



Component Layout

GENERAL

This manual, when used in conjunction with *Bulletin 40-40, System Sizing and Layout* should provide the necessary information to determine the *UNICO SYSTEM* sizing, layout and job material list. The many specification and installation instructions for the *UNICO SYSTEM* equipment should be studied so the system designer understands the equipment thoroughly before proceeding with the system design and layout.

SYSTEM SIZING

Before the proper equipment can be selected for a *UNICO SYSTEM* installation, it is imperative that the heat gain and/or heat loss be calculated for the structure that is to be comfort conditioned. To assure a proper layout and a well-balanced system, room by room heat gain and/or heat losses should be calculated using generally recognized methods, such as *ACCA Manual J* or the *ASHRAE Cooling and Heating Load Calculation Manual*. The extra time spent designing a proper system will be repaid many times and result in:

1. Correctly sized equipment
2. Properly balanced system
3. Less call backs
4. Satisfied customers
5. More profit

Note: It is permissible to use shorter and quicker procedures for job estimating purposes. These are covered in a separate instruction. However, it is important to remember that such procedures are for the initial cost estimates and are no substitute for the more detailed longer procedures as outlined above.

EQUIPMENT SELECTION

Unico, Inc. air handlers are available in three (3) basic models in the 'M' series. The M1218 provides a small compact unit in one package for 1 and 1-1/2 ton cooling systems. The M series modular air handling units are available in 3 sizes, the M2430 for 2 and 2-1/2 ton cooling systems, the M3642 for 3 and 3-1/2 ton cooling systems, and the M4860 for 4-5 ton cooling systems. All air handlers are available as cooling only (either DX or chilled water), heat pump with auxiliary electric heating and hot water coil heating.

EQUIPMENT LOCATION

All *UNICO SYSTEM* air handlers can be installed in the horizontal and vertical upflow configurations. Additionally,

the modular units (M2430, M3642, and M4860) can be installed in the vertical downflow configuration. The installation possibilities are:

- A. Horizontal Units:
 1. Attic installation supported on a platform or suspended from attic rafters.
 2. Basement installation suspended from the floor joists.
 3. Furred down installation in hallways, closets or utility rooms.
- B. Vertical Upflow Units:
 1. Closet or utility room installation on a cabinet base or wall brackets.
 2. Basement installation on a cabinet base or platform.
- C. Vertical Downflow Units:
 1. First floor closet or utility room installation over a crawl space or slab (requires special consideration for the distribution system – *Bulletin 30-05, Air Distribution Systems*)
 2. Second story closet or utility room installation feeding into plenum between floors.

OUTDOOR EQUIPMENT

The *UNICO SYSTEM* air handling units can be matched with any compatible outdoor condensing unit or outdoor heat pump section from any ARI listed manufacturer; however, the matchups are the responsibility of the installer since different outdoor units have different operating characteristics. *Bulletin 30-20, 'M' Series Modular Air Handling Units Installation Manual* provides for the recommended charging procedures for cooling systems and *Bulletin 30-24, Heat Pump Installation* for heat pump systems. Using chilled water and hot water coils, multiples of units can be matched to individual or larger capacity chillers and boilers. If desired the chilled water coil can be used with both chilled and hot water.

INSTALLATION INSTRUCTIONS

Detailed installation instructions are available for the various system components and should be consulted for the applicable equipment before beginning the system layout. The following installation instructions are available:

- Bulletin 30-05, Air Distribution Systems*
- Bulletin 30-10, M1218 Fan Coil*
- Bulletin 30-20, M Series Modular Air Handler Units*
- Bulletin 30-24, M Series Modular Heat Pump Systems*
- Bulletin 30-30, Hot Water Coils*

Except for *Bulletin 30-05*, a copy of each instruction is shipped with each piece of equipment. For air distribution system components there are many individual specifications which include installation instructions. Check for the instruction upon unpacking the equipment.

DISTRIBUTION SYSTEM AND ACCESSORIES

The key distribution system components are depicted on *Bulletin 20-15, System Component Specifications*. The many accessory items shown on this specification sheet facilitate installation in a variety of situations.

Any system installed where water leakage from condensate or a hot water coil **MUST HAVE A SECONDARY DRAIN PAN** installed. These are available as UPC-94 for the M1218, UPC-20B and -20C for the M2430 models when 2 or 3 modules are used and UPC-24B or -24C for the M3642 models for 2 or 3 modules or for the M4860 for 2 modules. The UPC-24D is used for the M4860 for 3 modules.

