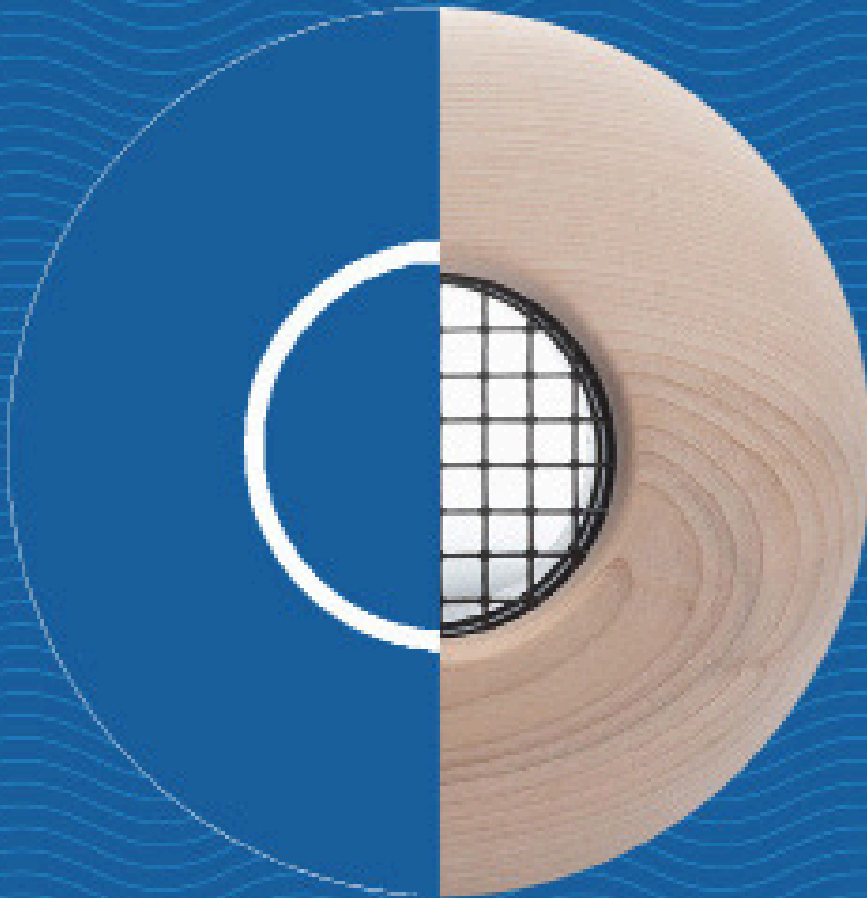


The Unico System[®]

Small-Duct High-Velocity Heating and Cooling

INSTALLATION REFERENCE MANUAL FOR AIR DISTRIBUTION SYSTEMS



• Notice to Installer & Equipment Owner | Retain This Manual at the Jobsite

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The following reference manual is to help save time on site, provide the best possible installation, and ensure continuous trouble-free operation. All Unico System components are factory-made so that they can be assembled on the job as described in this manual.

NOTE:

This reference manual describes only the installation of the duct components. Details for wiring, piping, refrigerant line connections and condensate drains are covered in the installation instructions for the specific models and accessories available at https://www.unicosystem.com/literature_media_categories/technical_manuals/or through your authorized Unico System distributor. This installation manual also refers to other Unico bulletins, manuals, and publications available through the factory or your authorized distributor.

This reference manual does not cover the necessary load calculations required before the installation of any HVAC system and assumes these calculations and proper system sizing have already been performed. For help with load calculations or sizing please visit <https://www.unicosystem.com/> or contact your authorized Unico System distributor.

SAFETY INFORMATION

Do not attempt to install or start up the system without first reading and understanding this reference manual and the appropriate wiring and commissioning manual for the chosen air-handling unit.

CAUTION

Before first operation, be sure the unit is properly earthed. The installation should be in accordance with all local codes and regulations, including all electrical wiring and condensate piping. Always install a secondary drain pan when an overflow of condensate could cause damage.

GENERAL

The Unico System® is a Small Duct High Velocity central air distribution system. In most cases this system is part of a larger system with a variety of heat and cooling sources. The installer is responsible for ensuring the installation is designed and installed in accordance with the regulations for the region it is being installed. Failure to comply with the applicable regulations and installation instruction may invalidate the warranty of this product. For technical support for this product contact **Bell Plumbing Supplies Ltd: Unico@bellplumbing.co.uk** or **01384 422094**

MCS Standards MIS 3005-D, MIS 3005-I

Electrical Standards BS 7671 18th Edition

Building Regulations Part L Dwellings, 2021 edits incorporating 2023 amendments

Building Regulations Part L Dwellings, BS7593:2019 heating system treatments and protection

Building Regulations Part L Buildings other than Dwellings, 2021 edits incorporating 2023 amendments

Building Regulations Part F Vol 1 applies to Dwellings; 2010, incorporating amendments 2022

Building Regulations Part F Vol 2 applies to buildings other than Dwellings; 2010, incorporating amendments 2022

Water and waste systems ISO 24510, Iso 24511, ISO 24512

SCOPE

The installation reference manual provides the specification data and the installation instructions for all of the components, ducts, accessories, and external system components such as heat pumps. You will need the following:

TOOLS REQUIRED

- Reciprocating saw with blades to cut joist, studs, and drywall.
- Hole saw, carbide-tip for plaster-and-lathe walls/ceilings
- Hole saw, wood for hardwood flooring

<i>Size:</i>	<i>Where used:</i>
90 mm	50 mm outlet in wood floor
100 mm	50 mm outlet in ceiling or wall
	63 mm outlet in wood floor
115 mm	63 mm outlet in ceiling or wall

- Use a specific hole cutter with debris cup when cutting into ceilings
- UPC-54 Clamp pliers for duct clamps
- Current meter with low scale (less than 10 amps)
- Turbometer* air velocity meter

If using fiberglass plenum:

- UPC-55 2-inch (51 mm) hole cutter
- UL-181A-H heat sealed aluminum foil tape or UL-181A-P pressure sensitive foil tape
- Iron for heat sealable tape

If using metal plenum:

- Hole saw, metal
- 50 mm ducts: 51 mm
- 63 mm ducts: 63 mm
- Tin snips
- UL-181A-M duct mastic or UL-181A-P (Unico P/N: A00207-001) pressure sensitive foil tape

