm from end cap.

### Plenum patterns – suggested layouts:

Below are the most typical layouts for ductwork



## Sound

**Acoustic Mini-Duct** – always use acoustic mini-duct of at least 1 meter at the end of each run. You can use any duct of say 70mm diameter prior to that or you can use acoustic mini-duct for the entire run. The Invisible.AC 1 meter silencer /damper component is the best most flexible option.

**Return Air Duct Attenuation** – use Invisible.AC acoustic Return Air Duct, duct-board, or sheet metal with acoustical duct liner. Never use flex duct with a solid plastic liner.

**Isolation** – isolate the air handler with foam rubber strips under the unit. Either hang the unit on anti-vibration hangers from the structure using angle iron framework under unit (do not hang directly with hooks in the cabinet) or set on a platform.

## Piping

**Secondary Drain Pan** – always use a secondary drain pan wherever overflow of condensate can cause water damage. Do not trap secondary drain line or connect to primary drainpipe. Place secondary drain line exit so that it is apparent when being used. For example, pipe the drain line so it drips on an outdoor windowsill and causes splashing to be noticed.

**Primary Drain** – always trap primary drain line and run drain line per local plumbing codes. See detail for deep trap needed because of the systems high static pressure.

**Check Total System Airflow** – check the airflow at each outlet with a Turbo-meter centred over the outlet. Add up the l/s for all outlets – it should not differ by +/- 5% from the design airflow.

## Start Up

### DO THIS BEFORE BOXING-IN THE DUCT WORK

**Check Static Pressure (Optional)** – measure the external static pressure in plenum 600mm from unit and before any fittings. Set as close as possible to 370Pa] or less, but no less than 220Pa or greater than 500Pa.

**Check for Full Flow** – inspect each outlet for full flow – it should be approximately 22.5L/s per outlet. Investigate for blockage or kinks if flow is insufficient.

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**UK**  
**IBD Distribution**  
T +44 1202 825682  
F +44 1202 813307  
www.ibd-distribution.com

**Spain**  
**Invisible.AC**  
T +34 693 795 953  
E terryp@invisible.ac  
www.invisible.ac/spain

**India**  
**Savitru Aircon Pvt.Ltd**  
T +91 22 2421 6755  
F +91 22 2438 4555  
E bhushanm@invisible.ac  
www.invisible.ac/india

**Oceania**  
**Invisible.AC**  
T +64 9889 8312  
E oceanasales@invisible.ac  
www.invisible.ac/oceania

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