Where a vertical installation is planned the Vertical Conversion Kits, UPC-63A for the M2430 and UPC-64A for the M3642 and M4860, are required. The M1218 is a multi-purpose unit and does not require any kits or modifications for vertical upflow applications.

RETURN AIR COMPONENTS

Unico, Inc. provides components for a complete return air system, including filters, which are particularly useful for attic type installations where one central ceiling return can be used. Different components are required for each size of air handler, which are detailed in Table 1.

Table 1. Return Air Box Components

Models	Return Grille	Return Air Duct	Return Cap
1218	UPC-01-1218	UPC-04-1218	UPC-104-1218
2430	UPC-01-2430	UPC-04-2430	UPC-59B-2430 (UPC-104-2430)*
3642	UPC-01-3642	UPC-04-3642	UPC-59B-3642 (UPC-104-3642)*
4860	UPC-01-4860	UPC-04-4860	UPC-59B-4860 (UPC-104-4860)*

*used to connect directly to the heating module

The return air duct, UPC-04-1218/2430/3642/4860, has a sound attenuating core; flexible duct with a solid plastic lining which should not be used as it will be noisy.

The standard return air components can be adapted to other than ceiling installation. The filter-grille can be installed in the sidewall (see Figure 1). However, if a filter-grille can not be used in the sidewall then other grilles can be used, such as a standard wall grille, a baseboard grille or an out-of-the wall baseboard grille. The filter-grille is more desirable because when other standard type grilles are used,

it is then necessary to build a suitable filter box or frame at

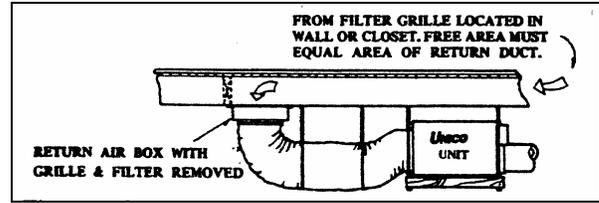


Figure 1. Optional Air Handler Placement

the air handler.

For basement or crawl space applications it can be handled as follows:

1. Install a filter-grille low in the sidewall.
2. Pan the basement or crawl space joists back to the air handler.
3. Connect the flexible return air duct to the panning:
 - A. By using the return air filter box normally supplied and fasten it to panning.

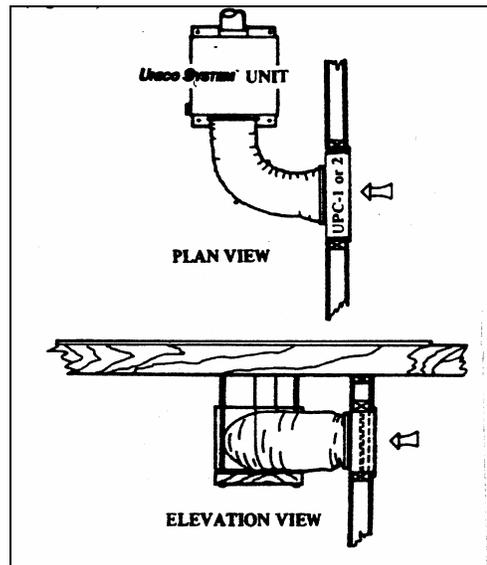


Figure 2. Optional Grille Placement

- B. Fabricate or obtain a sheet metal collar to which flexible return duct can be fastened and connect to the panning. See Figure 2.

When desired or necessary due to space limitations, a fabricated return duct system can be used. This would usually be done when multiple return ducts are required. Fabricated duct board or metal duct with acoustical lining may be used. The return duct including filter should be designed for a maximum static pressure drop of 0.15 IWC (37 Pa). A 90° bend or elbow should always be used for proper acoustical performance.

Duct Layout

To provide optimum system performance several important guidelines must be followed in doing the duct layout. The static pressure of the system determines the airflow for good system performance. The system operates most effectively

in the range of 1.0 to 1.5 IWC of total static pressure reflecting both the return air system and the supply side or distribution system.