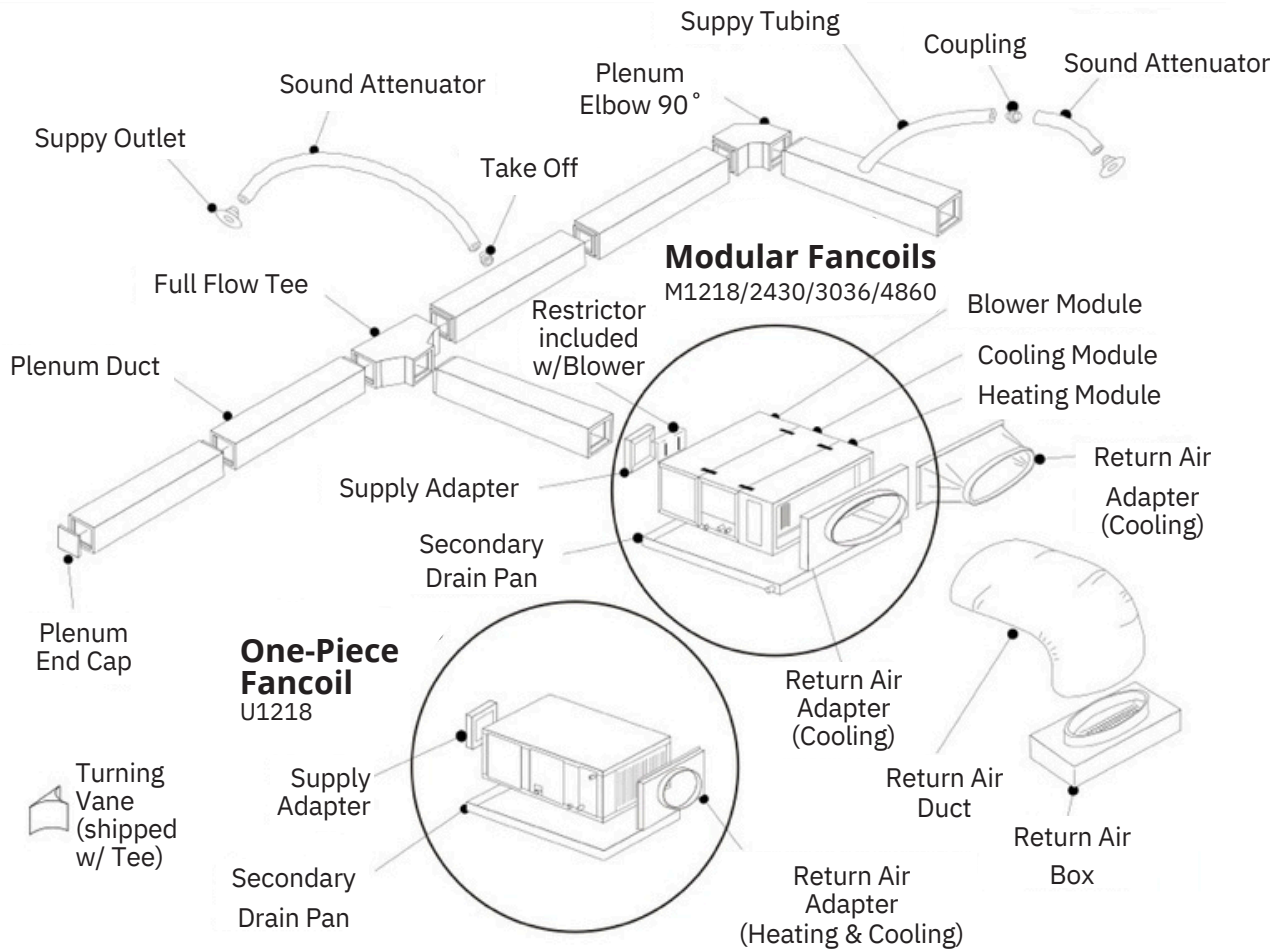


Figure 1. Air Distribution System Components (fiberglass duct board plenum shown)

General:

The Unico System can be installed in loft/roof or ceiling voids, basements/underfloor spaces, or laterally in adjoining utility areas. Unico System air handlers can be installed in vertical as well as horizontal configurations. These instructions are primarily oriented to horizontal installations (as shown in Figure 1) but, where appropriate, reference will be made to other possibilities.

Note: Where possible the air handler and air distribution system should be located in the conditioned space to reduce energy loss that can result in non-conditioned areas, such as loft spaces, garages, or unheated utility rooms.

Step-By-Step-Overview

NOTE: The following procedure is a general guideline describing the most popular installation sequence. It is not required to proceed in the same order; however, each step must still be performed.

- Step 1: Design & Site Preparation**
Produce layout drawing of duct design showing approximate location of all outlets, the air handler, the return openings, and a layout of the supply plenum and return duct
- Step 2: Supply & Return Openings**
Locate and cut the openings for the return air system and supply outlets
- Step 3: Supply Air – Branch Ducts**
Install the branch ducts
- Step 4: Supply Air – Outlets**
Install the outlets and mount to floor, ceiling, or wall
- Step 5: AHU Location**
Mount the air handler
- Step 6: Supply Air – Plenum**
Install supply plenum
- Step 7: Supply Air – Duct Connections**
Connect branch ducts to plenum
- Step 8: Return Air**
Install return grille and return duct
- Step 9: Wiring**
Connect air handler to electrical power
- Step 10: Testing**
Test airflow
- Step 11: Indoor to Outdoor Connection**
Connect refrigerant lines and charge
- Step 12: Paperwork**
Fill out service report form and register unit for warranty

Step 1: Design & Site Preparation

The design layout drawing is an important part of your tool kit when installing the system. Once you can confirm your air handler, supply plenum, supply outlets and return plenum can be safely and correctly installed, then prepare the site for work.

Move any furniture or other items away from construction areas and cover all surfaces or contents that may be damaged by debris with an appropriate tarpaulin or ground cloth.

It is recommended that good lighting and a fan be provided when working in poorly ventilated loft or crawl areas. The fan can be set over the return air opening and used to force cooler air into the area during installation.

For loft and crawl space installations many installers find it practical and easier to use “working boards” laid over the open joists or on the ground. These are 330 mm wide plywood sheets 2.7 m long.

Step 2: Supply & Return Openings

RETURN OPENING

Table 3. Return Air Filter-Grille

Model	Return Air Box Part No.	Opening Size (mm)
1218	UPC-01-1218	365 x 520
2430	UPC-01-2430	365 x 648
3036	UPC-01-3036	365 x 775
3642	UPC-01-3642	365 x 775
4860	UPC-01-4860 UPC-01-4860NC	619 x 775 517 x 775

Cut the opening for the return air box in accordance with the dimensions of Table 3. By doing this first it provides an opening to move equipment and components into the attic when other access is not sufficient.

OUTLET OPENINGS

Determining Number & Locations of Outlets

Table 2. Unico System Sound Level Recommendations

Sound Level	Approx. dB(A) [†]	2-inch (50 mm)		2.5-inch (63mm)		Recommended Application
		CFM	Outlet/Ton*	CFM	Outlet/Ton*	
Ultra Low	25	14	18	17	14	Multimedia Rooms
Very Low	27	19	13	23	11	Rooms with Hard Surfaces (wood or concrete floors and walls)
Low**	29	30	8	36	7	Rooms with carpet, Drapes, Furniture
Normal	32	40	6	50	5	Large Rooms or Where sound is not critical (min. number of outlets)
Excessive	35	50+	5	60+	4	Industrial Environments

[†] dB(A) is A-weighted Sound Pressure level measured 3ft (1m) from outlet in a reverberant room 20 x 30 ft.

* Outlets/Ton is based on rated airflow of 250 CFM per nominal cooling ton

** Recommended

NOTE: The actual sound levels measured in a room will vary depending on how the duct was installed (bends, wrinkles, outlet design) and the room environment (carpeted, draperies, etc.) Also, the overall sound in the room depends on the number of outlets in that room.

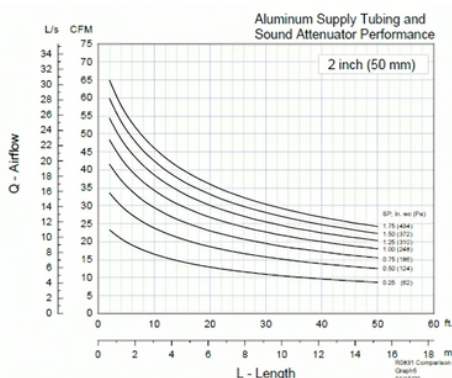


Figure 7. Variation in airflow along length of 2-inch duct at multiple static pressures

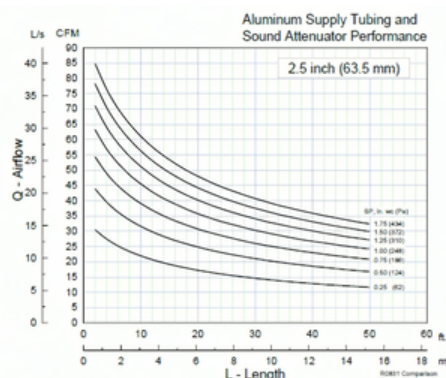
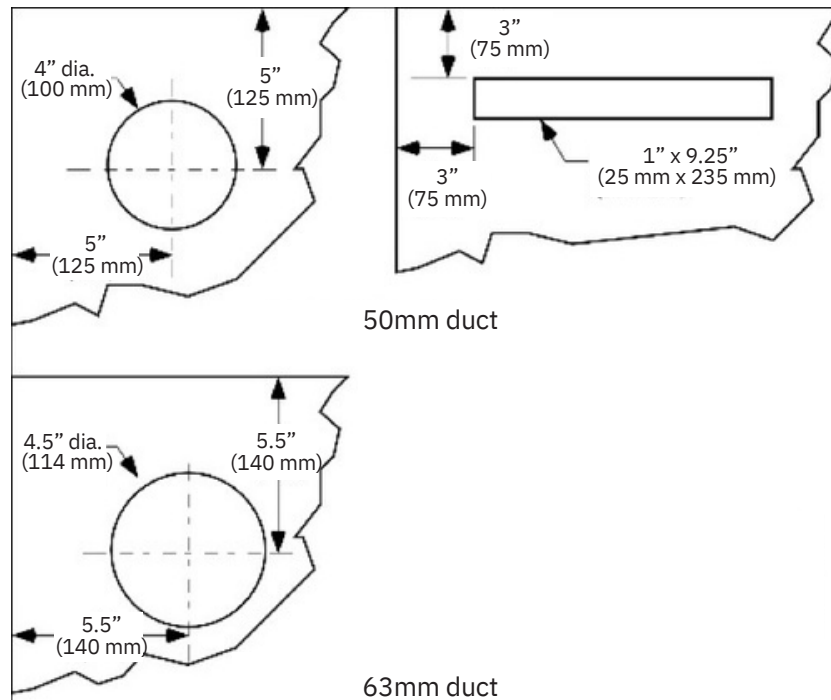


Figure 8. Variation in airflow along length of 2.5-inch duct at multiple static pressures

Figure 4. Location of Corner Outlets



Supply outlet locations should be pre-determined in accordance with the prepared layout following Bulletin 40-030: Component Layout.