Plenum Layout

For the *Unico System* the installer has a choice of 2 different types of plenum systems: square fiberglass duct board (6-1/2 x 6-1/2, 8-1/2 x 8-1/2, and 9-1/2 x 9-1/2-inches I.D.) and field insulated round sheet metal (7, 9 and 10-inch I.D.). In certain cases with space limitations, such as dropped ceilings, it is possible to use plenum that is flatter, such as rectangular fiberglass ductboard or sheet metal. In these cases the dimensions should provide a flow area at least equal to or greater than the factory supplied plenum, e.g. 4 x 11-inch I.D. or 5 x 9-inch I.D.

The following guidelines should be followed for the plenum system:

1. **More Plenum, Less 2-inch run length:** The plenum has less pressure drop than the 2-inch duct runs so the plenum system should be designed to keep the 2-inch duct runs to a shorter length (12-ft. or less, if possible). This may require using more plenum and plenum fittings and consideration of layouts that are not always the most obvious.
2. **Minimize Restriction:** The *UNICO SYSTEM* supplied plenum fittings are designed to minimize restriction of the plenum system. They include full flow tees with turning vanes (where helpful) and full flow elbows. If locally supplied components, such as sheet metal fittings, are to be used be sure they are of full flow design.
3. **First Fitting—Tee:** Every effort should be made to use a tee as the first fitting off the air handler, particularly with the M4860. When an elbow is used

it imposes a much higher-pressure drop. Suggested layouts using tees are shown in Figure 3. It is best to install the tee or elbow 48-inches from the unit although 24-inches is acceptable in tight places.

4. **Tee Airflow Splits:** When using a tee, split the flow as close to 50/50 as possible—no more than 60/40. Use a turning vane for the M4860; it is not necessary for the smaller models. For the M4860 unit it is preferable to us 10-inch insulated round sheet metal up to the tee, then a 10x9x9-inch tee (Unico Part No. UPC-19(V)-100909) providing 9-inch branch runs in both directions. In this case a 70/30 split in airflow is possible.
5. **Shotgun Systems:** Where a shotgun system (see Figure 3) provides a better layout for the M4860 unit, use 10-inch insulated metal or fiberglass duct for the first 40% of the airflow, then reduce to 9-inch for the remaining 60%, if desired. For smaller units, 9-inch may be run the entire length.
6. **Horseshoe / Perimeter Patterns:** Where horseshoe or “H” systems are used, consider closing the horseshoe or end of the “H” into a perimeter loop (see Figure 4).

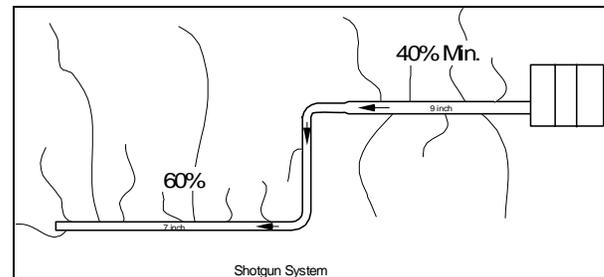


Figure 4. Typical Shotgun System Layout

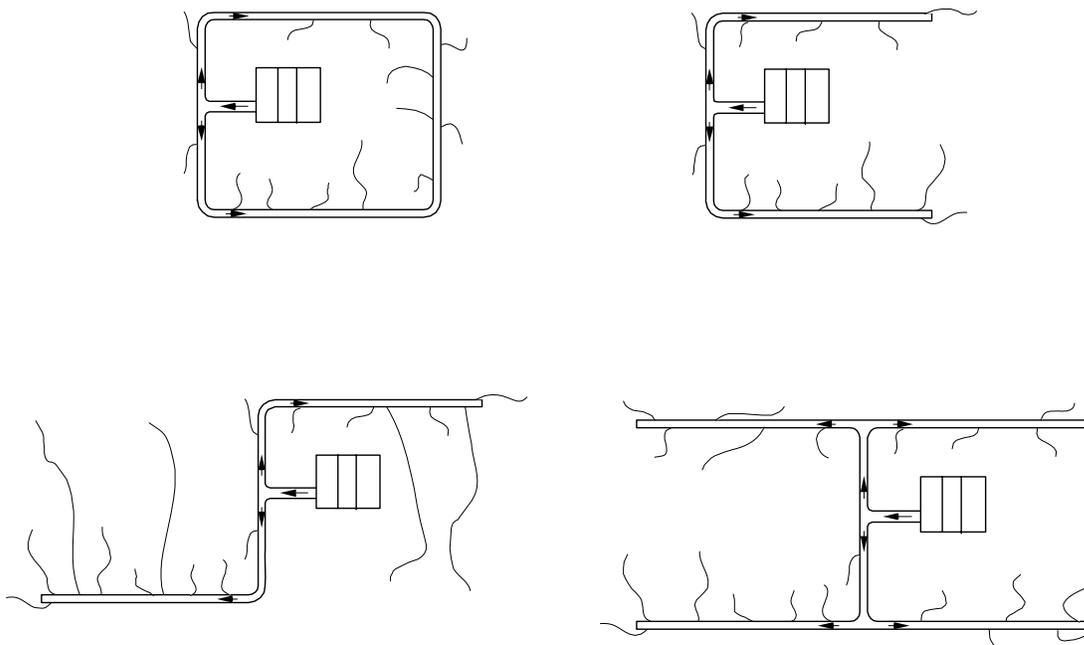


Figure 3. Typical System Layouts

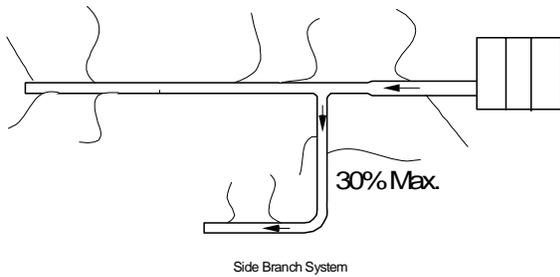


Figure 6. Typical Side-Branch System Layout

7. **Side Branch:** For a side branch, turn the tee 90° and never use a turning vane. Take no more than 30% of the airflow from the side branch (see Figure 5).
8. **Minimum Distance to Fittings:** Always use a straight duct prior to any fitting such as elbow, tee, plenum takeoff, or electric heater. It is best to have 48 inches before each fitting although 24-inches is acceptable in most applications. Avoid elbows

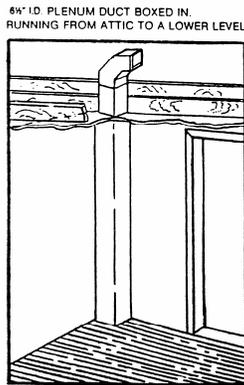


Figure 5. Typical Plenum Vertical Layout

directly off units, which is the worst design possible.

9. **Space Takeoffs Evenly:** Maintain the distance between takeoffs as evenly as possible. Space the takeoffs at least 6-inches apart and 12-inches from the end cap.
10. **Plenum for Multiple Stories:** The plenum is normally in the attic or basement. In some two story or split-level home it is advantageous to go from one level to another with the plenum. Boxing in the plenum (see Figure 6) or routing it through a closet usually accomplishes this.
11. **Plenum in Living Area:** In some homes where attic space is not available, the plenum can be enclosed by boxing it in (see Figure 7) or running it above dropped ceilings. In areas with cathedral ceilings, this can be done along with boxing in the supply tubing next to an exposed beam. Remember that once the system is boxed in it is difficult to gain access for changes so it is imperative that the system be properly designed and checked out for airflow before final boxing is done.

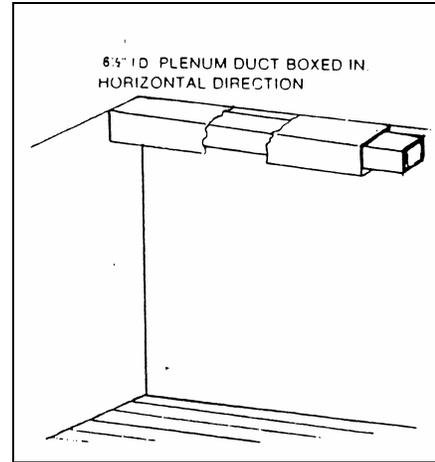


Figure 7. Typical Plenum Horizontal Layout

REMEMBER THAT ANY TIME THE DISTRIBUTION SYSTEM CAN BE LOCATED IN THE CONDITIONED SPACE THERE IS NO DUCT LOSSES AND ENERGY WILL BE SAVED.