The outlets can be placed in the ceiling, floor, or wall. The best place for ceiling outlets is the corner (Figure 4). If that is not possible or practical, anywhere out of the room or area's traffic pattern is acceptable.

After the location of the outlet is determined, a hole must be cut to accept the supply tubing and terminating outlet.

For side wall outlets, position the outlet above head height as near to the ceiling as possible. The standard round supply outlet cannot be installed in a stud wall as there is insufficient room to bend the sound attenuating tubing. For such installations use the 90° slotted outlet.

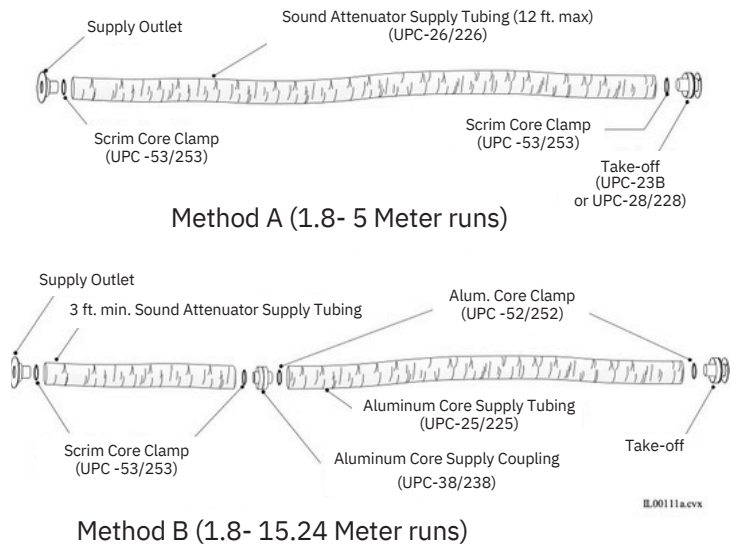
Only if there is room for an inside bend radius equal to 152mm or greater, should you use a round outlet. For example, a soffit above a kitchen cabinet or space above closet doors usually has enough room behind the wall for a proper bend radius. If the bend is too sharp, the outlet will likely be noisy.

Step 3: Air Supply — Branch Ducts

All branch runs are 50mm or 63mm in diameter. There are two types of branch ducts: sound attenuator and aluminium supply tubing. Branch runs must include a minimum of 1 m of sound attenuator at termination to maintain proper sound levels.

For maximum noise reduction, the entire duct run can be made from the sound attenuator. The ducts are available with four different insulation thicknesses to achieve higher R-factor ratings: R- 3.3 (standard), R- 4.2, R-6, and R-8.

Figure 2. Branch (Supply) Duct Assembly



The entire branch duct can consist of sound attenuator (method A, Figure 2) or with 1 m of sound attenuator and the remainder aluminium supply tubing (method B, Figure 2). For branch runs over 5 m long, method B is recommended because the aluminium duct is stronger than the sound attenuator and long runs typically are handled more roughly. All the items necessary for branch construction, including plenum connections and terminations, are listed in Table 4.

Note: For proper acoustical attenuation, always use a minimum of 1 m of sound attenuator supply tubing at the end of each run.

Table 3. Return Air Filter-Grille

Part No.	Description
UPC-26Cxx-6	Sound Attenuator Tubing, 3.6 m lengths
UPC-26Dxx-6	Double Vapor Barrier Sound Attenuator Tubing, 3.6m lengths
UPC-25xx-4	Aluminium Supply Tubing, 7.3 m lengths
UPC-80Fxx-1	Outlet Kit (for fiberglass plenum), 3.6 m sound attenuator with outlet and take-off
UPC-80Mxx-1	Outlet Kit (for metal plenum), 3.6 m sound attenuator with outlet and take-off
UPC-89F-6	Installation Kit (for fiberglass plenum), 6 outlets, includes take-offs, clamps, and couplings 63 mm duct
UPC-226Cxx-5	Sound Attenuator Tubing, 3.6 m lengths
UPC-226Dxx-5	Double Vapor Barrier Sound Attenuator Tubing, 3.6 m lengths
Double Vapor Barrier Sound Attenuator Tubing, 3.6 m lengths	Aluminium Supply Tubing, 7.3 m lengths
UPC-280Mxx-1	Outlet Kit (for metal plenum), 3.6 m sound attenuator with outlet and take-off
UPC-289M-5	Installation Kit (for metal plenum), 5 outlets, includes take-offs, clamps, and couplings

xx – indicates optional R-factor, R4/R6/R8

All the necessary items to make a 5 m branch from the plenum to the supply outlet are available in the single outlet kits. For lengths greater than 5 m, the 50mm aluminium supply tubing must be ordered separately. The materials are also available in bulk packaging with the outlets and hardware sold as an Installation Kit and the sound attenuator sold separately.

DUCT PENETRATION BETWEEN FLOORS

Whenever you penetrate a floor with the ducts, special care must be taken to assure that the installation complies with local building codes. There are several different methods of installation, depending on the application.

BRANCH DUCT INSTALLATION

Feed the assembled branch duct runs through the outlet openings you've already cut and leave the connecting ends near where you will place the plenum layout. Be sure to leave enough supply duct exposed so that you may connect the terminating outlets later. Follow these steps as you feed the supply ducting:

1. Use as few bends as possible.
2. If bends are necessary, provide as generous a bend radius as possible. The minimum radius is 152mm.
3. Support the supply tubing every 1.2m.
4. Be careful not to tear or puncture the supply tubing outer jacket.

FOR NEW BUILD APPLICATIONS (ROUND OUTLETS)

Reference document [Datasheet 20-080.002](#)

The Unico System plaster frame kit (UPC-86/286) is designed for new construction or wherever the ductwork is installed prior to installation of drywall/plaster board.

It can serve as a positive locator for cutting the outlet hole and can support the outlet in a plaster ceiling.

The plaster frame is designed to fit between ceiling joists. The plaster frame uses nail-less captive hanger bars adjustable between 250 to 610-mm.

ASSEMBLY

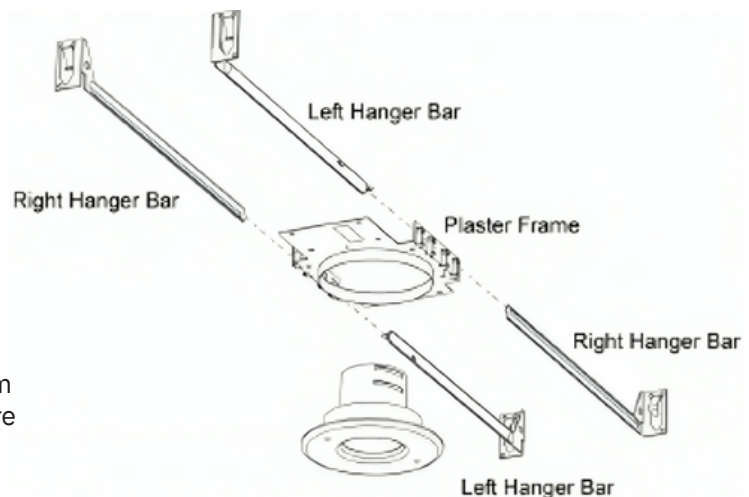
1. Insert the left hanger bar (with tabs) into the slots of the plaster frame.
2. Slide the bar as far as it goes then snap the tabs through the slot of the right hanger bar.
3. Complete the same procedure for the other side.