OUTLETS AND SUPPLY DUCT LAYOUT

The following guidelines apply to the outlets and 2-inch duct runs:

1. **Minimize Length, Minimize Restriction:** Keep the 2-inch supply duct length as close to 12-feet as possible and never less than 6-feet. Use the fewest number of bends as possible. Maximize the radius of any bends making sure the bend in the sound attenuating tubing near the outlet is at least 6-inches

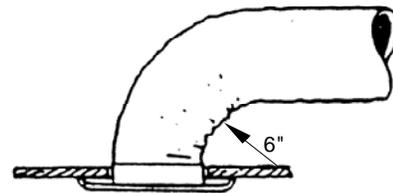


Figure 8. Typical Supply Tubing Bend

(see Figure 8).

2. **6 Outlets Per Ton Minimum:** Provide a minimum of 6 **full** outlets per ton of cooling (200 CFM/ton minimum). For the M4860 unit on a 5-ton system and any heat pump system use 6-1/2 full outlets per cooling ton. For hot water heating, use 40 CFM per full outlet and refer to hot water coil performance charts to get the required total. A full outlet is 10-feet of supply duct without any balancing orifices. Add more outlets for those less

than full. For example, two runs 10-feet long with 50% balancing orifices are equal to one full outlet.

3. **10% Rule:** For supply ducts longer than 10-feet, the air is reduced in that run by 10% for every 5-feet over 10-feet. The curves provided in *Bulletin 40-40, System Sizing and Layout Procedure* takes this into account when doing the detailed layout for room outlet selection.
4. **Consider Traffic Pattern:** Place outlets out of

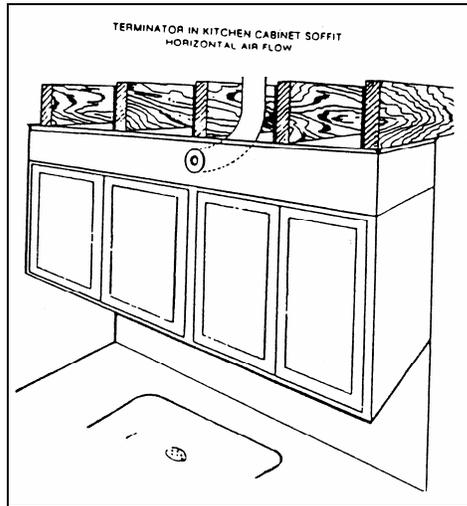


Figure 9. Typical Kitchen Soffit Layout

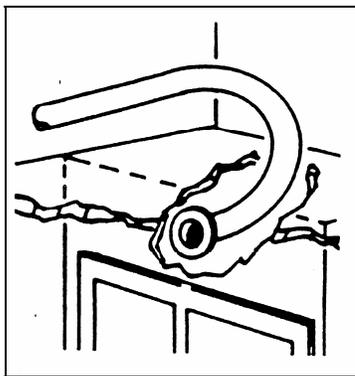


Figure 10. Typical Cabinet Layout

traffic pattern. A corner, 5-inches from each wall, is a good location, or along walls or blowing horizontally. Two excellent spots for horizontal discharge are in the soffit above kitchen cabinets (see Figure 9) and in the top portion of closets (see Figure 10). Consider floor outlets (with screens) for units located in the basement.

5. **Allow for aspiration:** Locate outlets so the air stream does not impinge on any objects or people – at least 3-feet away. Use outlet deflectors and outlet balancing orifices sparingly as they disrupt the aspiration.
6. **No Terminators in Stud Walls:** Do not attempt to install the terminators in a standard 2 x 4-inch

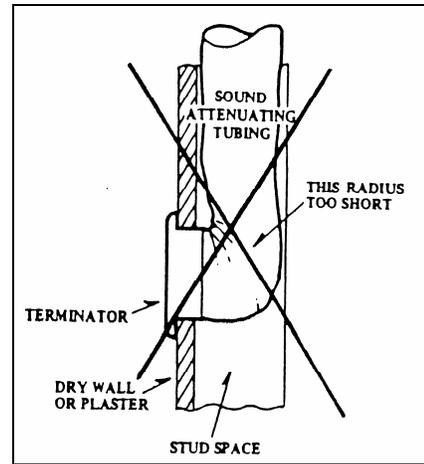


Figure 11. Incorrect Placement of Tubing

stud wall (usually 3-1/2-inches wide) for horizontal discharge with the sound attenuating tubing in the wall with a 90° turn. This application is not acceptable because of the short radius in the tubing. The air noise would not be acceptable (see Figure 11). For stud wall applications use the slotted outlet.

7. **Proper Installation for Noise:** In planning the length of duct runs be sure to provide sufficient length that gives as generous a radius as possible in the sound attenuating tubing at the outlet. Minimum radius must be 6-inches as indicated but the greater the radius of any bend at the outlet the quieter the run will be. Be sure to include a minimum of 3-feet of sound attenuating tubing (UPC-26C) at the end of each run. For runs up to 12-feet all sound attenuating tubing may be used. For greater lengths, use the aluminum core supply tubing (UPC-25) with a 3-foot attenuator at the end.

Also, adding a few extra outlets can reduce sound levels further. The round outlet is designed for 20 to 40 cfm. The slotted outlet is designed for 20 to 35 cfm. As a general rule the more outlets, the lower the cfm per outlet and the lower the sound level will be. For applications where all the surfaces (floor, wall, and ceiling) are hard it is best to design the number of outlets to achieve approximately 30 cfm.

Also, sound is additive so that if you have a small space with lots of outlets it is best to design for 30 cfm.

Sound is subjective meaning what is acceptable for some is not for others. Therefore, when in doubt add a few extra outlets. Rest assured, though, that the noise level for any outlet within its allowable range will be quieter than most conventional duct systems, provided the outlets are properly installed.

SINGLE STORY APPLICATION LAYOUT

This application is normally the quickest and simplest application to make. Figure 12 is a typical layout for this type of structure.

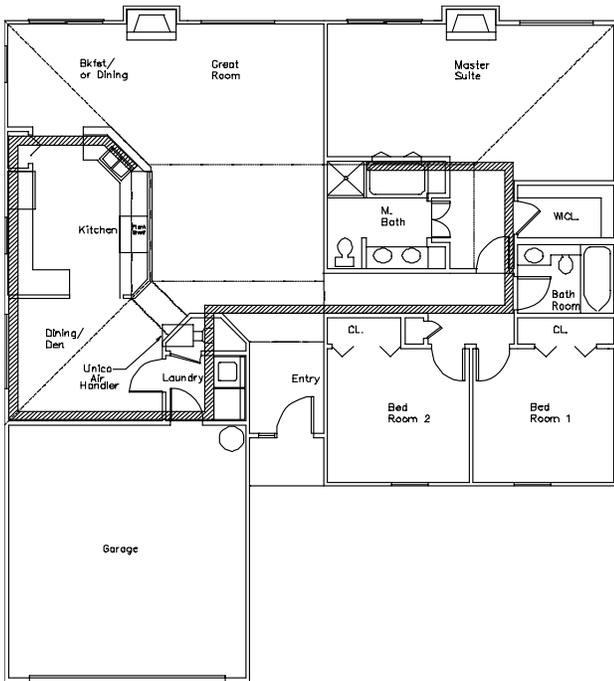


Figure 12. Typical System Placement and Layout

Two Story Application Layout

The two-story residence is usually handled in one of two manners:

1. One UNICO SYSTEM in the attic with supply tubing run in the attic to ceiling outlets for the second

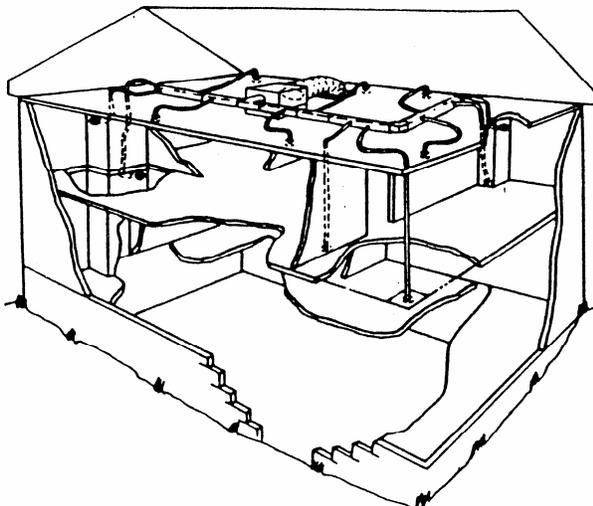


Figure 14. Two-Story Home with One Unico System

story. The first floor tubing is run from the plenum in the attic down through the second story to ceiling outlets on the first floor (see Figure 13).