[This configuration can be adjusted between 360 – 610mm](#)

INSTALLATION

Determine where the outlet will be placed. The center of the outlet should be as close as possible (120-mm) from any internal or external wall, out of the way of traffic patterns.

1. Position the plaster frame assembly so that the bottom of the plate will be flush with the ceiling.
 - a. For wood joists hammer the hanger bar nails to mount the assembly.
 - b. Screws may also be used if necessary.
2. Slide the plaster frame on the hanger bars to the proper position then bend the centre tabs with pliers to lock the frame in place.
3. New build construction usually requires the plenum system and tubing runs to the outlet locations to be installed before the drywall/plaster board is installed.
 - a. If necessary, remove the terminal from the attenuator assembly.
 - b. Connect the attenuator to aluminium supply tubing if extended length is needed.



4. Connect the duct to the plenum. Run the duct so the attenuator protrudes through the plaster frame with enough slack, approx. 150-mm, to connect the terminator.
5. When the ceiling is finished, connect the terminal, push the excess tubing into the hole, and secure the terminal with the toggle screws.
6. If the plenum is accessible, the supply tubing may be left unconnected until after the terminal is mounted in the ceiling.
 - a. In this case, pull the tubing to take up the slack and remove any excess tubing.
 - b. Likewise, the entire attenuator with terminator attached may be left unconnected until the ceiling is finished. Just connect the attenuator to the aluminium supply tubing and pull the duct up into the ceiling.
 - c. Then secure the terminator with the toggle screws, remove any excess tubing at the plenum, and connect to the plenum take-off.

FOR NEW BUILD APPLICATIONS (SLOTTED OUTLETS)

For new build applications (Slotted Outlets)

The Unico System 90° slotted outlets (UPC-66 and UPC-67TA) are specially designed to quietly turn the air inside a typical wood frame stud wall cavity. The 90° outlets are particularly useful where there is insufficient room to provide the minimum sound attenuator bend radius. Other applications for the 90° outlet include placement near the perimeter of a low-pitched roof, and in applications with only a small cavity between a dropped ceiling and the roof.

ASSEMBLY

The Unico System, Twist-Fit System straight slotted outlet (UPC-68T) with its contour shape is designed for use where placement of the standard round outlet is not practical. The straight slotted outlets are useful where there is insufficient room for a round outlet at the desired termination point. A typical application for the straight slotted outlet would be placement in a cabinet soffit. The UPC-68T is made of plastic and is intended for residential use. Both the 90° and straight slotted outlets may also be used as ceiling outlets

INSTALLATION

For wall installations the slotted outlet should be located high on the wall above head height and a minimum of 130-mm) below the ceiling. For ceiling installations locate it a minimum of 100-mm) away from the adjacent wall.

New build installations

1. Mount the outlet between the joists with the tip of the outlet protruding 12 mm beyond the joists.
1. Cut an opening large enough to fit the outlet from either the front or backside of the wall. The minimum size opening for the 90° outlets is 125 - 240 mm.
2. The minimum size opening for the straight outlet is 89 - 240 mm. You will need to cut a larger opening to use the mounting brackets for both types of outlets.
3. Position the hanger rails so the outlet discharge will be square with the dry wall once it is installed. For certain UPC-68T installations, support for the duct may be necessary by suspending the duct by a support.
4. Position the supporting wire near the connection of the duct and outlet making sure the wire does not kink the duct.
5. Expand the hanger rails to reach the studs and nail securely so the mounting plate will be flush with the backside of the dry wall when it is installed. The UPC-66 and UPC- 67TA tend to swing out at the bottom. Use the second set of hanger rails to act as a stop at the location of the tape ring.
6. Position the hanger rails so the outlet discharge will be square with the dry wall once it is installed. For certain UPC-68T installations, support for the duct may be necessary by suspending the duct by a support wire as shown in Figure 4.
7. Position the wire near the connection of the duct and outlet making sure the wire does not kink the duct.

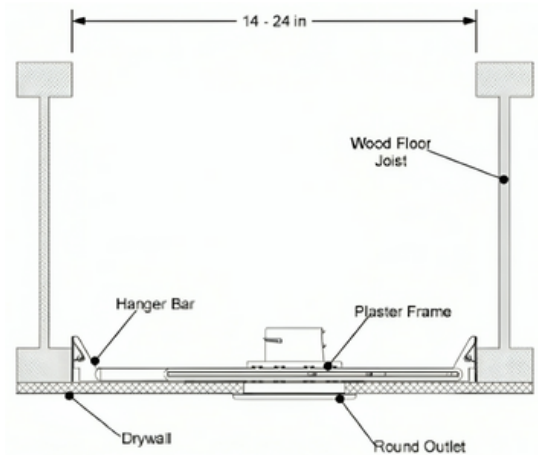
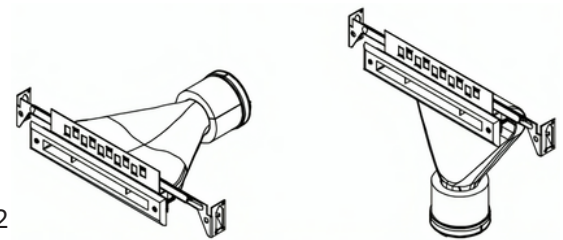
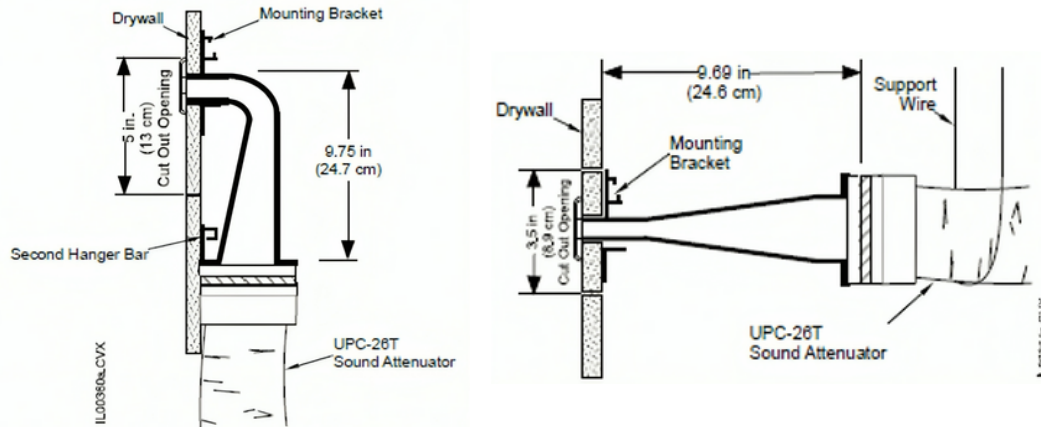


Figure 1. Typical Installation



SPECIAL INSTRUCTIONS FOR HUMID CONDITIONS:

Anytime the outlets are in a humid space, be sure to wrap the exterior of the outlet with at least 25-mm of additional insulation or use a polyurethane foam spray equivalent to an R-4. The UPC-66 should not be used in areas of high humidity. As an option to the UPC-66, the UPC-67TA is recommended for use in humid spaces with the additional R-4 equivalent insulation.



UPC-67TA Alternative Mounting Instructions: As an alternative to the supplied mounting bracket, the UPC-67TA is light enough to secure to any cross member or stringer using sheet metal screws. Metal duct drives can also be used to hold the outlet in place. Installing the Trim Plate: Once the outlet and ducting are in place, hang the interior wall, cutting a rectangular hole for the tip of the outlet to protrude. The size of the hole is different for the UPC-66 and UPC-67TA/68T because they have different trim plates. The size of hole to cut for each outlet is listed in Table 1. The UPC-66 trim plate fits around the tip of the outlet, whereas the UPC-67TA and UPC-68T trim plates fit inside of the outlet.

Table 1. Rough-In Hole Size

Model	Rough-In Size of Slot
UPC-66	1.25 x 9.25 inches (30 x 235mm)
UPC-67TA	1.00 x 9.25 inches (25 x 235mm)
UPC-68T	1.00 x 9.25 inches (25 x 235mm)

The UPC-66 is supplied with a removable cardboard ring you can use as a spacer to maintain the correct clearance for the trim plate when you patch the wall.