The supply tubing is small enough to go in stud spaces but this is often difficult in older homes because of hidden obstructions in the walls. It is

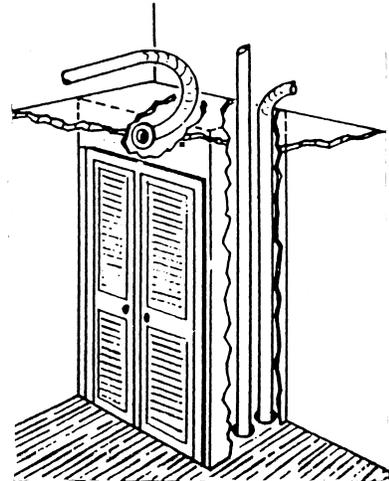


Figure 15. Placement of Supply tubing

usually easier to run the supply tubing from the attic down through second story closets to first story termination (see Figure 14).

Another common practice is to run supply tubing from the attic down into corners of the second story rooms to first story outlets. Supply tubing in the corners of the second story rooms

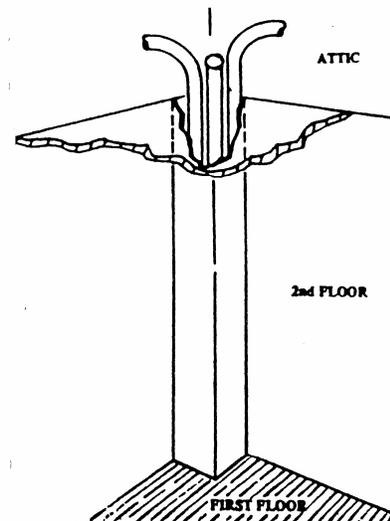


Figure 13. Placement of Supply Tubing between Floors

can then be boxed in and are hardly noticeable since the overall diameter of tubing is only 3-1/2-inches (see Figure 15).

- The second most common way to handle the older two-story home is to install two separate systems. One is placed in the attic to handle the second story

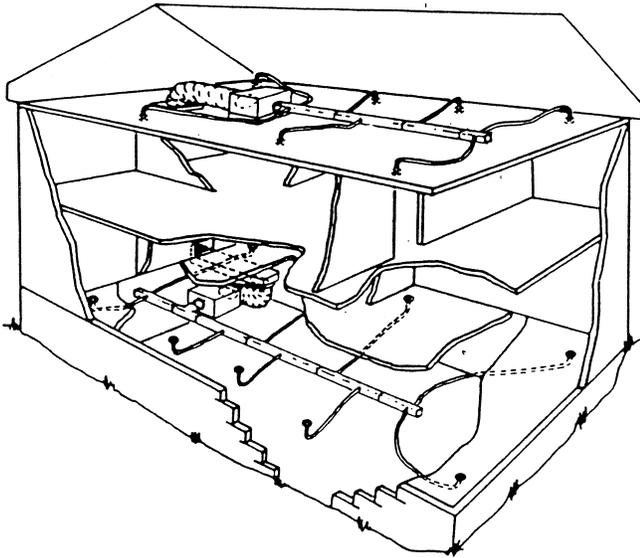


Figure 16. Placement of Supply Tubing between Floors

with ceiling terminators and return air. The other system is placed in the basement utilizing floor terminators with the duct system suspended in the basement area (see Figure 16).

With two systems, it often takes less time on the job and gives the homeowner a truly zoned system where the comfort conditions of the two areas can be independently controlled.

Split Level Applications

The *UNICO SYSTEM* distribution system on cooling only installations where the duct system is in the non-conditioned areas, such as attics, should be blocked off during the winter season. Winter shutoff caps are shipped with the installation kits. For the return air grille a sheet metal plate can be fabricated to fit in front of the filter.

If a residence has proper or more than adequate humidity during the heating season, it is possible for this air to travel throughout the distribution system. When this occurs, moisture from the humidified air can condense on the inside of the plenum and the supply tubing. An excess quantity of moisture collected in the distribution system may result in wet ducts and water dripping from the terminators.

Be sure the Homeowner is given the winter shutoff caps and return air grille block off and understands the importance of their use during the heating season.