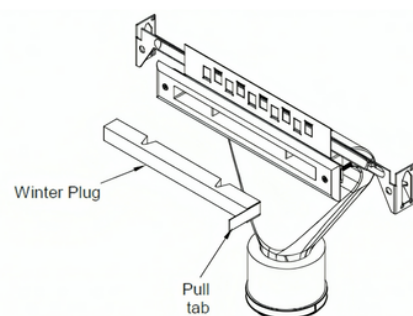
No extra clearance is required for the UPC-67TA or the UPC- 68T. Leave the Styrofoam plug in place while patching the wall to maintain the shape of the outlet. The trim plate mounting fixings are supplied with the outlet.

The UPC-66 includes two screws and the UPC- 67TA and UPC-68T include two screws and toggles. When installed properly, the trim plate and the outlet mounting plate will sandwich the wall. Once installed, you can paint the trim plate if desired.

Figures 3 and 4 show typical wall installations. Insert one of the hanger rails in the slotted channel on the backside of the mounting plate.

WINTER PLUG:

A winter plug is provided in the kit and comes pre-installed in the faceplate of the outlet. Pull the tab located on one end to remove the plug from the faceplate. If necessary, during winter months, insert the plug into the slot of the faceplate.



Step 4: Air Supply — Outlets

The branch ducts terminate with either a round or rectangular outlet. The outlets come in a variety of colours and finishes, including several species of wood, unfinished. The round outlets are usually the best choice for floor or ceiling outlets. The rectangular outlets are ideal for in wall applications and are designed for standard 2 x 4 construction. The rectangular or 'slotted' outlets are available in both cast aluminium and plastic. In addition, Unico makes an angled round outlet designed for sloped ceilings. For applications without branch ducts use the plenum slotted outlets (part number UPC-101).

For certain applications where it is desired to attach the outlet as close as possible to the plenum, 305mm rigid sound attenuator is available. These attenuators are available in kits. Use kit UPC-84-5 for fiberglass plenum and kit UPC-85-5 for sheet metal plenum. The kits include all the necessary components to complete an outlet branch run. These kits are well-suited for masonry or concrete structures with no ceiling joists or crawl spaces. They can also be used for under-slab installations. See Bulletin 20-060: Rigid Sound Attenuator for installation details.

For exposed duct applications, use the UPC-101 slot outlet attached directly to the plenum. This is acceptable as long as 2 outlets per nominal kW are used and the plenum is acoustically lined or made of fiberglass duct board.

CONNECTING THE BRANCH DUCT TO AN OUTLET

Follow these steps to connect the duct to an outlet:

1. Pull back the jacket and insulation about 50 mm to expose the inner core.
2. Slip the core over the connection stub of the outlet as far as you can. Then secure with the clamp using clamp pliers (UPC-54). Use the UPC-53B clamp for clamping the sound attenuator core and the UPC-52 clamp for clamping the aluminium core.
3. Pull the insulation and outer jacket over the core and stub and stuff under the tape ring. Secure the outer jacket with UL181A-P aluminium tape.

CONNECTING R-6 OR R-8 BRANCH DUCT TO AN OUTLET

The R-6 and R-8 ducts require special installation instructions because the duct is too large to pass through a 100mm hole. To properly install these outlets, you will need access to both sides of the wall.

These ducts have two layers of insulation and two vapor barriers. Simply peel back the outermost vapor barrier and layer of insulation, exposing the inner vapor barrier. The inner layer is the same thickness as the R-4.2 and will pass through the 100mm hole. Then clamp the inner duct and seal it the same as any standard or R-4.2 duct. Push the outlet into place and secure it to the ceiling or wall with the toggles.

From the backside of the wall unroll or unpeel the outer insulation and vapor barrier to its previous position. Then tape any seams with UL-181A-P tape.

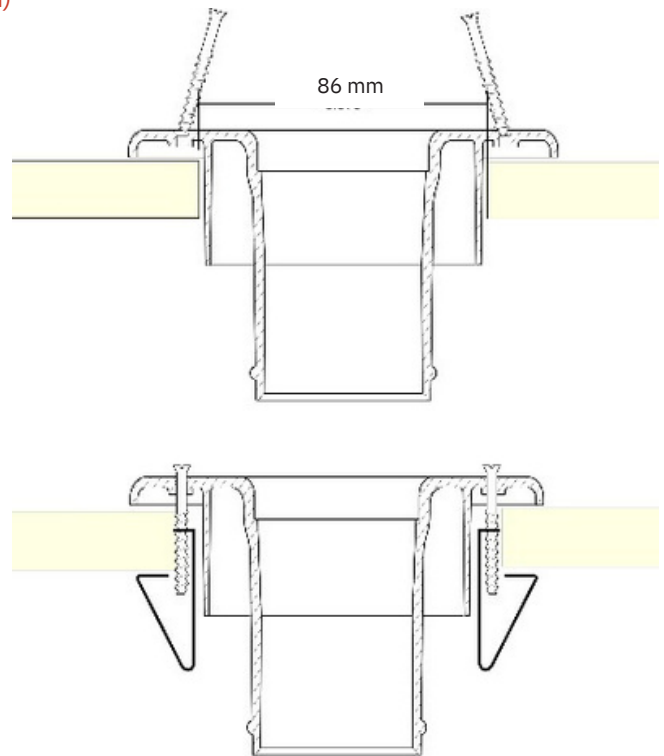
If you do not have easy access to backside of the wall, then you will need to attach a short length of standard sound attenuator to the R-6 or R-8 duct. Use a 1 m section of sound attenuator coupled to the inside vapor barrier of the heavier insulated duct. Push the outer insulation away from the outer vapor barrier and then seal the outer vapor barrier to the tape ring of the coupling with aluminium tape.



INSTALLING & SECURING ROUND OUTLETS

Figure 5. Round supply outlet installed in floor without toggles (top) and with toggles and screws (bottom)

With the outlet terminal connected to the end of the sound attenuator install the two toggles and screws in the mounting holes in the terminal faceplate. Feed or pull the terminal through the 100 mm hole in the ceiling or floor until the two spring toggles begin to enter the hole. Force the upper portion of the toggles inward until they snap over the edge of the ceiling or floor. The toggles should be centered on a line parallel to the direction of the duct run from the outlet to the plenum take-off. Loosen the screws if necessary to assure toggles are sprung over the edge of the hole. Tighten the screws until the cover plate is snug against the ceiling or floor.



CAUTION: TO PREVENT DAMAGE TO THE OUTLETS DO NOT OVERTIGHTEN THE TOGGLE SCREWS.

The supply outlet can be installed in the floor without toggles by drilling a hole 86mm in diameter instead of 102 mm and screw the cover plate directly to the floor by drilling two 2mm diameter holes on a 95 mm diameter bolt circle. The UPC-56B supply outlet can be inserted into the 86mm hole and used as a template for the two screw holes. When installing the screws be careful that they do not break into the 86mm hole; drill and install at a very slight angle away from the 86mm hole if necessary (Figure 5).

If installing an outlet in a wall, floor, or ceiling thicker than 37mm, the outlet toggles will need to be trimmed. Trim the leg of the outlet toggle that normally contacts the back side of the wall at a 30 – 60-degree angle, giving it a sharp point (Figure 6). This will allow the toggle to dig into the wall. Install the outlet according to the instructions in the previous paragraph.

Figure 6a. Modification of outlet toggles for walls thicker than 38 mm.

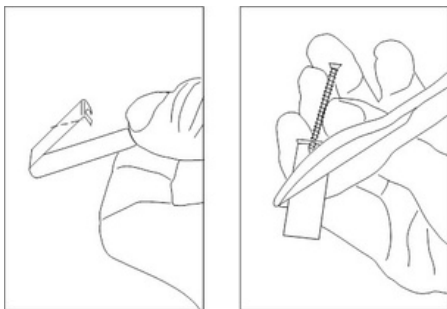
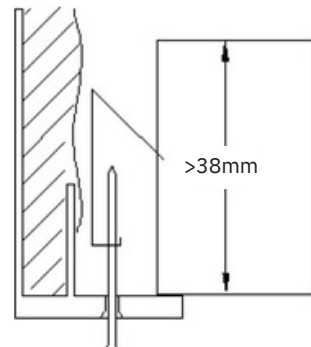


Figure 6b. Modified toggle secured into thick wall material.



UPC-57 UNFINISHED WOOD OUTLET INSTALLATION

Cut a 86 mm hole for mounting the UPC-57 without using toggles. The UPC-57 is furnished without any mounting holes in the wood faceplate. Rather than mar the wood surface an adhesive can be used under the faceplate to adhere it to the floor or other mounting surface. In some floor applications, the weight of the tubing below the floor will keep the outlet in place without any retention means.

If desired, holes can be drilled in the wood face plate at about a 98mm bolt circle and wood screws used to mount the UPC-57 directly to any wooden mounting surface, such as the floor or panelling on the wall or ceiling.



Step 5: AHU location

MOUNTING THE AIR HANDLER

The Unico System air handlers can be either platform mounted or suspended from the ceiling or loft rafters as detailed in Bulletin 30-020: Modular Unit Installation Instructions. The U1218 can be mounted flush to the ceiling or vertically against a wall using the mounting rails.

SECONDARY DRAIN PAN

Where an overflow of condensate could cause water damage, a secondary drain pan **MUST BE INSTALLED**. Table 5 lists the models and dimensions of the secondary drain pans for horizontal installations. For vertical installations a secondary drain pan should be fabricated so the dimensions are about 50mm greater than the footprint of the base of the air handler.

Place the drain pan on the mounting base, platform, or angle iron frame. Be sure to allow enough room for the drain line connection. The assembled unit should be placed over the secondary drain pan supported by rails with rubber pads for isolation to raise the unit above the 38mm sides of the secondary drain pan.

Like the modules, all secondary drain pans except UPC-24C and 24D will fit through the return air opening. Those drain pans may simply be folded and unfolded to fit through the return opening.

Table 5. Secondary Drain Pan Dimensions, mm

Model	Part No.	Size (mm)	2 Modules		3 Modules		
			Model	Part No.	Size (mm)	Part No.	Size (mm)
1218	UPC-94	1067 x 610	2430	UPC-20B	736x800†	UPC-20C	737x1110†
			3036	UPC-27B	864x800	UPC-27C	864x1110
			3642	UPC-24B	1067x800†	UPC-24C	1067x1110†
			4860	UPC-24C	1067x1110†	UPC-24D	1067x1372†

† The drain fitting extends 22 mm beyond this dimension



Step 6: Air Supply Plenum



Table 1. Duct Sizes (mm)

<i>I.D. Round mm</i>	<i>Square or Rectangle, mm</i>	<i>L/s</i>
200	165 x 165	330 L/s
	152 x 203	
	102 x 305	
	89 x 356	
250	216 x 216	472 L/s
	203 x 254	
	102 x 508	
	89 x 610	
300	267 x 267	708 L/s
	254 x 305	
	203 x 356	
	152 x 457	

THE SUPPLY AIR SYSTEM: PLENUM

All supply air is distributed through a compact duct system consisting of a plenum (main duct) and small branch ducts. In some cases, the branch ducts may be omitted. The plenum can be any material provided it is insulated and designed for up to 744 Pa and 14.2 m/s. Table 1 lists common sizes along with the maximum recommended airflow.

For applications without branch ducts, the plenum must have acoustical dampening properties. Examples include ducts made from fiberglass insulation such as duct board or metal ducts with internal fiberglass insulation lining

PLENUM DESIGN

As described in Bulletin 40-030, the best plenum design is the perimeter loop because it uses a tee to split the flow. This effectively reduces the pressure drop of the entire duct system and boosts the plenum static pressure. The tee should be the first fitting coming off the air handler at 1.2 m away for best performance and no less than 610mm.

The plenum size, using internal dimensions, should be based on the maximum airflow shown in Table 1. For simplicity and to take maximum advantage of static regain, do not downsize the plenum except where needed for tight spaces. In some cases, when the plenum equivalent length is over 150 feet (45 m), the plenum should be oversized.

Model	Duct Diameter
1218	200mm
2430	200mm
3036	250mm
3642	250mm
4860	300mm

PLENUM INSTALLATION

Fiberglass Plenum

Before beginning plenum installation, it will save on fabrication of plenum joints if the layout is consulted as to the location of tees and elbows in relation to the air handler. Proper planning at the outset as to the match-up of these joints can save on having to fabricate ship-lap joints when the standard 4-foot plenum lengths are cut to shorter lengths.

Where fiberglass is used, the plenum, tees, and elbows are supplied with prefabricated male and female shiplap joints on each end. Tees and elbows are supplied with male and female ends as shown in Figure 8.

To seal the jointed duct sections use UL-181-P sealing foil tape. UL-181-H Heat seal tape and/or UL-181-M mastic should be used for the appropriate application. The UL-181A-H is a heat seal tape that requires the use of a hot iron. Heat seal joints when applied correctly are the most secure jointing method. Where duct is installed in tight spaces and enclosures UL-181A-P and UL-181-M are acceptable jointing methods. Be sure to use a small squeegee to apply pressure to the tape. And always be sure that external surface of the duct is clean. For more information, refer to the manufacturer of tape, regarding shelf life, surface preparation and application temperatures for these closure systems. For square plenum use a short 102 mm piece of tape on each side of the ship-lap joint taping across the flap. Be sure to pull flap tight before ironing. Once all four sides are secured, tape completely around the duct. As each length of plenum is added be sure it is properly supported so no strain is put on the joints. The square tees and elbows have tape flaps on all four sides of each male ship-lap joint. The end cap has extra foil facing that extends on each side to serve as a tape flap. To facilitate folding the flap over each side of the plenum the end cap flap can be cut at each corner.

Be sure tape is centered over the joint and provide an overlap of at least 50 mm at the end of the tape before ironing. Be sure surface of plenum is clean and free of dust or dirt.

Metal Plenum

All joints, including the longitudinal snap-lock seam in the metal pipe and the tee and elbow joints must be sealed with tape to prevent any air leakage. The complete metal plenum system should be insulated with a minimum of 50 mm of fiberglass insulation with vapor barrier. Where higher R factors are desired, the thickness of the insulation can be increased.

Insert male shiplap ends into the female end. Use a minimum of three self-tapping sheet metal screws to mechanically secure each plenum joint, including the one at the plenum adapter. Tape each joint using UL-181A-P pressure sensitive tape or use UL-181A-M duct mastic. Be sure that all longitudinal seams of the metal pipe are also sealed with tape. It is also helpful to locate the longitudinal seam at one location such as at the top of the pipe as once the pipe is insulated the longitudinal seam is to be avoided for cutting holes for the attachment of the plenum take-offs.

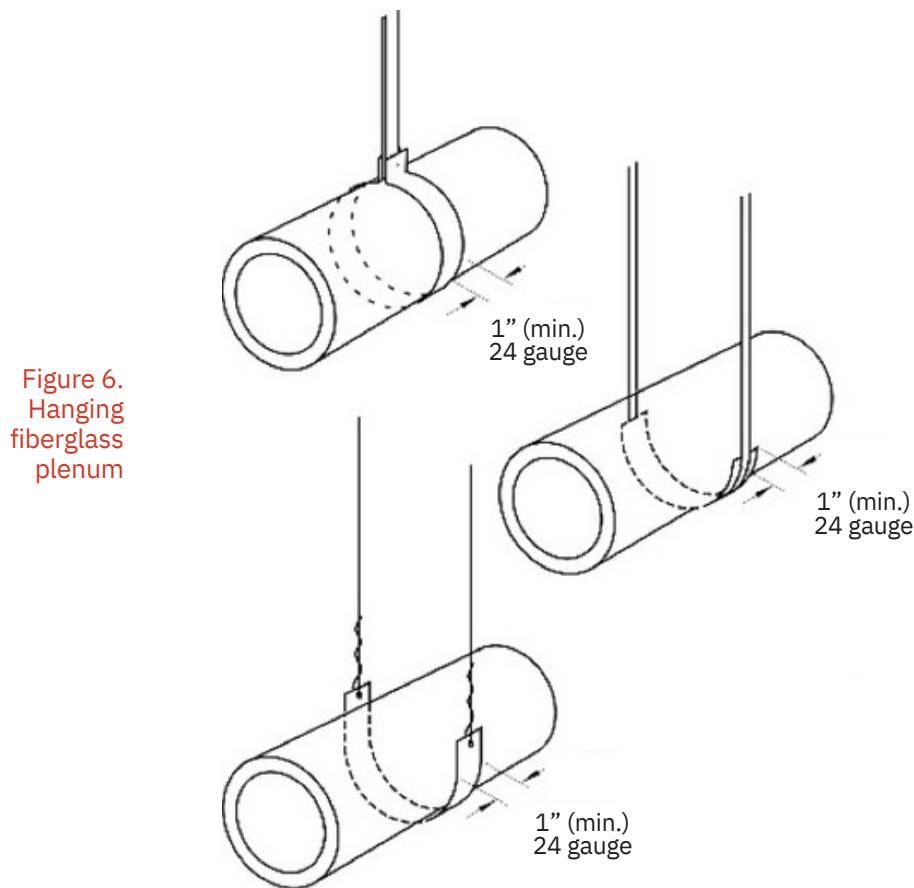
Insulate the bare metal with a minimum of 50mm of fiberglass insulation with vapor barrier and tape securely in place. Use either an aluminium foil faced fiberglass insulation blanket or a silver insulation sleeve. Tape all insulation seams with UL-181A-P or UL-181B-FX tape. Be careful not to compress the insulation while wrapping it around the duct or while taping the seams. **NOTE: It is important for system efficiency that you do not**

When using metal plenum, be sure that the elbows have a generous radius and the tees are the full flow design. All joints in tees and elbows must be sealed with UL181A-P tape before insulating. Never use an elbow as the first fitting off the air handler; always use a least 610mm of straight duct before the elbow and use large radius elbow. If a tee is not used, maintain the maximum duct size whenever possible. Reduce the duct size only if the plenum equivalent length is less than 46 m and the airflow is below the maximum allowable in Table 1.

Accidental punctures or tears in the plenum facing should be repaired to minimize leakage and provide a neat appearance. If the damaged area is small, repair it with the same tape as used for sealing the plenum joints or vapor barrier. Where large areas of the facing have been damaged in fiberglass duct remove the section of damaged duct and replace with new duct, using ship-lap joints at both ends.

Plenum Support

The plenum can be extended horizontally and rest directly on floor or ceiling joists or be suspended from above. When hanging fiberglass plenum, be sure the hanger will not damage the plenum surface. Use either plastic or metal strapping material with minimum width of 25mm (see Figure 6). Covering the metal hanger with a cloth type duct tape will help to avoid the puncturing the facing. Hangers should be no greater than 1.83 m apart and located as close to plenum joints as practical.



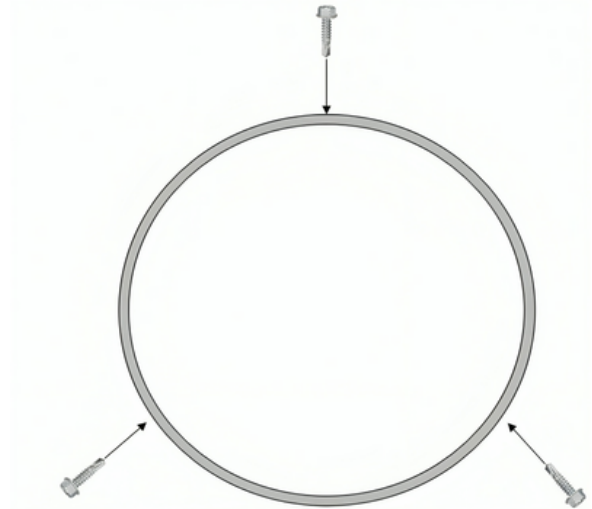
When hanging or supporting metal plenum, additional steps should be taken over those used with fiberglass plenum to avoid condensation at the points of support since the fiberglass surrounding the metal plenum will compress and significantly reduce the R-factor. At these points a saddle of rigid fiberglass or foam rubber should be provided to rest the plenum in.

Step 7: Air Supply – Duct Connections

CONNECTING PLENUM TO AIR HANDLER

Install Plenum Adapter

Use the UPC-61-xxxx supply plenum adapter for round metal plenum (Figures 5 and 6). Use the UPC-62-xxxx supply adapter for square fiberglass duct board plenum (Figure 7). Any other shapes or sizes require a field installed adapter.



Connecting Metal Plenum to Plenum Adapter

To connect a metal plenum, slip the un-crimped end of the plenum duct over the crimped end of the adapter. Secure the duct with a minimum of three self-tapping sheet metal screws at the joint and seal all seams with UL-181A-P pressure sensitive tape or UL-181A-M duct mastic. Then wrap the 25 mm thick fiberglass blanket insulation around the UPC-61-xxxx adapter and seal again with UL181A-P tape. Make the blanket snug but not compressed to maximize the insulation effect.

Connecting Fiberglass Plenum to Plenum Adapter

Cut off the male shiplap to make the end flush; then insert the duct into the plenum adapter. Push plenum in tightly to form a snug joint. Insert four large headed nails at least 25 mm long through the four holes on each side of the square plenum adapter to help secure the duct. Then seal the duct to the metal collar with UL-181A-P tape. Be sure to use a squeegee to adhere the tape. After the duct is sealed to the adapter, wrap the supplied insulation tape around the exposed metal of the adapter to prevent condensation.



CONNECTING BRANCH DUCTS TO PLENUM TAKE-OFF

Refer to Bulletin 30-050: Plenum Take-off Installation Instructions for complete details for attaching the take-offs to the plenum (Figure 10).

USING BALANCING ORIFICES

The Installation Kits (5 outlet) include one of each of the 3 sizes of balancing orifices. The UPC-35-15 Take-off Balancing Orifice Package is available where additional orifices are needed. They reduce airflow for the individual branch runs to better balance the air supplied to rooms for the cooling and heating loads. Upon completing the individual room heat gain and heat loss calculations and determining the number of outlets, the runs requiring orifices should have been determined allowing for the 3 sizes of orifices which give 15%, 35%, and 50% reduction in air flow. See Table 6 for the combinations that can be used.

These orifices are mounted at the UPC-23 or UPC-28 take-off fittings. The orifice cap alone provides the 15% reduction, the cap with the 7mm diameter hole disc provides 35% reduction and the cap with the 5mm diameter hole disc provides 50% reduction in airflow. The discs are designed to just press into the orifice cap before installing over the connector stub protruding from the plenum take-off fitting. The cap is designed to fit snugly over the connector stub and still permit the 50mmID insulated supply tubing core (UPC-25 or UPC-26) to slide freely over it.

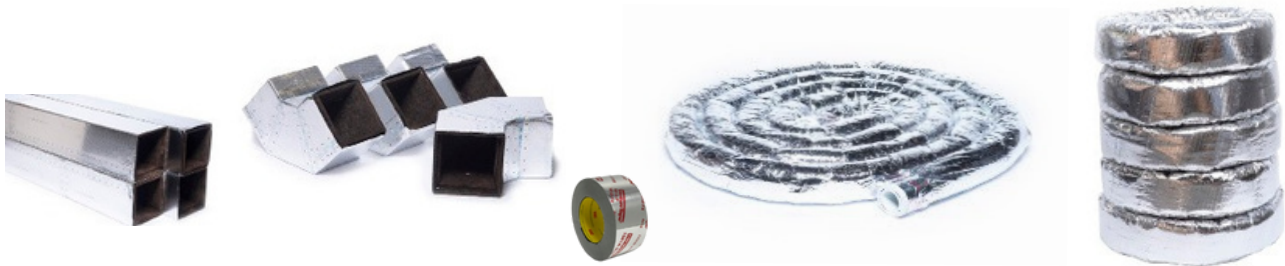


Table 6. Outlet Orifice Combination

<i>Desired No. of Outlets</i>	<i>Outlet-Orifice Combination</i>
.5	(1) .5
.65	(1) .35
.85	(1) .15
1.00	(1)
1.15	(1) .5 + (1) .35
1.30	(2) .35
1.50	(1) .35 + (1) .15 or (1) + .5 or (3) .5
1.65	(1) + (1) .35 or (2) .5 + (1) .35
1.70	(2) .15
1.80	(2) .35 + (1) .5
1.85	(1) + (1) .15
1.95	(3) .35
2.00	(2)

REDUCTION OF LEAKAGE & ENERGY LOSSES

For fiberglass plenum systems with all plenum joints taped carefully using the UL181A-H tape, there should not be any leakage from joints or be any need to mechanically brace plenum fittings into which air impacts. This may be necessary when other tapes are used. In such cases, a caulking compound (such as DAP butyl rubber) or fiberglass adhesive should be used at all plenum joints to reduce leakage and energy losses.



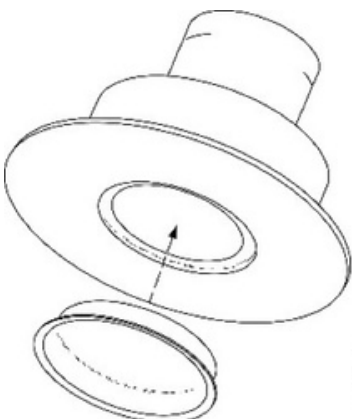
In unconditioned locations, and especially in more humid areas, it may be necessary to over-wrap the joints with foil-faced fiberglass and tape in place covering all edges to provide a complete vapor barrier. The R-factor of 25mm thick square fiberglass plenum is 4.2. Where a higher R factor is desired, it is usually better to use a metal plenum as it can be over-insulated with a thicker insulation sleeve or blanket insulation with thicker insulation. Alternatively, thicker fiberglass duct board may be used but this complicates the installation because the elbows and tees must be fabricated in the field. Several manufacturers make a 38mm duct board which has an R-factor of R-6 or a 50mm duct board is also available which has an R-Factor of R8. Special spin-in take-offs are available for the 38mm duct board.

DUCT SYSTEMS IN UNCONDITIONED SPACES

To minimize energy losses, it is best to run the duct system in conditioned spaces, such as basements, utility rooms, and closed or furred down areas. When the distribution system is located in unconditioned spaces and especially in the more humid areas of the country, it may be necessary to take extra precautions against condensation as follows:

1. Be sure tape rings are used at every 50mm tubing connection. They are specifically intended to keep the insulation from being compressed whenever a joint is being taped. Since the connection joints are more susceptible to leakage and condensation they can be over-wrapped with a 152mm wide piece of foam insulation tape or fiberglass insulation with a vapor seal. All edges of the fiberglass overwrap should be taped with UL181A-P tape to assure a complete vapor barrier.
2. At the take-off fitting (UPC-23 or UPC-28), cuffs of Rubatex® type or equivalent tubing 82 x 6mm or 10 x 152mm long can be slipped over the supply tubing and pushed snugly against the plenum vapor barrier (Figure 11). A good adhesive, such as DAP® butyl caulking compound or equivalent, can be used to seal the end of the Rubatex cuff to the plenum vapor barrier. The other end of the cuff should be sealed to the supply tubing jacket with UL181A-P tape to form a complete vapor barrier. The caulking compound can be used to fill this joint before taping.
3. Like step two (2), precautions can be taken at the supply outlet (UPC-56B). Use a similar Rubatex cuff and slip this piece over the scrim core tubing where it is connected to the supply outlet. Notch or compress the Rubatex so it slips over the taping collar of the UPC-56B between the collar and toggles so the Rubatex can seat against the back of the supply outlet face plate; adhesive can be used to seal cuff to back of face plate. To facilitate the installation this cuff might be pre-assembled to the supply outlet-scrim core tubing connector assembly taking care that the toggles are free to compress and snap over the ceiling or floor.
4. Plenum joints can be over wrapped with 152 mm wide vapor barrier faced insulation and taped in place covering all edges to provide a complete vapor barrier.
5. In extreme humidity areas the air handler can also be protected against condensation by covering the top, sides and ends with foil-faced duct board. All bare ends and joints should be taped with UL181A-H to give a complete vapor barrier. Since side panels and the control box cover may have to be removed, leave cut outs or taped pieces (use UL181A-P tape) that can be easily removed.

Figure 7.
Installing winter shut-off caps.



For cooling only systems where the air distribution system is in an unconditioned space, such as the attic or an unheated garage or utility room, steps must be taken to keep moisture from collecting in the duct and plenum system during the winter months. Winter supply air shut-off plugs are included in the Installation Kits. They can also be ordered separately in kits of 20 as UPC-42-20. These plastic plugs fit into the supply outlet opening. Push them in until they seat against the ledge inside the mouth of the supply outlet (see Figure 7).

In addition to the winter shutoff caps, be sure to seal the return air opening. Use both plastic sheet and tape to seal the filter in place or wrap the filter with plastic so that no air enters the return.

BE SURE THE HOMEOWNER UNDERSTANDS THE WINTER SUPPLY SHUTOFFS AND THE RETURN AIR SHUTOFF PLATE ARE TO BE INSTALLED AT THE BEGINNING OF THE HEATING SEASON AND MUST BE REMOVED WHEN THE COOLING SYSTEM IS STARTED IN THE SPRING.

Step 8: Return Air

Unico provides factory-made components for the complete return air system, including the return air box with grille and filter, return air duct, and return air adapter. These components are ideal for horizontal attic type installations where one central ceiling return can be used.

Where the single packaged return air system cannot be used, such as in tight closets, vertical installations or where multiple returns are needed, a field fabricated return duct system made from duct board, or sheet metal with acoustical lining can be used. A 90° bend or elbow should be used in the field fabricated return system for correct acoustical performance.

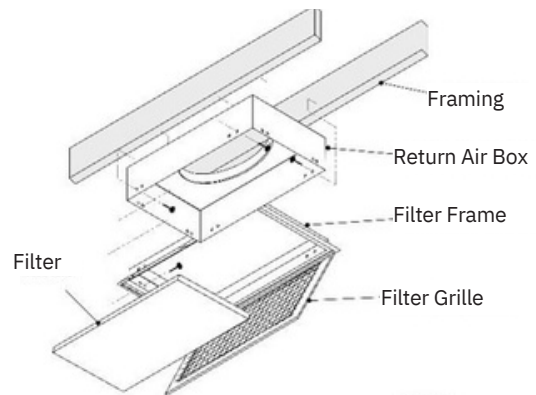
Each Unico System air handler is designed with a rectangular return air opening that will accommodate the field fabricated duct which should be designed for a pressure loss not to exceed 37 Pa, including filter. Generally, this means sizing the duct for a pressure loss of 12 Pa at the required airflow and sizing the filter for a pressure drop of 25 Pa at the required airflow. It may help to remember that the return duct system is a conventional design, not high velocity. For most systems, the minimum duct size is sufficient for up to 8m with no more than three 90° bends (Table 2).

Note: For more detailed information on return duct design see Unico Tech Note 106, Return Duct System Design Requirements.

Table 2. Return Duct Size

Model	Part No.	Diameter	Length
1218	UPC-04-1218	305 mm	3 m
2430	UPC-04-2430	356 mm	3 m
3036	UPC-04-3036	406 mm	3 m
3642	UPC-04-3642	457 mm	3 m
4860	UPC-04-4860	508 mm	3 m

Figure 3. Return Box & Air Filter Grille



If the joists or studs are less than 406mm centre-to-centre or in the wrong direction, it will be necessary to cut and header the joists or build a frame to hold the return air box. Centre the return air box so the filter frame flange covers all the gaps and make sure the flange is flush against the wall or ceiling. Install the return box inside the surrounding frame using nails or screws. Holes are provided in the long sides of the return air box. Use the four 6.4mm holes nearest to the corners. The other holes are for mounting the filter grille (Figure 3).

1. Center the return air box so the filter frame flange covers all the gaps and make sure the flange is flush against the wall or ceiling.
2. Install the return box inside the surrounding frame using nails or screws. Holes are provided in the long sides of the return air box.
3. Use the four 6.5mm holes nearest to the corners. Additional holes are for mounting the filter grille (Figure 3).

Step 9: Wiring

Connect air handler to electrical power
Please see Bulletin/Manual/Publication #XXXXX

Step 10: Testing

Test airflow
Please see Bulletin/Manual/Publication #XXXXX

Step 11: Indoor to Outdoor Connection

Connect refrigerant lines and charge
Please see Bulletin/Manual/Publication #XXXXX

Step 12: Paperwork

Fill out service report form and register unit for warranty
Please see Bulletin/Manual/Publication #XXXXX

The Unico System[®]

Small-Duct High-Velocity Heating and Cooling

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